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Possibility to Modify Shrimp Trammel Net to Reduce Discard Species

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ABSTRACT

The study on shrimp trammel net in cooperation with a fisherman at Warnnapasup Beach, Chonburi Province was undertaken during Oct 2004-Sep 2005. A total of 11 fishing operations was conducted to observe the fishing method, catch composition, discard problem, catch characteristic and net position of caught species in order propose an application for the modified methods to reduce discard species by this fishing gear. Shrimp trammel net is a kind of gillnet operated by sweeping the bottom net on seafloor with tidal current force. From the fishing operations, shrimps were target species and caught only about 10 % by number while 90 % was non-target species and almost all of them were discarded including economically important species. The majority of caught species were obtained by entangling and pocketing function around the bottom net panel. Increasing the mesh size of inner net and decreasing the net height are possible methods to modify the net to reduce those non-target species while least affect on shrimp catch efficiency. However, the modifications may affect the net operation especially on the net sweeping. So how big of mesh size should be increased, how tall of the net should be decreased and the affects of modified fishing gear should be considered and studied before promoting to the fishers.

Key words: trammel net, discard

INTRODUCTION

Shrimp trammel net is a kind of gillnet (Department of Fisheries, 1997) that the main target catch is shrimps. Trammel net is composed of 3 layers, i.e. 2 outer layers net (same mesh size) which cover 1 inner layer (smaller mesh size). The net is made of nylon multifilament (210 d/2 for inner net and 240 d/4 for outer net). The inner mesh size is about 4 cm and the outer is about 14-26 cm. Hanging ratio of the inner net at the float line is about 52-54 % and at the foot rope is about 43-45 % while the outer net hanging ratio is about 21-63 % (SEAFDEC, 1986). The shrimp trammel net plan and operation are shown in Figure 1.

According to Fisheries Statistics of Thailand (Department of Fisheries, 2003), in the year 2000 Thailand caught marine shrimps 145,920 tons in total, with the value of 8,974.206 million baht. The caught shrimp from shrimp trammel net was 14,074 tons (9.65 % of total). Even though the shrimps from trammel net contributed only small catch, but this fishing gear is common practiced along coastal areas of Thailand.

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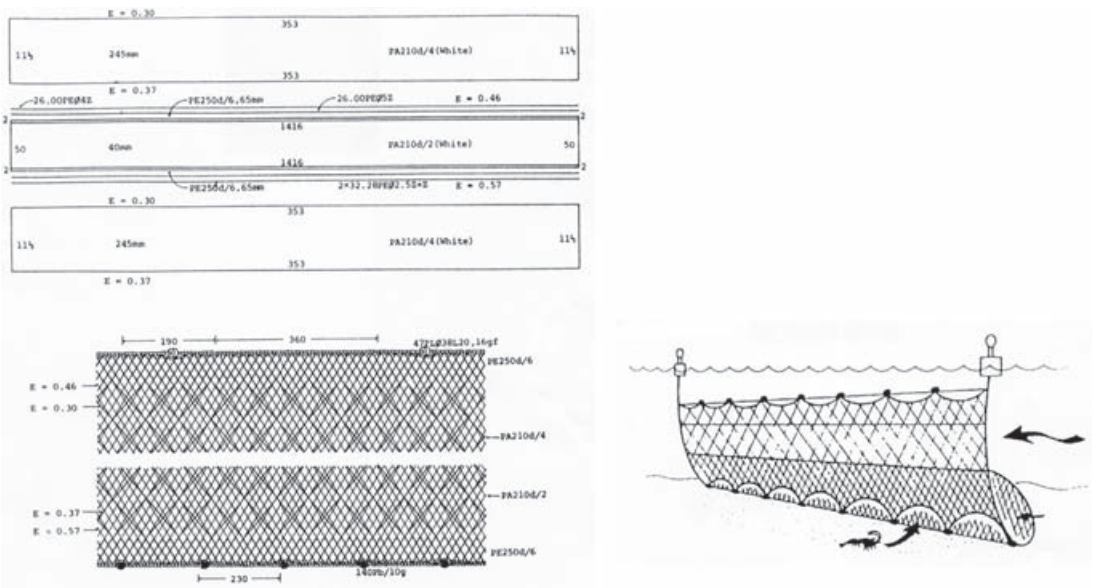

