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Fisher Profiles and Perceptions of Sea Turtle-Fishery Interactions: Case Study of East Coast Peninsular Malaysia

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Contents

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1 Introduction

Fisheries provide important food sources to many people around the world and contribute significantly to the livelihoods of coastal communities. In rural coastal areas where sources of income are limited, local communities have for decades and through generations depended extensively on fisheries resources. It has been estimated that developing countries currently supply 70% of fish for human consumption (FAO 2004). Some of these coastal areas are also important sea turtle nesting sites. Fisheries bycatch (both coastal and high seas) among other reasons have been identified to cause mortality and decline of sea turtle populations. Sea turtles have been existing for 110 million years and are known to have survived the extinction of dinosaurs by 65 million years (Mast et al. 2005). Due to the threats facing the survival of sea turtles, they are known as one of the most endangered marine species. Six of the seven species of sea turtles are designated as endangered or critically endangered on the IUCN Red List of Threatened Species (IUCN 2006).

Four out of seven sea turtles species can be found in Malaysia, namely, leatherback (*Dermochelys coriacea*), green (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*) and olive ridley (*Lepidochelys olivacea*). The East Coast of Peninsular Malaysia, particularly Terengganu, had been popularly known for the unique and abundant nesting of sea turtles in the 1970s and 1980s. The green turtle is the most extensively distributed in Malaysia with about 13,300 nests recorded yearly in East Malaysia (10,800 in Sabah and 2,500 nests in Sarawak) and 2,950 in Peninsular Malaysia (Liew 2002). The highest concentration of green turtle nesting in Peninsular Malaysia occurs mainly around the islands and mainland of the states of Terengganu and Pahang. Leatherback nesting was mainly found on the 1.5 km stretch of beaches of Rantau Abang and Paka in Terengganu and was recorded at Chendor in Pahang and in Johor (Kamarruddin 1996 and Mohd Najib and Kevin 1999). Around 2,000 leatherback nests were recorded in the 1950s which dropped drastically in the 1990s to around 213 nests in 1994 and 14 nests in 2003 (Zulkifli et al. 2004). In 2005, one leatherback landing was reported while five landings were reported in 2006 (K. Ibrahim, pers. comm.).

The major threats that affect the viability of these species worldwide include egg and turtle harvesting; turtle poaching or illegal hunting; loss of nesting and foraging habitats; exposure to coastal gill net, trawl, set net and trap fisheries; exposure to pelagic longline fisheries; injuries caused by boat propellers; tourism impacts related to excess lighting on nesting beaches and noise; and ingestion of plastic (FAO 2007). The dependence of coastal communities on natural resources such as fisheries and turtle egg consumption creates conflict

between human use and sea turtle conservation goals. This underscores the importance of understanding the human impacts to sea turtle populations and at the same time the perception of local communities/fisheries industry on turtle conservation efforts to devise management options and garner acceptance of the relevant stakeholders.

In Malaysia, various studies have reported incidences of sea turtle-fishery interactions. The earliest dated back to 1847 as observed by Cantor that green turtles were plentifully caught in fishing stakes in the Strait of Malacca at all seasons, and Siow and Moll (1982) attributed fishing to be responsible for the growing numbers of dead turtles on the beaches each year (both studies were reviewed in Chan et al. 1988). More recent studies provided insights to the extent of incidental catch (Chan et al. 1988; Mortimer 1989; Sukarno and Omar 1989; Chan 1993; Chan and Liew 2002) and discussed the impacts of fishery-related activities on sea turtles (Suliansa et al. 1996; Sukarno et al. 2006).

Chan et al. (1988) reported that data derived from interviews with fishers revealed that incidental captures of sea turtles in fishing gear contribute significantly to the mortality of these animals in Terengganu. Trawl nets were mainly involved, with drift/gill nets and bottom longlines also capturing appreciable numbers of turtles. It was estimated that trawl and drift nets each had the potential of capturing an average of 742 and 422 turtles respectively, per year. A large number of turtles reported caught in the 1988 study were leatherbacks, followed by both olive ridleys and green turtles. Mortimer (1989) identified the following gears such as trawl nets, drift/gill nets, bottom longlines (*rawai*), ray nets, fish traps and potentially large meshed monofilament driftnets for squid to be detrimental to sea turtles based on reviews of existing studies in Terengganu and international waters.

Hamann et al. (2006) provided a summary of threats to foraging populations of leatherback turtles in Malaysia based on existing literature (Table 1.1).

Table 1.1. Threats to foraging populations of leatherback turtles.

Threats	Current occurrence			Historical occurrence		
	Low	Medium	High	Low	Medium	High
Directed take of leatherback turtles at sea	X[1]			X[1]		
Trawl fisheries			X[2]			X[2]
Gill net fisheries		X[2]				X[2]
Longline fisheries		X[3]			X[3]	

[1] Possibly in Indonesia (Kei Islands – Suarez and Starbird 1996).

[2] Chan et al. (1988).

[3] Yatsu et al. (1991) and Wetherall et al. (1993).

Source: Hamann et al. (2006).

Noordin et al. (1995) reported the study of Sukarno and Omar (1989) that drift nets particularly with mesh size of 35.6 cm wide were found to catch turtles. These large mesh-sized drift nets were introduced in 1987 mainly to catch rays and sharks. The survey in Terengganu waters conducted in 1988 showed that drift nets with mesh sizes greater than 17.8 cm were capable of catching 16 turtles in one operation (Sukarno and Omar 1989). The study led to a nationwide ban in 1989 on the use of drift nets with mesh sizes greater than 25.4 cm. Other relevant efforts to address sea turtle-fishery interactions in Malaysia include the creation of areas closed to fishing such as the Fisheries (Prohibited Areas) (Rantau Abang) Regulations 1991 that provides offshore protection to leatherback turtles during the nesting season (April to September) every year (Chan 1993). Apart from this, the deployment of artificial reefs to deter trawling in the shallow areas has been implemented on the East Coast. This indirectly discourages the illegal practice of trawling near the coastal areas and hence reduces the potential of sea turtle-fishery interaction (K. A. Musa, pers. comm.).

Although there have been studies on sea turtle-fishery interactions, most studies in Malaysia focused on characterizing gear type, fishing practices and estimating turtle interactions, while few have systematically documented and highlighted primary information on the socioeconomic profile of fishers and the perception and understanding of local communities, particularly regarding fishers and sea turtles.

2 Scope and Objectives of the Study

This discussion paper was developed based on the paper "A Socioeconomic Study and Survey of Sea Turtle-fishery Interactions in Malaysia: Case Studies in Terengganu and North Pahang" (Yeo et al. 2007). The study was carried out as one of the priorities identified at the 2004 Workshop on Charting Multidisciplinary Research and Action Priorities for Sea Turtle Management in Malaysia, which resulted from the 2003 Bellagio Conference on Sea Turtle Conservation in the Pacific Ocean. The study involved the collaboration of the Department of Fisheries (DOF) Malaysia, WWF-Malaysia, National Oceanic and Atmospheric Administration (NOAA)-Fisheries and The WorldFish Center.

The paper focuses on coastal fisheries, particularly examining sea turtle-fishery interactions and determining the socioeconomic profile and perception of local fishers about sea turtle issues along the East Coast of Peninsular Malaysia. The annual DOF 2005 statistics showed the contribution of the fisheries sector to the national gross domestic product was 1.08%. Marine capture fisheries contributed 87% of the total fisheries production in 2005, with coastal fisheries contributing 71% of the total nation's production. This signifies the importance of coastal fisheries in the country. Peninsular marine capture fisheries sector produce 70% of total marine production. Out of these, about 20% of the marine landings were contributed by traditional gears, with 54% from trawlers and 26% by purse seiners.

The geographical area of the study was chosen due to the historical significance of the East Coast of Peninsular Malaysia, particularly Terengganu, that had a major rookery for leatherback turtles. Although the population numbers of leatherback nesting in Terengganu have fallen to extremely critical levels, this study is important for the following key reasons:

- Leatherback turtles originating from one of the largest remaining western Pacific nesting beaches in Papua, Indonesia, have been documented to move and forage around Terengganu waters (Benson et al. 2007). This may have major implications for the conservation and survival of leatherback turtles, particularly with the possibility of Terengganu as one of the areas where post-nesting leatherbacks from other countries frequent.
- The decline of sea turtle populations, particularly leatherbacks, provide important lessons for future management of sea turtles. It is imperative that future management options and initiatives reflect upon past mistakes and every effort is taken to avoid similar recurrence.
- A viable green turtle population still exists in Malaysia and with proper and careful conservation measures, there is still hope for survival of this population.

3 Methodology

3.1 Study areas

The study sites covered key areas of the East Coast of Peninsular Malaysia across three states which contain sea turtle nesting sites. These sites begin near Kuantan in the state of Pahang up to Besut district in the state of Terengganu and Pasir Puteh district in the state of Kelantan. The study sites by port areas are shown in Figure 1.1. The study also included the islands of Redang and Perhentian which are located off the coast of Terengganu. These islands are important nesting areas for green and hawksbill turtles. Potential interaction between sea turtles and fisheries also arises in the area, as vessels from the mainland states fish in the waters near the islands.

3.2 Sampling and survey implementation

A planning meeting among the collaborators was held before the survey to discuss the design of the questionnaire, key areas to conduct the interviews and roles of various organizations. The group identified three criteria to guide the selection of study areas, namely, nesting sites; areas where damaging fishing gears were frequently used; and areas where DOF managed and maintained contacts. The team engaged the support from relevant state and district DOF offices of Terengganu and Pahang, which was critical in the design and implementation of the surveys. The project also gained valuable insights from consultations with key institutes working on sea turtle-related research. These include the Universiti Malaysia Terengganu, UMT (formerly known as Kolej Universiti Sains dan Teknologi Malaysia, KUSTEM) and Marine Fishery Resources Development and Management Department (MFRDMD).

The final selection was sampled out of port areas for medium to large-scale fishing boats, whereas fishers who operated small-scale and traditional boats were sampled at villages near nesting sites. In total, 354 mainland fishers, 32 island fishers and 50 local villagers were interviewed in the study. This paper will examine findings only from the fisher surveys. Only vessel owners or individuals that operated the vessels were interviewed, as some questions required in-depth knowledge of the fishing activity. Tables 3.1 to 3.2 provide the names of the areas covered, gear types, number of licensed fishers and sampling ratio of the survey. The total number of licensed fishers were based on 2004 statistics and sourced from respective DOF district offices. Overall, the sample ratio was 45% for mainland sampling and 41% for island sampling. Table 3.3 provides an overview of the sample coverage by gear for mainland

and island fishers. The proportion of respondents selected by gear type was based on the overall fisher composition.

Table 3.1. Areas on the mainland covered in the survey.

District	Gear type	Sample size	Licensed fishers	Sample ratio (%)
Pasir Puteh/Besut	14T, 3P, 21D	38	108	35
Setiu	41D, 7P, 3B, 3H	54	107	50
Marang	25D, 17P, 1B, 1T	44	100	44
KT	12P, 28T, 4P, 3D, 1H	45	96	47
Dungun	42D ,11T,12P	65	142	46
Kemaman	17T 30D 14P	61	122	50
Kuantan	45D, 2H	47	115	41
Total		354	790	45

Key: T=trawl, P=purse seine, D=drift, H=hook and line, B= trap.

Table 3.2. Areas on the islands covered in the survey by ports and gears.

Port	Village	Gear type	Sample size	Licensed fishers	Sampling ratio (%)
Pulau Redang	Kg. Baru Pulau Redang	14H 6D 2P 2B 1L	25	70	36
Pulau Perhentian	Kg. Pasir Hantu	5H 1P 1B	7	9	78
Total			32	79	41

Table 3.3. Sample coverage by gears.

Gear type	Mainland fishers		Island fishers	
	Frequency	Percentage	Frequency	Percentage
Trawl	71	20	NA	NA
Purse seine	86	24	3	9
Drift	186	53	7	22
Hook and line	6	2	19	60
Trap	5	1	3	9
Total	354	100	32	100

The surveys were carried out between 20 September 2005 and 24 March 2006. Interviewers were screened and selected from among university students of UMT. Training, role-playing and pretest exercises were undertaken to familiarize the interviewers with the questionnaires in order to improve their interviewing skills as well as the questionnaires. The questionnaires were translated into Bahasa Melayu, the Malaysian national language and also the common language used among the locals. A t-shirt, with a sea turtle

design, was produced and handed out as token of appreciation to those who participated and assisted in the survey.

The questionnaire was composed of three main sections that included socioeconomic profile; fisheries background and turtle interactions; and perception and knowledge of turtle issues. Data were entered into SPSS software for analysis and tabulation. In addition to surveys, a focus group discussion (FGD) was held on 30 March 2006 to find out the views of fishers on key sea turtle interaction issues. The discussion also covered ways and approaches to minimize fisheries impacts on sea turtles. The FGD was adopted to complement the results of the questionnaire survey and capture views that were difficult to elicit in a structured questionnaire format. A total of 22 fishers, representing the districts of Dungun, Kemaman and Kuantan, participated. These fishers also participated in the questionnaire survey.

Figure 3.1. Map of the study sites.

4 Demographic and Socioeconomic Characteristics

4.1 Family profile

The results showed that the average household number is 8 among mainland fishers and 9 among island fishers and more than 90% of the respondents are married (Table 4.1). The average household size is larger among the fishers compared to the state average household statistics (4.5 – 5) for Terengganu State, 2004 (EPU 2006). It is common among rural communities to have larger families, as children help out in daily jobs as well as take care of young family members. However, this also reflects responsibilities of the household heads to fend for their families. Most of the respondents have lived for many years in their respective villages (average of 44 years among island fishers and 36 years among mainland fishers).

Table 4.1. Respondents' family profile.

Marital status (%)	Mainland fishers	Island fishers
	n = 351	n = 32
Married	94	97
Single	5	3
Widower	1	-
Average household size	8	9
Average number of years living in the village	36	44

4.2 Education level

Overall, the majority of the respondents have received formal education, with over 50% having at least 6 years of basic primary schooling. A higher percentage of mainland fishers completed secondary education compared to island fishers (Figures 4.1 and 4.2). This could be due to the fact that there are more facilities and access to education on the mainland.

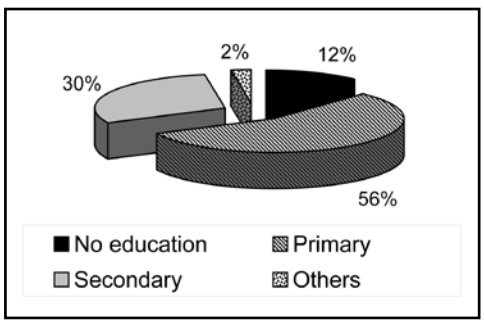


Figure 4.1. Percentages of mainland fishers by education level.

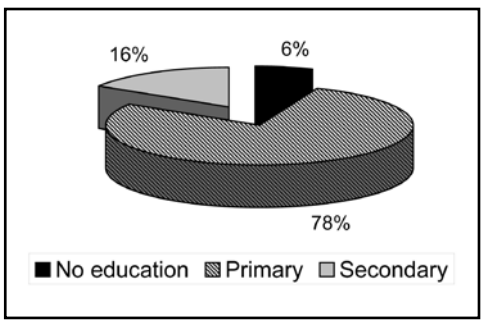


Figure 4.2. Percentages of island fishers by education level.

4.3 Occupation

The majority of the respondents adopted fishing as their primary occupation and fish full time. A handful undertook side jobs (Figure 4.3) during nonfishing seasons (22% among mainland fishers and 25% among island fishers) and had alternative income. The reasons often cited for not undertaking side jobs were attributed to lack of knowledge, education and skills to do other jobs. Island fishers had more opportunities to undertake side jobs compared to mainland fishers due to the tourism industry on the islands. Most mainland fishers who undertook side jobs provided labor at construction sites and farms, worked as carpenters, conducted small businesses selling food, and related fisheries work such as making fish/prawn crackers and processing anchovies.

