GEF SGP MALAYSIA

PROJECT FINAL REPORT (Nov. '06 to Oct. '08)

Project No. MAL/OP3/2/06/FP-56

Project Title:

Improving the Sustainable Livelihood of Fishermen and Conservation of Marine Biodiversity Through the Reduction of Sea Turtle By-Catch in Commercial Fisheries in Sabah, Malaysia.

Project Grantee:

Marine Research Foundation (MRF), Malaysia

Global Environment Facility Funded by GEF SGP Malaysia SGP The GEF Small Grants Programme UNDP

October 2008

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A project by:

In association with:

Funded by:

List of Acronyms

ANOVA	–	Analysis of Variance
ASEAN	–	Association of South East Asian Nations
GEF	–	Global Environment Fund
GPS	–	Global Positioning Satellite
IUCN	–	World Conservation Union
MRF	–	Marine Research Foundation
MTSG	–	Marine Turtle Specialist Group
NMFS	–	National Marine Fisheries Service
NOAA	–	National Oceanic and Atmospheric Administration
PL	–	Public Law
SEAFDEC	–	Southeast Asian Fisheries Development Center
SGP	–	Small Grants Programme
SSC	–	Species Survival Commission
TED	–	Turtle Excluder Device
WTO	–	World Trade Organisation
WWF	–	World Wildlife Fund for Nature and Natural Resources Malaysia

1.0 Project Background

The primary goals of this project were to improve the sustainable livelihoods and building the capacity of the local fisherfolk communities to enable them i) to undertake much more sustainable fishing efforts, particularly among the local communities operating out of Sandakan, Sabah, Malaysia, and ii) to reduce the loss of marine biodiversity, especially of the green turtle *Chelonia mydas*, listed as Endangered by the IUCN Red List. The project aimed to demonstrate the impact of commercial trawling on adult and juvenile endangered sea turtle populations off the east coast of Borneo, and also determine its potential impacts on marine diversity and on the sustainable livelihoods of local fisherfolk communities, while developing potential mitigation options at the operational and management levels.

This project was developed in partnership with the Sabah Department of Fisheries, and is already providing the data upon which the Government can base further fishery practice controls to conserve marine turtles, be it through the use of excluder devices, or possibly seasonal and/or temporal closures. The project is the first of its kind to receive the blessing of the Sabah Fisheries Department as a first step in determining 1) the level of bycatch and 2) the opportunities for introducing TEDs on a voluntary basis (at first) and subsequently as a Government mandate.

The reduction in the bycatch of endangered marine turtles and other key taxa is a key conservation objective of many global marine biodiversity programmes, besides being identified as one of the focal species groups (turtles, cetaceans, birds and sharks) of marine bycatch reduction efforts.

Following the outcome of the WTO trade issues and the US requirements for compliance with P.L. 101-162 with regard to turtle excluder devices and shrimp trawling operations, and in keeping with Malaysia's willingness to conserve turtles, as evidenced by its participation in the ASEAN Memorandum of Understanding on Sea Turtle Conservation and its key role in discussions to develop a Regional Agreement, this pilot project plan was developed to evaluate the use of TEDs in Sabah, Malaysia. The plan was formulated between the Sabah State Department of Fisheries and the

Marine Research Foundation, and with the blessing of the Sabah Fishing Boat Owner's Association, to carry out a pilot project to evaluate the effects of TEDs installed on Malaysian trawlers on catches, bycatch reduction and turtle conservation, and to investigate the obstacles that might arise in the their use and enforcement of their use in Sabah trawl fisheries. Sabah was chosen for its significant trawler industry and the fact that nothing is known on the magnitude of these trawler fleet's impacts on turtle mortality. Funding for the project was generously provided by Malaysia's GEF Small Grants Programme.

2.0 Project Methodology

This project was carried out in four key phases. The first phase entailed developing and strengthening linkages between the MRF, the Sabah Fisheries Department and the local fishermen associations, both in Sandakan and Kota Kinabalu. Through these personal linkages the project was able to operate within what can be construed as a very sensitive market, and addressing an even more sensitive issue: bycatch reduction. Much of this was achieved through explaining the implications of TED use which could reduce fuel costs and increase value of catches. With this in mind, fishermen were generally keen to participate in a voluntary manner.

The second phase entailed a training course in May 2007 on TED use and installation conducted by NOAA/NMFS specialists David Bernhart and Nick Hopkins, as part of more wide-reaching efforts by the US Agency to allow countries to comply with the provisions of P.L. 101-162 as it relates to the export of shrimp to the USA and the related protection of marine turtles in trawler fleet operations.

Phase three involved the local manufacture of 20 operational TEDs in Sandakan and initial trials on trawlers to evaluate performance in July 2007. A similar number of trawlers also operated without TEDs to compare catches. The two sets of vessels operated at the same time in the regularly fished waters off the East coast of Sabah, out of Sandakan during peak trawling periods.

Phase four involved a series of extensive trials following modification of the locally-manufactured TEDs, and a switch from stainless steel construction to aluminium. The numbers of actual

trawlers varied with time, restricted not by access to fishing boat, but rather availability of suitable on-board observers

An independent 100% observer coverage recorded catch statistics as well as numbers of turtles caught / released, their condition, and any other fishery interaction-related data. Observers were equipped with hand-held GPS receivers to log exact trawl tracks for comparative analysis among trawl sites, and a detailed data sheet on which to record catch and bycatch data, (see Annex I).

3.0 Trials and Observer Programme

Paired tows were planned with one vessel outfitted with a TED and another without, so that catches and bycatch rates could be comparable. While this paired system was maintained as much as practicable, fuel consumption and vessel departure schedules often meant that a degree of variability was introduced. It was felt that with the overall number of trials, any changes in catch through geographical variations in fishing grounds would have a minimal impact on overall results.

An initial series of comparisons using the first stainless steel TED prototypes (dubbed "*Sabah TED 1.0*") manufactured in Sandakan comprised a total of 215 trials. However, following the discovery of some manufacturing defects – which were manifested through fisher dissatisfaction, twisting of the net and a reduction in overall catches – a new range of TEDs (the "*Sabah TED 2.0*") was developed in Kota Kinabalu, where quality control could be fully implemented. These newer TEDs featured aluminium (lighter weight) frames which and were fully sewn into the net sleeves, whereby the correct angle and opening and flap dimensions could be assured. A second batch of 155 trials was conducted with the new TEDs, and data from the

The first official trial started on 14th September 2007, with two Hai Leng Enterprise shrimp trawler vessels heading out to sea, one with a TED and one without a TED.

During the next two days another four vessels followed suit. Due to a lack of available observers towards the end of the session, the number of vessels used in the trials had to be cut down to four, lowering the overall number of runs made simultaneously with TEDs and without TEDs. While the number of boats involved in the trials was lowered, the overall number of trials was still kept as originally planned during the design phase of this project. Originally the project had intended to use 20 boats for 20 trials (400 trials), and by the end of the project a total of 370 valid trials had been conducted.

Observers were present on all trials (100% coverage). These comprised various groups of people, which comprised WWF volunteers, ex- and current UMS interns, and Fisheries Department associates.

Trials were all conducted out of Sandakan, and ranged as far as 12 nautical miles (~22 km) offshore, spanning 1.15 degrees of latitude (**Figure 1**), or a spread of some 105 km. Trawlers did not venture far from shore, but did spread out considerably log the coast.

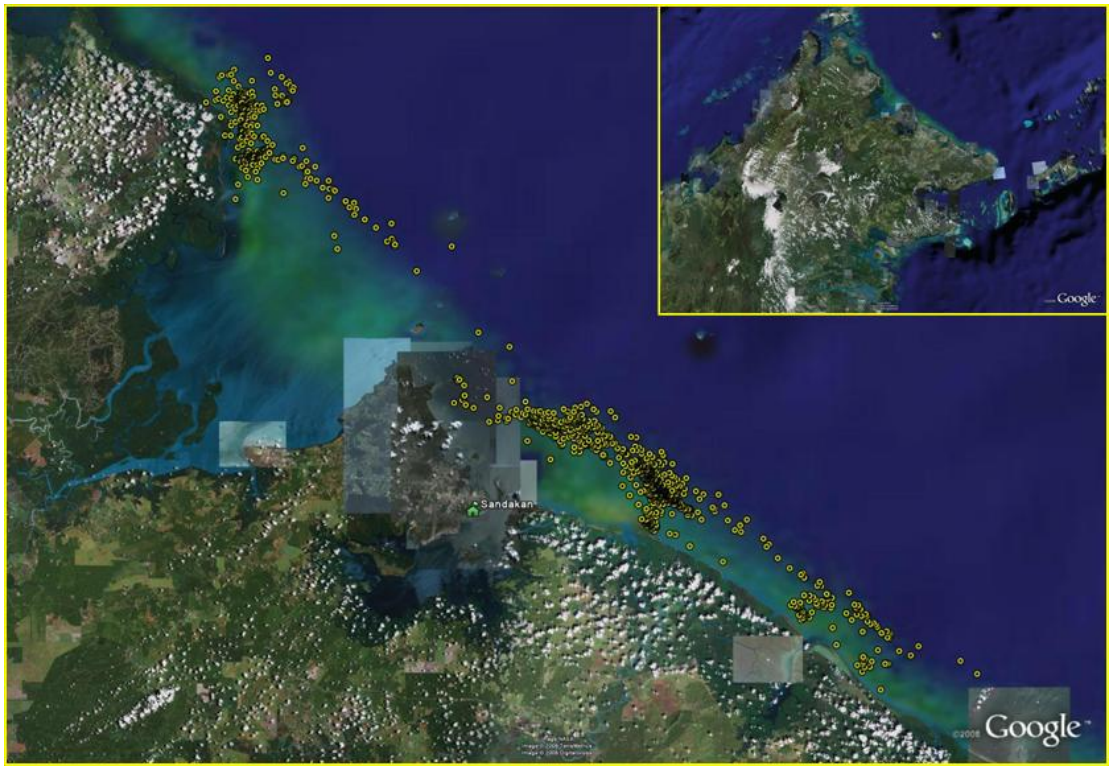

Fig. 1: Location of TED efficiency trials, inclusive of those vessels operating with and those without TEDs.

4.0 Results and Interpretation

4.1 Results – Fishing Comparisons

Fishing behaviour and aspects of fishing activity which could have impacted catch and bycatch composition were not found to be substantially different. Often, amongst trials of these type, there is a degree of hesitance in accepting results which often contradict initial impressions. Graphic depiction of results is often overridden by statistically robust analyses, and personally impressions are found to be biased based on (often) preconceived opinions. For this reason the results of these trials are presented following robust statistical analyses but coupled with explanatory text and graphics.

