



Baseline surveys in PrachuapKhiri Khan and Chumphon Provinces

“Strategies for Trawl Fisheries Bycatch Management”

(REBYC-II CTI; GCP/RAS/269/GFF)

Pavarot Noranarttragoon

2015

¹ Project Technical Document
² PhD Senior Fisheries Biologist
Department of Fisheries

1. Introduction

PrachuapKhiri Khan and Chumphon Province are located in the upper part of the western Gulf of Thailand. PrachuapKhiri Khan Province adjoins Republic of the Union of Myanmar in the west, Phetchaburi Province in the north and Chumphon in the south. There are 23 islands in the province waters; however, all islands are smaller than one km² except Talu Island which is 1.18 km². The land area is approximately 6,368 km² and the island area 3.23 km². The coast line is about 225 km. All eight districts open to the Gulf of Thailand (Fig. 1).



Figure 1. PrachuapKhiri Khan Province with the districts (Amphoe) numbered
1) MueangPrachuapKhiri Khan, 2) KuiBuri, 3) Thap Sakae, 4) Bang Saphan,
5) Bang SaphanNoi, 6) PranBuri, 7) HuaHin and 8) Sam RoiYot

Source: http://en.wikipedia.org/wiki/Prachuap_Khiri_Khan_Province

Chumphon Province adjoins Republic of the Union of Myanmar in the northwest, Ranong Province in the west and SuratThani Province in the south. There are 54 islands in the province waters. Only two of them are larger than one km². The land area is roughly 6,011 km² and the island area is 7.27 km². The coast line is about 222 km. Six of eight districts open to the Gulf of Thailand (Fig. 2).



Figure 2. Chumphon Province with the districts (Amphoe) numbered
 1) Mueang Chumphon, 2) Tha Sae, 3) Pathio, 4) Lang Suan, 5) Lamae,
 6) Phato, 7) Sawi and 8) Thung Tako.

Source: http://en.wikipedia.org/wiki/Chumphon_Province.

The upper part of the western Gulf of Thailand is the most productivity in terms of capture fisheries production. The areas of catch statistical data in the Gulf of Thailand are divided into five areas (Fig 3). Area 3, the locality of Prachuap Khiri Khan, Chumphon and Surat Thani Province, contributed the highest production and value. In 2013, the catch of Area 3 was

120,943 tons, while the catch of the Gulf of Thailand was 1,280,489 tons, accounted for 9.44% of the Gulf of Thailand's production.

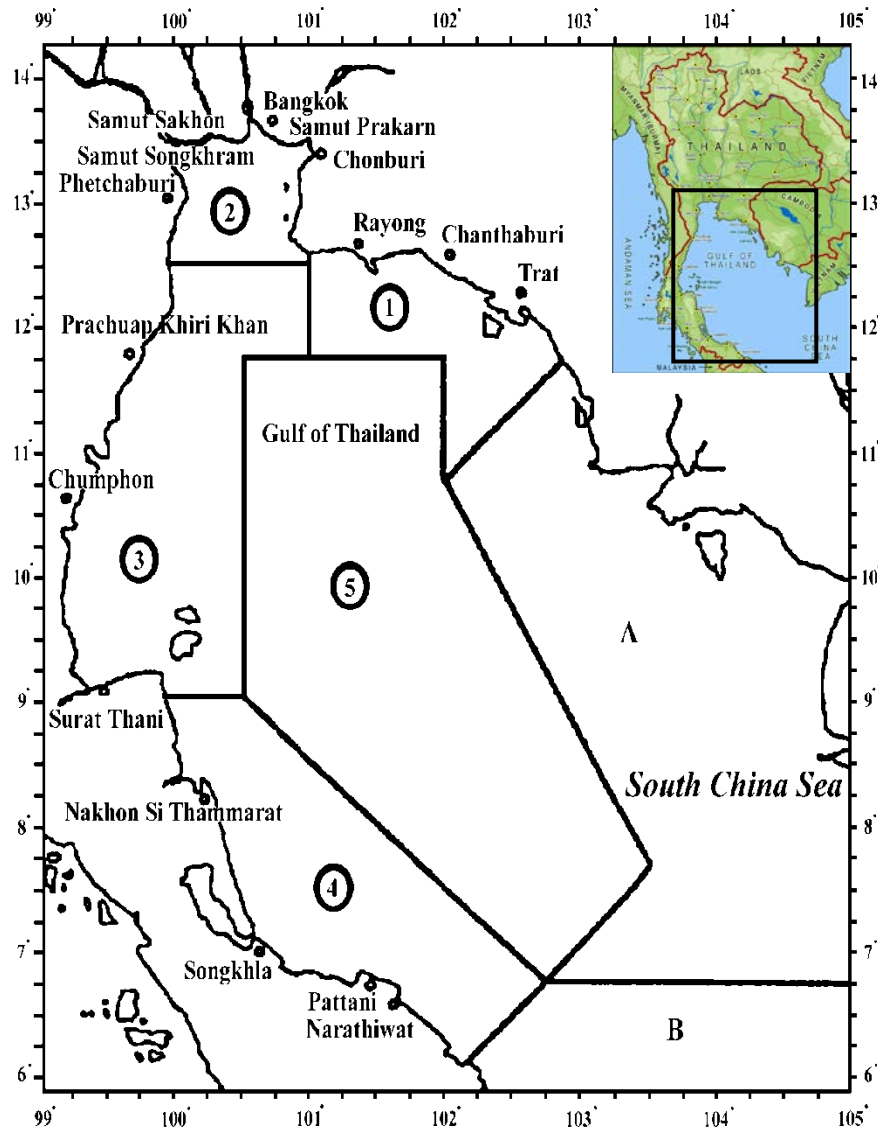


Figure 3. Statistical areas of catch data in the Gulf of Thailand.