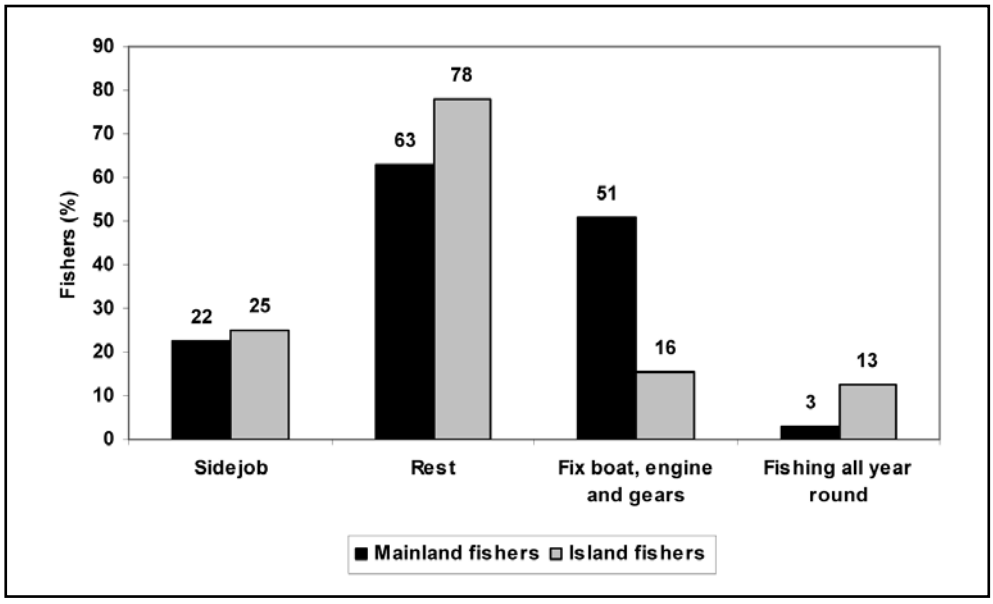


Figure 4.3. Activities of fishers during nonfishing periods.

Among the mainland fishers that undertook side jobs, they performed this work during the northeast monsoon period (November – March), while most island fishers conducted their side jobs during peak tourist months (March – October) to transport goods or people on their fishing boats to Redang and Perhentian Islands. A high percentage of the fishers preferred to rest (63% mainland fishers and 78% island fishers) (Figure 4.3). Around 51% of mainland fishers and 16% of island fishers fixed their boats, engines and gears during the monsoon season to prepare for the next fishing season. Three percent of mainland fishers and 13% of island fishers fished all year round regardless of the monsoon.

4.4 Spouse's occupation

Generally, most of the spouses of fishers that are married do not work or earn additional family income. Some 82% of the spouses of mainland fishers and 81% of the spouses of island fishers are housewives (Figures 4.4 and 4.5). As fishers are normally engaged full time at sea, the spouses provide important support to care for their children and family members. Some 9% and 10% of mainland and island fishers' spouses, respectively, conduct small businesses. These include having retail shops, operating restaurants, and making and selling fish crackers (especially among the spouses of mainland fishers). About 5% and 9% of the spouses of mainland and island fishers, respectively, provide labor by being cooks and cleaners. On the mainland, some of these spouses are rubber tappers, fishers and also involved in farming, while on the island some of the spouses work with chalet operators. Some of the spouses of mainland fishers are skilled workers (4%) such as nurses, teachers and clerks.

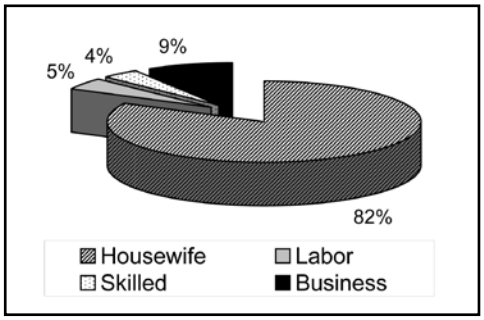


Figure 4.4. Percentages of mainland fishers by occupation of spouse.

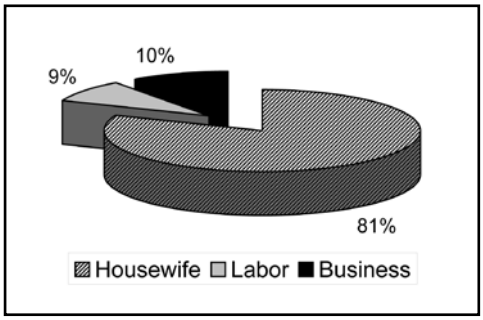


Figure 4.5. Percentages of island fishers by occupation of spouse.

4.5 Household income profile

The average monthly household income was estimated by the total income earned by the family members who lived in the same house. This included income from the household head's primary and secondary occupations (i.e., mostly fishing), spouse's occupation, and contribution or remittances from children/family members. Monthly household income can differ from month to month, depending on the weather and seasonal catch or activities. Recalled data and variability in income opportunities make it difficult to estimate the exact household income level. However, these estimates are aimed at providing a picture of the fishers' income breakdown and profile. Income from side jobs was also obtained but not included in the monthly household

estimates, as these jobs were not regular and sometimes undertaken during nonfishing seasons.

Figure 4.6 shows the average household income of mainland and island fishers with different fishing gears. This average includes income from fishing, spouse's income, contribution from family members and also secondary jobs[1]. Purse seine fishers had the highest household income (RM1,800)[2] among all the other mainland gear groups followed by trawlers (RM1,155). Although the average purse seine fishers' and trawlers' household income was greater than RM1,000 a month, the minimum income for these groups was RM300 and the maximum was as high as RM20,000. The difference indicates the variability in fishers' income despite using the same gear, because their gear or vessel might be different in size, thus affecting the catch. The same pattern was observed in all gear types. The remaining mainland fishers whose monthly household income was lower then RM1,000 monthly were trap (RM690) and drift net (RM660) licensed holders and hook and line fishers (RM533). The total average household income for the mainland fishers was RM1,033, and about 50% lower compared to the average monthly household income for Terengganu State (RM1,984) in 2004 (Yeo et al. 2007).

All island fishers had monthly household income of less than RM1,000, which was lower than that of mainland fishers. This could be due to the scale and size of their fishing operation, gears and vessels. Fishers using traps had the highest household income (RM833) followed by purse seines (RM733), hook and line (RM658) and drift nets (RM615) (Figure 4.6). The average overall income of RM672 among island fishers was about 70% lower than the average state monthly household income (Yeo et al. 2007).

1 Secondary jobs are work that fishers undertake throughout the year. Side jobs undertaken only during nonfishing months are not included in the household income.
2 Licensed purse seine fishers could earn up to RM50,000 a month. This entry was recorded as an outlier due to its effect on the average income as compared to other respondents.

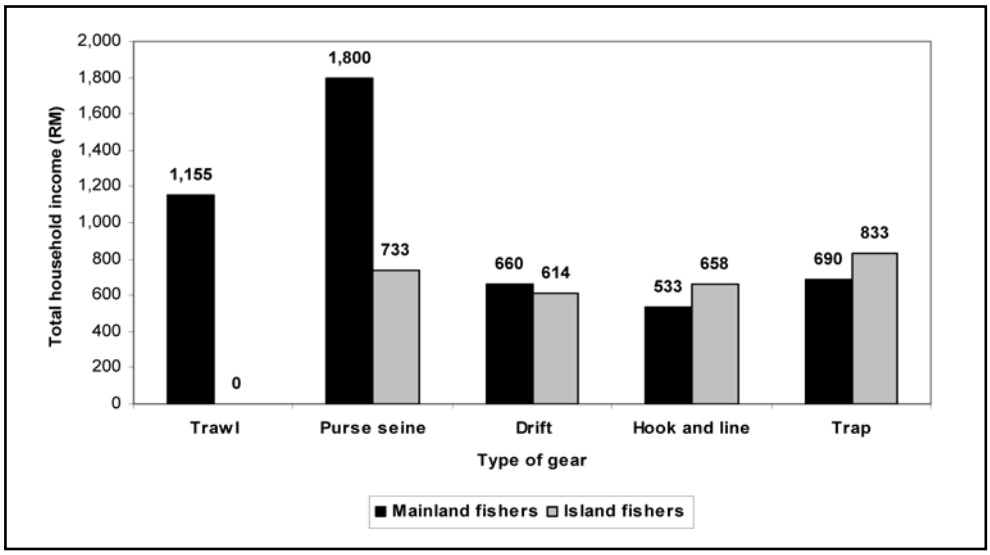


Figure 4.6. Monthly household income of mainland and island fishers with different fishing gears.

Figure 4.7 highlights the average monthly income earned from the fishers' primary occupation. Overall, almost all the respondents' primary income was from fishing. The average income from fishing was highest among purse seine mainland fishers (RM1,590), followed by trawls (RM1,055). The average monthly income among fishers of drift nets, hook and line, and traps was within the range of RM440-533.

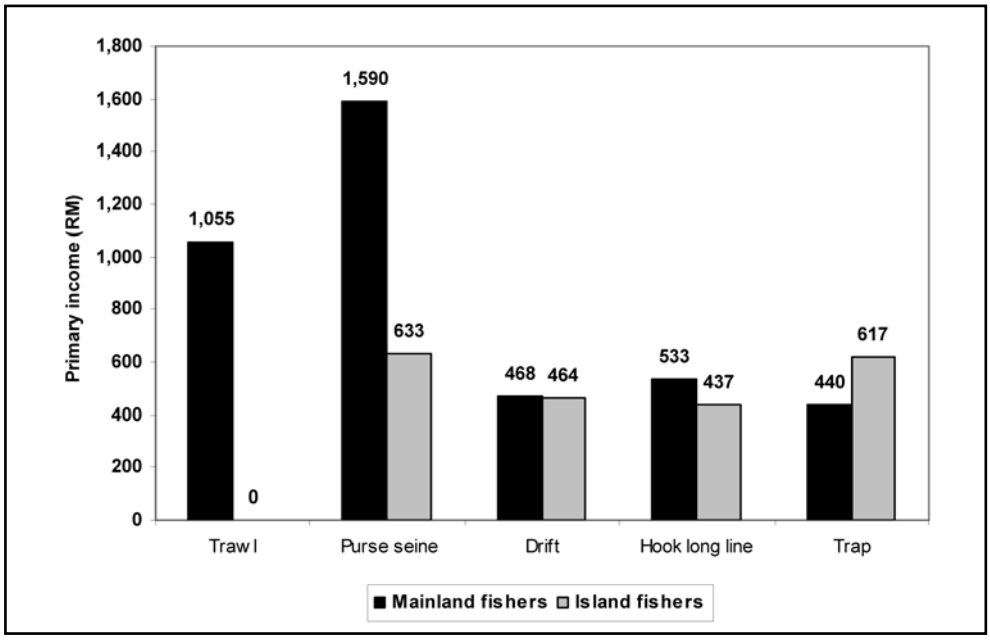


Figure 4.7. Monthly primary income of mainland fishers with different fishing gears.

Figures 4.8 and 4.9 provide a summary of the monthly household income composition for mainland and island fishers. Income from fishing provided the bulk of the monthly household income (83% among mainland fishers and 71% among island fishers). On average, around 9% of the monthly household income for mainland fishers and 6% among island fishers were contributed by secondary jobs (defined as regular income generated throughout the year compared to less regular income from side jobs). The contribution from spouse's income among island fishers (10%) was greater than mainland fishers (5%). The spouses of island fishers had more opportunities to work in the tourism industry on the islands, offering opportunities such as being cleaners or cooks at the chalets or operating small businesses. Contributions and remittances from children and family members remained small among mainland fishers at around 1-2% compared to 5-8% among island fishers. The contribution from side incomes are usually unpredictable and occur only during nonfishing months. These incomes were not included in the average household income. Nevertheless, estimates of the proportion of side income to the total household income were around 8% among mainland fishers and 12% among island fishers.

It is important to note that these percentages of income composition only provide an indication of the average figures and may not necessarily reflect the actual situation or welfare of fishers, partly because the income figures were based on recalled data. In rural areas, opportunities or practices that do not incur any monetary transactions, such as planting fruits and vegetables to support daily needs, may contribute significantly to household welfare. The extent of these practices and contribution to household income were not covered as they were beyond the scope of this study.

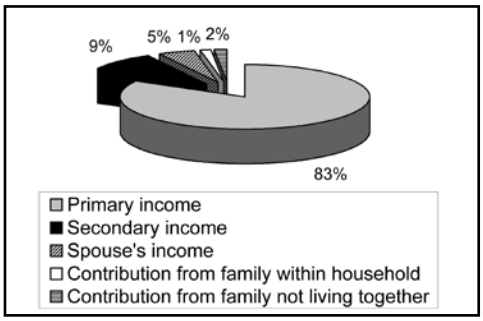


Figure 4.8. Average composition of household income of mainland fishers.

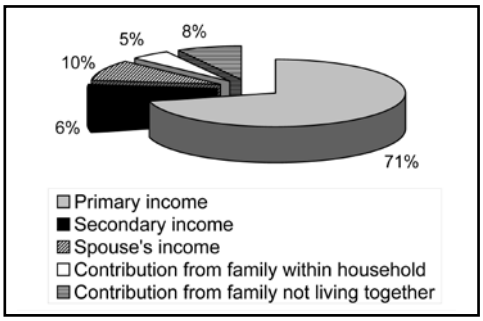


Figure 4.9. Average composition of household income of island fishers.

The poverty line income (PLI) provides a standardized basis for defining whether a household is poor – 'if its average monthly household income is below a certain threshold'. A household is considered poor if its income is less than its own PLI, that is, it lacks the resources to meet the basic needs of its individual members. A household is considered hardcore poor if its monthly household income is less than the food PLI (EPU 2006). The overall gross PLI for Terengganu was RM734 and the percentage incidence of poverty was 15.4 in 2004 whereas the gross food PLI was RM469 and the percentage incidence of hardcore poverty was 4.4 (EPU 2006).

Figures 4.10 and 4.11 summarized the percentage of respondents that fall under the monthly PLI, food PLI categories and above monthly PLI. These high percentages compared to the average state figures show that mainland and island fishers represent the poorer segments of society in the state. Incidence of poverty among both mainland and island fishers was 32% while about 33% of the mainland fishers and 37% of the island fishers fell within the hardcore poor category.

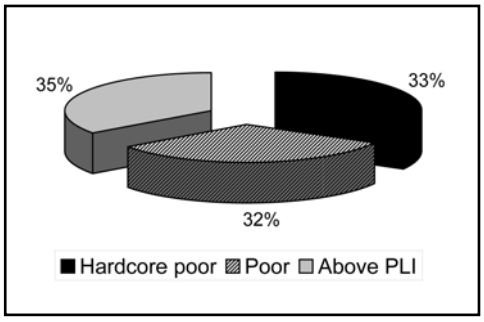


Figure 4.10. Composition of mainland fishers by measurement of PLI.

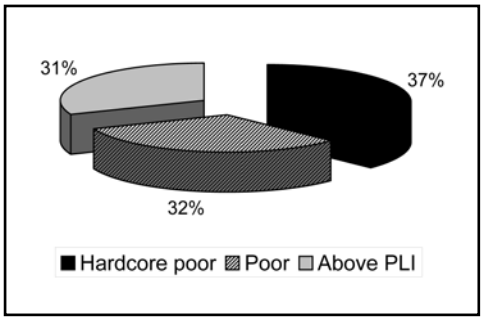


Figure 4.11. Composition of island fishers by measurement of PLI.

These figures provide only an indication of the poverty level and thus need to be carefully interpreted. Nonetheless, due to the dependence of these groups on natural resources and limited options for income generation, these results caution that any measures with potential negative economic impacts, especially on the lower-income groups need to be carefully designed and supported with appropriate measures to minimize these impacts. Yeo et al. (2007) recorded that in general, nonfisher communities on the islands in Terengganu had less incidences of poverty because there were more job opportunities due to the tourism industry. Hence, the role of sea turtles in attracting visitors to the islands and in creating opportunities that contribute to the overall ecotourism economy was also important.

5 Economic Fishing Activities

5.1 Fishing experience and reasons for being a fisher

Over 85% of the fishers had fished for more than 10 years. Island fishers had an average of 36 years of fishing experience while mainland fishers, of 27 years. Although many of these fishers did not complete formal education, they can be considered knowledgeable in their profession.

The majority of mainland fishers fish because of family tradition (47%), while island fishers fish because it is their only source of income (56%) (Figures 5.1 and 5.2). Generally, fishing gears, skills and boats are passed on from one generation to another. Thus, most children are taught fishing skills so that they will be capable of taking over their parent's assets when they grow up. Some fishers (13%, mainland fishers and 16%, island fishers) fished because they were interested. This may be due to their exposure to fishing at an early age. The remaining fishers fished due to good income from this occupation.

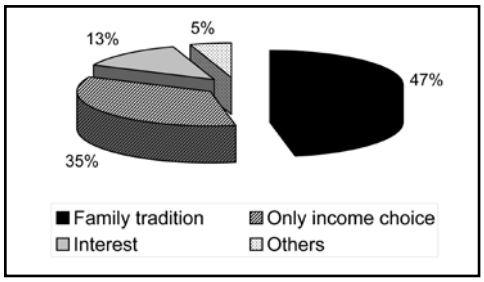


Figure 5.1. Reasons for being a fisher among mainland fishers.

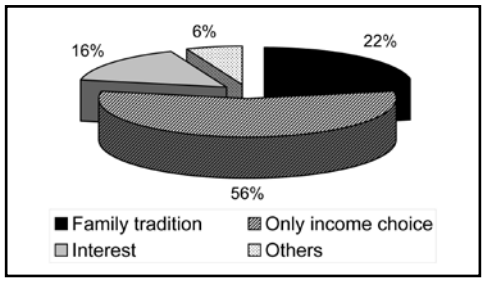


Figure 5.2. Reasons for being a fisher among island fishers.

