แนวโน้มของปริมาณการจับสัตว์น้ำมูลค่าต่ำในทะเลสาบสงขลา (ข้อมูล พ.ศ.2546-2549)

Trends of Low Value Fish in Capture Fisheries of Songkhla Lake: 2003-2006

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บทคัดย่อ

ทะเลสาบสงขลาเป็นแหล่งน้ำขนาดใหญ่ ที่เป็นแหล่งการทำประมงที่สำคัญในภาคใต้ของประเทศไทย การจับสัตว์น้ำมูลค่าต่ำที่เพิ่มขึ้นเป็นสิ่งบ่งชี้ถึงความเสื่อมโทรมและการทำประมงที่มากเกินไปของทะเลสาบ การวิจัยนี้มีวัตถุประสงค์เพื่อประเมินแนวโน้มปริมาณสัตว์น้ำมูลค่าต่ำตามฤดูกาล ข้อมูลได้จากสถาบันวิจัยการเพาะเลี้ยงสัตว์น้ำชายฝั่ง (NICA) ซึ่งมีการสำรวจปริมาณสัตว์น้ำที่ขึ้นท่ารอบทะเลสาบสงขลา 10 แห่ง ระหว่างปี พ.ศ. 2546 - 2549 ตัวแปรตาม คือ ปริมาณสัตว์น้ำมูลค่าต่ำ จำแนกตาม ปี เดือน เครื่องมือ และชนิด ใช้กราฟอนุกรมเวลาและตัวแบบการถดถอยเชิงเส้นพหุคูณวิเคราะห์ศึกษาแนวโน้มของปริมาณสัตว์น้ำมูลค่าต่ำ ผลการศึกษาพบว่าผลการจับสัตว์น้ำมูลค่าต่ำ มีปริมาณ 1343.3 เมตริกตัน/ปี คิดเป็นร้อยละ 13.4 ของผลจับสัตว์น้ำทั้งหมด มีจำนวน 23 ชนิด ปริมาณการจับสัตว์น้ำดังกล่าวสูงสุดในปี พ.ศ. 2549 คิดเป็นร้อยละ 27.2 โดยเฉพาะในเดือนมีนาคมของทุกปี ส่วนใหญ่เป็นการจับด้วยเครื่องมือโพงพาง พบว่าแนวโน้มของปริมาณการจับสัตว์น้ำมูลค่าต่ำในทะเลสาบสงขลาในภาพรวมมีปริมาณสูงขึ้น โดยเฉพาะในปี 2549 และระหว่างเดือนมีนาคมถึงเดือนธันวาคม มีผลจับรวมสูงกว่าในเดือนมกราคมอย่างมีนัยสำคัญทางสถิติ

(p-value<0.01) บ่งชี้ให้เห็นถึงการทำประมงที่มากขึ้นอย่างต่อเนื่องในทะเลสาบสงขลา ข้อเสนอแนะจากการวิจัยควรมีการควบคุมการทำประมงอย่างเร่งด่วนต่อไป

คำสำคัญ: ประมงชายฝั่ง ปลาเป็ด รูปแบบฤดูกาลทำประมง

Abstract

Songkhla Lake is the largest natural lagoon in Southern Thailand. The lake has played an important role for both recreation and food supply. However, the increasing in low value fish capture indicating that deterioration of the fishery resource and over-exploited in the Lake is occurring. This study aimed to determine the trends, and seasonal patterns in fish catch of low value species and to develop relevant statistical models. Data were taken from ten major commercial fish landing sites around the Lake which were monthly collected by the National Institute of Coastal Aquaculture (NICA) during January 2003 to December 2006. The results found that, there were 23 species of the low value fish (13.4% of the total catch weight), with the highest proportion of low value fish, being 27.2%, in 2006 and with peak in March, mostly caught by set bag net. The results found that the overall catch of low value fish increased, trend showed statistically significant the catch in 2006 higher than those in 2003 and from March to December higher than those in January (p-value<0.01). It is indicating to the over-exploited and continually fisheries in the Lake. This suggests that fishing regulations in the Lake are urgently desirable.

