Review of the Marine Fisheries in Trat Province, Thailand

"Strategies for Trawl Fisheries Bycatch Management" (REBYC-II CTI; GCP/RAS/269/GFF)

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PREPARATION OF THIS PAPER

This document has been prepared as a part of the Strategies for Trawl Fisheries Bycatch Management Project (REBYC-II CTI; GCP/RAS/269/GFF) and aims to review the marine fisheries in Trat province. Trat province is one site of the project which has been selected to establish a fisheries management measure in order to reduce the bycatch with emphasizing on fishing area and season closure. The coastal zone of Trat is one of the most fruitful area in the Gulf of Thailand. Several marine ecosystems, such as mangrove forest, sea grass bed and coral reef, can be found in Trat water. As a result, Trat coastal area is the breeding and nursing ground for a number of marine species. Therefore, bycatch in this context involves juvenile and sub-adult fish.

Types of fishing gear, species composition and status of fisheries resources were reviewed in this paper in order to point out the previous status of marine fisheries, be compared with the results of upcoming data and be used as base line information in case of the area and season closure is implemented.

The author is a Fisheries Biology Consultant of Thailand, a member country of REBYC-II CTI besides Indonesia, Papua New Guinea, Philippines and Viet Nam. This paper has been done under the Terms of Reference for the consultant as following.

> "Baseline surveys report for fisheries around Trat province (trawlers, fishing gear type, catch, dominant species, fishing boat mobility, fisher and owners"

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GLOSSARY

AFN	Anchovy falling net
APS	Anchovy purse seine
cm	Centimeter
CPUE	Catch per unit effort
DOF	Department of Fisheries
OBT1	Small-sized otter board trawl, length less than 14 m
OBT2	Medium-sized otter board trawl, length 14-18 m
MFRDB	Marine Fisheries Research and Development Bureau
MSY	Maximum sustainable yield
MEY	Maximum economic yield
PT	Pair trawler
SEAFDEC	Southeast Asian Fisheries Development Center
TPS	Thai purse seine

1. Introduction

Trat Province is located in the eastern part of the Gulf of Thailand bordered by Kingdom of Cambodia and Chanthaburi Province. The land area is 2,819 km^2 and sea area is 7,257 km^2. There are seven districts with five seaside districts and 52 islands governed by Trat Province (Fig. 1). The southern Trat closes to Gulf of Thailand and Cambodian waters. The coastal line is about 165 km.

Figure 1 Trat Province with the districts (Amphoe) numbered
1) Mueang Trat, 2) Khlong Yai, 3) Khao Saming, 4) Bo Rai, 5) Laem Ngop, 6) Ko Kut and 7) Ko Chang
Sources: http://th.wikipedia.org/wiki/Trat_Province

There are several rivers running into the seaside of Trat such as Trat River and Welu River. Those rivers bring numerous nutrients to the sea and Trat water become a high productivity area in the Gulf of Thailand. Furthermore, mangrove forests can be found along the coast of

Trat and used as breeding and nursing grounds of numbers of aquatic species. In addition, coral reefs exist throughout the group of islands and benefit aquatic animals for taking refuge and nursing ground.

The gross provincial product (GPP) in 2009 was 18,550 million Baht including 9,022 million Baht from agricultural sector. Fisheries sub-sector contributed about one half of agricultural sector GPP, 4,250 million Baht. Capture fisheries made up one third of fisheries sub-sector GPP while culture fisheries sum up the remaining. The GPP occurred from capture fisheries had grown up swiftly from 2003-2007, 1,176-1,517 million Baht. After 2007, however, its GPP lessened slightly. The last report in 2009 showed that it was 1,431 million Baht (www.trat.go.th).

Although GPP gained from non-agricultural sector reached 51% of Trat total GPP in 2009, industrial sub-sector made up only 4% of the province GPP. This indicates that Trat is not industrial province. As a result, marine fishing ground can be maintained a good quality due to it is not affected by chemical pollutants from the factories.

The last survey on number of fishers and fishery establishments in Thailand was held on 2000. In Trat Province, the number of marine capture fishery establishments was added up to 2,959 establishments making up 8.13% of the establishment along the Gulf of Thailand whereas the number of fishers during peak season was counted to 6,389 fishers calculated to 5.30% of the fishers along the Gulf of Thailand (Table 1; DOF, 2013a).

Table 1 Number of marine capture fishery establishments and fishers during peak season in Trat Province

	Number of fishery establishments		Number of fisher	
Gulf of Thailand	37,098	100.00%	120,603	100.00%
Trat Province	2,959	8.13%	6,389	5.30%

The areas of catch statistical data in the Gulf of Thailand are divided into five areas (Fig 2). The production harvested by small scale fishing gear in Area 1 was shown in Table 2. A half of the production was several kinds of fish. Anchovy contributed to approximately 74% of the total amount of fish caught or 38% of the total production followed by short necked clam and squids and cuttlefish, 19% and 16% of the total production respectively.