Overall, around half of the fishers would not want to change their occupation if given a choice because they felt that they were old and not capable of change. Some were still interested in fishing or satisfied with their current income. As for those who wanted to switch jobs, they considered the following options, e.g., business and service-related, a laborer in industries or a contractor, and into farming or plantation work. The majority doubted their capability to change as they felt that they held low educational qualifications and lacked skills, limiting their opportunity for other jobs. Although fishing was passed on as a family tradition, most fishers did not want their children to continue fishing. The majority believed that fishers endure a difficult life, as incomes are low while risks are high – there is no guarantee that they will catch fish every time they go out to sea. Some also felt that fish stocks were decreasing day by day.

5.2 Association in fishing community

There were three main associations in the fishing community: Fishers' Association, Fishers' Economic Group (Kumpulan Ekonomi Nelayan, KEN) and Trawlers' Association (for trawl net fishers only) (Figure 5.3). In addition, there were other small associations that were organized by fishers within the same port or village. The majority of the fishers belonged to the Fishers' Association (84%, mainland and 78%, island fishers) followed by Fishers' Economic Group (9%, mainland and 50%, island fishers). About 11% among mainland fishers and 6% among island fishers did not join any association, while 7% were part of the Trawlers' Association. Members of the associations were able to apply for government loans or subsidies in the fisheries sector and to avail of training.

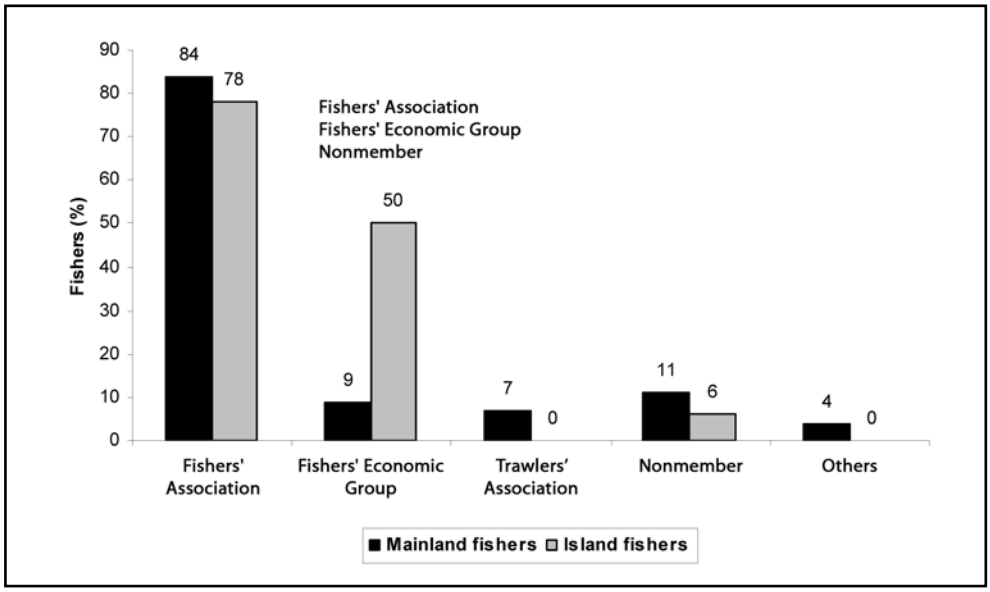


Figure 5.3. Percentage of fishers by association.

5.3 Fishing vessels and gears

Table 5.1 describes the fishing zones in Malaysia (reviewed in Sukarno et al. 2003). Zone A is defined from shoreline onwards and reserved for small boats operating with traditional fishing gears while Zone B starts from 5 nautical miles (nm) for commercial gears. Zones C1 and C2 are defined from 12 nm and 30 nm onwards. Based on DOF's classification, different class vessels are allowed in different fishing zones as follows: Zone A: traditional fishing gear, Zone B: commercial vessels <40 GRT, Zone C: 40-70 GRT and Zone C2: > 70 GRT.

Table 5.1. Fishing zones in Malaysia.

Zone	Definition
A	Within 5 nm from shoreline, reserved for traditional owner operator vessels
B	5 nm and above from shoreline for commercial gear of owner operator vessels below 39.9 gross registered tonnage (GRT)
C1	12 nm and above from shoreline for commercial gears operating with vessel 40 GRT and above
C2	30 nm and above from shoreline for commercial gears operating with vessel 70 GRT and above

5.3.1 Fishing vessels

The survey showed that 25% of the vessels operated by mainland fishers were Zone A vessel licenses; 32%, Zone B; and 9%, Zone C. Fishers operating fiberglass boats (27%) and traditional wooden vessels (7%) did not require licenses (Figure 5.4). As for island fishers, the majority of the vessels operated with Zone A licenses (85%) and only 6%, with Zone B licenses. The remaining 9% operated fiberglass boats (Figure 5.5). In Malaysia, all fishing vessels from Zone B and below must be owned and operated by Malaysians whereas Zone C vessels can be operated by foreign fishers.

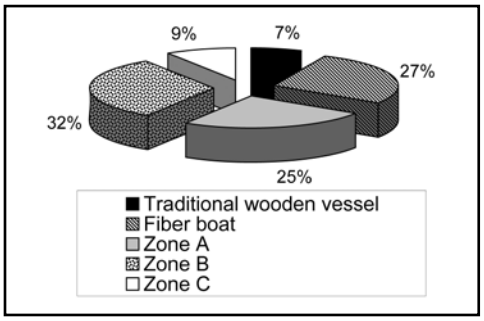


Figure 5.4. Percentages of mainland fishers by type of vessel licenses.

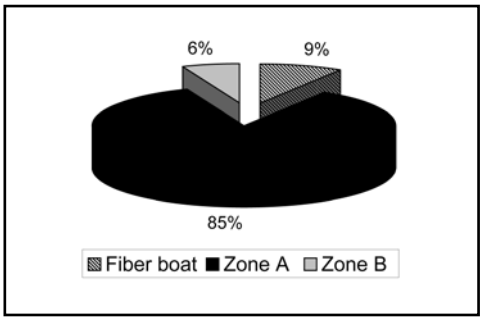


Figure 5.5. Percentages of island fishers by type of vessel licenses.

The majority of the fishers owned and operated their vessels (71%, mainland and 86%, island, see Figures 5.6 and 5.7). About 24% of mainland and 9% of island fishers operated but did not own the vessels. In some cases, the availability of loans and subsidies provided by local authorities enabled fishers to own their vessels. About 62% of mainland fishers used wooden vessels compared to 38% that used fiberglass vessels. Most of the island fishers used wooden vessels (88%) instead of fiber boats (12%) (Yeo et al. 2007).

Table 5.2 provides a snapshot of the average horsepower (hp) and GRT of mainland and island fishers by different types of gears. The standard deviation

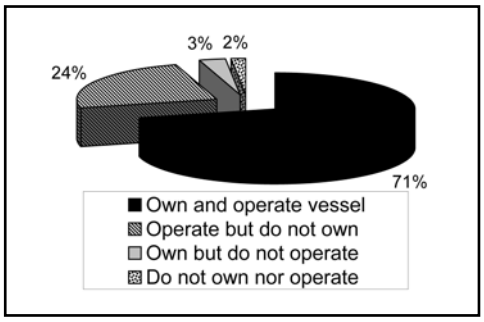


Figure 5.6. Percentages of mainland fishers by ownership of vessels.

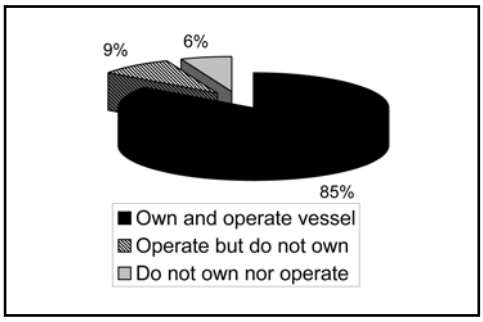


Figure 5.7. Percentages of island fishers by ownership of vessels.

(SD) for these data is reported and the ranges are mentioned. The difference in engine capacity between mainland and island fishers indicated that mainland fishers were operating on a larger scale compared to island fishers. Fishers with purse seine vessels had the highest hp and GRT with an average of 200 hp and 21 GRT among mainland fishers and 77 hp and 15 GRT among island fishers. The vessels of fishers operating with other gear types such as drift nets and hook and line had an average of 26 hp and 3 GRT among mainland fishers and 23 hp and 5.2 GRT among island fishers.

Table 5.2. Average vessel horsepower and GRT by gear type.

Gear		Mainland fishers		Island fishers	
		hp	GRT	hp	GRT
Trawl	Average	194	18	NA	NA
	SD	100.5	11.5		
Purse seine	Average	200	21	77	15
	SD	172.8	24.1	62.5	13.2
All others (drift, lift nets)	Average	26	3	23	5
	SD	21.3	5	13.4	3.8

5.3.2 Fishing gears

Fishers are required to apply for a license to operate one main gear (trawl, purse seine or drift net) and are entitled to a sublicense to operate a traditional gear (hook and line, trap, etc.) where no limit in gear quantity or type is imposed. Fishers can operate two or three types of traditional gears during every fishing trip, provided that both the main license and sublicense are renewed yearly. At sea, fishers are required to carry their licenses, which contain the Malaysian Fisheries Act 1985 and terms of the license issued for both vessel and gear. The licenses also contain a list of 17 protected islands in the East Coast of Peninsular Malaysia including Redang and Perhentian.

Among mainland fishers, more than half held drift net licenses (53%), followed by purse seine (24%), trawl (20%), hook and line (2%) and trap (1%) (Figure 5.8). Drift net was the most preferred gear because it is easy to operate, compared to other commercial gears. The study showed that some fishers used gears other than their licensed gear in their latest trip. For example, although 53% of mainland fishers were drift net license holders, only 50% fished with drift nets in their latest trip. (See Figure 5.9.) Some drift net fishers used traps (increased from 1% to 2%) and hook and line (increased from 2% to 3%).

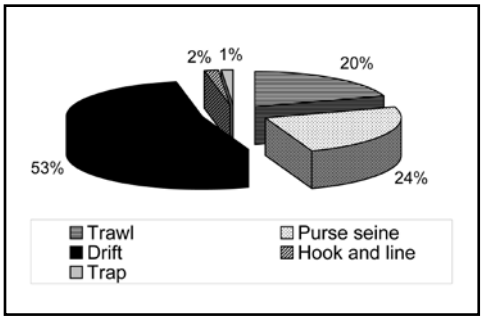


Figure 5.8. Percentages of mainland fishers by type of gear licensed.

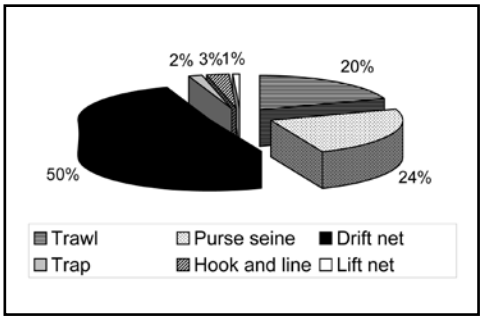


Figure 5.9. Percentages of mainland fishers by type gear used in the latest trip.

Island fishers showed a different pattern of gear usage. Hook and lines (60%) were the primary gear licensed compared to 22% drift net, 9% purse seine and 9% trap (Figure 5.10). Some fishers used different gears from their licensed gears during their latest trip. Some switched to hook and line from their licensed gear (e.g., drift gear usage reduced from 22% to 6% while hook and line increased from 60% to 69%). Some of the fishers also used lift nets (7%). These occurrences could be influenced by weather conditions. Fishers that used trap and purse seines remained at 9% (Figure 5.11). The results showed that no island fishers operated trawl nets. This could be because island fishers operated on a smaller scale, using traditional methods. Trawl nets require larger vessels and better technology to operate.

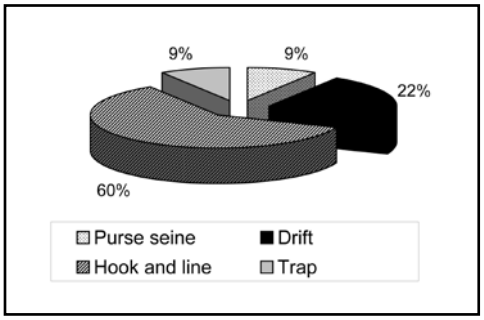


Figure 5.10. Percentages of island fishers by type of licensed gear.

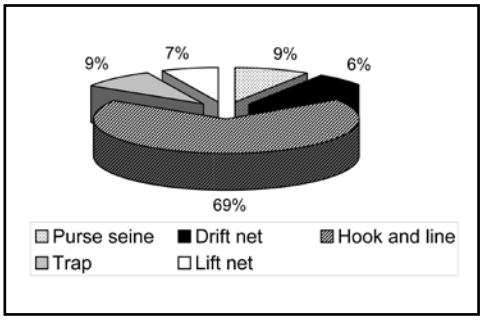


Figure 5.11. Percentages of island fishers by type of gear used in the latest trip.

Gear features such as width, length and mesh size varied among fishers depending on their targeted catch. Table 5.3 provides a broad overview of the magnitude of these features by different types of gear. Purse seine nets recorded the greatest width as these vessels often fish farthest away from shore, at an average width of 83 m, followed by trawl nets at an average of 16 m and other nets (such as drift, lift and dip nets) at 5 m. Similarly, among island fishers, purse seine nets had the greatest average width at 71 m, followed by other gears. The length of the nets varied greatly, even reaching up to 2,800 m for mainland fishers with drift nets (under other gears), at an average of 811 m, followed by purse seines at 513 m and trawl at 42 m. The mesh size of nets averaged around 1.5-3 m for mainland and island fishers. There were respondents that reported using mesh sizes greater than 10 inches. Fisheries laws ban mesh sizes above 10 inches.

Table 5.3. Average and range of gear width, length and mesh sizes.

Gear		Mainland fishers			Island fishers		
		Width (m)	Length (m)	Mesh (in)	Width (m)	Length (m)	Mesh (in)
Trawl	Average	16	42	3	NA	NA	NA
	SD	14.2	48.7	4.1			
Purse seine	Average	83	513	1.5	71	281	1.7
	SD	33.8	259.1	0.9	41.3	191.8	0.9
All others (drift and lift nets)	Average	5	811	2.5	56.2	122	1.8
	SD	41.8	627.5	1.4	46.3	48.6	0.2

As Perhentian and Redang Islands are gazetted marine parks, fishers are not allowed to fish within 2 nm from the shore. Fishers fish (normally hook and squid jigging) in coral reef areas outside the marine park area. *Rawai*, a popular local gear, is a type of bottom longline which usually uses large hooks. Some of the *rawai* are used to fish sting rays.

5.4 Fishing seasons

Fishing activities of the study areas were mainly affected by the north-east monsoon (November – February), regardless of the location of fishers. However, mainland and island fishers fished during different seasons. (See Figures 5.12 and 5.13.) The graphs illustrate that when peak and lean seasons escalate, no-fishing months decrease.

Mainland fishers started to fish once after the north-east monsoon, sometime around January. The first peak fishing period occurred around April and dropped in May. The second peak fishing period was the duration before the monsoon (September–October). After that, the fishing activities dropped tremendously due to the monsoon.

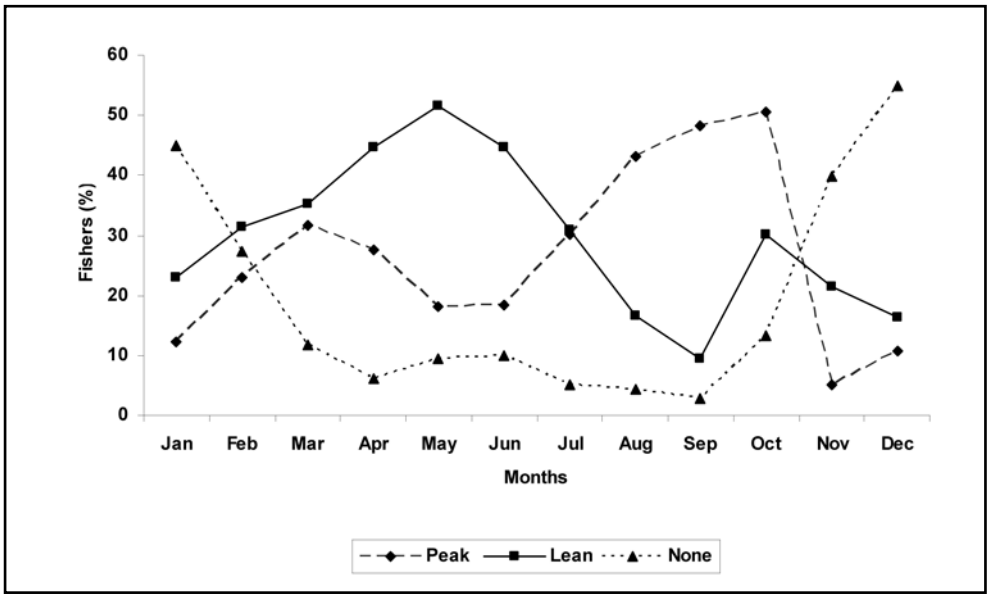


Figure 5.12. Percentage of fishers by different fishing seasons among mainland fishers.

