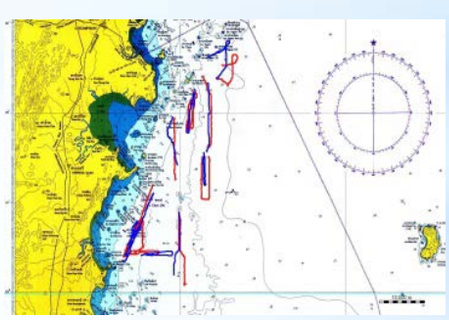
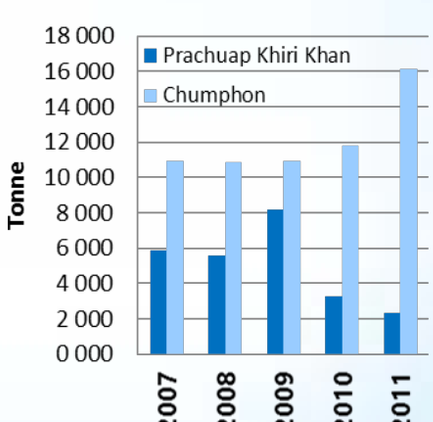
“Strategies for trawl fisheries by-catch management”

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

THAILAND

Research Documents





Preface

Between April 2013 and September 2016, The Food and Agriculture Organization of the United Nations ("FAO") and the Department of Fisheries, Thailand collaborated in the execution of the GEF supported project "Strategies for trawl fisheries by-catch management" (REBYC-II CTI; GCP /RAS/269/GFF). The Project was implemented by The Marine Fisheries Research and Development Division of the Thai Department of Fisheries, in two areas of the Gulf of Thailand.

At the first site, Prachuab Kiri Khan and Chumphon Provinces, the focus of the work was on the enlargement of cod end mesh sizes for trawlers. The Central Gulf Marine Fisheries Research and Development Center (CMDEC), located in Chumphon took a lead research role in this work. The second site was in Trat province, where management measures for closed areas and closed seasons were established to protect fish larvae and spawners. The Eastern Marine Fisheries Research and Development Center (EMDEC), located in Rayong province lead this work.

The full list of research work carried out by CMDEC and consultants in Prachup Kiri Khan-Chumphon site was as follows:

1) An experiment in cooperated with trawl fishers, fish processor, fishmeal plant operators, NGOs and revelant authorities in Prachuap Kiri Khan and Chumphon provinces to test the effects of using a cod end mesh size of 4.0 cm.

2) A baseline survey to assess the present status of fisheries in Prachaup Kiri Khan and Chumphon provinces,

3) A socio-economic study of fishers and fishing communities in Prachaup Kiri Khan and Chumphon provinces,

4) The hosting of Prachuap Kiri Khan/Chumphon stakeholder meetings to disseminate the results of research works, and formulate management measures.

The full list of research work carried out by EMDEC and consultants in Trat province was as follows:

1) A survey of fish lavae and spawner abundance and distribution in Ao Trat using the DOF research vessel and local fisher's boat,

2) A baseline surveys to assess the present status of fisheries in in Trat province;

3) A socio-economic study of fishers and fishing communities in Trat province.

4) The hosting of Trat stakeholder meetings to disseminate the results of research works, and formulate management measures.

In addition, the DOF has provided a national consultant to review the Laws and Regulations impacting on trawl fisheries and by catch, in the Fisheries Act 2490 (1976).
From these studies, the project produced nine research documents

1. Chintana Nettasna. 2014. Review of Thai Laws in Relation to Trawl Fisheries, bycatch Management.

2. Pavarot Noranarttragoon.2014. Review of the Marine Fisheries in Trat Province, Thailand.

3. Pavarot Noranarttragoon. 2016.Fisheries Resources in Trat Province, Thailand.

4. Pavarot Noranarttragoon. 2015.Baseline surveys in Prachuap Khiri Khan and Chumphon Provinces.

5. Pavarot Noranarttragoon. 2016. Fisheries Resources from Trawlers in Prachuap Khiri Khan and Chumphon Provinces, Thailand.

6. Sirisuda Jumnongsong. 2016. Socio-Economic Status of Trawl Fishers in Prachuap Khiri Khan - Chumphon and Trat Provinces, Thailand.

7. Ratanawalee Phoonsawat, Udomsin Auksonphaob, Thitipon Cheuamankong and Sampan Panjarat. 2016. Trawling experiment by using the extending mesh size cod end net.

8. Apichart Termvidckakorn. 2016. Biodiversity, abundance and distribution of fish larvae in Ao Trat, Thailand.

9. A ninth paper; 'Piyachoke Sinanun and Thiwarat Sinanun 2016. 'The Compilation of Thailand Research Works for policy makers', integrates the main findings from the eight studies into a single paper intended it provide policy makers with an overview of trawl fisheries issues in the Gulf of Thailand.

The Department of Fisheries is deeply grateful to GEF, FAO, SEAFDEC, stakeholders, fishers and colleagues for their work on supporting management measures that can be practically implemented so that fishers can fish in a more sustainable fisheries manner. The reduction of small-sized economic species is a major concern, as are other management measures to protect and conserve areas so that GOT fish stocks can be rebuilt in the future

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September 2016

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

Gulf of Thailand Trawl Experiments Using 4.0 cm Codend Mesh[1]

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2016

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Gulf of Thailand Trawl Experiments Using 4.0 cm Codend Mesh

Summary

In responce to the depletion of fisheries resources in the Gulf of Thailand, the DOF Thailand, in collaboration with the Food and Agriculture Organization of the United Nations (FAO) and Southeast Asian Fishery Development Center (SEAFDEC) implemented participatory research into the use of increased (4.0 cm mesh size) trawl codend mesh sizes in Chumporn province, Thailand. The study resulted in four sets of analyses: 1) Catch rate, catch composition and escapement rate between current codend mesh size (1.25 – 1.8 cm stretched full mesh lenght) and esperimental 4.0 cm codend; 2) Comparison analysis of revenue from trawling with the current mesh size and 4.0 cm codend; 3) The assessment of overall financial loss, financial gain and impacts of changing the codend mesh size from the current to 4.0 cm; and 4) Length at first capture of fish from the enlarged mesh size.

For Pair trawls, comparing catch rates (catch per unit of effort,CPUE) of 1.8 and 4.0 cm codend mesh size, catches of trash fish reduced from 1,053.8 kg/haul (1.8 cm) to 300 kg/haul (4.0 cm) (Table 3). Catches of economically important species increased from 501.5 kg/haul (1.8 cm) to 525.2 (4.0 cm) kg/haul. Overall income was found to be higher

For Otter board trawls, comparing catch rate (CPUE) of 1.25 cm and 4.0 cm codend mesh size,there was a reduced catch rate (76 kg/haul) with the larger mesh size. In particular, there was a significant reduction of the trash fish catch rate from 64.7 kg /haul to 16.7 kg. Catches of demeral and pelagic fish increased but catch of squid and shrimp remained constant. There was a remarkable increase of shellfish, from 0.3 kg/haul in 1.25 cm codend to 16.6 kg/haul in the codend with mesh size of 4.0 cm. Revenue from shellfish was able to offset lost income from trash fish and others.

Comparisons with an earlier DoF Study on catch rate and species composition of research vessel (Promong 1) during 2010-2013 showed that catches by the fisheries research vessel were not significantly different to catches from local otter board trawls, 158.5 kg/haul. However, escapement rates from the 4.0 cm codend, calculated as 47 % were higher, possibly because of the shorter towing time (1 hour), used in the experiment.

The study suggests potential positive benefits by releasing juveniles of economic species through a larger codend mesh size. The study showed that no matter what composition and size of catch, the escape rate of juvelines increases when the mesh size is increased. However, the study suggests that changing codend mesh size would not alone allow for a significant replenishment of the fisheries resources, even if mesh size was increased to 4.0 cm. The reduced catch of juveniles and small sized trash fish would not dramatically impact fisher's income. In addition, there would be positive impacts including reduced catch sorting time, increased catch quality and higher price of catch, reduced crew costs due to the decrease in the amount of sorting of catch onboard. By using increased mesh it is possible also to reduce the costs of ice and reduce the fuel use, which are major costs for trawl operators. However considering the decrease in catches, many trawl fishers do not seem to be willing to modify codend mesh size to 4.0 cm.

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1. Background

The uncontrolled development of Thailand's marine fisheries, especially the rapid increase in the number of trawling vessels has resulted in the severe degradation of demersal marine resources. The Thai Department of Fisheries (DOF) reported the catch per unit of effort (CPUE) of otter board trawlers, beam trawlers and pair trawlers during the periods 2003-2006 as 24, 35 and 155 kg/hr. while 50% 49% and 36% of the total catch weight were made up of trash fish, respectively. Within the trash fish (low valued fish) component of the catch, small-sized low-economic fish accounted for 34%, 31% and 48%, respectively. This indicated that the trawl fishery exploits a high proportion of non-targeted species at a small size and many of these fish are likely well below their maximum size and value, resulting in a significant loss of potential resources from the fishery.

The DOF is cooperating with the Food and Agriculture Organization of the United Nations (FAO) and Southeast Asian Fishery Development Center (SEAFDEC) in conducting research and strategising for trawl bycatch management through the project"Strategies for Trawl Fisheries Bycatch Management" (REBYC-II CTI; GCP/RAS/269/GEF). The main funding of the Project is through the Global Environmental Fund (GEF) and the participating countries. According to the REBYC-II CTI Thailand plan, trawls using the 4.0 cm mesh size in the codend is now tested to assess the degree of selection achieved and to evaluate the effect on fishing economics. This study was executed for demonstration purpose and was done in cooperation with trawl fishers in the middle Gulf of Thailand area (Prachaupkirikhan, Chumphonand Surat Thani Provinces).

1.1. Objectives of the study

1. Study the catch rate, species composition and escape rate between the current codend mesh size (1.2 (OBT) and 1.8 cm (PT)) and the experimental 4.0 cm codend mesh size in otter board trawls and pair trawls operating in the Gulf of Thailand;
2. Carry out a comparative analysis of incomes from trawling with the current mesh size and trawling with the 4.0 cm codend mesh size and make an assessment of any financial loss, gains and other impacts of changing the codend mesh size to 4.0 cm;
3. Study on the catch rate and species composition from previous studies including the research vessel (Pramong 1) during the period 2010-2013;
4. Study the length and length at first capture of fish when using codend mesh size of 4.0 cm.

1.2. The Study area and timeframe

The Study Area selected for the trawl experiment was around Koh Noo and Koh Maew island in Chumphon Province where the water depth is approximately 5 m. The experiment was carried out on 3-8 July 2014.

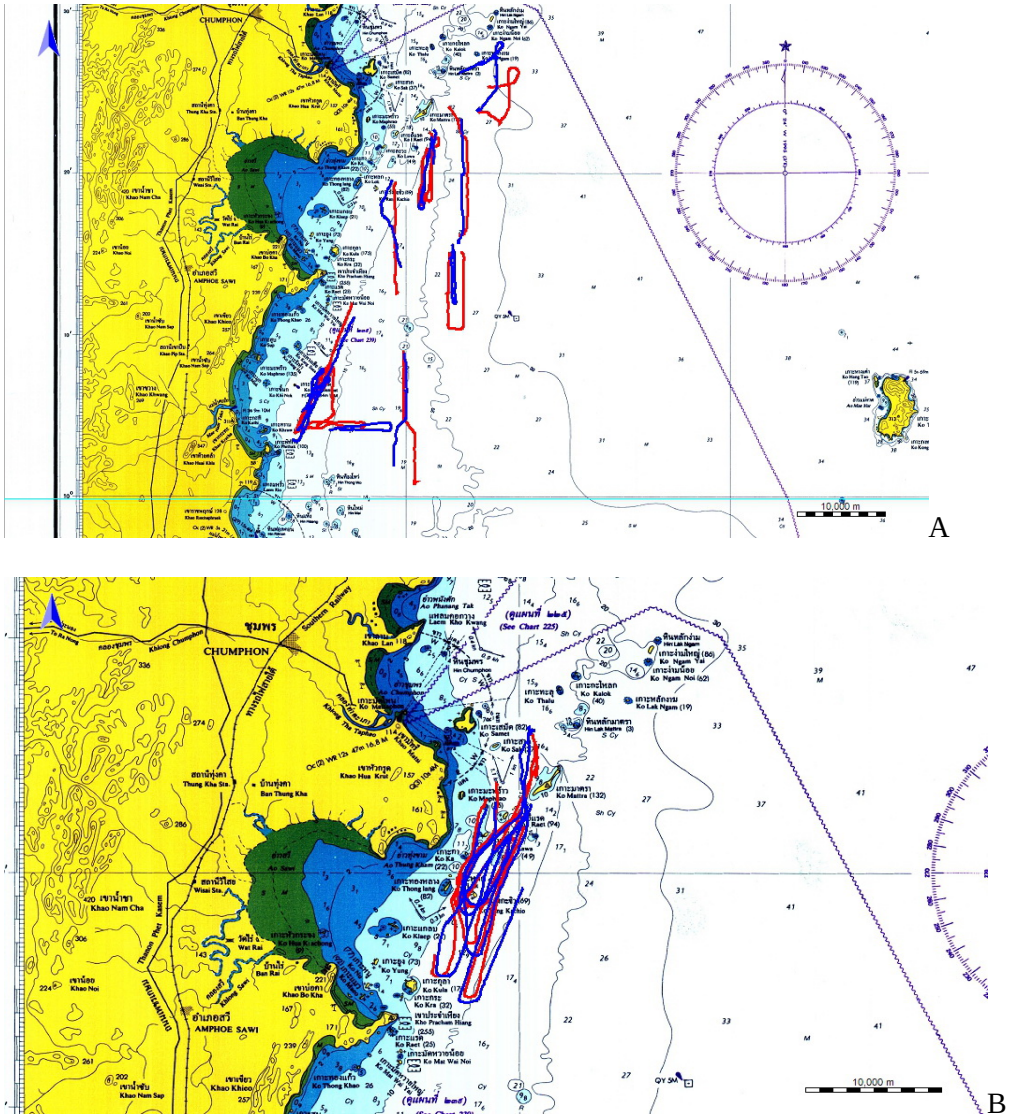


Figure 1. Experimental area A: for pair trawl B: for otter board trawl
The red line indicates the route of the vessel that used the current mesh size,
The blue line indicates the route of the vessel that used the enlarged mesh size.

2. Methodology

The trawling experiment was carried out using two otter board trawlers and four pair trawlers (2 pairs). The length of the otter board trawler was below 16 m while the length of the paired trawler vessels was below 25 m. One of each otter board trawl and one set of pair trawlers trawled with their current codends with mesh size in otter board trawl of 1.25 cm and pair trawls of 1.8 cm, while the other otter board trawler and other set of pair trawlers used a 4.0 cm codend mesh size. The netting material used was Polyethylene, double twin 700 denier/15 for all experiemental work.

To measure the escape rate and selectivity, the 4.0 cm codend was covered with a small mesh cover net (the cover mesh size was in otter board trawl 1.25 cm and in pair trawl 1.8 cm).Two metal rings were attached to the cover net in order to create a space between the inner and outer nets (Figure 2). This allowed fish to escape from the 4.0 cm codend without masking and these escapeeswere then retained in the cover. The net design was developed by SEAFDEC (Figure 3,4). Each of otter board trawlers operated 4hr/haul (total 11 hauls) while the pair trawler operated 5 hr/haul (total 5 hauls).

The 2 otter board trawlers were the Sor Chokesiriwan and Sor Chokeanakewit 2. The 2 pair trawlers were the Jor Theerachareonchai 1 paired to Jor Theerachareonchai 3 and Jor Theerachareonchai 5 paired to Jor Theerachareonchai 6 (Table 1).

Table 1. Characteristics of the trawlers and operating nets

Type of trawler	Trawlers Name	Operating net mesh size(cm)	Length of boat (m)	Main engines	Average Speed of boat of trawling
Pair trawlers	Jor Theerachareonchai 5 and Chor Theerachareonchai 6	4.0	21.00	Cummin 500	2.5
	Jor Theerachareonchai 1 and Chor Theerachareonchai 3	1.8	18.50	Cummin 500	2.5
Otter board trawlers	Sor Chokeanakewit 2	4 .0	15.65	Hino 275	2.5
	Sor Chokesiriwan	1.25	15.80	Hino 275	2.5

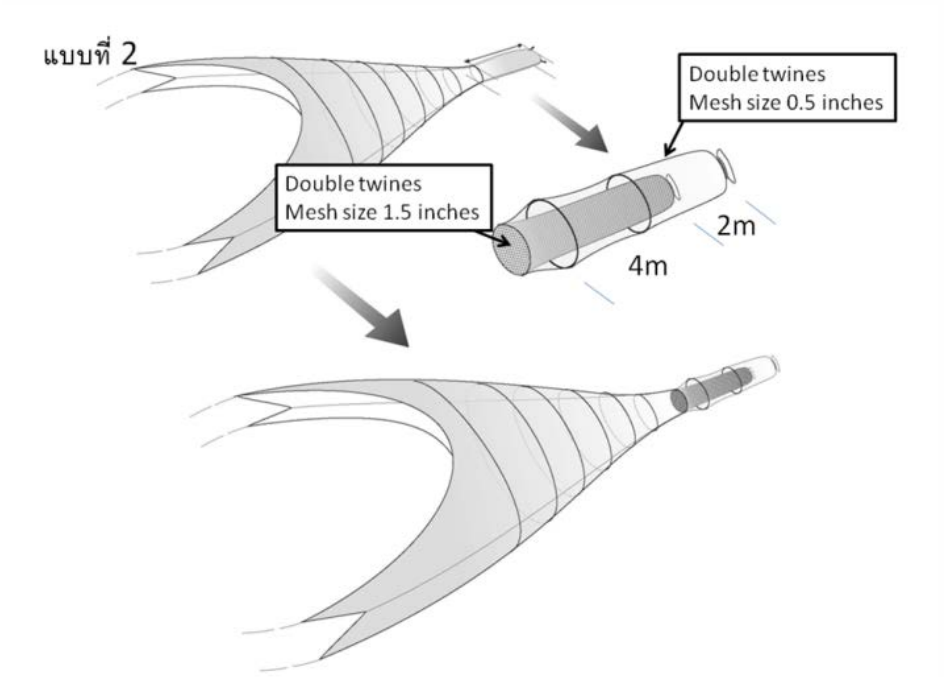


Figure 2. Characteristics of bag net for the experiment

The cutting pattern of the codend net operated by the pair trawlers was as follows:

- Codend net: 200 mesh round, 110 mesh long, 4 cm mesh size and double twine.
- Cover net : 900 mesh round, 480 mesh long, 1.8 cm mesh size and double twine
- Chafing net: 150 mesh round, 80 mesh long and 8 cm mesh size.

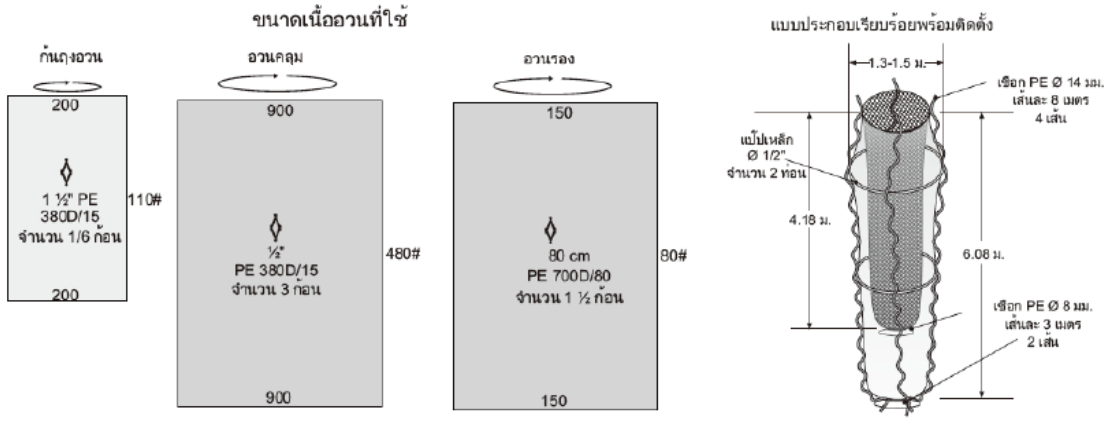


Figure 3. Cutting pattern of codend net for pair trawlers

The cutting pattern of the codend net operated by the otter board trawlers was as follows:

- Codend net: 200 mesh round, 110 mesh long, 4 cm mesh size and double twine
- Cover net : 600 mesh round, 480 mesh long, 1.25 cm mesh size and double twine
- Chafing net: 150 mesh round, 80 mesh long and 8 cm mesh size.

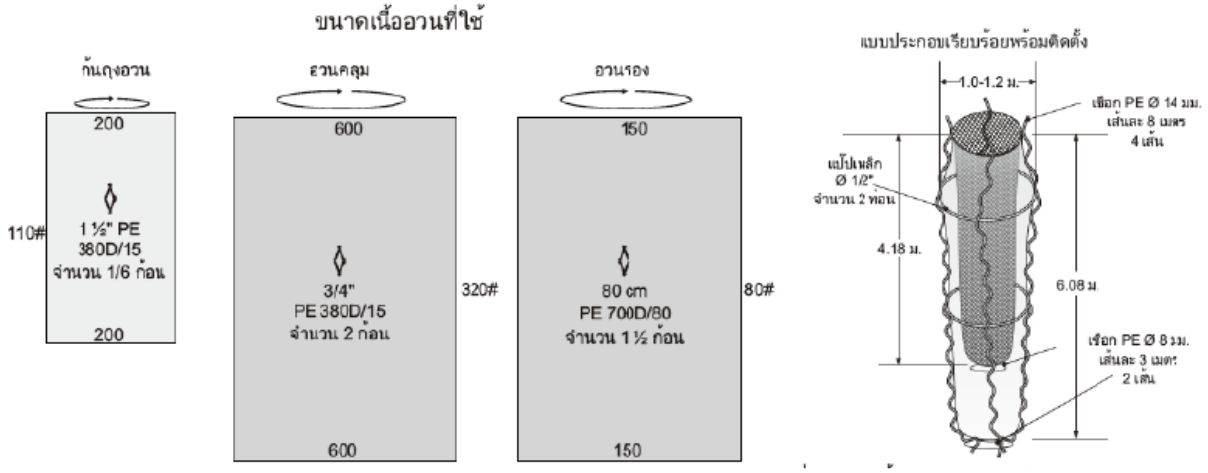


Figure 4 Cutting pattern of codend net for otter board trawlers

Trawl fishermen were invited from Prachuab Khiri Khan, Chumphon and Surat Thani province to participate in the experiement and verify the experimental process. Workshops were run for the participation of fishers and other stakeholders before the launch of the experiment. At the workshops, stakeholders discussed and considered the experimental design, technical data collection and data analysis. The information gained from the workshop and the findings from the experiment was considered useful for the fisheries resources administration in their efforts to achieve the sustainable use of the resources as well as fishery occupations.

3. Data collection methodology

For the collection of data on catch, effort and sizes of fish caught by the experimental trawling, the following metodology was used

1. First, the catch was hand sorted by fishers using their customy practice, i.e. separating the catch into commercial/economic fish and trash fish groups. The catch from the cover net catch was treated as trash fish.
2. After sorting, the total amouts of economic fish and trash fish were weighed (by kilogram) and the respective amounts recorded. For the economic class of fish, the catch was sorted by weight into the following categories; demersal fish; pelagic fish; cephalopod; shrimp; crab; and others.
3. From each haul, 10-20 kg of economic fish was randomly sampled to be identified by species and their length and weight was measured. A sample was then taken from the trash fish catch and different species were identified and their respective proportions calculated.
4. The catch from the economic group fish were identified at the species level and their lengths measured (cm). The total length was applied for fish; mantle length for squid; total length from rostrum to telson for shrimp: and carapace width was used for crabs.
5. The catch from the trash fish group was mainly made up of juveniles of economic species and true trash fish. True trash fish comprised of inedible fish and adults of small fish species and species that fetched a low market price. For each haul, the total weight of trash fish was recorded and a 3-5 kg sample was taken, sorted into individual fish species, weighed and the data reorded in grame (g).
6. Current fish prices were collected in order to calculate the return, financial loss and analyze the financial expected gain of replacing the current net with the 4.0 mesh size net.

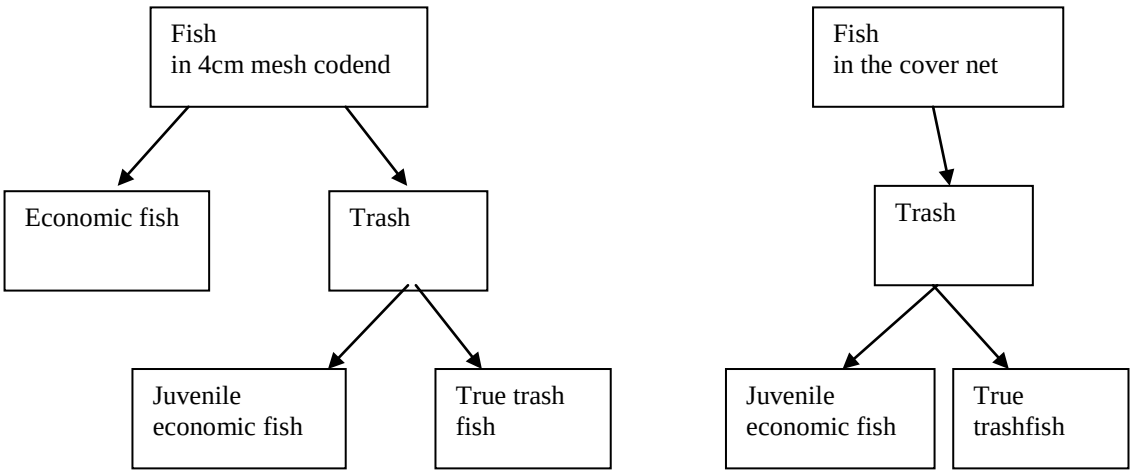


Figure 5. Data collection methodology

4. Data analysis methodology

1. Calculation of the catch per unit effort (CPUE) kg/haul [1]
2. Calculation of the percentage of species composition
3. Calculation of average size of fish caught.
4. Calculation of fish escape rate by using

Escape rate (%) = $\frac{\text{total weight of fish in cover net} \times 100}{\text{Total weight}}$

Total weight= total weight of fish in codend net+ total weight of fish in cover net

4.1. Revenue

Total revenue was calculated by using Solmon's equation (Total revenue, TR=PQ; whenP=price per commodity unit, Q=number of commodity) (Solmon, 1980), modified as follows;

$$TR = \sum_{S=1}^{n} Y_S P_S$$

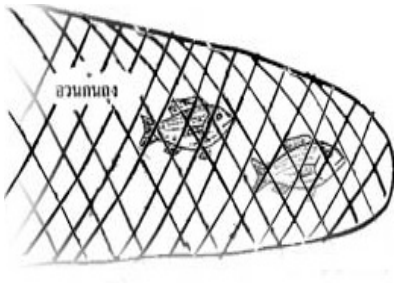
when TR = Total revenue
Y = catch amount
P = fish price
S = fish species

4.2.The economics of changing codend mesh size from the current size to 4.0 cm

The assessment of the impact of introduction of 4.0 cm mesh on the economics of trawl fishing was done through the calculation of the lost revenue from trash fish and juveniles that escaped through the 4.0 cm mesh. In a normal fishing operation with a conventional small-meshed codend, these fish would have been retained.

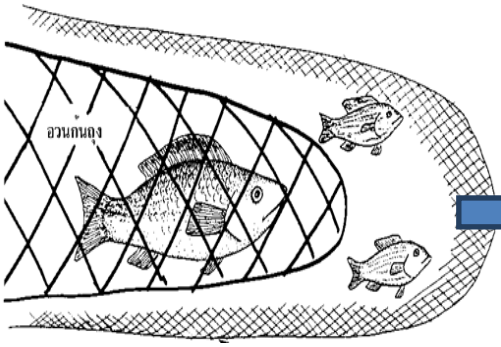
Assuming that the small fish that escape from the 4.0 cm mesh codend will survive and continue to grow, there maybe a significant potential value to the fishery. To calculate this the numbers and weights of each species that escaped but were retained in the cover net, were estimated by using the Length-weight relationship equation, the von Bertalanffy's growth equation of and the Exponential decay model (Sparre and Venema, 1998). The potential market weight and value of those small-sized economic species and some trash fish species could be calculated. For the economic analysis the difference between this value and the value of the juvenile of economic fish usually retained in the form of trash was calculated through multiplying the increased weight at market size with the fish price.

[1]Haul was used because the information was collected on a recall basis from fishers. Earlier studies have shown that this,is easier for fishers to understand than asking for data per hour.



Current net mesh size catches juvenile economic fish which are then sold as trashfish. This translates to a long term financial loss.

Current codend mesh size



If these small fish were released to the sea by using a larger mesh size in the codned, some of them would grow up to reach at the marketable size. This would translate to a long term financial gain.

Enlarged codend mesh size

The growth of fish to market size has'mortality' as a negative factor. The mortality of fish comprises Natural mortality (M) and Fishing mortality (F) that together equal Total mortality (Z).

Growth (K) is the naturally positive factor. Particular species increase their size and weight to reach market size but may also be affected by natural mortality and fishing mortality. This phenomenon is shown as following diagram:

Length of fish in trash → [(+) Growth / (-) Total mortality] → market size

4.3 Calculation steps

The calculation to find the weight of juvenile economic fish from the acquired body length uses the modified length - weight relationship equation (Sparre and Venema, 1998) as follows:

$$W_0 = aL_0^b$$

when W_0 = weight of each individual small sized economic fish in codend and cover net (g)

L_0 = average total length of small sized economic fish in codend and cover net (cm)

a = Y-intercept

b = slope of the regression

The calculation of number of individual juvenile economic fish

$$N_{t_n} = \frac{W}{W_0}$$

when N_{t_n} = number of individual juvenile economic fish in the codend and the cover net

W = Total weight of juveniles of economic fish in the codend and cover net (g)

The calculation to find the number of juvenile economic fish that could later grow to reach market size uses an exponential decay model (Sparre and Venema, 1998). This model assumes that the population being studied is closed. So, any decrease in the population is through mortality only and is not influenced by in or out migration.

$$N_{t\,p} = N_{t_n} \times e^{-z\,\Delta t}$$

when Nt_p = Number of small sized economic fish survivedwhich later grow to reach to market size

Nt_n = Number of small sized economic fish in codend and cover net

Z = Total mortality coefficient

Δt = Timing of growing to reach the marketable size

The calculation to find the time required to reach marketable size (Δt) uses the inverse von Bertalanffy growth equation (Sparre and Venema, 1998). The assumption of using this equation is that the growing pattern of the fish is isometric, meaning that the growth does not cause changes in the morphological or specific gravity of fish, as the growth of all parts of the body is proportional, and the body weight is directly proportion to the power of three of its length.

$$t(L) = t_0 - \frac{1}{K} \times \ln\left(1 - \frac{L_t}{L_\infty}\right)$$

When L = Length of economic fish at the age "t" (cm)

L_∞ = Asymptotic length (cm)

K = Curvature parameter (per year)

t_o = Initial condition parameter (year)

t (L) = Age of fish when the fish length is L (year)

$$\Delta t = t\,(L_m) - t\,(L_t)$$

whent (L_t) = Age of fish when its length is in the size L (year)

$t(L_m)$ = Age at fish marketable size (year)

The calculation to find the weight of juvenile economic fish that survive from the natural mortality and fishing mortality and later reach a maketable size uses the length-weight relationship equation is as follows:

$$W_m = aL_m^b$$

When W_m = Weight at marketable size (g)

L_m = Length at marketable size

a = Y-intercept

b = Slope of the regression

The following equation is used to calculate total weight when each kinds of economic fish reaches a marketable size

$$W = Nt_p \times W_m$$

Where as W = weight of market size fish

The calculation used to find the value of the fish that survive and later grow to reach a market size is calculated by multiplying the price and projected market weight (W). This value is the "Expected value and was then used to calculate the effect on the economics.

Expected value= (W_1 x price) + (W_2x price) +…+(W_n x price)

In the case that the time required for the fish to reach market size (Δt) was longer than 1 year, a discount rate was applied by using the concept to analyse the project of the Office of the National Economic and Social Development Board in 1997 for developing country. This study applied a 12% discount rate to calculate the future values.

The financial loss through using small sized economic fish in the form of trash uses the following equation:

Financial losses = Total catch value – value derived from selling trash fish.

Comparison of the financial loss or gain through replacing the current codend net with 4.0 cm codend mesh size net

The parameters used for this calculation were derived from studies of the biological aspects of marine animals in the Gulf of Thailand and adjacent waters (Appendix 3). For some fish species, e.g. lizard fishes (*Saurida isarankurai* and *S. elongata)* for which the parameters had not yet been studied or reported, published parameters from the most similar fish of the same genus were applied.

The average length of marine animals found in the trash (L_o) was used to calculate the approximate weight of the marine animals in the codend, while the average length of fish found in the cover net was used to calculate the approximate weight of the fish and from that the financial loss and gain from the codend could be calculated.