Moreover, there is a well-known and most important fisheries management measure implemented in Area 3. Declared since 1984, an area of approximately 26,400 km² in the locality of Prachuap Khiri Khan, Chumphon and Surat Thani Provinces has been prohibited in order to protect the important and valuable species as well as for the fertility and sustainable utilization of those species during their spawning season extending from 15 February to 15 May every year. Most high efficiency and destructive fishing gear are not allowed in the said area and period (CHARM, 2005). The regulation was amended several times due to the fishers had adapted their fishing gear to avoid the regulation. The last amended has been issued since 2007.

The last survey on number of fishers and fishery establishments in Thailand was held on 2000. In PrachuapKhiri Khan Province, the number of marine capture fishery establishments was added up to 1,448 establishments making up 3.90% of the establishment along the Gulf of Thailand whereas the number of fishers during peak season was counted to 4,579 fishers calculated to 3.80% of the fisher along the Gulf of Thailand. Likewise, in Chumphon Province, the number of fishery establishments and number of fishers is moderately higher than PrachuapKhiri Khan, 2,275 establishments and 7,895 fishers estimated to 6.13% and 6.55% of the establishments and fishers in the Gulf of Thailand (Table 1; DOF, 2013).

Table 1. Number of marine capture fishery establishments and fishers during peak season in PrachuapKhiri Khan and Chumphon Province

	Number of fishery establishments		Number of fisher	
Gulf of Thailand	37,098	100.00%	120,603	100.00%
PrachuapKhiri Khan	1,448	3.90%	4,579	3.80%
Chumphon	2,275	6.13%	7,895	6.55%

2. Trawl fisheries in the upper western Gulf of Thailand

Trawl fishing in the Gulf of Thailand is classified into three kinds; otter board trawl (including otter with boom-trawl), pair trawl and beam trawl. Among these, otter board trawl is the most widely operated gear in Thailand. These kinds of fishing gear are to use a bag-linked net operated with a motorized boat to pull the net during operation. The principle of these types of catching are to use the boat to pull the net that looks like a bag to move forward and to catch the fish that swimming at the same level of the mouth opening of the net. Fish get caught and further accumulated into the cod end of the net. Fishers haul the cod end after finishing their operations and open the cod end to collect fish on board.

During trawling operation, the mouth of the trawl net is widely expanded by three methods:

- a) by two otter boards at mouth of the net to widely expand the mouth of net (otter board trawl; Fig. 4).
- b) by two boats that operate together and keep a constant distance and speed between one and another all the time (pair trawl; Fig. 5).
- c) by using a pair of beams to widely expand the mouth of the net (beam trawl; Fig. 6)

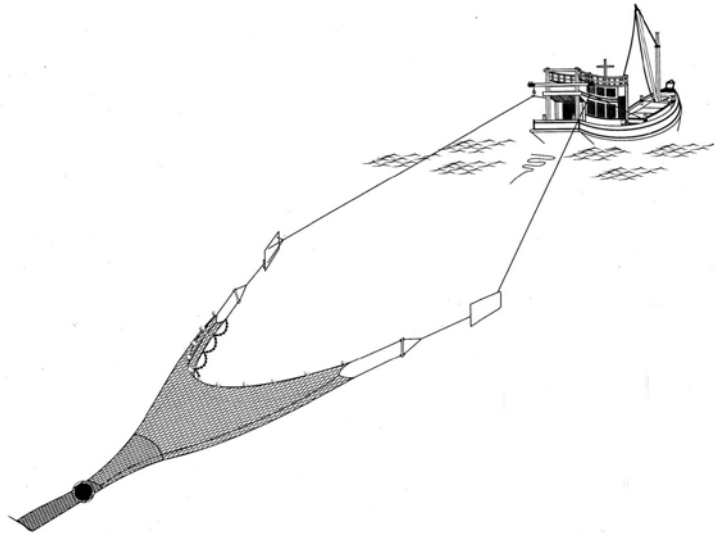


Figure 4.Otter board trawl
Adapted from SEAFDEC (2004)

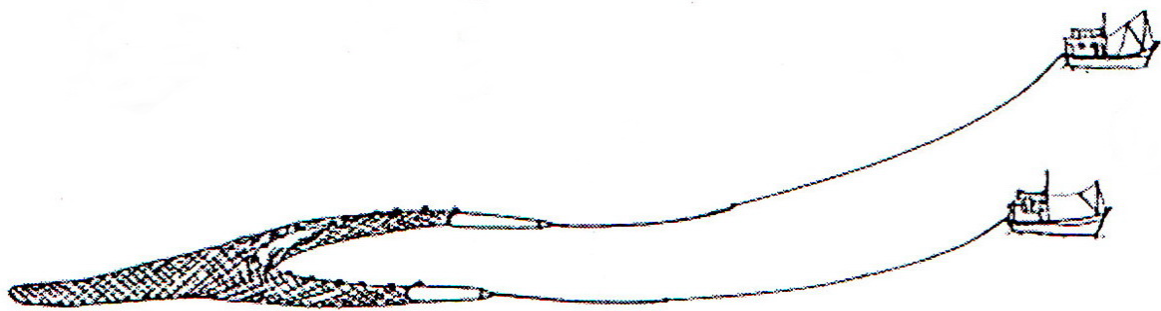


Figure 5.Pair trawl
Adapted from SEAFDEC (2004)

