Available online at: www.mbai.org.in doi: 10.6024/jmbai.2014.56.1.01750s-11

Development of closed seasons and areas in the Gulf of Thailand

Pirochana Saikliang
Marine Fisheries Research and Development Bureau, Department of Fisheries, Thailand.

*Correspondence e-mail: pirochas@hotmail.com

Received: 01 Mar 2014, Accepted: 30 Jun 2014, Published: 15 Oct 2014

Original Article

Abstract

Thailand has been placed in the top ten fisheries production countries in the world in marine capture fisheries. However, increasing demand for protein sources, together with the rapid development and improvement of fishing gear and fishing techniques has resulted in major stock reduction of the Indo-Pacific mackerel and some other commercially important pelagic species in the Gulf of Thailand (GoT). Therefore, the Department of Fisheries Thailand (Thai-DoF) planned to establish fisheries *refugia* or closed seasons and areas in some part of the Gulf of Thailand and prohibit some kinds of fishing gear. The DoF monitored the changes in status of aquatic resources and also the fishing methods with the aim at determining appropriate measures from time to time for sustainable use of pelagic species. In the past 60 years (1953-2013), Thai-DOF implemented a total of 13 fisheries management measures on the development of fishing gears and fishing techniques including "Gulf Closing" in the southern areas (Prachaup Khiri Khan, Chumphon, and Surat Thani) with the aim of conserving spawning and nursery areas of aquatic resources in the GoT. The measures for conserving Indo-Pacific mackerel were also used as a basis for formulation and development of other conservation measures. Cancellation and revision of these measures were also made from time to time according to the change of status of fisheries resources, and to effectively manage aquatic resources for sustainable exploitation.

Keywords: *Fisheries refugia, closed seasons and areas, Gulf of Thailand.*

Introduction

The marine capture fisheries of Thailand are highly significant both nationally and internationally with Thailand being among the top ten countries world-wide in terms of fisheries production. Capture fisheries are dominated by "trawl fisheries" which mainly harvest demersal species. Pelagic fisheries are also significant and total production of pelagic species in 2011 was about 37.89% of overall production, of which 66.12% was harvested from the Gulf of Thailand (GoT). Indo-Pacific mackerel (*Rastrelliger brachysoma*) is one of the most important pelagic species for the Thai people being considered as "good meat and delicious". However, increasing demand for protein sources together with rapid development and improvement of fishing techniques resulted in stock reduction of the Indo-Pacific mackerel and some other commercially important pelagic species in the Gulf of Thailand during the 1980s.

The Gulf of Thailand is one of the most highly productive shallow water areas resulting from the high sediment and organic inputs, including nutrients from river runoff, that provide suitable conditions for high natural productivity. The Gulf of Thailand also supports high biological diversity and a study has shown that there are more than 4,300 aquatic species here (Sukhavisidh, 1996). Inter-annual variations in climate, including extreme events, are neither as extreme nor frequent as in the Andaman Sea and together with the wide continental shelf these conditions support important fishing grounds and permit the use of a variety on fishing gears including trawl nets, surrounding nets, gillnets and a variety of smaller gear types.

Traditionally capture fisheries in Thailand first operated in near-shore waters using stationary fishing gears such as bamboo stake traps. In 1925, surrounding nets or purse seines were introduced from China. Subsequently fishing operations evolved from the initial use of two small boats pulling the net from the mother boat, to the use of only a single main boat. At the same time as the fishing technology changed, the size of fishing boats was increased and the means of propulsion changed from the original rowed boats, to sailing boats, and finally motorized vessels. Japanese trawlers with engines were also introduced in the 1930s, but were not readily adopted by Thai fishermen at that time.

During the early development, Thai marine fisheries focused mainly on harvesting pelagic fish and concentrated on development and improvement of fishing gear and methods to increase fishing efficiency. Following the use of purse seines operated by two boats and the change to a single large size fishing boat, the so-called "Thai purse seine/regular purse seine" or "auan-chaloum" has become the dominant technology used by Thai fishers for catching Indo-Pacific mackerel (Phasuk, 1979).