Keywords: Coastal Fishery, Discard fish, Trash fish, Fishing seasonal pattern

Introduction

A global concern about the state of the world's fisheries is focused on the non-target species and non-selective or by-catch or discards. The discards are unmarketable, undersized or damaged fish of commercially fish species (Clucas, 1997). Many countries are confronted on this problem and attempt to overcome this silent discards issue. Most of studies on discards focused on species and quantities, discards rate and normally concern fishing ground, gear types used, fishing period, season and catch per unit effort (CPUE). See examples in Kennelly, 1999; Moranta *et al*., 2000; Rochet *et al*., 2002; Monteiro *et al*., 2001; Allain *et al*., 2003; Enever *et al*., 2007; Goncalves *et al*., 2007).

Usually deep-water fisheries have many discards and appear to be over-exploited. In the Asia Pacific, the discards are low value fish or trash fish (Simon *et al*., 2005) to produce fish meal of cattle feed manufacturing industry, not directly for human consumption. Kelleher (2004) reported that the discard rate in the Gulf of Thailand was 1%, Kaewnern and Wangvoralak (2004) found that the estimated quantities of low value fish amounted to about 765,000 tons or 31% of total catch. Goncalves *et al*., (2008) studied the relationship of selectivity of the gear, depth, soak time, season and non-commercial invertebrates, and found that discards were 48% of the total catch in southern Portugal. Similarly, in Panay Gulf of Philippines it was found that 25 of non-commercial species comprised the discards (Cornelio *et al*., 2008). Furthermore, 35% of trash fish were defined as low value marine fish (Kaewnern and Wangvoralak, 2005).

Songkhla Lake is the largest natural lagoon located in Southern Thailand. The Lake has played an important role both for recreation and food supply for inhabitants. However, there is increasing low value fish capture indicating the deterioration of fishery resources in the Lake (Chesoh *et al*., 2008). This study aimed to investigate both species and quantities of low value fish, based on the commercial fish landings around the Lake. Trends and seasonal patterns were also determined.

Materials and Methods

Data on 127 aquatic species were collected monthly from January 2003 to December 2006. For the period Jan 2003 to September 2005 this was from ten major commercial fish landing sites around the Lake by the National Institute of Coastal Aquaculture (NICA) of the Department of Fisheries of Thailand, and thereafter to December 2006 from the owner's data. Although, some fish species are economic fish species, in this study we determined that 'low value fish' were the fish species that had a unit price equal or less than 25 baht per kilogram, based on Khemakorn *et al*. (2005). Fish catch was also classified in term of fish group according to biological characteristics (vertebrate and invertebrate) and their living habitat (freshwater, brackish and marine) (Choonhapran, 1996). Preliminary data analysis involves percentage and time series plot. Month, year, gear types used and lake zones were identified. Multiple linear regressions were used to model the low value fish.

Results

The data cover the four year study period from January 2003 to December 2006. The fish catch was classified by unit price into 3 groups; low, medium and high price. The catch weight was 1343.3, 4686.7 and 3981.5 metric tons (13.4%, 46.8% and 39.8%) for low, medium and high priced fish, respectively.

Total low value fish catches

Table 1 shows the catch weight in metric tons and percentages of low value fish, by year, fishing gear, and area. The total weight was approximately 13.4% of the total catch weight (1,343.3 metric tons). The year with highest catch weight of low value fish was 2006, when 365.4 metric tons were caught. The fishing gear type 'set bag net' accounted for the majority of low value catch (971.7 metric tons (72.3% of all low value fish). Marginally more of these low value fish (about 547.7 metric tons or 40.8%) were caught in the Lower Lake, compared with 38.9% being caught in the Upper Lake.

Table 1: Total catch weight and percentage of low value fish categorized by year, gear type, and lake zones of Songkhla during 2003–2006.