Estimation of length at first capture (Lc)

Length at first capture means the length at which 50 % of the fish are retained in the codend and is here after referred to as 'Length at First Capture'. The catch of individual fish in each length interval are calculated as a cumulative frequency (CC_i) and converted to be probability of capture ($P_{(i)}$) by the following equation:

$$P_{(i)} = CC_{(i)} / CC_{(n)}$$

where $P_{(i)}$ = probability of catch of fish in the length interval i
$CC_{(i)}$ =total individual caught fish of the length interval 1toi
$CC_{(n)}$ = total individual caught fish of the length interval 1to the last length interval

The logistic curve is used to calculate the gear selection (Sparre and Venema, 1998) as follows:

$$S_L = \frac{1}{1 + e^{(S_1 - S_2 L)}}$$

This equation can be rewrittenas

$$\ln\left(\frac{1}{S_L} - 1\right) = S_1 - S_2 L$$

When S_L = number of fish of length L in the codend / Number of fish of length L in codend and cover net

L = mid-length
S_1 = constant (S_1 =a)
S_2 = constant (S_2 =b)

This equation is sued to calculate $L_{25\%}$ $L_{50\%}$ และ $L_{75\%}$

$$L_{25\%} = \frac{(S_1 - \ln 3)}{S_2}$$

$$L_{50\%} = \frac{S_1}{S_2}$$

$$L_{75\%} = \frac{(S_1 + \ln 3)}{S_2}$$

When $L_{25\%}$ = The length at which 25% of the fish are retained in the codend

$L_{50\%}$ = The length at which 50 % of the fish are retained in the codendor is called Length at first capture (L_c)

$L_{75\%}$ = The length at which 75% of the fish are retained in the codend

5. Study on catch rate and species composition of research vessel (Promong 1)

The research vessel (Pramong 1) is a 25.25 m LOA vessel equipped with 412 hp engine. It operates with the German type otter board trawl where the length of head rope is 39 m and the ground rope is 51 m. The codend mesh size is 4.0 cm and it was covered by 2.5 cm mesh size cover net (Figure 6). Historical data from cruise surveys during 2010 – 2013 were also used for examining the escape rate of fish.

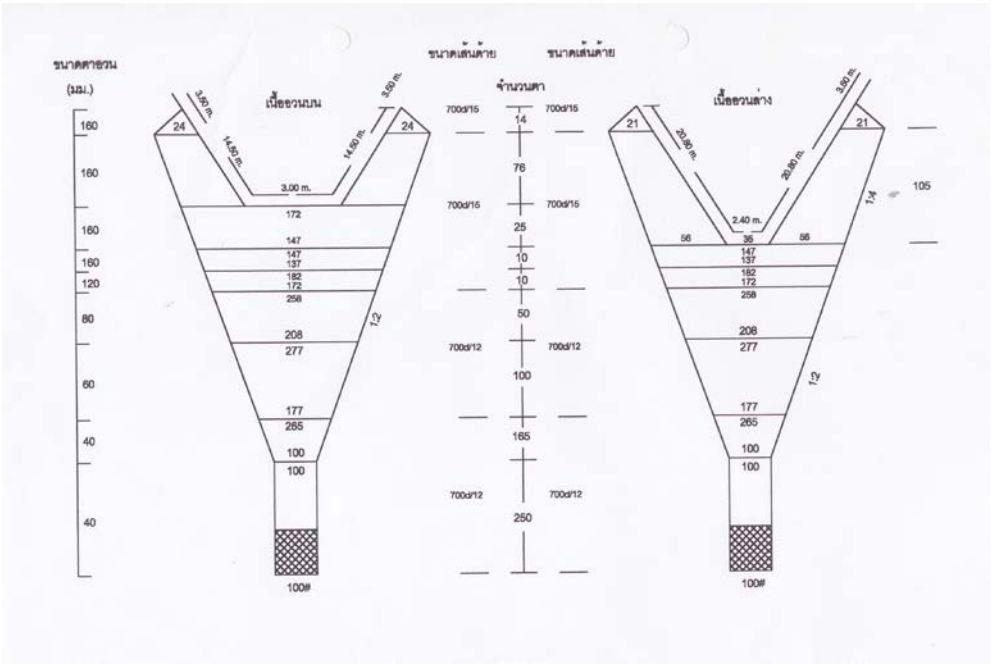


Figure 6. Pattern of trawl net used by research vessel (Pramong 1)

6. Results

6.1. Study on catch rates, species composition and escape rates between the current sized codend and 4 cm mesh size codend.

6.1.1. Pair trawl experiment;

The experiment used 1.8 cm mesh codend net for pair trawling for 5 hauls (4 hauls in the day time and 1 haul in the night-time).The lowest catch rate was 516 kg/haul and the highest catch rate was 2,407 kg/haul. The percentage of trash fish ranged from 59.74-74.74 (Table 2). The percentage ratio of economic fish to the trash fish was 32:68. The economic fish in a hauls included demersal fish for 287 kg (18.5%), pelagic fish 160.6 kg (10.3%), squid and cuttlefish 47.1 kg (3%), shrimps and prawn 0.3 kg (0.02 %), crab 0.9 kg (0.06 %) and other fish 5.5 kg (0.36 %) (Table3). The demersal fish species most common in the catch were *Terapon theraps* (88.3 kg) followed by *Scolopsis taeniopterus* (44 kg) (Appendix 4).

Table 2 Catch rate (kg/haul) from pair trawlers using 1.8 cm mesh size codend net.

Haul	Economic fish		Trash fish		Total
	Catch rate (kg/haul)	%	Catch rate (kg/haul)	%	Catch rate (kg/haul)
1	380.9	25.26	1,127.0	74.74	1,508.9
2	969.0	40.26	1,438.0	59.74	2,407.0
3	187.0	36.24	329.0	63.76	516.0
4	442.5	26.18	1,248.0	73.82	1,690.5
5	528.0	31.90	1,127.0	68.10	1,655.0
Average	**501.5**	**32.24**	**1,053.8**	**67.76**	**1,555.3**

The average catch of 'trash fish' was 1,053.8 kg/haul. The average amount of juvenile economic fish in the trash fish catch was 511.8 kg whilst the'true trash fish'catch averaged 542 kg. (Table3) Therefore, the percentage ratio of juvenile economic fish relative to true trash fish was 49:51 The juvenile economic fish in the trash fish catch included pelagic fish (317.9 kg/haul), demersal fish

(125.7 kg/haul) cephalopods (61.2 kg/haul), crabs (6.3 kg/haul) and other fish (0.4 kg/haul) (See Appendix 4, for more details).

6.1.1.1.Pair trawlers with 4.0 cm mesh size codend net cover with 1.8 cm mesh size

The total number of trawls recorded was 5 hauls. The trawling duration of each haul was 5 hr and the speed of vessel averaged 2.5 knots. The lowest catch rate was 448.8 kg/haul and the highest catch rate was 1,880.5 kg/haul (Table 4).

The result showed that the escape rate (by weight) from the 4.0 cm mesh size of codend net ranged from 24.06-50.14 %. The average escape rate was calculated at 34.42 %. The average catch in the 4 cm mesh size codend net was 825.4 kg/haul, which included juvenile economic fish (525.2 kg) and 'true trash fish' 300.2 kg. The average weight of fish that escaped from the 4.0 cm mesh size codend was 433.2 kg (Table3). The percentage ratios of economic fish, trash fish, escaped fish were 41.73 % 23.85 % and 34.42 % respectively. The economic fish catch per haul in the 4.0 cm mesh codend included demersal fish (313.8 kg -38.02%), pelagic fish (174.6 kg - 21.15 %), cephalopods (34.4 kg- 4.17 %), shrimp (0.6 kg -0.07 %)and others (1.7 kg - 0.21%). The demersal fish species featuring highest in the catch were barracuda (*Sphyraena jello*) (70.4 kg/haul) and Pomadasyidae (51.7 kg/haul) see Appendix 5.

The average catch of trash fish in the codend was 300.2 kg/haul which included juvenile economic fish (198.2 kg) and true trash fish, (102 kg) (See Table3) The percentage ratio of juveniles of economic fish to 'true trash fish' was 49:51.The juveniles of economic fish comprised of pelagic fish (105.6 kg), demersal fish (73.6 kg), cephalopod (1.6 kg), crabs (14 kg) and others (3.4 kg) – See Appendix 5.

The escaped fish from the 4 cm mesh size codend, averaged 433.2 kg/haul and the average escape rate was 34.42 % (Table3). Pelagic fish species had the highest escape rate (average 210.7 kg/haul).The species that most commonly escaped from the 4 cm mesh were the species of anchovy *Stolepholus indicus* (escape 58.1 kg/haul). and *Encrasicholina* spp. (escape 42.1 kg/haul). 'True trash fish' retained in the cover net mostly comprised Leiognathidae (escape 133.3 kg/haul). These data indicate those species with an elongated body shape which were more likely to escape from the 4 cm mesh. The value of the escaped fish, sold as'trash fish'was 5.1 baht/kg (Appendix 5)

Table 3. Pair Trawl - Catch rate, percentage and escape rate of marine fauna using 1.8 mesh size codend net and 4.0 cm mesh size codend net cover with the 1.8 cm mesh size net.

effort (hr/haul)	**Codend mesh size 1.8 cm 5**			**Enlarge mesh size to 4.0 cm cover by 1.8 cm 5**				
	Codend			**Codend**		**Cover net**		**Rate of Escape (%)**
Group	**CPUE (kg/haul)**	**%**	**% in group**	**CPUE (kg/haul)**	**%**	**CPUE (kg/haul)**	**%**	
Total catch	**1,555.3**	**100**		**825.4**	**100.00**			
Total economic fish	501.5	32.24	100	525.2	63.63			
Economic Pelagic fish	161.6	10.33	32.02	174.6	21.15			
Economic Demersal fish	287.0	18.46	57.24	313.8	38.02			
Economic Cephalopod	47.1	3.03	9.39	34.4	4.17			
Economic Shrimp	0.29	0.02	0.06	0.6	0.07			
Economic Crab	0.91	0.06	0.18	0.00	0.00			
Economic Other	5.54	0.36	1.10	1.7	0.21			

Table 3. (cont.)

effort (hr/haul)	Codend mesh size 1.8 cm 5			Enlarge mesh size to 4.0 cm cover by 1.8 cm 5				
	Codend			Codend		Cover net		Rate of
Group	CPUE (kg/haul)	%	% in group	CPUE (kg/haul)	%	CPUE (kg/haul)	%	Escape (%)
Total trash fish	**1,053.8**	**67.76**	**100.00**	**300.2**	**36.37**	**433.2**	**100.00**	**34.42**
True trash fish	542	34.85	51.43	102	12.35	152	35.08	12.08
Total juvenile economic fish in trash fish catch	**511.8**	**32.91**	**48.57**	**198.2**	**24.02**	**281.2**	**64.92**	**22.34**
Juvenile Pelagic fish	317.9	20.44	30.17	105.6	12.79	210.7	48.63	16.74
Juvenile Demersal fish	126.7	8.08	11.93	73.6	8.91	63.1	14.57	5.01
Juvenile Cephalopod	61.2	3.94	5.81	1.6	0.20	7.26	1.68	0.58
Juvenile Shrimp	0.31	0.02	0.03	0.00	0.00	0.11	0.03	0.01
Juvenile Crab	6.32	0.41	0.60	14.02	1.70	0.06	0.01	0.005
Juvenile Other	0.39	0.03	0.04	3.43	0.42	0.00	0.00	0.00

A comparison between the catch rates from the 1.8 cm mesh size codend net and the 4 cm mesh size codend net showed that the catch of trash fish decreased with the larger mesh size codend net. The average 'trash fish' catch from the 1.8 cm mesh size codend net was 1,053 kg/haul whilst the average trash fish catch from the 4cm mesh size codend net was 300.2 kg/haul (Table 3). The average reduction in trash fish catch was 753.6 kg/haul.

However, the catch of the economic fish increased slightly from 501.5 kg/haul to 525.2 kg/haul, mainly from increased demersal fish and pelagic fish. Demersal fish increased from 287 to 313.8 kg/haul and pelagic fish increased from 160.6 to174.6 kg/haul.

Although the total catch of cephalopods decreased from 47.1 to 34.4 kg/haul, the catch of the target high-value squid increased. The catch of squid (genus Photololigo) increased from 14.1 to15.2 kg/haul. The catch of cuttlefish decreased from 14.20 (with big, middle and small size cuttlefish as 6.60, 1.40 and 6.20 kg/haul, respectively) to 7.2 kg/haul but the cuttlefish caught by the 4.0 cm mesh size codend net were all of a large size.

Accordingly, fishers derived more income from the economic fish species caught whilst the escaped juvenile economic fish had the opportunity to grow and contribute to higher economic returns to trawl fishers in the future. (Appendix 4, 5)

Table 4 Catch rate (kg/haul) of pair trawl operated with the 4.0 cm mesh size codend net cover with 1.8 cm mesh size for 5 hauls.

Haul	Codend				Cover net		Total	Escape rate
	Economic fish		Trash fish		Trash fish			
	Catch rate (kg/haul)	%	Catch rate (kg/haul)	%	Catch rate (kg/haul)	%	Catch rate (kg/haul)	%
1	1005.5	53.47	270	14.36	605	32.17	1,880.5	32.17
2	602.0	35.83	603	35.89	475	28.27	1,680.0	28.27
3	188.8	42.07	152	33.87	108	24.06	448.8	24.06
4	458.5	37.26	322	26.17	450	36.57	1,230.5	36.57
5	371.0	35.23	154	14.62	528	50.14	1,053.0	50.14
average	**525.2**	**41.73**	**300**	**23.85**	**433**	**34.42**	**1,259.6**	**34.42**

6.1.2. Otter board trawl experiment.

The experiment in trawling with 1.25 cm mesh size codend net was done for 11 hauls, with each haul of 4 hour duration. 6 hauls were done during the daytime and 5 hauls were done during the nighttime. The average speed of trawling was 2.5 knots. The area of trawling is shown in figure 1.

The lowest and highest catch rates were 86.7 and 326.6 kg/haul. The average catch rate was 158.6 kg/haul or 39.7 kg/hr. The catch included economic fish (93.9 kg/haul) and trash fish (64.7 kg/haul) (Table 5). The percentage of economic fish against trash fish was 59: 41. Table 6 shows that the economic fish comprised of demersal fish totaling 45.6 kg/haul (28.7 %), pelagic fish 2.7 kg/haul (1.7 %),cephalopods, 5.8 kg/haul (3.66 %), the shellfish *Amusium plueronectes*, 0.28 kg/haul (0.18 %), shrimps and prawn, 6.67 kg/haul (4.21 %), crab 0.53 kg/haul (0.33 %) and others, 32.3 kg/haul (20.35 %). The lizardfish, (*Saurida elongata)*, was the highest demersal fish catch, 13.2 kg/haul followed by stinging catfish, (Plotosidae) 10.8 kg/haul. *Metapeneopsis palmensis, and* king prawn (*Metapeneous intermedius*) were the highest catch among other shrimps. The catch rate was 2.5 and 1.7 kg/haul respectively, (Appendix 6).

6.1.2.1. Otter board trawl with 4.0 cm mesh size codend net and 1.25 cm cover net mesh size.

This experiment involved a comparison of two trawling nets. The first boat trawling with 4.0 cm mesh size in the codend net, and a cover net of 1.25 cm mesh, which is the current mesh size of net used by fishers. The second boat trawled with a 1.25 cm mesh size codend net. Both of the boats trawled for 11 hauls (4 hr./haul) at 2.5 knots trawling speed. The highest catch of both boats were from the 5th haul of trawling.

Table 5. The catch rate (kg/haul) of otter board trawl operated with 1.25 cm mesh size codend for 11 hauls.

Haul	Time of experiment	Economic fish		Trash fish		Total
		Catch rate (kg/haul)	%	Catch rate (kg/haul)	%	Catch rate (kg/haul)
1	Day time	60.6	67.27	29.5	32.73	90.1
2	Night time	47.7	55.02	39.0	44.98	86.7
3	Night time	93.0	50.82	90	49.18	183.0
4	Day time	101.3	84.21	19	15.79	120.3
5	Day time	156.6	47.95	170	52.05	326.6
6	Night time	111.6	63.55	64	36.45	175.6
7	Night time	71.4	56.04	56	43.96	127.4
8	Day time	75.3	64.19	42	35.81	117.3
9	Night time	97.0	51.87	90	48.13	187.0
10	Night time	81.2	55.93	64	44.07	145.2
11	Day time	136.9	74.03	48	25.97	184.9
average		**93.9**	**59.21**	**65**	**40.79**	**158.6**

Table 6. Catch rate, percentage and rate of escape of marine fauna caught by otterboard trawl using codend mesh size 1.25 cm and enlarge mesh size to 4.0 cm and cover with mesh size 1.25 cm.

effort (hr/haul)	Codend mesh size 1.25 cm 4			Enlarge mesh size to 4.0 cm cover by 1.25 cm 4				
	Codend			Codend		Cover net		Rate of
	CPUE (kg/haul)	%	% in group	CPUE (kg/haul)	%	CPUE (kg/haul)	%	Escape (%)
Total catch	158.6	100.00		82.6	100.00			
Total economic fish	93.9	59.21	100	65.9	79.75			
Economic Pelagic fish	2.7	1.73	2.93	1.2	1.49			
Economic Demersal fish	45.6	28.74	48.54	30.1	36.45			
Economic Cephalopod	5.8	3.66	6.19	5.7	6.86			
Economic Shell	0.3	0.18	0.30	16.6	20.07			
Economic Shrimp	6.7	4.21	7.11	6.6	7.95			
Economic Crab	0.5	0.33	0.56	2.3	2.83			
Economic Other	32.2	20.35	34.37	3.4	4.10			
Total trash fish	64.7	40.79	100.00	16.7	20.25	62.9	100.00	43.21
True trash fish	48.3	30.46	74.66	14.4	17.48	37.4	59.51	25.72
Total juvenile economic fish in trash fish	16.4	10.34	25.34	2.3	2.77	25.5	40.49	17.49
Juvenile Pelagic fish	1.2	0.74	1.82	0.3	0.39	1.6	2.55	1.10
Juvenile Demersal fish	13.7	8.63	21.15	1.9	2.26	17.7	28.09	12.14
Juvenile Cephalopod	0.02	0.01	0.03	0.00	0.00	0.08	0.13	0.06
Juvenile Shell	-			0.00	0.00	3.04	4.83	2.09
Juvenile Shrimp	0.9	0.55	1.36	0.10	0.12	2.3	3.62	1.56
Juvenile Crab	0.4	0.24	0.60	0.00	0.00	0.7	1.22	0.53
Juvenile Other	0.2	0.16	0.38	0.00	0.00	0.03	0.05	0.02

The lowest and highest catch rates from the **4.0 cm mesh size codend** were 85.3 and 238.8 kg/haul.(Table 7) The escape rates ranged from 11.05-66.9 % and the average escape rate was 43.2%. The catch rate of the 4.0 cm mesh size codend net was 82.6 kg/haul made up of economic fish (65.9 kg) and trash fish (16.7 kg).

The percentages of economic fish, trash fish and escapees were 45:12:43. The economic fish comprised of demersal fish (30.1 kg), pelagic fish (1.2 kg), cephalopods (5.7 kg), shrimps (6.6 kg), crabs (2.3 kg) and others (3.4 kg) (Table 6). The most dominant catch of demersal fish was lizardfishes, *Saurida elongata*, for which the catch rate was 7 kg/haul, followed by Platycephalidae at 6.4 kg/haul.

The catch rate of trash fish was 16.7 kg/haul which comprised of juvenile economic fish (2.3 kg/haul) and 'true trash fish'(14.4 kg/haul). The percentage ratio between juvenile economic fish and 'true trash fish' was 49:51. The juvenile economic fish comprised of demersal fish (1.9 kg/haul), followed by pelagic fish and shrimps (0.32 and 0.10 kg/haul respectively) (Appendix 7)

The amount fish in the **cover net** was 62.9 kg/haul and the average escape rate was calculated as 43.21%. These fish comprised juvenile economic fish and 'true trash fish' at 25.5 and 37.4 kg/haul respectively (Table 6). Demersal fish accounted for the highest composition in the cover net catch (17.7 kg/haul) which was mostly Threadfin bream, *Nemipterus hexodon, and* Platycephalidae (8.7 and 4.6 kg/haul, respectively). True trash fish was calculated as 37.4 kg/haul and the escape rate was 25.72 %. These 'true trash fish' mostly comprised of Leiognathidae and Apogonidae species, (12.8 and 7.14 kg/haul respectively). The catch from the cover net was sold out as a trash fish at a price of 5.10 baht/kg (Appendix 7).

The total catch from the 1.25 cm mesh minus the total catch from the 4.0 cm mesh, equaled 75.9 kg/haul. i.e. 75.9 kg/haul of fish would be lost by changing from 4.0 cm to 1.25 cm mesh. (See table 5). There is a significant reduction in trash fish fish catch from 64.7 kg/haul to 16.7 kg /haul when using a codend mesh size of 4.0 cm. However, the catch of demeral and pelagic fish increased whilst squid and shrimp were found to be constant.

There was a remarkable increase in the shellfish catch from an average of 0.29 kg/haul by 1.25 cm codend mesh size trawl, to 16.6 kg/haul in the 4.0 cm codend mesh size. From the eleven hauls made by the 1.25cm mesh, the highest catch of shellfish was 0.5 kg. However, from the seven hauls with 4.0 cm mesh, five hauls resulted in shellfish catches of higher than 28 kg, with the highest catch being 55 kg (see Apprendix 19). The reason for this huge discrepency in shellfish catch rate from the two trawl types is unknown. However, in the economic analysis, the additional revenue that would have been generated from the sale of shellfish was used to offset the lost income from trash fish escapes through the 4.0 cm mesh.

Table 7. Catch rate (kg/haul) of the experimental otter board trawler operated with the 4 cm mesh size codend net covering by 1.25 cm mesh size net for 11 hauls.

Haul	Experiment time	Codend				Cover net		Total	Escape rate
		Economic fish		Trash fish		Trash fish			
		CPUE (kg/haul)	Percent	CPUE (kg/haul)	Percent	CPUE (kg/haul)	Percent	CPUE (kg/haul)	Percent
1	Day time	64.3	75.38	6	7.03	15	17.58	85.3	17.58
2	Day time	46.5	51.37	34	37.58	10	11.05	90.5	11.05
3	Night time	38.0	28.57	6	4.51	89	66.92	133.0	66.92
4	Day time	60.1	54.84	6	5.47	43.5	39.69	109.6	39.69
5	Day time	71.8	30.06	47	19.69	120	50.26	238.8	50.26
6	Night time	52.3	29.01	13	7.21	115	63.78	180.3	63.78
7	Night time	107.1	62.59	27	15.78	37	21.63	171.1	21.63
8	Day time	63.0	40.38	16	10.26	77	49.36	156.0	49.36
9	Night time	69.0	43.95	6	3.82	82	52.23	157.0	52.23
10	Night time	87.0	62.59	14	10.07	38	27.34	139.0	27.34
11	Day time	65.8	47.06	9	6.44	65	46.50	139.8	46.50
Avg.		65.9	45.29	16.7	11.50	62.9	43.21	145.5	43.21

6.2. Comparison of incomes between deriving from trawling with the current mesh size and trawling with 4.0 cm mesh size codend

6.2.1. Pair trawl

The total income from trawling with the 1.8 cm mesh size codend was 20,504.9 baht/haul (Table 8 &Appendix 4) and the income of trawling with the 4 cm mesh size codend net was 21,618.6 baht/haul (see Appendix 5), an increase of 1,113.7 baht/haul. The additional income was from an increase in the value of the demersal fish, pelagic fish and shrimp catches, accounting for 5,440.5 and 799.1 and 98 baht/haul, respectively. Incomes derived from cephalopod, shell, crabs, other and trash fish catches from the 4.0 cm mesh were lower than from the 1.8 cm codend mesh.

The major income from pair trawling, whether 1.8 or 4.0 cm mesh size, was from demersal and pelagic fish, which contributed 52.21 % and 78.39 % of the total income respectively. The increase in mesh size resulted in a lower catch of 729.9 kg/haul or 46.93 % (Table 3). However, this decerease was mainly from trash fish, which decreased from 1,053.8 to 300.2 kg/haul. Accordingly, the decrease in trash fish (753.6 kg) can be partially accounted for by the escaped juvenile economic fish, (313.6 kg). Therefore, the lost income due to decreased trash fish, (3,843.3 baht/haul) was offset by the increased income from the catch of larger sized economic fish. (Table 8) Therefore, it can be concluded that although the increase in mesh size resulted in a decrease in the total catch, the total income increased because of the larger size of economic fish caught. The study indicated that the catch rate of the economic fish was an important variable factor of income. However, fishers who focus only on the amount of catch, may not agree with the increasing the mesh size of their trawls.

Table 8. Income of pair trawl using codend mesh size of 1.8 cm and enlarged to 4.0 cm.

	Codend mesh size 1.8 cm		Codend mesh size 4 cm		Difference
	Income (Baht/haul)	percent	Income (Baht/haul)	Percent	
Pelagic fish	4,942.2	24.10	5,741.3	26.56	799.1
Demersal fish	5,764.5	28.11	11,205	51.83	5,440.5
Cephalopod	4,124.5	20.11	2,934.2	13.57	-1,190.3
Shell	150.0	0.73	-	0.00	-150
Shrimp	91.6	0.45	189.6	0.88	98
Crab	16.4	0.08	-	0.00	-16.4
Other	41.3	0.20	17.5	0.08	-23.8
Trash fish	5,374.4	26.21	1,531	7.08	-3,843.4
Total	20,504.9	100.00	21,618.6	100.00	1,113.7

6.2.2. Otter board trawl

The income from trawling with the 1.25 cm mesh size codend net was 3,809.5 baht/haul (Table 9) and the income of trawling with the 4.0 cm mesh size codend net was 3,831.1 baht/haul (more detail in Appendix 6,7). The small increase of income (21.6 baht/haul) was mainly from scallop that accounted for 1,629.5 baht/haul. Incomes from all other fish decreased, except crabs and cephalopods. The enlargement of the codend mesh size resulted in a decreased trash fish catch. The trash fish from 1.25 cm mesh size codend was 64.7 kg/haul (Table 6). When sold at a price of 5.10 baht/kg, fishers could derive an income of 329.9 baht/haul. The trash fish from 4.0 cm mesh size codend decreased to16.7 kg/haul with the income from this catch, 85.3 baht/haul. Therefore, fishers lost income from trash fish of 244.6 baht/haul.

Although the increase of the mesh size resulted in the decreased catch, the income from selling fish increased. Although this increase was marginal, it should also be considered that the escapee fish would have the opportunity to grow in size and value should they be caught at a later time. Leading to a more sustainable and efficient way of utilization.

Table 9. Income of otter board trawl use codend mesh size 1.25 and enlarge to 4.0 cm.

	Codend mesh size 1.25 cm		Codend mesh size 4 cm		Difference
	Income (Baht/haul)	percent	Income (Baht/haul)	percent	
Pelagic fish	41.2	1.08	12.8	0.34	-28.4
Demersal fish	1,632.5	42.85	670.6	17.50	-961.8
Cephalopod	429.2	11.27	440.2	11.49	10.9
Shell	28.5	0.749	1,658.0	43.28	1,629.5
Shrimp	1,122.2	29.46	877.7	22.91	-244.5
Crab	32.4	0.85	69.2	1.81	36.8
Other	193.6	5.08	17.3	0.45	-176.4
Trash fish	329.9	8.66	85.3	2.23	-244.6
Total	3,809.5	100.00	3,831.1	100.0	21.6

6.3. Assessment of financial loss, financial gain and impacts of changing the codend mesh size from the current to 4.0 cm.

6.3.1. Pair Trawl

The catch of trash fish from 1.8 cm mesh size codend net was 1,053.8 kg/haul. This comprised of juvenile economic fish (511.8 kg/haul (48.6%)) and true trash fish (542 kg/haul (51.4%)) (see Table 3). From this, fishers derived a total income of 5,374.4 baht/haul. However, fishers would have derived 7,737.9 baht/haul, if the juvenile fish had been allowed to reach market size. So, the economic loss of utilizing these fish as trash fish was 2,363.5 baht/haul.

From interviews with fishers, one year involved 234 trawl fishing days operating 3 hauls a day. Thus, fishing in this way results in the loss of value of economic fish of 659,204.33 baht/year/boat (Table10). In the case of trawling with the 4.0 cm codend net mesh size, small fish were released at a rate of 433.2 kg/haul. This included juvenile economic fish (281.2kg/haul (64.9%)) and true trash fish, (152 kg/haul (35.08%)). The financial gain from allowing these fish to market size would generate 2,932.5 baht/haul or 2,058,599.38 baht/boat/year.

Table 10. Comparison of financial losses from utilization of juveniles of economic fish and true trash fish as trash fish and financial gain of pair trawl using codend mesh size 1.8 and 4.0 cm.

	Codend mesh size 1.8 cm (baht/hual)			Codend mesh size 4 cm (baht/hual)
Group of fish	Value at trash	Value at marketable size	Financial losses	Financial gains
Pelagic fish	1,621.2	2,323.7	702.5	2,014.8
Demersal fish	641.2	783.4	142	352.1
Cephalopod	312.2	4,629	4,316.8	564.8
Shrimp	1.6	2.1	0.47	0.76
Crab	32.2	0	- 32.2	0
Other	2.0	0	- 2.00	0
True trash fish*	2,764	0	- 2,764	0
Total	5,374.38	7,737.9	2,363.5	2,932.5

Remarks: The calculations are shown in Appendix 8 and 9

6.3.2. Otter board trawl

The catch of trash fish from the 1.25 cm mesh size codend net was 64.7 kg/haul which included juvenile economic fish, (16.4 kg/haul (25.34%)) and true trash fish, (48.3 kg/haul (74.66%)), (Table6) Fishers derived totally 329.9 baht/haul. If the juvenile fish had been allowed to grow then fishers would derive 542.4 baht/haul (Table11). So, the financial loss of the juvenile fish being utilized as trash fish was 193.5 baht/haul. Interviews with fishers indicated an average fishing frequency of 208.5 fishing days/year, with 4 trawl hauls a day. Thus, otter board trawling is resulting in loss of value from economic fish to the tune of 161,413.7 baht/year/boat.

Table 11. Comparison financial losses from utilization of juveniles of economic fish and true trash fish as trash fish and financial gain of otter board trawl using codend mesh size 1.25 and 4.0 cm.

	Codend mesh size 1.25 cm (baht/hual)			Codend mesh size 4 cm (baht/hual)
Group of fish	Value at trash	Value at marketable size	Financial losses	Financial gains
Pelagic fish	6.02	7.32	1.30	11.6
Demersal fish	69.8	509.42	439.64	446.9
Cephalopod	0.09	0.89	0.79	5.02
Shrimp	4.48	5.79	1.32	29.4
Crab	1.97		-1.97	
Other	1.26		-1.26	
True trash fish	246.3		-246.28	
Total	329.9	523.4	193.5	492.9

Remarks: The calculation is shown in Appendix 10 and 11

In the case of trawling with 4.0 cm codend net mesh, small fish were released at a rate of 62.9 kg/haul. This included juvenile economic fish, (25.5 kg/haul (40.49%)) and the true trash fish, (37.4 kg/haul (59.51%)). From this fishers would receive 329.9 bath/haul if they sold these juveniles as trash fish.Whereas, if the fish were allowed to grow up to market size, the financial gain of these fish would be 492.9 baht/haul or 411,056.3 baht/boat/year.

6.4. Length at first capture of fish when codend mesh size is enlarged to 4.0 cm

6.4.1. Pair trawl

6.4.1.1.Atule mate (common name: one finlet scad)

Premkit, W *et al*. (2004) reported the lengths at first maturity of female and male of one finlet scad are 21.25 cm and 21.75 cm, respectively.The total lengths of one finlet scad caught by the 1.8 cm mesh size codend were in the range of 3.25 - 25.25 cm (Appendix 14), with the average length 17.25 ± 1.41 cm. The total lengthsof one finlet scad caught by the 4.0 cm mesh size codend were in the range of 15.75 - 26.75 cm (Appendix 15) with the average length -20.76 ± 0.37 cm. Althouth the scad from the 4.0 cm net were larger than the 1.8 cm net, they were still smaller than the length at first maturity. The length at first capture by 4 cm meshes size codend net (Lc) was 12.11 cm, (Table12). The curve of possibility of capture (Appendix 12) shows that there was a 85.8 % probability of 50% of the fish of 12.11 cm being caught. So, the possibility of these fish reaching maturity was very low.

6.4.1.2. Rastrelliger brachysoma, (common name: short mackerel)

Krajangdara *et al* (2007) reported that the lengths at first maturity of female and male short mackerel were 17.95 cm and 16.45 cm, respectively The total lengths of short mackerel caught by the 1.8 cm mesh size codend net were in the range of 16.25 - 23.25 cm, (Appendix 14) with the average length 19.25 ± 0.72 cm. The total lengthsof short mackerel caught by the 4.0 cm mesh size codend net were in the range of 13.25 – 20.25 cm (Appendix 15) with the average length 16.84 ± 0.14 cm. Fish length at first capture by 4.0 cm meshes size codend net (Lc) was 16.64 cm. Therefore the curve of possibility suggests a probability of 84.72% that 50% of the fish of 16.64 cm would be caught, (Appendix12)

6.4.1.3. Rastrelliger kanagurta (common name: Indian mackerel)

According to the study of Maila-iad *et al* (2006), the lengths at first maturity of female and male Indian mackerel are 17.12 and 20.07 cm, respectively. The total lengths of Indian mackerel caught by the 1.8 cm mesh size codend were in the range of 9.25 - 14.75 cm (Appendix 14) and they were found only in the trash fish catch. The average length was 9.58 ± 0.06 cm. The total lengths of Indian mackerel caught by the 4 cm mesh size codend were in the range of 15.25 – 26.25 cm (Appendix 15) and their average length was18.73 ± 0.91 cm. The average length of the fish in the trash fish catch was13.01 cm. Average size of escapees from the 4.0 cm mesh size codend net was 10.55 cm. The length at first capture by 4.0 cm meshes size codend net (Lc) was13.05 cm. The curve of possibility of capture (Appendix12) shows that there was a 92.80%probability of 50 % of the fish of 13.05 cm in length being caught. So, the possibility of these fish to grow to a mature size was very low.