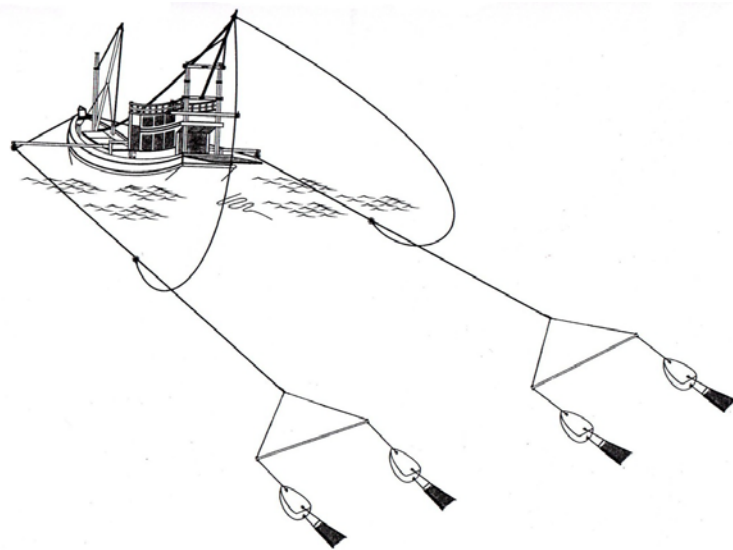


Figure 6.Beam trawl
Adapted from SEAFDEC (2004)

Otter board trawl (OBT) can be operated both day and night time. Because of low capacity of engine power, small-sized OBT, which overall length is less than 14 m, normally operated at night targeting shrimps. Larger OBT is usually operated at daytime and target fishes and squids due to it can generate high trawling speed. The cod-end mesh size of fish OBT is generally 2.5 cm while of shrimp OBT is smaller. Whereas pair trawl is performed during day and night time. The cod-end mesh size is 2.5 cm. However, cod-end mesh size of pair trawl targeting anchovies, particularly in the upper Gulf of Thailand, has been modified to be 1.3-1.9 cm.

The catch of trawls is sorted by species or group and selected the size on board, and is divided into 2 main clusters, economic fish and trash fish. Economic fishes are sorted by species, genus, family or group, e.g., short mackerel, threadfin breams (*Nemipteridae*), and lizardfishes (*Synodontidae*), etc., which is the same size. Those fish are kept in the trays (wooden or plastic rectangle storage, 35-36 x 51-53 x 9-14 cm in width, length and height respectively) in order to be convenient for selling and transferring to fish market. Ice is used for keeping the fish fresh by pouring it on the fish in each tray. The trays are layered in the storage room. When the storage room is full, ice is poured on the top before closing the room. On the other hand, trash fish, which may consist of juvenile economic fish, such as mackerel, threadfin bream, bigeye and true trash fish, such as, *Siganus* spp., *Leiognathus* spp., and cardinal fish, are sorted out from economic fish and kept non-punctiliously. Most of them are also put in the trays with less ice.

Catch of marine production is mainly harvested by trawls. In 2010, the total catch in the Gulf of Thailand was 1,027,898 tons which were caught by trawls, i.e., otter board trawl, pair trawl and beam trawl, 528,090 tons made up more than one half of total catch in the Gulf of Thailand (Table 2; DOF, 2012). More than one thirds of the total catch was produced from OBT and 16% of the total catch was harvested from pair trawl. In addition, the total catch in Area 3 was xxx ton while the catch of trawlers was xxx tons made up xx% of the total catch in the area.

Table 2 Marine catch (metric tons) in the Gulf of Thailand, 2010

	Gulf of Thailand(mt)	%	Area 3(mt)	%
Total catch	1,027,898	100.00		
Trawl catch	528,090	51.38		
Otter board trawl	360,637	35.09	59,261	
Pair trawl	166,351	16.18	86,430	
Beam trawl	1,102	0.11	507	

Source: DOF, 2012

Table 3 shows the catch per unit effort of trawls in the Gulf of Thailand and Area 3. It is not surprised that CPUE of OBT in Area 3 was fewer than the average CPUE in the Gulf of Thailand. Although there is a closed area measure in the central Gulf of Thailand, OBT which the overall length is less than 16 m can be operated during nighttime. Consequently, the CPUE of OBT less than 14 m and 14-18 m was only one half of the average CPUE in the Gulf

of Thailand. While pair trawl is prohibited according to the measure; therefore, CPUE of pair trawl can be kept up in the similar level of the average CPUE.

Table 3. Fishing effort, catch and CPUE of trawls in the Gulf of Thailand, 2010.

Fishing Gear	Fishing effort(hours)		Catch (tons)		CPUE (kg/hour)	
	Gulf of Thailand	Area 3	Gulf of Thailand	Area 3	Gulf of Thailand	Area 3
Otter board trawl	10,060,678	1,516,565	596,689	59,261	59.31	39.08
OBT less than 14 m length	2,402,203	268,220	75,140	4,226	31.28	15.76
OBT 14-18 m length	3,994,035	753,293	194,631	16,821	48.73	22.33
OBT 18-25 m length	3,321,138	495,052	258,057	38,214	77.70	77.19
Pair trawl	1,602,153	585,288	212,097	86,430	132.38	147.67
PT less than 18 m length	374,817	58,910	36,944	5,193	98.57	88.15
PT over 18 m length	1,227,336	526,378	175,153	81,237	142.71	154.33

Source: DOF, 2012.

3. Number of fishing boats

Since 1990, the number of fishing boat registered by trawlers in the Gulf of Thailand has shown a decreasing trend (Fig. 7). The total number of trawlers in 1990 was 10,661 boats; then, it dropped to 2,922 boats in 2011. Recently, OBT is the main type of trawler used in Thailand accounted for 65-70% of the total trawls' number. The number of pair trawl also showed a reduction trend and reported at 966 boats in 2011. On the other hand, beam trawl showed only few percentages. In 2011, the total number of trawlers in PrachuapKhiri Khan and Chumphon Province was 188 boats making up 6.43% of the total number in the Gulf of Thailand.