Variable	Category	Weight (metric tons)	%
Year	2003	319.3	23.8
	2004	337.2	25.1
	2005	321.3	23.9
	2006	365.4	27.2
Gear	Trap	138.6	10.3
	Set bag net	971.7	72.3
	Gillnet	233.1	17.3
Lake zones	Upper Lake	522.4	38.9
	Middle Lake	273.2	20.3
	Lower Lake	547.7	40.8

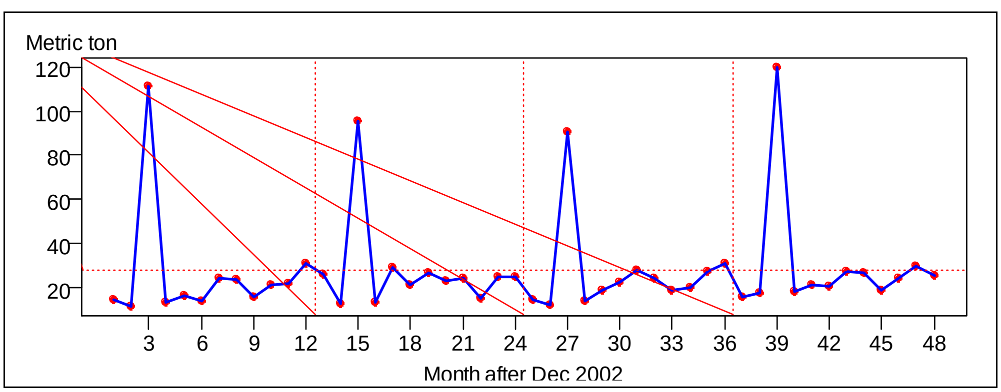

Figure 1: Monthly catch weight of low value fish in Songkhla Lake during 2003-2006.

Figure 1 shows the annual distribution, from monthly data collection, of low value fish catch during 2003-2006. The monthly catches have similar seasonal pattern, with the highest catch in March and the lowest around January and February. In 2003, the maximum monthly catch weight was 111.0 metric tons and the minimum monthly catch was 11.4 metric tons. In 2004, the maximum monthly catch weight was 95.7 metric tons and the minimum monthly catch was 12.5 metric tons. In 2005, the maximum monthly catch weight was 90.9 metric tons and the minimum monthly catch was 11.8 metric tons. In 2006, the maximum monthly catch weight was 119.5 metric tons and the minimum monthly catch was 15.8 metric tons.

Species group and catch weight by group

Table 2 shows species, family and weight of the low value fish that were caught in the Lake during 2003–2006. Twenty three species of 6 fish groups were identified including freshwater invertebrates, estuarine invertebrates, marine invertebrates, freshwater vertebrates, estuarine vertebrates and marine vertebrates. However, no freshwater invertebrate was found in the landing record. The estuarine vertebrates were the largest group, at 533.2 metric tons (39.7%) for the period. The highest catches were of yellow rasbora, naked-head glassy perchlet, estuary perchlet and dussumier's thryssa, comprising 158.4, 143.7, 139.8 and 111.5 metric tons (11.8, 10.7, 10.4 and 8.3% of total low value catch), respectively.

Trends of species group

Macrobrachium equidens was the only estuarine invertebrate among low value species. The maximum and minimum catch weights of *Macrobrachium equidens* were 4.6 and 0.4 metric tons, found in June 2004 and February 2003, respectively. Similarly, its catch weight was increased from February to June in 2004, as shown in Figure 2. *Ocypode macrocera* and *Sphaerozius nitidus* were low value species of marine invertebrate. The maximum catch weights of ghost crab, at 1.0, 2.5, 2.6, and 1.2 metric tons occurred in March in 2003, 2004, 2005, and 2006, respectively. Catch weight was rather stable in the other months. Catch weight of *Sphaerozius nitidus* was found at 3.4, 5.8, 4.7 and 5.0 metric tons in 2003, 2004, 2005, and 2006, respectively. Peaks were found in March of 2003, 2004, 2005 and 2006. An additional peak was found in May of 2004, at 7.4 metric tons, as show in Figure 3, but the intervening lower catch in April invites some consideration.