2. Number of fishing boats

The total number of fishing boat registered by different fishing gear in Trat Province during 1990-1997 ranged from 607-799 boats. In 1998 and 2000, the number of boat extremely increased to 1,264 and 1,702 boats respectively (Fig. 3) due to increasing of small-scale fishing gear (short mackerel gill net, crab gill net, shrimp trammel net, squid trammel net and other gill nets) and falling net and lift net (squid falling net, anchovy falling net, other falling nets, anchovy lift net and other lift nets).

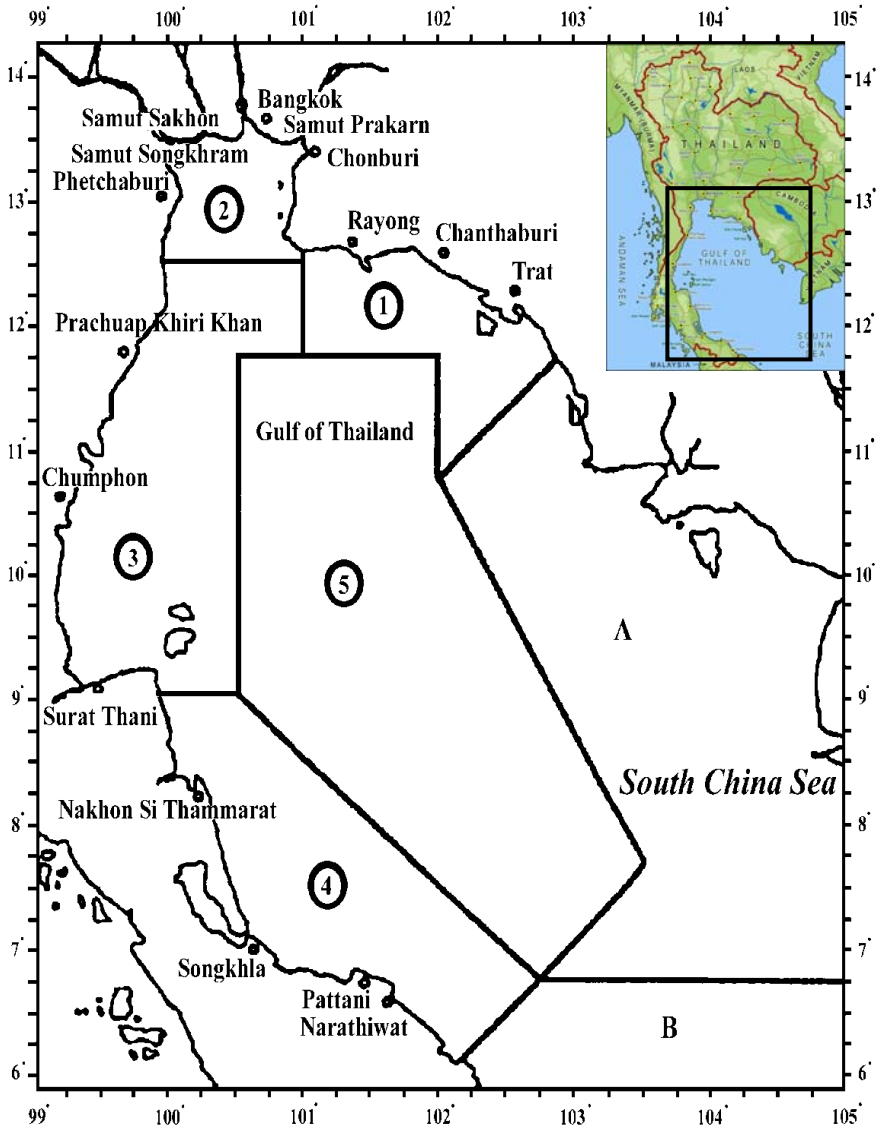

Figure 2 Statistical areas of catch data in the Gulf of Thailand

Otter board trawler (OBT) made up the highest ratio of the total number of fishing boat in 1990-1997 ranging from 461-607 boats. After that, the number of OBT showed a decreasing trend. The last recorded data in 2011 presented that there were 153 OBT boats. While the number of pair trawl registered in Trat Province was very few; the last two year displayed only two boats. On the other hand, the number of purse seines, including Thai purse seine (purse seine with 2.5 cm black nylon net) and anchovy purse seine (purse seine with 0.6 cm knotless net), was not much different in number during 1991-2011 making up 50-140 boats.