Island fishers showed a different fishing season from the mainland fishers. Many island fishers consider the monsoon period to be their peak fishing season as they are able to obtain higher prices for their catch. Furthermore, island fishers said that fish migrate from the open seas to coral reef areas around the island to seek shelter from the monsoon, allowing them to catch more fish during the monsoon period. Based on Figure 5.10, fishing seasons started to dip from March onwards and only picked up around September. This coincided with the tourists season (April – September) as island fishers moved to tourism-related work as an opportunity to earn complementary side income.

5.5 Fishing operations

Relevant fishing characteristics based on the latest trip, such as fishing areas, duration required to reach fishing grounds and number of people operating the vessels, are discussed below. The majority of the island fishers (60%)

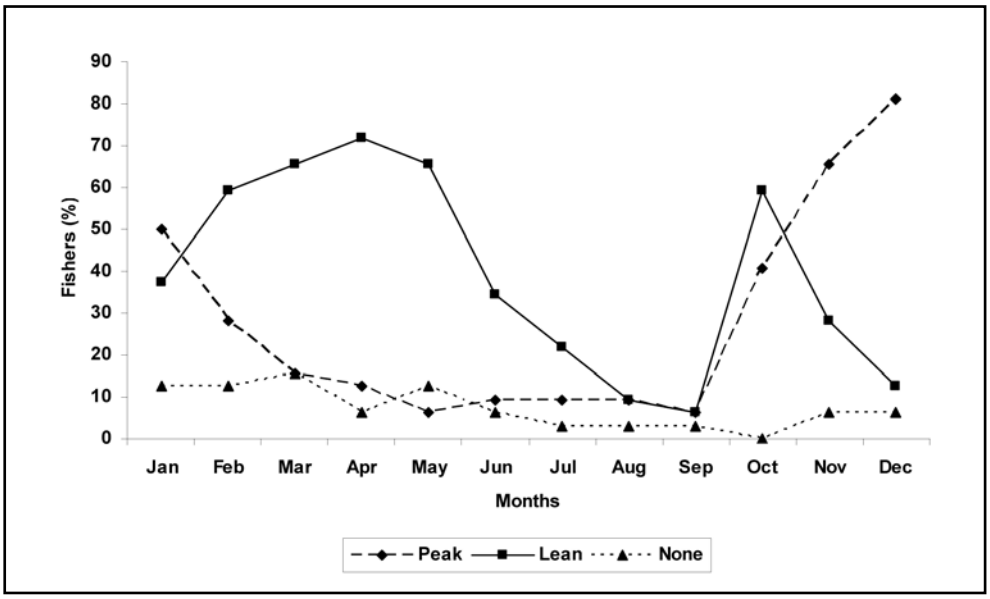


Figure 5.13. Percentage of fishers by different fishing seasons among island fishers.

preferred to fish around the islands because these were near to coral reef areas which served as breeding and feeding grounds for fish (Yeo et al. 2007). Moreover, this minimizes fuel costs from transit. Based on the latest trip, the majority of mainland fishers fished within Zone B (41%), followed by Zone C1 (28%) and Zone A (23%), while a handful were involved in deep-sea fishing, i.e., Zone C2 (8%). Island fishers fished dominantly within Zone A (76%), corresponding to their vessel size, capacity and gear type. Around 9% of island fishers fished in Zones B and C each. See Figures 5.14 and 5.15.

Tables 5.4 and 5.5 summarize average figures on distance and time to fishing areas, number of people and number of times to sea. Fishers with purse seine gears traveled the farthest (average of 27 nm for mainland and 5.5 nm for island fishers); required the most time (average of 2.9 hours for mainland and

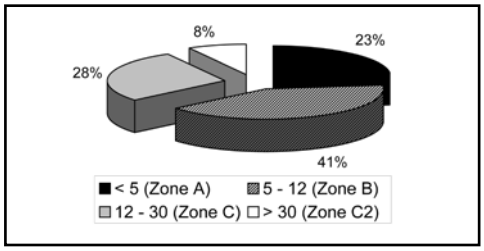


Figure 5.14. Percentages of mainland fishers according to fishing areas.

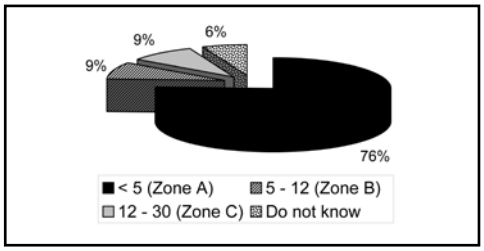


Figure 5.15. Percentages of island fishers according to fishing areas.

1.75 for island fishers) to get to their fishing areas and had the most number of people (average of 19 among mainland and 15 among island fishers) to operate the vessels. This demonstrates that often purse seine gears involve larger operations, followed by trawlers and all other gears which are dominantly drift nets.

Table 5.4. Details of fishing operations of mainland fishers by type of gear.

Gear		Mainland fishers			
		Distance (nm)	Time to sea (hour)	No. of people	No. of times to sea
Trawl	Average	18	2.2	4	7
	SD	60.1	3.1	2.2	7.1
Purse seine	Purse seine	27	2.9	19	12
	SD	45.3	2.1	8.5	8.4
All others (drift and lift nets)	Average	10	1.4	2	15
	SD	15.1	1.6	0.9	8.7

Table 5.5. Details of fishing operations of island fishers by type of gear.

Gear		Distance (nm)	Time to sea (hour)	No. of people	No. of times to sea
Purse seine	Average	5.5	1.75	15	15
	SD	3.9	1.4	8.6	5
All others (drift and lift nets)	Average	4.5	1.18	2	13
	SD	6.5	0.6	1.4	6.9

The majority of fishers made day trips (81% mainland and 97% island fishers) (Yeo et al. 2007). Figure 5.16 highlighted that most of the mainland and island fishers went out to sea in the morning (86% and 94%, respectively). Around 39% of mainland fishers came back from their fishing trip in the afternoon and 29% in the evening. For island fishers, 82% came back in the evening.

The number of hauls and the period between hauls provide an idea of the soak time of the gear used. This affects the probability of gear and turtle interaction. A shorter soak time would mean a lesser chance of turtles being caught in the nets, while shorter periods between hauls would allow fishers to check their nets more often and provide greater chances of releasing a turtle alive if detected in time. Table 5.6 provides an indication of hauling practices among different gears during the last fishing trip. It shows that mainland fishers operating traps leave their gear in the water for long periods (on average 18 hours) and only haul twice on average during their fishing

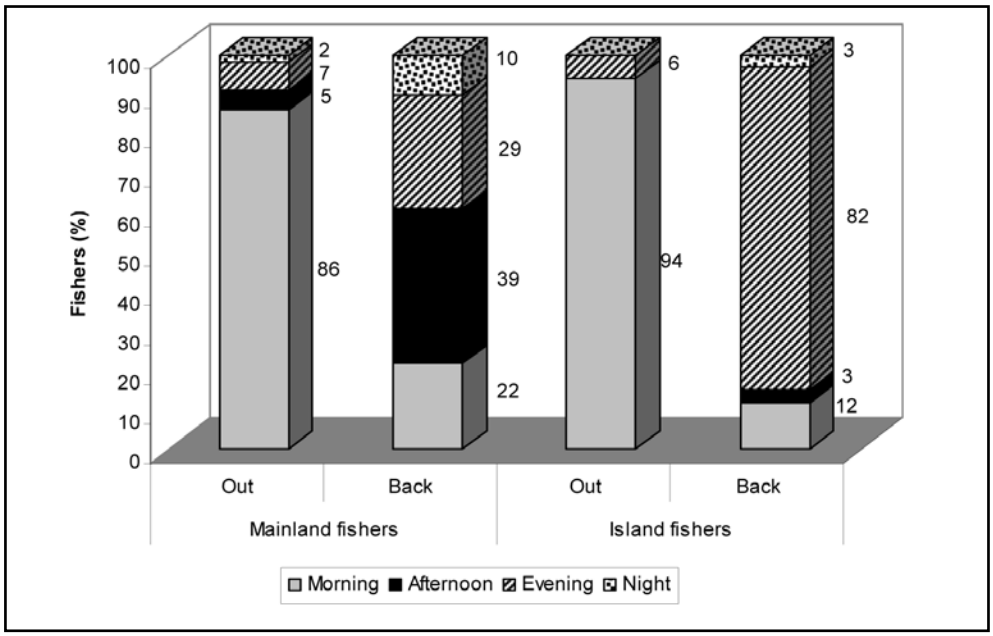


Figure 5.16. Percentages of fishers by time of the day to go out and to return from sea.

period. The data also show that some gill net fishers left their nets overnight in the water for 24 hours. As use of gill nets (greater than 10 inches in mesh size, used for catching sting rays) has been banned, fishers usually do not stay near these gears during soak time to avoid being detected and caught. This practice often results in turtles being caught in the nets.

Table 5.6. Average number of hauls and period between hauls among mainland and island fishers by type of gear.

Gear		Mainland fishers		Island fishers	
		No. of hauls	Period between hauls	No. of hauls	Period between hauls
Trawl	Average	8	3.1	NA	NA
	SD	10.3	1.2		
Purse seine	Average	5	1.6	3	1.2
	SD	3.7	0.7	1.5	0.6
Drift/gill net	Average	4	1.4	2.5	0.6
	SD	2.3	2.2	0.7	0.4
Trap	Average	2	18	16	0.2
	SD	2.1	8.5	16.9	0.1
Hook and line	Average	6	0.7	50	0.2
	SD	3	0.2	NA	0.14
Others	Average	15	3	3	1
	SD	7	4.1	0	0

5.6 Short-run profit estimates

The estimates below reflect the average gross profit and total variable costs incurred by a vessel at the end of a fishing trip, based on the latest trip. The net average short-run profit by gears was obtained by deducting the average variable costs from average gross profit. These figures provide a rough indication and may vary depending on season and weather. Variable cost components include diesel, petrol, lubricant oil, ice, bait and food. Variable costs for mainland fishers include labor cost. This cost is not present in the computation of variable costs among island fishers. Due to the smaller scale and capacity of island fishing operations, per unit labor costs were not applicable as the fishers divided the earnings among themselves based on net total (i.e., after deducting all variable costs).

Figure 5.17 provides a summary of the average gross revenue and average total variable costs for different types of gears. It demonstrates that purse seine gears have the highest average short-run net revenue (RM4,981) followed by trawlers (RM3,860) and traps (RM1,615). For traps, revenues may be due to high season and low operating costs. Gears categorized under "others" include dip and lift nets with an average net revenue of RM331. Drift net average net revenue was around RM111, while hook and line remained as the lowest net profit earner at RM4 per vessel based on the latest trip.

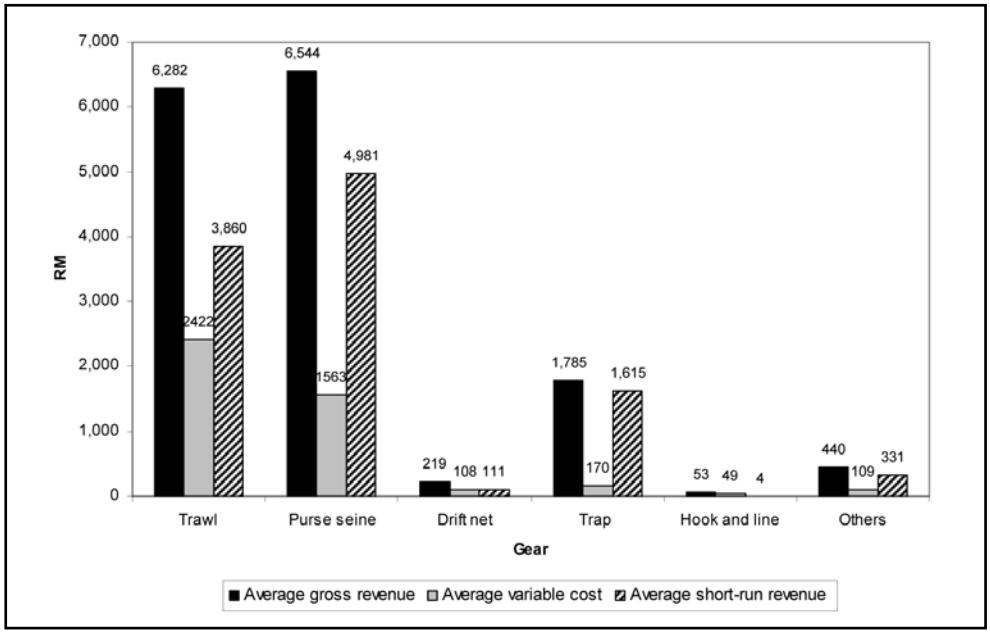


Figure 5.17. Short-run profit* per vessel per trip by gear for mainland fishers.
*** US$1 = RM3.5.**

Figure 5.18 reflects the cost composition of the variable costs for mainland fishers. Diesel comprised the bulk of the average cost incurred per vessel during the latest trip. This is followed by labor (5%), ice (5%), food (3%) and lubricant oil (2%). The cost of bait was insignificant compared to the other costs.

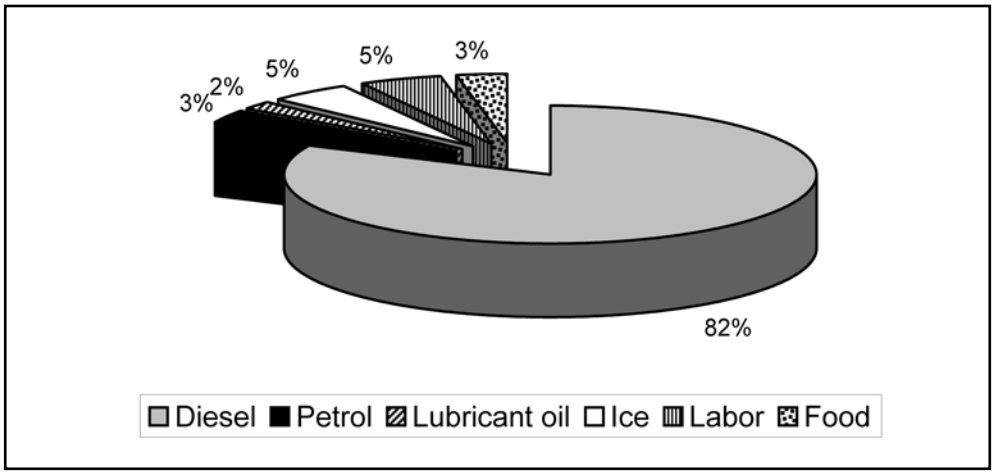


Figure 5.18. Percentage breakdown of variable costs by item for mainland fishers.

Consistent with mainland fishers, the average short-run net revenue of purse seine fishers was the highest (RM1,197) followed by traps (RM718) (see Figure 5.19). Hook and lines were more popular compared to drift nets (some used for squid jigging). These gears generated more revenue at RM416 compared to drift nets (RM67). Figure 5.20 depicts the average cost composition for island fishers. Similar to mainland fishers, diesel was the highest cost component (60%), followed by ice (24%), food (7%), petrol (5%), lubricant oil (3%) and bait (1%).

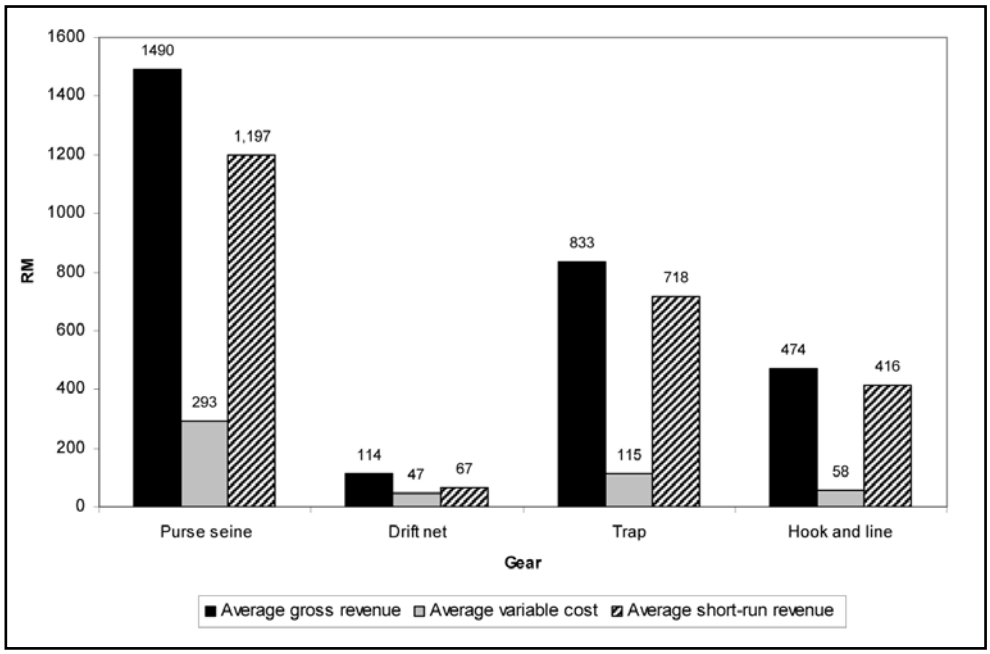


Figure 5.19. Short-run profit per vessel per trip by gear for island fishers.