Table 2: Species, family and the catch weight in metric tons, of low value fish in each group.

Group	Family	Common Name	Scientific Name	Weight (metric tons)
Estuarine Invertebrates	Palaemonidae	Dwarf prawn	*Macrobrachium equidens*	78.3
Marine Invertebrates	Xanthidae	Xanthid crab	*Sphaerozius nitidus*	63.2
	Ocypodidae	Ghost crab	*Ocypode macrocera*	16.7
Freshwater Vertebrates	Cyprinidae	Yellow rasbora	*Rasbora lateristriata*	158.4
	Osphronemidae	Tree spot gourami	*Trichogaster trichopterus*	38.2
	Belontiidae	Croaking gourami	*Trichopsis vittata*	27.8
Estuarine Vertebrates	Chandidae	Naked-head glassy perchlet	*Ambassis gymnocephalus*	143.7
		Estuary perchlet	*Ambassis marianus*	139.8
	Aplocheilidae	Blue panchax	*Aplocheilus panchax*	72.1
	Hemiramphidae	Quay garfish	*Tylosurus crocodilus crocodilus*	59.1
	Gobiidae	Long-tailed sand goby	*Rhinogobius hongkongensis*	58.2
		Dwarf goby	*Parioglossus phillippinus*	28.1
	Eleotridae	Mud sleeper	*Butis koilomatodon*	28.9
	Synathathidae	Beady pipefish	*Hippichthys penicillus*	3.2
Marine Vertebrates	Engraulididae	Dussumier's thryssa	*Thryssa dussumieri*	111.5
		Dusky-hairfin anchovy	*Setipinnata melanochir*	49.2
		Sabretoothed thryssa	*Lycothrissa crocodilus*	38.1
	Trypauchenidae	Horse face loach	*Scomberomorus commerson*	69.9
	Gobiidae	Tropical sand goby	*Acentrogobius caninus*	58.5
		Bighead goby	*Acentrogobius chloreostigmatoides*	41.1
	Apogonidae	Candystripe cardinalfish	*Apogon endekataenia*	25.7
	Platycephalidae	Bartail flathead	*Platycephalus indicus*	24.1
	Tetraodontidae	Spotted green pufferfish	*Tetraodon nigroviridis*	9.4

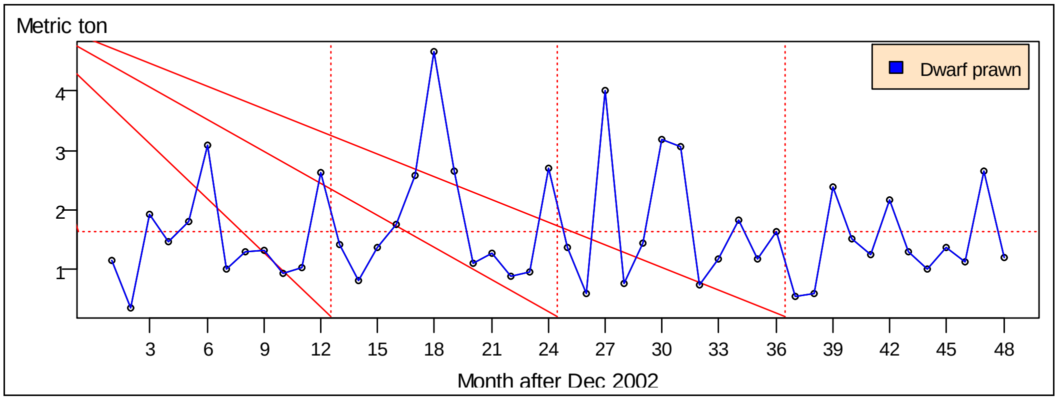

Figure 2: Monthly catch weight of the low value fish of estuarine invertebrate.

