STUDY ON *THE JUVENILE AND TRASH EXCLUDER DEVICES (JTEDs)* IN MALAYSIA

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It has been recognized for some time that trawling in shallow coastal waters has an adverse impact upon the bio-diversity of the areas and more directly, catches the juveniles and immature fish seeking both for food and protection in the target waters. There are several unanswered regional questions to which the solutions should be found. It has been found possible to selectively harvest single target species, but where there is a diversity of target species, as there are in tropical waters, the identification of the most suitable Bycatch Reduction Devices (BRDs) / Juvenile and Trash Excluder Devices (JTEDs) to perform the selective harvesting has yet to be established. It may well be that a variety of selective devices could be used, but certainly the experimental approach will identify the most suitable designs.

Today, the development of fishing technology has placed more emphases on the design of devices having the aim of selectively harvesting the target catch while at the same time reducing the level of undesirable catch in the form of juveniles, immature commercial fish and non commercial fish. In 1998 and 1999, SEAFDEC Training Department carried out a series of experiments with varying degrees of success, in the Gulf of Thailand. These experiments investigated the use of shrimp trawls equipped with various types of Turtle Excluder Devices (TEDs). The preliminary results and conclusions from these experiments were reasonably good in terms of catching and release efficiency of economically important fish species. Comparing nets with and without TEDs proved the efficiencies of the designs.

In the year 2000, a study was carried out in the waters of other countries in this region, starting with the experiments on JTEDs in Brunei Darussalam in September 2000. In this experiment, the design of the devices had been refined and the results indicated an immediate and satisfactory improvement. In May 2001, JTEDs were introduced into Vietnam in collaboration with RIMP of Vietnam. The experiment and demonstrations were carried out at Cat Ba Island in Hai Phong Province. Malaysia was the selected country for the implementation of such devices that can be beneficial as the Department of Fisheries of Malaysia, also has a project on selective fishing gear in the West Coast of the Peninsular Malaysia.

The objectives of the activity in Malaysia are as follows; 1) to conduct experiments and evaluations on a new type of JTED for fish trawl nets, 2) To evaluate and determine the catching and escape level efficiency of JTED designs, and 3) To promote suitable JTEDs under the responsible fishing technology and practices program through training and demonstration to Malaysian fishermen.

This paper describes the results of the Juvenile and Trash fishes Excluder Device (JTEDs) tested onboard a Malaysian Fishing Trawler in cooperation

with the Department of Fisheries, Malaysia. In particular, it provides estimates of Catch per Unit Effort (CPUE) of trawl fishery, catch composition in day and night times, distribution of length-frequencies for the capture fishes and released fishes using two different grid intervals.

MATERIALS AND METHODS

Experiments on JTEDs attached to fish trawl nets were conducted in cooperation with the Department of Fisheries, Malaysia between12 - 15 September 2001 in the waters off the coast of Kedah on the west coast of Peninsular Malaysia. Fig 1 Shows the fishing area and local fishing trawler employed for the experiments.

1. JTED Designs

The SEAFDEC/Training Department, having consideration to the efficiency of the escape levels for small or juvenile/trash fishes, developed a new type of JTED which was modified from the NOFI TRAOMSO A/S Sort-X . The size of the JTED frame was 50 by 80 cm and comprised of three pieces. The sorting grid of 12 mm and 20 mm which covered 0.8 sq. meters were placed at angle of attack of about 120 °, in mouth of the codend part. In the experiments, a cover net was mounted covering the device to collect the escaped species. Fig 2 shows the installation and operation diagram of the JTEDs.

2. Experiment and Data Collection

Fishing experiments for the JTEDs were scheduled, and carried out during daytime from 0900 - 1600 hrs and in the nighttime from 1900 - 2430 hrs. To compare catch composition and testing the JTED for shrimp trawl operation two different bar spacings of 12 and 20 mm were tested during both day and night time fishing.

One hour trawling with a towing speed of 4 to 5 knots was scheduled. The water depth, measured by sounding methods was between 20 and 28 m.

Catch data, by total weight taken from the codend and the covernet were recorded. For species identification, samples were randomly drawn from each haul. They were sorted by species and group. Each group or species were weighed in grams and individually measured for the fork length for determination of the length-frequency of the catch from both codends.