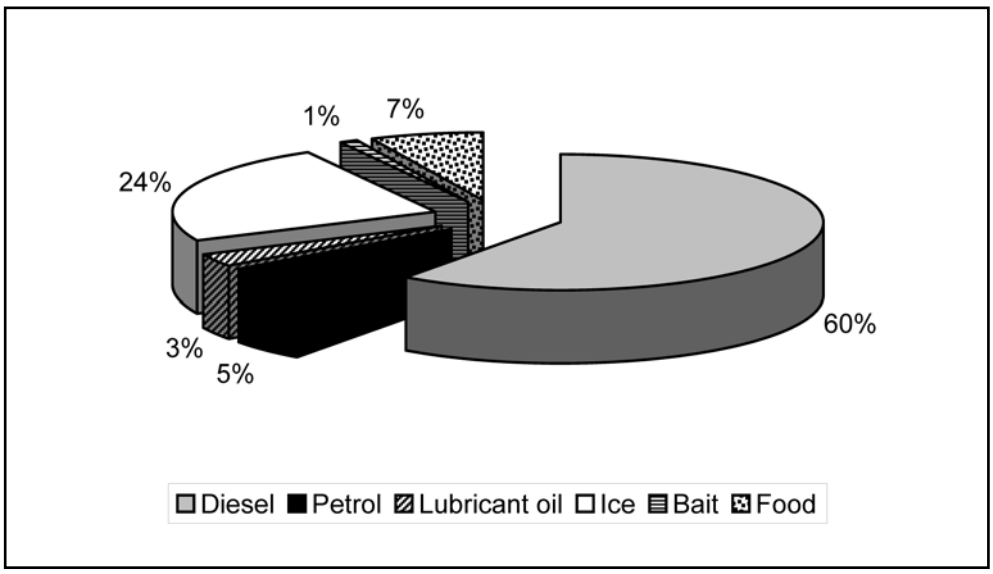


Figure 5.20. Percentage breakdown of variable costs by item for island fishers.

6 Issues Related to Sea Turtles

This section presents findings on sea turtle issues and fishery interactions. Results from the survey are presented followed by findings from the FGD. A summary of responses from the FGD, which was conducted to facilitate discussion on key issues and management options, is in Appendix 2. Twenty-two fishers from the districts of Dungun, Kemaman and Kuantan participated. Figure 6.1 shows the fishing areas, turtle nesting areas and study sites. Fishers generally fish along the East Coast and are prohibited from fishing within the vicinity of port areas, such as Kertih port and also within a 500-m radius from oil rigs at sea. The fishing areas shaded in Figure 6.1 were identified based on discussions with the respective DOF district heads (only Kuantan, Kemaman and Dungun districts) to represent the intensive fishing areas. This spatial representation indicates the potential areas of turtle-fisheries interactions, particularly during nesting seasons when sea turtles congregate near the nesting sites.

6.1 Perception of sea turtle abundance

Fishers were asked for their perception of sea turtle populations 20 years ago compared to the present situation in the study area[3]. Most indicated an overall decline in all turtle population species found in the study area. The majority of the mainland fishers (58%) agreed that green turtles had a higher population 20 years ago, followed by leatherbacks (40%), olive ridleys (36%) and hawksbills (34%) (Table 6.1). The perception regarding the turtle populations showed a sharp decline from 20 years ago compared to the present. About 44% of the mainland fishers said that the present green turtle population is low while 53% indicated that no leatherbacks can be seen in the study area. Similar observations were mentioned about olive ridleys (41% of the mainland fishers said there are none at present) and hawksbills (36% said that this population is low).

Fishers (85%) living on Redang and Perhentian stated that green turtles were most abundant, followed by hawksbills and olive ridleys. Only 9% of the island fishers said that they had seen leatherback turtles. Similar declining trends for all species were observed by these fishers – 72% and 63%, respectively, said that the present green turtle and hawksbill populations are low.

3 The figures did not include the percentage of respondents who had no opinion regarding population abundance. Hence, the figures do not total to 100%.

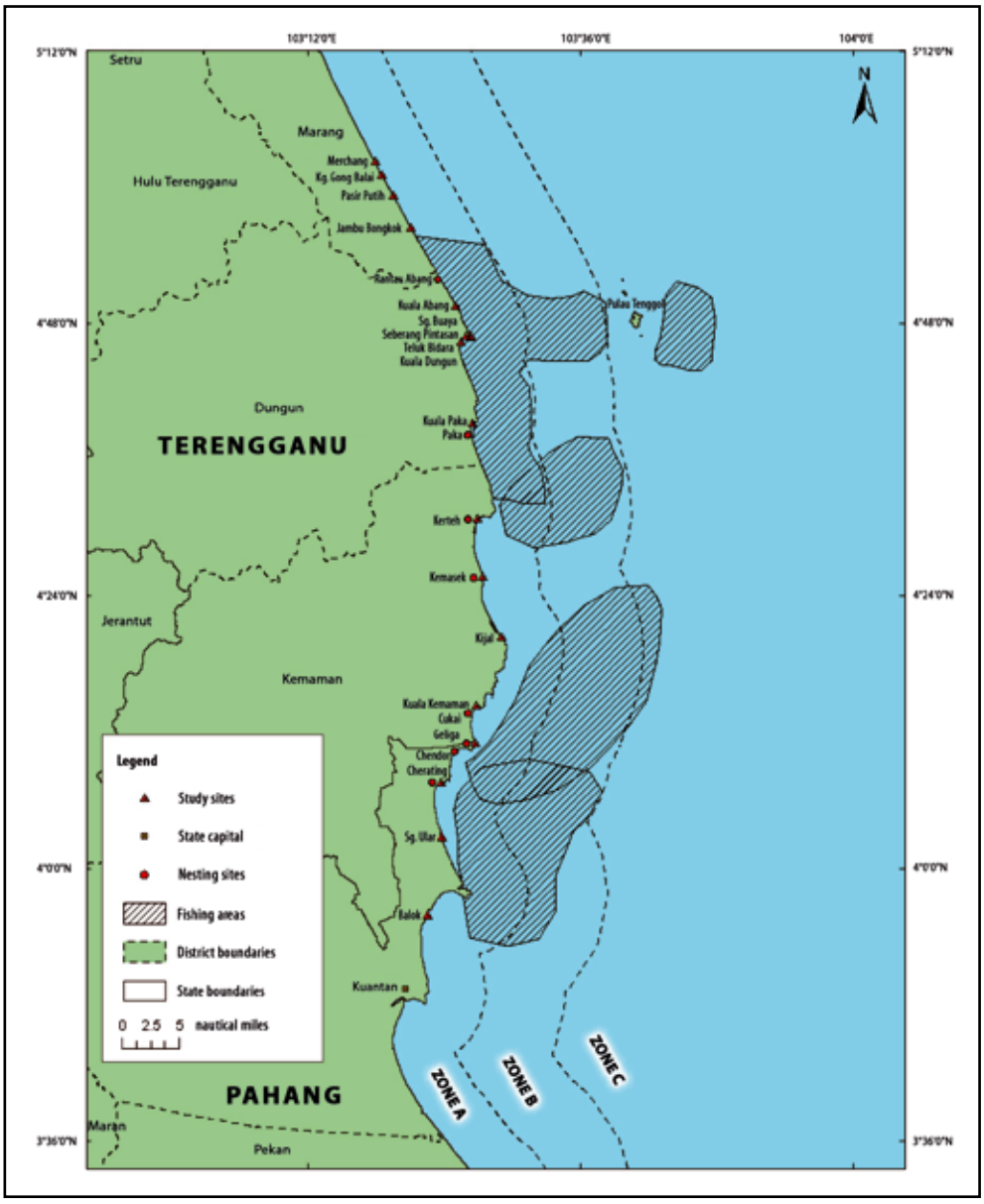


Figure 6.1. Map of turtle nesting areas, study sites and fishing areas.

Table 6.1. Comparison of turtle population between 20 years ago and present.

Species	20 years ago (%)				Now (%)			
	Mainland fishers (n=354)							
	High	Medium	Low	None	High	Medium	Low	None
Green	58	16	8	6	1	7	44	37
Leatherback	40	11	19	9	0	1	26	53
Hawksbill	32	17	13	15	1	2	36	38
Olive ridley	36	13	11	15	1	2	33	41
	Redang and Perhentian fishers (n=32)							
	High	Medium	Low	None	High	Medium	Low	None
Green	85	0	9	6	3	13	72	12
Leatherback	9	0	6	85	0	3	0	97
Hawksbill	63	25	6	6	9	16	63	12
Olive ridley	22	6	9	63	3	6	28	63

In terms of species abundance, green turtles were the most frequently sighted species (64%, mainland and 87%, island fishers), followed by hawksbill turtles (Figure 6.2). Hawksbill turtles were seen by 84% of island fishers, compared to 36% of mainland fishers. This indicates that hawksbill turtles can be found more frequently around the islands compared to the coastal areas of Terengganu and Pahang.

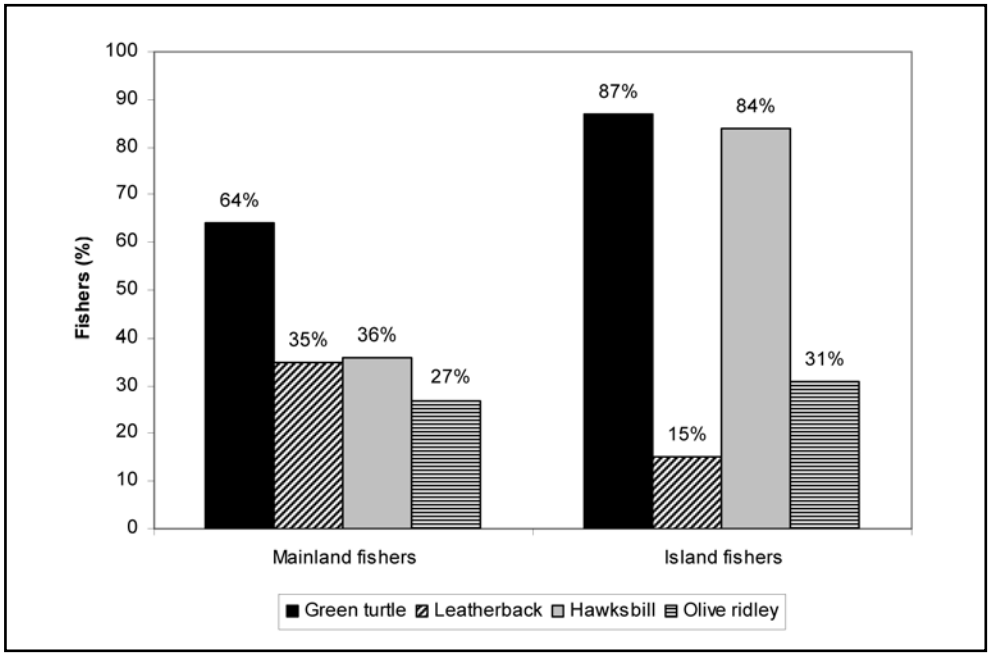


Figure 6.2. Turtle species seen.

The sighted species abundance distribution between mainland and island areas was consistent with the nesting data of DOF (Figures 6.3-6.6). Hawksbill turtles were seen more frequently around the waters surrounding the islands compared to the mainland. Similarly, leatherback turtles were known to nest only in the mainland areas and not around the islands. Except for leatherback and olive ridley turtles, the nestings of green turtles and hawksbills were higher in the islands compared to the mainland.

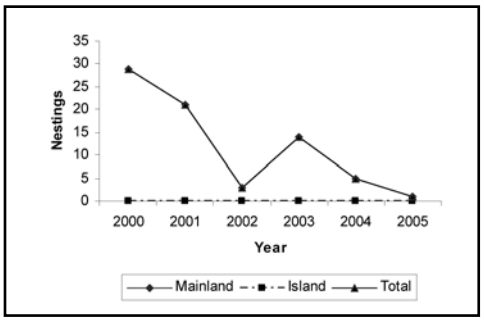


Figure 6.3. Leatherback turtle nesting trends in the study site.

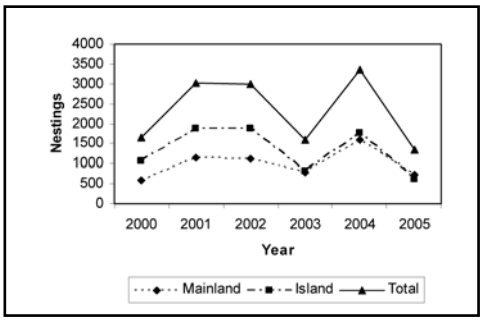


Figure 6.4. Green turtle nesting trends in the study site.

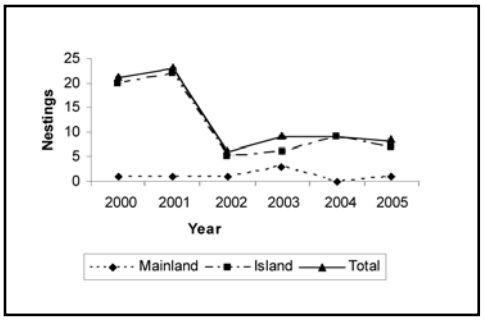


Figure 6.5. Hawksbill turtle nesting trends in the study site.

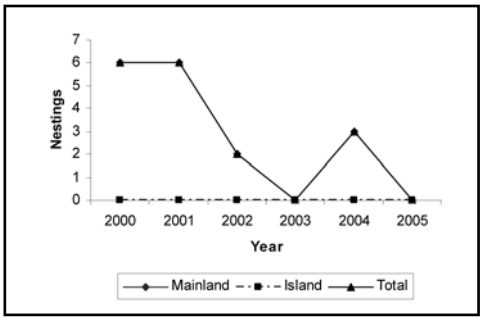


Figure 6.6. Olive ridley turtle nesting trends in the study site.

Source: TUMEC-DOF, 2000-2005. Turtle nestings.

6.2 Perceptions of the importance of turtles and reasons for their decline

Almost all of the respondents were aware of the importance of sea turtle conservation. The majority of the mainland fishers perceived turtles as an important heritage of the East Coast (93%) (Yeo et al. 2007). Turtles were also considered to be important for future generations (92%) and for promoting local economy for tourism (88%) among mainland fishers. The island fishers ranked "future generations" as the main reason why turtle conservation is important (100%). They also indicated the importance of turtles as heritage

of the East Coast (97%). It is interesting to note that many of the island fishers still maintain the view that sea turtle eggs are important food sources (91%). This shows that the mindset and traditional habits of the local fishers still remains even though all major nesting beaches at the islands were declared sanctuaries since 2005 (Chan 2006).