In PrachuapKhiri Khan Province, the number of registered trawlers presented the highest number in 1991 at 159 boats (Fig. 8). Then, the reduction in number has been observed. The last reported data showed that the number of trawlers was 22 boats in 2011 including 20 OBT and 2 pair trawl. Whereas the number of pair trawl was very less documented two boats in the last two reported years. Beam trawl was rarely found and had not registered during the last seven years in PrachuapKhiri Khan Province.

OBT was the main type of trawlers in Chumphon Province. However, the number of OBT had fluctuated during 1990-2005 at 105-511 boats (Fig. 9). After that, the number of OBT has continuously decreased to 159 boats on the last recorded year. In addition, very little number of pair trawl has been registered. Only two pair trawl was recorded in 2011. Moreover, beam trawl had not registered in the recent years.

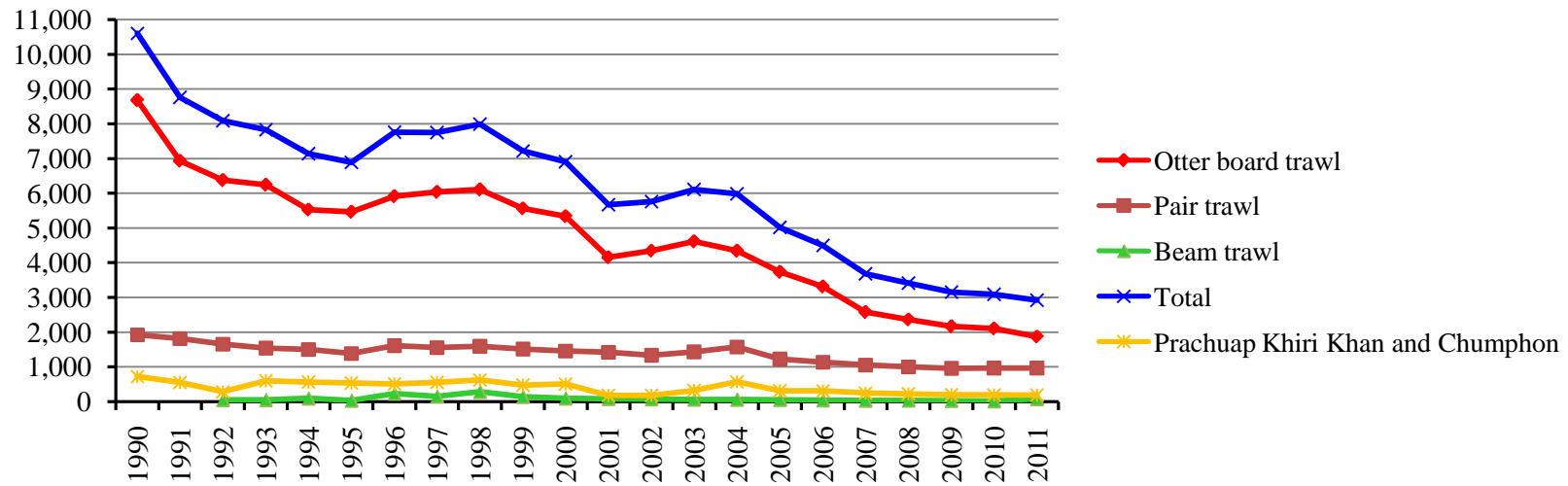


Figure 7.Number of fishing boat registered by trawlers in the Gulf of Thailand during 1990-2011.

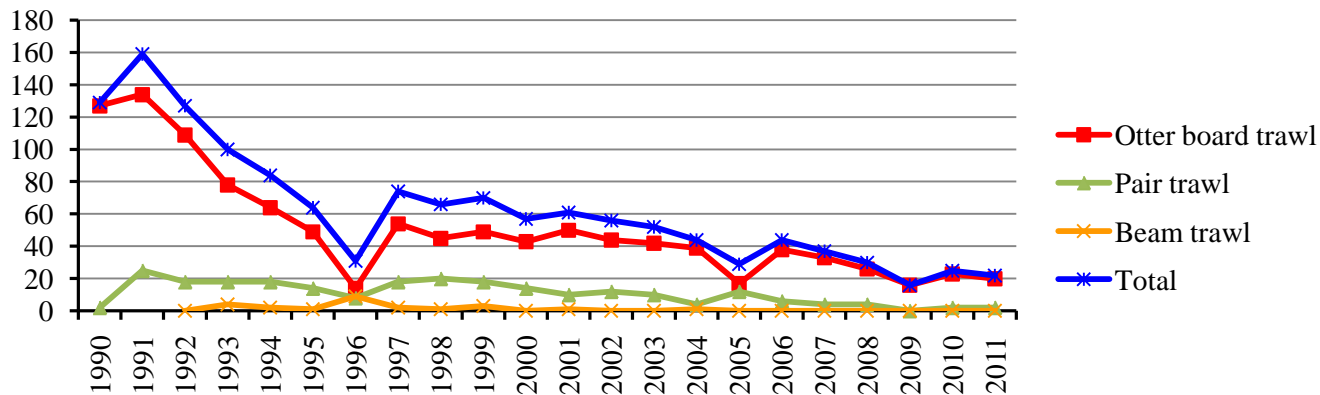


Figure 8. Number of fishing boat registered by trawls in PrachuapKhiri Khan Province during 1990-2011.