4.1.1 Setting Time

The setting time – the time of day at which nets were deployed – was not found to differ significantly between trials with TEDs and trials without TEDs. Fishing vessels operating with TEDs set their nets at night 64.2% of the time (in two deployments around eight pm and two am) while those without TEDs set their nets at night 61.5% of the time (similarly in two deployments around eight pm and two am). While graphically there may be slight variations in the proportions of tows at varying setting times amongst the two trial groups (**Figure 2**), an analysis of variance of the individual trawl patters concluded statistically that tows with TEDs were not significantly different than those operating without TEDs ($ANOVA_{1,368}$: F=0.976, P=0.323) with respect to setting times. That is, the very slight differences in setting times between the groups was more likely due to natural variation than any purposeful behavioural variations amongst fishing crews on the two trial sets (TEDs and no TEDs).

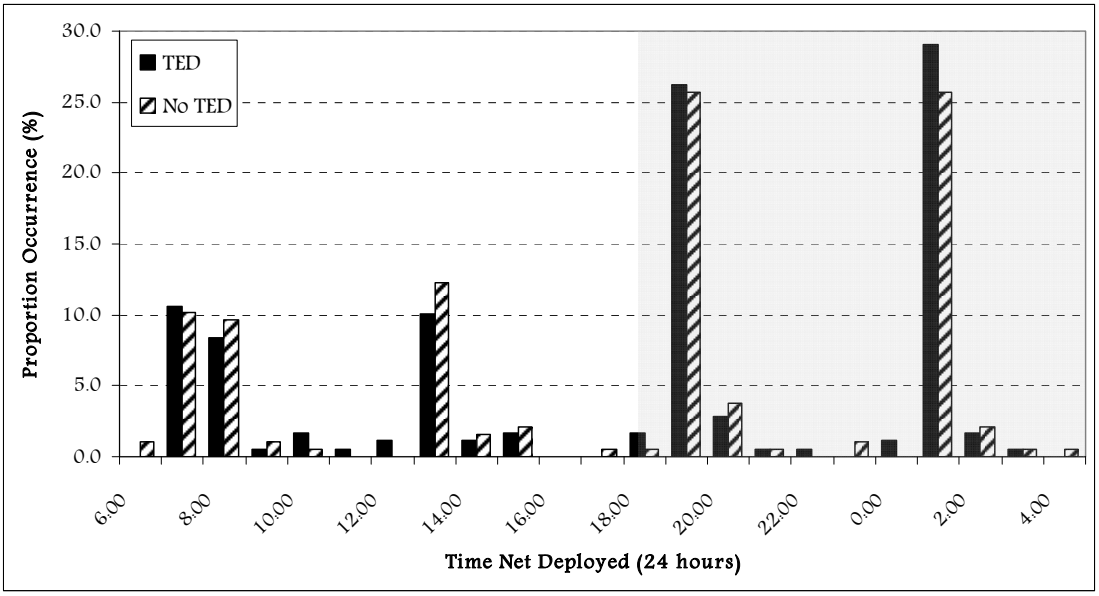

Fig. 2: Time of day the nets were set during trials on vessels operating with TEDs and those operating without TEDs. The shaded portion represents night fishing hours. Slightly over 60% of fishing took place at night, with no significant differences in setting times between the two groups. Net set times were not believed to have affected catch or bycatch rates.

4.1.2 Trawl Depth

Trawl depth – the average depth in waters through which the net was towed – was not found to differ significantly between trials with TEDs and trials without TEDs. While graphically there may also be slight variations in the proportions of tows at varying depths amongst the two trial groups (**Figure 3**), an analysis of variance of the individual trawl patters concluded statistically that tows with TEDs were not significantly different than those operating without TEDs ($ANOVA_{1,368}$: F=1.173, P=0.280) with respect to trawl depth. Here again, the very slight differences in trawl depths between the groups was more likely due to natural variation than any purposeful behavioural variations amongst fishing crews on the two trial sets (TEDs and no TEDs).

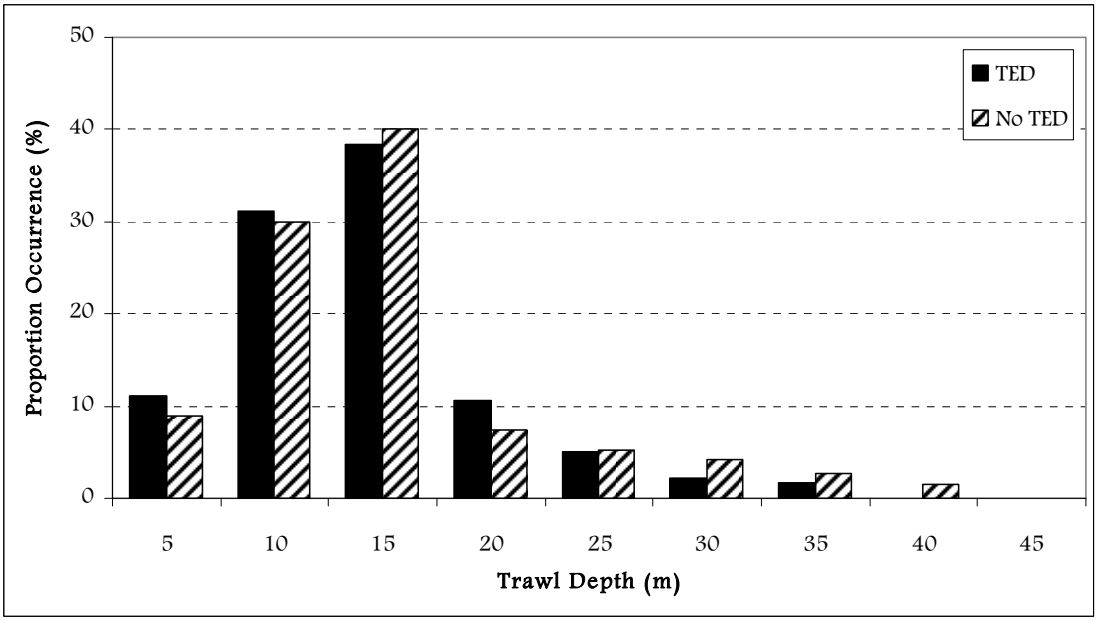

Fig. 3: Depths at which nets were set during trials on vessels operating with TEDs and those operating without TEDs. Most fishing (~70%) took place between 10m and 15m, with few tows made in deeper waters. Trawl depths did not differ substantially and were not believed to have affected catch or bycatch rates.

4.1.3 Trawl Duration

Trawl duration – the length of time each net was 'soaked' – was the only aspect of the fishing that varied to any notable extent, with trials using TEDs being slightly shorter than those operating without TEDs. An analysis of variance of the individual trawl patters concluded statistically that tows with TEDs lasted approximately 8 minutes shorter on average than those operating without TEDs ($ANOVA_{1,368}$: F=18.212, P=0). More trials with TEDs were found to last six hours than in trials without TEDs, but conversely more trials lasted five hours in trials without TEDs (**Figure 4**). Trials with TEDs lasted an average of 5.04 hours while those without TEDs lasted 5.43 hours. Overall however, these results are not believed to have had any substantial impact on the overall results of this project.

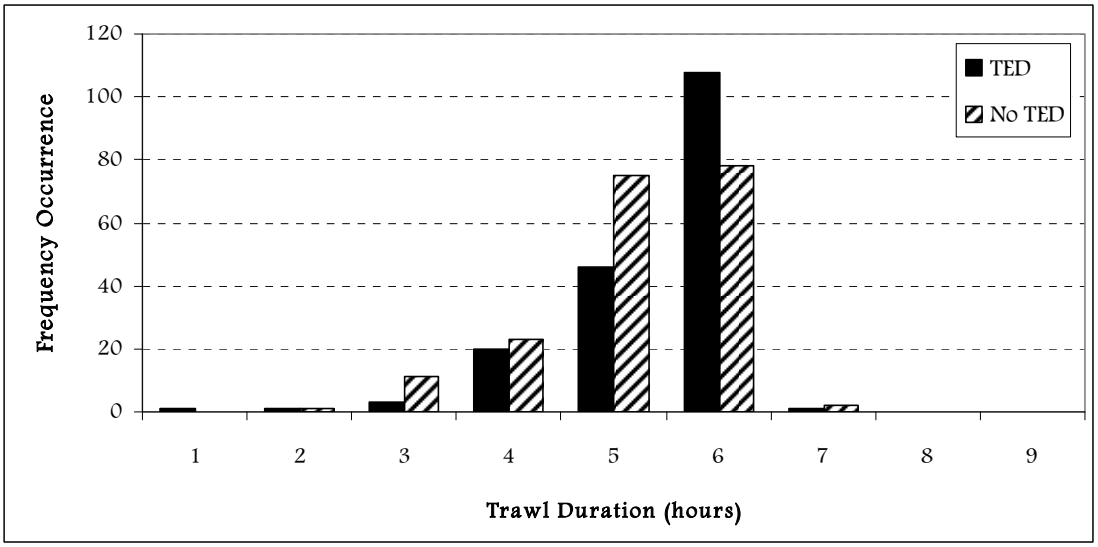

Fig. 4: Trawl durations in fishing trials on vessels operating with TEDs and those operating without TEDs. While the overall duration was significantly different (trials with TEDs were about 8 minutes shorter on average than trials without TEDs) they were not believed to have substantially impacted catch and bycatch results.

Trawl duration was, however, found to have more profound implications, irrespective of its impact on catch and bycatch *rates*. Simply put, these long trawl durations will undoubtedly drown any turtle they capture. Turtles are air-breathing reptiles, and able to hold their breaths for 1-2 hours under normal circumstances. Caught in fishing nets these abilities are compromised, and breath-holding drops to less than 1 hour. For this reason trawl durations are recommended to last < 1 hour to be turtle-friendly in TED-compliant nations.

In addition, in discussions with fishing vessel owners, the average trawl duration was believed to be around 2 hours, a drastic departure from the current findings. Whether this reduction in frequency of net deployments is intentional or accidental, it is clear that it can have a substantial impact on catches: Catch will not be in nearly as good a condition after 6 hours trapped in a net as it would be after only one or two hours. Turtles and cetaceans would simply drown. If fishing vessel owners and fishery authorities wanted to regulate trawl duration, some tamper-proof mechanical device would need to be devised to record winch activity, recording on a time-stamped data logger the times at which the nets were deployed and retrieved. This device would need to be downloaded by the fisheries authorities and copies of the data then shared with vessel owners.