3. Data Analysis

All catch data from each trip was determined into percentage of catch composition and catch per unit effort (CPUE in kg/hr). Because of the size the compositions of populations fished, escape levels determined experimentally differ, thus the estimated escapement at length are applied to length frequencies of commercial catches. Estimates of "overall escapement" were calculated as the weight or number of fish in the covernet divided into the total caught in the cover net and codend.

Length - frequencies of major economically important species, from both cover net and codend were analyzed in relation to the percentage escapement. Trash fishes were not measured.

RESULTS AND DISCUSSION

1. CPUE and Catch Composition

The catch per unit effort (CPUE) in the experimental ground are between 27.54 to 48.93 kg / hr / haul in daytime and 31.69 to 35.11 kg / hr / haul in the night time operations. Fig 3 shows the catch composition by group (by percentage of total weight) between day time and night time operations. Comparison between day and night time operation found that the percentage of catch composition are clearly different. Percentage of trash fishes, pelagic species and cephalopod group in day time trawling are higher than at night. The amount of catch for pelagic species, especially in day time is about 7 times higher than night time trawling. In contrast, demersal species found at night time are about 3 times higher than in day time trawling. Large shrimp like *Penaeus* sp. are found both in day and night time, however there are many small shrimps including *Metapenaeus* sp. and *Tachypenaeus* sp. in night time trawling only.

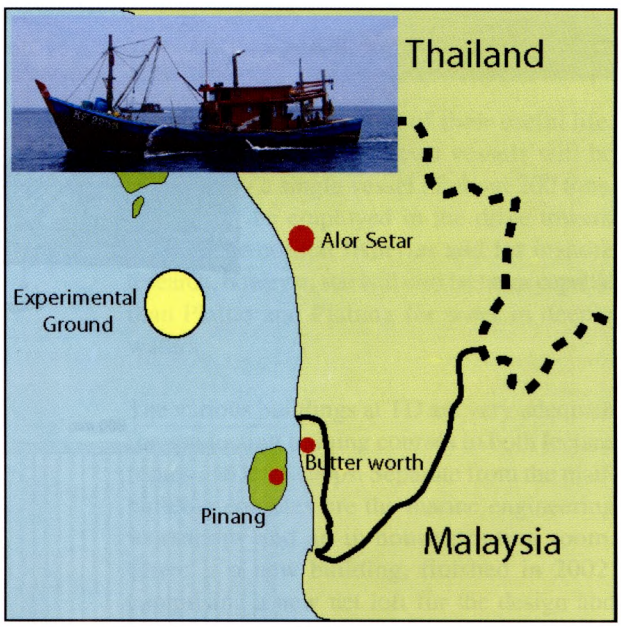

Fig 1. Experimental ground off Alor Setar,

Commercial species commonly found in this experimental ground are *Rastrelliger brachysoma*, *R. kanagarta*, *Atule mate*, *Upeneus sulphureus*, *Selaroides leptolepis*, *Nemipterus* sp., *Priacanthus macracanthus*, large shrimp (*Penaeus* sp.), *Loligo* sp. and *Sepioteuthis* sp.

2. Escape Levels

The overall escape levels of each target group (without consideration of size) in day time trawling between 20 mm and 12 mm bar spacing have been compared as shown in Fig 4. The difference in escape levels between the two bar spacing are relatively great, not only for the trash fishes group but also the target group. About 73 % of total catch were released by JTED with the 20 mm of bar spacing, and about 35 % escape levels for the 12 mm bar spacing. The trash fish group represents the highest escape levels which are about 87 % and 70 % for both 20 mm and 12 mm bar spacing of JTEDs respectively. Averaged, 63 % and 44 % of the pelagic fish and shrimp are released by a 20 mm bar spacing JTED. Whilst the 12 mm bar spacing released less than 10 % of the pelagic fish and shrimp. About 2-3 % of the total catch is crab including swimming crab, in which 100% were found to be captured in the codend.

3. Length Frequency of Catch and Escape Levels

From the overall escape level results without consideration of the size of the escaped fish, it is not possible to determine a suitable bar spacing for the two JTEDs.

Length frequency of the catch found in the codend and cover net for different bar spacing of 20 mm and 12 mm is very useful data to decide the size of bar spacing in JTEDs. The results from the comparative study of the length frequency of some commercial or dominant species like *Rastrelliger brachysoma, Atule mate, Nemipterus* sp., large shrimp (*Penaeus* sp.), *Loligo* sp. and *Sepioteuthis* sp. caught during experimental trawling with different bar spacings of JTED are shown in Fig 4.