The fishers were asked if they thought turtle populations in the area decreased over the last 20 years. Around 89% of mainland fishers and 94% of island fishers said yes. Of all the fishers that agreed sea turtle populations in the area have decreased over the last 20 years, the majority acknowledged that the key reasons were use of illegal gears (37%, mainland fishers and 74%, island fishers) and fishery activities (33%, mainland fishers and 20%, island fishers) (see Figure 6.7). Many of the respondents highlighted ray nets as the main illegal gear that caused accidental catch of turtles besides *gerek* or *rawai* which are longlines. Some respondents (6%, mainland fishers) also stated that beach and tourism development led to reductions in turtle populations. There were also respondents citing reasons such as illegal take and consumption by foreign fishers (5%, mainland fishers) and egg collection and habitat loss (4%, mainland fishers) that contributed to turtle decline. Other reasons cited included construction of oil and gas facilities and ancillary services near nesting grounds, and sea pollution. Fishers acknowledging being part of the problem causing turtle decline could be attributed to the fact that it is a common sight to witness turtles being caught in fishing gears. In addition, the

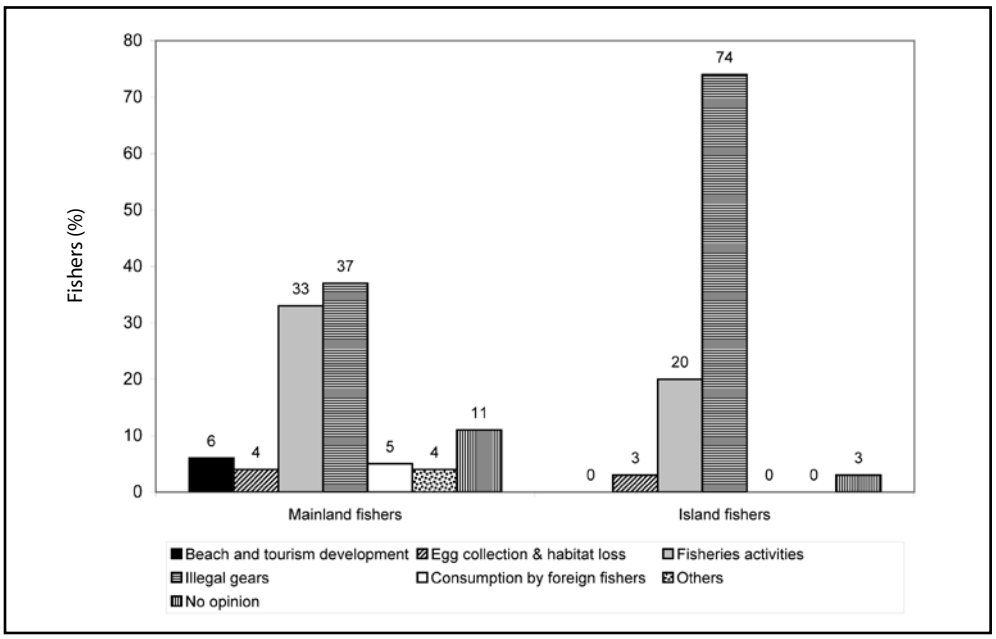


Figure 6.7. Fishers' perceptions of reasons contributing to sea turtle decline.

fishers' admission could be due to the setting of the survey implementation. Fishers were assured that all of their answers would be strictly confidential and would only be used for statistical purposes. This assurance could have encouraged them to give their real opinions.

FGD results showed similar responses which highlighted the use of non-turtle-friendly gears as one of the main reasons for turtle decline, followed by destruction of habitat/nesting sites and human consumption of eggs (see Appendix 2).

6.3 Sea turtle and fishery interaction

The survey attempted to estimate the number of turtle and fishery interactions in a year, which referred to the number of turtles accidentally caught in fishing nets. The number of fishers projected to have accidentally caught turtles in the area was scaled up, using the percentage of fishers that had reported accidentally catching turtles from the survey and applying it to the number of licensed fishers in the area. It is assumed that the fishers that accidentally caught turtles were not from the same boat, as the interviews were only carried out with either the boat owner or captain. The average number of turtles caught per boat was obtained and multiplied with the projected number of fishers that accidentally caught turtles in the waters of Terengganu and north Pahang coast, in order to estimate the annual number of turtle interactions. These estimates need to be carefully interpreted due to weaknesses of recalled data and absence of observers' data.

The study assumes that the likelihood for fishers to report turtle capture is low. Hence, the estimate of fishers accidentally catching turtles in their own nets serves as a lower-bound estimate. Additional questions to elicit fishers' responses regarding turtles accidentally caught in other fishers' nets were also included as an upper-bound estimate of turtle intercept.

Twenty percent of the mainland fishers (72 respondents) and 31% of island fishers (10) reported witnessing turtles being accidentally caught. This percentage included interactions in the fishers' own nets and in other fishers' nets over a period of several years. Out of these total figures, 6% of the fishers and 22% of the island fishers witnessed turtles being caught in 2005. The year 2005 was used in the study to estimate the annual number of interactions. See Table 6.2.

Table 6.2. Percentage of fishers that reported witnessing turtles accidentally caught.

Witnessing turtles trapped (%)	Mainland fishers (n=354)	Island fishers (n=32)
Witnessed turtles trapped	20	31
Witnessed turtles trapped (2005)	6	22
Witnessed in own net (2005)	1	6
Witnessed in others' nets (2005)	5	16

Among mainland fishers, the average number of turtles caught in fishers' own nets and in others' nets in 2005 was 1 and 3.11, respectively. The average number of turtles caught was obtained by summing up the numbers caught in 2005 and dividing the total with the number of fishers that caught the turtles. A mainland fisher stated that about 300 sea turtles were caught in 2005, which was considered an outlier. The average number of turtles caught among island fishers' own nets was 2.5 and in others' nets, 3.4 (Table 6.3).

Table 6.3. Average numbers of turtles reported caught in 2005.

	Mainland fishers	Island fishers
Caught in fisher's own net	1	2.5
Caught in others' nets	3.11	3.4

Based on the estimates above, the number of fishers that accidentally caught turtles was extrapolated, based on the total number of licensed gear fishers (790 among mainland fishers and 79 among island fishers based on DOF statistics on licensed gears). The figures obtained were 7.9 and 4.74 fishers, respectively, for mainland and island fishers. Multiplying these with the average turtles caught by licensed fishers produces estimates of 8 turtles accidentally caught among mainland fishers and 12 among island fishers, based on catches experienced in own nets (Table 6.4).

Table 6.4. Lower-bound estimates of fishery and turtle interactions for captures in own nets.

Estimates	Mainland fishers	Island fishers
Population of licensed gear fishers	790	79
Scaled-up estimate of number of licensed gear fishers accidentally catching turtles in own nets	7.9 (1% of 790 fishers)	4.74 (6% of 79 fishers)
Estimated number of turtle interactions	~8 turtles (7.9 fishers *1 average per vessel)	~12 turtles (4.74 fishers * 2.5 average per vessel)

Similarly, the same approach yields an estimate of 123 turtles accidentally caught in 2005 as witnessed in others' nets among mainland fishers and 17 turtles among island fishers as the upper-bound estimates (Table 6.5).

Table 6.5. Upper-bound estimates of fishery and turtle interactions for captures in others' nets.

Estimates	Mainland fishers	Island fishers
Population of licensed gear fishers	790	79
Scaled-up estimate of licensed gear fishers accidentally catching turtles in own nets	39.5 (5% of 790 fishers)	5.12 (16% of 79 fishers)
Estimate of turtle interactions	~123 turtles (39.5 fishers * 3.11 average per vessel)	~17 turtles (5.12 fishers * 3.4 average per vessel)

In summary, in 2005, the lower-bound and upper-bound estimates of fishery and turtle interactions, respectively, were 8 and 123 among mainland fishers, and 12 and 17 among island fishers (Table 6.6).

Table 6.6. Summary of lower and upper- bound estimates of turtle interactions in 2005.

Fishers	Lower-bound	Upper-bound
Mainland	8	123
Island	12	17

The subsequent sections highlight various features (such as age category, conditions of turtle, species caught and when turtles were caught) of turtle fishery interactions based on respondents' reported accidental catching of turtles in 2005. The survey found out that all turtles caught in mainland and island fishers' own nets were alive (Figures 6.8 and 6.9).

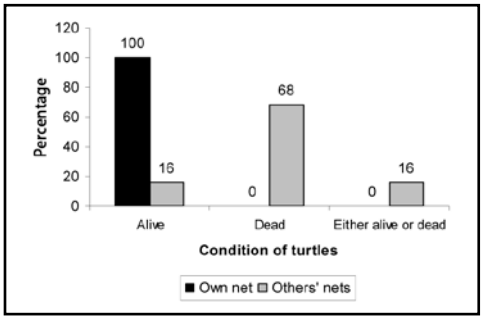


Figure 6.8. Condition of turtles by ownership of nets for mainland fishers.

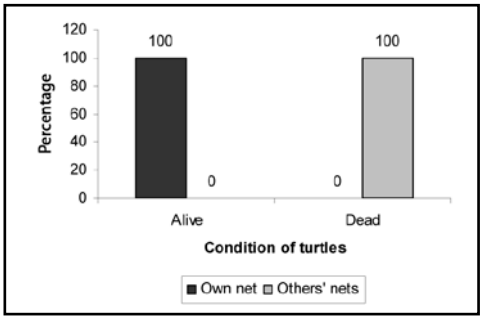


Figure 6.9. Condition of turtles by ownership of nets for island fishers.

Mainland fisher-respondents that witnessed turtles being accidentally caught in other fishers' nets reported that 17% of the turtles caught were alive, 67% were dead and 16% could not be concretely determined (and hence categorized as either dead or alive) (Figure 6.8). All island fisher-respondents that witnessed turtles caught in others' nets said that these were found dead. The most frequently caught species was green turtles (4%, mainland and 6.2%, island fishers), followed by hawksbills (1.7% and 6.2%, respectively) (Figure 6.10). These two species were recorded to be more abundant, based on nesting data, compared to leatherbacks and olive ridleys. None of the island fishers reported seeing leatherbacks and olive ridleys being accidentally trapped around the islands.

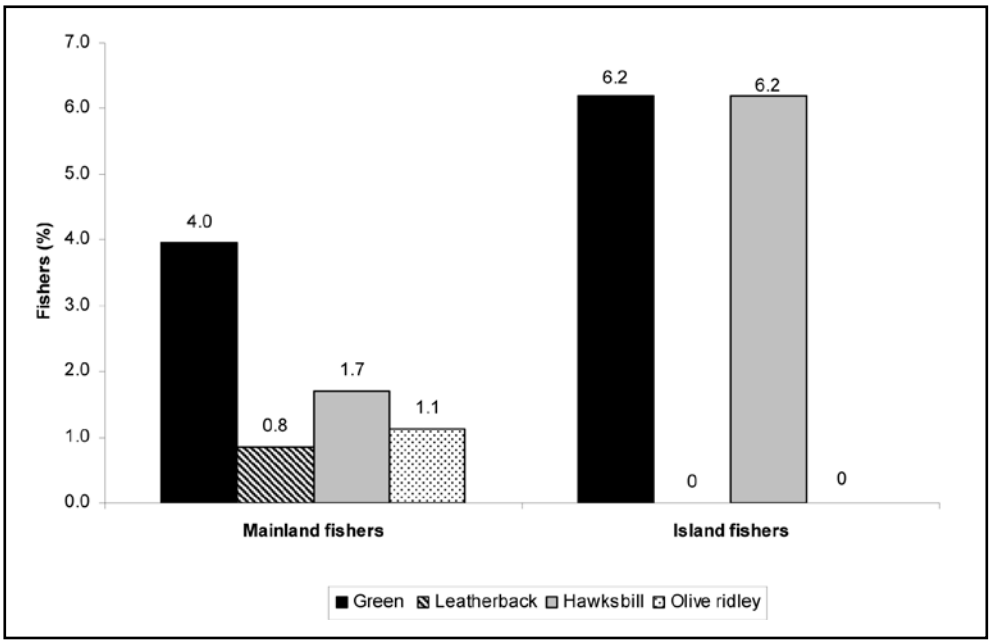


Figure 6.10. Percentage of fishers reporting accidental capture of various turtle species.

Fishers said they accidentally caught sea turtles between April and August, which coincides with the nesting data of DOF (see Figures 6.11 and 6.12). An exception was when an island fisher caught a turtle in his own net in November 2005. The majority of the accidental turtle interactions occurred in April and July among mainland fishers and in June among island fishers (Figure 6.11). Responses during FGD indicated that turtles were normally entangled in nets between March and August, with peaks around June and July (see Appendix 2). The important observation that indicated turtle interactions to be highest during nesting season suggests that policy options such as area closure and

complementary actions including incentive measures need to be explored. It is important to examine current approaches such as the case of Rantau Abang Fisheries Prohibited Area and how it can be enhanced to effectively minimize turtle interactions during nesting season.

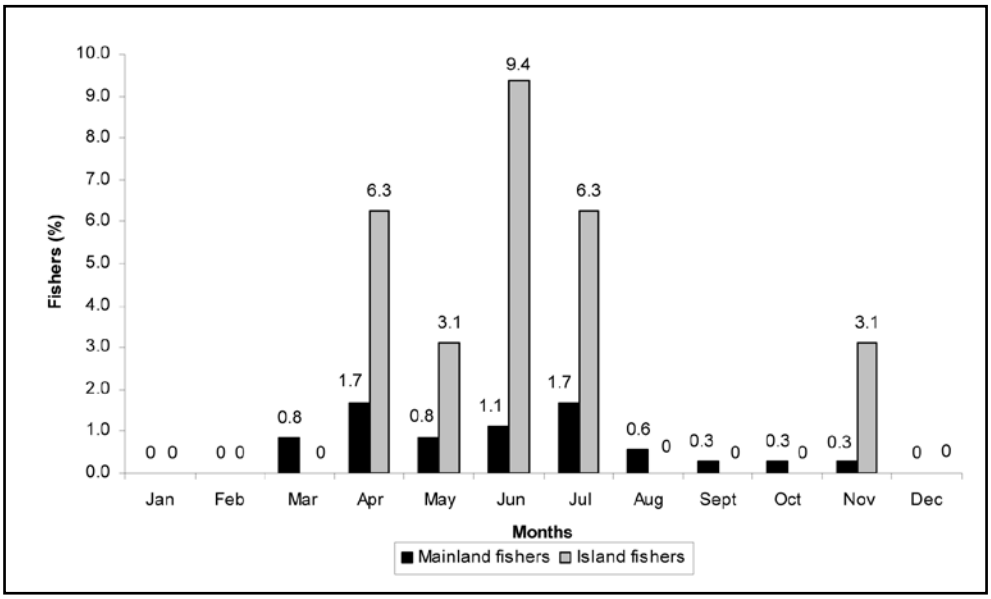


Figure 6.11. Months when turtles were accidentally trapped in 2005.

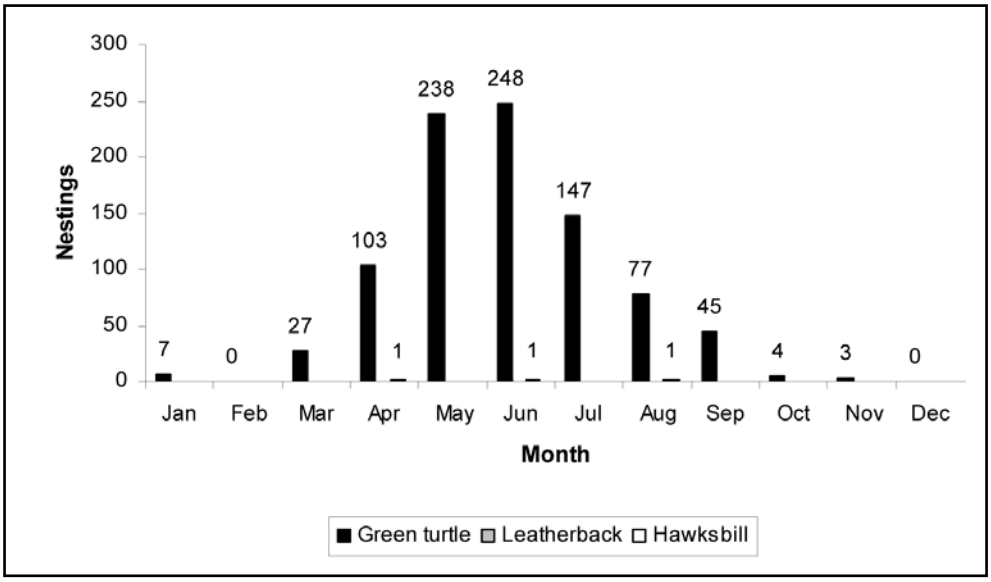


Figure 6.12. Monthly nesting data (DOF 2005).

Figures 6.13 and 6.14 highlight the age categories of caught turtles. The majority of the turtles were adults (74%, mainland and 75%, island fishers); juveniles were 11% and 25%, respectively; and 15% were in between juvenile and adult categories.

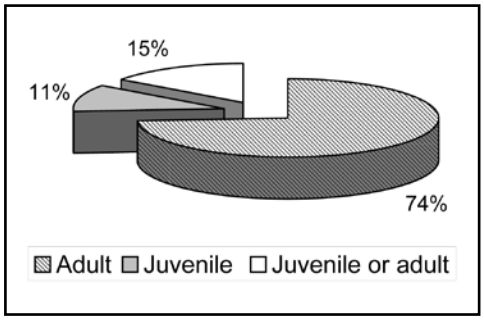


Figure 6.13. Age categories of turtles caught by mainland fishers.

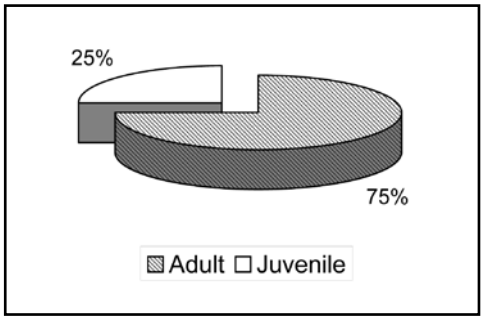


Figure 6.14. Age categories of turtles caught by island fishers.