6.4.1.4. Nemipterus hexodon (common name: ornate threadfin bream)

The total lengths of ornate threadfin bream in the economic fish catch from the 1.8 cm mesh size codend were in the range of 11.75 – 26.75 cm. (Appendix 14) with the average length being 15.38 ± 1.29 cm. The ornate threadfin bream found in trash fish were in the range of 4.75 – 8.75 cm and the average length was 7.43 ± 0.04 cm. The length of ornate threadfin bream caught by the 4.0 cm meshes size codend net and found in the economic fishcatch was in the range of 12.75 – 30.25 cm (Appendix

15) and the average was 20.08 ± 1.98 cm. The average length of ornate threadfin bream found in the trash fish catch was 11.22 cm. The average length of the escapee fish from the 4.0 cm mesh size was 8.41 cm. This indicates that the 4.0 cm mesh size codend net catches the larger size ornate threadfin bream and the length at first capture (L_c) was 12.31 cm. The curve of possibility of capture is shown in Appendix12.

6.4.1.5 *Nemipterus peronii* (common name: notched fin threadfin bream)

The total lengths of notched fin threadfin bream caught by the 1.8 cm mesh size and found in economic fish catch were in the range of 12.25 – 21.75 cm. (Appendix 14) with the average length being 16.02 ± 1.21 cm. The notched fin threadfin bream found in trash fish were in the range of 4.75 – 8.75 cm with the average length was 7.43 ± 0.04 cm. The length of notched fin threadfin bream caught by the 4.0 cm mesh and found in the economic fish catch was in the range of 12.75 – 30.25 cm (Appendix 15) with the average being 20.08 ± 1.98 cm. The average length of notched fin threadfin bream found in the trash fish catch was 11.22 cm. The average length of the escaped fish from the 4.0 cm mesh size was 8.41 cm. This indicates that the 4.0 cm mesh size codend net catches larger size notched fin threadfin bream and the length at first capture (L_c) was 17.95 cm. The curve of possibility of capture is shown in Figure 7.

6.4.2. Otter board trawl

6.4.2.1.Clupeidae (*Sardinella spp.*except *Sardinella gibbosa*) Common name: Herring

Nasuchon, N (2010) reported the lengths at first maturity of herring as 10.35 cm.The length at first capture by the 4.0 cm mesh size codend net (Lc) was 13.20 cm. Total lengths of herring caught by the 1.25 cm mesh size codend were in the range of 11.25–14.25 cm (Appendix16). Average length of herring in the economic fish catch was 14.25 cm. The average length of herring in the trashfish catch was 12.48 ± 0.19 cm. The total lengths of herringcaught by the 4.0 cm mesh size codend were in the range of 12.25 - 16.75 cm (Appendix17) with an average length of 14.20 ± 0.53 cm. herring from the 4.0 cm net were larger than from the 1.25 cm mesh net.The curve of possibility of capture (Appendix13) showing that 50% of fish of 13.20 cm length being caught was 7.84%. The probability of herrings surviving to mature size is therefore very high, (Figure 8).

6.4.2.2. *Rastrelliger brachysoma* (common name: short mackerel)

Krajangdara *et al* (2007) reported that the lengths at first maturity of female and male short mackerel as 17.95 cm and 16.45 cm, respectively.The total lengths of short mackerel caught by the 1.25 cm mesh size codend net and found in the economic fish catch were in the range of 14.75–19.75 cm (Appendix 16) with the average length 17.21 ± 1.05 cm. The total lengths of short mackerel caught by the 4.0 cm mesh and found in the economic fish catch were in the range of 11.25 – 18.25 cm (Appendix 17) with the average length of 15.88 ± 0.93 cm. The length at first capture by 4.0 cm meshes size codend net (Lc) was15.37 cm. The curve of possibility of capture (Appendix 13) showing that 50% of fish of 15.37 cm length being caught was 90.01%.

***6.4.2.3. Nemipterus hexodon* (common name: ornate threadfin bream)**

The total lengths of ornate threadfin bream caught by the 1.25 cm mesh size codend and found in the economic fish catch were in the range of 8.25 – 24.75 cm.(Appendix 16) with the average length13.23 ± 1.11 cm. The ornate threadfin bream found in trash fish catch were in the range of 5.25 – 10.25 cm, with the average length 7.70 ± 0.05 cm. The length of ornate threadfin bream caught by the 4.0 cm meshes size codend net and found in the economic fish catch was in the range of 7.25 – 28.25 cm (Appendix17) with the average 11.68 ± 1.49 cm. The average length of ornate threadfin bream found in the trashfish catch was 7.61 cm. The length of ornate threadfin bream caught by the cover net was

in the range of 4.25 – 12.25 and the average length was 6.86 ± 0.08 cm. This indicates that the 4 cm mesh can catch the larger size of ornate threadfin bream and the length at first capture (L_c) was 10.35 cm. The curve of possibility of capture is shown in Figure 13.

6.5. Example of short mackerel

As mentioned earlier, length at first maturity for short mackerel (L_m) is 17.95 cm (Krajangdara *et al*, 2007). With reference to the probability of capture at a length of first maturity (L_m), of catches by pair trawls is 84.72%, and otter board trawls is 90.01%. Therefore the probability of Short mackerel surviving long enough to spawn is extremely low. Nevertheless, the biological study of Short Mackerel revealed that their smallest length at first maturity (L_m) is 16.45 cm, which is the same as length at first capture (L_c). Fisheries science suggests that marine fish with L_m less than L_c are mostly species that feed at a low tropic level on the food chain e.g. anchovy, sardine, etc.

Table 12 Length at first capture and probability of capture of the economic fish caught by pair trawl and otter board trawl use codend 4.0 cm.

	Lc (cm.)		Lm (cm.)	Probability of capture at L_m (percent)	
	Pair trawl 4.0 cm	Otter board trawl 4.0 cm		Pair trawl 4.0 cm	Otter board trawl 4.0 cm
Atule mate	12.11	-	21.25	85.77	-
Encrasicholina spp	7.81	-	6.44	5.63	-
Clupeidae	12.11	13.20	10.35	11.66	7.84
Rastrelliger brachysoma	16.64	15.37	17.95	84.72	90.01
R. kanagurta	13.05	-	17.12	92.80	-
Selaroides leptolepis	-	13.53	11.73	-	21.06
Nemipterus hexodon	12.31	10.35	14.57	69.00	83.46
N. peronii	17.95	-	14.57	11.20	-
N. mesoprion	-	12.60	-	-	92.75
N. japonicus	-	11.41	-	-	78.61
Saurida undosquamis.	12.45	-	22.44	88.94	-
S. elongate	18.72	20.91	28.85	99.63	74.08
Photololigo duvaucelii	8.48	11.52	17.71	99.95	99.91
Sepioteuthis lessoniana	10.58	-	13.67	89.41	-
Penaeus merguiensis	-	14.52	14.14	-	39.60
P. japonicus	-	13.95	-	-	55.22
Portunus pelagicus	-	9.32	9.47	-	55.01

7. Summary and Conclusions

7.1. Study on catch rate, catch composition and escapement rate between current codend and 4 cm mesh size codend.

For **Pair trawls**, on comparing catch rate of 1.8 and 4.0 cm codend mesh size, catches of trash fish reduced from 1,053.8 kg/haul (1.8 cm) to 300.2 kg/haul (4.0 cm). (Table 3) Catches of economic species increased from 501.5 kg/haul (1.8 cm) to 525.2 (4.0 cm) kg/haul. Demersal fish and pelagic fish increased in quanitity but squid was reduced from 47.1 kg/haul (1.8 cm) to 34.4 kg/haul (4.0 cm). Squid retained in 4.0 cm codend mesh size was reduced in quantity but the size was bigger and it was therefore able to generate better income. Overall income, was found to be higher

For **Otter board trawls**, there was a reduced catch rate, (75.9 kg/haul), compared 1.25 cm codend mesh size. There was a reduction of the trash fish catch from 64.7 kg /haul to 16.7 kg. Catches of demeral and pelagic fish had increased but catch of squid and shrimp remained constant. There was a remarkable increase of shellfish, from 0.285 kg/haul in 1.25 cm codend mesh size to 16.6 kg/haul in the codend mesh size of 4.0 cm. Revenue from shellfish was able to offset lost income from trash fish and others.

However considering the decrease in catches, many trawl fishers do not seem willing to cooperate with government to modify codend net to 4.0 cm mesh size. Results from both pair trawl and otter board trawl net experiment reveal that the reduced catch do not impact on fisher incomes. In addition, there are other positive impacts including; reduced catch sorting time, increased freshness and higher prices, reduced crew costs due to the decrease in the quantity of catch onboard. By using expanded mesh it is possible to reduce the costs of ice and fuel oil which are major costs for trawl operators.

7.2. Comparison analysis of the revenue between trawling with the current mesh size codend and 4 cm mesh size codend.

For Pair trawls**,** it can be concluded that although increasing mesh size resulted in a decreased total catch, total incomes increased due to the larger sized economic fish catch. The study indicated that the catch rate of the economic fish was the variable factor of income. Fishers who focus only in the amount of catch may not agree with the increasing mesh size of the net.

For Otter board trawl, although the increase of the mesh size resulted in a decrease of catch, the income derived from selling fish marginally increased. However, it must also be consdeired that the escapee fish will have opportunities to grow and be of higher value when/if they are recaptured.

7.3. The assessment of financial loss, financial gain and impacts of changing the codend mesh size from the current to 4.0 cm.

For Pair Trawls, the catch of trash fish from 1.8 cm mesh size codend net, comprised the juveniles of economic fish (511.8 kg/haul and true trash fish 542 kg/haul. Fishers are deriving a total of 5,374.4 baht/haul. However, fishers would have derived 7,737.9 baht/haul, if the economic catch had been sold at market size. So, an economic loss resulted of 2,363.5 baht/haul. Over one year this would amount to 1,659,204.3 baht/boat/year. In the case of trawling with the 4 cm mesh, juvenile economic fish (281.2 kg/haul) and the true trash fish (1521.981 kg/haul) were released. If recaptured these fish would contribute a financial gain of 2,932.5 baht/haul or 2,058,599.4 baht /boat/year.

For Otter board trawls, fishers derived a total of 329.9 baht/haul. However, they would have derived a total of 542.4 bah/haul if the juvenile fish had been sold at market size. So, the financial loss of these fish in the form of trash fish was equal to 193.5 baht/haul. It was calculated that otter board trawling results in the lost value of 161,413.7 baht/year/boat through juvenile economic fish, being utilized as

trash fish, In the case of trawling with the 4 cm codend net mesh size, true trash fish accounted for 37.4 kg/haul (59.51%) whilst juvenile economic fish made up 40.49% of the total trash fish catch.. Over one year this represents a lost income of 411,056.3 baht/boat/year.

7.4. Length at first capture of fish from enlarged mesh size to 4 cm

The study suggests that, escapement rate increases when mesh size is expanded regardless of shape of the fish.However, this work suggests that using 4 cm mesh size would not result in the escape of enough fish of 'length at first maturity' to allow for the replenishment of fisheries resources. In this study, ten (10) dominant economic marine species caught by otter board trawl and pair trawl, most fish catches show length at first capture (L_c) to be less than length at first maturity (L_m), meaning that 50% of fish with length at first capture (L_c) were less than length at first maturity. It means that 50% of fish with length at first capture (L_c) is caught and harvest. There are less chance of survive and grow to broodstock or occur parnetial overfishing caused by trawling in the Gulf of Thailand. (Table 12)

7.5. Study on catch rate and species composition of research vessel (Promong 1) during 2010-2013

Between 2010-2013, the Department of Fisheries Research Vessel (Promong 1) conducted fisheries resources exploration around the Central of Gulf of Thailand through using otter board trawl nets with 4 cm codend mesh size, covered by a 2.5 cm cover net. The standard towing time was 1 hour. Summary result reveals trends similar catches during the 4 years of resource exploration. The catch rate in year 2010 was 39.8 kg/hr with a decrease during the following year, (23.6 kg/hr). The catch rate, increased in 2012 and 2013, (37.8 and 40.7 kg/hr respectively). Results showed the ratio of economic species and trash fish surveyed in year 2010, was 52:48. The proportion of economic species and trash fish showed a positive trend in year 2013, with 69:31. Demersal fish and cephalopod were the 2 dominant species during 2010-2013. (Appendix 18)

Fish escapement rates from using data collected from with 342 1-hour trawl fishing hauls, during 2010-2013 resulted in higher escape rates than that found through this research, possibly due to the codend not being clogged. The average catch from the 2.5 cm codend mesh size was 34.7 kg/hr. As the usual trawl towing time is usually 4 hours, a catch rate of 138.7 kg/haul can be calculated. Catches by the fisheries research vessel were not significant different to the catches from local otter board trawls, 158.6 kg/haul (Table 4). Escapement rates from the 4 cm codend was calculated as 47.03%

Conclusions

The study suggests potential positive benefits by releasing juveniles of economic species through a larger codend mesh size. The study showed that no matter what composition and size of catch, the escape rate of juvelines increases when the mesh size is increased. However, the study suggests that changing codend mesh size would not alone allow for a significant replenishment of the fisheries resources, even if mesh size was increased to 4.0 cm. The reduced catch of juveniles and small sized trash fish would not dramatically impact fisher's income. In addition, there would be positive impacts including reduced catch sorting time, increased catch quality and higher price of catch, reduced crew costs due to the decrease in the amount of sorting of catch onboard. By using increased mesh it is possible also to reduce the costs of ice and reduce the fuel use, which are major costs for trawl operators. However considering the decrease in catches and income, many trawl fishers do not seem to be willing to modify codend mesh size to 4.0 cm.

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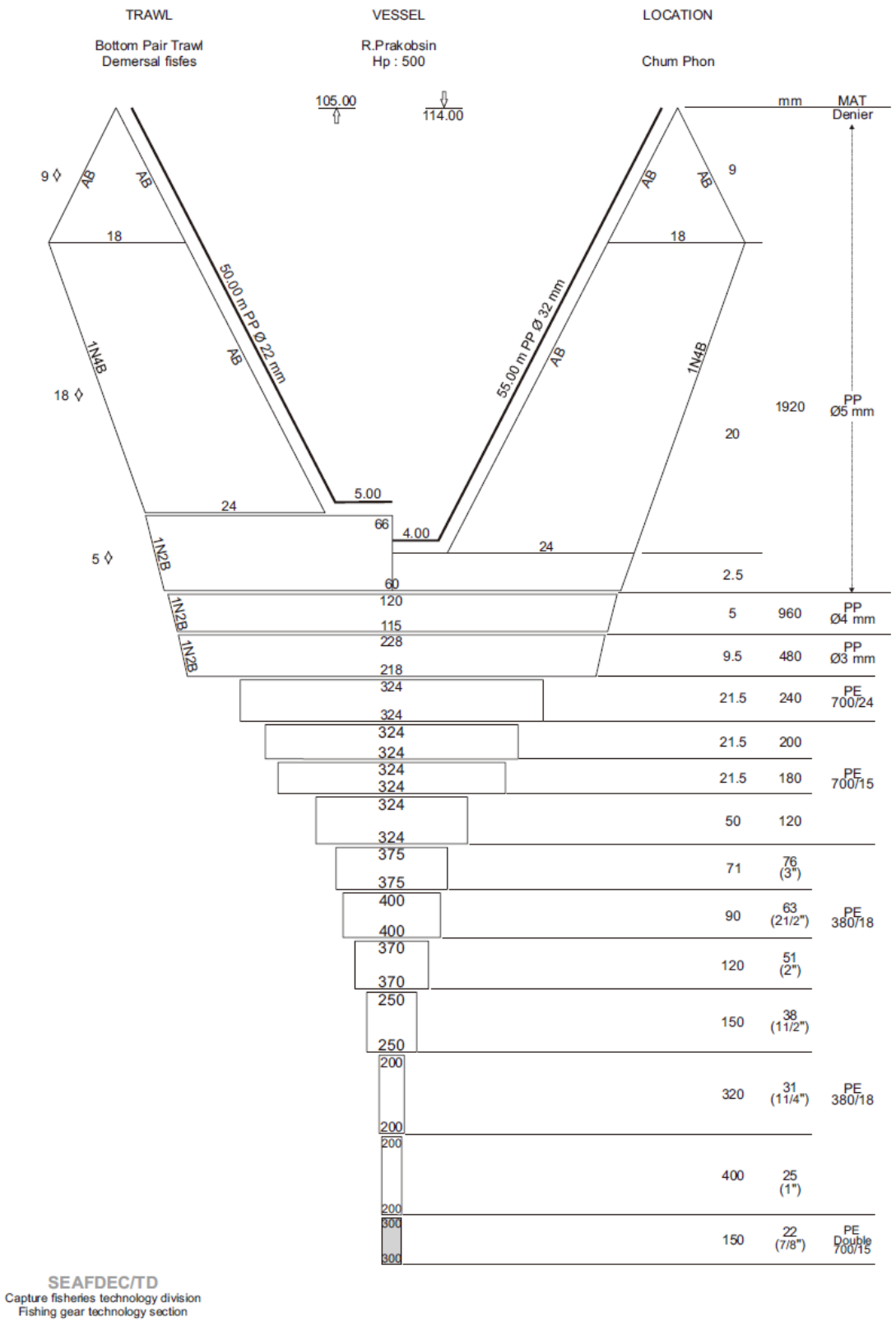
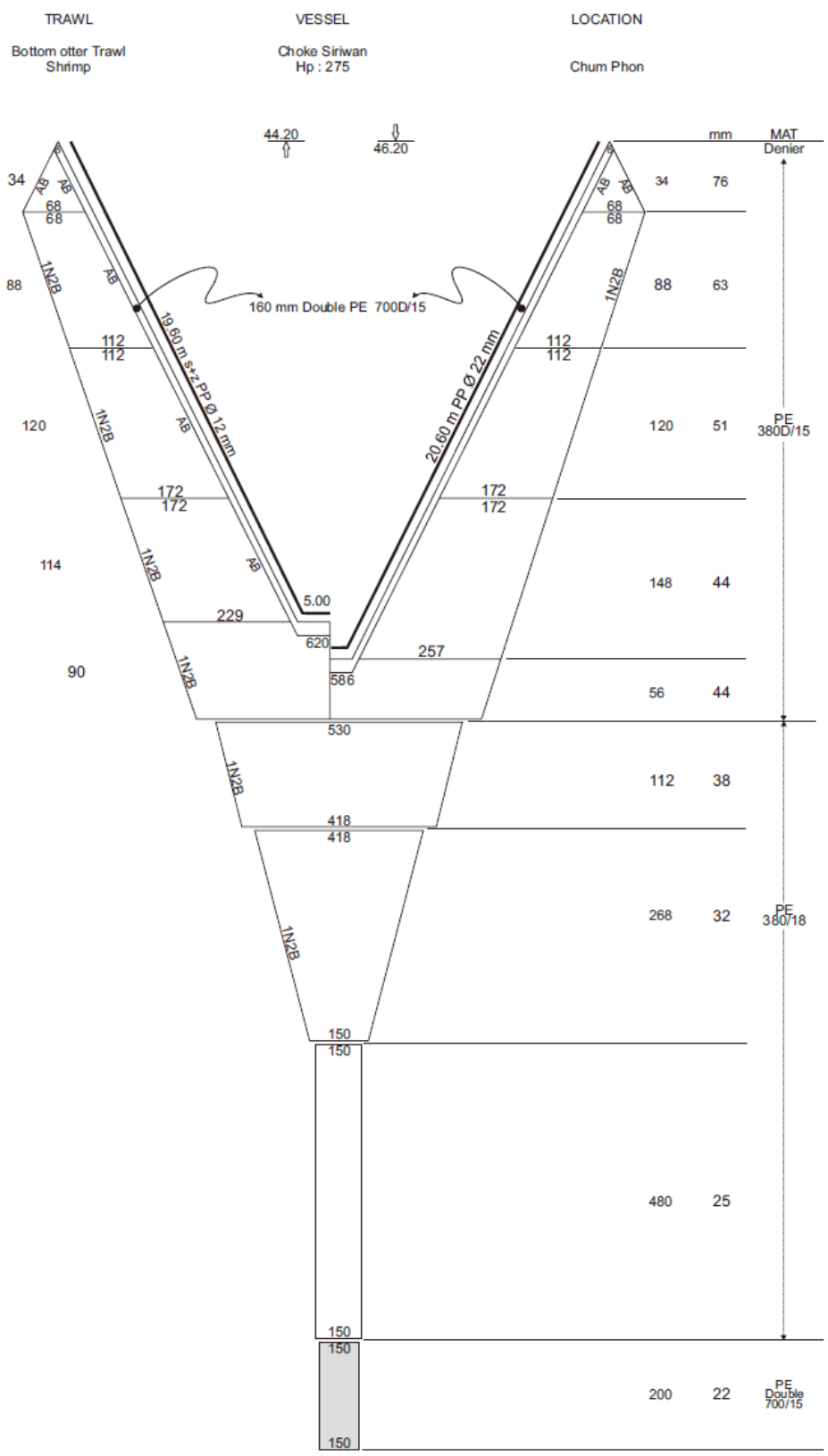
Appendices

Appendix 1. Net plan of pair trawl.



Appendix 2. Net plan of otter board trawl



Appendix 3. Length-weight relationship, total mortality (Z), asymtotic length (L_∞), the initial condition parameter (t_o) and curvature parameter (K)

Species	Y-intercept (a)	Slope (b)	Reference	Z	t_o	K	L_∞	Reference
Sciaenidae	0.00001259	2.9927	DOF cite after Dechboon, 1998	5.55	-	1.40	26.5	Ingles and Pauly (1984, cite after Dechboon, 1998)
Nemipterus hexodon	0.018005	2.914143	Isara (1993)	7.88	-	1.74	31.83	FAO (1996)
N.*peronii*	0.011	3.040	www.fishbase.org	-	-	0.6	34.1	www.fishbase.org
Scolopsis taeniopterus	0.02745	2.763954	Isara (1993)		-	1.04	31	Kongprom *et al*. (2003)
Saurida elongata	0.006532	3.054309	FAO (1996)	6.70	-	1.94	39.30	FAO (1996)
S.*undosquamis*	0.004026	3.185354	FAO (1996)	8.46	-	1.80	36.20	FAO (1996)
Siganus oramin	0.012	3.011	www.fishbase.org	-	-	0.6	23	www.fishbase.org
Terapon theraps	0.0097	3.139	www.fishbase.org	-	-	0.61	34	www.fishbase.org
Lutjanus lineolatus	M=0.0263 F=0.0663	2.754 2.412		8.79	-	1.5	23	Kongprom *et al*. (2003)
Lutjanus johnii	0.0182	2.984	www.fishbase.org	-	-	-	-	-
Priacantus tayenus	0.01823	2.947151	FAO (1996)	6.15	-	1.2	30	Kongprom *et al*. (2010)
Gerres spp.	0.0169	3.0519	www.fishbase.org	-	-	-	-	-
Gerres oyena	0.0095	3.3371	www.fishbase.org	-	-	1.1	18.2	www.fishbase.org
Gerres filamentosus				-	-	1.788	26.9	www.fishbase.org
ปลาแพะ	0.000016154	2.9768	Badrudin (1978, cite after Dechboon, 1998)	2.71	-	0.78	16.5	Martosubroto (1979, cite after Dechboon, 1998)
Sillago spp.	0.017219	2.74882	Isara (1993)	2.7	-	0.7	23.5	Ingles and Pauly (1984)
Sphyraena jello	0.0040	3.110	www.fishbase.org	-	0.01	0.1	148	www.fishbase.org
Siganidae	0.012	3.011	www.fishbase.org					

Appendix 3 (Cont.)

Species	Y-intercept (a)	Slope (b)	Reference	Z	t_o	K	L_∞	Reference
Terapon theraps	0.0097	3.139	www.fishbase.org			0.61	34.0	www.fishbase.org
Cynoglossus spp.	0.0000019433	3.166825	Dechboon, 1998	3.29	-	0.65	24.5	Ingles and Pauly (1984)
Rastrelliger brachysoma	0.00614	3.213	FAO (1996)	6.12	-0.003	2.50	22.00	FAO (1996)
R.*kanagurta*	0.009	3.065	Maila-iad, P*et al*. (2006)	8.1783	-0.0066	0.955	31.75	Sumontra M.*et al.*(2010)
Carangoides armatus	0.10	2.520	www.fishbase.org	-	-	0.82	21.5	www.fishbase.org
Alepes Kleinii	0.00696	3.244	www.fishbase.org		0.83	17.1	12.9	www.fishbase.org
Scomberoides tol	0.0154	2.7875	www.fishbase.org	-	-	-	-	
S.*lysan*	0.01085	2.923	www.fishbase.org	-	-	0.33	66.3	www.fishbase.org
Parastomateus niger	0.0625	2.642	www.fishbase.org	-	-	1.03	37.3	www.fishbase.org
Megalaspis cordyla	0.01317	3.0145	Songkaew*et al*(2009)	6.31	-	1.34	39.6	Sinanun*et al*(2009)
Selaroides leptolepis	0.00438	3.30647	Noopeth (1984)	8.64	-0.08	1.536	19.17	Noopeth (1984)
Sardinella gibbosa	0.008825	3.01873	Saikliang *et al*(2003)	10.10	-0.0073	1.47	23.3	Saikliang *et al*(2003)
Stolephorus heterolobus	0.004384	3.186	Yoo-Sook-Swat (1995)	10.914	0.0106	1.70	10.60	Boonsuk*et al*(2010)
Stolephorus indicus							15.7	www.fishbase.org
Penaeus merguiensis	0.00000338	3.1600	Boonvanich (1993)	5.43*	-0.0048	1.40	25.89	Boonvanich (1993)
Metapenaeus affinis	0.00774	3.01434	Vibhasiri(1987)	13.19	-0.0014	2.60	17.76	Vibhasiri(1987)
Photoligo duvauceli	0.374216	2	Supongpan (1988)	4.68	-0.003	M=0.99 F=1.14	M=37.6 F=23	Supongpan*et al*(1996)

Remark Z, K andtounit per year, weight (W) unit g, Length(L,L∞) unit cm.
M = Male, F = Female

Appendix 4. Catch rate, species composition of marine fauna by species caught by pair trawl using codend mesh size 1.8 cm. and return of fisher.

Pair trawl Scientific name	Size	CPUE kg/boat	CPUE kg/hr.	CPUE kg/haul	% 	in group %	Price baht/kg	Return baht/boat	Return baht/haul	Return %
Economic fish										
Pelagic										
Alepes djeddaba	Misc.S	0.418	0.017	0.084	0.01	0.02	32	13.36	2.67	0.01
Alepes melanoptera	L	6.000	0.240	1.200	0.08	0.24	35	210.00	42.00	0.20
	Misc.	1.449	0.058	0.290	0.019	0.058	15	21.73	4.35	0.02
total *A.melanoptera*		7.449	0.298	1.490	0.10	0.30		231.73	46.35	0.23
Atule mate	L	51.000	2.040	10.200	0.66	2.03	25	1,275.00	255.00	1.24
	M	26.000	1.040	5.200	0.33	1.04	22	572.00	114.40	0.56
	S	24.000	0.960	4.800	0.31	0.96	13	312.00	62.40	0.30
	X	4.000	0.160	0.800	0.05	0.16	15	60.00	12.00	0.06
	Misc.	0.604	0.024	0.121	0.008	0.024	15	9.06	1.81	0.01
total *A.mate*		105.604	4.224	21.121	1.36	4.21		2,228.06	445.61	2.17
Carangidae	X	18.000	0.720	3.600	0.23	0.72	32	576.00	115.20	0.56
	Misc.	1.821	0.073	0.364	0.023	0.073	15	27.31	5.46	0.03
total Carangidae		19.821	0.793	3.964	0.25	0.79		603.31	120.66	0.59
Caranx armatus	X	1.883	0.075	0.377	0.02	0.08		28.25	5.65	0.03
Caranx malabaricus	L	74.000	2.960	14.800	0.95	2.95	25	1,850.00	370.00	1.80
Clupeidae	X	237.000	9.480	47.400	3.05	9.45	15	3,555.00	711.00	3.47
Engruaridae		7.315	0.293	1.463	0.09	0.29	15	109.73	21.95	0.11

Appendix 4. (Cont.)

Pair trawl Scientific name	Size	CPUE kg/boat	CPUE kg/hr.	CPUE kg/haul	% 	in group %	Price baht/kg	Return baht/boat	Return baht/haul	Return %
Megalaspis cordyla	Misc.S	0.251	0.010	0.050	0.00	0.01	15	3.76	0.75	0.00
Mugillidae	X	4.000	0.160	0.800	0.05	0.16	13	50.00	10.00	0.05
Parastromateus niger	X	4.000	0.160	0.800	0.05	0.16	110	440.00	88.00	0.43
Parastromateus niger	Misc.L	0.680	0.027	0.136	0.01	0.03	110	74.83	14.97	0.07
total *P.niger*		4.680	0.187	0.936	0.06	0.19		514.83	102.97	0.50
Rastrelliger brachysoma	L	45.000	1.800	9.000	0.58	1.79	84	3,780.00	756.00	3.69
	M	58.645	2.346	11.729	0.75	2.34	55	3,225.50	645.10	3.15
	S	10.500	0.420	2.100	0.14	0.42	11	115.50	23.10	0.11
	X	25.000	1.000	5.000	0.32	1.00	45	1,125.00	225.00	1.10
total *R.brachysoma*		139.145	5.566	27.829	1.79	5.55		8,246.00	1,649.20	8.04
Rastrelliger kanagurta	M	8.355	0.334	1.671	0.11	0.33	45	375.96	75.19	0.37
	X	5.000	0.200	1.000	0.06	0.20	35	175.00	35.00	0.17
total *R.kanagurta*		13.355	0.534	2.671	0.17	0.53		550.96	110.19	0.54
Sardinella gibbosa	X	53.000	2.120	10.600	0.68	2.11	18	927.50	185.50	0.90
	Misc.S	0.125	0.005	0.025	0.00	0.00	15	1.88	0.38	0.00
total *S.gibbosa*		53.125	2.125	10.625	0.68	2.12		929.38	185.88	0.91
Scomberoides tol	L	23.000	0.920	4.600	0.30	0.92	100	2,300.00	460.00	2.24
	S	16.000	0.640	3.200	0.21	0.64	70	1,120.00	224.00	1.09
	X	2.000	0.080	0.400	0.03	0.08	60	120.00	24.00	0.12
	Misc.L	2.068	0.083	0.414	0.03	0.08	60	124.08	24.82	0.12
total *S.tol*		43.068	1.723	8.614	0.55	1.72		3,664.08	732.82	3.57

Appendix 4. (Cont.)

Pair trawl Scientific name	Size	CPUE kg/boat	CPUE kg/hr.	CPUE kg/haul	% 	in group %	Price baht/kg	Return baht/boat	Return baht/haul	Return %
Scomberomorus commerson	S	9.500	0.380	1.900	0.12	0.38	92	874.00	174.80	0.85
	X	6.000	0.240	1.200	0.08	0.24	70	420.00	84.00	0.41
	Misc.S	0.334	0.013	0.067	0.00	0.01	70	23.38	4.68	0.02
total *S.commerson*		15.834	0.633	3.167	0.20	0.63		1,317.38	263.48	1.28
Selar crumenopthalmus	Misc.S	1.002	0.040	0.200	0.01	0.04	10	10.02	2.00	0.01
Selaroides leptolepis	S	7.000	0.280	1.400	0.09	0.28	10	70.00	14.00	0.07
	X	56.000	2.240	11.200	0.72	2.23	10	560.00	112.00	0.55
	Misc.S	1.023	0.041	0.205	0.01	0.04	10	10.23	2.05	0.01
total *S.leptolepis*		64.023	2.561	12.805	0.82	2.55		640.23	128.05	0.62
Stolephorus indicus	X	11.000	0.440	2.200	0.14	0.44	15	165.00	33.00	0.16
Total Pelagic		802.973	32.119	160.595	10.33	32.02		24,711.07	4,942.21	24.10
Dermersal										
Dasyatidae	L	52.000	2.080	10.400	0.67	2.07	26	1,352.00	270.40	1.32
Epinephelus sexfasciatus		7.164	0.287	1.433	0.09	0.29	75	537.26	107.45	0.52
Gerres abbreviatus	X	97.797	3.912	19.559	1.26	3.90	10	977.97	195.59	0.95
Gerres filamentosus		1.786	0.071	0.357	0.02	0.07	10	17.86	3.57	0.02
Lutjanus malabaricus	X	2.000	0.080	0.400	0.03	0.08	10	20.00	4.00	0.02
Nemipterus hexodon	L	10.556	0.422	2.111	0.14	0.42	50	527.78	105.56	0.51
	S	7.293	0.292	1.459	0.09	0.29	15	109.39	21.88	0.11
	X	16.497	0.660	3.299	0.21	0.66	15	247.45	49.49	0.24
total *N.hexodon*		34.345	1.374	6.869	0.44	1.37		884.62	176.92	0.86

Appendix 4. (Cont.)