Since the 1930s, aquatic resources have been increasingly harvested to meet the market demand with a resultant decline in stocks. Since the 1950s the Department of Fisheries Thailand (Thai-DoF) has monitored the changes in the status of aquatic species and also the fishing methods used, with the aim of determining appropriate measures for the sustainable use of pelagic species. Various management measures have been promulgated including mesh size regulation, fishing zone delimitation, and establishment of fishing and closed seasons. One of the important measures was the "Gulf Closing" that has been implemented in the Gulf of Thailand to prohibit some fishing activities operating during the spawning and nursing periods. Concurrently, such measures have also been implemented in the Andaman Sea.

This report presents the development of marine fisheries management in the Gulf of Thailand over the past 60 years. During the course of implementation on fisheries management measures, focus has been paid to conserve Indo-Pacific mackerel. Later, other commercially important species have also been included under these measures.

A history of measures implemented

Period One: 1953

No measures were established prior to 1953 for the conservation and management of any marine resources including the Indo-Pacific mackerel (Hongskul, 1975). In 1953 Thai-DoF recognized that the Indo-Pacific mackerel in the GOT had been exploited in substantial quantities, and a Notification of the Ministry of Agriculture and Cooperatives (MOAC), dated 25th August 1953, was issued in order to

Fig. 1. Closed areas in the earlier period

conserve the Indo-Pacific mackerel stock by prohibiting the use of some fishing gear and methods during their spawning period. The prohibition focused on the use of specific types of fishing gear (such as large-scale Chinese purse seine, Thai purse seine etc.) operating in the area of southern Chumphon Province to the southern Gulf of Thailand from the first day of the fourth waning moon to the full moon day of the sixth (Fig. 1). However, in practice fishing vessels continued to operate in the prohibited area during the closed season.

Period Two: 1954-1967

Due to rapid of improvements and development of new fishing gear and methods for catching pelagic fish in the Gulf of Thailand, the pelagic fish catch, particularly Indo-Pacific mackerel, increased. However, from 1957, the catch of Indo-Pacific mackerel started declining. The Thai-DoF established a Technical Committee for Indo-Pacific mackerel Investigation Program to study the causes for the decline, in response to the requests and complaints from fishers.

In 1960, some of the fishers changed their fishing gear to otter-board trawl, which was introduced from Germany. Even though the overall production from pelagic capture fisheries was high during that time, it was found that the quantities of Indo-Pacific mackerel displayed a decreasing trend. Therefore, Notification of MOAC, dated 18th March 1959, was issued to prohibit the use of some fishing gears and practices including the purse-seine and encircling gillnets in the areas identified as spawning grounds of the Indo-Pacific mackerel. Exceptions were given to those who received individual fishing licenses (Phasuk, 1982). In addition, this notification also aimed to obtain catch data of Indo-Pacific mackerel from the fishers, through the use of logbooks provided by the DoF. In practice all fishers applied for licences and none were refused. Consequently fishing effort remained much the same as before.