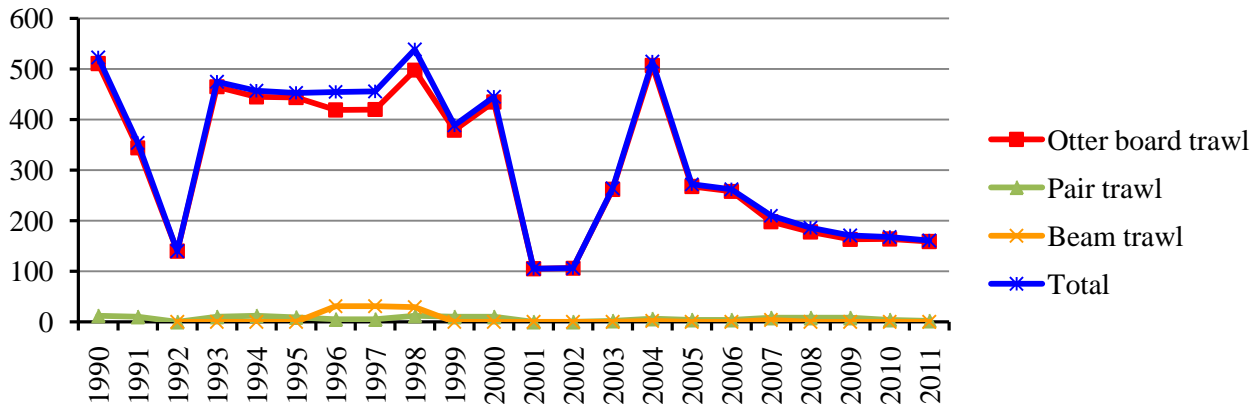


Figure 9. Number of fishing boat registered by trawls in Chumphon Province during 1990-2011.

4. Fisheries resources status

Chuapun (2006) examined the catch rate and composition of small-sized OBT, medium-sized OBT and pair trawl in the prohibited are of PrachuabKhiri Khan, Chunphon and SuratThani in 1998. The results found that CPUE was 38.33, 22.00 and 354.51 kg/hr respectively and trash fish made up 72% for small-sized OBT and 47% for medium-sized OBT and pair trawl.

Chuapunet *al.* (2008) surveyed fisheries resources by DOF research vessel using otter board trawl in the Gulf of Thailand and Andaman Sea. The trawling station in Gulf of Thailand has been divided into nine areas (Fig. 10). The CPUE of trash fish demonstrated that it was mainly caught in Area 4-6 which are the localities of PrachuapKhiri Khan and Chumphon Province. The total CPUE of trash fish in the Gulf of Thailand ranged from 24.819-30.987 kg/hr while it varied from 14.223-20.378 kg/hr in Area 4-6 (Table 4). As a result, the CPUE of trash fish in Area 4-6 accounted for 57.31%-75.89% of the Gulf's CPUE.

Table 4. CPUE of trash fish (kg/hr) in the Gulf of Thailand surveyed by DOF research vessel in 2003-2005

Year	Gulf of Thailand (Area 1-9)	Area 4-6	%
2003	30.987	20.206	65.21
2004	26.853	20.378	75.89
2005	24.819	14.223	57.31

Source: Chuapunet *al.* (2008)

Phoonsawat (2000) collected the fisheries resources and economic data from small-sized OBT at HuaHin and PranBuri fishing port, PrachuapKhiri Khan Province, and reported that the ration of economic fish and trash fish was 61:39. Economic loss, which was arisen from juvenile economic species caught as trash fish, was estimated by comparing the value of juvenile economic species (sold as trash fish) and their marketable size. The result presented that economic loss was 74,458.78 Baht/boat/year. In addition, the annual income was less than the annual fishing cost; as a result, a minus profit of 25,139 Baht/boat/year was given to the fishers.

Phoonsawat (2005) studied demersal fish resources caught by small-sized OBT at PranBuri District, PrachuapKhiri Khan Province, and found that the CPUE declined from 21.949 kg/hr in 1997 to 20.122 kg/hr in 2002. Shrimps were the main target species estimated at 52% of the total catch. However, size of targeted shrimp, *Trachypenaeusmalaianus*, decreased from 6.26 cm to 5.84 cm for male and 7.25 cm to 6.14 cm for female compared between 1995-1997 and 2002. In addition, one third of the total catch was trash fish including sub-adult economic fish and true trash fish.