4.1.4 Fishing Location

Where possible fishing vessels operated in pairs so that data would be comparable. However, it soon became apparent that the fishers selected similar places on each outing, with a significant degree of overlap, and it is suggested that there was little overall difference between the sites selected by fishers operating with TEDs (**Figure 5**) and those operating without TEDs (**Figure 6**).

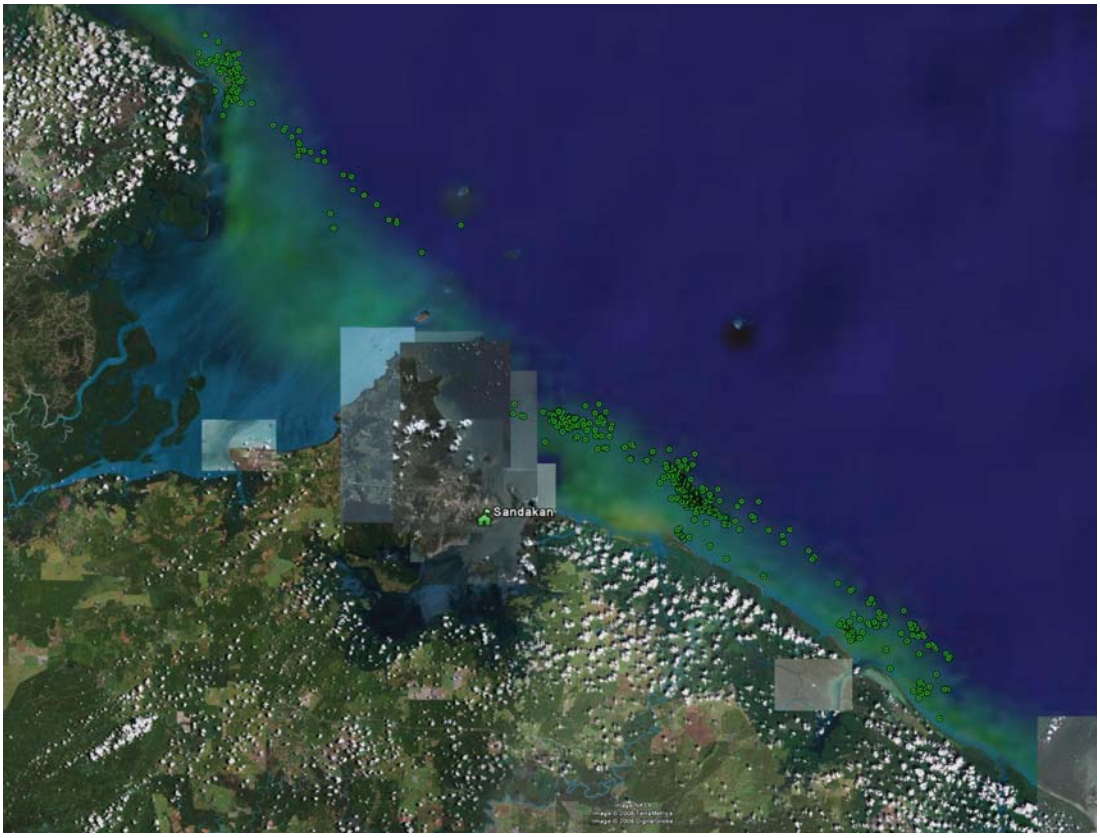

Fig. 5: Trawl locations for vessels operating with TEDs (green points), with the port of origin (Sandakan) near the centre of the graphic.

These fishing trials were conducted over an 18-month fishing period, with trials both in the monsoon and the non-monsoon seasons. There was a lack of geographical variation across both set of fishing trials, which showed concentrations of activity to the south off the mouths of the Sandakan bay and upper Kinabatangan river mouth, down to the lower Kinabatangan river mouth and as far as Kg. Tangau; and to the north of Sandakan as far as Kg. Gum Gum and Terusan. Interestingly, few among both groups of fishers elected to fish in the vicinity of the Turtle Islands Park, a marine protected area, as depicted by the dearth of points (both green in **Figure 5** and red in **Figure 6**).

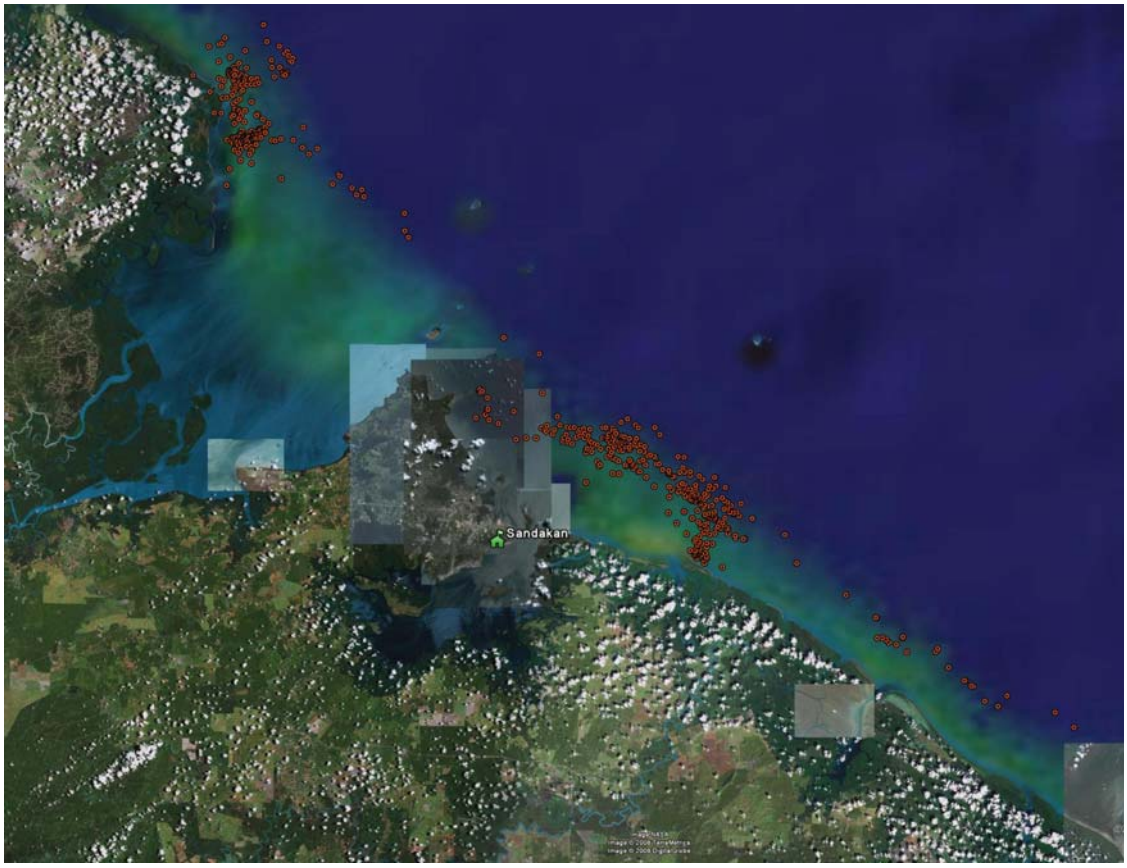

Fig. 6: Trawl locations for vessels operating without TEDs (red points), with the port of origin (Sandakan) near the centre of the graphic.

4.1.5 Conclusions – Fishing Comparisons

It appears that there was no significant variation in fishing behaviour through the use of TEDs, except for the slightly longer trials in vessels operating without TEDs (by only some 8 minutes over five and a half hours). Thus, so long as trials were conducted in a similar manner in similar places (invariably vessels operated in pairs and covered similar fishing grounds), the evaluations of catch composition and quality and bycatch and debris exclusion rates should be directly comparable with no introduced bias. It is a measure of credit to the fishers who participated in these trials, and the impartiality of the observers, that this is so.

4.2 Results – Catch Composition

Almost more importantly than any impacts on turtle bycatch are the impacts of gear changes on the catches themselves. While there has to be an acceptable level of variation in catches, also described as a 'cost' to fishing operations, to which fishers must subscribe as a consequence of gear modifications, if these 'costs' are

prohibitive there will never be buy-in and wide-scale acceptance. However, if TEDs can be shown to have little impact on fishing returns, while at the same time promoting marine conservation and more sustainable and responsible fisheries, then the opportunities for a TED-compliant fishery will be enhanced.

These initial trials have demonstrated that there is a minimal impact on catches through the use of Turtle Excluder Devices in the Sandakan shrimp trawl fishery, with no significant changes to catch quantity through the use of TEDs, which translates into a no-cost impact to fishers, except for the up front cost of then TED itself. Indeed, where catch quality was found to improve, likely though a reduction in debris accumulation in the net and a complete exclusion of marine turtles, there is the likelihood of a positive cost benefit to Sandakan shrimp trawl fishers through the use of TEDs.

4.2.1 Fish Catches

Fish catches were not found to differ significantly through the use of TEDs. Tows with TEDs caught an average of 15.4 kg per tow while those without TEDs caught an average of 16.8 kg. While graphically it may appear that there are slight differences (**Figure 7**), an analysis of variance of the individual catch rates concluded statistically this variation was not statistically significant ($ANOVA_{1,366}$: F=1.489, P=0.223).