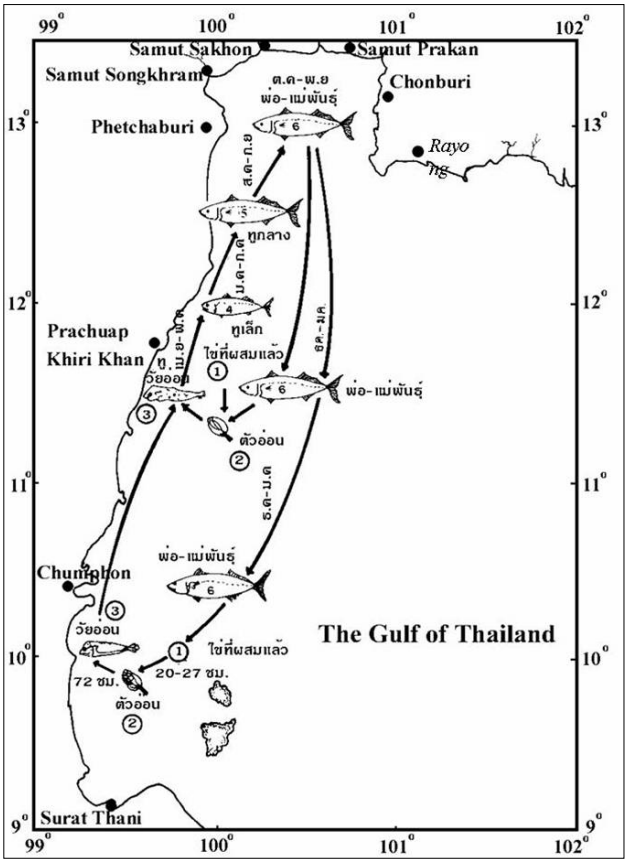

Fig. 2. Life cycle of the Indo-Pacific mackerel in the Gulf of Thailand (Boonprakob, 1974)

In 1962, Notification of the MOAC, dated 8th March 1962, was issued with the aim of defining the spawning duration of Indo-Pacific mackerel and to limit the mesh size in some fishing gear for catching small size Indo-Pacific mackerel. This was due to the heavy exploitation of the small size Indo-Pacific mackerel during the closed season. The closed season was extended for one month and divided into two periods as follows: The first from 15th January to 31st March which was the spawning period of Indo-Pacific mackerel; in this season the use of all types of fishing gear equipped with purse line and encircling gillnets were prohibited. The second from 15th April to 14th June which was the period of juvenile abundance; in this season the use of purse seine and mackerel encircling gillnets of mesh size smaller than 4.7 cm were prohibited. At the same time, Thai-DoF also issued the regulation that any fishers who wanted to engage in any fishing activity must receive individual permission in advance with the obligation to record catch data in the logbook (Phasuk, 1979). However, illegal and un-reported activities during the closed season continued to occur due to the DoF's weak capacity for law enforcement regulations. The life cycle of the Indo-Pacific mackerel in the Gulf of Thailand is shown in Fig. 2.

Period Three: 1968 to 1982

Overcapacity of fishing fleet continued and resulted in a serious problem over this period due to an increase in the number of fishing boats, as well as development and improvement of bottom trawlers in the Gulf of Thailand (Bunyubon and Hongskul, 1978). Modified trawlers for catching Indo-Pacific mackerel were developed and resulted in an increasing quantity of fish being caught by these vessels for many years (Boonprakob, 1974). In 1972, MOAC Notification dated 13th October 1972 was issued to prohibit the use of trawlers in the southern areas (Prachuap Khiri Khan, Chumphon, Surat Thani, and Nakhon Si Thammarat provinces), during the period from 1st February to 31st March. This regulation aimed to prevent trawlers from catching Indo-Pacific mackerel during the spawning period. This was based on the fact that between 17 and 22% of the catch taken from bottom trawlers and pair-trawlers was composed of spawners and juveniles.

The oil crisis in 1973 resulted in changes and modifications to pelagic fishing practices aimed at reducing harvest expenses; these included the use of fish aggregating devices (usually using a bunch of coconut leaves), and use of lights to attract fish (Phasuk, 1979). MOAC Notification dated 7th November 1975 was issued to specify spawning season and prohibit the use of some fishing gear; and also to regulate mesh size. By revising the Notification dated 8th March 1962, the gear

prohibition was extended to include luring purse seine using coconut shelter with/without light. The previously defined closed season was extended by an additional month starting from 15th April to 14th July annually (Phasuk, 1979).

Fisheries statistics for the Gulf of Thailand during 1974 to 1976 showed that Indo-Pacific mackerel juveniles continued to be exploited at a high rate, resulting in reduction of the number of mature individuals. The production of Indo-Pacific mackerel showed its lowest in 1977, when the catch was only half of that of the previous year. In 1977, a peak in the catch of Indian mackerel (*Rastrelliger kanagurta*) was recorded, which exceeded that of Indo-Pacific mackerel for the first time. The increase in Indian mackerel production probably resulted from the increased number of luring purse seine fishing vessels, from 100 in 1973 to 383 in 1977 (Phasuk, 1979).