The relationship between the length frequency and percentage of escape levels of the *Rastrelliger brachysoma* show that their fork length found during this period varied from 120 –170 mm as shown in Fig 4a. The results of escape level indicate that 100 % of the *Rastrelliger brachysoma* size larger than 120 mm will be caught by a 12 mm bar spacing JTED. In contrast, about 40% of the *Rastrelliger brachysoma* can escape when using a 20 mm bar spaced JTED.

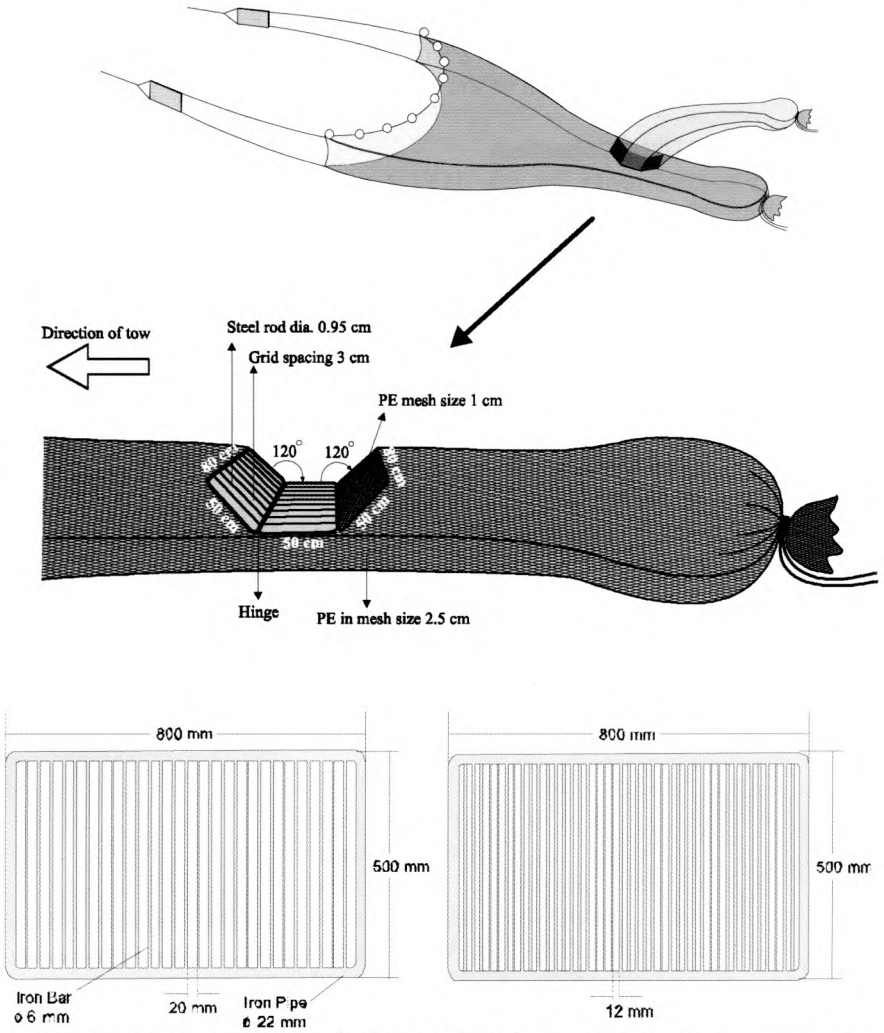

Fig 2. Installation of the juvenile and trash excluder devices on the fish trawl net for the experiments