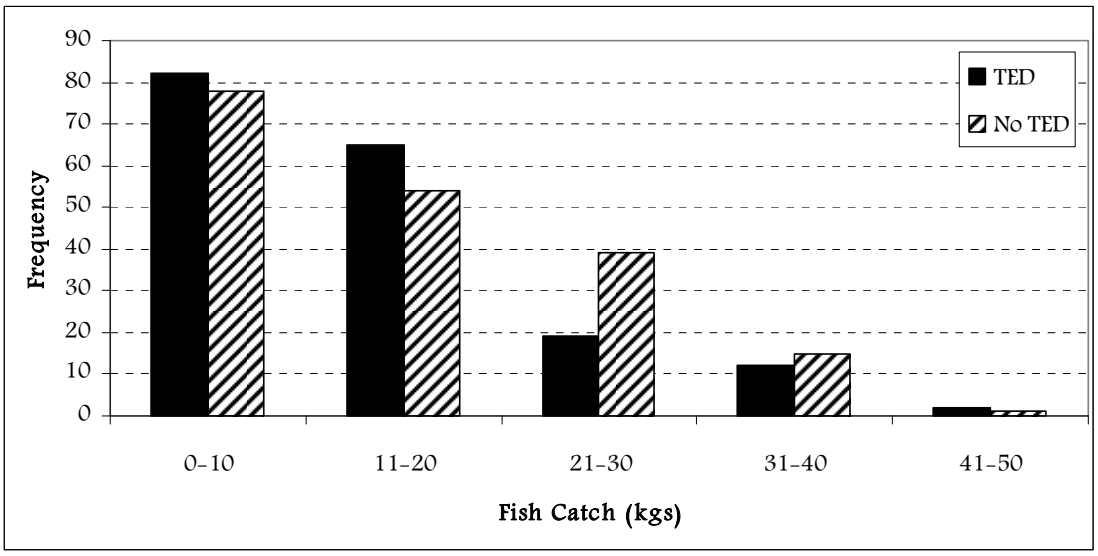

Fig. 7: Fish catches from fishing trials on vessels operating with TEDs and those operating without TEDs. Most catches were less than 20kg per haul, and in the two lower categories vessels operating with TEDs catch more than vessels operating without TEDs.

It is interesting to note that catch rates in excess of 20kg per tow were more frequent in vessels operating without TEDs than those operating with TEDs, possibly as a manifestation of the catches of larger fish. TED-compliant vessels simply did not catch large fish: Only one fish with a head greater than 10 cm wide (the size of the TED opening) was ever recorded from 180 trials using TEDs, while 132 fish with heads greater than 10 cm wide were recorded from 190 trials without TEDs, representing a loss of roughly 0.69 'large' fish per haul. However, when one takes into account overall fish catch statistics, there was no notable difference in catches, and thus revenue, amongst trials with and without TEDs.

Fish quality was slightly better in catches using TEDs than those without. Some 65% of catches using a TED were considered as category A, or high quality – based on determinations by crew members and upon landing in Sandakan (**Figure 8**). Conversely, only 12.6% of catches from vessels without TEDs were considered as category A, with the majority of catch reported as B quality (76.8%) from these vessels. The increase in the proportion of low grade (C) fish from TED vessels is presently unexplainable.

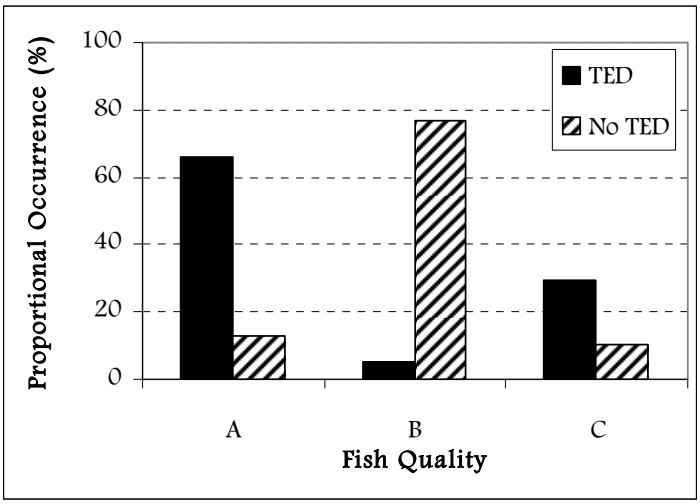

Fig. 8: Quality of fish catches from fishing trials on vessels operating with TEDs and those operating without TEDs. Vessels operating with TEDs caught more 'high quality' fish than did vessels operating without TEDs.

The principal difference in fish catches was noted in the size frequency of fishes. Vessels without TEDs caught a higher proportion of medium fishes, and vessels with TEDs did not catch large fish (**Figure 9**). While the groupings are subjective, they do

provide an indication of the impact of TEDs on the type / size of captures. It is likely that TEDs excluded any large sharks and rays. The increase in Mixed Small catches from vessels using TEDs was simply a reflection of the size limitations on captures. In a fishery which is directly shrimp-oriented this phase-shift to smaller fish would not be a cost issue, but there will obviously be cost issues in a mixed or fish-only fishery as the larger fish will likely fetch a higher price per kg. Further economic evaluation of these changes will be required in future phases of this programme.

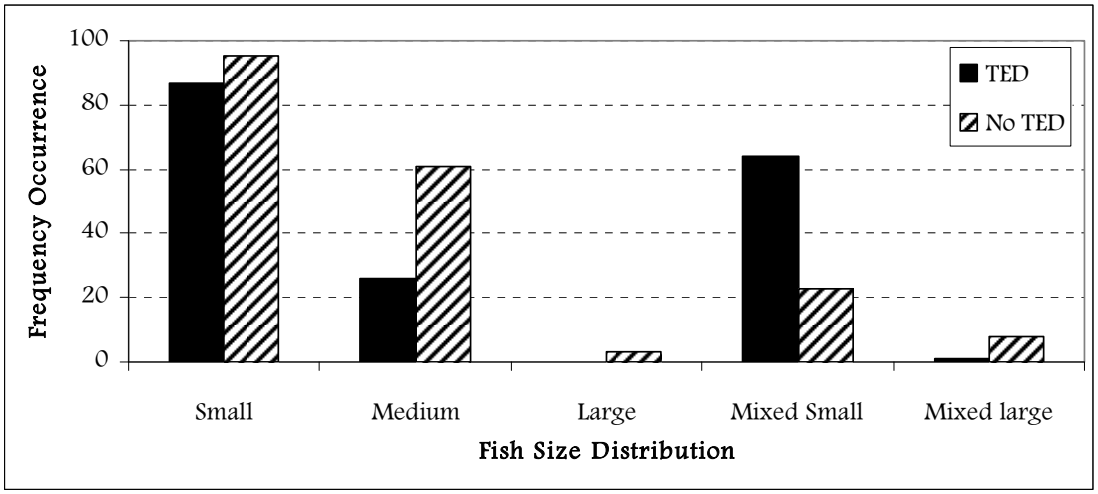

Fig. 9: Size composition of fish catches from fishing trials on vessels operating with TEDs and those operating without TEDs. Vessels operating with TEDs caught more large and medium fish than did vessels operating without TEDs, and while the overall volumes were not significantly different, it is likely there is a revenue reduction through TEDs via the limitation on catching large fish.

4.2.2 Shrimp Catches

As in the case of fish catches, the catches of shrimp were also not found to differ significantly through the use of TEDs. Tows with TEDs caught an average of 15.4 kg per tow while those without TEDs caught an average of 16.6 kg. Overriding slight variances in catch rates from individual trials (**Figure 10**), an analysis of variance of the individual catch rates concluded statistically this variation was not statistically significant ($ANOVA_{1,366}$: F=0.044, P=0.832).

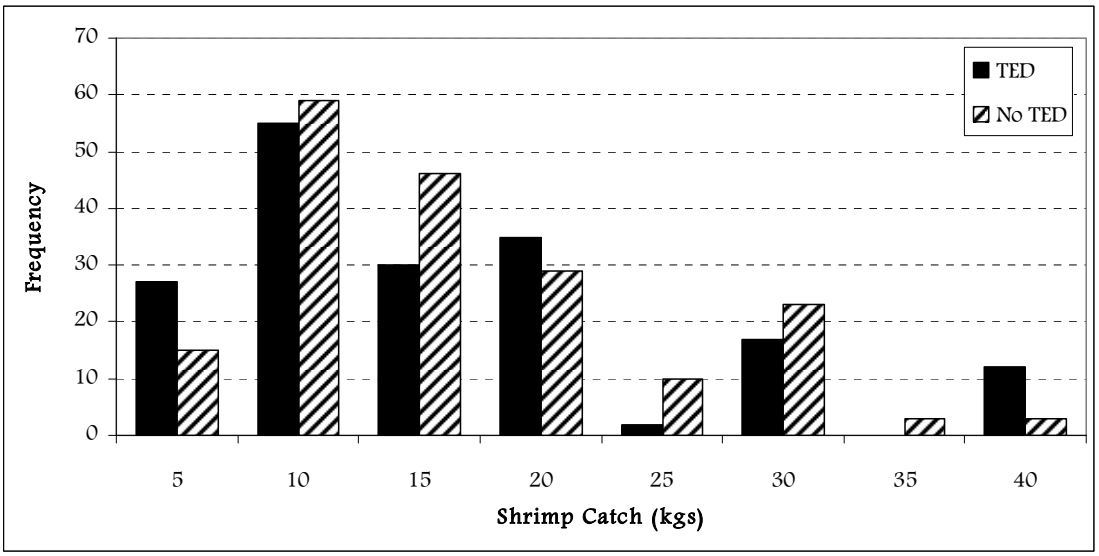

Fig. 10: Shrimp catches from fishing trials on vessels operating with TEDs and those operating without TEDs. Most shrimp catches were between 10kg and 20kg per haul, and although the catches varied slightly, there was no significant overall differences in shrimp catches amongst vessels operating with TEDs and those operating without.

There was no significant difference in shrimp quality between catches using TEDs and than those without TEDs (**Figure 11**). These results deviate from original theories whereby shrimp qualities would improve through the use of TEDs, and indeed this may be proven with a greater data set. However, the important point to note is that there was *no reduction* was recorded in quality through the use of TEDs, which coupled with the lack of any significant differences in catch quantities, indicates that there was no significant negative cost effect of TED use, or loss of catch through the TED escape opening. As addressed earlier and as important here, the economic profiling of the impacts to industry will need a careful review in future phases of this project in order to ensure that fishers are not unduly impacted through the implementation of TEDs across the fishery. However, of similar importance, is the assurance that marine turtles and other key marine taxa will not be detrimentally impacted by vessels operating without TEDs.