Due to the shortage of gas in the domestic market, fishers started to lure fish by using lights generated by dynamo-motor, with capacities from 5 to 50 kW. The luring purse seine has become the common fishing practice since 1978 until the present (Sreungcheep, 1997). Over the period from 1979 to 1981, fishers began to use electronic equipments such as echo sounders and sonar for locating fish schools. Since then net hauler or power block had been used to minimize the number of crew during fishing operations.

Over the period from 1953 to 1977, it is recognized that a total of 5 Notifications related to management and conservation of Indo-Pacific mackerel were issued, aimed at protecting both the mature and juvenile stages of the Indo-Pacific mackerel. These notifications revised rules regarding the length of closed seasons, gear prohibition and other regulations that reflected changes in the status of the fishery. Control and enforcement of regulations were major constraints due to insufficient number of officials and surveillance vessels, and non-compliance of fishers in following the regulations (Phasuk, 1979). The fishers modified their gear and equipment in order to make their fishing gear different from those defined in the Notifications (Phusuk *et al*., 1988).

It was found that the area of Prachuap Khiri Khan, Chumphon, and Surat Thani are also important as spawning and nursing grounds not only for the Indo-Pacific mackerel, but also for other aquatic species (Phasuk, 1982). It was obvious that during the years 1977 to 1983 the Thai DoF had attempted to revise the Notification issued in 1975 for effective management of marine capture fisheries, by prohibiting all types of fishing boats in order to protect not only Indo-Pacific mackerel but also other aquatic species (Phusuk *et al*., 1988).

On the basis of the available data and information, the Pelagic Fisheries Investigation Unit of the Marine Fisheries Division, DoF had proposed to control the fisheries during the spawning and nursing period of Indo-Pacific mackerel by moving from closure of the whole area of the Gulf to closure of the specific spawning and nursing grounds for two months from 1st February to 31st March. Under this Notification, dated 13 October 1974, all types of fishing gears and methods were not allowed to operate, except the bamboo stake trap (Phasuk, 1982). The increasing number of trawlers in the Gulf resulted in the status of demersal resources reaching critical levels, since juveniles of both pelagic and demersal resources were in an over-exploited state.

Period 4: 1983 to 1997

During 1983 - 1984, large amounts of juvenile Indo-Pacific mackerel were caught contributing 27-30% to the total catch of mackerel (Srireungcheep, 1997). Therefore, Thai-DoF issued MOAC Notification dated 3rd March 1983, by revising the Notifications dated 19th October 1972 and 7th November 1986. All trawl nets and purse-seine with purse lines were not allowed to operate during the period from 1st February to 31st March (spawning period), and during 1st June to 31st July (nursery and juvenile period) for a total period of 4 months. This Notification was effective from 1st June 1983 to reduce the pressure of trawling and purse-seining on all demersal and pelagic resources especially the Indo-Pacific mackerel. However, this Notification was temporally suspended due to fishers' complaints, and then MOAC issued a Notification dated 6th May 1983 to support the cancellation. After 1984, the bamboo stake trap and encircling gillnet of mesh size larger than 4.7 cm were allowed to operate (Phasuk *et al*., 1988).

Subsequently, MOAC issued Notification dated 28th November 1984 to revise the Notification dated 29th August 1983 by extending the closed season from 2 months to 3 months and again dividing it into two periods: the first phase, spawning period from 15th February to 31st March; the second phase, nursery and juvenile period from 1st April to 15th May of each year. Under this Notification, trawlers and otter board beam trawls were not permitted to operate during daytime and purse seines were prohibited for 45 days from 15th February to 31st March.

From 1980 onwards, the anchovy purse seine fishing fleets developed and expanded rapidly due to market driven demand, and the fishing fleet from the Andaman Sea moved into the Gulf of Thailand in the areas of Surat Thani and Chumphon Provinces. Anchovy fishers, who were affected by the existing measures, requested Thai-DoF to allow them to fish during the spawning period and noted that their fishing practices targeted mainly anchovies and had little by-catch and no effect on other economically important species (letter of complaint dated 2nd February 1984). Later, Surat Thani,

Governor, requested the DoF to consider the proposal of anchovy fisheries and the Thai-DoF agreed to delay the implementation and instead issued a new Notification dated 11th January 1988. Based on this Notification, anchovy purse-seine was allowed to operate only in the daytime during closed season from 15th February 31st March.