Push net is one of the most destructive fishing gears used in Thailand. In 1990, the number of push net was 30 boats; then it showed only one boat in the last three statistical years.

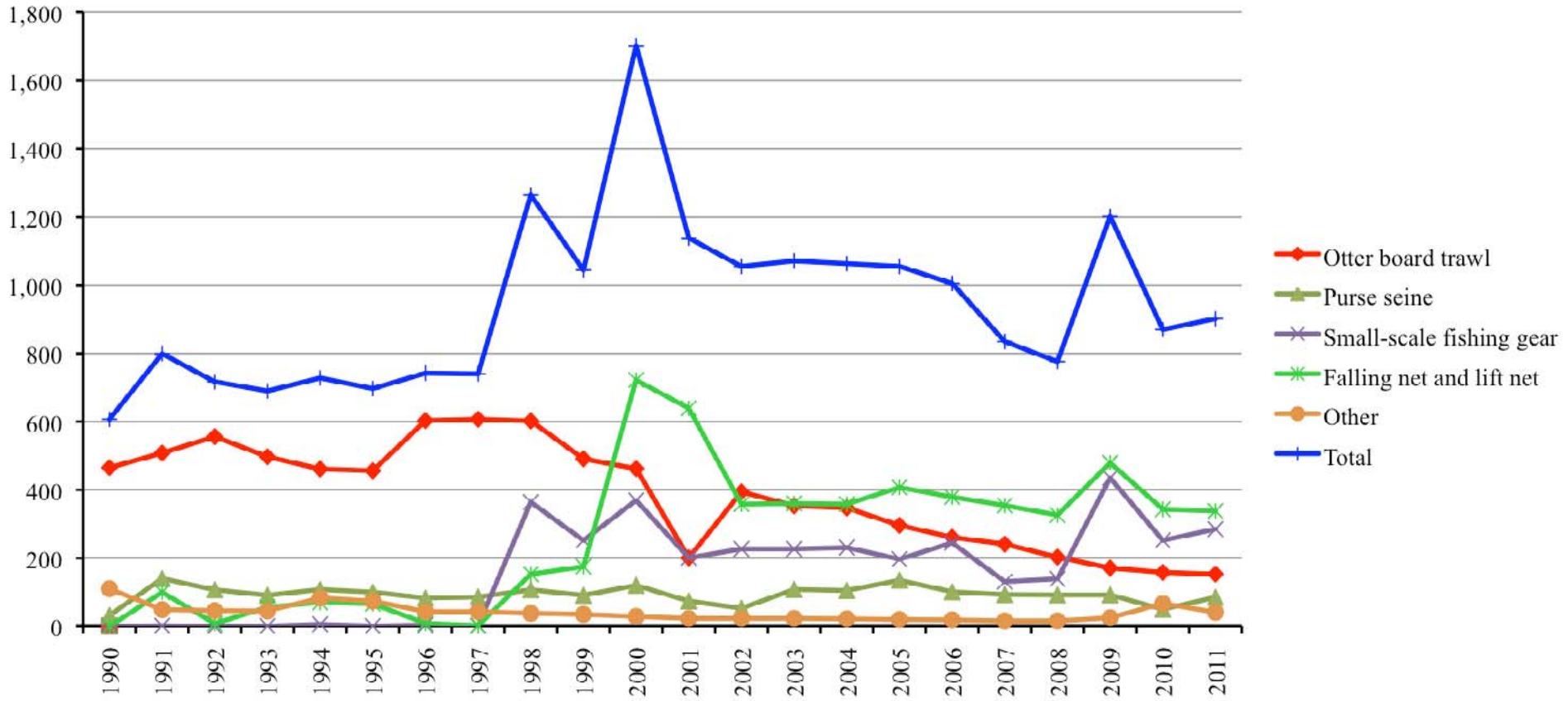

Figure 3 Number of fishing gear registered in Trat Province during 1990-2011

3. Fisheries resources status

The last recorded catch data in 2011 showed that the total catch of small scale fisheries was 20,334 tons from more than 20 kinds of fishing gear including gill nets, falling nets and traps (Table 2). Pelagic fish was the main catch of small scale fisheries made up 9,412 tons. Mackerel, mullet and sardine were the main composition capture of gill net while anchovy was the highest composition of pelagic fish which was harvested only by falling net. Squid falling net was also an important fishing gear. The catch of squid and cuttlefish made up 2,691 tons.

Blue swimming crab was another economically important species which was commonly caught by crab gill net and crab trap. Moreover, short-necked clam was an important marine capture production in Area 1 particularly in Trat province. Two areas of approved zone for short-necked clam have been declared in the Gulf of Thailand, i.e., Trat and Surat Thani. The clam production in Area 1 was mainly harvested in Trat province and ranked second after Area 3.