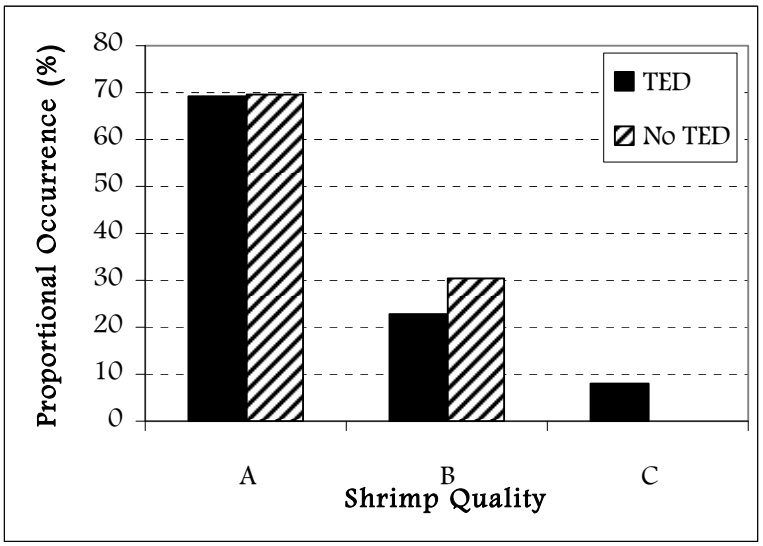

Fig. 11: Quality of shrimp catches from fishing trials on vessels operating with TEDs and those operating without TEDs. Vessels operating with TEDs caught a slightly higher proportion of low grade shrimp, but overall there were no significant differences amongst vessels operating with or without TEDs.

Similarly, there was no major difference in size composition (**Figure 12**). Most shrimp were classified as Medium, in both trials with TEDs and those without. The remainder of variances in size composition represented less than 3% of total catches – that is, the slight increase in Small and Mixed Small shrimp from TED trials was offset by the increase in Medium and Mixed Large shrimp in non-TED trials, but that these variances accounted for less than 3% of total catches.

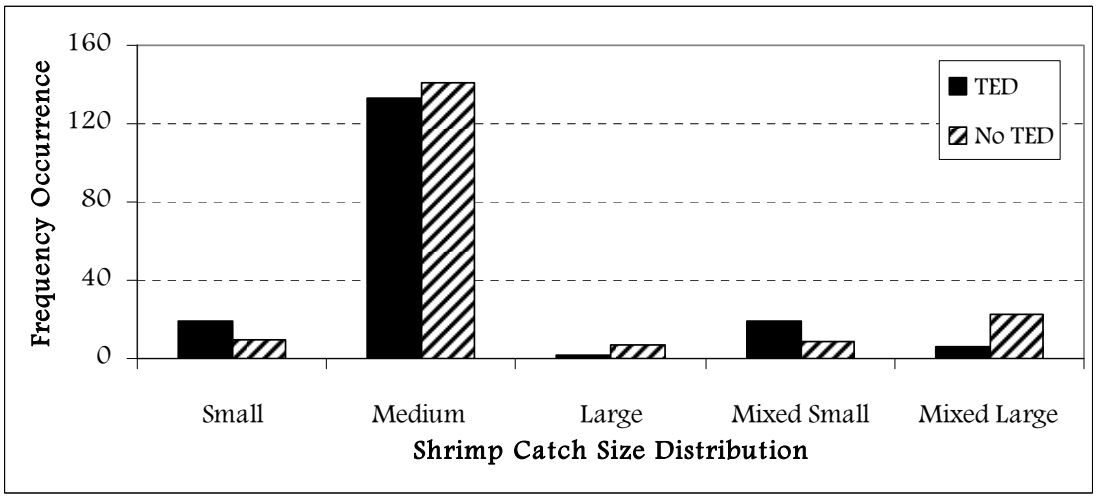

Fig. 12: Distribution of size composition in shrimp catches from fishing trials on vessels operating with TEDs and those operating without TEDs. Overall there were no significant differences amongst vessels operating with or without TEDs.

4.2.3 Conclusions – Catch Composition and Quality

Overall then, there appeared to be no significant differences in catch composition or quality between vessels operating with TEDs and those operating without, except for the loss of catches of large fish, which were caught at a rate of some 0.65 fish per haul. While this loss of large fish is a direct 'cost' to the fishers due to the introduction of TEDs, there are various potential offsets to this, be it through the increase in quality of fish (**Figure 8**, above) or the reduction in bycatch and debris (see sections below). It is acknowledged that this programme has only investigated the at-sea component of this fishery, and an assessment of the overall economic impacts of TED introductions is recommended as a critical future component of this programme.

4.3 Results - Bycatch

Bycatch of turtles was infrequent, but sufficient to warrant concern. Four turtles were recorded as bycatch in this study, with all of them being taken in vessels operating without TEDs. Three of the four turtles were dead when the nets were hauled, while one was semi-comatose. They were all returned immediately, even the semi-comatose, one, even though instructions had been provided on possible care practices. There was no significant bias in geographical distribution, with two being caught in the southern fishery grounds and two more in the northern fishery grounds (**Figure 13**).

However, bycatch rates of turtles need to be considered in the larger context of the entire fishery, rather than simply the boats operated during these trials. When one considers an annual fishery strength of some 500 vessels (there are over 1000 registered, but not all are active at one time), operating for some four to five months of the year – or some 150 fishing days (during the non-monsoon period) at four trials per day, this roughly translates into some 30,000 annual fishing events, and up to a potential 325 turtles per annum in bycatch.

Given that many of the 'green' trials occurred during the initial stages, when the vessel captains were purposefully heading away from the main turtle areas, and given the restrictive number of trials, it is believed these rates are an underestimate of overall potential turtle take.

A dolphin was also captured on a vessel operating without a TED.

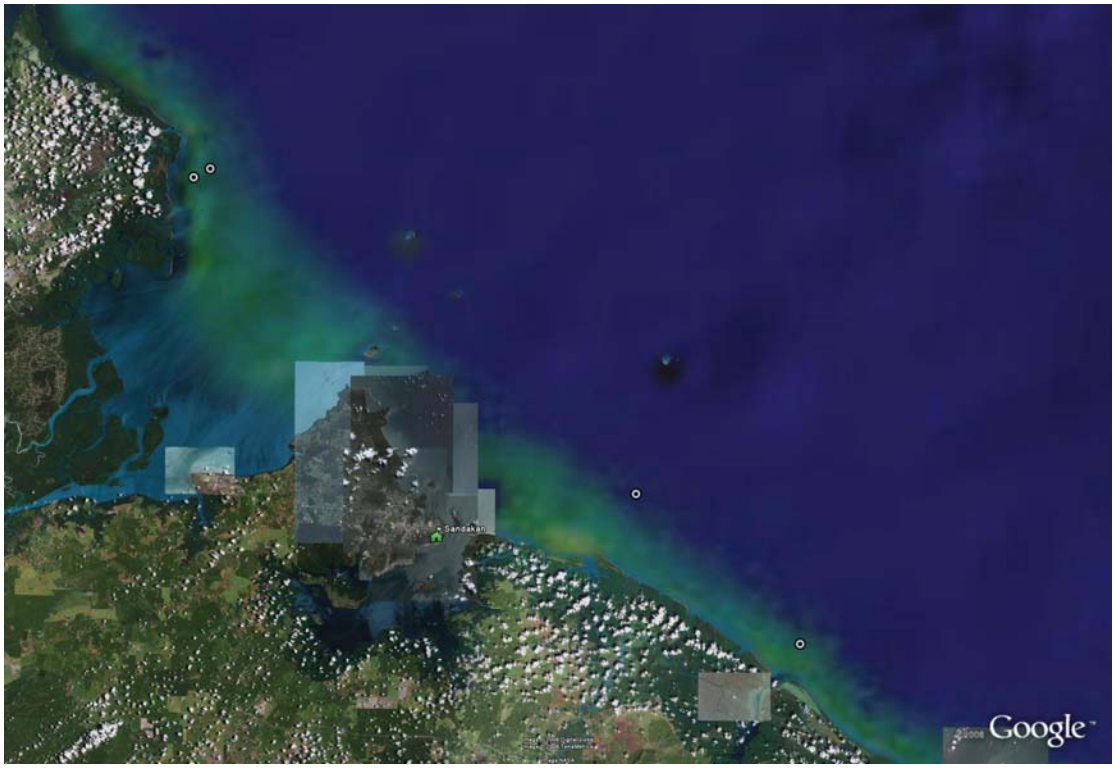

Fig. 13: Locations of turtle encounters (white circles), all of which resulted in the death of the turtle, on vessels operating without TEDs.

4.4 Results - Debris

TEDs were found to affect debris collection significantly, with those nets fishing with TEDs recording only 26 pieces of debris in 23 out of 180 trials, while vessels operating without TEDs recorded 1148 pieces of debris in 175 out of 190 trials (**Figure 14**). This reduction in debris in the nets represents a substantial impact to fishing efforts through a reduction in fuel (less power required to tow the net through the water) and a potential increase in catch value through reductions in physical damage.

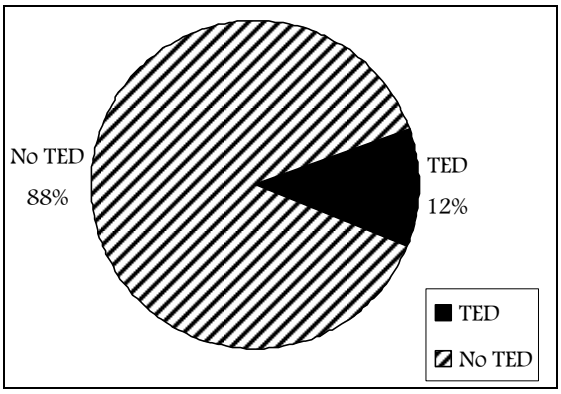

Fig. 14: Proportion of fishing trials which collected unwanted debris.

The amount of debris was also related to location of fishing operations, with those tows conducted close to the river mouth returning higher amounts of debris than those from fishing areas offshore. Debris was mostly wood and coconuts, with some nets and larger logs also recorded (**Figure 15**).

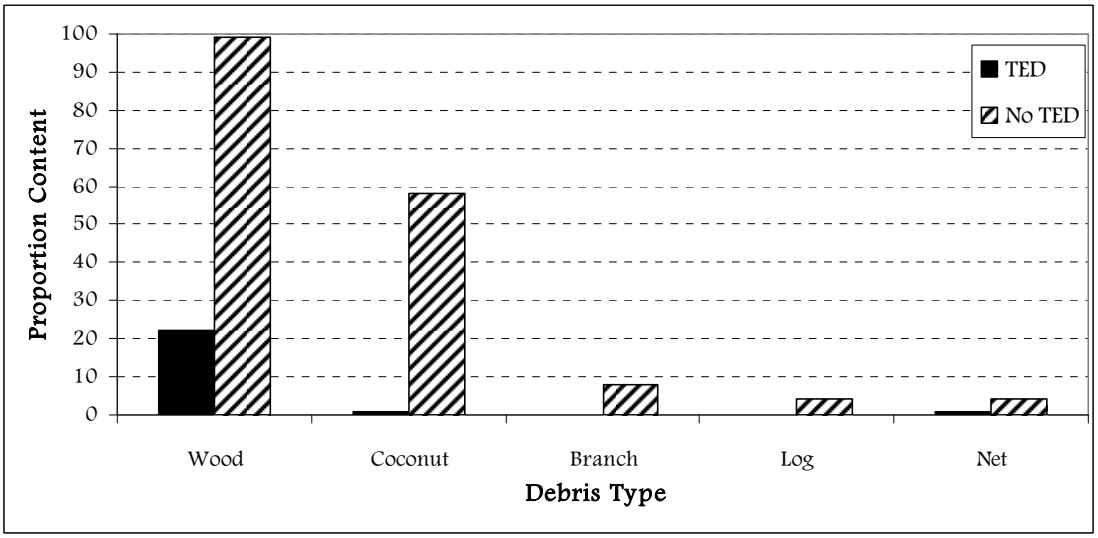

Fig. 15: Composition of debris from vessels operating with TEDs compared with those operating without TEDs. It is apparent that the TEDs served well as '*Trash Eliminating Devices*' as well as performing their role excluding turtles.