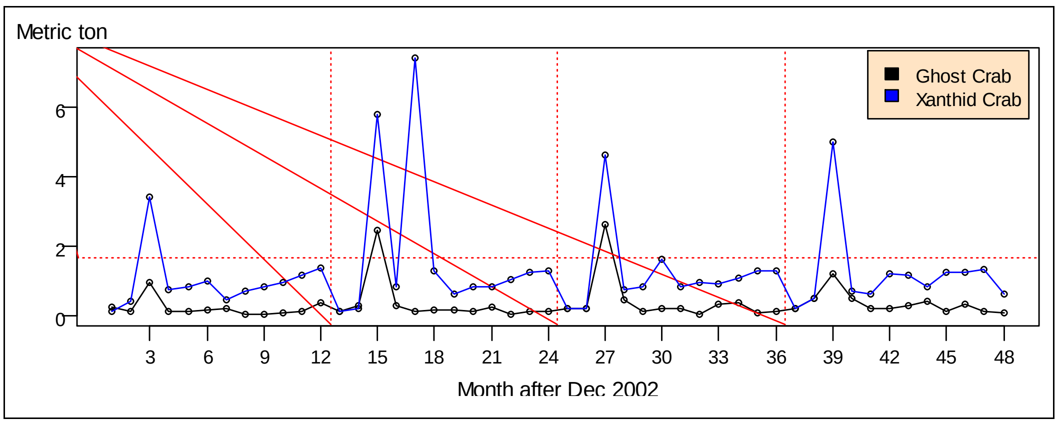

Figure 3: Monthly catch weight of the low value fish of marine invertebrates.

Rasbora lateristriata, *Trichopsis vittata* and *Trichogaster trichopterus* were low value species of freshwater vertebrates. The catch weight of *Rasbora lateristriata* increased greatly in July and remained high in August, on an annual seasonal pattern. About 12 metric tons in 2003, 2004 and 2005, and 10 metric tons in 2006 were caught. There was not such a strong seasonal pattern in the catch weightsof *Trichopsis vittata* and *Trichogaster trichopterus*, as shown in Figure 4.

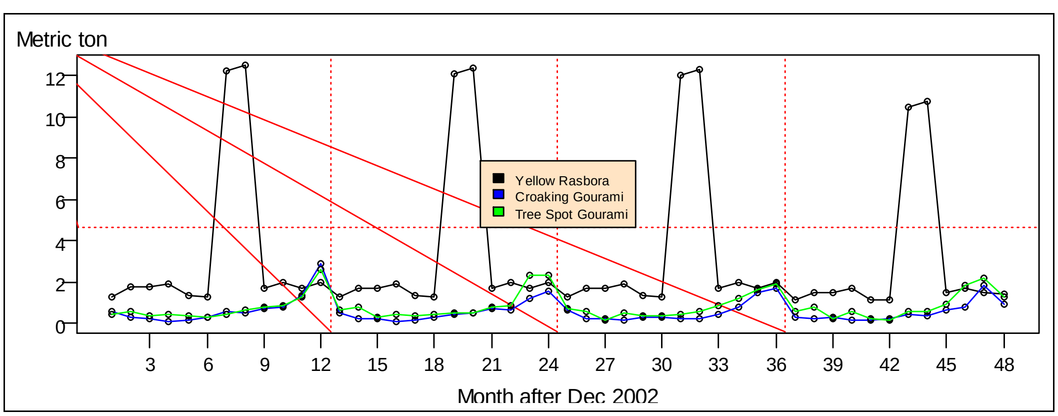

Figure 4: Monthly catch weight of the low value fish of freshwater vertebrates

Ambassis gymnocephalus, *Ambassis marianus*, *Aplocheilus panchax*, *Tylosurus crocodilus crocodilus*, *Rhinogobius hongkongensis*, *Parioglossus phillippinus*, *Butis koilomatodon* and *Hippichthys penicillus* were the low value fish of estuarine vertebrates. All of these species were found to have their highest catch weights in March, as shown in Figure 5. Similarly, *Thryssa dussumieri*, *Setipinnata melanochir*, *Lycothrissa crocodilus*, *Scomberomorus commerson*, *Acentrogobius caninus*, *Acentrogobius chloreostigmatoides*, *Apogon endekataenia*, *Platycephalus indicus* and *Tetraodon nigroviridis* were low value fish of marine vertebrates for which the peak happened in March, Figure 6.

