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Analyses of catch, fishing efforts and nominal CPUE of neritic tuna and king mackerel exploited by purse seine and king mackerel drift gillnet fisheries in the Andaman Sea

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Abstract

- There are a number of the data which quality are unlikely good due to large outliers. We need to investigate this by checking the original data.
- Fishing efforts have been in stable. Thai purse seine fisheries in Area 7 (southern part of the Andaman Sea) are most active (70% of the total effort).
- King mackerel and longtail catch (1998-2010) have been decreasing consistently and the total catches in 2010 are less than 10% of the catches in 1998.
- It is difficult to suggest on the catch trends of bonito due to mixed species nature and also those for kawakawa because data are available only for a short period of time.
- In the king mackerel drift gillnet fisheries, target species is king mackerel nearly 60% of the total catch, while in purse seine, they are bonito (earlier years) and kawakawa (later years) (54% and 62% respectively).
- Annual trends of nominal CPUE of kawakawa, longtail tuna and king mackerel suggest that all three species have been decreasing consistently to 2010. This further suggests that we need to conduct stock assessments in order to understand the status of stocks of these 3 species.

Contents

1. Introduction

Using available historical catch and effort data (1991-2010), we attempted nominal fishing efforts, catch and CPUE analyses for neritic tuna (Longtail tuna *Thunnus tonggol*, kawakawa *Euthynnus affinis* and frigate tuna *Auxius* spp.) and also king mackerel *Scomberomorus commerson*) exploited by purse seine and king mackerel gillnet in the Andaman Sea. The data set is obtained from the Information Technology Center, Department of Fisheries. For this time we use the aggregated data to year. We would like to contribute these catch and effort data to the IOTC Secretariat. In the future we plan to attempt CPUE standardization using fine scale data.

2. Description of Fisheries

Purse seines fisheries

Purse seines of neritic tuna fishery along the Andaman sea coast of Thailand are basically classified in to 4 types namely, (a) Thai purse seine (TPS), (b) light luring purse seine (LPS) and (c) purse seine with fish aggregating devices (FADs) and (d) Tuna purse seine (TUN). Fishing boats of TPS, LPS, FADs are 21-25 m LAO with 300-500 hp of power engine. They use same type of net: black nylon with mesh size 25 mm, length of net 800-1,000 m, depth of net 80-100 m. While TUN is the largest purse seine operated with black nylon net, 1,800-2,000 m long and 120-150 m deep with the mesh size 50-98 mm. Fishing boat are 28-30 m LAO with 300-520 hp of engine.

Thai purse seine fishing vessel

King mackerel drift gill net fishery

King mackerel drift gill net fisheries are less important than purse seines for capturing small tunas as they mainly target king mackerel. The fishing boat ranges from14 - 18 meters in length. The nets vary from 4 km in length and 7.5 meters in depth. The stretched mesh size is ranging from 90 - 100 mm.

King mackerel gillnet fishing vessel

Fishing grounds and landing places

Fig. 1 shows landing places and fishing grounds in the Andaman Sea and the Gulf of Thailand.