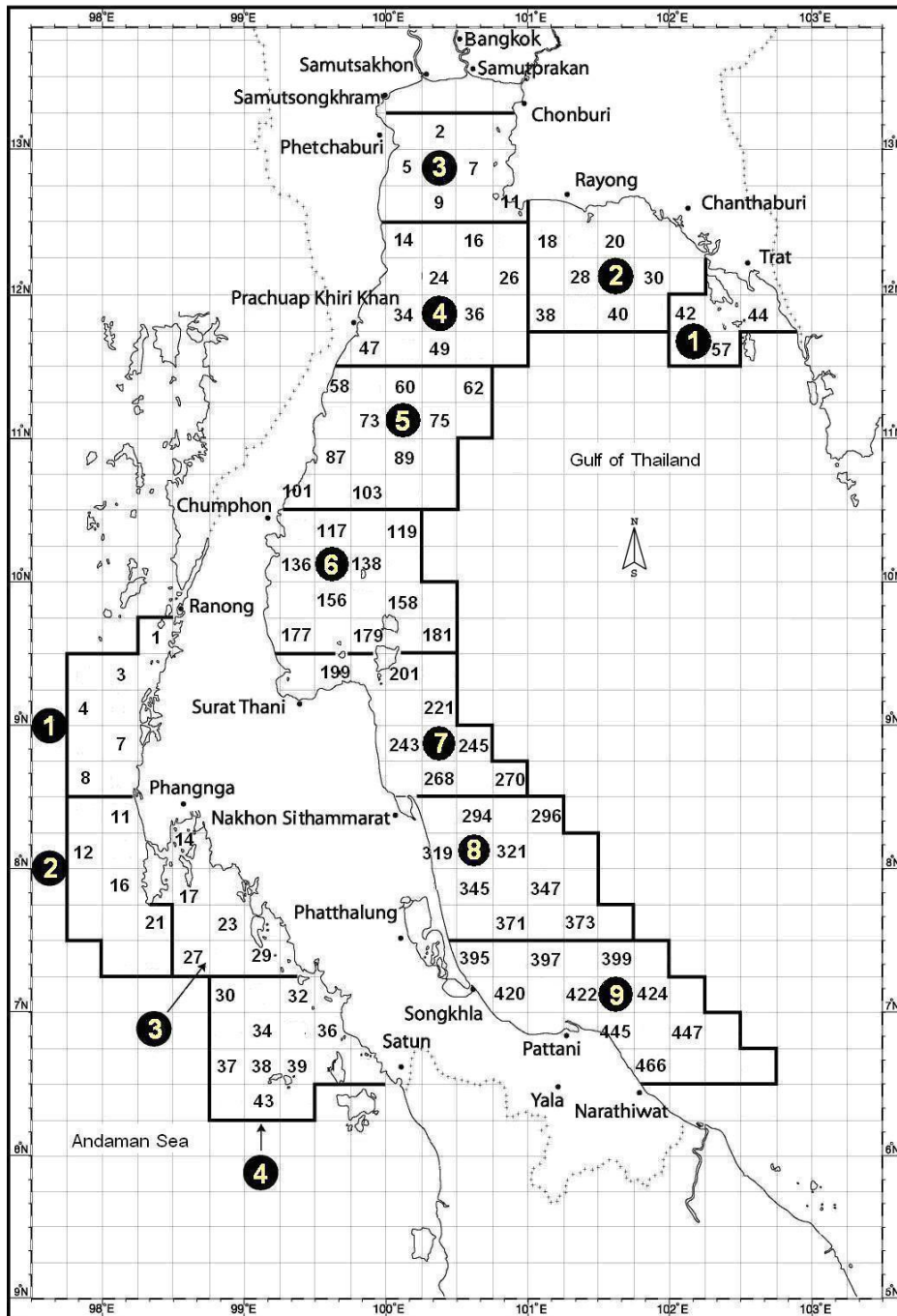


Figure10. Survey station of DOF research vessels in the Gulf of Thailand and Andaman Sea
Source: Chuapunet *al.* (2008).

Although the number of fishing boats registered by trawls in the Gulf of Thailand, including PrachuapKhiri Khan and Chumphon Province, has decreased since 1990, fishing efforts need to be reduced. Several technical paper disclosed that current fishing effort was over MSY and MEY (Table 5). For instance, the fishing effort of lizardfishes, *Sauridaelongata* and *S. undosquamis*, should be reduced by 80%.

Table 5. Scientific advices on reduction of fishing effort of some fish stocks in the Gulf of Thailand

Stock	Fleet	Reduce by	Reference
<i>Priacanthustayenus</i>	OBT1	20%	Kongpromet <i>al.</i> , 2010
	OBT2	30%	
	PT	40%	
<i>Sauridaelongata</i> and <i>S. undosquamis</i>	OBT1	80%	Sinanunet <i>al.</i> , 2012
	OBT2	80%	
	PT	80%	

Mean length of some target species of trawls caught in the Gulf of Thailand was smaller than size at first maturity. Mean length of purple-spotted bigeye, *Priacanthustayenus*, was larger than the size at first maturity only few months in the studied year. Moreover, most of them were smaller than the smallest maturity size. Besides, mean length of lizardfishes, *Sauridaelongata* and *S. undosquamis*, caught by all kind of trawls was smaller than the size at first maturity across the studied year. Squids also showed the same consequence that the mean length was smaller than the size at first maturity (Table 6). It is very important to note that this situation leads to recruitment overfishing which the spawning stock has come down to a very low level (FAO, 1992).

In addition, mean length of some economically important species caught by trawls in the Upper West Gulf of Thailand was presented by Kongpromet *al.* (2007). Certainly, mean length of economic in trash fish was all smaller than the size at first maturity (Table 7). Furthermore, mean lengths of food fish caught by small-sized OBT were totally smaller than the size at first maturity, although, mean lengths of few species caught by medium-sized OBT and pair trawl were larger than the size at first maturity.

Table 6. Monthly mean lengths (cm) of some target species of trawls caught in the Gulf of Thailand compared to size at first maturity