The above Notifications reflected the problems of conflict among resource users, especially in Chumphon and Surat Thani Provinces. At the same time, the anchovy purse-seine fleet from the eastern port moved into the western part of the Gulf of Thailand with the use of light luring and small mesh size, which resulted in substantial catches of juveniles and other aquatic resources. Consequently, fishers from Chumphon and Surat Thani provinces requested the government to control the anchovy purse-seine fishery.

At the same time, Thai Fishermen Association submitted a complaint dated 14th April 1989 to DoF not to allow anchovy purse-seine to operate in the closed area and requested DoF to reconsider and repeal the measure for anchovy purse-seine. Together with the results from the Seminar on "Fishermen and Aquatic Animals Conservation" organized in Surat Thani province in December 1989, and the details of the joint meeting among governmental and private representatives on 8th March 1990, all parties agreed to delay the implementation of Notification dated 11th January 1988.

Thai-DoF issued the Order No. 7/2533 dated 3rd January 1990 with regard to appointment of the members of the committee to study and resolve the problems and complaints concerning anchovy fishing. The results showed that the distribution of anchovy eggs and larvae was extensive, covering the area from 1 - 40 nautical miles from shore during January to March. On the basis of this, Thai-DoF issued Notification dated 12nd February 1994, aimed to conserve anchovy resources, and prohibiting the use of some fishing gear that operated during spawning and nursery periods in specific areas. This Notification eventually caused cancellation of the Notification dated 11th January 1988. This also included the prohibition of daytime anchovy fishing during the period from 15th February to 15th May annually. This Notification resulted in the stabilisation of the Indo-Pacific mackerel catch in the Gulf of Thailand at about 90,000 metric tones annually for the next six years (Srireungcheep, 1997). In addition to the problems resulting from anchovy fishing, fishers tried to develop and change their fishing gears and methods to increase fishing efficiency, and to enable them to operate during the closed season. Indo-Pacific mackerel fishers modified their encircling gillnets (of mesh size over 4.7 cm) targeting mature Indo-Pacific mackerel and Indian mackerel by increasing the net length, which was not prohibited by the Notifications. The number of this type of gear increased rapidly (DoF, 1996). In the year 1996, it was found that the catch by using mackerel encircling gillnet from fishing boat of size less than 10 meters was approximately 90 kg/boat/trip. The catch by fishing boats of size 10 -14 m and $>$ 14 m was 1,212 and 1,270 - 1,740 kg/boat/trip, respectively.

Period 5: 1998 to the present

From a study in 1998, it was found that average catch from the mackerel encircling gill net was 941 - 1,367 kg/trip during the prohibited period (in Prachaup Khiri Khan, Chumphon, and Surat Thani areas). More than 80% of the catch was Indo-Pacific mackerel mixed with Indian mackerel, carangids, other hardtail scad, flyingfishes, croakers and ponyfishes. This study found that the total length of individual Indo-Pacific mackerel ranged from 15.19 to 16.20 cm representing completely mature individuals (DoF, 1998). The encircling gill net fishing from February to June 1999 yielded a total fish catch of 6,316 tonnes, estimated as 86,365 mature individuals of Indo-Pacific mackerel. It was further calculated that such numbers of Indo-Pacific mackerel individuals could themselves produce 130,027 million mature individuals (Nakrobru and Saikliang, 2003).

At the same time, other developments were occurring in terms of fishing technology; fishers had improved the push nets by increasing the net size, using longer push sticks and operating with bigger boats and more powerful engines. Such gear is considered as a destructive fishing gear to various types of aquatic resources and benthic habitats. In addition, fishers modified the push net and anchovy purse-seine fishing boats to be used along with casting net, falling net, and lift net equipped with light for catching anchovy. A study from this type of fishing operation found that the catch included large numbers of juveniles of commercially important species. The results from the study on the status of marine fisheries development resulted in MOAC amending the 1984 Notification by issuing Notification dated 24th September 1999 encompassing areas of Prachuap Khiri Khan, Chumphon, and Surat Thani Provinces. The focus of this notification covered the spawning and nursery period from 15th February to 15th May annually, and specified prohibition of certain types of fishing gear as follows:

1. Pair trawl and bottom trawl changed to all types of motorized trawls except trawl net used from a single motorized boat of length less than 16 meters operating at night between sunset and sunrise.