For commercial fishing gear, the CPUE of Thai purse seine in Area 1 was 4,169.39 kg/day which a much higher than the average CPUE in the Gulf of Thailand. Indian mackerel, short mackerel and yellowtail scad were the main composition of TPS made up more than half of catch composition (Table 3).

On the other hand, trawls' CPUE was lower than the Gulf of Thailand's average, i.e., 12.45, 11.39 and 113.04 kg/hr of OBT1, OBT2 and PT respectively (Table 4). The ratio of economic fish and trash fish was 69:31, 71:29 and 70:30 respectively. However, a large amount of true trash fish remained in the composition, 71% of OBT1 and OBT2's composition and 40% of PT's composition. Demersal fish and shrimp were the main composition of OBT1 and OBT2 while demersal fish and pelagic fish were the main composition of PT (Table 3).

Commercial anchovy fishery is another important fishing gear found in Trat waters. Large-sized falling net which light luring (AFN) and anchovy purse seine (APS) are mostly found. Sinanun *et al.* (2012b) documented that small-sized AFN, which the length is less than 14 m, was abundantly found around Kut Island at the water depth of 10-20 m while large-sized AFN was plentifully operated at the western of Kut Island and around Chang Island at the water depth of 10-30 m. Furthermore, APS with light luring was also found southward of Kut Island although daytime APS was not found in Trat water.

Table 2 Quantity of marine fisheries production (tons) by species and type of fishing gear in coastal Area 1, 2011

	Total	Sub-total fish	Sub-total Pelagic fish	Short mackerel	Indian mackerel	Sardine	Anchovy	Mullet	Other Pelagic fish	Sub-total Demersal fish	Red snapper	Grouper	Other demersal fish	Other food fish
Total	**20,334**	**10,557**	**9,412**	**184**	**583**	**299**	**7,803**	**391**	**152**	**210**	**73**	**75**	**36**	**896**
Mullet gill net	310	310	310	0	0	0	0	310	0	0	0	0	0	0
Mackerel gill net	129	129	74	72	2	0	0	0	0	8	0	0	8	47
Fourfinger treadfin gill net	3	3	3	0	0	0	0	0	3	0	0	0	0	0
Sardine gill net	339	339	299	0	0	299	0	0	0	0	0	0	0	100
Sand whiting gill net	13	13	0	0	0	0	0	0	0	13	0	0	13	0
Other gill net	1,589	1,589	854	110	578	0	0	59	107	35	33	2	0	700
Shrimp trammel net	314	0	0	0	0	0	0	0	0	0	0	0	0	0
Crab gill net	1,630	3	0	0	0	0	0	0	0	0	0	0	0	3
Squid falling net	2,691	0	0	0	0	0	0	0	0	0	0	0	0	0
Anchovy falling net	7,803	7,803	7,803	0	0	0	7,803	0	0	0	0	0	0	0
Other cast net	11	11	2	0	0	0	0	2	0	4	2	0	2	5
Hand push net	12	0	0	0	0	0	0	0	0	0	0	0	0	0
Lift net	26	12	12	0	0	0	0	12	0	0	0	0	0	0
Long line	27	27	8	0	0	0	0	0	8	19	2	0	6	0
Handline and pole & line	300	118	34	0	0	0	0	0	34	66	28	19	4	18
Set bag net	81	48	5	2	3	0	0	0	0	4	0	4	0	0
Fish trap	78	75	8	0	0	0	0	8	0	51	3	48	0	16
Crab trab	569	2	0	0	0	0	0	0	0	2	0	2	0	0
Squid trab	387	0	0	0	0	0	0	0	0	0	0	0	0	0
Miscellaneous Gear	3,962	15	0	0	0	0	0	0	0	8	5	0	3	7

Table 2 (Cont.)

	Trash fish	Sub-total shrimp & prawn	Banana prawn	School prawn	Other shrimp & prawn	Sub-total squid & cuttlefish	Squid	Big fin reef squid	Other squid & cuttlefish	Sub-total crab	Blue swimming crab	Other crab	Sub-total molluscs	Short-necked clam	Other
Total	**39**	**377**	**210**	**114**	**164**	**3,259**	**2,612**	**407**	**240**	**2,228**	**1,718**	**510**	**3,813**	**3,800**	**100**
Mullet gill net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mackerel gill net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fourfinger treadfin gill net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sardine gill net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sand whiting gill net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other gill net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Shrimp trammel net	0	314	195	114	5	0	0	0	0	0	0	0	0	0	0
Crab gill net	0	0	0	0	0	0	0	0	0	1,627	1,387	240	0	0	0
Squid falling net	0	0	0	0	0	2,691	2,578	39	74	0	0	0	0	0	0
Anchovy falling net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other cast net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hand push net	0	12	0	0	12	0	0	0	0	0	0	0	0	0	0
Lift net	0	0	0	0	0	0	0	0	0	14	7	7	0	0	0
Long line	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Handline and pole & line	0	0	0	0	0	182	11	102	69	0	0	0	0	0	0
Set bag net	39	30	12	0	18	0	0	0	0	3	1	2	0	0	0
Fish trap	0	0	0	0	0	0	0	0	0	3	0	3	0	0	0
Crab trab	0	0	0	0	0	0	0	0	0	567	322	245	0	0	0
Squid trab	0	0	0	0	0	386	23	266	97	1	1	0	0	0	0
Miscellaneous Gear	0	21	3	0	18	0	0	0	0	13	0	13	3,813	3,800	100