Pair trawl Scientific name	Size	CPUE kg/boat	CPUE kg/hr.	CPUE kg/haul	% 	in group %	Price baht/kg	Return baht/boat	Return baht/haul	Return %
Nemipterus japonicus	X	1.245	0.050	0.249	0.02	0.05	15	18.67	3.73	0.02
N. mesoprion	X	0.851	0.034	0.170	0.01	0.03	15	12.77	2.55	0.01
N. metopias	X	10.235	0.409	2.047	0.13	0.41	15	153.52	30.70	0.15
N. peronii	L	1.944	0.078	0.389	0.03	0.08	50	97.22	19.44	0.09
	S	1.707	0.068	0.341	0.02	0.07	15	25.61	5.12	0.02
	X	4.173	0.167	0.835	0.05	0.17	15	62.59	12.52	0.06
	Misc.S	0.084	0.003	0.017	0.00	0.00	10	0.84	0.17	0.00
total *N.peronii*		7.908	0.316	1.582	0.10	0.32		186.26	37.25	0.18
Plectorhynchus pictus	X	24.543	0.982	4.909	0.32	0.98	10	245.43	49.09	0.24
Plotosidae	X	7.500	0.300	1.500	0.10	0.30	100	750.00	150.00	0.73
Pomadasyidae	X	88.131	3.525	17.626	1.13	3.51		881.31	176.26	0.86
Priacanthus tayenus	Misc.S	1.461	0.058	0.292	0.02	0.06	10	14.61	2.92	0.01
Saurida elongata	X	42.869	1.715	8.574	0.55	1.71	20	857.37	171.47	0.84
S. undosquamis	X	0.131	0.005	0.026	0.00	0.01	20	2.63	0.53	0.00
Sciaenidae	L	10.000	0.400	2.000	0.13	0.40	39	390.00	78.00	0.38
	S	15.000	0.600	3.000	0.19	0.60	39	585.00	117.00	0.57
	X	3.000	0.120	0.600	0.04	0.12	20	60.00	12.00	0.06
	Misc.S	0.376	0.015	0.075	0.00	0.01	10	3.76	0.75	0.00
total Sciaenidae		28.376	1.135	5.675	0.36	1.13		1,038.76	207.75	1.01
Scolopsis taeniopterus	X	220.000	8.800	44.000	2.83	8.77	15	3,300.00	660.00	3.22
Siganidae	X	6.935	0.277	1.387	0.09	0.28	10	69.35	13.87	0.07

Appendix 4. (Cont.)

Pair trawl **Scientific name**	**Size**	**CPUE** **kg/boat**	**CPUE** **kg/hr.**	**CPUE** **kg/haul**	**%**	**in group** **%**	**Price** **baht/kg**	**Return** **baht/boat**	**Return** **baht/haul**	**Return** **%**
Sillago sihama	X	25.400	1.016	5.080	0.33	1.01	28	711.20	142.24	0.69
Sphyraena jello	M	3.000	0.120	0.600	0.04	0.12	85	255.00	51.00	0.25
	S	49.000	1.960	9.800	0.63	1.95	28	1,372.00	274.40	1.34
total *S.jello*		52.000	2.080	10.400	0.67	2.07		1,627.00	325.40	1.59
Sphyraena obtusata	L	98.000	3.920	19.600	1.26	3.91	85	8,330.00	1,666.00	8.12
	S	3.000	0.120	0.600	0.04	0.12	28	84.00	16.80	0.08
total *S.obtusata*		101.000	4.040	20.200	1.30	4.03		8,414.00	1,682.80	8.21
Terapon theraps	X	441.500	17.660	88.300	5.68	17.61	10	4,415.00	883.00	4.31
Upeneus sulphureus	X	9.255	0.370	1.851	0.12	0.37	15	138.83	27.77	0.14
U. sundiacus	X	80.745	3.230	16.149	1.04	3.22	15	1,211.17	242.23	1.18
U. tragula	X	17.000	0.680	3.400	0.22	0.68	15	255.00	51.00	0.25
Misc. demersal fishes		73.000	2.920	14.600	0.94	2.91	10	730.00	146.00	0.71
Total Dermersal		1,435.176	57.407	287.035	18.46	57.24		28,822.59	5,764.52	28.11
Cephalopod										
Octopus	X	18.000	0.720	3.600	0.23	0.72	65	1,170.00	234.00	1.14

Appendix 4 (Cont.)

Pair trawl Scientific name	Size	CPUE kg/boat	CPUE kg/hr.	CPUE kg/haul	% 	in group %	Price baht/kg	Return baht/boat	Return baht/haul	Return %
Photololigo duvaucelii	1	10.500	0.420	2.100	0.14	0.42	85	892.50	178.50	0.87
	2	16.500	0.660	3.300	0.21	0.66	85	1,402.50	280.50	1.37
	3	21.500	0.860	4.300	0.28	0.86	85	1,827.50	365.50	1.78
	4	11.000	0.440	2.200	0.14	0.44	80	880.00	176.00	0.86
	5	4.000	0.160	0.800	0.05	0.16	65	260.00	52.00	0.25
	6	2.000	0.080	0.400	0.03	0.08	50	100.00	20.00	0.10
	X	5.000	0.200	1.000	0.06	0.20	86	430.00	86.00	0.42
total *P.duvaucelii*		70.500	2.820	14.100	0.91	2.81		5,792.50	1,158.50	5.65
Sepia pharaonis	X	56.497	2.260	11.299	0.73	2.25	86	4,858.77	971.75	4.74
S. recurvirostris	X	15.162	0.606	3.032	0.19	0.60	86	1,303.93	260.79	1.27
Sepiella innermis	X	4.341	0.174	0.868	0.06	0.17	86	373.30	74.66	0.36
Sepioteuthis lessoniana	L	33.000	1.320	6.600	0.42	1.32	117	3,861.00	772.20	3.77
	S	7.000	0.280	1.400	0.09	0.28	103	721.00	144.20	0.70
	X	31.000	1.240	6.200	0.40	1.24	82	2,542.00	508.40	2.48
total *S.lessoniana*		71.000	2.840	14.200	0.91	2.83		7,124.00	1,424.80	6.95
Total Cephalopod		235.500	9.420	47.100	3.03	9.39		20,622.50	4,124.50	20.11
Shrimp										
Penaeus japonicus	X	0.170	0.007	0.034	0.00	0.01	316	53.72	10.74	0.05
P. latisulcatus	X	0.080	0.003	0.016	0.00	0.00	316	25.28	5.06	0.02
P. merguiensis	X	1.200	0.048	0.240	0.02	0.05	316	379.20	75.84	0.37
Total Shrimp		1.450	0.058	0.290	0.02	0.06		458.20	91.64	0.45

Appendix 4. (Cont.)

Pair trawl **Scientific name**	**Size**	**CPUE** **kg/boat**	**CPUE** **kg/hr.**	**CPUE** **kg/haul**	**%**	**in group** **%**	**Price** **baht/kg**	**Return** **baht/boat**	**Return** **baht/haul**	**Return** **%**
Crab										
Charybdis feriatus	X	1.044	0.042	0.209	0.01	0.04	45	46.97	9.39	0.05
C. natator	X	1.420	0.057	0.284	0.02	0.06	10	14.20	2.84	0.01
Podolpthalmus vigil	X	2.088	0.084	0.418	0.03	0.08	10	20.88	4.18	0.02
Total Crab		4.551	0.182	0.910	0.06	0.18		82.04	16.41	0.08
Other										
Amusium pleuronectes		7.500	0.300	1.500	0.10	0.30	100	750.00	150.00	0.73
Mantis shrimps		0.146	0.006	0.029	0.00	0.01	20	2.92	0.58	0.00
Thenus orientalis		0.292	0.012	0.058	0.00	0.01	20	5.85	1.17	0.01
Other		19.762	0.790	3.952	0.25	0.79	10	197.62	39.52	0.19
Total Other		27.700	1.108	5.540	0.356	1.105		956.38	191.28	0.93
Total Economic fish		**2,507.350**	**100.294**	**501.470**	**32.24**	**100.00**		**75,652.79**	**15,130.56**	**73.79**
Trash										
Pelagic										
Clupeidae	Trash	296.169	11.847	59.234	3.81	5.62	5.10	1,510.46	302.09	1.47
Encrasicholina spp.	Trash	705.507	28.220	141.101	9.07	13.39	5.10	3,598.09	719.62	3.51
Megalaspis cordyla	Trash	16.463	0.659	3.293	0.21	0.31	5.10	83.96	16.79	0.08
Rastrelliger kanagurta	Trash	61.753	2.470	12.351	0.79	1.17	5.10	314.94	62.99	0.31
Rastrelliger spp.	Trash	206.949	8.278	41.390	2.66	3.93	5.10	1,055.44	211.09	1.03
Sardinella gibbosa	Trash	34.307	1.372	6.861	0.44	0.65	5.10	174.97	34.99	0.17
Selaroides leptolepis	Trash	177.007	7.080	35.401	2.28	3.36	5.10	902.74	180.55	0.88

Appendix 4. (Cont.)

Pair trawl Scientific name	Size	CPUE kg/boat	CPUE kg/hr.	CPUE kg/haul	 %	in group %	Price baht/kg	Return baht/boat	Return baht/haul	Return %
Stolephorus indicus	Trash	91.281	3.651	18.256	1.17	1.73	5.10	465.53	93.11	0.45
Total Pelagic		1,589.437	63.577	317.887	20.44	30.17	5.10	8,106.13	1,621.23	7.91
Dermersal										
Lutjanus vitta	Trash	30.134	1.205	6.027	0.39	0.57	5.10	153.68	30.74	0.15
Nemipterus hexodon	Trash	96.633	3.865	19.327	1.24	1.83	5.10	492.83	98.57	0.48
Nemipterus peronii	Trash	13.102	0.524	2.620	0.17	0.25	5.10	66.82	13.36	0.07
Plectorhynchus pictus	Trash	28.125	1.125	5.625	0.36	0.53	5.10	143.44	28.69	0.14
Priacanthus tayenus	Trash	7.838	0.314	1.568	0.10	0.15	5.10	39.97	7.99	0.04
Scolopsis taeniopterus	Trash	150.530	6.021	30.106	1.94	2.86	5.10	767.71	153.54	0.75
Siganidae	Trash	9.749	0.390	1.950	0.13	0.19	5.10	49.72	9.94	0.05
Sphyraena jello	Trash	210.109	8.404	42.022	2.70	3.99	5.10	1,071.56	214.31	1.05
Upeneus sundiacus	Trash	66.956	2.678	13.391	0.86	1.27	5.10	341.47	68.29	0.33
U. tragula	Trash	15.438	0.618	3.088	0.20	0.29	5.10	78.74	15.75	0.08
Total Dermersal		628.614	25.145	125.723	8.08	11.93	5.10	3,205.93	641.19	3.13
Cephalopod										
Nipponololigo sumatrensis	Trash	306.040	12.242	61.208	3.94	5.81	5.10	1,560.80	312.16	1.52
Total Cephalopod		306.040	12.242	61.208	3.94	5.81	5.10	1,560.80	312.16	1.52
Shrimp										
Metapenaeopsis palmensis	Trash	1.568	0.063	0.314	0.02	0.03	5.10	7.99	1.60	0.01
Total Shrimp		1.568	0.063	0.314	0.02	0.03	5.10	7.99	1.60	0.01

Appendix 4. (Cont.)

Pair trawl Scientific name	Size	CPUE kg/boat	CPUE kg/hr.	CPUE kg/haul	% 	in group %	Price baht/kg	Return baht/boat	Return baht/haul	Return %
Crab										
Podolpthalmus vigil	Trash	29.247	1.170	5.849	0.38	0.56	5.10	149.16	29.83	0.15
Misc. crabs	Trash	2.351	0.094	0.470	0.03	0.04	5.10	11.99	2.40	0.01
total Crab		31.599	1.264	6.320	0.41	0.60	5.10	161.15	32.23	0.16
Other										
Miscellaneous (other)	Trash	1.959	0.078	0.392	0.03	0.04	5.10	9.99	2.00	0.01
total Other		1.959	0.078	0.392	0.03	0.04	5.10	9.99	2.00	0.01
True Trash fish										
Apogonidae	Trash	33.806	1.352	6.761	0.43	0.64	5.10	172.41	34.48	0.17
Lagocephalus inermis	Trash	30.629	1.225	6.126	0.39	0.58	5.10	156.21	31.24	0.15
L. lunaris	Trash	50.947	2.038	10.189	0.66	0.97	5.10	259.83	51.97	0.25
Leiognathidae	Trash	2,474.861	98.994	494.972	31.83	46.97	5.10	12,621.79	2,524.36	12.31
Miscellaneous trash	Trash	20.089	0.804	4.018	0.26	0.38	5.10	102.45	20.49	0.10
Pentapodidae	Trash	24.373	0.975	4.875	0.31	0.46	5.10	124.30	24.86	0.12
Trichiuridae	Trash	75.078	3.003	15.016	0.97	1.42	5.10	382.90	76.58	0.37
total True Trash fish		2,709.783	108.391	541.957	34.85	51.43	5.10	13,819.89	2,763.98	13.48
Total Trash fish		5,269.000	210.760	1,053.800	67.76	100.00		26,871.90	5,374.38	26.21
Total		**7,776.350**	**311.054**	**1,555.270**	**100**			**102,524.69**	**20,504.94**	**100.00**

Remark : size of fish L=large S=small X= unsorted Misc.=sold with mix fish

Appendix 5. Catch rate, species composition of marine fauna by species caught by pair trawl using codend mesh size 4 cm. cover with 1.8 cm. and return of fisher

Pair trawl with cover net Scientific name	Size	CPUE kg/boat	CPUE kg/hr.	CPUE kg/haul	Total %	in group %	Escape Rate	Price baht/kg	Return baht/boat	Return baht/haul	Return %
Economic fish											
Pelagic											
Alepes melanoptera	L	3.000	0.120	0.600	0.05	0.07		35.00	105.00	21.00	0.09
	X	5.500	0.220	1.100	0.09	0.13		15.00	82.50	16.50	0.07
total *A.melanoptera*		8.500	0.340	1.700	0.13	0.21			187.50	37.50	0.16
Atule mate	L	90.000	3.600	18.000	1.43	2.17		25.00	2,250.00	450.00	1.88
	M	70.000	2.800	14.000	1.11	1.69		22.00	1,540.00	308.00	1.28
	S	48.000	1.920	9.600	0.76	1.16		13.00	624.00	124.80	0.52
total *A.mate*		208.000	8.320	41.600	3.30	5.02			4,414.00	882.80	3.68
Parastromateus niger	L	15.800	0.632	3.160	0.25	0.38		132.00	2,085.60	417.12	1.74
	X	2.000	0.080	0.400	0.03	0.05		110.00	220.00	44.00	0.18
total *P.niger*		17.800	0.712	3.560	0.28	0.43			2,305.60	461.12	1.92
Caranx armatus	X	5.000	0.200	1.000	0.08	0.12		35.00	175.00	35.00	0.15
C. malabaricus	L	72.000	2.880	14.400	1.14	1.74		25.00	1,800.00	360.00	1.50
	M	17.000	0.680	3.400	0.27	0.41		22.00	374.00	74.80	0.31
total *C.malabaricus*		89.000	3.560	17.800	1.41	2.15			2,174.00	434.80	1.81
Selar crumenopthalmus	X	6.000	0.240	1.200	0.10	0.14		13.00	78.00	15.60	0.07
	XS	0.817	0.033	0.163	0.01	0.02		10.00	8.17	1.63	0.01
total *S.crumenopthalmus*		6.817	0.273	1.363	0.11	0.16			86.17	17.23	0.07

Appendix 5. (Cont.)

Pair trawl with cover net Scientific name	Size	CPUE kg/boat	CPUE kg/hr.	CPUE kg/haul	Total %	in group %	Escape Rate	Price baht/kg	Return baht/boat	Return baht/haul	Return %
Selaroides leptolepis		33.369	1.335	6.674	0.53	0.81		10.00	333.69	66.74	0.28
Carangidae	X	6.000	0.240	1.200	0.10	0.14		32.00	192.00	38.40	0.16
Clupeidae	X	196.000	7.840	39.200	3.11	4.73		15.00	2,940.00	588.00	2.45
Engruaridae	X	7.000	0.280	1.400	0.11	0.17		15.00	105.00	21.00	0.09
Mugillidae	X	1.500	0.060	0.300	0.02	0.04		12.50	18.75	3.75	0.02
Rastrelliger brachysoma	L	45.000	1.800	9.000	0.71	1.09		84.00	3,780.00	756.00	3.15
	M	105.000	4.200	21.000	1.66	2.54		55.00	5,775.00	1,155.00	4.82
	S	62.500	2.500	12.500	0.99	1.51		11.00	687.50	137.50	0.57
total *R.brachysoma*		212.500	8.500	42.500	3.37	5.13			10,242.50	2,048.50	8.55
Rastrelliger kanagurta	L	10.500	0.420	2.100	0.17	0.25		75.00	787.50	157.50	0.66
	M	19.000	0.760	3.800	0.30	0.46		45.00	855.00	171.00	0.71
	S	6.000	0.240	1.200	0.10	0.14		11.00	66.00	13.20	0.06
total *R.kanagurta*		35.500	1.420	7.100	0.56	0.86			1,708.50	341.70	1.43
Scomberoides tol	L	6.000	0.240	1.200	0.10	0.14		100.00	600.00	120.00	0.50
	M	10.000	0.400	2.000	0.16	0.24		70.00	700.00	140.00	0.58
	X	6.000	0.240	1.200	0.10	0.14		60.00	360.00	72.00	0.30
total *S.tol*		22.000	0.880	4.400	0.35	0.53			1,660.00	332.00	1.39
Scomberomorus commerson	S	22.000	0.880	4.400	0.35	0.53		92.00	2,024.00	404.80	1.69
	X	2.000	0.080	0.400	0.03	0.05		70.00	140.00	28.00	0.12
total *S.commerson*		24.000	0.960	4.800	0.38	0.58			2,164.00	432.80	1.81
total Pelagic		872.986	34.919	174.597	13.84	21.08			28,706.71	5,741.34	23.95

Appendix 5. (Cont.)

Pair trawl with cover net Scientific name	Size	CPUE kg/boat	CPUE kg/hr.	CPUE kg/haul	Total %	in group %	Escape Rate	Price baht/kg	Return baht/boat	Return baht/haul	Return %
Dermersal											
Dasyatidae	X	37.000	1.480	7.400	0.59	0.89		26.00	962.00	192.40	0.80
Gerres abbreviatus		71.358	2.854	14.272	1.13	1.73		10.00	713.58	142.72	0.60
G. filamentosus	L	3.000	0.120	0.600	0.05	0.07		10.00	30.00	6.00	0.03
G.oyena	S	0.960	0.038	0.192	0.02	0.02		10.00	9.60	1.92	0.01
Lutjanus malabaricus	L	6.000	0.240	1.200	0.10	0.14		10.00	60.00	12.00	0.05
L.vitta	Misc.S	1.977	0.079	0.395	0.03	0.05		10.00	19.77	3.95	0.02
Muraenesocidae	Misc.S	2.821	0.113	0.564	0.04	0.07		31.00	87.45	17.49	0.07
Nemipterus hexodon	L	14.261	0.570	2.852	0.23	0.34		50.00	713.04	142.61	0.59
	X	31.431	1.257	6.286	0.50	0.76		15.00	970.59	194.12	0.81
total *N. hexodon*		45.692	1.828	9.138	0.72	1.10			1,683.64	336.73	1.40
N. japonicus	S	1.146	0.046	0.229	0.02	0.03		15.00	17.19	3.44	0.01
N. metopias		4.081	0.163	0.816	0.06	0.10		15.00	61.21	12.24	0.05
N. peronii	L	1.739	0.070	0.348	0.03	0.04		50.00	86.96	17.39	0.07
	M	1.000	0.040	0.200	0.02	0.02		15.00	15.00	3.00	0.01
	S	3.684	0.147	0.737	0.06	0.09		15.00	55.26	11.05	0.05
total *N. peronii*		6.423	0.257	1.285	0.10	0.16			157.22	31.44	0.13
Platycephalidae	L	4.500	0.180	0.900	0.07	0.11		25.00	112.50	22.50	0.09
Plectorhynchus pictus		78.000	3.120	15.600	1.24	1.89		10.00	780.00	156.00	0.65
Plotosidae	X	3.000	0.120	0.600	0.05	0.07		100.00	300.00	60.00	0.25
Pomadasyidae		258.500	10.340	51.700	4.11	6.26		10.00	2,585.00	517.00	2.17
Priacanthus tayenus		3.797	0.152	0.759	0.06	0.09		10.00	37.97	7.59	0.03

Appendix 5. (Cont.)

Pair trawl with cover net Scientific name	Size	CPUE kg/boat	CPUE kg/hr.	CPUE kg/haul	Total %	in group %	Escape Rate	Price baht/kg	Return baht/boat	Return baht/haul	Return %
Rachycentron canadus	L	10.000	0.400	2.000	0.16	0.24		180.00	1,800.00	360.00	1.50
	M	33.000	1.320	6.600	0.52	0.80		130.00	4,290.00	858.00	3.58
	X	2.000	0.080	0.400	0.03	0.05		100.00	200.00	40.00	0.17
total *R.canadus*		45.000	1.800	9.000	0.71	1.09			6,290.00	1,258.00	5.25
Saurida elongata		41.101	1.644	8.220	0.65	1.00		20.00	822.02	164.40	0.69
S.undosquamis	X	8.899	0.356	1.780	0.14	0.21		20.00	177.98	35.60	0.15
Sciaenidae	L	37.000	1.480	7.400	0.58	0.89		39.00	1,443.00	288.60	1.19
	X	2.000	0.080	0.400	0.03	0.05		20.00	40.00	8.00	0.03
total Sciaenidae		39.000	1.560	7.800	0.62	0.94			1,483.00	296.60	1.24
Scolopsis taeniopterus		165.500	6.620	33.100	2.63	4.01		15.00	2,482.50	496.50	2.08
Siganidae	X	10.000	0.400	2.000	0.16	0.24		10.00	100.00	20.00	0.08
Sillago sihama		43.000	1.720	8.600	0.68	1.04		28.00	1,204.00	240.80	1.01
Sphyraena jello	L	312.000	12.480	62.400	4.95	7.53		85.00	26,520.00	5,304.00	22.13
	S	40.000	1.600	8.000	0.63	0.97		28.00	1,120.00	224.00	0.93
total *S.jello*		352.000	14.080	70.400	5.58	8.50			27,640.00	5,528.00	23.06
S.obtusata	L	44.000	1.760	8.800	0.70	1.06		85.00	3,740.00	748.00	3.12
	S	108.000	4.320	21.600	1.71	2.61		28.00	3,024.00	604.80	2.52
	Misc.S	0.501	0.020	0.100	0.01	0.01		28.00	14.03	2.81	0.01
total *S.obtusata*		152.501	6.100	30.500	2.42	3.68			6,778.03	1,355.61	5.66
Terapon theraps		85.591	3.424	17.118	1.36	2.07		10.00	855.91	171.18	0.72

Appendix 5. (Cont.)

Pair trawl with cover net Scientific name	Size	CPUE kg/boat	CPUE kg/hr.	CPUE kg/haul	Total %	in group %	Escape Rate	Price baht/kg	Return baht/boat	Return baht/haul	Return %
Upeneus sundiacus	X	20.625	0.825	4.125	0.33	0.50		15.00	309.38	61.88	0.26
U.tragula	X	11.875	0.475	2.375	0.19	0.29		15.00	178.13	35.63	0.15
Misc. demersal fishes		80.000	3.200	16.000	1.27	1.94		10.00	800.00	160.00	0.67
total Dermersal		1,583.347	63.334	316.669	25.10	38.24			56,738.07	11,347.61	47.34
Cephalopod											
Cuttle fishes	X	3.212	0.128	0.642	0.05	0.08		86.00	276.20	55.24	0.23
Octopus	X	4.828	0.193	0.966	0.08	0.12		65.00	313.80	62.76	0.26
Photololigo duvaucelii	1	13.752	0.550	2.750	0.22	0.33		85.00	1,168.91	233.78	0.98
	2	18.876	0.755	3.775	0.30	0.46		85.00	1,604.45	320.89	1.34
	3	10.544	0.422	2.109	0.17	0.25		85.00	896.22	179.24	0.75
	4	11.000	0.440	2.200	0.17	0.27		80.00	880.00	176.00	0.73
	5	7.000	0.280	1.400	0.11	0.17		65.00	455.00	91.00	0.38
	6	9.500	0.380	1.900	0.15	0.23		50.00	475.00	95.00	0.40
	X	5.085	0.203	1.017	0.08	0.12		86.00	437.29	87.46	0.36
total *P.duvaucelii*		75.756	3.030	15.151	1.20	1.83			5,916.87	1,183.37	4.94
Sepia pharaonis	X	31.386	1.255	6.277	0.50	0.76		86.00	2,699.23	539.85	2.25
S.recurvirostris	X	14.140	0.566	2.828	0.22	0.34		86.00	1,216.01	243.20	1.01
Sepiella innermis	X	6.523	0.261	1.305	0.10	0.16		86.00	560.94	112.19	0.47
Sepioteuthis lessoniana	X	36.156	1.446	7.231	0.57	0.87		102.00	3,687.87	737.57	3.08
total Cephalopod		172.000	6.880	34.400	2.73	4.15			14,670.94	2,934.19	12.24

Appendix 5. (Cont.)

Pair trawl with cover net Scientific name	Size	CPUE kg/boat	CPUE kg/hr.	CPUE kg/haul	Total %	in group %	Escape Rate	Price baht/kg	Return baht/boat	Return baht/haul	Return %
Shrimp											
Penaeus japonicus	X	1.416	0.057	0.283	0.02	0.03		316.00	447.46	89.49	0.37
P. latisulcatus	X	1.200	0.048	0.240	0.02	0.03		316.00	379.20	75.84	0.32
P. merguiensis	X	0.384	0.015	0.077	0.01	0.01		316.00	121.34	24.27	0.10
total Shrimp		3.000	0.120	0.600	0.05	0.07			948.00	189.60	0.79
Other											
Other		8.727	0.349	1.745	0.14	0.21		10.00	87.27	17.45	0.07
total Other		8.727	0.349	1.745	0.14	0.21		10.00	87.27	17.45	0.07
Sub-total economic fish		**2,640.061**	**105.602**	**528.012**	**41.86**	**63.75**			**101,150.99**	**20,230.20**	**84.40**
Trash											
Pelagic											
Alepes djeddaba	Trash	5.780	0.231	1.156	0.09	0.14		5.10	29.48	5.90	0.02
A.kleinii	Trash	3.226	0.129	0.645	0.05	0.08		5.10	16.45	3.29	0.01
Megalaspis cordyla	Trash	2.537	0.101	0.507	0.04	0.06		5.10	12.94	2.59	0.01
Parastromateus niger	Trash	8.703	0.348	1.741	0.14	0.21		5.10	44.39	8.88	0.04
Selaroides leptolepis	Trash	41.354	1.654	8.271	0.66	1.00		5.10	210.91	42.18	0.18
Carangidae	Trash	5.116	0.205	1.023	0.08	0.12		5.10	26.09	5.22	0.02
Clupeidae	Trash	143.433	5.737	28.687	2.27	3.46		5.10	731.51	146.30	0.61
Encrasicholina spp.	Trash	31.014	1.241	6.203	0.49	0.75		5.10	158.17	31.63	0.13
Stolephorus indicus	Trash	27.746	1.110	5.549	0.44	0.67		5.10	141.50	28.30	0.12
Rastrelliger kanagurta	Trash	65.922	2.637	13.184	1.05	1.59		5.10	336.20	67.24	0.28

Appendix 5. (Cont.)

Pair trawl with cover net Scientific name	Size	CPUE kg/boat	CPUE kg/hr.	CPUE kg/haul	Total %	in group %	Escape Rate	Price baht/kg	Return baht/boat	Return baht/haul	Return %
*Rastrelliger*spp.	Trash	189.039	7.562	37.808	3.00	4.56		5.10	964.10	192.82	0.80
Caesiodidae	Trash	4.128	0.165	0.826	0.07	0.10		5.10	21.06	4.21	0.02
total Pelagic		527.999	21.120	105.600	8.37	12.75		5.10	2,692.79	538.56	2.25
Dermersal											
Gerres oyena	Trash	18.746	0.750	3.749	0.30	0.45		5.10	95.61	19.12	0.08
Lutjanus vitta	Trash	7.844	0.314	1.569	0.12	0.19		5.10	40.00	8.00	0.03
Nemipterus hexodon	Trash	24.611	0.984	4.922	0.39	0.59		5.10	125.52	25.10	0.10
Platycephalidae	Trash	0.648	0.026	0.130	0.01	0.02		5.10	3.31	0.66	0.00
Plectorhynchus pictus	Trash	10.903	0.436	2.181	0.17	0.26		5.10	55.60	11.12	0.05
Plotosidae	Trash	24.547	0.982	4.909	0.39	0.59		5.10	125.19	25.04	0.10
Pomadasyidae	Trash	15.622	0.625	3.124	0.25	0.38		5.10	79.67	15.93	0.07
Priacanthus tayenus	Trash	7.454	0.298	1.491	0.12	0.18		5.10	38.02	7.60	0.03
Saurida elongata	Trash	13.897	0.556	2.779	0.22	0.34		5.10	70.87	14.17	0.06
S. undosquamis	Trash	2.064	0.083	0.413	0.03	0.05		5.10	10.53	2.11	0.01
Sciaenidae	Trash	4.687	0.187	0.937	0.07	0.11		5.10	23.90	4.78	0.02
Scolopsis taeniopterus	Trash	9.551	0.382	1.910	0.15	0.23		5.10	48.71	9.74	0.04
Siganidae	Trash	39.679	1.587	7.936	0.63	0.96		5.10	202.36	40.47	0.17
Sphyraena jello	Trash	39.785	1.591	7.957	0.63	0.96		5.10	202.90	40.58	0.17
S. obtusata	Trash	0.648	0.026	0.130	0.01	0.02		5.10	3.31	0.66	0.00
Terapon theraps	Trash	9.495	0.380	1.899	0.15	0.23		5.10	48.43	9.69	0.04
Upeneus sundiacus	Trash	137.600	5.504	27.520	2.18	3.32		5.10	701.76	140.35	0.59
total Dermersal		367.781	14.711	73.556	5.83	8.88		5.10	1,875.68	375.14	1.56

Appendix 5. (Cont.)

Pair trawl with cover net Scientific name	Size	CPUE kg/boat	CPUE kg/hr.	CPUE kg/haul	Total %	in group %	Escape Rate	Price baht/kg	Return baht/boat	Return baht/haul	Return %
Cephalopod											
Nipponololigo sumatrensis	Trash	8.141	0.326	1.628	0.13	0.20		5.10	41.52	8.30	0.03
total Cephalopod		8.141	0.326	1.628	0.13	0.20		5.10	41.52	8.30	0.03
Crab											
Charybdis natator	Trash	37.492	1.500	7.498	0.59	0.91		5.10	191.21	38.24	0.16
Misc. crabs	Trash	9.477	0.379	1.895	0.15	0.23		5.10	48.33	9.67	0.04
Podolpthalmus vigil	Trash	23.145	0.926	4.629	0.37	0.56		5.10	118.04	23.61	0.10
total Crab		70.114	2.805	14.023	1.11	1.69		5.10	357.58	71.52	0.30
Other											
Mantis shrimps	Trash	17.184	0.687	3.437	0.27	0.41		5.10	87.64	17.53	0.07
total Other		17.184	0.687	3.437	0.27	0.41		5.10	87.64	17.53	0.07
True trash fish											
Apogonidae	Trash	4.414	0.177	0.883	0.07	0.11		5.10	22.51	4.50	0.02
Gobioidei	Trash	0.972	0.039	0.194	0.02	0.02		5.10	4.96	0.99	0.00
Lagocephalus inermis	Trash	45.667	1.827	9.133	0.72	1.10		5.10	232.90	46.58	0.19
L.lunaris	Trash	28.999	1.160	5.800	0.46	0.70		5.10	147.89	29.58	0.12
Leiognathidae	Trash	384.728	15.389	76.946	6.10	9.29		5.10	1,962.11	392.42	1.64
Pentapodidae	Trash	34.763	1.391	6.953	0.55	0.84		5.10	177.29	35.46	0.15
Pentaprion longimanus	Trash	8.618	0.345	1.724	0.14	0.21		5.10	43.95	8.79	0.04
Trichiuridae	Trash	1.620	0.065	0.324	0.03	0.04		5.10	8.26	1.65	0.01
total True trash fish		509.781	20.391	101.956	8.08	12.31		5.10	2,599.88	519.98	2.17

Appendix 5. (Cont.)

Pair trawl with cover net Scientific name	Size	CPUE kg/boat	CPUE kg/hr.	CPUE kg/haul	Total %	in group %	Escape Rate	Price baht/kg	Return baht/boat	Return baht/haul	Return %
Total trash fish		1,501.000	60.040	300.200	23.80	36.25		5.10	7,655.10	1,531.02	6.39
Total Codend		**4,141.061**	**165.642**	**828.212**	**65.66**	**100.00**			**108,806.09**	**21,761.22**	**90.78**
Cover net											
small sized economic fish											
Pelagic											
Alepes kleinii	Cover	2.602	0.104	0.520	0.04	0.12	0.04	5.10	13.27	2.65	0.01
Megalaspis cordyla	Cover	35.150	1.406	7.030	0.56	1.62	0.56	5.10	179.27	35.85	0.15
Parastromateus niger	Cover	17.840	0.714	3.568	0.28	0.82	0.28	5.10	90.99	18.20	0.08
Selaroides leptolepis	Cover	34.944	1.398	6.989	0.55	1.61	0.55	5.10	178.21	35.64	0.15
Clupeidae	Cover	304.397	12.176	60.879	4.83	14.05	4.83	5.10	1,552.42	310.48	1.30
Encrasicholina spp.	Cover	210.579	8.423	42.116	3.34	9.72	3.34	5.10	1,073.95	214.79	0.90
Stolephorus indicus	Cover	290.745	11.630	58.149	4.61	13.42	4.61	5.10	1,482.80	296.56	1.24
Rastrelliger kanagurta	Cover	61.151	2.446	12.230	0.97	2.82	0.97	5.10	311.87	62.37	0.26
*Rastrelliger*spp.	Cover	95.974	3.839	19.195	1.52	4.43	1.52	5.10	489.47	97.89	0.41
total Pelagic		1,053.381	42.135	210.676	16.70	48.63	16.70		5,372.24	1,074.45	4.48
Dermersal											
Gerres abbreviatus	Cover	11.150	0.446	2.230	0.18	0.51	0.18	5.10	56.87	11.37	0.05
Muraenesocidae	Cover	14.295	0.572	2.859	0.23	0.66	0.23	5.10	72.91	14.58	0.06
Nemipterus hexodon	Cover	52.306	2.092	10.461	0.83	2.41	0.83	5.10	266.76	53.35	0.22
N.peronii	Cover	0.858	0.034	0.172	0.01	0.04	0.01	5.10	4.37	0.87	0.00
Priacanthus tayenus	Cover	1.430	0.057	0.286	0.02	0.07	0.02	5.10	7.29	1.46	0.01

Appendix 5. (Cont.)