In addition, two other key issues related to debris were recorded. It was found that the TED grids themselves were not often clogged with any debris (**Figure 16**), even though a common complaint was the clogging of the TED. Similarly, the trapdoors in the net which cover the opening were also not often found clogged or 'propped open' which would allow a disproportionate amount of catch loss (**Figure 17**). Both of these aspects suggest the TEDs were working relatively normally, even given the debris-rich seabeds over which the fishing trials were conducted.

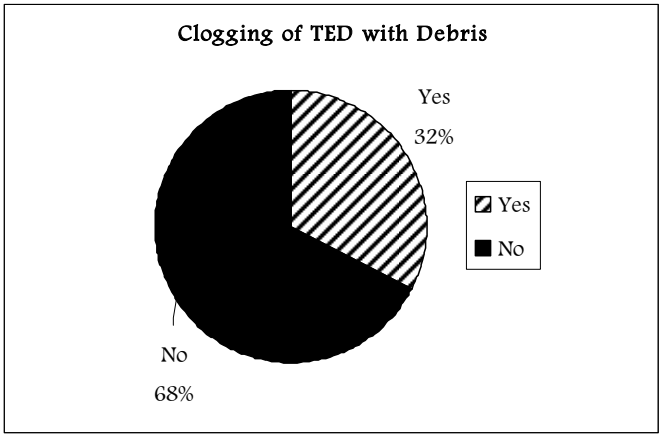

Fig. 16: Proportion of fishing trials using TEDs which were found to be clogged by debris, impeding the passage of catch into the cod end of the net.

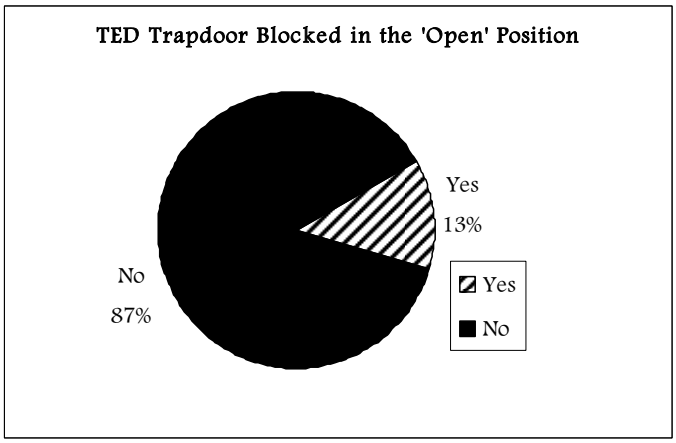

Fig. 17: Proportion of fishing trials using TEDs in which the trapdoors were found to be propped open through clogging with debris, leaving an opening through which catch could be lost.

5.0 TED Pilot Project Implementation – Discussion

The following points address the socio-economic impacts and issues of the project and the potential conversion to a TED-compliant fishery. While not 'statistically definitive', these insights reveal the complexities of the programme and the challenges which lie ahead. At the same time the results reflect the wonderful support the project has received to date from fishing crews in Sandakan, particularly from Hai Leng Enterprises, the Government sector in the form of the Sabah Fisheries Department, and also from the main donor institution, the Malaysian GEF Small Grants Programme.

5.1 Bottom Line – The effectiveness of TEDs and the (lack of) impacts on catch and bycatch

Overall the impact of TEDs on catches was negligible, or not statistically significant, for both fish and shrimp, with the exception that TED-equipped vessels did not catch large fish (heads wider than 10 cm – or the width of the gap in the TED grill). The catch composition (what the vessels were actually catching) did not differ substantially amongst vessels operating with a TED and the vessels without a TED (**Figure 18**). Vessels without a TED recorded a high level of 'Mostly Fish' in their catch, and there were similar catches of 'Fish & Shrimp' amongst both vessel groups. Trawl nets with a TED installed continued to demonstrate a similarly high catch of shrimp when compared with non-TED trawlers, indicating the TEDs did not influence the actual composition of the catch, something which fishermen were particularly worried about initially.

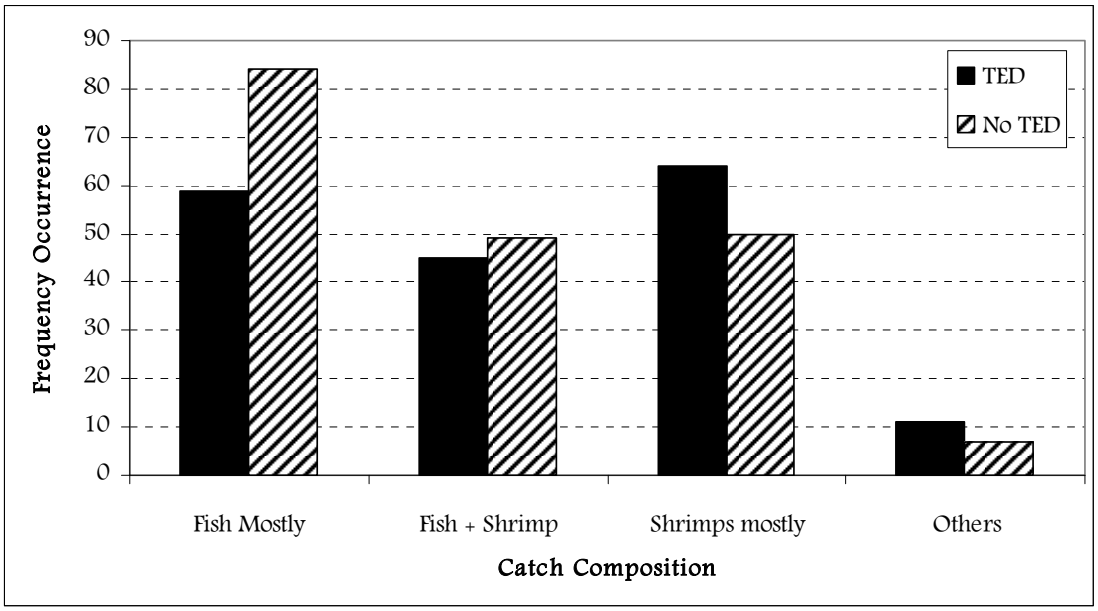

Fig. 18: Catch composition from fishing trials on vessels using TEDs and those without. There were no major changes in catch composition – vessels without TEDs caught more fish and vessels with TEDs caught more shrimp, but not substantially so – suggesting a minimal impact of TEDs on catches in the Sandakan shrimp trawl fishery.

5.2 Bottom Line – The potential impact of the Sandakan fishery on marine turtles

The Turtle Excluder Device was designed to do just as the name implies – exclude turtles from the net – and this it did in the Sandakan shrimp trawl fishery to perfection. While the overall number of turtles was not high, much of this was

attributed to fishing location and timing of the surveys. Interviews earlier in 2007 with many of the local fishermen revealed that turtles were taken in a more constant manner than that revealed in this survey. When one considers the total potential take of turtles in a year, some 300 turtles, or 20% of the current annual nesting numbers at the nearby Turtle Islands Park, this is a worrisome trend.

However, it is heartening to find that the take levels were as low as they were. Original fears were that bycatch rates would be up to a turtle a day, and the Sandakan fishery never even came close. While bycatch is thus a significant problem, it appears it is one which can be solved through improved fishery practices and the use of TEDs.

5.3 Fisher Acceptance – Preconceived ideas on impacts to catch

The initial phases of the project received great support from the fishers of Sandakan following the briefings and demonstrations given by the NOAA/NMFS specialist. The observers were welcomed with open arms to be part of the crews on vessels designated for use in project. Most of the crewmen, with poor education backgrounds and originating from mainly from Indonesia and the Philippines, had never been in close contact with researchers or the scientific community in any manner prior to this programme. Indeed, being a part of a global marine conservation programme appeared to make them rather enthusiastic.

The observers had many chances to share aspects of turtle biology with the crews, and they likewise had ample opportunity to share fishing experience with the observers.

As the project progressed to trials with the first set of TEDs, which resulted in significant drops in catches, drastically reducing catches, the fisherfolks started raising their concerns on the effect of TED use on their livelihood. This is worthy of note, given the pay scale these fishers are under – primarily a catch-based bonus

system. Thus, when catches drop, incomes drop, not so much to owners, who may receive increased revenue through higher quality products, but to the actual fishers out on vessels, who are the ones who will need to implement the programme. The defect was rectified following a site visit by Dr. Pilcher, who ordered the manufacture of new TEDs in Kota Kinabalu as replacements. However, this replacement did not gain the trust of the fishing community immediately, and it has been a gradual process to bring them back on board. The overall acceptance will come when TEDs are not seen to affect fishers' livelihoods, which depend mainly on the volume of catch per trip.

The effects of the TED programme in Sandakan have brought about benefits over and above those of reducing bycatch however, and these are worth of note: This project has become a vital link in promoting Government, NGO and private sector working agreements in the fisheries realm (Sabah Department of Fisheries, MRF and Sandakan fishermen), and has helped promote integration among enforcement agencies such as the Sabah Fisheries Department, the Sabah Fishing Boat Owners Associations, the scientific community (budding marine researchers in the form of UMS industrial training interns) and most importantly, the fisherfolks themselves.

It is important to note that the fishers believe catches differ when TEDs are used, yet the statistical analysis of the results of this project do not support their conclusions. Final analysis and clear presentation of the results of this project to the boat owners and the fishermen themselves are expected to prove informative and a key requirement in the design of future phases of this project.