Month	<i>Priacanthustayenus</i> ¹			<i>Sauridaelongata</i> ²			<i>S. undosquamis</i> ²			<i>Photololigochinensis</i> ³			<i>P. duvaucelii</i> ³		
	OBT1	OBT2	PT	OBT1	OBT2	PT	OBT1	OBT2	PT	OBT1	OBT2	PT	OBT1	OBT2	PT
January	14.82	16.69	11.01	14.35	16.80	16.93	11.30	10.83	12.26	17.96	13.37	12.98	11.15	8.86	9.39
February	9.83	8.83	9.87	10.18	8.98	13.35	8.82	9.24	12.74	16.13	15.83	12.07	15.43	10.11	8.94
March	10.21	11.40	12.38	11.28	17.75	10.95	8.23	8.84	10.28	16.41	11.92	10.78	9.36	10.56	10.63
April	8.76	14.85	9.92	11.59	11.52	10.38	12.18	10.10	12.23	10.77	11.01	12.72	10.60	9.90	8.17
May	11.88	11.37	11.62	14.38	10.13	10.78	13.15	13.89	10.97	13.92	15.67	13.15	9.04	9.18	8.83
June	11.72	14.35	10.56	15.23	15.51	8.83	12.41	15.17	11.68	16.38	15.95	13.10	8.13	11.72	8.83
July	12.93	14.32	12.63	11.55	19.73	11.80	12.37	13.28	12.10	12.95	14.04	12.85	8.83	8.27	8.89
August	15.04	18.55	8.14	12.87	6.79	12.10	16.27	20.06	13.12	14.61	12.29	14.53	10.20	9.69	10.66
September	12.42	12.06	8.30	12.33	9.12	11.82	12.24	13.14	14.16	10.90	14.91	12.42	8.66	9.16	9.44
October	10.18	11.51	10.94	11.04	10.80	11.54	9.78	20.09	13.18	16.87	17.99	14.39	7.77	7.70	9.93
November	10.49	10.94	15.27	11.12	27.84	10.53	12.75	11.49	11.01	16.43	16.18	16.28	8.99	10.23	9.43
December	8.85	13.96	9.74	15.00	11.96	13.20	14.60	11.15	9.39	7.13	15.41	15.05	8.86	8.76	6.95
Total	11.21	11.72	9.93	11.61	9.67	11.10	10.24	11.20	11.25	12.98	14.00	13.01	9.33	9.57	9.17
Size at first maturity	F = 14.19 ⁴			F = 31.62 ⁵ M = 25.15			F = 28.26 ⁶ M = 20.48			F = 17.71 ⁷ M = 21.50			F = 9.04 ⁷ M = 13.89		
Smallest maturity size (cm)	13.10			15.75			15.75			7.30			6.00		

Remarks: 1 Kongpromet *al.*, 2010a
2 Sinanunet *al.*, 2012
3 Kongpromet *al.*, 2010b
4 Krajangdara and Yakoh, 2005
5 Vibunpantet *al.*, 2012
6 Vibunpantet *al.*, 2011
7 Suppanirunet *al.* 2011

Table 7. Mean length and female size at first maturity (cm) of some economic fish caught by trawls in the Upper West Gulf of Thailand during November 2003 to September 2005

Species	Small-sized OBT		Medium-sized OBT		Pair trawl		Female size at first maturity
	Food fish	Trash fish	Food fish	Trash fish	Food fish	Trash fish	
<i>Nemipterushexodon</i>	9.56	4.91	17.78	-	18.67	7.23	14.57 ¹
<i>Sauridaelongata</i>	18.02	8.34	22.54	6.83	19.67	9.88	31.62 ²
<i>S. undosquamis</i>	20.03	6.38	19.71	8.00	17.46	9.73	28.26 ³
<i>Priacanthustayenus</i>	9.93	8.75	15.69	11.42	16.23	7.95	14.19 ⁴
<i>Sepia aculeata</i>	7.96	3.02	-	-	10.77	4.92	9.44 ⁵
<i>Metapenaeusaffinis</i>	6.68	-	12.69	-	-	-	12.18 ⁶
<i>M. ensis</i>	8.62	-	11.88	-	-	-	11.24 ⁷

Source: Kongpromet *al.*, 2007

Remarks: ¹Pinuttasinet *al.*, 2008

²Vibunpantet *al.*, 2012

³Vibunpantet *al.*, 2011

⁴Krajangdara and Yakoh, 2005

⁵Charoensombatet *al.*, 2013

⁶Sritakonnet *al.*, 2012

⁷Pinuttasinet *al.*, 2012

5. Experiment on enlargement of cod-end mesh size

Cod-end mesh sizes of trawl net have been considered that they are too small. Aquatic animals have therefore been harvested before they should be getting caught. That means the fish size is smaller than marketable size or maturity size. As a result, they cannot lay their egg to supplement new recruitment to the fisheries.

Experiments on enlargement of cod-end mesh size have been conducted more than 30 years ago. The first experiment was carried out by Marine Fisheries Division, DOF in 1982. Four size of cod-end mesh of shrimp trawl was selected, i.e., 30, 40, 50, and 60 mm, in the experiment off Songkhla Province. The result was roughly given that the amount of catch reversed variation with the enlarged mesh size. In other words, enlargement of each mesh size would reduce the catch amount. On the other hand, the optimum mesh size could not be summarized because there are two groups of economic shrimp viz. large shrimp, for example, giant tiger prawn and banana prawn, and small shrimp which the maximum size is not more than 10 cm, for example, *Metapenaeopsis* spp. and *Trachypenaeus* spp. (Bramhmasakha Na Sakolnagara, 1983 cited in Bramhmasakha Na Sakolnagara and Lohsawaskul, 1986).

5. Conclusion

Although the number of fishing boats registered by trawls has continuously decreased during last decades, the demersal fish stocks are in declining state. Closed area in the Upper Western Gulf of Thailand, including PrachuapKhiri Khan and Chumphon Province, has been effective almost 30 years. However, it seems that it is not sufficient to sustain fisheries resources. Several issues demonstrating the decadence of fisheries resources have been discussed. Huge amount of trash fish, overfishing, lower CPUE and sub-adult economic fish being caught are all sign that management actions are needed. Enlargement of cod-end mesh size is a possible management measure to restore the resources and to ensure sustainable fisheries in the country.