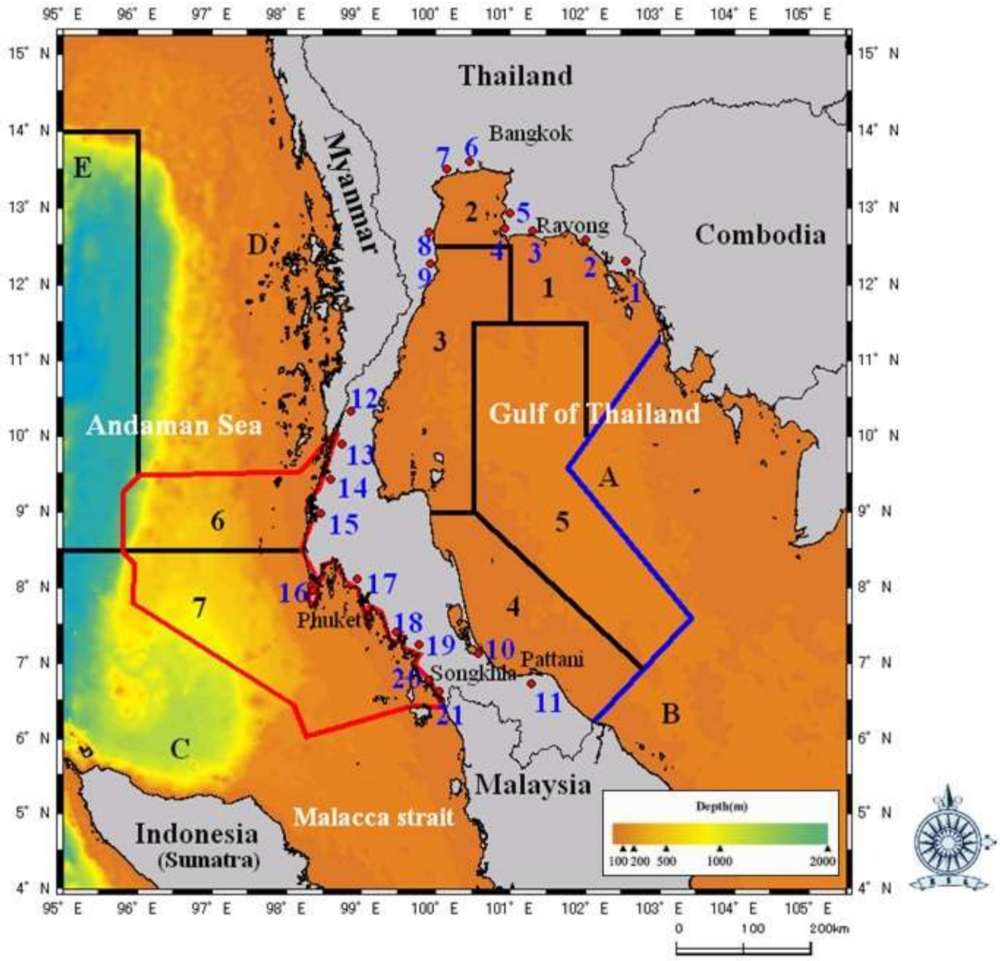

Fig. 1 Locations of fishing grounds (1-7 and A-E) and landing places (1-21) inthe Andaman Seaand the Gulf of Thailand.

Fishing grounds

Andaman Sea	Gulf of Thailand
6-7 Thailand	1-5 Thailand
C Indonesia (Sumatra)	A Cambodia
D Myanmar	B Malaysia and Indonesia
E Myanmar?	

Landing places

Andaman Sea	Gulf of Thailand
12. Muang, Ranong Province	*1. LaemNgop, Trat Province*
13. Kuraburi, Phang-nga Province	*2. Thamai, Chanthaburi Province*
14. Takuapa, Phang-nga Province	*3. Muang, Rayong Province*
15. Taimuang, Phang-nga Province	*4. Sattahip, Chonburi Province*
16. Muang, Phuket Province	*5. Sriracha, Chonburi Province*
17. Muang, Krabi Province	*6. Pak Nam, Samutprakan Province*
18. Kantang, Trang Province	*7. Muang, Samutsakhon Province*
19. Palian, Trang Province	*8. Cha-Um, Phetchaburi Province*
20. La-nga, Satun Province	*9. Pranburi, PrachuapKhiri Khan Province*
21.Munag , Satun Province	*10. Muang, Songkhla Province*
	11. Muang, Pattani Province

3. Data preparation

In the analyses we used catch and effort from area 6 and 7 as they are the core zone of the Andaman Sea in Thailand (Fig. 1), so that we can conduct reliable analyses and evaluate reliable N_CPUE.

Data inventory

As a first step, we made the data inventory to understand specifications of available data (Table 1). From Table 1, we understand that fishing effort data are available for all years, while catch data are not always available. In addition, separate kawakawa catch data are available from 2004/2005, while it was combined with frigate tuna before 2004/2005.

Table 1 Data inventory

Color legend:
- Data by area (6+7) are available
- Data are available, but areas are aggregated
- Data are not available

GILL: King mackerel drift gillnet fisheries and PS: Thai purse seine fisheries

year	Fishing effort		Catch							
			King mackerel		Longtail tuna		Bonito (kawakawa+ frigate tuna)		Kawakawa	
	PS	GILL	PS	GILL	PS	GILL	PS	GILL	PS	GILL
1991										
1992										
1993			No area information		No area information		No area information			
1994									No data	
1995										
1996										
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2004										
2005										
2006										
2007										
2008							No data			
2009										
2010										

Quality control

We investigated the data quality graphically. We noticed that purse seine (PS) catch included often large outliers in neritic tuna catch, while gill net (GILL) catches area likely good in general. Table 2 shows results of data quality control investigation for catch statistics.

Table 2Quality of the catch data (Area 6 and 7)

<table>
<tr><td>Color legend:</td><td style="background:#fde9d9">Data are available, but areas are aggregated. Quality is unknown.</td></tr>
<tr><td></td><td style="background:#d8e4bc">Data by area (6+7) are available and the data quality is likely good.</td></tr>
<tr><td></td><td style="background:red">Data by area (6+7) are available and the data quality is unlikely good.</td></tr>
<tr><td></td><td>Data are not available</td></tr>
</table>