Figure 1 Shrimp trammel net plan (left) that conduct fishing around the coastal of Chonburi Province (Source; SEAFDEC, 1986) and The operation of shrimp trammel net (deploy the net against the current)

Generally, fishing is operated in the early morning at the fishing ground of 5-20 m depth (sand-mixed mud) especial in the rainy season (May-October). Fisherman deploys the net against currents (Figure 1) and let it move slowly for 1-2 hrs, after that the net will be hauled and shrimps are collected. If the catch is good, shrimp trammel net operations will be repeated.

The main target of shrimp trammel net is many kinds of shrimps, such as banana shrimp, school prawn and tiger prawn. They have high price, up to 200-500 baht/kg, depending on the size of the shrimp and season. The trammel net in operation in Thailand is a less selectivity fishing gear. They will catch a lot of others non-target species including juvenile of many economic species. Lunn (2003) surveyed the shrimp trammel net fishing around Koh Chang, Trat Province and reported that the average catch was 2-10 kg/boat/day, catch per unit effort (CPUE) was 0.36-1 kg/hr while the non-target species was quite high, 16.9-18.7 kg/boat/day (2.61-2.21 kg/hr) and almost all of them were died. Even though some of them were utilized (bring back home for family or neighbors) but a lot of them were discarded including some small size of economic species. Moreover, fishermen actually do not want to catch those non- target species because almost all of them have low market value. Besides, it takes time to remove those non-target species which could easily damage the net, and as a result could lead to less efficiency of the net.

In order to reduce the non-target species catch that become discard problem from shrimp trammel net, the study on the catch composition, catch characteristic and net position of the catch species from this fishing are necessary. The application study from this paper was to propose the possibility to modify the shrimp trammel net to release non-target species while having least affect on the catch efficiency of shrimps.

MATERIALS AND METHODS

Onboard data on shrimp trammel net operations by a fisherman's boat were collected around Warnnapasup Beach, Chonburi Province of the fishing ground of 6-8 m depth, approximately 2-3 km from shore, on 6 October, 11,12 Dec 2004, 3,4 Mar, 6,7 Apr, 26-27 Aug and 9,10 Sep 2005 in total of 11 fishing operations with 1-2 hrs early morning soaking time,. The catch from the operations was recorded. The catch species were identified and counted. Catch composition was analyzed for the numbers and weight in each species, to identify the discard aspects (Alverson *et al*. 1994; Matsuoka 1997), as follows;

Discard Ratio = Discards/Retentions

Discard Rate = Discards/(Retentions+Discards)

The catch characteristic was identified (snagged, gilled, wedged, entangled and pocketed) (Figure 3) based on Karlsen and Bjarnasson (1986), the net position of species caught was

Figure 2 Shrimp trammel net boat (left) and deploying operation (right).