6. References

- Bramhmasakha Na Sakolnagara, W. and Lohsawaskul, S. 1986. *The optimum mesh size of codend for shrimp trawl in Thailand*. Technical Paper no. 2/1986. Bangkok: Marine Fisheries Division, DOF.
- Charoensombat, B., Khrueniam, U., Khongchai, T., Jindalikit, J. and Singharachai, C. 2013. *Reproductive biology of cuttlefish (Sepia aculeata and S. recurvirostra) in the Gulf of Thailand*. Technical Paper no. 1/2013. Bangkok: MFRDB, DOF.
- Chuapun, K. 2006. *Catch and composition of marine fauna from trawl fisheries in prohibited area, PrachuapKhiri Khan, Chumphon, and SuratThani province in 1998*. Technical Paper no. 23/2006. Bangkok: MFRDB, DOF.
- Chuapun, K., Sinanun, P., Sanitmajjaro, W., Hoimuk, S., Augsonpaob, U. and Chimkaew, W. 2008. *Marine resources in the Gulf of Thailand and Andaman Sea from research vessel during 2003-2005*. Technical Paper no. 2/2008. Bangkok: MFRDB, DOF.
- Coastal Habitats and Resources Management Project (CHARM). 2005. *Thai fishery laws*. Bangkok: CHARM, DOF.
- DOF. 2012. *The marine fisheries statistics 2010 base on the sample survey*. Document no. 15/2012. Bangkok: Information Technology Center, DOF.
- DOF. 2013. *Fisheries statistics of Thailand 2011*. Document no. 11/2013. Bangkok: Information Technology Center, DOF.
- FAO. 1992. *Introduction to tropical fish stock assessment. Part I – Manual*. FAO Fisheries Technical Paper 306/1 Rev. 1. Rome: FAO.
- http://en.wikipedia.org/wiki/Chumphon_Province Retrieved on 21 January 2014.
- http://en.wikipedia.org/wiki/Prachuap_Khiri_Khan_Province Retrieved on 21 January 2014.
- Kongprom, A., Phoonsawat, R., Tossapornpitakkul, S., Augsonpa-ob, U., Hoimuk, S., Loychuen, K, Sumontha, M. and Sripanpaibool, S. 2007. *Status of marine resources*

- from commercial trawlers in the Gulf of Thailand and Andaman Sea.* Technical Paper no. 8/2007. Bangkok: MFRDB, DOF.
- Kongprom, A., Chuapun, K., Augsornpa-ob, U., Sinanun, T., Khongchai, N., Phoonsawat, R. 2010a. *Stock Assessment of Purple-Spotted Bigeye (Priacanthustayenus Richardson, 1846) in the Gulf of Thailand.* Technical Paper no. 4/2010. Bangkok: MFRDB, DOF.
- Kongprom, A., Kulanujaree, N., Augsornpa-ob, U., Thongsila, K. 2010b. *Stock Assessment of Mitre Squid (Photololigo chinensis) and Indian Squid (P. duvaucelii) in the Gulf of Thailand.* Technical Paper no. 11/2010. Bangkok: MFRDB, DOF.
- Krajangdara, T. and Yakoh, A. 2005. *Reproductive biology of bigeye, Priacanthustayenus Richardson, 1846 and P. macracanthus Cuvier, 1829 in the Andaman Sea of Thailand.* Technical Paper no. 6/2005. Bangkok: MFRDB, DOF.
- Pinputtasin, C., Hassadee, P., Sereeruk, K., Keawmun, P. and Wongtho, S. 2008. *Reproductive biology of ornate threadfin bream (Nemipterus hexodon (Quoy and Gaimard, 1824)) in the upper Gulf of Thailand.* Technical Paper no. 9/2008. Bangkok: MFRDB, DOF.
- Pinputtasin, C., Saikliang, P., Sereeruk, K., Chunhapran, A. and Keawmun, P. 2012. *Reproductive biology of greasyback shrimp, Metapenaeusensis (De Haan, 1844) in the Inner Gulf of Thailand.* Technical Paper no. 33/2012. Bangkok: MFRDB, DOF.
- Phoonsawat, R. 2000. *Financial losses from utilization of juvenile fish by otter board trawler length over all less than 14 meters.* Master Thesis, Kasetsart University. Bangkok: Kasetsart University.
- Phoonsawat, R. 2005. *A study on indicators of demersal resources: case study otter board trawler length over all less than 14 meters at PranBuri District, PrachuapKhiri Khan.* Technical Paper no. 20/2005. Bangkok: MFRDB, DOF.
- SEAFDEC. 2004. *Fishing gear and methods in Southeast Asia: I Thailand.* SamutPrakan: Training Department, SEAFDEC.
- Sinanun, P., Sinanun, T., Chaimeesook, K., Augsornpa-ob, U. and Kongprom, A. 2012. *Stock Assessment of Saurida elongata (Temminck & Schlegel, 1846) and S. undosquamis (Richardson, 1848) in the Gulf of Thailand.* Technical Paper no. 3/2012. Bangkok: MFRDB, DOF.
- Sritakon, T., Vibunpant, S., Chotitammo, U. and Songnui, J. 2012. *Biology of jinga shrimp (Metapenaeus affinis H. Milne Edwards, 1837) from KoSamui to KoKra.* Technical Paper no. 12/2012. Bangkok: MFRDB, DOF.
- Suppanirun, T., Songkeaw, N., Khrueniam, U., Pinputtasin, C. 2011. *Reproductive Biology*

of Indian Squid, Photololigoduvaucelii (d'Orbigny, 1835) and Mitre Squid, P. chinensis (Gray, 1849) in the Gulf of Thailand. Technical Paper no. 2/2011. Bangkok: MFRDB, DOF.

Vibunpant, S., Hussadee, P., Puttharaksa, K. and Suppanirun, T. 2011. *Reproductive biology of brushtooth lizardfish Sauridaundosquamis (Richardson, 1848) in the Gulf of Thailand.* Technical Paper no. 1/2011. Bangkok: MFRDB, DOF.

Vibunpant, S., Puntuleng, P., Hussadee, P. and Yangphonkhan, B. 2012. *Reproductive biology of slender lizardfish, (Sauridaelongata (Temminck & Schlegel, 1846)), in the Gulf of Thailand.* Technical Paper no. 13/2012. Bangkok: MFRDB, DOF.