2. Entangling net of mesh size lower than 4.7 cm, changed to entangling gillnet operated with motorized fishing boat for surrounding and entangling Indo-Pacific mackerel or similar method.

3. Surrounding net, the same as before, no revision.

4. Additional, prohibited fishing gears are: cast net, falling net and lift net that used generated electricity for catching anchovy; and push net that used motorized boats of length over 14 meters.

Following the announcement of these measures, various groups of fishers especially the Fishermen's Association of Lang-soun district, Chumphon Province did not accept them as they used mackerel encircling gillnet to catch Indo-Pacific mackerel during the closed season. The Thai-DoF sent an official team to explain the background and rationale of this measure that was issued based on scientific study. It was agreed to postpone implementation of the measures for a year (Notification dated 24th September 1999). During the intervening period, the Notification issued in 1984 was temporally used. In order to solve the problems that may occur in the area, multi-stakeholders committees were established in each province, consisting of representatives from each group of fishing gear users, and relevant governmental officials. Figure 3 shows the present closed areas.

Since then, the DoF proposed to MOAC to issue the Notification dated 10th February 2000 with regard to the prohibition of the use of some types of fishing gear in the area of Prachaup Khiri Khan, Chumphon, and Surat Thani during the closed season

Fig. 3. Present closed areas in the Gulf of Thailand.

(the 2nd edition). The main reason was to temporarily delay the implementation of the Notification dated 24th September 1999, that would be effective from 15th February to 15th May 2000. Consequently, fishers of Lang-soun district demonstrated and disagreed with this Notification. As a result of consultations with fishers on 22nd February 2001, permission was given for a joint scientific study on the use of the following fishing gear:

1. During the first 45 days (15th February to 31st March 2001), permission was given only for: beam trawl or bottom otter board (small trawl) that use only one single motorized boat and operate during the night time; push net and anchovy purse seine that operate during day time; lift net and anchovy cast net which are equipped with electric generator.

2. During the next 45 days (1st April to 15th May 2001), permission was given only for encircling gillnet that use together with motorized boat and use similar fishing method with Indo-Pacific mackerel purse-seine.

It was specified that this study would be carried out in collaboration between DoF, fishers and scientists, through a working committee. Subsequent to that, 23 fishers from Paknam Lang-soun submitted a plea to the Central Administrative Court for revision of the Notification dated 24th September 1999, the Minister of Agriculture and Cooperatives being the primary defendant and Thai-DoF as the co-defendant. The defendants were acquitted by the courts in 2004.

Points to be considered for conservation of aquatic resources in the three provinces

Following the prohibition of the use of mackerel encircling gill net resulting from the Notification dated 24th September 1999 there was a dramatic increase in the numbers of Indo-Pacific mackerel caught by drift gillnetters during 2002 and 2005. The catch composition was mainly medium and large sized Indo-Pacific mackerel, approximately 10 -15 and 8 - 10 individuals/kg, respectively. In addition, various demersal fish was also caught, e.g. red snapper, big eyes, lizard fishes, and wolf herring.

At the same time, some of fisher groups improved the fishing technique of drift gillnet fishing gear (targeting Indo-Pacific mackerel) by increasing the net depth from 50 - 80 meshes to 200 - 300 meshes. Fishing methods were also changed from nets setup straight, to nets set in circles and in zigzag manner. This type of gear was called "Auon-short" (gillnet). In 2005, the results from the follow-up study indicated that the catch rate of this gill net, operated using long-tail boats and inboard engine boats of length less than 10 m, was

approximately 60 – 100 kg/day/boat, of which 85% was Indo-Pacific mackerel. The catch rate for those short nets operated by boat size over 10 m averaged 800 kg/day/boat, of which 77.49% was Indo-Pacific mackerel. It was also found that 75 - 98% of both males and females were fully mature.