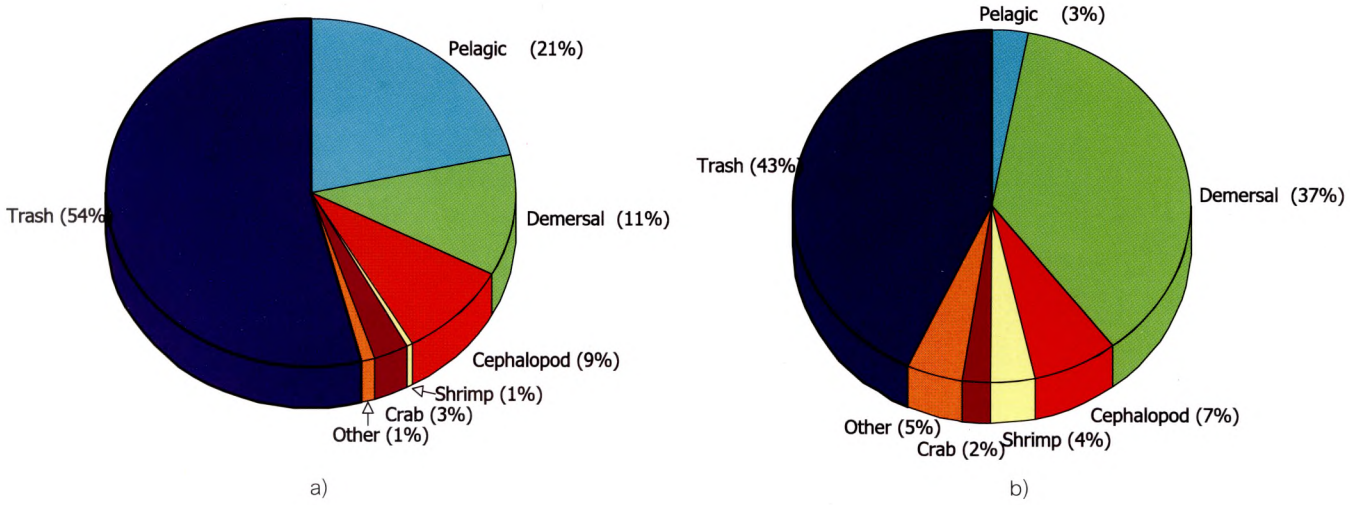

Fig 3.Catch composition of day and nighttime experiments, a) daytime and b) nighttime.

The 12 mm bar spacing JTED show good efficiency in catching medium and larger sizes (>120 mm) of *Rastrelliger brachysoma* both in day and night time trawling.

For *Nemipterus sp.*, the fork length varied from 30 - 230 mm as shown in Fig 4b. The escape results of the 12 mm bar spacing JTED shows it to be very good in selecting the larger sizes of *Nemipterus* sp. (> 110 mm) and releasing the small sizes during day time trawling. For night time trawling with a 12 mm JTED, about 45 % of smaller sizes of fish (<110 mm) were caught in the codend, this is because they live near the bottom and may directly pass through the codend not through the sorting grid. It showed also the escape levels for 20 mm bar spacing.

The same escape results were found for *Atule mate* (Fig 4c).

The dominant species in trash fish composition were the juveniles of *Siganus* sp. All were in the juvenile stage size smaller than 70 mm More than 70% of these juveniles were released through the sorting grid.

Many squid and cuttlefish were found especially in day time trawling. The squid found in this area were from 30 - 140 mm mantle length. About 80 % of the total catch of squid escaped through the 20 mm bar spacing JTED and about 50 % could escape through the 12 mm JTED in day time trawling. It is probable that the squid move vertically to the upper layer at night time, therefore, less squid were caught during the day time experiments.

For cuttlefish the escape levels related to the size of the cuttlefish, which varied from 50 – 290 mm mantle length. Using the 20 mm JTED could release about 65 % of the 50 - 130 mm cuttlefish. For the 12 mm JTED, only cuttlefish of less than 100 mm could escape, however, they were very few in number.

Large shrimp like *Penaeus merguiensis* and *P. semisulcatus* varied between 100 – 200 mm Fig 4d shows the escape results of shrimp for the 12 mm bar spaced JTED, there is no significant difference in the catch of large shrimp between day and night time. It indicates that only about 5% of the total shrimp could escape from the sorting grid of 12 mm bar spacing and about 95% of shrimp (>100 mm) were caught in the codend. In the case of the 20 mm bar spaced JTED, some large shrimp (up to 190 mm long) could escape. This shows the efficiency in size selection of the 12 mm spaced sorting grid.

CONCLUSION

The Implementation and introduction of selective devices is very urgent in the Southeast Asia Countries because of the over-fishing of the marine resources of both demersal and pelagic fish. The JTED is one of the size selection devices that can be used to release small sizes of fish and catch only the larger sizes. The principal of using this device is that the target species or large size of fish, shrimp or squid / cuttlefish should be retained in the codend and the small/juvenile should be released. From the experiments in this study, the 12 mm bar spacing JTED may be a suitable device to release the juvenile and small fishes including trash fish for sustainable fishing. Detailed studied must to be carried out to confirm this conjecture.