<table>
<tr><td rowspan="3">year</td><td colspan="2" rowspan="2">Fishing effort</td><td colspan="8">Catch</td></tr>
<tr><td colspan="2">King mackerel</td><td colspan="2">Longtail tuna</td><td colspan="2">Bonito
(kawakawa+ frigate tuna)</td><td colspan="2">Kawakawa</td></tr>
<tr><td>PS</td><td>GILL</td><td>PS</td><td>GILL</td><td>PS</td><td>GILL</td><td>PS</td><td>GILL</td><td>PS</td><td>GILL</td></tr>
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<tr><td>2009</td><td style="background:#d8e4bc"></td><td style="background:#d8e4bc"></td><td style="background:#d8e4bc"></td><td style="background:#d8e4bc"></td><td style="background:#d8e4bc"></td><td style="background:#d8e4bc"></td><td style="background:#d8e4bc"></td><td style="background:#d8e4bc"></td></tr>
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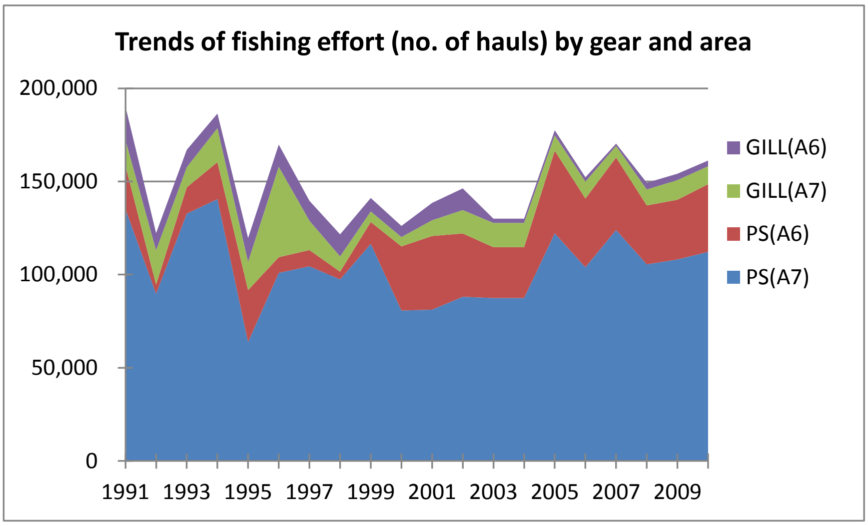
4. Analyses of fishing efforts, catch and nominal CPUE

Using the data with green color (good quality of the data) in Table 2, we made various qualitative analyses for fishing efforts, catch and nominal CPUE.

Fishing effort (Fig. 2)

There are 4 types of annual effort are available, i.e., *No. of fishing trips*, *No. of fishing days*, *No. of fishing hauls* and *No. of fishing hours*. We consider that *No. of fishing hauls* is the most appropriate fishing effort, thus it is used for analyses.



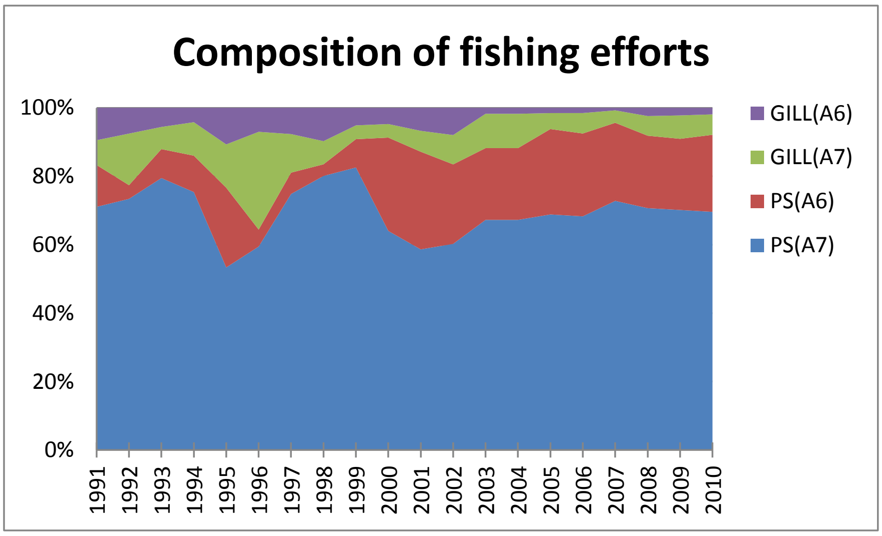


Fig. 2 Annual trend of fishing effort (number of hauls) by gear and areas and their compositions

Total fishing efforts are fairly constant around 150,000 hauls for all the period (1991-2010). Fishing effort of purse seiners in area 7 (southern part of the Andaman Sea) is highest (about 60% of the total fishing efforts), then followed by PS (area 6, northern part) (about 30%) and GILL (area 7+ 6) (10%).

Catch (Figs. 3-6)