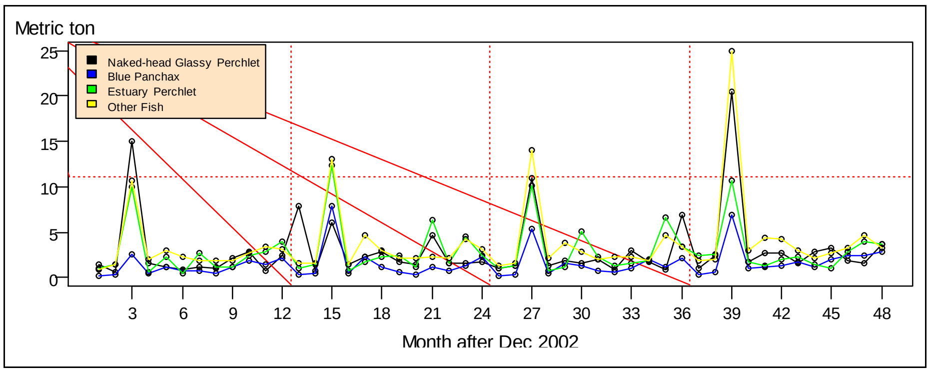

Figure 5: Monthly catch weight of the low value fish of estuarine vertebrates

Trends of gears

Figure 7 shows the monthly catch weights of low value fish using trap, set bag net and gill net type. The maximum catch weights by trap were 4.5, 6.9, 6.2 and 5.3 metric tons in June in 2003, 2004, 2005 and 2006, respectively (upper panel). The maximum catch weights by set bag net were 104.9, 90.5, 83.7 and 113.1 metric tons in March in 2003, 2004, 2005 and 2006, respectively (middle panel). In addition, the maximum catch weights by gill net were 12.2, 12.2, 12.2 and 11.4 metric tons in July in 2003, 2004, 2005 and 2006, respectively (lower panel). The patterns were different when we separated by gear.

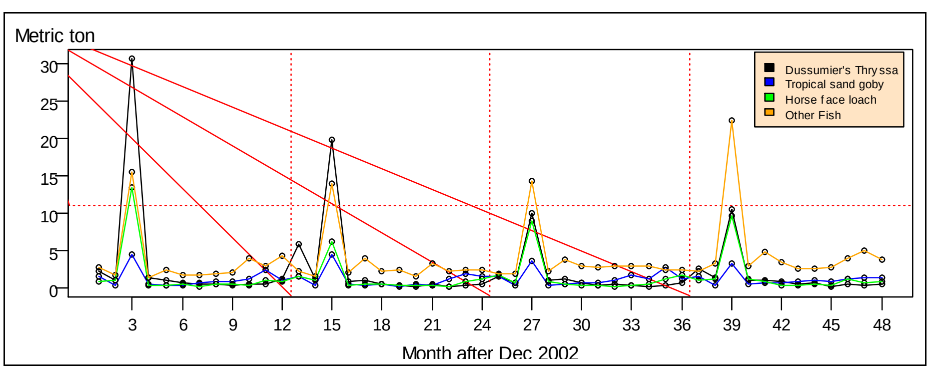

Figure 6: Monthly catch weight of the low value fish of marine vertebrates.