Pair trawl with cover net Scientific name	Size	CPUE kg/boat	CPUE kg/hr.	CPUE kg/haul	Total %	in group %	Escape Rate	Price baht/kg	Return baht/boat	Return baht/haul	Return %
Saurida elongata	Cover	30.261	1.210	6.052	0.48	1.40	0.48	5.10	154.33	30.87	0.13
Sillago sihama	Cover	14.309	0.572	2.862	0.23	0.66	0.23	5.10	72.98	14.60	0.06
Sphyraena jello	Cover	54.419	2.177	10.884	0.86	2.51	0.86	5.10	277.54	55.51	0.23
Terapon theraps	Cover	35.681	1.427	7.136	0.57	1.65	0.57	5.10	181.97	36.39	0.15
Upeneus sundiacus	Cover	100.804	4.032	20.161	1.60	4.65	1.60	5.10	514.10	102.82	0.43
total Dermersal		315.512	12.620	63.102	5.00	14.57	5.00		1,609.11	321.82	1.34
Cephalopod											
Nipponololigo sumatrensis	Cover	36.342	1.454	7.268	0.58	1.68	0.58	5.10	185.35	37.07	0.15
total Cephalopod		36.342	1.454	7.268	0.58	1.68	0.58		185.35	37.07	0.15
Shrimp											
Metapenaeopsis palmensis	Cover	0.572	0.023	0.114	0.01	0.03	0.01	5.10	2.92	0.58	0.00
total Shrimp		0.572	0.023	0.114	0.01	0.03	0.01		2.92	0.58	0.00
Crab											
Misc. crabs	Cover	0.286	0.011	0.057	0.00	0.01	0.00	5.10	1.46	0.29	0.00
total Crab		0.286	0.011	0.057	0.00	0.01	0.00		1.46	0.29	0.00
true trash fish											
Apogonidae	Cover	19.529	0.781	3.906	0.31	0.90	0.31	5.10	99.60	19.92	0.08
Lagocephalus inermis	Cover	43.719	1.749	8.744	0.69	2.02	0.69	5.10	222.97	44.59	0.19
L.lunaris	Cover	10.395	0.416	2.079	0.16	0.48	0.16	5.10	53.01	10.60	0.04
Leiognathidae	Cover	666.299	26.652	133.260	10.56	30.76	10.56	5.10	3,398.13	679.63	2.84
Pentaprion longimanus	Cover	11.150	0.446	2.230	0.18	0.51	0.18	5.10	56.87	11.37	0.05

Appendix 5. (Cont.)

Pair trawl with cover net Scientific name	Size	CPUE kg/boat	CPUE kg/hr.	CPUE kg/haul	Total %	in group %	Escape Rate	Price baht/kg	Return baht/boat	Return baht/haul	Return %
Trichiuridae	Cover	0.143	0.006	0.029	0.00	0.01	0.00	5.10	0.73	0.15	0.00
Miscellaneous trash	Cover	8.671	0.347	1.734	0.14	0.40	0.14	5.10	44.22	8.84	0.04
total true trash fish		759.906	30.396	151.981	12.05	35.08	12.05		3,875.52	775.10	3.23
Sub-total cover net		**2,166.000**	**86.640**	**433.200**	**34.34**	**100.00**	**34.34**		**11,046.60**	**2,209.32**	**9.22**
Total		**6,307.061**	**252.282**	**1,261.412**	**100.00**				**119,852.69**	**23,970.54**	**100.00**

Remark: size of fish L=large S=small XS= extra small X= unsorted Misc.=sold with mix fish

Appendix 6. Catch rate, species composition of marine fauna by species caught by otter board trawl using codend mesh size 1.25 cm. and return of fisher.

Otter board trawl Scientific name	Size	CPUE kg/boat	CPUE kg/hr	CPUE kg/haul	Total %	in group %	Price baht/kg	Return baht/boat	Return baht/haul	Return %
Codend										
Economic fish										
Pelagic										
Alepes djeddaba	Misc.	0.420	0.010	0.038	0.02	0.04	15	6.29	0.57	0.02
A. kleinii	Misc.	0.024	0.001	0.002	0.001	0.002	15	0.36	0.03	0.001
A. melanoptera	Misc.	1.639	0.037	0.149	0.09	0.16	15	24.58	2.23	0.06
Atule mate	Misc.	0.842	0.019	0.077	0.05	0.08	15	12.63	1.15	0.03
Selar crumenopthalmus	Misc.	1.078	0.025	0.098	0.06	0.10	15	16.18	1.47	0.04
Selaroides leptolepis	X	6.000	0.136	0.545	0.34	0.58	15	90.00	8.18	0.22
	Misc.	14.352	0.326	1.305	0.82	1.39	15	215.28	19.57	0.51
total *S. leptolepis*		20.352	0.463	1.850	1.17	1.97		305.28	27.75	0.73
Caranx armatus	Misc.	0.140	0.003	0.013	0.01	0.01	15	2.10	0.19	0.01
Parastromateus niger	Misc.	0.173	0.004	0.016	0.01	0.02	15	2.60	0.24	0.01
Scomberoides tol	Misc.	0.145	0.003	0.013	0.01	0.01	15	2.17	0.20	0.01
Carangidae	Misc.	1.893	0.043	0.172	0.11	0.18	15	28.40	2.58	0.07
Clupeidae	Misc.	0.098	0.002	0.009	0.01	0.01	15	1.47	0.13	0.004
Mugillidae	Misc.	0.165	0.004	0.015	0.01	0.02	15	2.48	0.23	0.01
Rastrelliger brachysoma	Misc.	1.613	0.037	0.147	0.09	0.16	15	24.20	2.20	0.06
Scomberomorus commerson	Misc.	1.519	0.035	0.138	0.09	0.15	15	22.79	2.07	0.05
Stolephorus indicus	Misc.	0.107	0.002	0.010	0.01	0.01	15	1.60	0.15	0.004
Total pelagic		30.207	0.687	2.746	1.73	2.93		453.111	41.19	1.08

Appendix 6. (Cont.)

Otter board trawl Scientific name	Size	CPUE kg/boat	CPUE kg/hr	CPUE kg/haul	Total %	in group %	Price baht/kg	Return baht/boat	Return baht/haul	Return %
Dermersal										
Anodontostoma chacunda	Misc.	0.241	0.005	0.022	0.01	0.02	9	2.17	0.20	0.01
Mullidae	X	5.000	0.114	0.455	0.29	0.48	10.5	52.50	4.77	0.13
Dasyatidae	Misc.	4.363	0.099	0.397	0.25	0.42	16	69.81	6.35	0.17
Epinephelus sexfasciatus	Misc.	0.953	0.022	0.087	0.05	0.09	75	71.50	6.50	0.17
Gerres abbreviatus	Misc.	0.556	0.013	0.051	0.03	0.05	9	5.01	0.46	0.01
G. filamentosus	Misc.	2.350	0.053	0.214	0.13	0.23	9	21.15	1.92	0.05
Leiognathus equulus	Misc.	0.652	0.015	0.059	0.04	0.06	9	5.87	0.53	0.01
Lutjanus malabaricus	Misc.	0.375	0.009	0.034	0.02	0.04	9	3.38	0.31	0.01
L. vitta	Misc.	0.107	0.002	0.010	0.01	0.01	9	0.96	0.09	0.002
Muraenesocidae	Misc.	6.726	0.153	0.611	0.39	0.65	27.5	184.96	16.81	0.44
Nemipteridae	Misc.	1.119	0.025	0.102	0.06	0.11	19.5	21.82	1.98	0.05
Nemipterus hexodon	L	3.253	0.074	0.296	0.19	0.32	35	113.85	10.35	0.27
	S	10.198	0.232	0.927	0.58	0.99	15	152.97	13.91	0.37
	X	23.480	0.534	2.135	1.35	2.27	19.5	457.87	41.62	1.09
total *N. hexodon*		36.931	0.839	3.357	2.12	3.58		724.68	65.88	1.73
N. japonicus	L	0.747	0.017	0.068	0.04	0.07	35	26.15	2.38	0.06
	S	14.132	0.321	1.285	0.81	1.37	15	211.98	19.27	0.51
N. japonicus	X	44.925	1.021	4.084	2.58	4.35	19.5	876.05	79.64	2.09
total *N. japonicus*		59.805	1.359	5.437	3.43	5.79		1,114.18	101.29	2.66

Appendix 6. (Cont.)

Otter board trawl Scientific name	Size	CPUE kg/boat	CPUE kg/hr	CPUE kg/haul	Total %	in group %	Price baht/kg	Return baht/boat	Return baht/haul	Return %
N. mesoprion	S	2.670	0.061	0.243	0.15	0.26	15	40.05	3.64	0.10
	X	3.359	0.076	0.305	0.19	0.33	19.5	65.51	5.96	0.16
total *N. mesoprion*		6.030	0.137	0.548	0.35	0.58		105.56	9.60	0.25
N. metopias	X	0.338	0.008	0.031	0.02	0.03	19.5	6.60	0.60	0.02
N. peronii	X	1.097	0.025	0.100	0.06	0.11	19.5	21.38	1.94	0.05
Scolopsis taeniopterus	X	12.100	0.275	1.100	0.69	1.17	13	157.30	14.30	0.38
	Misc.	1.411	0.032	0.128	0.08	0.14	13	18.34	1.67	0.04
total *S. taeniopterus*		13.511	0.307	1.228	0.77	1.31		175.64	15.97	0.42
Platycephalidae	X	55.700	1.266	5.064	3.19	5.39	17	946.90	86.08	2.26
	Misc.	2.313	0.053	0.210	0.13	0.22	17	39.33	3.58	0.09
total Platycephalidae		58.013	1.318	5.274	3.33	5.62		986.23	89.66	2.35
Plotosidae	X	118.500	2.693	10.773	6.79	11.48	100	11,850.00	1,077.27	28.28
Pomadasyidae		3.826	0.087	0.348	0.22	0.37	9	34.43	3.13	0.08
Priacanthus tayenus	Misc.	1.781	0.040	0.162	0.10	0.17	12	21.38	1.94	0.05
Saurida elongata	X	144.920	3.294	13.175	8.31	14.03	14	2,028.88	184.44	4.84
	Misc.	0.213	0.005	0.019	0.01	0.02	14	2.98	0.27	0.01
total *S. elongata*		145.133	3.298	13.194	8.32	14.06		2,031.87	184.72	4.85
S. micropectoralis	X	2.799	0.064	0.254	0.16	0.27	14	39.19	3.56	0.09
S. undosquamis	X	2.581	0.059	0.235	0.15	0.25	14	36.13	3.28	0.09
Sciaenidae	Misc.	2.879	0.065	0.262	0.17	0.28	17	48.95	4.45	0.12
Siganidae	Misc.	4.029	0.092	0.366	0.23	0.39	9	36.26	3.30	0.09
Sillago sihama	Misc.	0.071	0.002	0.006	0.00	0.01	50	3.56	0.32	0.01

Appendix 6. (Cont.)

Otter board trawl Scientific name	Size	CPUE kg/boat	CPUE kg/hr	CPUE kg/haul	Total %	in group %	Price baht/kg	Return baht/boat	Return baht/haul	Return %
Sphyraena jello	Misc.	9.708	0.221	0.883	0.56	0.94	15	145.62	13.24	0.35
S. obtusata	X	3.000	0.068	0.273	0.17	0.29	15	45.00	4.09	0.11
	Misc.	0.626	0.014	0.057	0.04	0.06	15	9.40	0.85	0.02
total *S. obtusata*		3.626	0.082	0.330	0.21	0.35		54.40	4.95	0.13
Terapon theraps	Misc.	1.954	0.044	0.178	0.11	0.19	9	17.59	1.60	0.04
Upeneus sulphureus	X	6.000	0.136	0.545	0.34	0.58	10.5	63.00	5.73	0.15
	Misc.	0.154	0.004	0.014	0.01	0.01	9	1.39	0.13	0.003
total *U. sulphureus*		6.154	0.140	0.559	0.35	0.60		64.39	5.85	0.15
Total dermersal		501.210	11.391	45.565	28.74	48.54		17,957.15	1,632.47	42.85
Cephalopod										
Photololigo duvaucelii	X	3.303	0.075	0.300	0.19	0.32	55	181.69	16.52	0.43
Nipponololigo sumatrensis	Misc.	0.160	0.004	0.015	0.01	0.02	22	3.52	0.32	0.01
Sepia pharaonis	X	15.020	0.341	1.365	0.86	1.45	80	1,201.62	109.24	2.87
S. recurvirostris	X	12.519	0.285	1.138	0.72	1.21	80	1,001.49	91.04	2.39
Cuttle fishes	X	20.203	0.459	1.837	1.16	1.96	80	1,616.26	146.93	3.86
Octopus	X	5.554	0.126	0.505	0.32	0.54	65	360.99	32.82	0.86
Sepioteuthis lessoniana	X	7.121	0.162	0.647	0.41	0.69	50	356.04	32.37	0.85
Total cephalopod		63.880	1.452	5.807	3.66	6.19		4,721.600	429.24	11.27
Shell										
Amusium pleuronectes	X	3.319	0.071	0.285	0.18	0.30	100	313.850	28.53	0.75
Total shell		3.319	0.071	0.285	0.18	0.30		313.850	28.53	0.75

Appendix 6. (Cont.)

Otter board trawl Scientific name	Size	CPUE kg/boat	CPUE kg/hr	CPUE kg/haul	Total %	in group %	Price baht/kg	Return baht/boat	Return baht/haul	Return %
Shrimp										
Metapenaeopsis palmensis	X	27.950	0.635	2.541	1.60	2.71	12	335.40	30.49	0.80
Metapenaeus intermedius	X	18.193	0.413	1.654	1.04	1.76	245	4,457.31	405.21	10.64
Penaeus japonicus	X	9.648	0.219	0.877	0.55	0.93	245	2,363.74	214.89	5.64
P. latisulcatus	X	0.165	0.004	0.015	0.01	0.02	245	40.43	3.68	0.10
P. merguiensis	X	11.407	0.259	1.037	0.65	1.10	245	2,794.70	254.06	6.67
P. monodon	X	6.032	0.137	0.548	0.35	0.58	390	2,352.49	213.86	5.61
Total shrimp		73.395	1.668	6.672	4.21	7.11		12,344.068	1,122.19	29.46
Crab										
Charybdis feriatus	X	2.653	0.060	0.241	0.15	0.26	70	185.73	16.88	0.44
Portunus pelagicus	X	1.988	0.045	0.181	0.11	0.19	70	139.18	12.65	0.33
P. sanguinolentus	X	0.400	0.009	0.036	0.02	0.04	70	28.00	2.55	0.07
Podolpthalmus vigil	X	0.783	0.018	0.071	0.04	0.08	5	3.92	0.36	0.01
Total crab		5.825	0.132	0.530	0.33	0.56		356.833	32.44	0.85
Other		310.712	7.062	28.247	17.82	30.09	6	1,864.27	169.48	4.45
Total other		310.712	7.062	28.247	17.82	30.09		1,864.27	169.48	4.45
Total-economic-fish		**1,032.591**	**23.468**	**93.872**	**59.21**	**100.00**		**38,276.22**	**3,479.66**	**91.34**

Appendix 6. (Cont.)

Otter board trawl Scientific name	Size	CPUE kg/boat	CPUE kg/hr	CPUE kg/haul	Total %	in group %	Price baht/kg	Return baht/boat	Return baht/haul	Return %
Trash fish										
Pelagic										
Caranx armatus	Trash	0.271	0.006	0.025	0.02	0.04	5.10	1.38	0.13	0.003
Selaroides leptolepis	Trash	5.612	0.128	0.510	0.32	0.79	5.10	28.62	2.60	0.07
Scomberoides tol	Trash	0.723	0.016	0.066	0.04	0.10	5.10	3.69	0.34	0.01
Clupeidae	Trash	4.174	0.095	0.379	0.24	0.59	5.10	21.29	1.94	0.05
Stolephorus indicus	Trash	1.152	0.026	0.105	0.07	0.16	5.10	5.88	0.53	0.01
Encrasicholina spp.	Trash	0.464	0.011	0.042	0.03	0.07	5.10	2.37	0.22	0.01
Rastrelliger spp.	Trash	0.588	0.013	0.053	0.03	0.08	5.10	3.00	0.27	0.01
Total pelagic		12.985	0.295	1.180	0.74	1.82	5.10	66.22	6.02	0.16
Dermersal										
Gerres filamentosus	Trash	4.472	0.102	0.407	0.26	0.63	5.10	22.81	2.07	0.06
G. oyena	Trash	1.130	0.026	0.103	0.06	0.16	5.10	5.76	0.52	0.01
Lutjanus vitta	Trash	1.401	0.032	0.127	0.08	0.20	5.10	7.15	0.65	0.02
Nemipterus hexodon	Trash	73.441	1.669	6.676	4.21	10.32	5.10	374.55	34.05	0.93
Scolopsis taeniopterus	Trash	17.500	0.398	1.591	1.00	2.46	5.10	89.25	8.11	0.22
Platycephalidae	Trash	35.750	0.813	3.250	2.05	5.02	5.10	182.33	16.58	0.45
Priacanthus tayenus	Trash	3.000	0.068	0.273	0.17	0.42	5.10	15.30	1.39	0.04
Saurida elongata	Trash	2.557	0.058	0.232	0.15	0.36	5.10	13.04	1.19	0.03
S. isarankurai	Trash	0.316	0.007	0.029	0.02	0.04	5.10	1.61	0.15	0.004
S. undosquamis	Trash	0.705	0.016	0.064	0.04	0.10	5.10	3.59	0.33	0.01

Appendix 6. (Cont.)

Otter board trawl Scientific name	Size	CPUE kg/boat	CPUE kg/hr	CPUE kg/haul	Total %	in group %	Price baht/kg	Return baht/boat	Return baht/haul	Return %
Sciaenidae	Trash	0.331	0.008	0.030	0.02	0.05	5.10	1.69	0.15	0.004
Siganidae	Trash	0.392	0.009	0.036	0.02	0.06	5.10	2.00	0.18	0.005
Sphyraena jello	Trash	1.948	0.044	0.177	0.11	0.27	5.10	9.94	0.90	0.02
Upeneus sulphureus	Trash	1.422	0.032	0.129	0.08	0.20	5.10	7.25	0.66	0.02
U. sundiacus	Trash	4.348	0.099	0.395	0.25	0.61	5.10	22.17	2.02	0.06
U. tragula	Trash	1.782	0.041	0.162	0.10	0.25	5.10	9.09	0.83	0.02
Total dermersal		150.497	3.420	13.682	8.63	21.15	5.10	767.53	69.78	1.91
Cephalopod										
Nipponololigo sumatrensis	Trash	0.204	0.005	0.019	0.01	0.03	5.10	1.04	0.09	0.002
Total cephalopod		0.204	0.005	0.019	0.01	0.03	5.10	1.04	0.09	0.002
Shrimp										
Metapenaeopsis palmensis	Trash	9.654	0.219	0.878	0.55	1.36	5.10	49.24	4.48	0.12
Total shrimp		9.654	0.219	0.878	0.55	1.36	5.10	49.24	4.48	0.12
Crab										
Misc. crabs	Trash	4.251	0.097	0.386	0.24	0.60	5.10	21.68	1.97	0.05
Total crab		4.251	0.097	0.386	0.24	0.60	5.10	21.68	1.97	0.05
Other										
Miscellaneous (other)	Trash	2.710	0.062	0.246	0.16	0.38	5.10	13.82	1.26	0.03
Total other		2.710	0.062	0.246	0.16	0.38	5.10	13.82	1.26	0.03

Appendix 6. (Cont.)

Otter board trawl Scientific name	Size	CPUE kg/boat	CPUE kg/hr	CPUE kg/haul	Total %	in group %	Price baht/kg	Return baht/boat	Return baht/haul	Return %
True Trash fish										
Apogonidae	Trash	81.123	1.844	7.375	4.65	11.40	5.10	413.73	37.61	1.03
Elates thompson	Trash	8.487	0.193	0.772	0.49	1.19	5.10	43.28	3.93	0.11
Gobioidei	Trash	17.133	0.389	1.558	0.98	2.41	5.10	87.38	7.94	0.22
Lagocephalus inermis	Trash	64.147	1.458	5.832	3.68	9.02	5.10	327.15	29.74	0.81
L. lunaris	Trash	1.221	0.028	0.111	0.07	0.17	5.10	6.23	0.57	0.02
Leiognathidae	Trash	271.130	6.162	24.648	15.55	38.11	5.10	1,382.76	125.71	3.44
Paralichthyidae	Trash	10.011	0.228	0.910	0.57	1.41	5.10	51.06	4.64	0.13
Scorpaenidae	Trash	0.701	0.016	0.064	0.04	0.10	5.10	3.57	0.32	0.01
Balistoidei	Trash	70.511	1.603	6.410	4.04	9.91	5.10	359.61	32.69	0.90
Trichiuridae	Trash	1.492	0.034	0.136	0.09	0.21	5.10	7.61	0.69	0.02
Miscellaneous trash	Trash	5.244	0.119	0.477	0.30	0.74	5.10	26.74	2.43	0.07
Total True trash fish		531.199	12.073	48.291	30.46	74.66	5.10	2,709.12	246.28	6.74
Total trash fish		**711.500**	**16.170**	**64.682**	**40.79**	**100.00**		**3,628.65**	**329.88**	**9.03**
Total		**1,744.090**	**39.638**	**158.554**	**100.00**			**40,173.27**	**3,652.12**	**100.00**

Remark: size of fish L=large S=small X= unsorted Misc.= sold with mix fish

Appendix 7. Catch rate, species composition of marine fauna by species caught by otter board trawl using codend mesh size 4 cm. cover with 1.25 cm. and return of fisher.

OBT with cover net Scientific name	Size	CPUE kg/boat	CPUE kg/hr.	CPUE kg/haul	Total %	In group %	Escape Rate (%)	Price baht/kg	Return baht/boat	Return baht/haul	Return %
Codend											
Economic fish											
Pelagic											
Alepes djeddaba	Misc.	0.461	0.010	0.042	0.03	0.05		9	4.15	0.38	0.01
Atule mate	Misc.	0.228	0.005	0.021	0.01	0.03		9	2.05	0.19	0.004
Megalaspis cordyla	Misc.	0.106	0.002	0.010	0.01	0.01		9	0.95	0.09	0.002
Selaroides leptolepis	X	3.500	0.080	0.318	0.22	0.39		14.5	50.75	4.61	0.11
	Misc.	4.711	0.107	0.428	0.29	0.52		9	42.40	3.85	0.09
total *S. leptolepis*		8.211	0.187	0.746	0.51	0.90			93.15	8.47	0.20
Clupeidae	Misc.	1.739	0.040	0.158	0.11	0.19		9	15.65	1.42	0.03
Rastrelliger brachysoma	Misc.	2.074	0.047	0.189	0.13	0.23		9	18.67	1.70	0.04
R. kanagurta	Misc.	0.499	0.011	0.045	0.03	0.05		9	4.49	0.41	0.01
Scomberomorus commerson	Misc.	0.236	0.005	0.021	0.01	0.03		9	2.13	0.19	0.005
Total Pelagic		13.554	0.308	1.232	0.85	1.49			141.23	12.84	0.31
Dermersal											
Dasyatidae	Misc.	5.820	0.132	0.529	0.36	0.64		16	93.12	8.47	0.20
Epinephelus sexfasciatus	Misc.	0.647	0.015	0.059	0.04	0.07		9	5.83	0.53	0.01
Gerres filamentosus	Misc.	3.990	0.091	0.363	0.25	0.44		9	35.91	3.26	0.08
G. oyena	Misc.	0.646	0.015	0.059	0.04	0.07		9	5.82	0.53	0.01

Appendix 7. (Cont.)

OBT with cover net Scientific name	Size	CPUE kg/boat	CPUE kg/hr.	CPUE kg/haul	Total %	In group %	Escape Rate %	Price baht/kg	Return baht/boat	Return baht/haul	Return %
Lethrinus lenjan	Misc.	0.653	0.015	0.059	0.04	0.07		9	5.87	0.53	0.01
L. malabaricus	Misc.	0.543	0.012	0.049	0.03	0.06		9	4.89	0.44	0.01
L. vitta	Misc.	0.273	0.006	0.025	0.02	0.03		9	2.46	0.22	0.01
Muraenesocidae	Misc.	0.783	0.018	0.071	0.05	0.09		9	7.05	0.64	0.02
Nemipterus hexodon	L	4.145	0.094	0.377	0.26	0.46		35	145.08	13.19	0.32
	S	8.848	0.201	0.804	0.55	0.97		15	132.72	12.07	0.29
	X	39.380	0.895	3.580	2.46	4.33		19.5	767.92	69.81	1.68
total N. hexodon		52.373	1.190	4.761	3.27	5.76			1,045.71	95.06	2.29
N. japonicus	L	0.855	0.019	0.078	0.05	0.09		35	29.92	2.72	0.07
	S	2.765	0.063	0.251	0.17	0.30		15	41.47	3.77	0.09
	X	42.349	0.962	3.850	2.65	4.66		19.5	825.81	75.07	1.81
total *N. japonicus*		45.969	1.045	4.179	2.87	5.06			897.20	81.56	1.96
N. mesoprion	S	0.387	0.009	0.035	0.02	0.04		15	5.81	0.53	0.01
	X	9.346	0.212	0.850	0.58	1.03		19.5	182.26	16.57	0.40
total N. mesoprion		9.734	0.221	0.885	0.61	1.07			188.06	17.10	0.41
N. peronii	X	1.824	0.041	0.166	0.11	0.20		19.5	35.57	3.23	0.08
Scolopsis taeniopterus	X	9.000	0.205	0.818	0.56	0.99		13	117.00	10.64	0.26
	Misc.	7.788	0.177	0.708	0.49	0.86		9	70.09	6.37	0.15
total *S. taeniopterus*		16.788	0.382	1.526	1.05	1.85			187.09	17.01	0.41
Platycephalidae	X	70.100	1.593	6.373	4.38	7.71		17	1,191.70	108.34	2.61
	Misc.	0.701	0.016	0.064	0.04	0.08		9	6.31	0.57	0.01
total Platycephalidae		70.801	1.609	6.436	4.42	7.79			1,198.01	108.91	2.62

Appendix 7. (Cont.)

OBT with cover net Scientific name	Size	CPUE kg/boat	CPUE kg/hr.	CPUE kg/haul	Total %	In group %	Escape Rate %	Price baht/kg	Return baht/boat	Return baht/haul	Return %
Plotosidae	X	20.500	0.466	1.864	1.28	2.26		100	2,050.00	186.36	4.49
	Misc.	0.729	0.017	0.066	0.05	0.08		9	6.56	0.60	0.01
total Plotosidae		21.229	0.482	1.930	1.33	2.34			2,056.56	186.96	4.50
Pomadasyidae	Misc.	0.727	0.017	0.066	0.05	0.08		9	6.55	0.60	0.01
Priacanthus tayenus	Misc.	2.263	0.051	0.206	0.14	0.25		12	27.16	2.47	0.06
Psettodes erumei	Misc.	2.510	0.057	0.228	0.16	0.28		100	250.99	22.82	0.55
Sciaenidae	Misc.	3.169	0.072	0.288	0.20	0.35		17	53.87	4.90	0.12
Saurida elongata	X	77.000	1.750	7.000	4.81	8.47		14	1,078.00	98.00	2.36
Siganidae	Misc.	0.663	0.015	0.060	0.04	0.07		9	5.97	0.54	0.01
Sillago sihama	Misc.	0.754	0.017	0.069	0.05	0.08		50	37.69	3.43	0.08
Sphyraena jello	Misc.	0.338	0.008	0.031	0.02	0.04		15	5.08	0.46	0.01
S. obtusata	Misc.	5.754	0.131	0.523	0.36	0.63		15	86.31	7.85	0.19
Terapon theraps	Misc.	4.349	0.099	0.395	0.27	0.48		9	39.14	3.56	0.09
Upeneus sulphureus	Misc.	1.629	0.037	0.148	0.10	0.18		10.5	17.11	1.56	0.04
Total Dermersal		31.231	7.528	30.112	20.70	36.45			7,377.01	670.64	16.15
Cephalopod											
Photololigo duvaucelii	X	1.029	0.023	0.094	0.06	0.11		55	56.57	5.14	0.12
Sepia pharaonis	X	12.020	0.273	1.093	0.75	1.32		80	961.62	87.42	2.11
S. recurvirostris	X	24.409	0.555	2.219	1.53	2.69		80	1,952.75	177.52	4.28
Cuttle fishes	X	17.663	0.401	1.606	1.10	1.94		80	1,413.07	128.46	3.09
Octopus	X	6.318	0.144	0.574	0.39	0.70		65	410.68	37.33	0.90
Sepioteuthis lessoniana	X	0.945	0.021	0.086	0.06	0.10		50	47.27	4.30	0.10

Appendix 7. (Cont.)

OBT with cover net Scientific name	Size	CPUE kg/boat	CPUE kg/hr.	CPUE kg/haul	Total %	In group %	Escape Rate %	Price baht/kg	Return baht/boat	Return baht/haul	Return %
Total Cephalopod		62.385	1.418	5.671	3.90	6.86			4,841.95	440.18	10.60
Shell											
Amusium pleuronectes	X	182.380	4.145	16.580	11.40	20.07		100	18,238.00	1,658.00	39.94
Total Shell		182.380	4.145	16.580	11.40	20.07			18,238.00	1,658.00	39.94
Shrimp											
Metapenaeopsis palmensis	X	35.310	0.803	3.210	2.21	3.89		12	423.72	38.52	0.93
Metapenaeus intermedius	X	13.183	0.300	1.198	0.82	1.45		245	3,229.88	293.63	7.07
Penaeus japonicus	X	12.919	0.294	1.174	0.81	1.42		245	3,165.08	287.73	6.93
P. latisulcatus	X	0.378	0.009	0.034	0.02	0.04		245	92.60	8.42	0.20
P. merguiensis	X	9.268	0.211	0.843	0.58	1.02		245	2,270.62	206.42	4.97
P. monodon	X	1.212	0.028	0.110	0.08	0.13		390	472.82	42.98	1.04
Total Shrimp		72.270	1.643	6.570	4.52	7.95			9,654.71	877.70	21.14
Crab											
Charybdis feriatus	X	1.159	0.026	0.105	0.07	0.13		70	81.11	7.37	0.18
C. natator	X	0.293	0.007	0.027	0.02	0.03		70	20.49	1.86	0.04
Portunus pelagicus	X	8.280	0.188	0.753	0.52	0.91		70	579.62	52.69	1.27
Podolpthalmus vigil	X	16.028	0.364	1.457	1.00	1.76		5	80.14	7.29	0.18
Total Crab		25.760	0.585	2.342	1.61	2.83			761.36	69.21	1.67
Other											
Other	X	37.216	0.846	3.383	2.33	4.10			189.80	17.25	0.42
Total Other		37.216	0.846	3.383	2.33	4.10			189.80	17.25	0.42
Total Eco.fish in codend		**724.795**	**16.473**	**65.890**	**45.29**	**79.75**			**41,204.06**	**3,745.82**	**90.22**

Appendix 7. (Cont.)

OBT with cover net		CPUE	CPUE	CPUE	Total	In group	Escape	Price	Return	Return	Return

Scientific name	Size	kg/boat	kg/hr.	kg/haul	%	%	Rate %	baht/kg	baht/boat	baht/haul	%
Cover net											
Small economic fish											
Pelagic											
Alepes djeddaba	Trash	0.612	0.014	0.056	0.04	0.07		5.1	3.12	0.28	0.01
Caranx armatus	Trash	0.329	0.007	0.030	0.02	0.04		5.1	1.68	0.15	0.004
Megalaspis cordyla	Trash	1.287	0.029	0.117	0.08	0.14		5.1	6.56	0.60	0.01
Selaroides leptolepis	Trash	0.482	0.011	0.044	0.03	0.05		5.1	2.46	0.22	0.01
Rastrelliger spp.	Trash	0.509	0.012	0.046	0.03	0.06		5.1	2.60	0.24	0.01
Stolephorus indicus	Trash	0.316	0.007	0.029	0.02	0.03		5.1	1.61	0.15	0.004
Total Pelagic		3.536	0.080	0.321	0.22	0.39			18.03	1.64	0.04
Dermersal											
Gerres oyena	Trash	2.168	0.049	0.197	0.14	0.24		5.1	11.06	1.01	0.02
Nemipterus hexodon	Trash	8.291	0.188	0.754	0.52	0.91		5.1	42.28	3.84	0.09
Scolopsis taeniopterus	Trash	2.089	0.047	0.190	0.13	0.23		5.1	10.66	0.97	0.02
Platycephalidae	Trash	5.539	0.126	0.504	0.35	0.61		5.1	28.25	2.57	0.06
Priacanthus tayenus	Trash	1.186	0.027	0.108	0.07	0.13		5.1	6.05	0.55	0.01
Saurida isarankurai	Trash	0.417	0.009	0.038	0.03	0.05		5.1	2.13	0.19	0.00 5
Sciaenidae	Trash	0.567	0.013	0.052	0.04	0.06		5.1	2.89	0.26	0.01
Sphyraena jello	Trash	0.105	0.002	0.010	0.01	0.01		5.1	0.54	0.05	0.001
Upeneus sundiacus	Trash	0.159	0.004	0.014	0.01	0.02		5.1	0.81	0.07	0.002
Total Dermersal		**20.522**	**0.466**	**1.866**	**1.28**	**2.26**			**104.66**	**9.51**	**0.23**

Appendix 7. (Cont.)