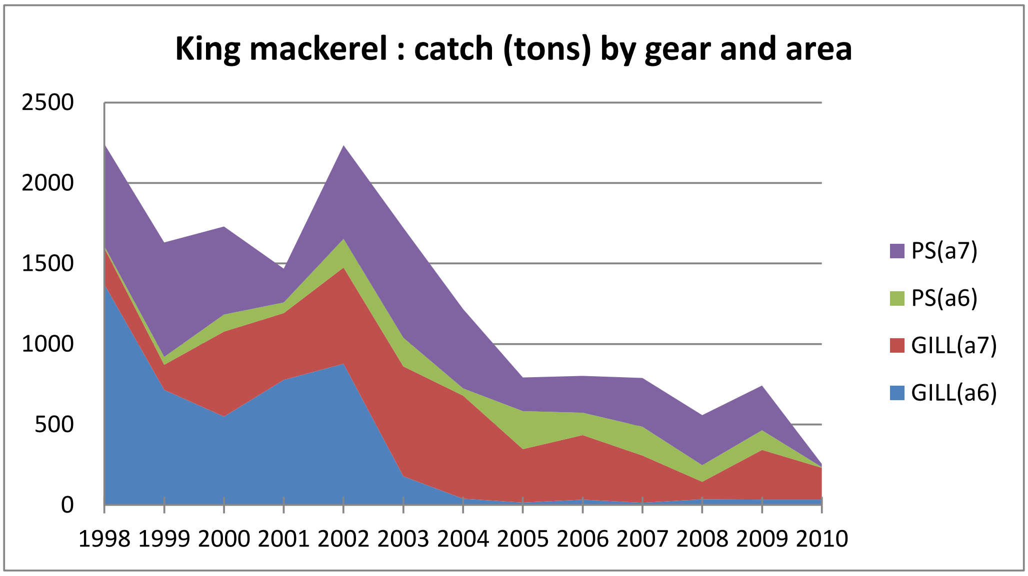


Fig. 3 King mackerel catch

The total catch in the earlier period (1998-2003) was in the high level (1,500-2,000 ton), but sharply decreased and stabilized (around 700 tons) (2005-2009). In 2010, it further decreased to 300 tons. GILL catch much higher than PS, but catch level between GILL and PS (area 6) (northern part) became closer in recent years (2005-2009).

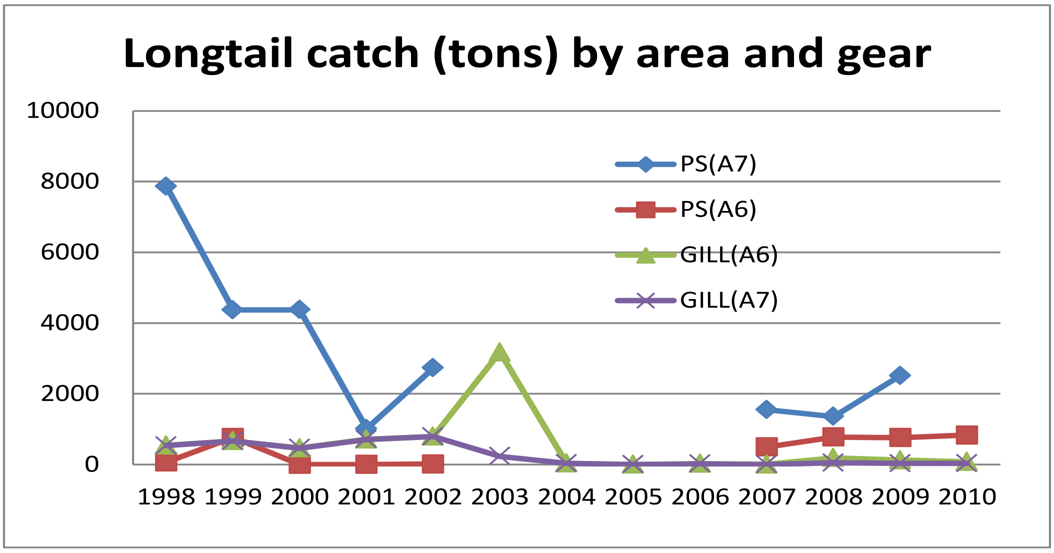


Fig. 4 Longtail tuna

PS Catch (area 7) (southern part of the Andaman Sea) has been decreasing from 8,000 tons to 2,000 tons and the catch level in recent years is stabilized at the lower level (2,000 tons). PS catch in area 6 (northern part) is very low. Longtail catch by king mackerel gillnet is negligible.

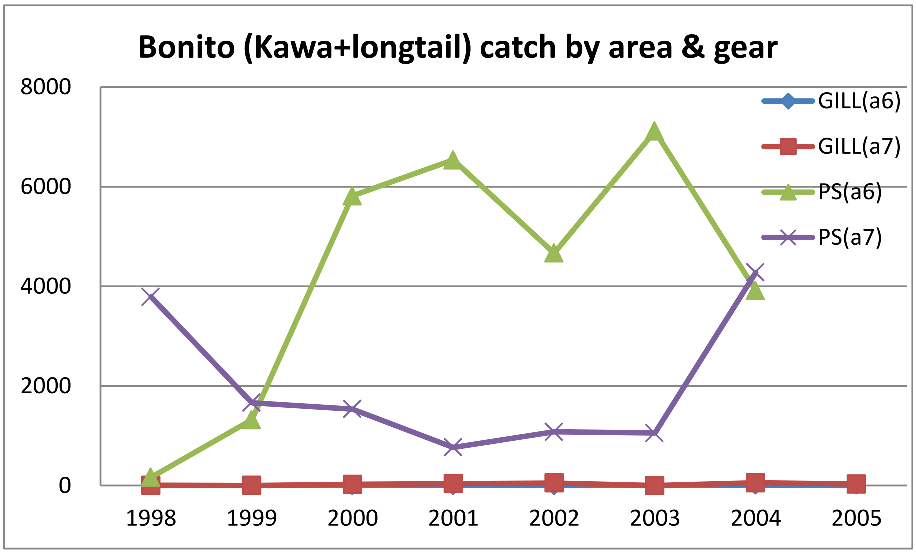


Fig. 5 Bonito

PS catch in area 6(northern part) is at the high level (4,200 tons); while, in area 7 (southern part), at the lower level (2,000 ton in average). It should be well noted that catch level depends on kawakawa and longtail catch due to the mixed species nature. Bonito catch by king mackerel gillnet is negligible.