Since these fishing gears are newly developed with high efficiency and mainly target large sized Indo-Pacific mackerel, the DoF is now considering appropriate measures to conserve the Indo-Pacific mackerel.

Conclusion

During the past 56 years (1953 - 2008), the Thai- DoF issued a total of 13 Notifications (specific management measures) relating to closures of fishing area in the Gulf of Thailand with the aim of conserving spawning and nursery stages of aquatic resources. The measures for conserving Indo-Pacific mackerel were used as the basis for the formulation and development of the other fishery resources in the same areas. Cancellation and revision of these measures were made from time to time in accordance with the change in status of the fisheries resources and the development of fishing practices with an attempt to effectively manage aquatic resources for sustainable fisheries.

References

Boonprakob U. 1974. Conclusion of Indo-Pacific mackerel's dynamic in the Gulf of Thailand for conservation on Indo-Pacific Mackerel. *Technical paper, Pelagic Fish Conservation Unit during 1967-1972* part 1. Survey and Research Division, Department of Fisheries. p. 203-231.

Bunyubon M. and V. Hongskhun. 1978. Conclusion of fishery situation, Demersal fish in the Gulf of Thailand in 1961-1975. *Demersal fish research No. 1/1981*. Marine fisheries Division, Department of Fisheries. p. 1-6.

Charyakul R. 1994. Spawning ground and spawning season of *Stolephorus heteroloba* (Ruppell) in Prachaup Khiri Khan, Chumphon and Surat Thani provinces. *Tech. pap. No.25/1994.* Upper Gulf Marine Fisheries Research and Development Center, Department of Fisheries. 256 pp.

Department of Fisheries. 1996. Summary of technical procedures on marine resource conservation at protected area Prachaup Khiri Khan, Chumphon and Surat Thani provinces in 1996. Particular of marine resource conservation during spawning period and habitat center in 1996.

Department of Fisheries. 1998. Summary of technical procedures on marine resource conservation at protected area Prachaup Khiri Khan, Chumphon and Surat Thani provinces in 1998. Particular of marine resource conservation during spawning period and habitat center in 1998.

Hongskul V. 1975. Marine Fisheries in Thailand. A Paper Present to the 1st Administered Seminar (Fisheries Development), Fish Market Organisation. p. 1-17.

Hongskul V. 1990. Anchovy fisheries problems. *Thai Fish. Gaz.* 43(5):349-353.

Nakrobru C. and P. Saikliang. 2003. The effect of Mackerel Encircling Gill Net Fishery of Indo-Pacific Mackerel parent stock in protected area, Prachuap Khiri Khan, Chumphon and Surat Thani provinces. *Tech. pap.* No. 14/2003. Marine Fisheries Division, Department of Fisheries. 35 pp.

Phasuk B. 1979. Situation of pelagic fishery in the Gulf of Thailand. *Thai Fish. Gaz.* 32(1): 27-50.

Phasuk, B. 1982. Pelagic fishery management in the Gulf of Thailand. *Technical paper No. 29/1982.* Pelagic Fisheries Section. Marine Fisheries Division, Department of Fisheries. 21 pp.

Phasuk B. M. Bunyubon, C. Vibhasiri, U. Sriruangcheep and C. Tantisawetrat.1988. Effective of fisheries resource enhancement on closed period in Prachaup Khiri Khan, Chumphon, Surat Thani and Khanom district, Nakhon Si Thammarat provinces. *Thai Fish. Gaz.* 41(3): 183-196.

Srireungcheep U. 1997. Changes in size composition of Rastrelliger neglectus (van Kamphen, 1907) caught from the Gulf of Thailand during 1968-1994. *Tech. pap.* No. 2/1997. Marine Fisheries Division, Department of Fisheries. 63 pp.

Sukhavisdh P. 1996. Checklist of Marine Fishes of Thailand. *Tech. pap.* No. 2/1996. Marine Resources Surveys Section, Bangkok Marine Fisheries Development Center, Marine Fisheries Division, Department of Fisheries. 120 pp.