OBT with cover net		CPUE	CPUE	CPUE	Total	In group	Escape	Price	Return	Return	Return

Scientific name	Size	kg/boat	kg/hr.	kg/haul	%	%	Rate %	baht/kg	baht/boat	baht/haul	%
Total Cephalopod											
Shell											
Total Shell											
Shrimp											
Metapenaeopsis palmensis	Trash	1.105	0.025	0.100	0.07	0.12		5.1	5.64		
Total Shrimp		**1.105**	**0.025**	**0.100**	**0.07**	**0.12**			**5.64**	**0.51**	**0.01**
Crab											
Total Crab											
True Trash fish											
Apogonidae	Trash	25.851	0.588	2.350	1.62	2.84		5.1	131.84	11.99	0.29
Cynoglossidae	Trash	0.421	0.010	0.038	0.03	0.05		5.1	2.15	0.20	0.005
Elates thompson	Trash	3.884	0.088	0.353	0.24	0.43		5.1	19.81	1.80	0.04
Gobioidei	Trash	2.954	0.067	0.269	0.18	0.33		5.1	15.06	1.37	0.03
Lagocephalus inermis	Trash	11.813	0.268	1.074	0.74	1.30		5.1	60.25	5.48	0.13
L. lunaris	Trash	5.254	0.119	0.478	0.33	0.58		5.1	26.80	2.44	0.06
Leiognathidae	Trash	78.625	1.787	7.148	4.91	8.65		5.1	400.99	36.45	0.88
Paralichthyidae	Trash	3.913	0.089	0.356	0.24	0.43		5.1	19.95	1.81	0.04
Balistoidei	Trash	20.897	0.475	1.900	1.31	2.30		5.1	106.57	9.69	0.23
Scorpaenidae	Trash	0.790	0.018	0.072	0.05	0.09		5.1	4.03	0.37	0.01
Miscellaneous trash	Trash	4.435	0.101	0.403	0.28	0.49		5.1	22.62	2.06	0.05
Total True Trash Fish		**158.837**	**3.610**	**14.440**	**9.93**	**17.48**			**810.07**	**73.64**	**1.77**
Total Small economic fish		**25.163**	**0.572**	**2.288**	**1.57**	**2.77**		**5.1**	**128.33**	**11.67**	**0.28**

Appendix 7. (Cont.)

OBT with cover net Scientific name	Size	CPUE kg/boat	CPUE kg/hr.	CPUE kg/haul	Total %	In group %	Escape Rate %	Price baht/kg	Return baht/boat	Return baht/haul	Return %

OBT with cover net Scientific name	Size	CPUE kg/boat	CPUE kg/hr.	CPUE kg/haul	Total %	In group %	Escape Rate %	Price baht/kg	Return baht/boat	Return baht/haul	Return %
Total trash in codend		**184.000**	**4.182**	**16.727**	**11.50**	**20.25**			**938.40**	**85.31**	**2.05**
total codend		**908.795**	**4.182**	**16.727**	**56.79**	**100.00**			**42,142.46**	**3,831.13**	**92.28**
Cover net											
Small Eco. Fish											
Pelagic											
Caranx armatus	Cover	0.477	0.011	0.043	0.03	0.07	0.03	5.1	2.43	0.22	0.01
Megalaspis cordyla	Cover	3.214	0.073	0.292	0.20	0.46	0.20	5.1	16.39	1.49	0.04
Selaroides leptolepis	Cover	7.110	0.162	0.646	0.44	1.03	0.44	5.1	36.26	3.30	0.08
Rastrelliger kanagurta	Cover	4.107	0.093	0.373	0.26	0.59	0.26	5.1	20.94	1.90	0.05
Stolephorus indicus	Cover	2.738	0.062	0.249	0.17	0.40	0.17	5.1	13.96	1.27	0.03
Total Pelagic		**17.646**	**0.401**	**1.604**	**1.10**	**2.55**	**1.10**		**89.99**	**8.18**	**0.20**
Dermersal											
Epinephelus sexfasciatus	Cover	0.370	0.008	0.034	0.02	0.05	0.02	5.1	1.89	0.17	0.004
Nemipterus hexodon	Cover	95.594	2.173	8.690	5.97	13.82	5.97	5.1	487.53	44.32	1.07
Scolopsis taeniopterus	Cover	9.780	0.222	0.889	0.61	1.41	0.61	5.1	49.88	4.53	0.11
Platycephalidae	Cover	50.116	1.139	4.556	3.13	7.25	3.13	5.1	255.59	23.24	0.56
Priacanthus tayenus	Cover	3.795	0.086	0.345	0.24	0.55	0.24	5.1	19.36	1.76	0.04
Psettodes erumei	Cover	10.016	0.228	0.911	0.63	1.45	0.63	5.1	51.08	4.64	0.11
Saurida elongata	Cover	16.071	0.365	1.461	1.00	2.32	1.00	5.1	81.96	7.45	0.18
Upeneus sulphureus	Cover	0.486	0.011	0.044	0.03	0.07	0.03	5.1	2.48	0.23	0.01
U. sundiacus	Cover	2.732	0.062	0.248	0.17	0.40	0.17	5.1	13.93	1.27	0.03
Cynoglossidae	Cover	5.254	0.119	0.478	0.33	0.76	0.33	5.1	26.79	2.44	0.06

Appendix 7. (Cont.)

OBT with cover net Scientific name	Size	CPUE kg/boat	CPUE kg/hr.	CPUE kg/haul	Total %	In group %	Escape Rate %	Price baht/kg	Return baht/boat	Return baht/haul	Return %
Total Dermersal		194.214	4.414	17.656	12.14	28.09	12.14		990.49	90.04	2.17
Cephalopod											
Nipponololigo sumatrensis	Cover	0.897	0.020	0.082	0.06	0.13	0.06	5.1	4.57	0.42	0.01
Total Cephalopod		**0.897**	**0.020**	**0.082**	**0.06**	**0.13**	**0.06**		**4.57**	**0.42**	**0.01**
Shell											
Amusium pleuronectes	Cover	33.417	0.759	3.038	2.09	4.83	2.09	5.1	170.43	15.49	0.37
Total Shell		**33.417**	**0.759**	**3.038**	**2.09**	**4.83**	**2.09**		**170.43**	**15.49**	**0.37**
Shrimp											
Metapenaeopsis palmensis	Cover	24.559	0.558	2.233	1.53	3.55	1.53	5.1	125.25	11.39	0.27
Metapenaeus intermedius	Cover	0.105	0.002	0.010	0.01	0.02	0.01	5.1	0.53	0.05	0.001
Penaeus merguiensis	Cover	0.363	0.008	0.033	0.02	0.05	0.02	5.1	1.85	0.17	0.004
Total Shrimp		**25.027**	**0.569**	**2.275**	**1.56**	**3.62**	**1.56**		**127.64**	**11.60**	**0.28**
Crab											
Misc. crabs	Cover	8.411	0.191	0.765	0.53	1.22	0.53	5.1	42.90	3.90	0.09
Total Crab		**8.411**	**0.191**	**0.765**	**0.53**	**1.22**	**0.53**		**42.90**	**3.90**	**0.09**
Other											
Miscellaneous (other)	Cover	0.352	0.008	0.032	0.02	0.05	0.02	5.1	1.79	0.16	0.004
Total Other		**0.352**	**0.008**	**0.032**	**0.02**	**0.05**	**0.02**		**1.79**	**0.16**	**0.004**
True trash fish											
Apogonidae	Cover	78.549	1.785	7.141	4.91	11.36	4.91	5.1	400.60	36.42	0.88
Elates thompson	Cover	21.201	0.482	1.927	1.32	3.07	1.32	5.1	108.13	9.83	0.24

Appendix 7. (Cont.)

OBT with cover net Scientific name	Size	CPUE kg/boat	CPUE kg/hr.	CPUE kg/haul	Total %	In group %	Escape Rate %	Price baht/kg	Return baht/boat	Return baht/haul	Return %
Gobioidei	Cover	3.102	0.070	0.282	0.19	0.45	0.19	5.1	15.82	1.44	0.03
Lagocephalus inermis	Cover	6.412	0.146	0.583	0.40	0.93	0.40	5.1	32.70	2.97	0.07
L. lunaris	Cover	5.386	0.122	0.490	0.34	0.78	0.34	5.1	27.47	2.50	0.06
Leiognathidae	Cover	140.668	3.197	12.788	8.79	20.34	8.79	5.1	717.41	65.22	1.57
Paralichthyidae (Bothidae)	Cover	14.201	0.323	1.291	0.89	2.05	0.89	5.1	72.42	6.58	0.16
Saurida isarankurai	Cover	3.644	0.083	0.331	0.23	0.53	0.23	5.1	18.58	1.69	0.04
Balistoidei	Cover	103.949	2.362	9.450	6.50	15.03	6.50	5.1	530.14	48.19	1.16
Scorpaenidae	Cover	3.002	0.068	0.273	0.19	0.43	0.19	5.1	15.31	1.39	0.03
Miscellaneous trash	Cover	31.423	0.714	2.857	1.96	4.54	1.96	5.1	160.26	14.57	0.35
Total true trash fish		**411.536**	**9.353**	**37.412**	**25.72**	**59.51**	**25.72**		**2,098.83**	**190.80**	**4.60**
Total cover net		**691.500**	**15.716**	**62.864**	**43.21**	**100.00**	**43.21**		**3,526.65**	**320.60**	**7.72**
Total cover+codend		**1,600.295**	**36.370**	**145.481**	**100.00**				**45,669.11**	**4,151.74**	**100.00**

Remark: size of fish L=large S=small X= unsorted Misc.=sold with mix fish

Appendix 8. Expected value from small sized economic fish were grown up to marketable size of pair trawl using codend mesh size 1.8 cm.

species	L_o (cm)	W_o (g)	CPUE (kg/haul)	N_{tn} (fish/haul)	L_m (cm)	W_m (g)	Δt	N_{tp} (fish/haul)	Price (Baht/kg)	W_n (kg/haul)	Expected value (baht/haul)
Clupeidae	10.78	40.0128	59.234	1,480.372	13.07	65.015137	0.14326	348.305	17.5	22.645	396.29
Sardinella gibbosa	14.25	26.8392	6.861	255.651	14.51	28.344903	0.02067	207.475	17.5	5.881	102.91
Stolephorus indicus	11.94	11.8360	18.256	1,542.427	12.02	12.090553	0.01195	1,312.650	15	15.871	238.06
Encrasicholina spp.	7.37	2.5446	141.101	55,450.998	12.02	12.090553	0.45386	120.986	10	1.463	14.63
Selaroides leptolepis	7.67	3.6900	35.401	9,593.959	14.00	26.984357	0.52049	106.895	10	2.884	28.84
Megalaspis cordyla	10.04	13.7820	3.293	238.907	18.25	83.495428	0.24281	51.620	32	4.310	137.92
Rastrelliger kanagurta	11	13.9995	12.351	882.226	19.69	83.388398	0.56822	8.460	65	0.705	45.86
Rastrelliger spp.	10.4	11.3736	41.390	3,639.119	17.60	61.659582	0.38776	339.137	65	20.911	1,359.22
Pelagic											2,323.73
Lutjanus vitta	11.00	21.5453	6.027	279.724	15.42	48.660105	0.30626	18.949	10	0.922	9.2207
Nemipterus hexodon	7.46	6.2904	19.327	3,072.380	16.98	69.120588	0.28469	325.996	15	22.533	338.00
N. peronii	6.25	2.8898	2.620	906.800	16.61	56.404840	0.77534	2**.014**	50	0.114	5.68
Scolopsis taeniopterus	9.29	13.0045	30.106	2,315.053	19.96	107.677823	0.65024	13.781	15	1.484	22.26
Plectorhynchus pictus	10.75	15.0271	5.625	374.321	23.44	160.717738	1.30683	0.013	10	0.002	0.02
Priacanthus tayenus	6.63	4.8074	1.568	326.080	17.45	83.280882	0.51811	13.474	10	1.122	11.22
Siganidae	11.25	17.5469	1.950	111.121	19.81	96.405187	2.17305	0.001	10	0.000	0.00
Sphyraena jello	12.11	9.3463	42.022	4,496.113	22.64	65.422278	0.80656	51.139	85	3.346	284.38

Appendix 8 (Cont.)

species	L_o (cm)	W_o (g)	CPUE (kg/haul)	N_{tn} (fish/haul)	L_m (cm)	W_m (g)	Δt	N_{tp} (fish/haul)	Price (Baht/kg)	W_n (kg/haul)	Expected value (baht/haul)
Upeneus sundiacus	9.14	0.0117	13.391	1,142,857.069	11.56	0.023577	0.51115	286,024.777	15	6.744	101.16
U. tragula	9.75	0.0142	3.088	217,411.260	12.99	0.033364	0.83837	22,416.908	15	0.748	11.22
Demersal											783.15
Nipponololigo sumatrensis	4.56	7.7813	61.208	7,866.035	8.89	29.575076	0.14104	4,065.343	38.5	120.233	4,628.96
Cephalopod											4,628.96
Metapenaeopsis palmensis	3.5	0.0004	0.314	729,588.062	7.00	0.003368	0.26240	51,211.169	12	0.172	2.07
Shrimp											2.07
Total											**7,737.92**

Appendix 9. Expected financial gains from small sized fish escape from pair trawl trawl using codend mesh size 4 cm (cover net mesh size 1.8 cm)

species	L_o (cm)	W_o (g)	CPUE (kg/haul)	N_{tn} (fish/haul)	L_m (cm)	W_m (g)	Δt	N_{tp} (fish/haul)	Price (Baht/kg)	W_n (kg/haul)	Expected value (baht/haul)
Alepes kleinii	7.75	5.339541	0.520	97.47	12.65	26.16923	0.89454	0.37	10	0.010	0.10
Selaroides leptolepis	6.56	2.202258	6.989	3,173.45	14.89	33.08379	0.70340	7.28	10	0.241	2.41
Megalaspis cordyla	10.42	15.428632	7.030	455.65	18.25	83.49543	0.23308	104.69	32	8.741	279.71
Parastromateus niger	12.25	46.852801	3.568	76.16	33.11	648.05546	1.73609	0.00	132	0.001	0.13
Clupeidae	11.44	13.845478	60.879	4,397.06	13.67	23.67518	0.1475	991.57	17.5	23.4755	410.821
Stolephorus indicus	11.93	11.818688	58.149	4,920.09	12.02	12.09055	0.01276	4,141.52	10	50.073	500.73
Encrasicholina spp.	8.18	3.545094	42.116	11,880.00	12.02	12.09055	0.39715	55.74	10	0.674	6.74
Rastrelliger kanagurta	10.55	12.317951	12.230	992.87	18.73	71.54360	0.51048	15.27	65	1.092	71.00
Rastrelliger spp.	11.60	16.154053	19.195	1,188.23	16.84	53.50637	0.28034	213.69	65	11.434	743.19
Pelagic											**2,014.83**
Gerres abbreviatus	12.25	35.380929	2.230	63.03	15.75	76.18461	0.8066	0.41	10	0.0313	0.313
Nemipterus hexodon	8.41	8.923562	10.461	1,172.31	20.08	112.67638	0.39637	51.59	15	5.813	87.19
Nemipterus peronii	11.50	22.203340	0.172	7.73	17.84	79.82458	0.21480	1.42	50	0.113	5.67
Priacanthus tayenus	6.02	3.622674	0.286	78.92	17.13	78.85984	0.51849	3.25	10	0.257	2.57
Saurida elongata	12.29	13.902979	6.052	435.32	20.89	70.23378	0.19754	115.88	20	8.139	162.77
Sillago sihama	13.75	23.173794	2.862	123.49	19.51	60.63075	1.2764	3.94	28	0.2386	6.680

Appendix 9. (Cont.)

species	L_o (cm)	W_o (g)	CPUE (kg/haul)	N_{tn} (fish/haul)	L_m (cm)	W_m (g)	Δt	N_{tp} (fish/haul)	Price (Baht/kg)	W_n (kg/haul)	Expected value (baht/haul)
Sphyraena jello	12.79	11.066191	10.884	983.53	28.14	128.66426	1.20535	1.22	85	0.1574	13.377
Terapon theraps	10.25	14.435570	7.136	494.34	17.13	72.36625	0.5607	22.00	15	1.5923	23.884
Upeneus sundiacus	9.82	0.014491	20.161	1,391,297.86	13.47	0.03717	1.01428	89,058.92	15	3.310	49.65
Demersal											352.11
Nipponololigo sumatrensis	4.47	7.477172	7.268	972.09	8.89	29.57508	0.14377	496.02	38.5	14.670	564.78
Cephalopod											**564.78**
Metapenaeopsis palmensis	3.50	0.000430	0.114	266,128.76	7	0.00337	0.26240	18,680.08	12	0.063	0.76
Shrimp											**0.76**
Total											**2,932.48**

Remark: no parameter for Muraenesocidae

Appendix 10. Expected value from small sized economic fish were grown up to marketable size of otter board trawl using codend mesh size 1.25 cm.

species	L_o (cm)	W_o (g)	CPUE (kg/haul)	N_{tn} (fish/haul)	L_m (cm)	W_m (g)	Δt	N_{tp} (fish/haul)	Price (Baht/kg)	W_n (kg/haul)	Expected value (baht/haul)
Caranx armatus	7.25	14.725	0.025	1.674	11.05	42.58660	0.37824	0.158	15	0.007	0.10
Scomberoides tol	16.25	36.540	0.066	1.800	21.00	74.68046	0.30217	0.273	15	0.020	0.31
Selaroides leptolepis	10.04	8.988	0.510	56.757	13.84	25.97804	0.35040	2.749	15	0.071	1.07
Clupeidae	12.48	57.871	0.379	6.557	14.75	88.17712	0.16700	1.214	15	0.107	1.61
Encrasicholina spp.	7.5	2.690	0.042	15.688	11.75	11.24634	0.40579	0.066	15	0.001	0.01
Stolephorus indicus	12.25	12.843	0.105	8.158	11.75	11.24634	-0.07519	22.513	15	0.253	3.80
Rastrelliger spp.	13.25	24.766	0.053	2.157	17.21	57.37627	0.24101	0.494	15	0.028	0.42
Pelagic											**7.32**
Gerres filamentosus	10.05	19.337	0.407	21.026	16.34	85.23356	0.26134	4.116	9	0.3509	3.16
G. oyena	9.91	21.651	0.103	4.746	16.34	116.84127	1.35861	0.001	9	0.0001	0.00
Lutjanus vitta	9.25	14.186	0.127	8.980	14.50	41.95011	0.32065	0.536	9	0.0225	0.20
Nemipterus hexodon	7.7	6.898	6.676	967.818	13.23	33.40249	0.14959	297.746	35	9.945	348.09
Scolopsis taeniopterus	9.24	12.812	1.591	124.171	12.64	30.45935	0.16336	34.273	13	1.044	13.57
Platycephalidae	7.35	3.971	3.250	818.516	11.32	14.50572	0.06839	517.630	17	7.509	127.65
Priacanthus tayenus	7.74	7.586	0.273	35.949	11.52	24.49331	0.15509	13.851	12	0.339	4.07

Appendix 10. (Cont.)

species	L_o (cm)	W_o (g)	CPUE (kg/haul)	N_{tn} (fish/haul)	L_m (cm)	W_m (g)	Δt	N_{tp} (fish/haul)	Price (Baht/kg)	W_n (kg/haul)	Expected value (baht/haul)
Saurida elongata	9.99	7.380	0.232	31.495	20.49	66.20649	0.22863	6.807	14	0.451	6.31
S. undosquamis	13.25	15.119	0.064	4.237	21	65.55567	0.22890	0.611	14	0.040	0.56
Sciaenidae	10.75	0.015	0.030	1,959.687	14.44	0.03718	0.19068	680.134	17	0.025	0.43
Siganidae	10.75	15.302	0.036	2.327	17.22	63.22328	1.25187	0.002	9	0.000	0.00
Sphyraena jello	14.02	14.738	0.177	12.018	20.20	45.88838	0.47224	0.874	15	0.040	0.60
Upeneus sulphureus	7.35	0.006	0.129	21,115.252	11.32	0.02215	0.72942	2,924.908	10.5	0.065	0.68
U. sundiacus	9.98	0.015	0.395	25,965.655	11.32	0.02215	0.29496	11,674.784	10.5	0.259	2.72
U. tragula	10.75	0.019	0.162	8,530.353	11.32	0.02215	0.13384	5,935.349	10.5	0.131	1.38
Demersal											**509.42**
Nipponololigo sumatrensis	4.25	6.759	0.019	2.740	9	30.31150	0.15427	1.331	22	0.040	0.89
Cephalopod											**0.89**
Metapenaeopsis palmensis	3.5	0.00043	0.878	2,042,369.790	7	0.00337	0.26240	143,357.807	12	0.4829	5.79
Shrimp											**5.79**
Total											**523.42**

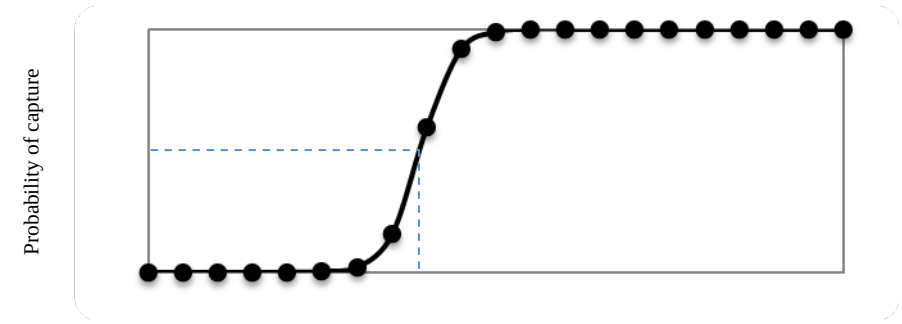
Appendix 11. Expected financial gains from small sized fish escape from otter board trawl using codend mesh size 4 cm(cover net mesh size 1.25 cm)

species	L_o (cm)	W_o (g)	CPUE (kg/haul)	N_{tn} (fish/haul)	L_m (cm)	W_m (g)	Δt	N_{tp} (fish/haul)	Price (Baht/kg)	W_n (kg/haul)	Expected value (baht/haul)
Caranx armatus	12.25	20.335099	0.043	2.131	20.00	83.785536	0.66162	0.034	15	0.003	0.04
Megalaspis cordyla	11.25	19.421602	0.292	15.046	15	46.228827	0.10588	7.713	15	0.357	5.35
Rastrelliger kanagurta	14.25	31.287836	0.373	11.933	14.92	36.264993	0.03617	9.563	15	0.347	5.20
Selaroides leptolepis	9.69	7.993263	0.646	80.865	14.32	29.078033	0.43633	1.864	15	0.054	0.81
Stolephorus indicus	8.75	4.396511	0.249	56.613	11.75	11.246339	0.31390	0.817	15	0.009	0.14
Pelagic											11.55
Epinephelus sexfasciatus	7.25	0.762156	0.034	44.177	20.75	17.868344	1.54773	8.176	75	0.146	10.96
Nemipterus hexodon	6.86	4.926758	8.690	1,763.920	11.68	23.231337	0.12326	667.816	19.5	15.514	302.53
Platycephalidae	9.41	8.332376	4.556	546.781	11.07	13.565720	0.02945	448.861	17	6.089	103.52
Priacanthus tayenus	8.24	9.123521	0.345	37.817	18.78	103.409370	0.55198	1.269	12	0.131	1.57
Saurida elongata	15.75	29.642236	1.461	49.289	21.15	72.937953	0.13426	20.049	14	1.462	20.47
Scolopsis taeniopterus	7.65	7.602246	0.889	116.950	13.13	33.835657	0.25719	15.412	12	0.521	6.26
Upeneus sulphureus	9.41	0.012778	0.044	3,456.266	11.07	0.020725	0.34198	1,368.091	7	0.028	0.20
Upeneus sundiacus	9.41	0.012778	0.248	19,434.788	11.07	0.020725	0.34198	7,692.860	7	0.159	1.12
Cynoglossidae	15.25	0.010858	0.478	43,984.72	22.89	0.039293	2.68983	6.31	40	0.000	0.31
Demersal											446.93

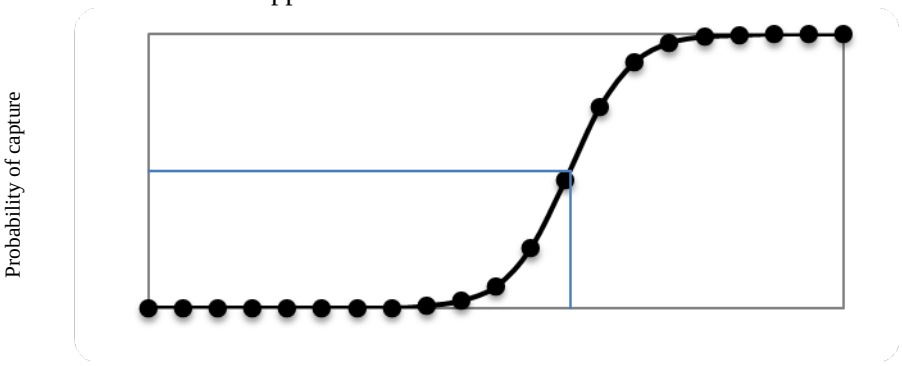
Appendix 11. (Cont.)

species	L_o (cm)	W_o (g)	CPUE (kg/haul)	N_{tn} (fish/haul)	L_m (cm)	W_m (g)	Δt	N_{tp} (fish/haul)	Price (Baht/kg)	W_n (kg/haul)	Expected value (baht/haul)
Nipponololigo sumatrensis	3.5	4.584146	0.082	17.780	8.5	27.037106	0.15920	8.440	22	0.228	5.02
Cephalopod											5.02
Metapenaeopsis palmensis	3.5	0.000430	2.233	5,195,535.680	6.25	0.002405	0.19097	751,551.590	12	1.808	21.69
Metapenaeus intermedius	10.5	9.267289	0.010	1.025	12.25	14.748678	0.10608	0.253	245	0.004	0.91
Penaeus merguiensis	10.25	0.052821	0.033	625.1400	14.84	0.1701	0.2481	162.4800	245	0.0276	6.770
Shrimp											29.38
Total											**492.87**

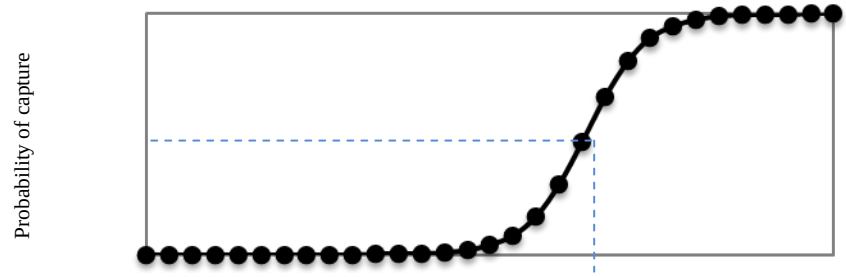
Remark: no parameter for Amusium pleuronectes



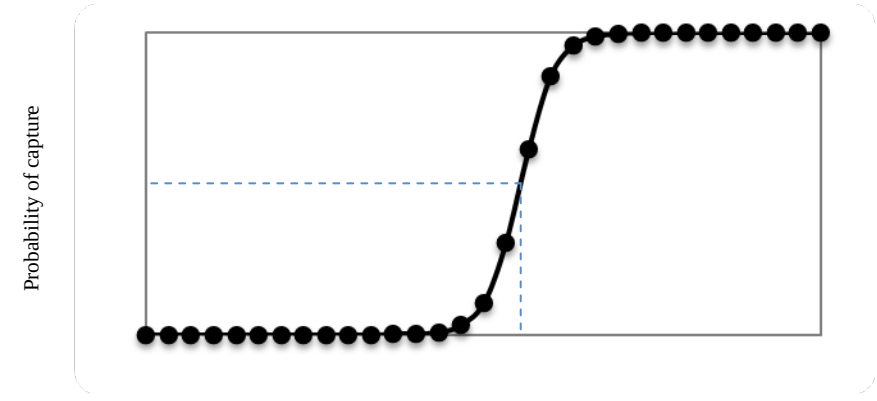
Encrasicholina spp. L 25%=7.28 L50%= 7.81 L75%= 8.35 cm.



Clupeidae L 25%=11.16 L50%= 12.11 L75%= 13.07 cm.

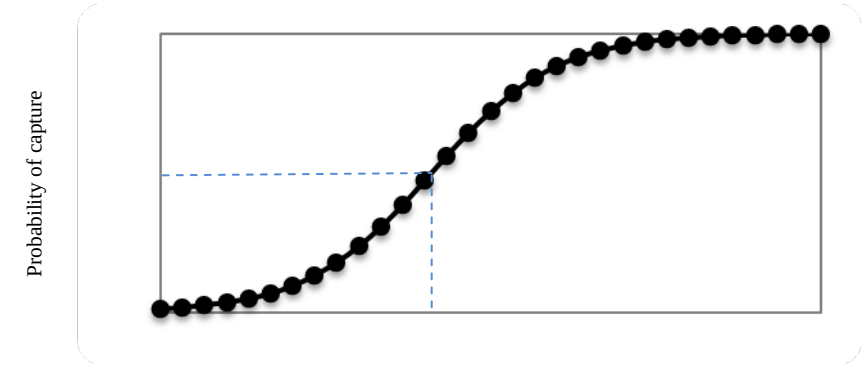


Atule mate L 25%=11.16 L50%= 12.11 L75%= 13.07 cm.

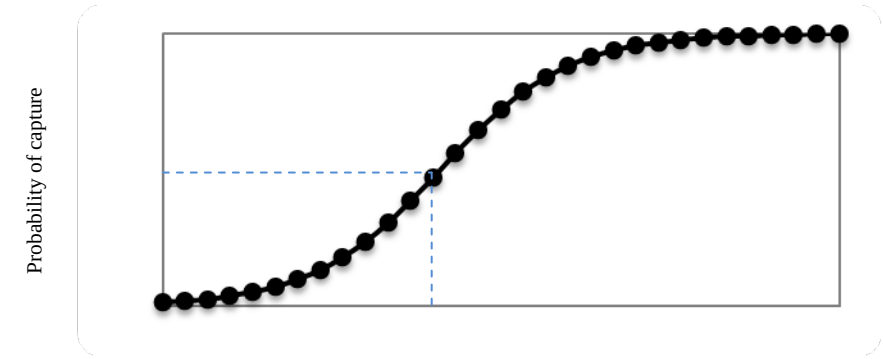


Rastrelliger brachysoma. L 25%=15.80 L50%= 16.64 L75%= 17.48 cm.

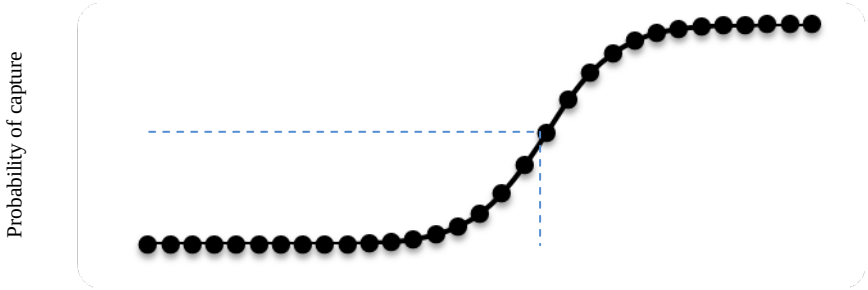
Appendix 12. Length at first capture and probability of capture of economic fish caught by pair trawl mesh size 4 cm.



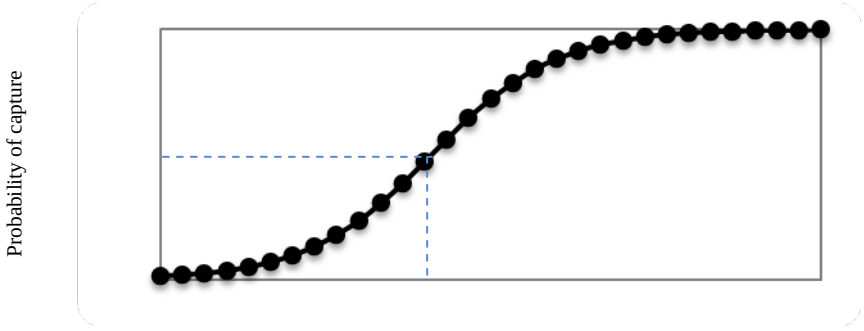
Rastrelliger kanagurta L 25%=11.30 L50%= 13.05 L75%= 14.80 cm.



Nemipterus hexodon L 25%=9.21 L50%= 12.31 L75%= 15.41 cm.

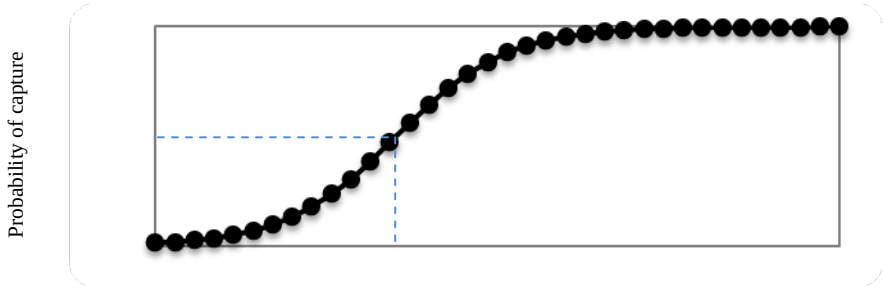


Nemipterus peronii L 25%=16.16 L50%= 17.95 L75%= 19.74 cm.