Source: DOF, 2013b

Table 3 Catch composition of Thai purse seine and trawls in the Gulf of Thailand Area 1 in 2007

Species/Group	TPS*	OBT1		OBT2		PT	
		Food fish	Trash fish	Food fish	Trash fish	Food fish	Trash fish
Total	**100.000**	**100.000**	**100.000**	**100.000**	**100.000**	**100.000**	**100.000**
Sub-total fish	**97.586**	**53.405**	**97.438**	**48.787**	**97.482**	**77.821**	**97.326**
Sub-total pelagic fish	**92.131**	**6.149**	**7.223**	**4.722**	**6.604**	**36.638**	**31.429**
Short mackerel	21.302	0.318	0.021	0.197	0.022	10.699	0.966
Indian mackerel	24.271	0.272	0.011	0.192	0.042	4.091	1.656
Narrow-barred Spanish mackerel	0.000	0.235		0.294	0.000	0.748	0.009
Dorab wolf-herring		1.338	0.003	0.306	0.028	0.174	0.084
Longtail tuna	0.181						
Kawakawa	1.686						
Frigate tuna	3.158						
Indian scad	6.576					0.332	0.139
Hardtail scad	6.620	0.017		0.003		0.660	0.165
Yellowstripe scad	3.908	0.769	0.361	1.189	0.130	7.218	1.454
Yellowtail scad	11.034	0.066	0.040	0.037	0.012	1.396	0.048
Bigeye scad	6.269	0.009		0.061		0.371	0.007
Other carangids	0.271	1.899	0.209	1.462	0.151	1.771	1.808
Goldstripe sardinella	2.755	0.087	0.000	0.004		0.322	0.202
Other sardines	0.914	0.147	0.062	0.021	0.032	2.258	0.836
Anchovies	0.478	0.170	5.401	0.318	5.161	2.779	21.160
Black pomfret	0.692	0.026		0.030		0.248	0.029
Barracudas	2.010	0.558	0.086	0.565	0.216	1.632	1.584
Other pelagic fishes	0.006	0.238	1.029	0.043	0.810	1.939	1.282
Sub-total demersal fish	**4.047**	**47.256**	**19.352**	**44.065**	**19.743**	**41.183**	**25.918**
Croakers		1.441	1.065	1.001	1.187	0.802	0.008
Ornate threadfin bream	0.065	0.350	0.024	0.600	0.006	2.645	0.186
Threadfin breams	0.007	0.434	0.025	0.557	0.015	4.977	0.631
Slender lizardfish	0.078	1.663	0.255	1.668	1.268	2.362	2.513
Brushtooth lizardfish	0.849	0.794	0.468	2.220	0.330	1.339	2.255
Other lizardfishes		0.114	0.579	0.203	0.207	0.062	1.520
Hairtails	1.892	0.321	1.094	0.194	1.286	4.395	0.973
Snappers	0.131	0.758	2.244	0.702	1.151	0.937	1.933
Purple-spotted bigeye	0.005	0.548	0.218	0.868	0.197	6.218	1.554
Sea catfishes		0.596	0.026	0.065	0.066	0.089	0.016
Rays		1.667	0.273	1.707	0.504	0.308	0.002
Sharks		0.049	0.078	0.086	0.200	0.017	
Flatfishes		1.857	1.410	1.055	1.450	0.220	0.094
Other demersal fishes	1.020	36.664	11.593	33.139	11.876	16.812	14.233
Trash fish	**1.408**		**70.863**		**71.135**		**39.979**
Sub-total crustacean	**0.012**	**25.322**	**1.664**	**20.573**	**1.453**	**0.543**	**0.696**
Metapenaeopsis spp.		0.021					0.085
Metapenaeus spp.		6.484		4.161		0.043	0.001
Parapenaeopsis spp.		0.353		0.254		0.000[2]	
Penaeus spp.		8.808	0.116	7.136	0.233	0.012	0.019
Trachypenaeus spp.		3.241	0.003	2.266	0.006	0.012	0.093
Other shrimps	0.012	0.078	0.404		0.384		0.241
Flathead lobster	0.000	0.001	0.002	0.020	0.005		0.008
Mantis shrimp		3.536	0.504	3.814	0.452	0.052	0.120
Blue swimming crab	0.000	0.754	0.053	1.161	0.050	0.245	0.003
Other crabs	0.000	2.046	0.582	1.761	0.323	0.179	0.126

Table 3 (Cont.)