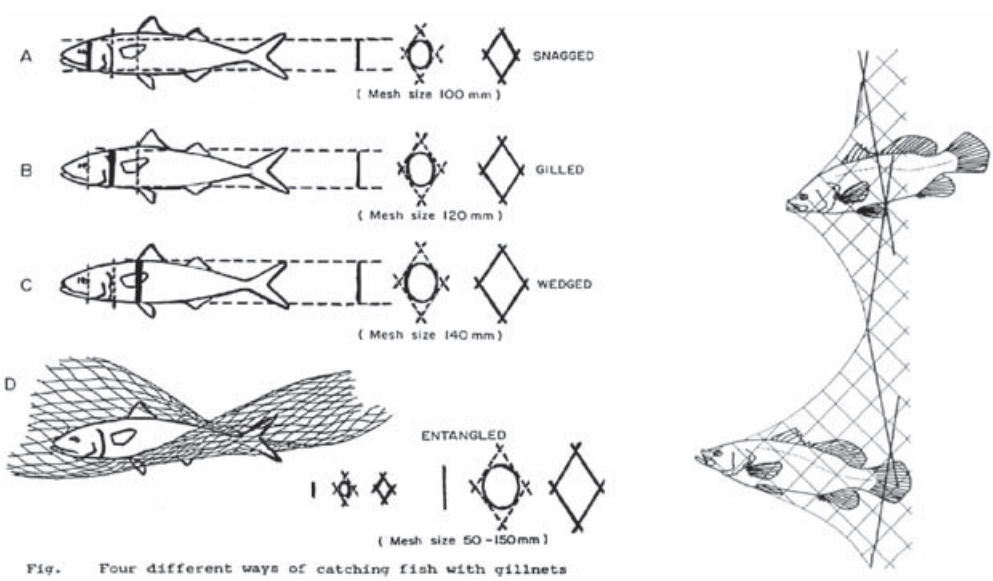

Figure 3 Four different ways of catching with gillnet (left) and pocketed catching function (right) from trammel net that added function from general gillnet (Sources: Karlsen and Bjarnasson, 1986; Matsuoka, 1991).

recorded (top or middle or bottom of the net) to analyze and propose the method for modification the shrimp trammel net to reduce the discard species.

RESULTS

Onboard data collecting was conducted with 11 fishing operations in total. The catch composition of 10 September 2005 (last operation) is shown in Table 1.

From 10 Sep 2005 fishing operation, the fisherman kept only banana prawns and discarded all of the other species. So;

By number, Discard ratio = 9.07, Discard rate = 0.90

By weight, Discard ratio = 6.81, Discard rate = 0.87

From onboard data collecting with shrimp trammel net in total of 11 fishing operations, the catch characteristic (%) of caught species are shown in Table 2.

From onboard data of 11 fishing operations, the position (top, middle and bottom) that caught species were snagged, gilled, wedged, entangled and pocketed the net are shown in Table 3.

DISCUSSION

The main target catches of trammel net from the study area were banana prawns and tiger prawns (Figure 4). The trammel net conducted on seafloor by bottom net will be swept by tidal current during operations. Hence, it has much affect on the others species in the fishing ground particularly demersal species. From the catch composition, the shrimps were caught only about 10% by number (Table 1) while 90% were the others and become discard problem including

Table 1 Catch composition from operation of 10 Sep 2005 (3 sets of trammel net)

No.	Common/Scientific name	Catch number	Weight (g)	Percent (%)	
				By number	By weight
1	Banana prawn *(Penaeus merguiensis)*	15	400	9.9	12.8
2	Small-eyed mantis shrimp *(Miyakea neap)*	1	15	0.7	0.5
3	Spiral melongena *(Pugilina cochlidium*)	3	73	2	2.3
4	Murex	5	13	3.3	0.4
5	Smoothshelled swimming crab *(Charybdis affinis*)	3	55	2	1.8
6	Blue swimming crab *(Portunus pelagicus*)	6	220	4	7
7	Three-lined theraponid *(Therapon theraps)*	2	70	1.3	2.2
8	Striped catfish *(Plotosus lineatus)*	1	285	0.7	9.1
9	Silver-biddy *(Gerres* sp.*)*	14	485	9.3	15.5
10	Pony fish *(Leignathus* sp.*)*	62	395	41.1	12.6
11	Short-nosed tripodfish *(Tricanthus biaculeatus)*	1	8	0.7	0.3
12	Chinese filefish *(Monacanthus chinensis)*	6	295	4	9.4
13	White-spotted spinefoot (*Siganus oramin*)	8	290	5.3	9.3
14	Silver whiting *(Silago sihama)*	1	30	0.7	1
15	Brown sea urchin *(Temonpleurus toreumaticus)*	15	155	9.9	5
16	Jelly fish	4	250	2.6	8
17	Cuttlefish *(Seapia* sp.*)*	2	80	1.3	2.6
18	Starfish	2	4	1.3	0.1
	Total	151	3,123		

Table 2 Catch characteristic of caught species from shrimp trammel net (11 operations).