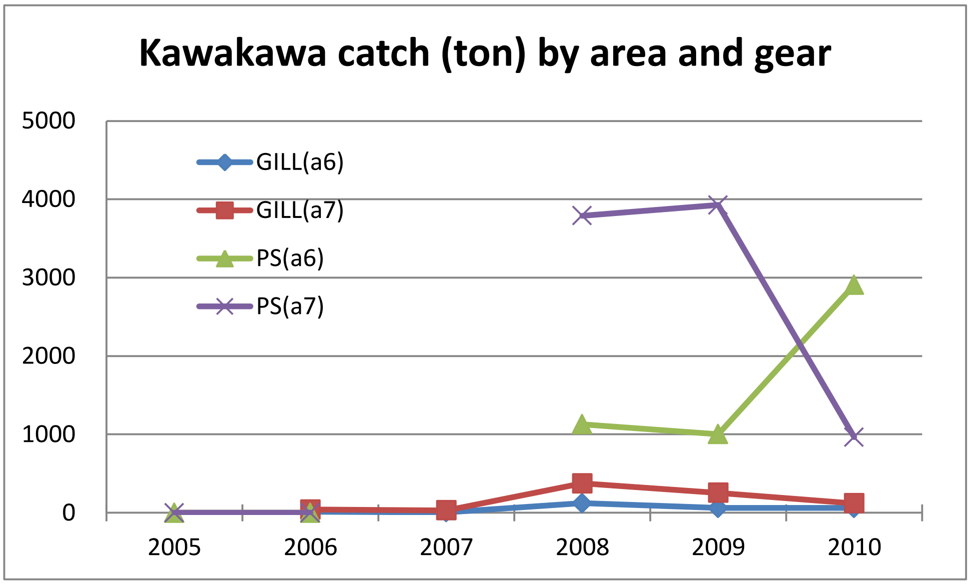


Fig. 6Kawakawa

PS catch in area 7 (southern part) sharply dropped to, 1,000 ton level (from 4,000 tons) in 2010, while the one in area 6 (northern part) jumped to 3,000 ton level (from 1,000 tons). It is difficult to interpret general catch trends due to the short period and the data quality. Catch by king mackerel drift gillnet is negligible.

Annual average species composition by gear and period (area 6+7 combined) (Fig. 7)

Fig. 7 shows annual average species compositions by gear and period in the Andaman Sea (area 6+7). In the analyses, 2 periods are used, i.e., the initial period (1998-2002) with bonito (kawakawa + frigate tuna) and the later period (2006-2010) with kawakawa. Fig. 7 suggests that in the king mackerel drift gillnet fisheries, the target species is king mackerel nearly 60% of the total catch, while in purse seine, target species are bonito (earlier years) (1998-2002) and kawakawa (later years) (2006-2010) are the major species (54% and 62% respectively).