Species/Group	TPS*	OBT1		OBT2		PT	
		Food fish	Trash fish	Food fish	Trash fish	Food fish	Trash fish
Sub-total mollusc	**2.402**	**21.273**	**0.898**	**30.640**	**1.065**	**21.636**	**1.978**
Squids	2.398	13.907	0.711	21.745	0.736	18.100	1.026
Cuttlefishes	0.001	3.449	0.114	3.275	0.189	1.221	0.167
Bigfin reef squid		0.242		0.941		1.298	0.015
Octopuses		1.051	0.050	0.969	0.050	0.141	0.022
Other cephalopods							0.086
Scallops		2.317	0.023	3.498	0.090	0.812	0.570
Other shellfishes	0.003	0.307		0.212		0.064	0.092

Source: Noranarttragoon, 2013

Remarks: * Catch of TPS is generally pelagic school, not sorted on board and not divided into food fish and trash fish.
Empty boxes signify zero value.
0.000 signify negligible value (< 0.0005).

Table 4 CPUE of some commercial fishing gear in 2007

Gear	CPUE	
	Gulf of Thailand	Area 1
Large-sized TPS (length more than 18 m)	2,317.17 kg/day	4,169.36 kg/day
OBT1	21.85 kg/hr	12.45 kg/hr
OBT2	32.66 kg/hr	11.39 kg/hr
PT	121.07 kg/hr	113.04 kg/hr

Source: Noranarttragoon, 2013

The study on short mackerel caught by small scale fishing gear along coastal waters of Trat province in 2008 was found that gill net was operated where water depth was 3-13 m whereas the fishing ground of bamboo stake trap was at the depth of 5-8 m. The mean length of short mackerel caught by gill net was 16.07 cm while by bamboo stake trap was 14.52 cm. These can be assumed that the small mackerel inhabit inshore waters and larger mackerel move to offshore waters (Siri and Srikum, 2012).

Kongprom *et al*. (2007) presented the mean length of economic fishes caught by trawls, i.e., OBT1, OBT2 and PT, in several parts of the Gulf of Thailand during the survey period of November 2003 to September 2005. Catch of trawls is usually sorted to food fish and trash fish. The lengths of some economic species, both in food fish and trash fish component, caught in the Eastern Gulf of Thailand (Area 1) were summarized in Table 5. The mean lengths of all economic fishes caught by OBT1 were smaller than the female size at first maturity. Although, in food fish group, some economic fishes caught by OBT2 and PT were larger than the female size at first maturity, every species in trash fish were smaller than the female size at first maturity. It is very important to note that there was a large amount of juvenile economic fish being caught by trawlers in the Eastern Gulf of Thailand. The catch compositions of OBT1, OBT2 and PT also showed a highly percentage of trash fish, 50.01%, 49.08% and 36.08% of the total catch respectively.

Table 5 Mean length and female size at first maturity (cm) of some economic fish caught by trawlers in the Eastern Gulf of Thailand (Area 1) during November 2003 to September 2005

Species	OBT1		OBT2		PT		Female size at first maturity
	Food fish	Trash fish	Food fish	Trash fish	Food fish	Trash fish	
Nemipterus hexodon	14.30	7.61	15.37	6.15	17.46	6.85	14.57 [1]
Saurida elongata	18.67	12.06	19.54	9.59	20.06	10.28	31.62 [2]
S. undosquamis	12.41	11.88	15.22	9.44	17.20	11.30	28.26 [3]
Priacanthus tayenus	13.40	6.98	15.51	9.07	17.62	7.36	14.19 [4]
Sepia aculeata	8.40	-	9.38	-	8.23	1.75	9.44 [5]
S. recurvirostra	6.84	3.56	-	-	7.61	3.75	8.42 [5]
Metapenaeus affinis	10.34	-	11.10	-	-	-	12.18 [6]
M. ensis	10.76	-	11.53	-	-	-	11.24 [7]
Penaeus merguiensis	12.24	-	13.67	-	11.37	-	14.14 [8]