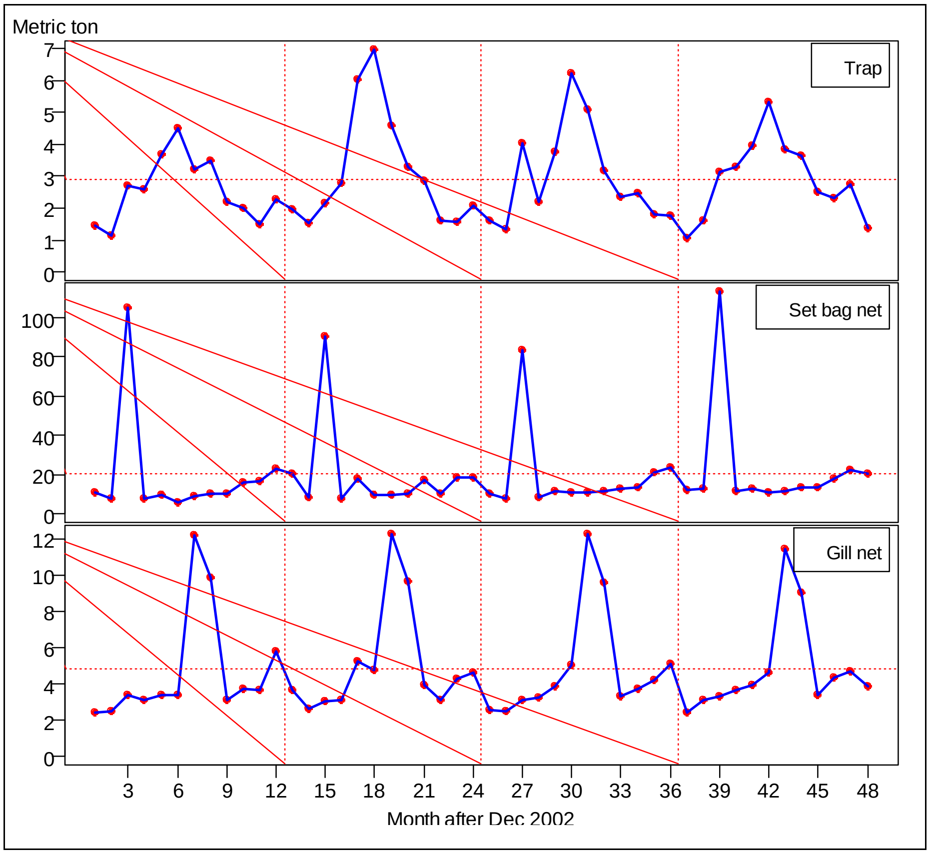

Figure 7: Monthly total catch weight of low value fish using trap, set bag net and gill net type

Table 3: Results from fitting linear regression model to logarithms of monthly low value fish catches.