In the interim however, we believe we have strongly demonstrated TEDs can be used in Sabah fisheries, that they do not result in a significant reduction in catch, and that the fishing community is open and willing to consider change for the benefit of preserving marine biodiversity, and that Government, NGO and private sector

linkages are likely the way forward in reducing bycatch and improving livelihoods. We are grateful for the continued support by the GEF SGP Malaysia programme which enables these important efforts to progress.

5.4 Fisher Acceptance – Financial issues

As alluded to above, financial issues will play a great role in the uptake of TED technology in Sabah. Salaries for fishermen range in the low hundred of Malaysian ringgit per month, with the balance consisting of bonuses based on catch value. If catches drop, so does income. Thus it is unlikely that the actual fishers on board, who are not themselves the owners of the vessels and are likely unaware of the longer-term impacts of unsustainable fishing practices, will lead the way in voluntary self-control in the face of reduced earning power. If, however, it can be demonstrated that TEDs do not have a significant impact on catch, while at the same time enabling the conservation of legally protected species in Malaysia, then a glimmer of hope exists for the industry. This will also depend largely on the wide-scale acceptance by a wider community of fishing boat owners, and their commitment to maintaining staff salaries even with the potential marginal impacts of TEDs on catches (particularly related to catches of large fish).

A second major finance issue is the up-front cost of the TEDs themselves – currently in the region of RM 500 each, including the aluminium TED grill and the net insert, and labour. For as long as this programme runs on a trial basis, the project funds can cover the costs of TEDs, but once the fishery starts embracing the technology, there will be a massive upscaling in the funding required to convert the fishery to TED-compliance.

5.5 Lessons Learnt - Issues with the old design TED

The original prototype Sabah TED 1.0 proved to have longer-ranging impacts on fisher acceptance than the mere fact the sewing of the grill into the net was incorrect.

When crews on the vessels found the net twisted and clogged each time it was retrieved, they were generally disheartened with the idea of using TEDs regularly. Even after remedying the problems, this feeling persisted and was only slowly being broken down towards the end of the trials. The shift from stainless steel to aluminium for the grids played a key role, as the aluminium was lighter and floats were not required on the TED, but overall the level of acceptance was not as high as one would have liked. Hind-sight, goes the old adage, is that of clear vision, but this manufacturing defect was not anticipated and the project did well to recover from it when it did and more on with the correct fixes. The new, improved Sabah TED 2.0 was made under close supervision, and the materials checked frequently for compliance with US-standards.

5.6 Lessons Learnt – Observer availability

One of the key unanticipated problems with the programme was the lack of availability of willing observers. Original salaries were budgeted too low, and finding willing bodies to put on vessels which stayed at sea for five to six days at a time was problematic. In the end the project was able to rely on interns from Universiti Malaysia Sabah, who had applied to MRF as interns for their Industrial Training module. In more developed fisheries, a professional observer programme is required, and this is no less the case for Sabah. An ultimate goal for the Sabah Fisheries Department should be the availability of a team of observers who are trained to evaluate fishery practices and bycatch in a suite of fishery types. For the immediate future, MRF plans to budget more for observers and be more realistic about how many can be employed at any given time.

5.7 Lessons Learnt – The need to recruit a larger audience

Finally, the issue of wider-scale acceptance within the Sandakan fishery needs address. The project worked well with one company, Hai Leng Enterprise, which provided vessels willingly and pretty much on demand. Had it not been for Hai Leng and the vision of their Managing Director, Mr. Chua, the project would have fallen short of its goals. While several other companies participated occasionally, this was

not felt sufficient to provide wide-scale exposure to the use and impact of TEDs. During future phases of this project MRF aims to engage with a wider audience and 'spread the word' with regard to the impacts (or lack thereof) or TEDs on fishing catches and their positive impacts on bycatch and debris reduction. If nothing else, the reduction in debris and the lower net maintenance and fuel costs should be an incentive to trial TEDs more thoroughly.

MRF, Sabah Fisheries Department and the fishers themselves all agreed at the start of the programme that we would work quietly towards solving bycatch issues in Sabah, without the need for undue negative exposure through the press. Where activities have been highlighted over this project period, they have been in a positive light and encouraging. It is expected that this positive approach to solving issues will lead to greater rewards in the later phases of this programme. Press coverage of the TED project can be found in Annex II.

6.0 Moving Forward

This project is the start of a much more encompassing programme, with a final goal of reducing to a minimal level any forms of bycatch of valuable marine species, coupled with an improvement in the livelihoods of fishers in Sabah through increased rewards from fishing activities. The project does not aim to stop fishing – indeed it tried to work on solution-seeking in partnership with the fishers themselves – but it does aim to lead a shift towards more sustainable fisheries.

Short-term pilot projects such as the work presented here are but the start of a complex programme. The project never envisioned solving the fishery issues overnight. Rome, as is said, was not built in a day, even the world took a little longer. Similarly, changing well-entrenched fishing activities, behaviour and understanding on the part of the fishers, and more proactive self-regulation and management activities will take time. MRF envisions a State where fishers livelihoods improve as part of more holistic marine conservation regimes.

For this reason the project can not be seen as only a project. It needs to be seen as a component of a longer-term programme to address not only trawl fisheries, but long-lining, gillnet and purse seine fisheries also. It needs to address observer programmes, the latest technological innovations – such as circle hooks in long-line fisheries rather than J hooks, complete buy-in and partnerships with fishing associations, financial issues and crew remuneration, and full-hearted Government support. Understanding that not all of this will happen overnight is also part of the process, and thus MRF envisions a second phase of this programme built around three core themes: Continuance, Expansion, and Upscaling.

6.1 Continuance

The experiences of this pilot programme can not be left to fade away. The project needs to continue in Sandakan, with a wider stakeholder involvement, to lead to wider acceptance. Only a continuous series of trials and self-evaluation will allow fisher buy-in.

6.2 Expansion

The fishery does not operate out of one port alone. At least four major ports and a suite of secondary ports support shrimp trawl fisheries. It is proposed that at least one additional major port needs to be brought into the programme, and initial inroads were already made during the course of this project with fishers from Kudat. There appears to be great enthusiasm for trials in Kudat, and a potential source of observers through a Youth Programme developed by WWF.

6.3 Upscaling

Finally, the project can not operate in isolation of wider National interests and policies. While small-scale trials serve to educate at a local level, the buy-in from the Federal Government and other State Governments will lead to a National fishery improvement process, which addresses not only marine conservation and sustainable fisheries, but also the livelihoods of the fishers themselves. Thus part of the next phase for this project has to be the wider inclusion of the Federal Government and regional fishery agencies such as the Southeast Asian Fisheries Development Centre (SEAFDEC) in the programme.

Annex I: Standard Observer Data Sheet

MARINE RESEARCH FOUNDATION

Trawl Fishery Target and Non-Target Catch Report

Data Recorder Name: _____ Port of Embarkation: _____

Date: _____ Vessel Length (m): _____ Vessel Registration: _____

Individual Trawl Tow Data (one sheet to be filled out for each trawl)

Time net set: (24 h format) ____ : ____ GPS location In: _____ N _____ E

Time net pulled (24 h format): ____ : ____ GPS Location Mid: _____ N _____ E

Total trawl duration: _____ (hours) GPS Location Out: _____ N _____ E

Trawl Pattern Straight ☐ Curved ☐ Zigzag ☐ Other (describe): _____

TED installed? Yes ☐ No ☐ Trawl Depth (m): _____ _____

Individual Trawl Catch Data

Composition (tick one): Mostly fish ☐ Even amounts fish and shrimp ☐ Mostly shrimp ☐

Other ☐ Describe: _____

Quantity of **Fish** Amount: _____ Measured in Baskets? ☐ or Kg? ☐

Proportion of total fish catch: 0-10% ☐ 11-25% ☐ 26-50% ☐ 51-75% ☐ 76-100% ☐

Major fish type name: _____ Other fish catch (list types): _____

Fish quality: A ☐ B ☐ C ☐

Average fish size: Small ☐ Medium ☐ Large ☐ Mixed (small) ☐ Mixed (large) ☐

Number of fish with heads > 10 cm _____

Quantity of **Shrimp** Amount: _____ Measured in Baskets? ☐ or Kg? ☐

Proportion of total shrimp catch: 0-10% ☐ 11-25% ☐ 26-50% ☐ 51-75% ☐ 76-100% ☐

Major shrimp type name: _____ Other shrimp catch (list types): _____

Shrimp quality: A ☐ B ☐ C ☐

Average shrimp size: Small ☐ Medium ☐ Large ☐ Mixed (small) ☐ Mixed (large) ☐

Quantity of **Squid** Amount: _____ Measured in Baskets? ☐ or Kg? ☐

Proportion of total squid catch: 0-10% ☐ 11-25% ☐ 26-50% ☐ 51-75% ☐ 76-100% ☐

Major squid type name: _____ Other squid catch (list types): _____

Squid quality: A ☐ B ☐ C ☐

Average squid size: Small ☐ Medium ☐ Large ☐ Mixed (small) ☐ Mixed (large) ☐

Quantity of **Other** Amount: _____ Measured in Baskets? ☐ or Kg? ☐

Proportion of total catch: 0-10% ☐ 11-25% ☐ 26-50% ☐ 51-75% ☐ 76-100% ☐

Individual Trawl Bycatch Data

Composition: Mostly fish ☐ Fish and invertebrates ☐ Mostly invertebrates ☐ Wood / Others ☐

Fate: Discarded ☐ Kept ☐

Number and type of pieces of debris > 10 cm (wood, coconuts, etc): _____

Was TED clogged? Yes ☐ No ☐ Was trapdoor blocked and open? Yes ☐ No ☐

Number of turtles: _____ Condition of turtle(s): Dead ☐ Near-dead ☐ Alive and healthy ☐

Species: Green ☐ Hawksbill ☐ Other (describe): _____

Turtle length (cm): _____ Tag Number (if any): _____

Fate of turtle(s): Released ☐ Kept ☐ Eaten: ☐

Condition of turtle(s) at release: Dead ☐ Near-dead ☐ Alive and healthy ☐

Other major bycatch: Dugong _____ Dolphin _____ Other (describe): _____

Notes:

Annex II: Project Press Coverage

Sabah shrimps may hit US market

US to issue license to Sabah if turtles catching stopped

By James Leong

SANDAKAN: The fishing industry in Sabah looks set to penetrate the United States market if the US Government provides the license for shrimps from Sabah to be exported into that country.