Figure 6.15 presents the percentages of fishers that reported turtles accidentally caught by gears in 2005. Drift/gill nets were the most frequently used gear (4.8%, mainland and 6%, island fishers), followed by trawlers (1.4%) and hook and line (0.8%) among mainland fishers. About 88% of the total drift/gill nets were ray nets. Ray nets are used to catch sting rays in the coastal areas of Terengganu and Pahang. Studies have shown that ray nets are detrimental, as turtles can easily be entangled due to the large mesh size. A nationwide ban on their use was imposed in 1989 (Sukarno and Omar 1989). Longlines are categorized within the hook and line license category, hence making it difficult to determine from official records the number of fishers that use longlines in the area. Based on local anecdotal responses, unbaited longlines called *gereks* could trap sea turtles. Though not banned, *gereks* are not

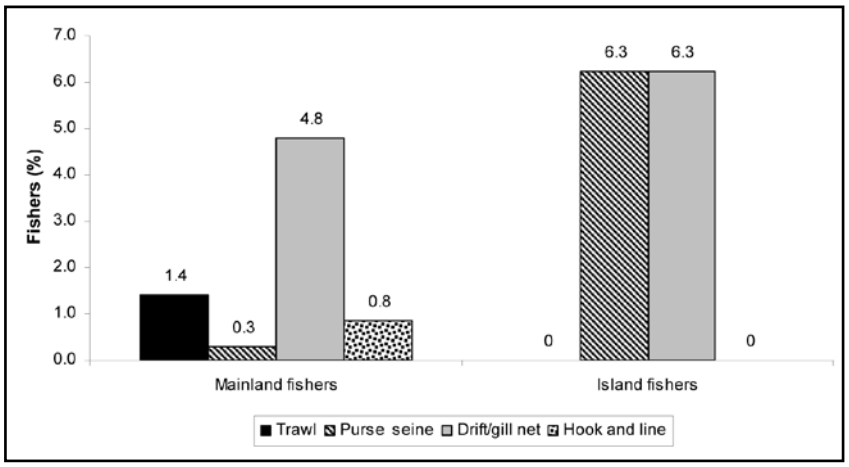


Figure 6.15. Percentages of fishers that reported turtles caught by gear, 2005.

encouraged in Terengganu as their tightly spaced hooks are known to be detrimental to species such as sea turtles and can cause damage to fishing nets. The usage of *gereks* are banned in Pahang. Investigations are being carried out in Terengganu to determine the extent of damage from *gereks*.

Among the island fishers, 6.3% of the respondents that reported catching turtles were purse seine license holders. Shrimp trawlers operate during the monsoon season. As the period does not coincide with turtle nesting season, shrimp trawlers do not pose significant threats to sea turtles nesting in the area. Due to the proximity and accessibility of the islands from the mainland, larger vessels such as purse seiners and trawlers from the mainland have been known to fish around the islands as well. Responses from FGDs indicated that trawl nets, ray nets and *rawai*/*gerek* which are longlines, trap sea turtles (see Appendix 2).

According to 38% of the mainland fishers that accidentally caught turtles in their nets, the interactions with sea turtles did not cause any damage or impact to nets, while 35% said that their nets were damaged but could still be salvaged/ repaired. The remaining 27% stated that their nets were beyond repair (Figure 6.16). All island fishers said that nets were not damaged when turtles were accidentally caught. The average cost to repair damaged nets among mainland fishers was RM5 (based on 12 observations, except 1 involving a trawler for a repair cost of RM500). The average time taken to release turtles (both dead and alive) was approximately 15-20 minutes, except for a trawler that took 3 hours. Among island fishers, 30% that caught turtles accidentally in 2005 said that on average they took less than 5 minutes to release the turtles.

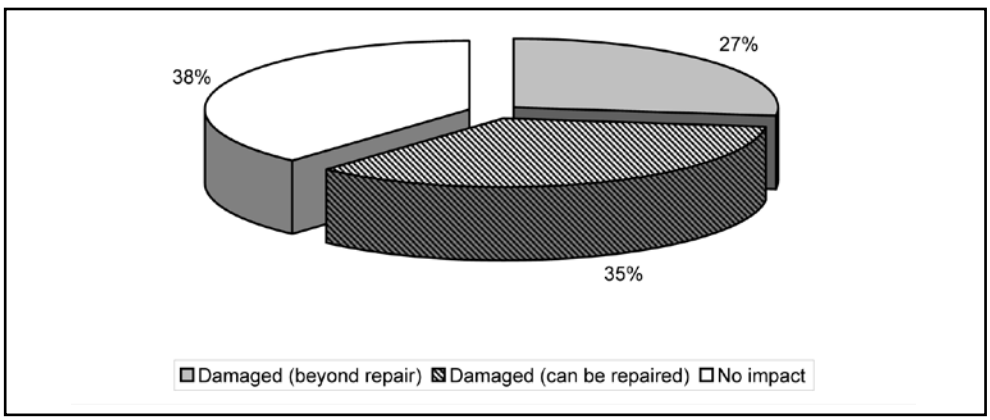


Figure 6.16. Percentage of fishers stating impacts of caught turtles on fishing gear of mainland fishers.

Based on the results of the study, a categorization of the main fishing gears by district was tabulated (see Table 6.7). These data were integrated with sightings of sea turtles bycatch reported in the survey results and statistics on stranding and confiscation of illegal gears from DOF. This was to provide an overall indication of the extent of sea turtle-fishery interaction by district. As the survey results were based on perception and recalled data, the interpretation of the results should be treated with caution. Nevertheless, by cross-checking these results with other sources of data and statistics, such as stranding and confiscation of illegal gears, an inference about the actual situation was made. It should be noted that stranding data included only reported cases. There were also unreported cases. The matrix indicated that Kemaman district had the highest incidence of fishers witnessing turtles being accidentally caught. It also had the highest incidence of stranding and confiscation of illegal gears based on collected statistics (DOF, unpublished data). From those who witnessed sea turtles being accidentally caught, the highest percentage was caught in gill nets (9%) among mainland fishers and in purse seines (28%) among island fishers.

Table 6.7. Summary of gears and turtle interaction by district.

District/ island	Gear	Witnessed turtles trapped	Stranding statistics (cases)	Confiscation of illegal gears
Pasir Puteh and Besut	Trawl	7 out of 38 respondents saw turtles trapped (21%); of this, 8% of 38 were caught in their own vessel	5 (2005)	1 ray net (2005)
	Purse seine			
Setiu	Drift/gill net	26% out of 55 respondents (2% owned boat)	1 (2005)	2 ray nets (2006)
	Purse seine			
Kuala Terengganu	Trawl	9% out of 45 respondents	1 (2006) 5 (2005)	7 ray nets (2005)
	Purse seine			
Marang	Drift/gill net	14% out of 43 respondents (2% owned boat)	2 (2005) 1 (2006)	10 ray nets (2006) 1 ray net (2005)
	Purse seine			
Dungun	Drift/gill net	22% out of 65 respondents (6% owned boat)	2 (2005) 2 (2006)	1 ray net (2006)
	Purse seine			
	Trawl			
Kemaman	Drift/gill net	34% out of 61 respondents (15% owned boat)	17 (2006) 3 (2005)	21 ray nets (2006) 2 ray nets (2005)
	Purse seine			
	Trawl *(geliga)*			
Kuantan	Drift net	11% out of 47 respondents (4% owned boat)	13 (2005) – 3 cases within study area	10 ray nets (2005) 4 ray nets (2006)
	Hook and line			
Redang	Hook and line	32% out of 25 respondents	1 (2005)	3 ray nets (2006)
	Drift net			
Perhentian	Hook and line	29% out of 7 respondents (100% owned boat)	No information	No information
	Purse seine			

Source: Survey statistics and DOF data, 2005-2006.

6.4. Perception on reporting of turtle stranding

The majority of the respondents stated that they expected fishers would never report when they found a dead turtle (49%, mainland and 50%, island fishers, see Figures 6.17 and 6.18). This may be due to the fact that some fishers may have negative sentiments about sea turtles and also harbor the fear of being prosecuted for killing them.

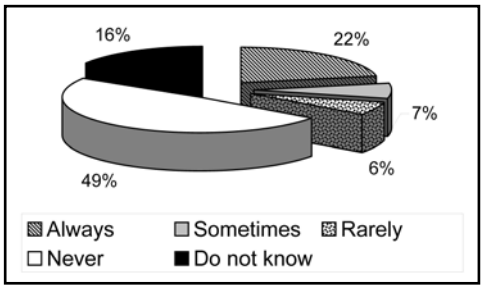


Figure 6.17. Mainland fishers' perception on whether fishers will report of stranding.

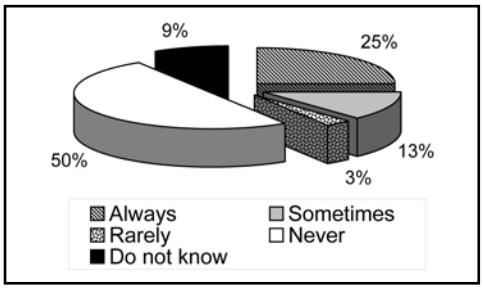


Figure 6.18. Island fishers' perception on whether fishers will report of stranding.

Among mainland (40%) and island fishers (59%), the major reason cited for not reporting turtle stranding or dead turtles was because it was too time-consuming (Table 6.8). Cases of dead turtles go unreported as reporting does not bring any benefit, according to 37% mainland fishers and 34% island fishers. Some fishers do not report because they are unsure where to report and according to 37% mainland fishers and 13% island fishers. The respondents also cited that the existing law does not encourage reporting for fear of being prosecuted, and that lack of response from authorities deters them from reporting. Other reasons were given (such as to avoid conflict) by 5% mainland and 9% island fishers.

Table 6.8. Reasons for not reporting dead turtles by mainland and island fishers.

Reason (%)	Mainland fisheries (n=354)	Island fisheries (n=32)
Unsure where to report	37	13
Too time-consuming and busy	40	59
Does not bring any benefit	35	34
Existing law does not encourage such reporting	16	3
Lack of response from authorities	6	19
Others	5	9
No comments	10	9

The majority of the respondents agreed that the most important way to increase reporting is to enhance cooperation among fishers and relevant agencies (44% mainland fishers and 56% island fishers). Providing information on where and how to report was also suggested to increase reporting (40% and 28% respectively). The respondents also thought that providing incentives would encourage reporting (29% and 20%). Other suggestions included increasing enforcement and educating fishers how to handle turtles that have been accidentally caught (Figure 6.19).

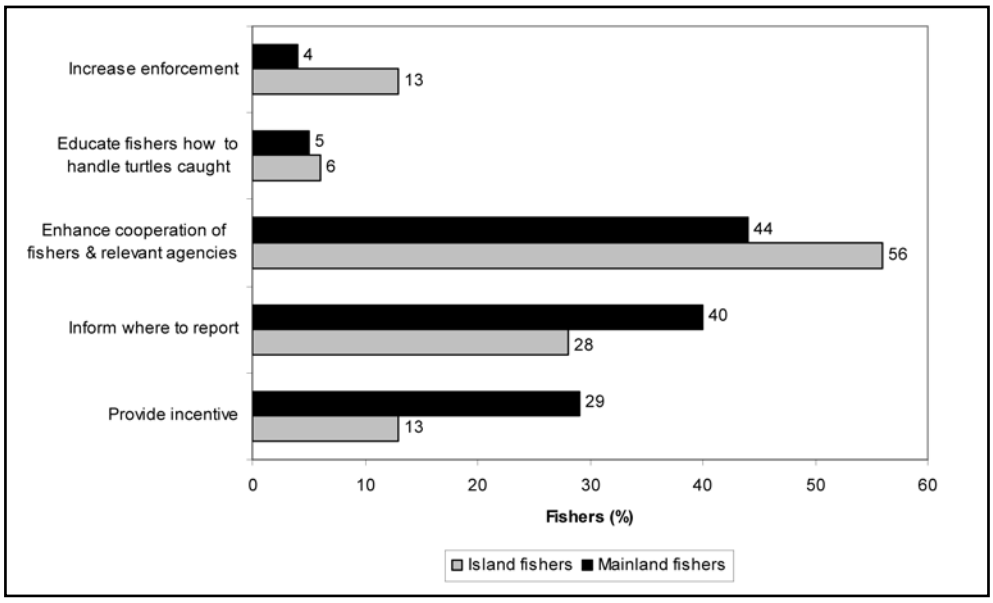


Figure 6.19. Suggestions given by fishers to encourage reporting of dead turtles.

6.5 Suggestions to reduce turtle-fishery interactions and stimulate awareness on legislation and conservation activities

Both mainland and island fishers perceived that stepping up enforcement efforts would be the most important initiative to enhance conservation of turtles and to reduce incidental catch in fishing nets (62% mainland and 65% island fishers, see Figure 6.20). They also stated that encouraging the use of appropriate fishing gears would be important (41% mainland and island fishers). Other suggestions from the respondents included curbing the use of ray nets and designing alternative fishing gears to catch rays. The respondents also suggested the need to increase fishers' awareness of sea turtles (24% mainland and 13% island fishers) and cooperation between fishers and relevant authorities (19% mainland fishers). The FGD obtained similar results whereby the majority proposed the need for better law enforcement and regulations

related to zoning, followed by use of appropriate fishing gears. A small number of participants proposed area closures with proper compensation for fishers, and highlighted the need for training on turtle resuscitation (see Appendix 2).

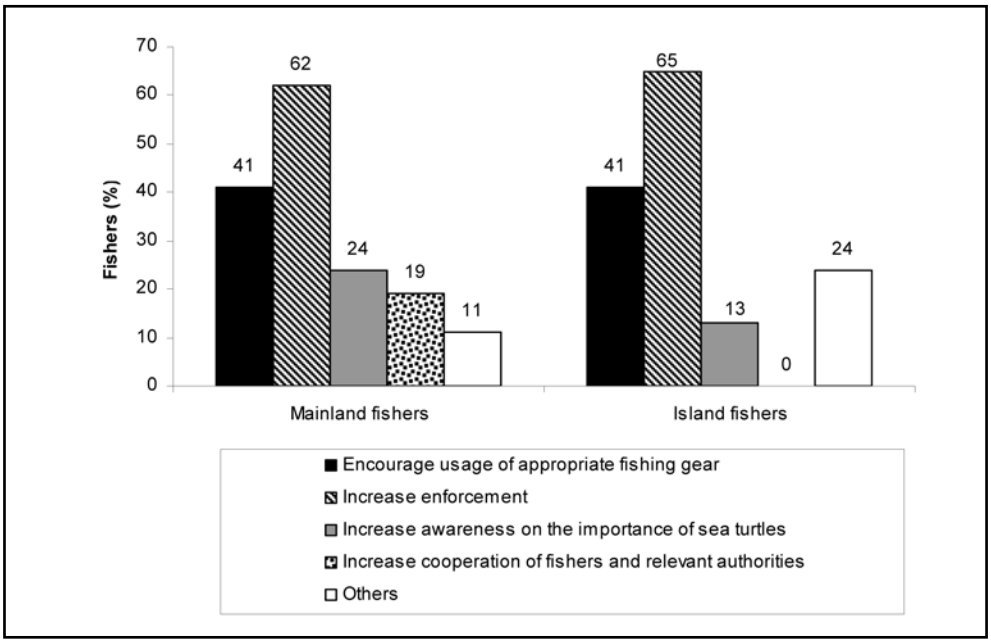


Figure 6.20. Suggestions to enhance turtle conservation and to reduce sea turtle-fishery interactions.

Most of the respondents were aware of legislation related to sea turtles (68% mainland and 59% island fishers) (Yeo et al. 2007). Around 35% of mainland and 34% of island fishers thought that laws related to sea turtles were effective, while 31% of mainland and 16% of island fishers said that the related laws were not effective (see Figures 6.21-6.22). Some of the key reasons cited were lack of enforcement – illegal gears are still being used, no one is prosecuted or caught for legal offenses – and the mindset of people has not changed, as turtle eggs are still consumed locally.

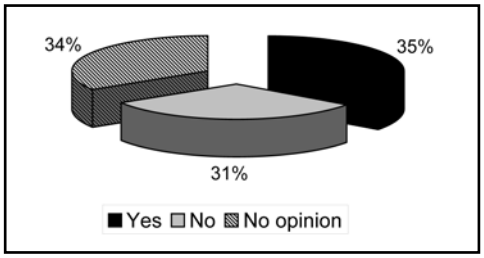


Figure 6.21. Perceptions of effectiveness of law among mainland fishers.