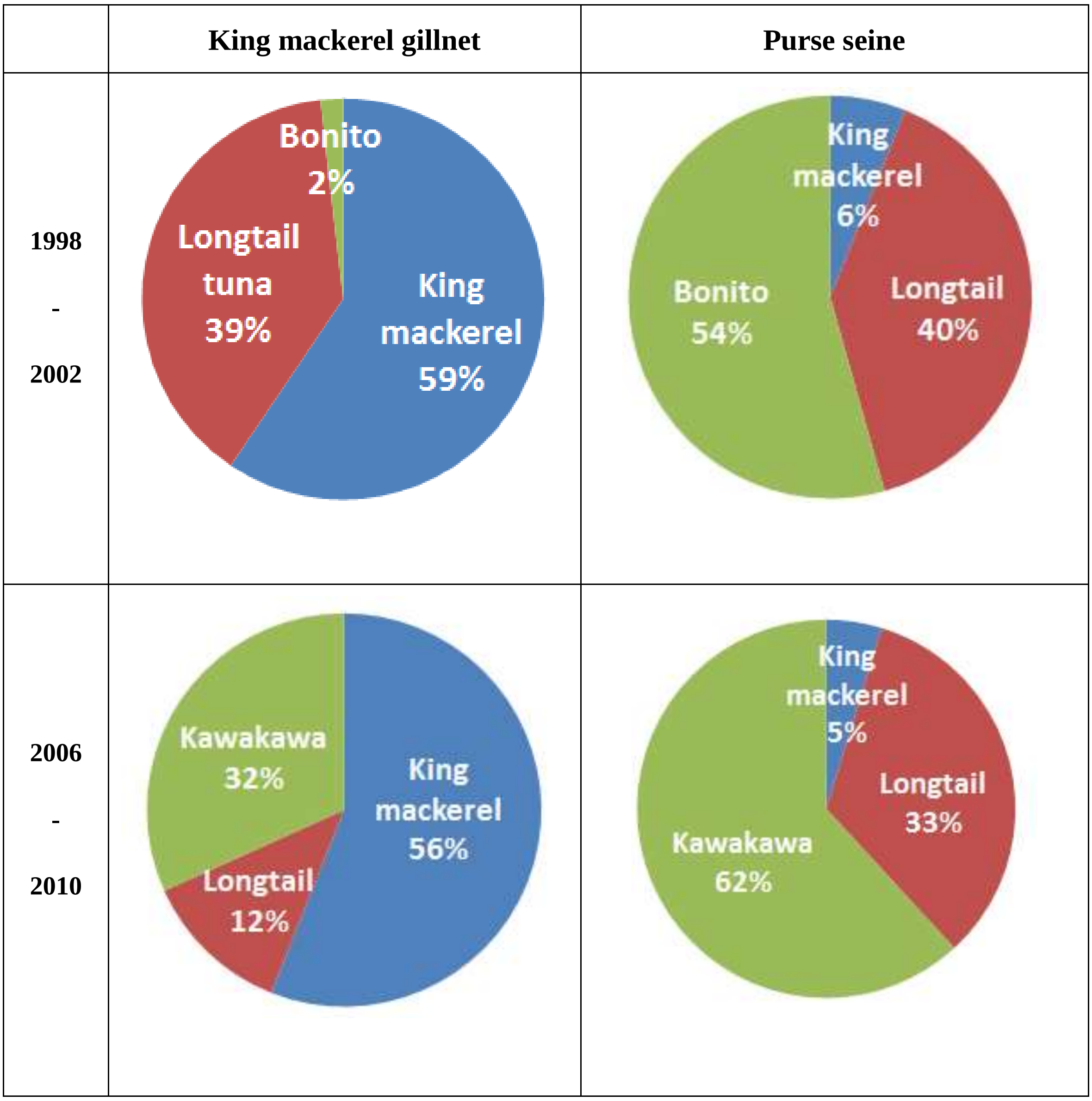


Fig. 7 Annual average species compositions by gear and period in the Andaman Sea

Nominal CPUE

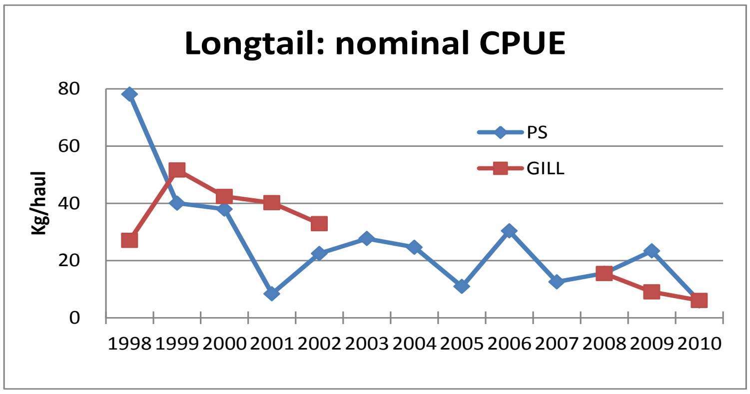
To compute N_CPUE, we use the data with green colors (Table 2) which are likely in good quality. As mentioned before, there are 4 types of annual effort are available, i.e., "*No. of fishing trips", "No. of fishing days"*, "*No. of fishing hauls"* and "*No. of fishing hours".* We consider that *No. of fishing hauls* is the most reliable fishing effort, thus it is used for analyses. We use annual catch (tons), hence our CPUE unit is kg/haul for both purse seine and king mackerel drift gillnet fisheries.

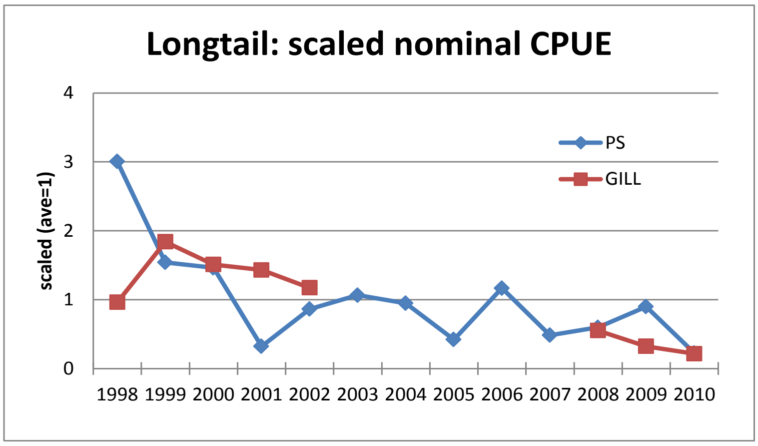
Caution is needed to evaluate N_CPUE for bonito (mixed species of kawakawa and frigate tuna). This is because if the mixing rates between two species are not constant, N_CPUE will not make any meaning. In our analyses we assume that the mixed ratios are roughly constant.

Boxes 1-4 show results of nominal CPUE for longtail tuna (1998-2010), kawakawa (2005-2010), mixed species (kawakawa and frigate tuna) (1998-2005) and king mackerel (1998-2010) respectively. In each box, annual nominal CPUE (in Tables), Trends of annual nominal CPUE and its scaled CPUE (by setting average=1) are provided for both purse seine and king mackerel drift gillnet. With scaled N_CPUE, we can compare trends of nominal CPUE between 2 gears objectively.