Species	Total No.	Snagged		Gilled		Wedged		Entangled & pocketed	
		No.	%	No.	%	No.	%	No.	%
1. Banana prawn	218	-	-	-	-	-	-	218	100
2. Green tiger prawn	40	-	-	-	-	-	-	40	100
3. Spear shrimp	2	-	-	-	-	-	-	2	100
4. Small-eyed mantis shrimp	3	-	-	-	-	-	-	3	100
5. Spiral melongena	4	-	-	-	-	-	-	4	100
6. Murex	57	-	-	-	-	-	-	57	100
7. Smoothshelled swimming crab	16	-	-	-	-	-	-	16	100
8. Pebble crab	2	-	-	-	-	-	-	2	100
9. Blue swimming crab	77	-	-	-	-	-	-	77	100
10. Dwarf ray	3	-	-	-	-	-	-	3	100
11. Three-lined theraponid	18	4	22.2	5	27.8	6	33.3	3	16.7
12. Jew fish	1	1	100	-	-	-	-	-	-
13. Jew fish	15	5	33.3	3	20.0	5	33.3	2	13.3
14. Jew fish	6	3	50	1	16.7	1	16.7	1	16.7
15. Pipefish	2	-	-	-	-	-	-	2	100
16. Catfish	1	-	-	-	-	-	-	1	100
17. Striped catfish	2	-	-	-	-	-	-	2	100
18. Silver-biddy	36	6	16.7	8	22.2	16	44.4	6	16.7
19. Gizzard shad	78	12	15.4	6	7.7	46	59.0	14	17.9
20. Indo-Pacific mackerel	1	1	100	-	-	-	-	-	-
21. Spotted sicklefin	1	-	-	-	-	-	-	1	100
22. Pony fish	865	131	15.1	48	5.5	300	34.7	386	44.6
23. Malayan flounder	1	-	-	-	-	-	-	1	100
24. Oriental sole	5	-	-	-	-	-	-	5	100
25. Short-nosed tripodfish	84	7	8.3	9	10.7	22	26.2	46	54.8
26. Chinese filefish	92	19	20.7	18	19.6	14	15.2	41	44.6
27. Baracuda	2	-	-	-	-	-	-	2	100
28. Travally	11	1	9.1	4	36.4	5	45.5	1	9.1
29. White-spotted spinefoot	17	4	23.5	3	17.6	2	11.8	8	47.1
30. Flathead fish	2	-	-	1	50.0	-	-	1	50
31. Silver whiting	3	1	33.3	1	33.3	-	-	1	
32. Fish (*Aplocheilus* sp.)	3	-	-	-	-	2	66.7	1	
33. Cardinal fish	2	1	50.0	1	50.0	-	-	-	
34. Brown sea urchin	57	-	-	-	-	-	-	57	100
35. Jelly fish	6	-	-	-	-	-	-	6	100
36. Triangle-tail horse-shoe crab	1	-	-	-	-	-	-	1	100
37. Cuttlefish	12	-	-	-	-	-	-	12	100
38. Octopus	1	-	-	-	-	-	-	1	100
39. Starfish	11	-	-	-	-	-	-	11	100

Table 3 Position of the net that species were caught (from 11 operations).