Source: Kongprom *et al*., 2007

Remarks: [1] Pinputtasin *et al*., 2008
[2] Vibunpant *et al*., 2012
[3] Vibunpant *et al*., 2011
[4] Krajangdara and Yakoh, 2005
[5] Charoensombat *et al*., 2013
[6] Sritakon *et al*., 2012
[7] Pinputtasin *et al*., 2012b
[8] Pinputtasin *et al*., 2012a

In 2009, stock assessment of several shrimp species in the Eastern Gulf of Thailand was conducted by using data collecting from OBT1 and push net. Sinanun and Pankaew (2012) assessed the stock of brown rough shrimp (*Trachypenaeus fulvus* Dall, 1957) and reported that the fishing efforts were over MSY and MEY. They also documented that the optimum fishing efforts should be at 80% and 60% of the fishing efforts in 2009 in order to optimize MSY and MEY respectively.

Furthermore, Sinanun *et al.* (2012a) evaluated the stock of jinga shrimp, *Metapenaeus affinis* (H. Milne Edwards, 1837). The similar results were revealed that the fishing efforts were over MSY and MEY and therefore it should be reduced. Moreover, its mean size was 10.05 and 9.86 cm from OBT1 and push net respectively and did not reach its size at first maturity, 11.24 cm (Pinputtasin *et al*., 2012). In addition, the length of the shrimp caught by push net ranged from 3.75-9.25 cm were smaller than the size at first maturity in a whole year.

As well, Thongsila and Sinanun (2013) assessed the stock of banana prawn (*Penaeus merguiensis* De Man, 1888*)* and pointed that the fishing effort of small-sized otter board trawl and push net almost reach MSY and MEY. The estimated MSY and MEY were 123.78 tons and 18.88 million Baht respectively. Whilst catch and value in 2009 were 121.28 tons and 18.87 million Baht respectively. However, banana prawn can be generally caught by shrimp trammel net which was not included in their studies.

The stock assessment of blue swimming crab was also carried out in the Eastern Gulf of Thailand by using data collecting from commercial and small scale crab traps and crab gill net during 2009. The results demonstrated that a number of small-sized crabs were harvested by small scale fisheries. Forty one and twenty two percent (by individual) of the crabs, which their sizes were smaller than size at first maturity, were caught by crab trap and crab gill net,

while very few of them were caught by commercial crab trap. Moreover, crab resource in the Eastern Gulf of Thailand was utilized over the optimum fishing effort at 10% of the MSY and 40% of the MEY (Sinanun, 2012).

Boonpukdee and Sujittosakul (2004) studied bamboo stake trap fishery in Trat Bay on June 2003 – May 2004. The result indicated that 21.85% of the total catch was trash fish consisted of 9.60% true trash fish and 12.25% juvenile economic fish. It was further estimated that the economic loss resulting from juvenile economic fish caught was about 380,000 Baht/trap/ year. They likewise suggested that government and local communities should join in setting up regulation and measures for fishing with bamboo stake trap. Fisheries management should also be participated by local communities to prevent the economic loss from resource exploitation and to encourage sustainable fisheries resource utilization.

The results from DOF research vessel also showed that there was a large amount of trash fish in catch composition. The research vessel trawling was conducted in the eastern part of the Gulf of Thailand during 1997-2000 among 20 stations including eight stations off Trat province (Fig. 3). For daytime trawling, more than one-half of the composition was true trash fish, 53%, while it made up to 40% for nighttime trawling. In addition, the most abundant areas were Chang Strait and west of Chang Island (Sinanun and Kaewmanee, 2012b). Additionally, the average CPUE for daytime trawling in 1997 was 32.202 kg/hr.