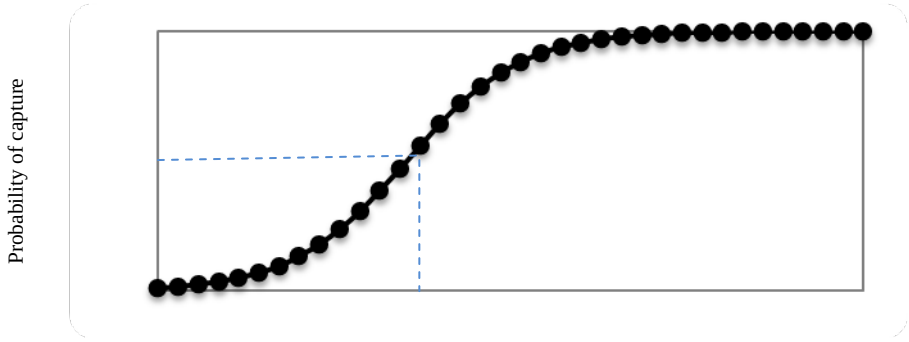


Saurida undosquamis. L 25%=7.19 L50%= 12.45 L75%= 17.71 cm.

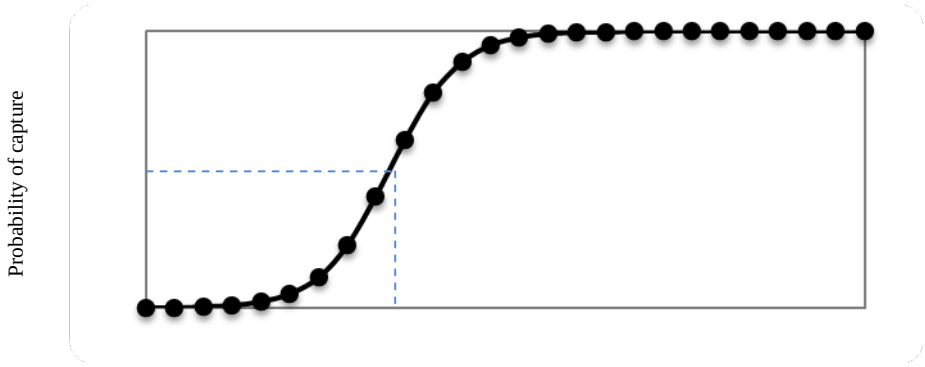
Appendix 12. (Cont.)



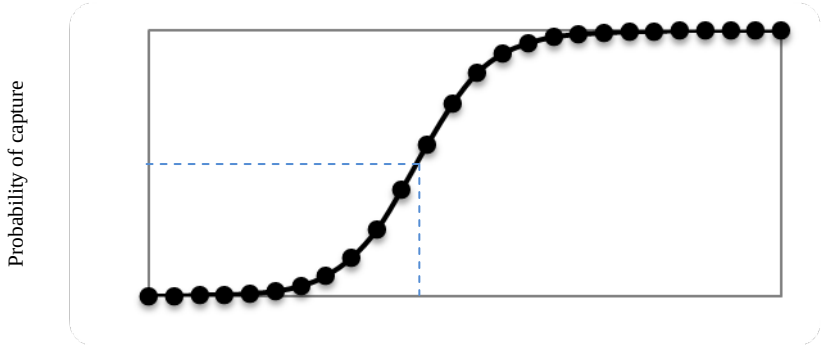
Saurida elongate L 25%=16.73 L50%= 18.72 L75%= 20.70 cm.



Sillago sihama L 25%=18.24 L50%= 19.12 L75%= 20.01 cm.

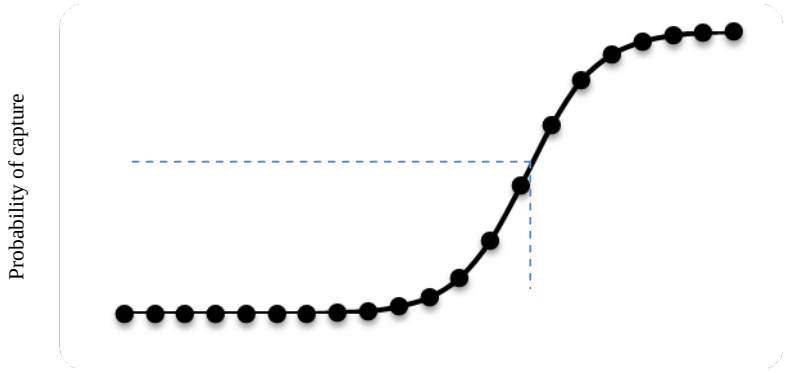


Photololigo duvaucelii L 25%=7.15 L50%= 8.48 L75%= 9.81 cm.

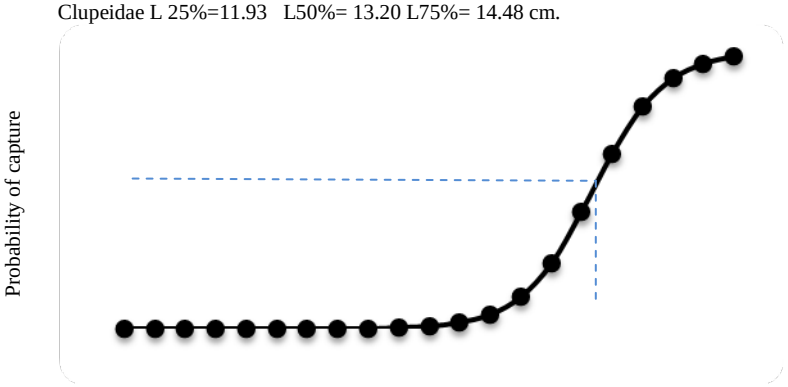


Sepioteuthis lessoniana. L 25%=8.99 L50%= 10.58 L75%= 12.17 cm.

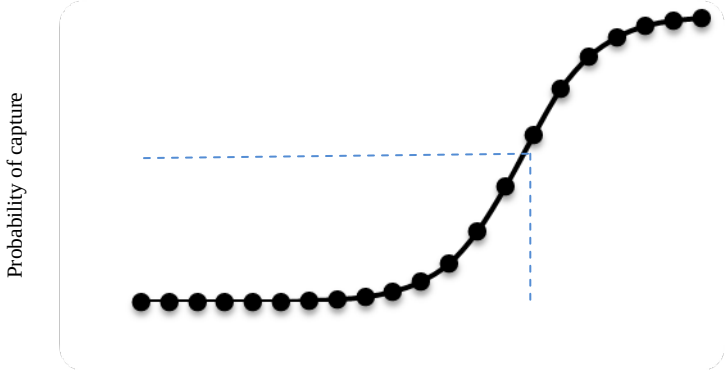
Appendix 12. (Cont.)



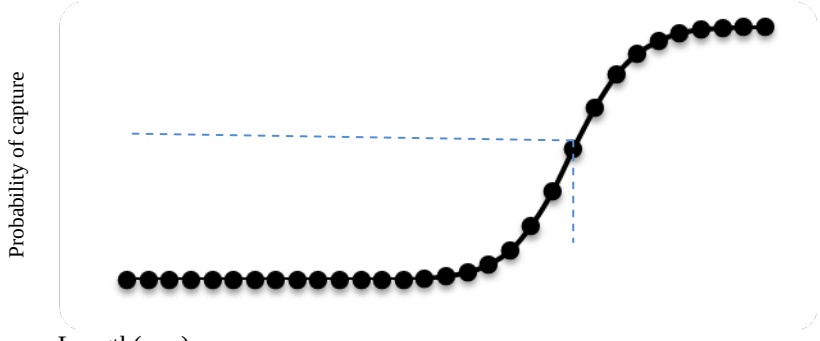
Clupeidae L 25%=11.93 L50%= 13.20 L75%= 14.48 cm.



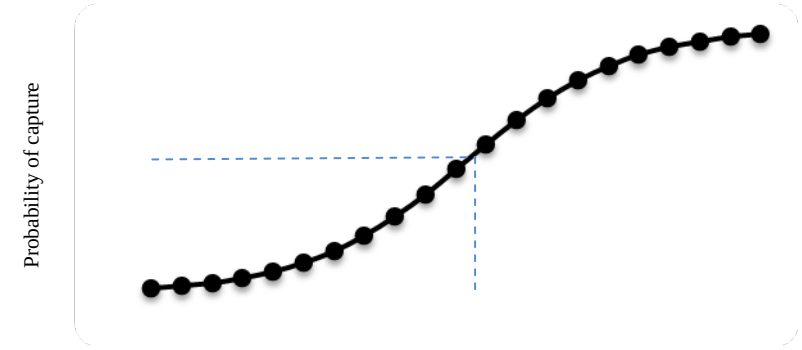
Rastrelliger brachysoma L 25%=14.08 L50%= 15.37 L75%= 16.66 cm.



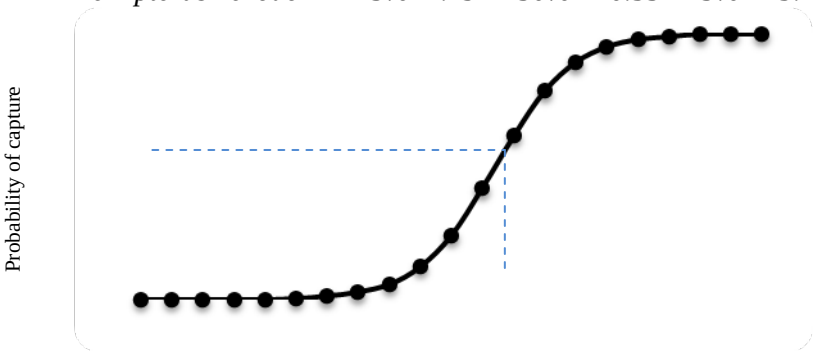
*Selaroides leptolepis*L 25%=12.03 L50%= 13.53 L75%= 15.04 cm.



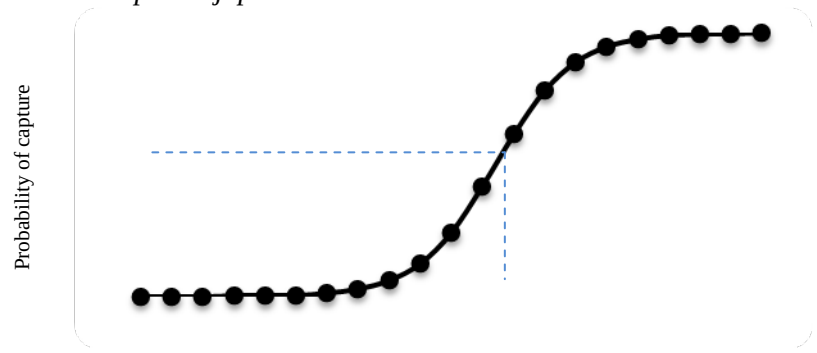
Appendix 13. Length at first capture and probability of capture of economic fish caught by otter board trawl mesh size 4 cm.



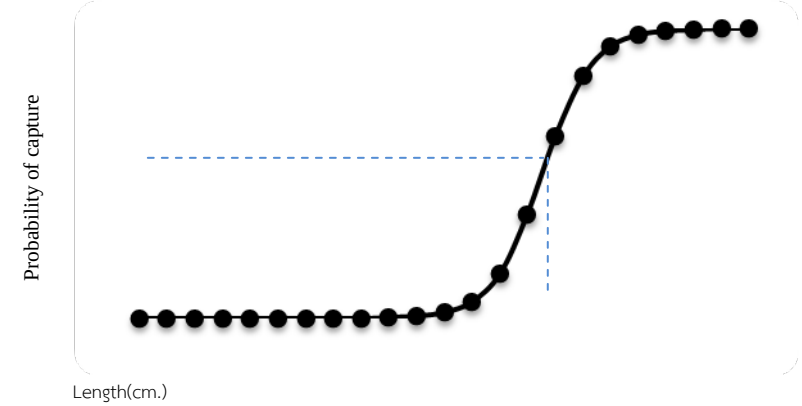
Nemipterus hexodon L 25%=7.49 L50%= 10.35 L75%= 13.21 cm.



Nemipterus japonicus L 25%=1.05 L50%= 11.41 L75%= 12.77 cm.

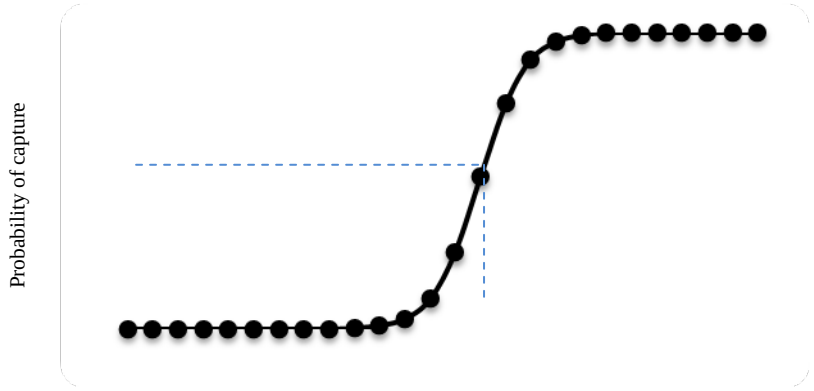


Nemipterus mesoprion L 25%=10.94 L50%= 12.60 L75%= 14.26 cm.

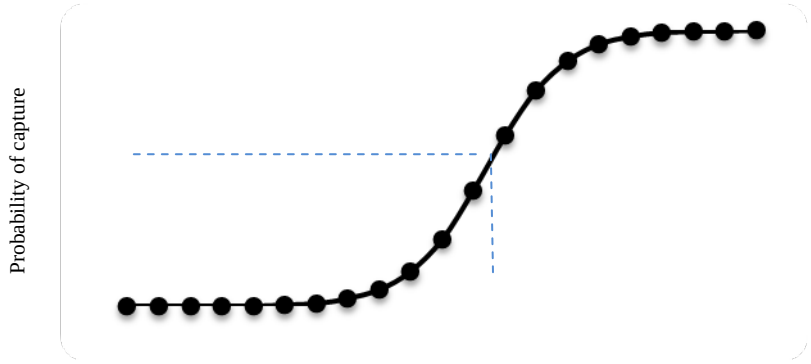


Penaeus merguiensis L 25%=13.53 L50%= 14.52 L75%= 15.51 cm.

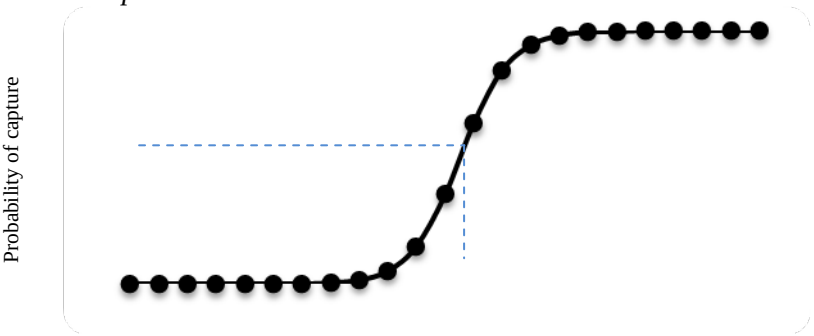
Appendix 13. (Cont.)



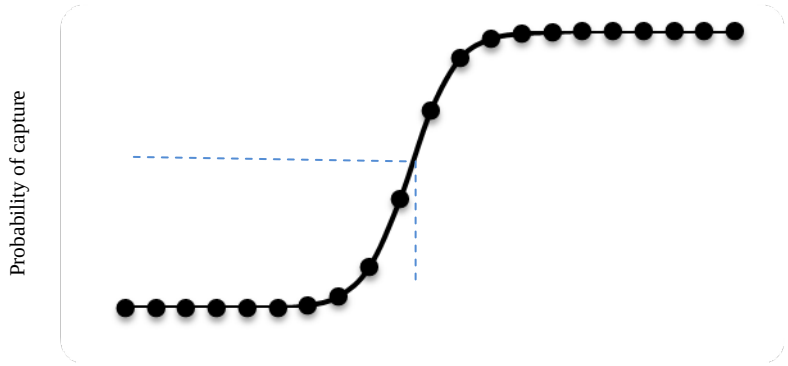
Penaeus japonicus L 25%=12.96 L50%= 13.95 L75%= 14.94 cm.



Metapenaeus intermedius L 25%=10.57 L50%= 11.29 L75%= 12.02 cm.



Photololigo duvaucelii L 25%=10.56 L50%= 11.52 L75%= 12.48 cm.



Portunus pelagicus L 25%=8.49 L50%= 9.32 L75%= 10.15 cm.

Appendix 13. (Cont.)

Appendix 14. Mean length (cm) of economic and trash fish in codend caught by pair trawl using codend mesh size 1.8 cm

pair trawl	Mean	Min	Max	SD	Num.	Mean	Min	Max	SD	Num.
Codend						**Codend**				
economic fish						**Small sized economic fish in trash fish**				
Pelagic										
Alepes djeddaba	12.13	12.25	13.25	0.17	20					
A. melanoptera	23.68	16.25	27.75	2.80	41					
Atule mate	17.25	3.25	25.25	1.41	1,141					
Scomberoides tol	25.79	19.25	63.75	13.47	177					
Caranx malabaricus	37.37	35.75	41.25	0.51	141					
Selar crumenopthalmus	18.75	18.75	19.75	0.21	12					
Selaroides leptolepis	13.48	10.25	18.75	0.25	1,993	7.67	5.75	10.75	0.03	37,704
Megalaspis cordyla	17.75	18.25	18.25	0.00	4	9.69	9.25	10.75	0.03	1,835
Parastromateus niger	25.00	23.75	40.25	16.54	4					
Carangidae	19.43	12.25	35.75	5.41	94					
Clupeidae	12.83	9.75	16.75	0.09	9,659	10.10	9.25	12.25	0.02	26,162
Sardinella gibbosa	16.64	13.25	19.75	0.60	172	7.37	5.75	10.25	0.01	279,473
Engruaridae spp.	11.52	11.25	13.25	0.06	855					
Stolephorus indicus	17.18	12.25	21.25	0.27	2,085					
Rastrelliger brachysoma	19.25	16.25	23.25	0.72	135					
R. kanagurta										
Rastrelliger spp.	14.28	11.75	15.75	0.10	1,972					
Scomberomorus commerson	18.70	16.25	40.25	5.45	192					

Appendix 14. (Cont.)

Codend						**Codend**				
economic fish						**Small sized economic fish in trash fish**				
Dermersal										
Nemipterus hexodon	15.38	11.75	26.75	1.29	469	7.43	4.75	8.75	0.04	10,354
N. japonicus	11.93	10.25	15.75	0.99	39					
Nemipterus mesoprion	13.45	12.75	16.75	1.14	13					
N. metopias	17.13	8.75	24.75	2.48	128					
N. peronii	16.02	12.25	21.75	1.21	117	5.50	5.75	6.75	0.01	3,274
Scolopsis taeniopterus	19.89	9.75	29.25	0.84	1,879	8.55	8.25	10.75	0.02	10,176
Priacanthus tayenus	16.75	16.25	18.75	0.48	20	6.25	5.75	7.25	0.03	1,565
Saurida elongata	21.46	15.25	28.25	0.90	502					
S. undosquamis	19.00	19.25	19.75	0.35	2					
Plectorhynchus pictus	18.56	12.25	43.25	9.09	73	10.25	10.75	10.75	0.00	4,017
Plotosidae	19.75	13.75	26.25	1.96	97					
Pomadasyidae	35.25	3.75	47.25	12.55	118					
Sciaenidae	14.01	12.75	23.75	0.79	562					
Epinephelus sexfasciatus	16.54	13.25	22.25	1.58	59					
Terapon theraps	14.63	12.25	28.75	0.48	7,404					
Dasyatidae	26.75	21.75	62.75	17.20	65					
Gerres abbreviatus	17.30	12.25	21.25	0.42	924					
G. filamentosus	16.00	11.75	20.25	2.92	16					
Lutjanus malabaricus	21.50	21.25	22.75	0.34	12					
L. vitta						9.50	9.75	12.25	0.03	4,016
Siganidae	19.34	16.75	28.25	3.16	47	10.75	11.25	11.25	0.00	2,437
Sillago sihama	18.59	13.25	22.75	0.70	367					
Sphyraena jello	24.78	11.25	30.25	1.45	654	11.75	10.25	16.25	0.06	20,550
S. obtusata	27.43	16.75	87.75	17.62	408					

Appendix 14. (Cont.)

Codend						**Codend**				
economic fish						**Small sized economic fish in trash fish**				
Mugillidae	16.79	14.75	41.75	5.73	227					
Upeneus sulphureus	28.88	28.25	32.25	1.17	14					
U. sundiacus	14.35	10.25	20.75	1.06	213	9.24	6.75	10.75	0.04	11,422
U. tragula	10.64	7.25	22.25	0.49	3,838	9.25	9.75	9.75	0.00	1,715
Cephalopod										
Photololigo duvaucelii	7.82	4.25	19.75	0.64	2,464					
Sepia pharaonis	16.25	9.75	25.75	2.59	119					
S. recurvirostris	9.09	7.75	17.75	1.82	106					
Sepiella innermis	10.50	8.25	15.75	2.00	24					
Sepioteuthis lessoniana	11.88	6.25	23.75	1.44	607					
Shrimp										
Penaeus japonicus	15.38	15.25	18.25	1.42	5	8.12	7.25	9.25	0.03	4,307
P. latisulcatus	13.50	13.75	18.75	5.24	2	8.25	7.75	9.25	0.02	4,579
P. merguiensis	15.03	13.75	19.25	1.01	45					
Shell										
Amusium pleuronectes	7.86	7.25	9.75	0.14	239	7.43	4.75	8.75	0.04	10,354

Appendix 15. Mean length (cm) of economic and trash fish in codend and cover net caught by pair trawl using codend mesh size 4.0 cm and cover net mesh of size 1.8 cm.

pair trawl	Mean	Min	Max	SD	Num.	Mean	Min	Max	SD	Num.	Mean	Min	Max	SD	Num.
Codend						**Codend**					**Cover net**				
economic fish						**Small sized economic fish in trash fish**					**Small sized economic fish**				
Pelagic															
Alepes melanoptera	26.29	22.75	30.25	1.56	36										
A. djeddaba						14.25	14.25	14.25	0.00	206					
A. kleinii						13.25	13.25	13.25	0.00	146	7.75	7.75	7.75	0.00	650
Atule mate	20.76	15.75	26.75	0.37	1,900										
Megalaspis cordyla						10.65	8.75	11.25	0.16	267	10.42	9.75	12.75	0.06	3,725
Selar crumenopthalmus	18.26	15.75	20.25	0.45	106										
Selaroides leptolepis	14.89	10.25	18.25	0.35	895	11.71	7.75	16.25	0.24	2,138	6.56	5.25	9.75	0.05	12,559
Caranx armatus	19.42	12.25	23.25	4.76	15										
C. malabaricus	36.96	22.25	42.75	3.83	163										
Scomberoides tol	27.14	20.75	57.25	13.59	103										
Parastromateus niger	33.11	24.25	39.25	5.82	21	10.86	10.25	11.25	0.04	331	12.25	12.25	12.25	0.00	446
Carangidae โฉมงาม	18.47	14.25	33.25	8.95	30	9.25	9.25	9.25	0.00	206					
Clupeidae	13.67	10.75	19.75	0.17	6,772	11.57	9.75	15.25	0.07	8,771	11.44	8.25	14.75	0.06	17,495
Engruaridae spp.	17.12	13.75	19.75	0.53	172										
Mugillidae	29.33	28.75	30.25	0.52	6										
Rastrelliger brachysoma	16.84	13.25	20.25	0.14	3,773										
R. kanagurta	18.73	15.25	26.25	0.91	423	13.01	11.75	14.75	0.05	3,415	10.55	7.75	12.25	0.06	6,502
Rastrelliger spp.						12.07	9.25	15.25	0.07	10,661	11.60	9.25	13.75	0.05	7,504
Scomberomorus commerson	20.50	17.75	23.75	0.34	395										
Stolephorus indicus						12.14	11.25	13.75	0.05	2,059	11.93	10.25	12.75	0.02	9,512
Encrasicholina spp.						7.69	5.25	9.75	0.04	10,818	8.18	5.75	10.25	0.02	65,704

Appendix 15. (Cont.)

pair trawl	Mean	Min	Max	SD	Num.	Mean	Min	Max	SD	Num.	Mean	Min	Max	SD	Num.
Codend						**Codend**					**Cover net**				
economic fish						**Small sized economic fish in trash fish**					**Small sized economic fish**				
Dermersal															
Gerres abbreviatus	15.75	11.75	21.25	0.44	912						12.25	12.25	12.25	0.00	446
G. filamentosus	17.61	15.75	20.25	0.91	28										
G. oyena	12.97	11.25	14.75	0.79	18	11.08	10.75	11.75	0.02	936					
Lutjanus malabaricus	22.56	19.25	28.75	2.59	32										
L. vitta	15.42	12.25	18.25	1.10	39	14.25	14.25	14.25	0.00	206					
Nemipterus hexodon	20.08	12.75	30.25	1.98	266	11.22	7.75	17.25	0.39	1,302	8.41	4.75	9.75	0.08	7,057
N. japonicus	17.25	17.25	17.25	0.00	10										
N. metopias	13.91	10.75	18.75	1.02	110										
N. peronii	17.84	12.75	24.25	1.88	85						11.50	10.25	12.75	0.25	70
Scolopsis taeniopterus	20.81	8.25	28.25	1.14	1,309	9.75	8.75	10.75	0.06	724					
Plectorhynchus pictus	45.51	29.75	60.25	10.52	46	13.34	10.75	14.75	0.22	368					
Plotosidae	23.92	17.25	30.25	4.32	23	14.21	12.25	16.25	0.12	1,021					
Pomadasyidae	34.60	19.25	41.75	2.70	386	15.75	15.75	15.75	0.00	312					
Priacanthus tayenus	17.13	14.25	19.25	0.75	52	6.92	5.75	9.75	0.14	1,163	6.02	5.25	6.75	0.06	390
Rachycentron canadus	37.04	32.25	80.25	48.81	24										
Saurida elongata	20.89	15.25	27.25	0.73	620	16.19	14.25	16.75	0.13	460	12.29	9.75	18.25	0.25	2,763
S. undosquamis	21.91	16.25	27.75	1.61	112	12.25	12.25	12.25	0.00	206					
Sciaenidae	15.44	13.75	24.25	0.75	880	13.25	13.25	13.25	0.00	312					
Siganidae	19.68	17.25	22.75	0.70	76	14.50	12.25	16.25	0.14	830					
Sillago sihama	19.51	15.25	23.25	0.43	553						13.75	13.75	13.75	0.00	715
Sphyraena jello	28.14	17.25	55.75	2.81	1,941	13.27	11.25	14.75	0.06	3,100	12.79	9.25	14.25	0.10	3,701
S. obtusata	28.80	16.25	73.25	8.03	947	12.50	12.25	12.75	0.03	128					
Terapon theraps	17.13	14.25	27.75	0.91	1,052	14.25	14.25	14.25	0.00	206	10.25	9.75	10.75	0.02	892

Appendix 15. (Cont.)

pair trawl	Mean	Min	Max	SD	Num.	Mean	Min	Max	SD	Num.	Mean	Min	Max	SD	Num.
Codend						**Codend**					**Cover net**				
economic fish						**Small sized economic fish in trash fish**					**Small sized economic fish**				
Upeneus sundiacus	13.47	9.75	19.75	0.62	594	11.17	8.75	14.25	0.06	9,461	9.82	5.75	12.25	0.08	11,382
U. tragula	20.28	15.25	25.25	1.27	120										
Dasyatidae	22.69	14.75	36.75	6.49	56										
Cephalopod															
Photololigo duvaucelii	8.89	4.25	20.25	0.69	2,364										
Sepia pharaonis	19.06	10.75	22.75	3.62	36										
S. recurvirostris	14.31	10.75	16.75	1.04	47										
Sepiella innermis	9.66	7.25	14.25	1.14	69										
Sepioteuthis lessoniana	10.68	6.25	16.75	0.88	309										
Nipponololigo sumatrensis						5.13	3.25	7.75	0.15	939	4.47	2.75	6.75	0.05	6,858
Shrimp															
Penaeus japonicus	15.00	12.25	17.75	0.83	53										
P. latisulcatus	14.41	11.75	16.75	0.79	46										
P. merguiensis	19.75	19.25	20.25	0.27	8										

Appendix 16. Mean length (cm) of economic and trash fish in codend caught by otter board trawl using codend mesh size 1.25 cm

otter board trawl	Mean	Min	Max	SD	Num.	Mean	Min	Max	SD	Num.
Codend						**Codend**				
economic fish						**Small sized economic fish in trash fish**				
Pelagic										
Alepes djeddaba	15.18	14.75	15.750	0.20	14					
A. kleinii	16.75	16.75	16.750	-	1					
A. melanoptera	17.20	16.25	17.750	0.26	22					
Atule mate	19.14	16.25	22.750	2.71	9					
Carangidae	23.14	16.75	28.250	6.10	9					
Caranx armatus	11.05	10.75	12.250	0.72	5	7.25	7.25	7.25	0	30
Clupeidae	14.75	14.75	14.75	0	3	12.48	11.25	14.25	0.19	202
Encrasicholina spp.						7.50	7.25	7.75	0.04	66
Mugillidae	18.75	18.75	18.750	0	3					
Parastromateus niger	10.5	10.25	10.75	0.16	6					
Rastrelliger brachysoma	17.21	14.75	19.75	1.05	26					
Rastrelliger spp.						13.25	13.25	13.25	0	22
Scomberoides tol	16.25	16.25	16.250	0	4	16.25	16.25	16.25	0	22
Scomberomorus commerson	20.97	18.75	22.25	0.85	18					
Selar crumenopthalmus	18.13	17.75	18.75	0.22	12					
Selaroides leptolepis	13.84	11.75	15.25	0.08	1,739	10.04	8.75	12.75	0.23	384
Stolephorus indicus	11.75	11.75	11.75	0	10					
Dermersal										
Anodontostoma chacunda	16.75	16.75	16.75	0	4					
Dasyatidae	21.86	20.25	23.75	0.906	14					
Epinephelus sexfasciatus	20.69	19.75	21.25	0.45	8					
Gerres filamentosus	16.34	15.25	19.75	0.97	37	10.05	9.25	10.25	0.05	319
Gerres abbreviatus	12.83	12.25	13.75	0.28	18					
Leiognathus equulus	19.25	19.25	19.25	0	6					
Lutjanus malabaricus	21.25	21.25	21.25	0	3					
Mullidae	14.16	11.25	17.25	0.63	116					

Appendix 16. (Cont.)

otter board trawl	Mean	Min	Max	SD	Num.	Mean	Min	Max	SD	Num.
Codend						**Codend**				
economic fish						**Small sized economic fish in trash fish**				
Upeneus sulphureus	11.32	6.75	16.25	0.77	281	7.35	6.25	8.25	0.10	252
Upeneus sundiacus						9.98	9.75	10.75	0.05	249
Upeneus tragula						10.75	10.75	10.75	0	103
Nemipteridae	6.68	5.25	8.75	0.19	315					
Nemipterus hexodon	13.23	8.25	24.75	1.11	957	7.70	5.25	10.25	0.05	12,625
N. japonicus	12.32	8.25	24.75	0.87	1,880					
N. mesoprion	13.53	11.25	16.25	0.41	169					
N. metopias	15.25	15.25	15.25	0.00	11					
N. peronii	14.89	13.25	16.25	0.47	33					
Scolopsis taeniopterus	12.64	9.75	22.25	1.30	389	9.24	6.75	11.25	0.12	1,366
Plotosidae	18.51	14.25	30.25	0.69	2,517					
Pomadasyidae	23.13	16.25	34.25	9.02	16					
Sphyraena obtusata	28.21	21.25	33.25	3.98	23					
Terapon theraps	15.53	12.75	17.25	0.87	32					
Balistoidei						8.69	7.25	11.75	0.07	5,714
Priacanthus tayenus	11.52	6.25	20.75	3.55	55	7.74	7.25	8.25	0.038	354
Saurida elongata	20.49	8.75	33.75	1.17	2,037	10.00	9.250	13.25	0.287	356
S. undosquamis	21.00	18.25	24.25	1.22	32	13.25	13.25	13.25	0	64
S. micropectoralis	21.55	20.25	23.75	0.56	40					
cephalopod										
Nipponololigo sumatrensis	3.52	2.75	4.75	0.17	93	4.25	3.75	4.75	0.10	50
Cuttle fishes	11.29	7.75	15.25	0.87	113					
Photololigo duvaucelii	9.59	7.75	12.25	0.50	89					
Sepia pharaonis	15.77	10.25	22.75	3.68	29					
S. recurvirostris	13.31	10.25	16.25	0.92	55					
Sepioteuthis lessoniana	12.40	8.25	16.75	1.61	48					

Appendix 16. (Cont.)

otter board trawl	Mean	Min	Max	SD	Num.
Codend					
economic fish					
Shrimp					
Metapenaeus intermedius	12.65	6.75	15.75	0.47	814
Penaeus japonicus	14.88	11.25	20.75	0.85	265
Penaeus latisulcatus	13.75	11.75	16.25	1.88	7
Penaeus merguiensis	13.71	8.25	21.25	1.09	371
Penaeus monodon	18.17	10.75	24.75	2.71	71
Trash					
Cynoglossidae	22.89	15.75	36.25	9.87	21
Lagocephalus inermis	9.40	6.75	19.25	2.36	127
L. spadiceus	23.75	23.75	23.75	0.00	3
L. lunaris					
Crab					
Charybdis feriatus	10.79	8.25	13.75	1.67	14
Portunus pelagicus	10.22	7.75	12.25	0.83	32