Species	Total No.	Top net		Middle net		Bottom net	
		No.	%	No.	%	No.	%
1. Banana prawn	218	7	3.2	56	25.7	155	71.1
2. Green tiger prawn	40	3	7.5	8	20.0	29	72.5
3. Spear shrimp	2	-	-	-	-	2	100
4. Small-eyed mantis shrimp	3	-	-	-	-	3	100
5. Spiral melongena	4	-	-	-	-	4	100
6. Murex	57	-	-	3	5.3	54	94.7
7. Smoothshelled swimming crab	16	-	-	3	18.8	13	81.3
8. Pebble crab	2	-	-	-	-	2	100
9. Blue swimming crab	77	1	1.3	9	11.7	67	87
10. Dwarf ray	3	-	-	-	-	3	100
11. Three-lined theraponid	18	-	-	4	22.2	14	77.8
12. Jew fish	1	-	-	-	-	1	100
13. Jew fish	17	2	11.8	5	29.4	10	58.8
14. Jew fish	6	-	-	1	16.7	5	83.3
15. Pipefish	2	-	-	-	-	2	100
16. Catfish	1	-	-	-	-	1	100
17. Striped catfish	2	-	-	2	100	-	-
18. Silver-biddy	36	-	-	10	27.8	26	72.2
19. Gizzard shad	78	13	16.7	37	47.4	28	35.9
20. Indo-Pacific mackerel	1	-	-	1	100	-	-
21. Spotted sicklefin	1	-	-	-	-	1	100
22. Pony fish	865	134	15.5	345	39.9	386	44.6
23. Malayan flounder	1	-	-	-	-	1	100
24. Oriental sole	3	-	-	1	33.3	2	66.7
25. Short-nosed tripodfish	84	5	6.0	21	25.0	58	69.0
26. Chinese filefish	92	3	3.3	22	23.9	67	72.8
27. Baracuda	2	-	-	1	50.0	1	50.0
28. Travally	11	3	27.3	4	36.4	4	36.4
29. White-spotted spinefoot	17	3	17.6	5	29.4	9	52.9
30. Flathead fish	1	-	-	-	-	1	100
31. Silver whiting	4	1	25.0	1	25.0	2	50.0
32. Fish (*Aplocheilus* sp.)	3	1	33.3	1	33.3	1	33.3
33. Cardinal fish	2	-	-	1	50.0	1	50.0
34. Brown sea urchin	57	-	-	11	19.3	46	80.7
35. Jelly fish	6	-	-	2	33.3	4	66.7
36. Triangle-tail horse-shoe crab	1	-	-	-	-	1	100
37. Cuttlefish	12	-	-	3	25.0	9	75.0
38. Octopus	1	-	-	-	-	1	100
39. Starfish	11	-	-	1	9.1	10	90.9

Figure 4 Main target catch from the shrimp trammel net in the fishing ground; banana prawn *(Penaeus merguiensis)* and green tiger prawn *(Penaeus semisulcatus)*.

economic species such as mantis shrimp, blue swimming crab, silver-biddy, cuttlefish, etc, (Table 1). Small size and few catch were main reasons that fisherman did not retain the others species even though some of them were economically important species.

The value of 9.07 of discard rate (by number) from an operation of this fishing was quite high. Moreover, about 90% (by number) of the catch was non-target species and will be discarded. Repetition of the operations with a lot of fishing boats can increase the discard problems. The other non-target species were caught by entangling around bottom net panel (Table 2-3) in majority. It should provide more efficiency to reduce those discarded species if the trammel net can be modified by shifting the bottom net with a horizontal slit between the net webbing and footrope. But shifting the bottom net panel will affect target catch efficiency certainly because almost all of shrimps were also caught by entangling around bottom net panel.

Although trammel net is classified in the same category as a gill net (FAO, 1982) but it has characteristic selectivity curve different from the gill net due to difference in capture condition as well as it's operation method (Kitahara, 1968). It is usually thought as a modified gillnet, however, for its selectivity curve has much wider range of high efficiency due to an additional capture function of pocketing (Matsuoka, 1991). Generally, the selectivity pattern of trammel net for fin-fish depends on the mesh size and slackness of its inner net (Gobert, 1992). The large individuals were entangled or entrapped mostly in the pocket formed by the loose inner net as a result of slackness. With the slackness about 2 times, the inner net became very loose, the selection range of 50% of trammel net became wider when the slackness was increased from 1.1 to 2.0 (Koike and Takeuchi, 1988). So the other possibilities to modify this fishing gear to reduce the discard species while having least affect on shrimp catch efficiency are increasing mesh size and slackness of inner net, and decreasing net height. Increasing mesh size can release small size catch especially species that will be caught with gilled characteristic while reducing the net height can decrease caught species around top net panel. However, mesh size increasing and net high decreasing may affect operation of the net. They can also affect capture process of the shrimps such as net sweeping efficiency and catching functions especially entangled and pocketed functions. Factors such as the compressing ratio of body girth and the mesh twine elasticity are considered to influence probability (Purbayanto *et al*., 2000). So how big of inner mesh size and slackness should be increased, how tall of the net should be decreased, and the affects of modified fishing gear to reduce the discards species while having least affect on shrimp catch efficiency should be

considered and studied before promoting to the fishermen.

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