Box 1 Longtail tuna nominal CPUE (kg/haul)by PS (purse seine) and GILL (King mackerel gillnet)

	PS	GILL
1998	78.1	27.0
1999	40.0	51.6
2000	38.0	42.4
2001	8.4	40.2
2002	22.4	32.9
2003	27.7	
2004	24.6	
2005	10.9	
2006	30.3	
2007	12.6	
2008	15.6	15.5
2009	23.3	9.0
2010	5.9	6.1

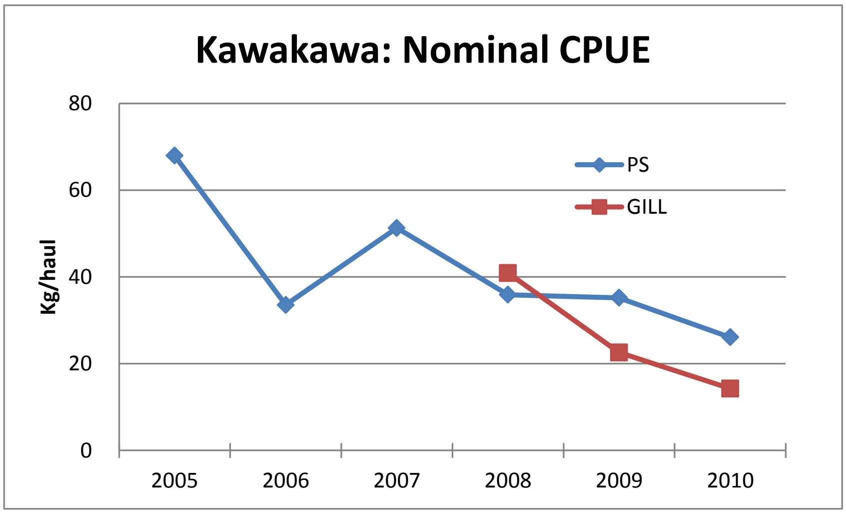


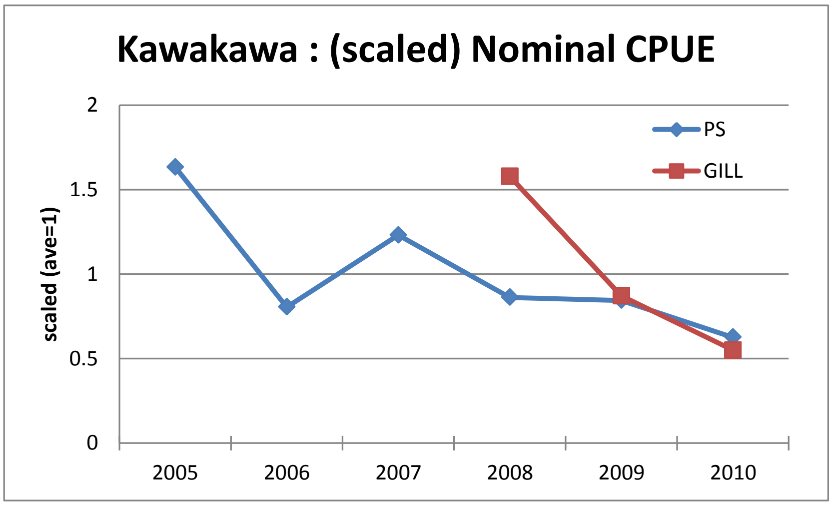


Generally the nominal CPUE for both purse seine and king mackerel gillnet fisheries show the decreasing trends (1998-2010).

Box 2Kawakawa nominal CPUE (kg/haul) by PS (purse seine) and GILL (king mackerel gillnet)

	PS	GILL
2005	68.0	
2006	33.5	
2007	51.3	
2008	35.9	40.9
2009	35.2	22.6
2010	26.1	14.2

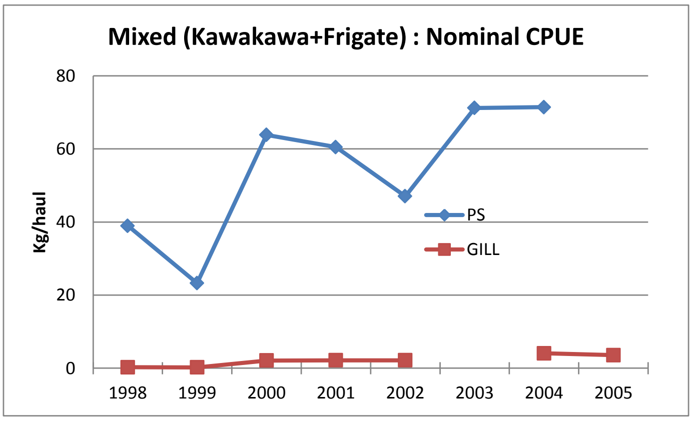


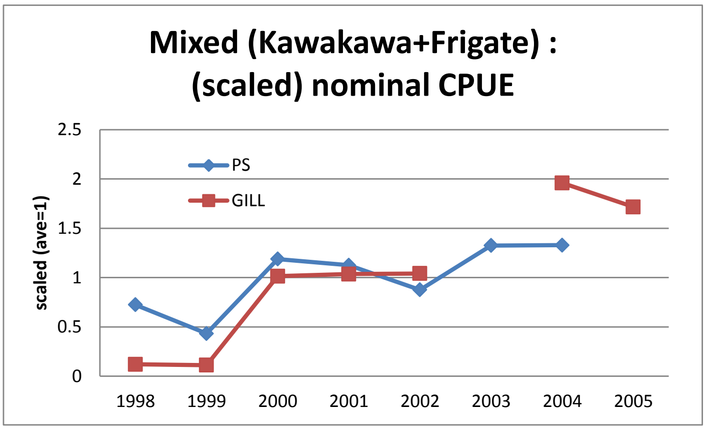


Generally the nominal CPUE for both purse seine and king mackerel gillnet fisheries show the decreasing trends (2005-2010).