	Mean	Min	Max	SD	Num.
Codend					
Small sized economic fish in trash fish					
	8.87	5.75	10.75	0.08	4,569
	9.08	8.25	9.75	0.14	66

Appendix 17. Mean length (cm) of economic species, trash fish in codend and cover net caught by otter board trawl using codend mesh size 4 cm and cover net mesh size 1.25 cm.

otter board trawl	Mean	Min	Max	SD	Num.	Mean	Min	Max	SD	Num.	Mean	Min	Max	SD	Num.
Codend						**Codend**					**Cover net**				
economic fish						**Small sized economic fish in trash fish**					**Small sized economic fish**				
Pelagic															
Alepes djeddaba	13.14	11.75	14.75	0.74	14	9.5	9.25	9.75	0.071	26					
Atule mate	17.75	17.75	17.75	0.00	4										
Clupeidae	14.20	12.25	16.75	0.53	78										
Caranx armatus						8.71	7.75	10.75	0.614	25	12.25	12.25	12.25	0	11
Megalaspis cordyla	10.42	9.25	11.75	0.74	9	11.846	11.25	12.75	0.124	89	11.25	11.25	11.25	0	178
Rastrelliger brachysoma	15.88	11.25	18.25	0.93	105										
R. kanagurta	14.92	14.75	15.25	0.10	15						14.25	14.25	14.25	0	136
Rastrelliger spp.						11.75	11.75	11.75	0.000	27					
Scomberomorus commerson	18.75	18.75	18.75	0.00	5										
Selaroides leptolepis	14.32	12.25	15.75	0.22	239	8.98	7.75	9.75	0.26	42	9.69	7.75	12.25	0.18	665
Stolephorus indicus						12.25	12.25	12.25	0.00	21	8.75	8.25	9.25	0.03	545
Demersal															
Balistoidei						9.13	7.25	11.75	0.12	1534	8.75	7.25	10.75	0.04	7246
Dasyatidae	15.45	9.25	19.75	2.55	38										
Epinephelus sexfasciatus	20.75	20.75	20.75	0.00	4						7.25	7.25	7.25	0.00	74
Gerres filamentosus	16.12	13.75	18.75	0.70	57										
G. oyena	14.47	12.25	16.25	1.01	16	10.26	9.25	10.75	0.11	124					
Lethrinus lenjan	20.38	20.25	20.75	0.23	4										
Lutjanus malabaricus	20.50	20.25	21.25	0.48	4										
Lutjanus vitta	14.50	13.75	15.25	0.42	8										
Nemipterus hexodon	11.68	7.25	28.25	1.49	1,469	7.61	5.25	10.75	0.15	1,664	6.86	4.25	12.25	0.08	18,790
N. japonicus	10.30	6.75	25.25	1.00	2,402										
N.mesoprion	12.39	8.75	18.75	0.78	380										
N. peronii	17.77	15.25	23.25	2.46	24										
Plotosidae	22.11	18.25	30.25	1.45	209										
Pomadasyidae	16.75	16.75	16.75	0.00	12										
Priacanthus tayenus	18.78	18.25	19.75	0.22	31	6.77	6.25	7.75	0.11	123					

Appendix 17. (Cont.)

otter board trawl	Mean	Min	Max	SD	Num.	Mean	Min	Max	SD	Num.	Mean	Min	Max	SD	Num.
Codend						**Codend**					**Cover net**				
economic fish						**Small sized economic fish in trash fish**					**Small sized economic fish**				
Saurida elongata	21.15	14.75	28.25	0.70	952										
S. isarankurai						12.25	12.25	12.25	0.00	27					
Sciaenidae	14.52	12.75	16.25	0.35	85	11.25	11.25	11.25	0.00	28					
Scolopsis taeniopterus	13.13	9.25	23.75	1.53	387	9.14	7.75	10.25	0.19	123					
Siganidae	16.92	13.75	19.25	2.17	9										
Sillago sihama	18.55	18.25	19.25	0.21	15										
Sphyraena jello	17.75	13.75	24.75	5.52	11	12.75	12.75	12.75	0.00	10					
S. obtusata	23.03	19.75	30.25	1.93	83										
Terapon theraps	14.78	11.75	17.75	0.67	102										
Upeneus sulphureus	11.07	8.75	15.25	0.84	98										
U. sundiacus						10.75	10.75	10.75	0	6					
Cephalopod															
Cuttle fishes	10.18	5.25	15.75	1.30	133										
Photololigo duvaucelii	11.67	9.75	14.75	1.61	13										
Sepia pharaonis	17.20	13.75	20.75	1.97	19										
Sepia recurvirostris	12.87	8.75	19.25	1.66	92										
Sepioteuthis lessoniana	13.58	12.25	14.75	1.49	3										
Nipponololigo sumatrensis											3.50	3.25	3.75	0.02	358
Shrimp															
Metapenaeus intermedius	12.25	8.75	15.75	0.31	731						10.50	10.25	10.75	0.08	20
Penaeus japonicus	14.26	11.25	18.25	0.43	392										
Penaeus latisulcatus	12.89	10.75	13.75	0.70	21										
Penaeus merguiensis	14.84	11.25	19.75	0.65	303						10.25	10.25	10.25	0.00	11
Penaeus monodon	21.47	20.25	22.75	0.74	9										
Shell															
Amusium pleuronectes	8.33	7.25	10.75	0.05	5013						7.68	6.25	8.25	0.06	925
Trash															
Cynoglossidae						17.30	15.75	20.75	0.45	185	15.24	14.25	15.75	0.09	183
Lagocephalus inermis						8.92	7.75	16.75	0.65	832	8.82	7.25	9.75	0.11	429
L. lunaris						8.76	7.75	10.25	0.12	318	8.47	7.75	9.25	0.05	571
L.spadiceus						20.04	12.25	21.25	2.54	55					

Appendix 18. Catch rate and species composition of fish caught by research vessel (Promong 1) in the center Gulf of Thailand between 2010-2013.

Year	**2010**	**2011**	**2012**	**2013**	**2010**	**2011**	**2012**	**2013**
effort (hour)	**72**	**90**	**90**	**90**				
	CPUE	**CPUE**	**CPUE**	**CPUE**	**%**	**%**	**%**	**%**
Codend	**20.724**	**8.182**	**18.545**	**28.058**	**52.04**	**34.63**	**49.01**	**68.89**
Pelagic								
Rastrelliger brachysoma	0.084	0.031	0.166	0.058	0.21	0.13	0.44	0.14
R. kanagurta	0.091	0.041	0.058	0.123	0.23	0.17	0.15	0.30
Rastrelliger spp.				0.073				0.18
others Scombrid	0.001				0.001			
Scomberomorus commerson			0.073	0.179			0.19	0.44
S. guttatus			0.004	0.006			0.01	0.01
Scomberomorus spp.	0.165	0.035			0.41	0.15		
Chirocentrus dorab	0.117		0.019	0.090	0.29		0.05	0.22
Alepes djeddaba			0.001	0.003			0.001	0.01
A. melanoptera			0.043	0.018			0.11	0.04
Atule mate	0.006	0.012	0.025	0.017	0.01	0.05	0.07	0.04
Megalaspis cordyla	0.017		0.014	0.025	0.04		0.04	0.06
Scomberoides tol				0.001				0.003
Selar crumenopthalmus	0.051	0.025	0.062	0.040	0.13	0.11	0.16	0.10
Selaroides leptolepis	0.011		0.002	0.003	0.03		0.01	0.01
Seriolina nigrofasciata			0.003	0.016			0.01	0.04
Caranx armatus				0.087				0.21
Decapterus maruadsi	0.004		0.027	0.570	0.01		0.07	1.40
Carangidae			0.120	0.062			0.32	0.15
Alepes kleinii				0.008				0.02
others Carangid	0.099	0.018	0.018		0.25	0.08	0.05	
Clupeidae	0.603	0.003	0.054	0.026	1.51	0.01	0.14	0.06
Stolephorus indicus			0.007	0.013			0.02	0.03
Anchovy	0.003		0.002		0.01		0.01	

Appendix 18. (Cont.)

Year	**2010**	**2011**	**2012**	**2013**	**2010**	**2011**	**2012**	**2013**
effort (hour)	**72**	**90**	**90**	**90**				
	CPUE	**CPUE**	**CPUE**	**CPUE**	**%**	**%**	**%**	**%**
Engruaridae				0.001				0.001
Mugillidae				0.001				0.002
Parastromateus niger			0.053	0.062			0.14	0.15
Pampus argenteus	0.099	0.070	0.016	0.057	0.25	0.30	0.04	0.14
Misc. Pelagic fishes	0.013		0.009		0.03		0.02	
total Pelagic	**1.363**	**0.235**	**0.775**	**1.539**	**3.42**	**1.00**	**2.05**	**3.78**
Dermersal								
Dorosomatidae	0.009		0.014		0.02		0.04	
Anodontostoma chacunda			0.110				0.29	
Sphyraena jello				0.464				1.14
S. obtusata			0.078	0.023			0.21	0.06
Sphyraenidae	0.267	0.019	0.073		0.67	0.08	0.19	
Sciaenidae	0.013		0.007	0.028	0.03		0.02	0.07
Nemipterus hexodon	0.138	0.139	0.257	0.218	0.35	0.59	0.68	0.53
N. japonicus	0.029	0.036	0.131	0.034	0.07	0.15	0.35	0.08
N. mesoprion	0.058		0.129	0.066	0.15		0.34	0.16
N. nematophorus	0.246	0.052	0.363	0.385	0.62	0.22	0.96	0.94
N. peronii	0.008	0.007	0.009	0.017	0.02	0.03	0.02	0.04
N. tamburoides	0.132	0.085	0.102	0.147	0.33	0.36	0.27	0.36
N. metopias	0.100	0.022	0.160	0.112	0.25	0.09	0.42	0.27
Scolopsis taeniopterus			0.287	0.658			0.76	1.61
Scolopsis spp.	0.361	0.125	0.072		0.91	0.53	0.19	
Saurida elongata	0.733	0.390	0.873	0.911	1.84	1.65	2.31	2.24
S. undosquamis	0.249	0.018	0.371	0.572	0.62	0.08	0.98	1.40
S. micropectoralis	0.034	0.004	0.075	0.088	0.08	0.02	0.20	0.22
S. isarankurai			0.112	0.071			0.29	0.18
S. isarankuraii	0.056	0.023			0.14	0.10		

Appendix 18. (Cont.)

Year	**2010**	**2011**	**2012**	**2013**	**2010**	**2011**	**2012**	**2013**
effort (hour)	**72**	**90**	**90**	**90**				
	CPUE	**CPUE**	**CPUE**	**CPUE**	**%**	**%**	**%**	**%**
Synodontidae	0.0003		0.001		0.001		0.001	
Trichiuridae	0.109	0.020	0.065	0.654	0.27	0.08	0.17	1.61
Lutjanus lineolatus	0.077	0.011	0.008		0.19	0.05	0.02	
L. vitta	0.003				0.01			
L. malabaricus	0.033	0.009	0.023	0.064	0.08	0.04	0.06	0.16
L. sebae			0.008	0.061			0.02	0.15
others Lutianid	0.018	0.020	0.004		0.04	0.08	0.01	
Plectorhynchus pictus				0.013				0.03
Priacanthus tayenus	0.613	0.098	0.745	0.364	1.54	0.42	1.97	0.89
P. macracanthus	0.001		0.018	0.002	0.00		0.05	0.005
Sillago maculata			0.000	0.001			0.00	0.004
Sillaginidae			0.001				0.00	
Plotosidae	0.038	0.044	0.268	0.121	0.10	0.18	0.71	0.30
Dasyatidae			0.155	0.063			0.41	0.15
Rays	0.007				0.02			
Chiloscyllium griseum			0.115				0.31	
Chiloscyllium punctatum				0.012				0.03
Sharks	0.027	0.021		0.043	0.07	0.09		0.10
Cynoglossidae	0.001		0.012	0.007	0.003		0.03	0.02
Psettodes erumei			0.001	0.009			0.002	0.02
Psettodidae	0.003				0.01			
Muraenesocidae				0.001				0.003
Epinephelus sexfasciatus	0.098	0.042	0.138	0.141	0.25	0.18	0.36	0.35
E.bleekeri	0.053	0.029	0.067	0.144	0.13	0.12	0.18	0.35
Serranidae	0.034	0.049	0.027	0.025	0.09	0.21	0.07	0.06
Rachycentron canadus			0.014	0.150			0.04	0.37
Rachycentridae	0.016	0.034	0.007		0.04	0.14	0.02	

Appendix 18. (Cont.)

Year	**2010**	**2011**	**2012**	**2013**	**2010**	**2011**	**2012**	**2013**
effort (hour)	**72**	**90**	**90**	**90**				
	CPUE	**CPUE**	**CPUE**	**CPUE**	**%**	**%**	**%**	**%**
Pomadasyidae			0.001	0.026			0.004	0.06
Lethrinidae	0.108	0.020			0.27	0.09		
Mullidae	0.182	0.010	0.346		0.46	0.04	0.91	
Upeneus sulphureus				0.562				1.38
Gerres filamentosus			0.024	0.007			0.06	0.02
G. abbreviatus			0.012	0.017			0.03	0.04
G. oyena			0.003	0.006			0.01	0.01
Gerreidae	0.020	0.007	0.010		0.05	0.03	0.03	
Platycephalidae				0.079				0.19
Siganidae	0.079	0.008	0.140	0.051	0.20	0.03	0.37	0.12
Lethrinus lenjan			0.011	0.016			0.03	0.04
Misc. Demersal fishes	0.013	0.004	0.001	0.023	0.03	0.02	0.003	0.06
Lagocephalus inermis	0.327	0.054	0.534		0.82	0.23	1.41	
L. lunaris				0.384				0.94
Total Dermersal	**4.292**	**1.400**	**5.984**	**6.837**	**10.78**	**5.93**	**15.82**	**16.79**
Cephalopod								
Photololigo duvaucelii	**0.707**	1.368	3.325	1.377	1.77	5.79	8.79	3.38
P. chinensis				0.239				0.59
Nipponololigo sumatrensis	0.056	0.011	0.178	0.114	0.14	0.05	0.47	0.28
others Cephalopod	0.962	0.500			2.41	2.12		
Sepioteuthis lessoniana	0.139	0.021	0.079	0.195	0.35	0.09	0.21	0.48
Sepia pharaonis			0.041	0.036			0.11	0.09
S. recurvirostris			0.105	0.042			0.28	0.10
S. aculeata			0.039	0.007			0.10	0.02
Sepia spp.	0.236	0.024	0.127		0.59	0.10	0.34	
Sepiella innermis			0.020	0.007			0.05	0.02
Cuttle fishes			0.088	0.030			0.23	0.07

Appendix 18. (Cont.)

Year	**2010**	**2011**	**2012**	**2013**	**2010**	**2011**	**2012**	**2013**
effort (hour)	**72**	**90**	**90**	**90**				
	CPUE	**CPUE**	**CPUE**	**CPUE**	**%**	**%**	**%**	**%**
Octopus			0.545	0.038			1.44	0.09
total Cephalopod	**2.099**	**1.925**	**4.546**	**2.085**	**5.27**	**8.15**	**12.02**	**5.12**
Shell								
Amusium pleuronectes			0.354	0.387			0.94	0.95
others Bivalve	0.247	0.002	0.038		0.62	0.01	0.10	
totalShell	**0.247**	**0.002**	**0.392**	**0.387**	**0.62**	**0.01**	**1.04**	**0.95**
Shrimp								
Penaeus merguiensis			0.014	0.012			0.04	0.03
P. monodon			0.015	0.002			0.04	0.005
P. semisulcatus			0.008				0.02	
P. japonicus				0.008				0.02
Penaeus spp.	0.022	0.014	0.009		0.05	0.06	0.02	
Metapenaeus ensis			0.0001	0.001			0.0004	0.003
M. affinis			0.001	0.002			0.003	0.004
M. intermedius			0.001				0.002	
M. lysianassa	0.000				0.0004			
Metapenaeus spp.	0.002		0.003		0.01		0.01	
Large sized shrimps			0.0002				0.001	
others large sized shrimps	0.0004		0.003		0.001		0.01	
Metapenaeopsis palmensis	0.011		0.045	0.002	0.03		0.12	0.005
totalShrimp	**0.035**	**0.014**	**0.099**	**0.027**	**0.09**	**0.06**	**0.26**	**0.07**
Crab								
Portunus pelagicus	0.003		0.042	0.020	0.01		0.11	0.05
P. sanguinolentus				0.003				0.01
Charybdis cruciata	0.042	0.006	0.025		0.10	0.02	0.07	
C. feriatus			0.055	0.109			0.14	0.27
Podolpthalmus vigil			0.003	0.016			0.01	0.04

Appendix 18. (Cont.)

Year	**2010**	**2011**	**2012**	**2013**	**2010**	**2011**	**2012**	**2013**
effort (hour)	**72**	**90**	**90**	**90**				
	CPUE	**CPUE**	**CPUE**	**CPUE**	**%**	**%**	**%**	**%**
others Portunid	0.089	0.159	0.022		0.22	0.67	0.06	
Misc. crabs			0.311	0.150			0.82	0.37
totalCrab	**0.133**	**0.165**	**0.458**	**0.298**	**0.33**	**0.70**	**1.21**	**0.73**
Other								
Thenus orientalis			0.003				0.01	
Flathead lobster			0.001				0.003	
Mantis shrimps	0.038		0.063	0.096	0.09		0.17	0.24
Miscellaneous (other)	0.009	0.003	0.040	0.0001	0.02	0.01	0.11	0.0002
total Other	**0.046**	**0.003**	**0.108**	**0.097**	**0.12**	**0.01**	**0.29**	**0.24**
Trash								
Lagocephalus lunaris				0.122				0.30
Paralichthyidae			0.251	0.079			0.66	0.19
Apogonidae	0.267	0.401	0.503	0.200	0.67	1.70	1.33	0.49
Mene maculata	0.350	0.204	0.386		0.88	0.86	1.02	
Caesiodidae	0.002			0.0004	0.004			0.001
Pentaprion longimanus	1.278	0.465	0.813	0.795	3.21	1.97	2.15	1.95
Leiognathus splendens	7.322	2.207	0.418	10.762	18.39	9.34	1.11	26.42
L. bindus	0.869	0.459	0.640	0.345	2.18	1.94	1.69	0.85
L. leuciscus	0.598	0.327	1.415	1.442	1.50	1.39	3.74	3.54
L. elongatus	0.001		0.008	0.049	0.002		0.02	0.12
L. equulus	0.190	0.012	0.024	0.004	0.48	0.05	0.06	0.01
L. lineolatus			0.027	0.321			0.07	0.79
Secutor insidiator	0.340	0.030	0.113	0.282	0.85	0.13	0.30	0.69
S. ruconius	0.023	0.023		0.122	0.06	0.10		0.30
Others Leiognathidae	0.567	0.167			1.43	0.71		
Gazza minuta	0.025		0.895	0.740	0.06		2.37	1.82
Leiognathidae			0.134	1.052			0.35	2.58

Appendix 18. (Cont.)

Year	**2010**	**2011**	**2012**	**2013**	**2010**	**2011**	**2012**	**2013**
effort (hour)	**72**	**90**	**90**	**90**				
	CPUE	**CPUE**	**CPUE**	**CPUE**	**%**	**%**	**%**	**%**
Callionymidae	0.062	0.011	0.211		0.16	0.05	0.56	
Gobioidei		0.016	0.029	0.008		0.07	0.08	0.02
Scorpaenidae				0.037				0.09
Elates thompson			0.009	0.013			0.02	0.03
E. ransonnetii			0.001				0.004	
Bothidae	0.065	0.028	0.046		0.16	0.12	0.12	
Balistoidei	0.099	0.059	0.036	0.323	0.25	0.25	0.10	0.79
Lagocephalus sceleratus	0.387		0.003		0.97		0.01	
Tetraodontidae	0.001				0.00			
Miscellaneous trash	0.062	0.029	0.220	0.091	0.16	0.12	0.58	0.22
total Trash	**12.508**	**4.439**	**6.182**	**16.788**	**31.41**	**18.79**	**16.34**	**41.22**
Cover net	**19.096**	**15.445**	**19.292**	**12.668**	**47.96**	**65.37**	**50.99**	**31.11**
Pelagic								
Rastrelliger brachysoma	0.010	0.019	0.314	0.004	0.02	0.08	0.83	0.01
R. kanagurta	0.015	0.028	0.001	0.006	0.04	0.12	0.00	0.01
Rastrelliger spp.				0.159				0.39
others Scombrid	0.002				0.01			
Scomberomorus commerson			0.001				0.003	
Scomberomorus spp.	0.072	0.055			0.18	0.23		
Chirocentrus dorab	0.042	0.049			0.11	0.21		
Atule mate	0.001	0.006	0.007	0.005	0.002	0.03	0.02	0.01
Megalaspis cordyla	0.015	0.014	0.026	0.0002	0.04	0.06	0.07	0.001
Selar crumenopthalmus	0.013	0.009	0.001		0.03	0.04	0.003	
Selaroides leptolepis	0.010	0.005		0.004	0.02	0.02		0.01
Caranx armatus				0.002				0.004
Decapterus maruadsi	0.057	0.000		0.064	0.14	0.001		0.16

Appendix 18. (Cont.)

Year	**2010**	**2011**	**2012**	**2013**	**2010**	**2011**	**2012**	**2013**
effort (hour)	**72**	**90**	**90**	**90**				
	CPUE	**CPUE**	**CPUE**	**CPUE**	**%**	**%**	**%**	**%**
Carangidae	0.030	0.078	0.014		0.08	0.33	0.037	
Alepes kleinii				0.022				0.05
Clupeidae	0.055	0.026	0.067	0.008	0.14	0.11	0.18	0.02
Stolephorus indicus			0.124	0.247			0.33	**0.61**
Anchovy	0.112	0.032	0.032		**0.28**	0.13	0.08	
Parastromateus niger			0.0005				0.001	
Pampus argenteus	0.008	0.011			0.02	0.04		
Misc. Pelagic fishes	0.006	0.010	0.053	0.012	0.01	0.04	0.14	0.03
totalPelagic	**0.448**	**0.342**	**0.641**	**0.532**	**1.13**	**1.45**	**1.69**	**1.31**
Dermersal								
Dorosomatidae	0.002	0.020			0.004	0.08		
Anodontostoma chacunda			0.222				0.59	
Sphyraena jello				0.782				1.92
Sphyraenidae	0.221	0.056	0.018		0.56	0.24	0.05	
Sciaenidae	0.017	0.009	0.002	0.024	0.04	0.04	0.01	0.06
Nemipterus hexodon	0.028	0.030	0.038	0.060	0.07	0.13	0.10	0.15
N. japonicus	0.007	0.034	0.019		0.02	0.14	0.05	
N. mesoprion	0.040	0.055	0.300	0.026	0.10	0.23	0.79	0.06
N. nematophorus	0.191	0.132	0.517	0.127	0.48	0.56	1.37	0.31
N. peronii	0.001	0.001		0.002	0.002	0.01		0.01
N. tamburoides	0.028	0.012	0.052	0.018	0.07	0.05	0.14	0.04
N. metopias	0.036	0.020	0.067	0.082	0.09	0.08	0.18	0.20
Scolopsis taeniopterus			0.030	0.018			0.08	0.04
Scolopsis spp.	0.079	0.134	0.011		0.20	0.57	0.03	
Saurida elongata	0.389	0.911	0.065	0.017	0.98	3.85	0.17	0.04
S. undosquamis	0.539	0.754	0.899	0.591	1.35	3.19	2.38	1.45
S. micropectoralis	0.075	0.081	0.045	0.010	0.19	0.34	0.12	0.02

Appendix 18. (Cont.)

Year	**2010**	**2011**	**2012**	**2013**	**2010**	**2011**	**2012**	**2013**
effort (hour)	**72**	**90**	**90**	**90**				
	CPUE	**CPUE**	**CPUE**	**CPUE**	**%**	**%**	**%**	**%**
Saurida isarankurai			1.106	0.993			2.92	2.44
S. isarankuraii	1.144	1.364			2.87	5.77		
Trichiuridae	0.186	0.377	0.227	0.148	0.47	1.59	0.60	0.36
Lutjanus lineolatus	0.003	0.034			0.01	0.15		
L. vitta	0.014				0.03			
others Lutianid	0.001	0.002			0.003	0.01		
Plectorhynchus pictus				0.004				0.01
Priacanthus tayenus	3.467	0.834	0.329	0.054	8.71	3.53	0.87	0.13
P. macracanthus		0.008				0.03		
Sillaginidae	0.001	0.0003			0.003	0.001		
Plotosidae	0.001	1.135	0.016		0.002	4.81	0.04	
Rays	0.028	0.011			0.07	0.04		
Sharks		0.012				0.05		
Cynoglossidae		0.0002				0.001		
Psettodes erumei				0.002				0.004
Psettodidae	0.003	0.005			0.01	0.02		
Epinephelus sexfasciatus	0.002	0.012			0.01	0.05		
E. bleekeri			0.009				0.02	
Serranidae	0.001	0.003			0.003	0.01		
Rachycentridae		0.008				0.03		
Mullidae	0.262	0.231	0.854		0.66	0.98	2.26	
Upeneus sulphureus				0.406				1.00
Gerres filamentosus			0.0004				0.001	
Gerreidae	0.005	0.012	0.001		0.01	0.05	0.002	
Platycephalidae				0.192				0.47
Siganidae	0.006	0.015	0.008		0.01	0.06	0.02	
Misc. Demersal fishes	0.003	0.006			0.01	0.03		

Appendix 18. (Cont.)

Year	**2010**	**2011**	**2012**	**2013**	**2010**	**2011**	**2012**	**2013**
effort (hour)	**72**	**90**	**90**	**90**				
	CPUE	**CPUE**	**CPUE**	**CPUE**	**%**	**%**	**%**	**%**
Lagocephalus inermis	0.367	0.296	0.106		0.92	1.25	0.28	
L. lunaris				0.116				0.28
totalDermersal	**7.146**	**6.615**	**4.941**	**3.672**	**17.95**	**28.00**	**13.06**	**9.02**
Cephalopod								
Photololigo duvaucelii	1.116	2.079	0.608	0.029	2.80	8.80	1.61	0.07
others Cephalopod	0.251	0.044			0.63	0.19		
Octopus			0.055	0.055			0.15	0.13
Nipponololigo sumatrensis	0.353	0.523	0.624	0.668	0.89	2.21	1.65	1.64
Sepioteuthis lessoniana	0.047	0.039			0.12	0.16		
Sepia recurvirostris			0.009				0.02	
Sepia spp.	0.110	0.192	0.007		0.28	0.81	0.02	
Cuttle fishes			0.013				0.03	
totalCephalopod	**1.878**	**2.876**	**1.316**	**0.751**	**4.72**	**12.17**	**3.48**	**1.84**
Shell								
Amusium pleuronectes				0.0001				0.0002
others Bivalve	0.089	0.243			0.22	1.03		
totalShell	**0.089**	**0.243**		**0.0001**	**0.22**	**1.03**		**0.0002**
Shrimp								
Penaeus merguiensis			0.0004	0.010			0.001	0.02
Penaeus spp.	0.006	0.004	0.003		0.01	0.02	0.01	
Metapenaeus affinis			0.0002				0.0004	
M. lysianassa	0.002	0.0005			0.005	0.002		
Metapenaeus spp.	0.006	0.004	0.001		0.02	0.01	0.001	
Large sized shrimps			0.001				0.002	
others large sized shrimps	0.001	0.0004	0.004		0.003	0.002	0.01	
Metapenaeopsis palmensis	0.009	0.003	0.014	0.003	0.02	0.01	0.04	0.01
totalShrimp	**0.024**	**0.011**	**0.023**	**0.012**	**0.06**	**0.05**	**0.06**	**0.03**

Appendix 18. (Cont.)

Year	**2010**	**2011**	**2012**	**2013**	**2010**	**2011**	**2012**	**2013**
effort (hour)	**72**	**90**	**90**	**90**				
	CPUE	**CPUE**	**CPUE**	**CPUE**	**%**	**%**	**%**	**%**
Crab								
Portunus pelagicus	0.001	0.006			0.003	0.03		
Charybdis cruciata	0.037	0.033			0.09	0.14		
others Portunid	0.033	0.023	0.014		0.08	0.10	0.04	
Misc. crabs			0.067	0.069			0.18	0.17
total Crab	**0.071**	**0.062**	**0.081**	**0.069**	**0.18**	**0.26**	**0.21**	**0.17**
Other								
Mantis shrimps	0.021	0.038	0.002	0.007	0.05	0.16	0.00	0.02
Miscellaneous (other)			0.005				0.01	
total Other	**0.021**	**0.038**	**0.007**	**0.007**	**0.05**	**0.16**	**0.02**	**0.02**
Trash								
Paralichthyidae			0.587	0.069			1.55	0.17
Apogonidae	0.102	0.105	0.375	0.087	0.26	0.44	0.99	0.21
Mene maculata		0.015	0.004			0.06	0.01	
Caesiodidae	0.008			0.024	0.02			0.06
Pentaprion longimanus	0.455	0.409	2.507	1.567	1.14	1.73	6.63	3.85
Leiognathus splendens	0.857	1.218	0.355	0.766	2.15	5.16	0.94	1.88
L. bindus	6.405	2.532	2.029	2.224	16.08	10.72	5.36	5.46
L. leuciscus	0.666	0.488	4.934	1.770	1.67	2.07	13.04	4.35
L. elongatus	0.001	0.001	0.067	0.002	0.003	0.004	0.18	0.005
L. equulus	0.020	0.073			0.05	0.31		
L. lineolatus			0.019	0.051			0.05	0.13
Others Leiognathidae	0.049	0.025	0.083	0.201	0.12	0.10	0.220	0.49
Secutor insidiator	0.153	0.003	0.023	0.201	0.38	0.01	0.06	0.49
S. ruconius	0.274	0.037	0.008	0.483	0.69	0.16	0.02	1.18
Gazza minuta	0.003	0.024		0.022	0.01	0.10		0.05
Callionymidae	0.104	0.059	0.711		0.26	0.25	1.88	

Appendix 18. (Cont.)

Year	**2010**	**2011**	**2012**	**2013**	**2010**	**2011**	**2012**	**2013**
effort (hour)	**72**	**90**	**90**	**90**				
	CPUE	**CPUE**	**CPUE**	**CPUE**	**%**	**%**	**%**	**%**
Lagocephalus sceleratus	0.091	0.029	0.001		0.23	0.12	0.004	
Gobioidei	0.004	0.045	0.107	0.021	0.01	0.19	0.28	0.05
Scorpaenidae				0.007				0.02
Elates thompson			0.003	0.00005			0.01	0.0001
E. ransonnetii			0.001				0.003	
Bothidae	0.187	0.108	0.246		0.47	0.46	0.65	
Balistoidei	0.009	0.052		0.001	0.02	0.22		0.001
Miscellaneous trash	0.030	0.034	0.220	0.132	0.08	0.14	0.58	0.32
totalTrash	**9.419**	**5.258**	**12.283**	**7.625**	**23.65**	**22.25**	**32.46**	**18.72**
Grand Total	**39.819**	**23.628**	**37.837**	**40.727**	**100.00**	**100.00**	**100.00**	**100.00**

Appendix 19. Data showing catches of shellfish from trawl experiment,

Codend mesh size 1.25 cm (current used)

Station	Vessel name		Type	Scientific name	Common name	Total Weight
1	Sor Chokesiriwan	Codend	Economic fish	*Amusium pleuronectes*	Shell	0.3
2	Sor Chokesiriwan	Codend	Economic fish	*Amusium pleuronectes*	Shell	0.2
3	Sor Chokesiriwan	Codend	Economic fish	*Amusium pleuronectes*	Shell	0.5
4	Sor Chokesiriwan	Codend	Economic fish	*Amusium pleuronectes*	Shell	0.3
5	Sor Chokesiriwan	Codend	Economic fish	*Amusium pleuronectes*	Shell	0.3
6	Sor Chokesiriwan	Codend	Economic fish	*Amusium pleuronectes*	Shell	0.2
7	Sor Chokesiriwan	Codend	Economic fish	*Amusium pleuronectes*	Shell	0.3
8	Sor Chokesiriwan	Codend	Economic fish	*Amusium pleuronectes*	Shell	0.2
9	Sor Chokesiriwan	Codend	Economic fish	*Amusium pleuronectes*	Shell	0.3
10	Sor Chokesiriwan	Codend	Economic fish	*Amusium pleuronectes*	Shell	0.3
11	Sor Chokesiriwan	Codend	Economic fish	*Amusium pleuronectes*	Shell	0.2
					Avg	0.282

Codend mesh size 4 cm (proposed mesh size)

Station	Vessel name		Type	Scientific name	Common name	Total Weight
3	Sor Chokeanakewit 2	Codend	Economic fish	*Amusium pleuronectes*	Shell	1
4	Sor Chokeanakewit 2	Codend	Economic fish	*Amusium pleuronectes*	Shell	2.1
5	Sor Chokeanakewit 2	Codend	Economic fish	*Amusium pleuronectes*	Shell	49
6	Sor Chokeanakewit 2	Codend	Economic fish	*Amusium pleuronectes*	Shell	16
7	Sor Chokeanakewit 2	Codend	Economic fish	*Amusium pleuronectes*	Shell	55
8	Sor Chokeanakewit 2	Codend	Economic fish	*Amusium pleuronectes*	Shell	31
10	Sor Chokeanakewit 2	Codend	Economic fish	*Amusium pleuronectes*	Shell	28
11	Sor Chokeanakewit 2	Codend	Economic fish	*Amusium pleuronectes*	Shell	0.28
					Avg	16.580
7	Sor Chokeanakewit 2	Cover net	Trash fish	*Amusium pleuronectes*	Shell	24.916
8	Sor Chokeanakewit 2	Cover net	Trash fish	*Amusium pleuronectes*	Shell	8.502
					Avg	3.038