r-squared: 0.6629 df: 3273

Determinant		Coefficient	Std. Error	t-value	p-value
(Intercept)		4.2982	0.1049	40.96	< 0.0001
Year (baseline: 2003)				< 0.0001	
	2004	0.0144	0.0475	0.30	0.7618
	2005	0.0439	0.0475	0.92	0.3557
	2006	0.1868	0.0475	3.93	< 0.0001
Month (baseline: January)				< 0.0001	
	February	0.0509	0.0823	0.62	0.5364
	March	0.9393	0.0823	11.41	< 0.0001
	April	0.4008	0.0823	4.87	< 0.0001
	May	0.7724	0.0823	9.38	< 0.0001
	June	0.8244	0.0823	10.01	< 0.0001
	July	0.6286	0.0823	7.64	< 0.0001
	August	0.5003	0.0823	6.08	< 0.0001
	September	0.4417	0.0823	5.37	< 0.0001
	October	0.3558	0.0823	4.32	< 0.0001
	November	0.2733	0.0823	3.32	0.0009
	December	0.5419	0.0823	6.58	< 0.0001
Gear (baseline: Trap)				< 0.0001	
	Set bag net	2.1304	0.0412	51.76	< 0.0001
	Gillnet	0.4471	0.0412	10.86	< 0.0001
Species (baseline: *Macrobrachium equidens*)				< 0.0001	
	Trichogaster trichopterus	-0.6652	0.1140	-5.84	< 0.0001
	Sphaerozius nitidus	-0.6753	0.1140	-5.93	< 0.0001
	Tylosurus crocodilus crocodilus	-0.6509	0.1140	-5.71	< 0.0001
	Trichopsis vittata	-1.0885	0.1140	-9.55	< 0.0001
	Tetraodon nigroviridis	-2.7281	0.1140	-23.94	< 0.0001
	Hippichthys penicillus	-3.8162	0.1140	-33.48	< 0.0001
	Rasbora lateristriata	0.5922	0.1140	5.20	< 0.0001
	Lycothrissa crocodilus	-1.1168	0.1140	-9.80	< 0.0001
	Thryssa dussumieri	-0.6415	0.1140	-5.63	< 0.0001
	Aplocheilus panchax	-0.5503	0.1140	-4.83	< 0.0001
	Apogon endekataenia	-1.6249	0.1140	-14.26	< 0.0001
	Platycephalus indicus	-1.7295	0.1140	-15.18	< 0.0001
	Ocypode macrocera	-2.1086	0.1140	-18.50	< 0.0001
	Ambassis gymnocephalus	0.1484	0.1140	1.30	0.1930
	Ambassis marianus	0.1849	0.1140	1.62	0.1048
	Rhinogobius hongkongensis	-0.8738	0.1140	-7.67	< 0.0001
	Parioglossus phillippinus	-1.4837	0.1140	-13.02	< 0.0001
	Acentrogobius chloreostigmatoides	-1.1920	0.1140	-10.46	< 0.0001
	Butis koilomatodon	-1.3555	0.1140	-11.89	< 0.0001
	Setipinnata melanochir	-0.9788	0.1140	-8.59	< 0.0001
	Scomberomorus commerson	-0.8319	0.1140	-7.30	< 0.0001
	Acentrogobius caninus	-0.6463	0.1140	-5.67	< 0.0001

Table 3 shows coefficients for years and months with their corresponding standard errors and overall p-values after fitting the regression model for the natural logarithm of the low value fish. The determinants, year, month, gear and species are statistically significant ($p<0.0001$) and r-squared is 0.66. The coefficients increase consistently with year and differences for month with peaks in March, June and May and lows in February.

Discussion and Conclusion

The total weight was approximately 13.4% of the total catch weight, mostly caught by set bag net, when compared to other studies. Stobutzki *et al*. (2005) reported 47.5% of trash fish by weight in coastal fisheries of Thailand and Malaysia. Grainger *et al*. (2005) reported the catch of low value fish was 15.7% of total catch in China. The maximum catches in species were *Rasbora lateristriata*, *Ambassis gymnocephalus*, *Ambassis marianus* and *Thryssa dussumieri*, while the other studies found in families were Leiognathidae (Khemakorn *et al*., 2005, Stobutzki *et al*., 2005), Nemipteridae (Khemakorn *et al*., 2005), Engraulidae, Mullidae, Synodontidae and Apogonidae (Stobutzki *et al*., 2005).

The time series plot for each of marine invertebrates, estuarine vertebrates and marine vertebrates was similar in the plot for total low value fish, with a peak in March. This can be explained that many species of marine fish migrated into the lake (Chesoh and Choonpradub, 2008). Freshwater vertebrates had peaks in July-August and estuarine invertebrates had various peaks. This can be explained that many freshwater fish move to spawning ground during July and August then they were easy to be caught (Chesoh and Lim, 2008).

The overall catch of low value fish increased, trend showed statistically significant the catch in 2006 higher than those in 2003 and from March to December higher than those in January, whereas Khemakorn *et al*. (2005) found the trends of commercial landings catch of trash fish and low value food fish were slightly decreased and Komontree *et al*. (2006) was no detectable trend in the trash fish.

Limitation of this study, the low value fish were defined as the fish that were caught by three major fishing gears and landed at fish port around Songkhla Lake, and had a unit price equal or not exceeding 25 baht per kilogram. The fish size, and catch by the other gears, were not recorded were not taken into account in this study.

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