Other factors like easy installation and operation for fishermen must also be considered. A design review and improvement of the devices to fulfil these factors is essential.

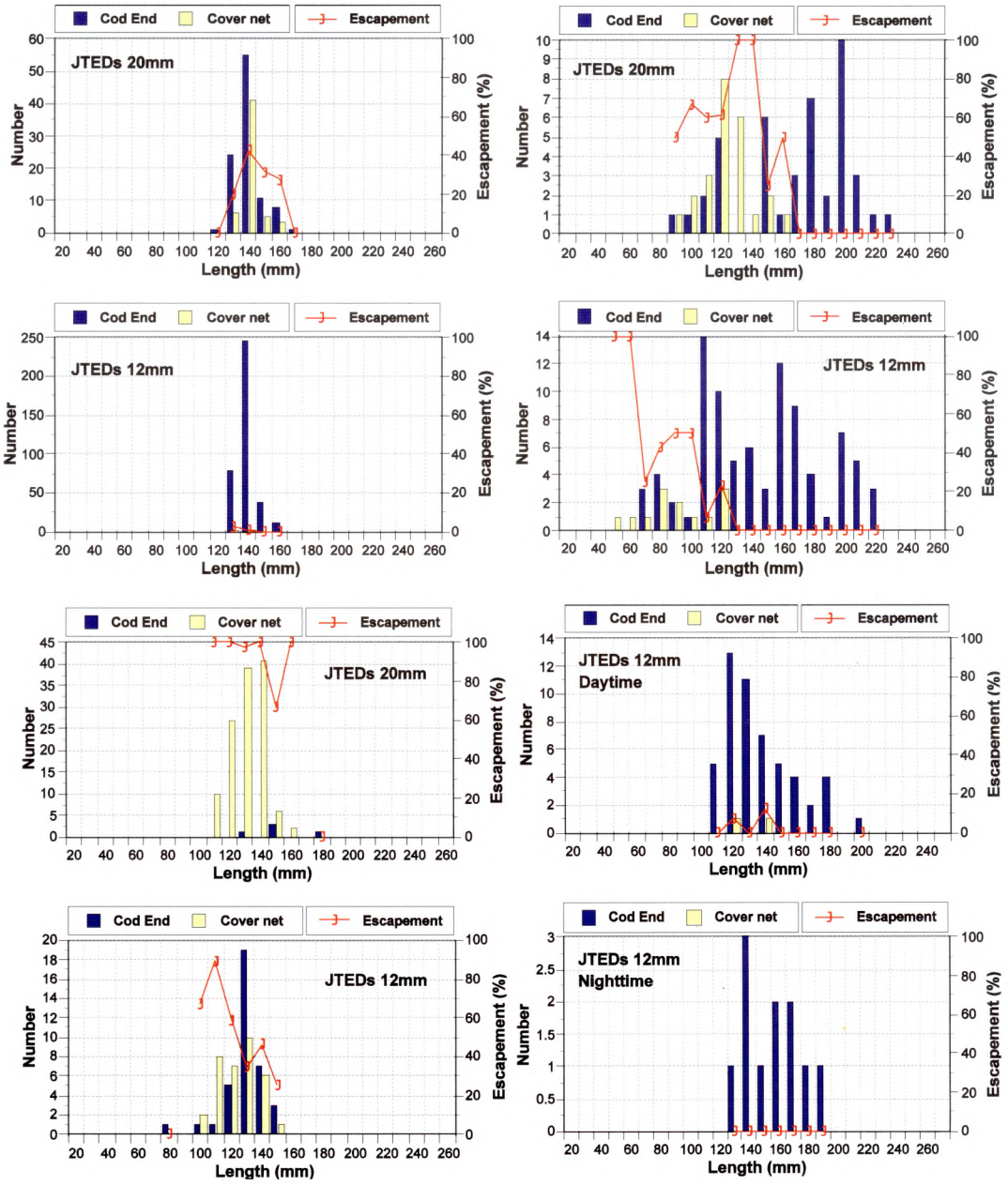

Fig 4. Length frequencies of some commercial or dominant species like *Rastrelliger brachysoma (a) Nemipterus* sp.*(b), Atule mate (c),* and large shrimp (*Penaeus* sp.) (*d*) which were caught from experimental trawling with different bar spacings of the JTED

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