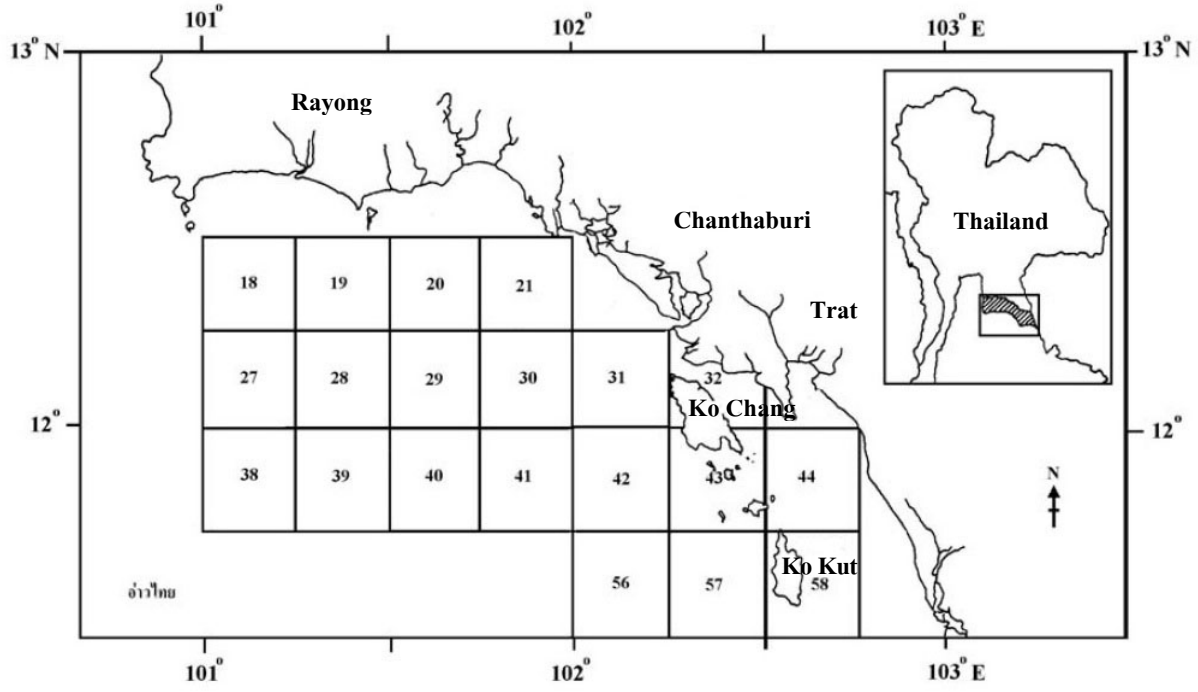

Figure 3 Survey station of DOF research vessel in the Eastern Gulf of Thailand.
Stations 31-32, 42-44 and 56-58 are defined to Trat waters.
(Adapted from Sinanun and Kaewmanee, 2012a)

The following trial of the research vessel in the Eastern Gulf of Thailand was conducted in 2006. The average CPUE was reported at 14.539 kg/hr, although the average CPUE in Trat waters was a little higher than in the whole eastern waters, 15.217 kg/hr. Comparing to 1997 trial, the 2006 CPUE declined more than 50% over 10 years. On the other hand, the composition of trash fish made up 32% for daytime trawling (Sinanun, 2008). The reduction

of the trash fish composition may be due to some fish were sorted to be trash fish in 1997; but they are sorted to be economic fish in 2006. Actually, the categorization of fish from trawl experiment is based on fishing activities of commercial fisheries. When the amount of economic fish decreases, some true trash fish, e.g., smaller economic fish or large true trash fish, are sold as economic to raise the fishers' income.

Sinanun and Kaewmanee (2012a) studied the abundance and distribution of fisheries resources around Chang and Kut Islands, Trat Province, in 2005 by using DOF research vessel. They reported that trash fish made up the highest composition (49%), the mean length of 16 economically important species was smaller than size at first maturity and the mean length of only one species was larger than its size of first maturity. They also summarized that trawl fisheries in these areas might not be profit due to the main species composition was trash fish including juvenile economic fish.

Khrueniam and Chareonsombat (2012) studied the maturation of short mackerel caught by gill net and bamboo stake trap along the coastal waters of Trat province in 2008. The results revealed that mature male was highly found at 85% in September and female was highly found at 95% in March. While spawning fish was found throughout the year.

4. Conclusion

There is a large number of fishing gear used and a high level of species diversity in Trat water. However, fisheries resource status in this area is in declining state. Sizes of some economic species caught also showed a critical status which are smaller than the spawner sizes (size at first mature). CPUE of research vessel trawl continuously declined. As a result, several research papers revealed that fishing effort should be reduced to optimize MSY and MEY levels. Consequently, effective fisheries management measures are urgently needed. Limit fishing in area and season closure is an alternative measure to protect the juveniles, spawners and habitats from several kinds of gear especially for trawl fisheries, which has successfully been implemented in the Upper Western Gulf of Thailand (covered Prachuab Kiri Khan-Chumphon-Surat Thani provinces) and has being performed in the Inner Gulf of Thailand in May 2014.

5. Recommendation

If area and season closure is implemented, it occur that, in the beginning of open season, there will be an intensive fishing efforts come to fish with a large number of boats and they will catch at large amount of fish. Consequently, tropical fishes grow fast and inhibit in the area closure with few months... Thus, it is a plentiful area of fishes and a good occasion to harvest as it was documented in several papers. Chuapun and Ratanaprom (2005) inspected the CPUE of purse seine and Chuapun (2006) examined the CPUE of PT operated during closed are and closed season in the Upper Western Gulf of Thailand. It can be concluded that the CPUE increase twice during the closed season. Therefore, limitation of fishing boats and/or total catch at the period of open season may be needed to ensure the sustained harvesting.

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