This will however has to depend on the outcome of the project to develop ecologically friendly fishing methods, in particular aimed at helping save endangered sea turtles which is expected to commence in the middle of next month.

The Marine Research Foundation, a non-profit agency based in Kota Kinabalu, in partnership with the Sabah Fisheries Department, has joined hands with the Sandakan Tongkang Fishing Association and Hai Leng Enterprise Sdn Bhd to undertake the two-month trial project which is being funded by the Small Grants Programme (Malaysia) of the Global Environment Facility.

The project is to develop fishing methods to improve the sustainable livelihood of fishermen and at the same time conserve marine biodiversity through the reduction of sea turtle catching off Sandakan.

There is a huge demand for shrimps in the US and the lucrative American market is worth multi-million US dollar annually.

At present Malaysian shrimps cannot be exported to the US because the authorities there are saying Malaysian fishermen are not meeting certain of their requirements.

In 1999 the US authorities wanted all countries that export shrimps to that country, including Malaysia, to use the Turtle Excluder Devices (TEDs) on trawlers.

"However, the US Government is willing to consider licensing only Sabah if we can convince them we are not catching sea turtles," Dr Nicolas J. Pilcher told reporters after his meeting with representatives of the Sandakan Tongkang Fishing Association and Hai Leng Enterprise Sdn Bhd on Wednesday night.

"I have been in discussions with the US authorities. If the Sabah fishing industry players can pass the study and I have the scientific data to prove it, then they are willing to certify only Sabah rather than the whole of Malaysia," he said.

Dr Nicolas explained this is because so far only Sabah was taking the initiatives while the other States in Malaysia were not doing this.

"We are going to do a demonstration project probably in the middle of May. A representative from the US Fisheries Agency will come here to assist the fishing boat owners to learn how to install this unit," Dr Nicolas said.

According to him, the project has two key objectives: firstly, to determine if commercial fishing boats operating in the general vicinity of the world-renowned Turtle Island Parks are accidentally impacting marine turtles and to try out the use of TEDs to reduce the loss of marine biodiversity, especially of the green turtle Chelonia mydas, listed as endangered by the World Conservation Union.

President of the Sabah Fishing Boat Owners Association, Simon Hong, commented

"All in all, it is a win-win arrangement, helping preserve the livelihood of Sabah fishermen while at the same time saving the valuable marine heritage.

Rooney Biusing, the Principal Assistant Director of State Fisheries Department (Aquaculture), also concluded it would be a win-win situation if the project proved to be a success.

He said the project is the first of its kind to work hand in hand with his department as a first step in determining the level of by-catch and the opportunities for introducing of TEDs on a voluntary basis.

"The State Fisheries Department is willing to look into ways and means to help subsidize the cost of installing the TED," he added.

Also present at the meeting were Markus Ruf, Research Assistant; Sheak Chee Chiew, chairman of Sandakan Tongkang Fishing Association and Chua Yau Tsen, Managing Director of Hai Leng Enterprise Sdn Bhd.

Project success depends on fishing communities

SANDAKAN: Marine Research Foundation Executive Director Dr Nicolas J Pilcher said the success of the project to develop ecologically friendly fishing methods relies and depends heavily on the active participation and involvement of the local fishing communities.

"In many parts of the world, fishing fleets have resisted the introduction of Turtle Excluder Devices (TEDs) simply out of the belief that the TEDs would limit their ability to fish," he said.

"Nothing could be further from the truth. With responsible fishing comes the preservation of our marine environment, and who better to help look after it than the people who depend on it for their very livelihood," he added.

The project which is expected to commence in the middle of May, came about following joint discussions among the Sabah Fisheries Director and Dr Nicolas, a long-time conservationist of marine turtles in the region and co-chair of the IUCN Marine Turtle Specialist Group.

TEDs allow fishermen to continue to catch their target species, fish or shrimps, while excluding the endangered turtles. They work by installing a grill in the narrow section of the trawl net that allows the target catch to pass through into the net but stop the turtles and shoots them out through a special opening.

Turtles are particularly susceptible to drowning in nets because they are reptiles, and have to rise frequently to the surface to breathe.

Enlisting the help of Simon Hong, the team established links with Sandakan-based Sheak Chee Chiew and Chua Yau Tsen. These links will prove vital to the success of the project, which will carry on board observers to assist with training and recording of catches for scientific analysis.

The Marine Research Foundation is a non-profit agency, working in the forefront of marine conservation activities in the Indo-Pacific region, with numerous projects ranging from protecting the giant leatherback turtles in Papua New Guinea to studying the thousands of turtles nesting on the shores of Oman, in the Middle East.

Device helps the turtles to escape

SC Tam

SANDAKAN: The used of the Turtle Excluder Devices (TEDs) can help reduce the loss of marine turtles, especially the green turtle (Chelonia mydas), which is listed as endangered by the World Conservation Union (IUCN).

The TEDs project is carried out jointly by the Marine Research Foundation (MRF), Sabah Fisheries Department, Sandakan Tongkang Fishing Association (STFA) and Hai Leng Enterprise while the funding is under the Small Grants Programme of the Global Environment Facility.

Marine turtle conservationist and MRF director, Dr. Nicholas Pilcher said that the project was aimed at developing an ecologically friendly fishing method and will help reduce the chances of turtles being netted accidentally.

This is because the device has a special opening for turtles to escape if netted, he said adding that turtles are particularly susceptible to drowning in nets as it needed to rise frequently to the surface to breath.

However, the success of the project depends heavily on the involvement of the local fishing industry and the response so far has been encouraging, he said.

He further said that in many parts of the world, fishing fleets have resisted the introduction of TEDs as they believed it limited their ability to fish.

Sabah Fisheries Department deputy director, Rooney Biusing said the project would be introducing TEDs on a voluntary basis.

THE BORNEO POST HOME

Boost to turtle conservation

Turtle Excluder Device helps trapped turtles to escape from trawl net

SANDAKAN: The Turtle Excluder Device (TED) is finally being brought to Malaysia and this initiative is founded by the joint venture of the Marine Research Foundation and the Sabah Fisheries Department, with full support from the Sandakan Fishing and Tongkang Association.

The project included the introduction of TED to the fishermen, the demonstration of the installation method, as well as a trial out in the waters off Sandakan for three days which ended Tuesday.

The basic concept of TED is to enable trapped turtles to escape from the trawl net. Lately turtle population has been dwindling with the intensity of trawling activities.

However, it is very fortunate for Sandakan as it still records approximately 5,000 Green turtles in its waters. These turtles play a vital role in balancing the food chain of the marine environment. They also promote the health of the ocean by grazing on the sea grass beds, providing a good habitat for fishes.

Therefore, it is important to conserve the turtles as a way to sustain the fisheries. Additionally, it helps to boost the local tourism as tourists from all over the world flock to the country to have a glimpse of these amazing creatures.

From the economic viewpoint, the TED will increase the quality and quantity of catch. Some of the fishermen are skeptical about the loss of catch following the use of TED.

However, according to David Barnhart of the National Marine Fisheries of the United States, only less than one per cent of reduction in shrimp catch is recorded in all the trial programmes performed throughout the world.

TED is also capable of excluding other larger by catch and debris which damage the catch or net and took up the space in the net. The development of TED makes every trip to the sea more cost effective in terms of fuel, gears and manpower.

The oomph factor is that the shrimps trawled by a TED enhanced trawling net can be exported to the United States. This opens a huge market for shrimp fisheries. At the moment, there are 17 TED certified countries in the world. In Asia, many trials had been carried out but none were successful.

In a nutshell, the TED is beneficial to turtle conservation as well as fisheries sustainability in the long term. Cooperation from the Fisheries Department and the fishing community is crucial in determine the future of turtles, and (thus, a better tomorrow for the country's fishing industry.

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漁民受促採用海龜排離器 試用效果良好不影響捕魚

尼可拉斯博士，美國漁業局人員，沙大畢業生與石志超，潘培潭主席等合攝。 ①

節省漁船消耗柴油

(本報山打根十三日訊) 曾于2個月前向山打根漁業界推介海龜排離器的海洋研究所執行董事 DR. NICOLAS J. PILCHER，兩日前聯同來自美國的漁業局研究人員及沙巴大學海洋學系的8位畢業生，前來山打根進行海龜排離器試驗的同時，昨晚在星彤律園書館前的漁業區時起卸碼頭，向山打根的漁業界講解排離器的製造，功用及使用與效果。

他們透過多媒體的放映，讓出席的山打根漁業界者及准員，瞭解有關海龜排離器的操作，海龜的排離過程，同時也在現場展示一個標準的海龜排離器。

昨日彼等一行人曾在此間海聯企業的協助下，在海上進行一整日的試驗，結果證實有關海龜排離器的動果良好，非但沒有妨礙拖網捕魚的操作，反而減少垃圾，捕到的海產數量也理想，節省漁船消耗的柴油，同時也達到保護海龜的目標。

根據調查，拖網漁船通常在海上操作時，都會拖到海龜，1980年的統計，全世界有50000隻海龜被漁船的拖網捕到，這是因為拖網沒有排離器的安裝，海龜無法被排離的結果。

海龜排離器於1970年在美國發明，至今已使用了多年，事實證明它擁有排離進入拖網海龜的作用。

在美國的漁船都需安裝排離器，同時美國已與很多國家合作，商討和使用排離器，確保漁船在海上拖網操作時，可以將入網的海龜排出。

目前在山打根岸外，大約有5000隻海龜，隨著捕魚業日益蓬勃，海龜的數量也跟著下降，美國漁業局的大衛指出，使用排離器只有少于1巴仙的魚或蝦逃脫，不必擔心大量海產的流失。

採用海龜排離器，本地的網有機會出口到美國，開拓一個龐大的市場，目前全世界只有17個國家採用海龜排離器，這些國家大多數在中美洲，南美洲，非洲及澳洲，亞洲暫時無國家響應。

本地漁民受促採用這項由海洋研究所 (MRF) 與沙巴漁業局合力推動的海龜排離器 (TURTLE EXCLUDER DEVICE) 以期達致雙贏或一石二鳥之良策。

昨晚的講解會獲本地漁業界熱烈反應，出席的包括山打根漁業公會主席石志超及理事，山打根漁業公會主席潘培潭及理事，兩個漁業公會的會員等，出席者亦受介紹如何製造海龜排離器，所用的材料，網眼大小，安裝在拖網的何處較適合等。

海洋研究所樂意為安裝排離器的漁船提供協助與諮詢。 (15)

潘培潭展示排離器的海龜排出口。 ①