Box 3 Bonito (mixed species of Kawakawa and Frigate) nominal CPUE (kg/haul) by PS (purse seine) and GILL (king mackerel gillnet)

	PS	GILL
1998	39.0	0.2
1999	23.3	0.2
2000	63.8	2.1
2001	60.5	2.1
2002	47.1	2.2
2003	71.2	
2004	71.4	4.1
2005		3.5

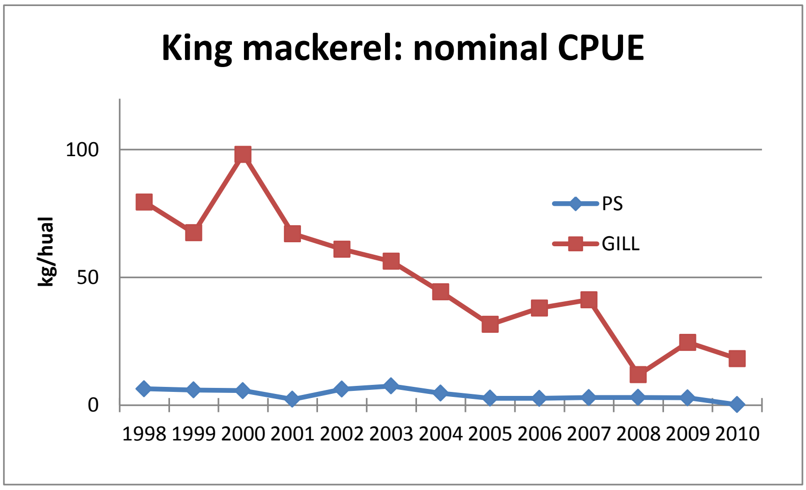


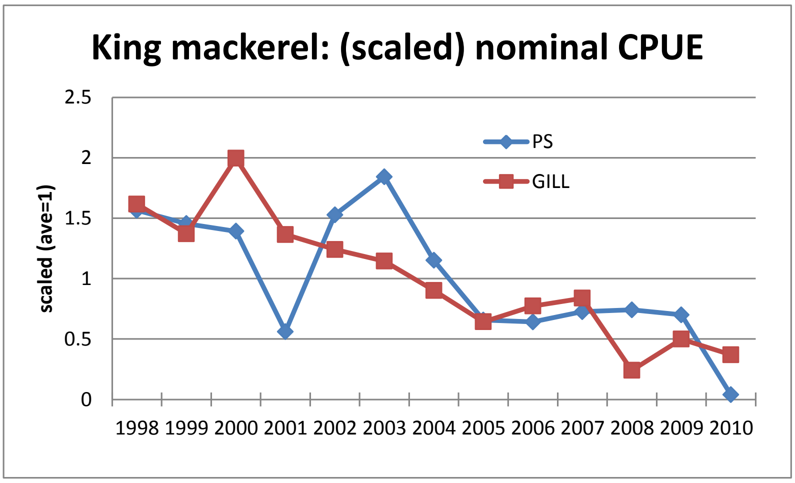


As this is N_CPUE trend of mixed species of kawakawa and frigate tuna and we don't know the annual composition of these two species, we cannot state any trends. If annul composition is similar, then we can suggest that N_CPUE of both kawakawa and frigate tuna increased from 1998-2005.

Box 4 King mackerel nominal CPUE (kg/haul) by PS (purse seine) and GILL (king mackerel gillnet)

	PS	GILL
1998	6.4	79.5
1999	5.9	67.4
2000	5.7	98.1
2001	2.3	67.1
2002	6.2	61.0
2003	7.5	56.3
2004	4.7	44.4
2005	2.7	31.6
2006	2.6	38.0
2007	3.0	41.2
2008	3.0	11.8
2009	2.9	24.5
2010	0.2	18.2





Generally the nominal CPUE for both Thai purse seine and king mackerel gillnet fisheries show the decreasing trends (1998-2010).

5. Summary

- There are a number of the data which quality are unlikely good due to large outliers. We need to investigate this by checking the original data.
- Fishing efforts have been in stable. Thai purse seine fisheries in Area 7 (southern part of the Andaman Sea) are most active (70% of the total effort).
- King mackerel and longtail catch (1998-2010) have been decreasing consistently and the total catches in 2010 are less than 10% of the catches in 1998.
- It is difficult to suggest on the catch trends of bonito due to mixed species nature and also those for kawakawa because data are available only for a short period of time.
- In the king mackerel drift gillnet fishery, target species is king mackerel nearly 60% of the total catch, while in purse seine, they are bonito (earlier years) and kawakawa (later years) (54% and 62% respectively).
- <u>Annual trends of nominal CPUE of kawakawa, longtail tuna and king mackerel suggest that all three species have been decreasing consistently to 2010. This further suggests that we need to conduct stock assessments in order to understand the status of stocks of these 3 species</u>. We may be request the technical support to CPUE standardization by using fine scale data.