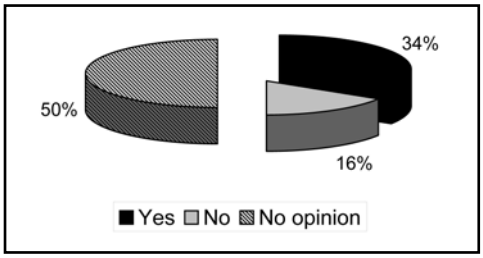


Figure 6.22. Perceptions of effectiveness of law among island fishers.

Most of the respondents were interested in participating in activities related to sea turtle conservation (70% mainland fishers and 59% island fishers; Yeo et al. 2007). The mainland fishers were mainly interested in community activities such as beach cleanup (60%), learning proper turtle resuscitation methods (38%) and conducting research related to conservation of sea turtles (29%). The island fishers were most interested in doing research (38%), carrying out community activities (28%) and ecotourism activities (22%). Island fishers were particularly aware of the importance of sea turtles in contributing to the local economy through ecotourism, as the number of visitors to the islands increases. Also cited were initiatives relevant to hatcheries. See Figure 6.23.

Many of the respondents who were not interested in joining such programs gave the following reasons: they were too busy, no benefits could be derived from those, the activities were not relevant and they were too old to take part in the activities. Finally, results from FGD on ways to increase support and involvement of the local community included organizing conservation activities and awareness programs, and emphasizing the importance of turtles as a symbol for the East Coast, particularly Terengganu. The participants also welcomed more open discussions and interaction with relevant authorities on turtle-fisheries related issues (see Appendix 2).

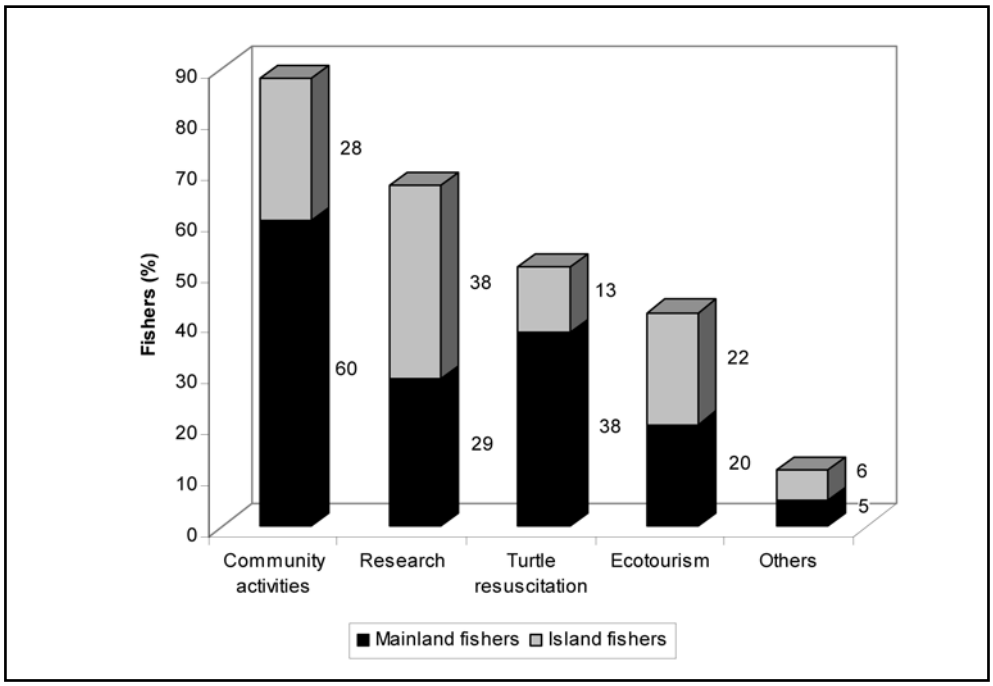


Figure 6.23. Percentages of respondents with interest in various sea turtle programs.

7 Conclusions and Recommendations

The results of the study showed that fishers have a good understanding of sea turtle population trends over the last 20 years, with high percentages citing a sharp decline over the period. Interestingly, the majority of the fishers attributed fisheries activities and illegal gears to be the main threats to sea turtle populations, highlighting the pressing need to prioritize efforts to reduce interactions of sea turtles with fishing activities.

Survey responses indicated that the majority of the interactions coincided with the nesting seasons, suggesting the potential to assess the effectiveness of management measures such as area closures and incentive measures. At present, legislation exists in terms of prohibited fisheries areas during nesting season (e.g., in Rantau Abang). It would be useful to assess the effectiveness of this regulation and examine ways for the legislative tool to be complemented with incentive measures and strengthened enforcement efforts for improved performance at the existing or future sites.

The results of the study also highlighted that the use of ray nets has continued to persist (eg. 88% of the drift nets identified to have captured sea turtles in the survey were ray nets) despite the ban on its use since 1989. Ray nets were one of the major gears causing the capture of turtles, besides trawl nets and purse seines. The use of banned ray nets continues as there are no alternative gears to catch sting rays, in addition to the difficulty of ensuring full enforcement. This has important implications for developing future management measures since the ban has been in place for almost 20 years and thus strengthens the urgency to engage fishers in fisheries-sea turtle related management measures which has been minimum.

Most fishers are aware of the Fisheries Act 1985 (Amended 1993) that prohibits the capture of marine turtles by any type of fishing method. Anecdotal responses suggested that fishers were fearful to be associated with bycatch. Most often, fishers would dispose of sea turtles that are accidentally caught the fastest way possible, sometimes hurting and killing the turtles in the process. Fear of being associated with turtle bycatch also discouraged fishers from resuscitating injured turtles, hence resulting in little chance for the turtles' survival. Fishers did not report stranding cases for fear of being prosecuted, in addition to the time and effort required to report a case.

The study also showed that most fishers are interested to participate in activities related to sea turtle conservation particularly learning proper resuscitation methods (38% among mainland fishers and 13% among island fishers) and

conducting research related to sea turtles (29% among mainland fishers and 38% among island fishers). So far there had been no training or discussions with fishers on ways to resuscitate turtles accidentally trapped in gears. Mortimer 1989 recommended that attempts should be made to resuscitate any turtles that are unconscious, even if they appear to be dead. An unconscious turtle should never be thrown back into the water before resuscitation efforts are attempted. Training fishers in such efforts will be an important first step in engaging their involvement in conservation efforts. Also important is the provision of tools for and training of fishers on appropriate methods to handle and release sea turtles to improve their chances of survival.

The findings also showed that fishers were aware of the importance of sea turtles. However, the welfare and socioeconomic status of fishers remained the most important priority for these families. Most fisher-families depended solely on fishing for their household income. Only a few undertook part-time jobs, while around 70% of their spouses did not work, thus further relying on fishing as the main source of household income. The contribution of the primary occupation to the overall household income was large. On average, the composition of household income among mainland fishers was around 83% from primary income (i.e., fishing), 9% from secondary jobs, 5% from spouse and 3% from family members.

Overall, the study shows that unless there are effective measures to engage and interest fishers in reducing turtle-fishery interactions while improving their welfare and socioeconomic conditions, the status quo of declining turtle populations will continue unabated. Fishery activities will persist as one of the major threats to the survival of sea turtle populations, particularly along the nesting beaches of the East Coast of Peninsular Malaysia.

Due to the highly migratory nature and complex life history of sea turtle species, efforts to reduce turtle-fishery interactions need to be implemented at a wider scale. Successful integration and coordination of management measures, at national or global levels, according to the life cycle of sea turtles are critical. While measures to promote turtle-friendly gears are being carried out through scientific experiments in Malaysia and the Southeast Asian region, a larger-scale effort or program that actively engages fishers, and effective monitoring, such as through an observer program, are critically lacking in the region.

This paper recommends three immediate priorities for addressing the impacts of sea turtle-fishery interactions for the East Coast of Peninsular Malaysia. These recommendations are:

1. Engaging and working with fishers to reduce turtle-fishery interactions
2. Enhancing enforcement and institutional capacity
3. Examining welfare-enhancing initiatives

These points are elaborated below:

1. **Engaging and working with fishers to reduce turtle-fishery interactions**

   Findings from the study point to the critical need for intensely engaging fishers in turtle-fisheries conservation measures. These include:

   a. ***Gear modification***: Innovative ways to engage fishers in gear modification/design have been introduced, such as through the WWF Smart Gear Program. Locally, a priority is to explore alternatives/ modifications for gill nets that are used for catching sting rays, followed by other gears.

   b. ***Designing relevant management options such as area closures or incentive mechanisms:*** Options for spatial and temporal control on fishing (especially during peak nesting seasons around nesting sites), to be complemented with incentive measures, were highlighted by a small number of fishers during FGD. Other measures include limiting tow-times for trawlers or soak time of fishing gears. The incorporation of incentive measures in management options needs to be examined within the local context and Asian culture, particularly among small-scale coastal fishers.

   c. ***Awareness building and behavior change:*** Experience from the Eastern Pacific has indicated that raising awareness among fishers helped in reducing hooking rates of sea turtles (see Appendix 3). Efforts to engage fishers and raise their awareness of their roles would be important to ensure participation and acceptance of turtle-related initiatives and better fishing practices. Observations from the study highlighted the need for better understanding of legislation among fishers, particularly when they accidentally catch or find injured turtles, through workshops or a series of discussions in order to dissipate fear among fishers to help in resuscitation efforts.

      Training and turtle resuscitation methods: An outreach effort from the management authorities to encourage resuscitation efforts, coupled with explanation of the law, is important so that such efforts by fishers

who use legal gears are not penalized. There have been no activities to encourage resuscitation efforts among fishers thus far.

d. ***Monitoring and research***: Monitoring, research and identification of management options and their impacts are important to encourage continual improvements to sea turtle management. Fishers could contribute important knowledge and participation in terms of monitoring and research efforts. Data through observer programs are lacking in the region. Efforts in these areas would greatly enhance understanding of the extent of bycatch rates.

Extensive expertise and experience on turtle-fishery interaction measures have been developed in the Eastern Pacific, for example, through the Eastern Pacific Regional Sea Turtle Program. The program focused on reducing sea turtle mortality in artisanal longline mahi-mahi and tuna fisheries of Latin America (Hall et al. 2006). In another initiative within the study site, WWF-Malaysia has been engaging the community of Kemaman district with the establishment of a community-based group called Persatuan Khazanah Rakyat Ma' Daerah (MEKAR). MEKAR is composed of people that live in the vicinity (including teachers, traders, fishers and villagers). These two initiatives provide important starting points and lessons to enhance existing efforts or to initiate a new program to work with fishers to reduce turtle-fishery interactions. In order to ensure effectiveness and success of these efforts, a few key conditions are required. Funding for such a program is crucial. Long-term engagement with fishers is also needed. The openness to participate and commitment of all parties, including management authorities, fishers and NGOs, would be underlying conditions for the success of such a program. While there is a need to start at a local level, efforts need to be scaled up to the regional level to enhance the program's effectiveness while actively sharing experiences learned at the regional scale.

2. Enhancing enforcement and institutional capacity

Over 60% of the mainland and island fishers proposed the need for strengthening enforcement efforts, particularly during nesting seasons, in order to reduce turtle-fisheries interactions. Proposals are in consideration to place relevant officers who are able to focus on natural resource/ conservation issues at State level DOF for more targeted conservation efforts on the ground. This is an important step to provide the institutional capacity to implement sea turtle-fishery interactions-related efforts, particularly in engaging fishers.

3. **Examining welfare-enhancing initiatives.**
   These initiatives can be described in two categories.
   a. Immediate measures such as involving fishers and providing incentives/ salaries for participating in turtle-related conservation programs.
   b. Longer-term measures that include examining household income sources from alternative livelihoods, particularly during nesting seasons, or income from spouses or other family members: For fishers to participate effectively in measures to reduce sea turtle-fishery interactions, it is critical that their livelihoods are not negatively affected. In areas where a tradeoff is unavoidable, these impacts on fishers should be minimized or offset. These efforts would require the broader involvement of other agencies, for example, the Department of Rural Development, women's groups and NGOs, who have the capacity to train or equip fishers for other livelihood activities (Sukarno, W., pers. comm.).

The uniqueness of sea turtles and their charismatic features make these species valuable not only to Malaysia as a nation but even more so at global levels. Lessons from efforts around the world provide useful stepping stones for similar approaches to be adapted to local conditions to ensure the survival of sea turtle populations in Malaysia.

References

Benson, S.R., P. H. Dutton, C. Hitipeuw, B. Samber, J. B. Arbessy and D. Parker. 2007. Post-nesting migrations of leatherback turtles (*Dermocheyls coriacea*) from Jamursba-Medi, Bird's Head, Peninsula, Indonesia. Chelonian Conserv. Biol. 6(1): 150-154.

Chan, E.H. 1993. Interactions between fisheries and sea turtles. Fishmail 5(3):12-15.

Chan, E.H. and H.C. Liew. 2002. Interactions between fishing gear and sea turtles in Terengganu. Paper presented at the Asian-Japan Workshop on Cooperative Sea Turtle Research and Conservation. 11-13 December 2001, Marine Biological Centre, Phuket, Thailand.

Chan, E.H., H.C. Liew and A.G. Mazlan. 1988. The incidental capture of sea turtles in fishing gear in Terengganu, Malaysia. Biol. Conserv. 43 (1): 1-7.

Chan, E. H. 2006. Marine turtles in Malaysia: On the verge of extinction? Aquat. Ecosyst. Health Manage. 9(2): 175-184. 2006.

DOF (Department of Fisheries) Malaysia. 2005. Annual fisheries statistics. Vol. 1. DOF, Malaysia.

DOF (Department of Fisheries). 2005 and 2006. Stranding statistics and confiscation of illegal gears. DOF, Malaysia. (Unpublished).

EPU (Economic Planning Unit). 2006. Ninth Malaysia Plan. Prime Minister's Department, Putrajaya, Malaysia.

FAO (Food and Agriculture Organization). 2004. Report of the Expert Consultation on Interactions between Sea Turtles and Fisheries within an Ecosystem Context, 9-12 March 2004, Rome, Italy.

FAO (Food and Agriculture Organization). 2007. Code of Conduct of Responsible Fisheries. Accessed on 26 January 2007 from http://www.fao.org/docrep/005/ v9878e/v9878e00.htm

Hall, M. A., N. Vogel and M. Orozco. 2006. Eastern Pacific Regional Sea Turtle Program. Final project report, June 2006, to the Western Pacific Regional Fishery Management Council. 72 p.

Hamann, M., C. Limpus, G. Hughes, J. Mortimer and N. Pilcher. 2006. Assessment of the conservation status of the leatherback turtle in the Indian Ocean and South-East Asia. IOSEA Marine Turtle MoU Secretariat, Bangkok, Thailand.

IUCN (International Union for the Conservation of Nature). 2006. IUCN red list of threatened species. Accessed on 28 January 2007 from www.iucnredlist.org

Kamarruddin, I., T.M.Y. Ismail and M.N. Azlan. 1996. Status of nesting population and related research on marine turtle in Peninsular Malaysia, p. 35-36. *In* SEAFDEC (ed.) Proceedings of the First SEAFDEC Workshop on Sea Turtle Research and Conservation, 15-18 January 1996, Kuala Terengganu, Malaysia. Marine Fisheries Resources Development and Management Department, Southeast Asian Fisheries Development Centre, Kuala Terengganu, Malaysia.

Liew, H.C. 2002. Status of marine turtle conservation and research in Malaysia, p. 51-56. *In* I. Kinan (ed.) Proceedings of the Western Pacific Sea Turtle Cooperative Research and Management Workshop, 5-8 February 2002, Hawaii, USA. Western Pacific Regional Fishery Management Council, Hawaii, USA. 300 p.

Mast, R.B., L.M. Bailey and B.J. Hutchinson, Editors. 2005. Volume 1: The state of the world's sea turtle report, Volume I. Conservation International, Washington, DC, USA. 40 p.

Mohd. Najib, R. and K.W.P. Hiew. 1999. Marine Turtle Management, Conservation and Protection Programme in Malaysia, p. 122-130. *In* M.N. Mohd. Taupek, A.K. Abdul Khalil and R. Mohd. Najib (eds.) Report of the SEAFDEC-ASEAN Regional Workshop on Sea Turtle Conservation and Management. Marine Fishery Resources Development and Management Department, 26-28 July 1999, Kuala Terengganu, Malaysia. Marine Fishery Resources Development and Management Department of Southeast Asian Fisheries Development Center, Kuala Terengganu, Malaysia.

Mortimer, J. A. 1989. Threats to the survival of Terengganu's sea turtles and a review of management options. Submitted to the Turtle Sanctuary Advisory Council of Terengganu. Produced under WWF Project 3868. July 1989. WWF-Malaysia, Petaling Jaya, Malaysia.

Noordin, R.O.R.M., W. Sukarno and N.R.F. Rahmat. 1995. Research and conservation of the leatherback turtle (*Dermochelys coriacea*) in Malaysia, 1988–1991. Fish. Bull. 98: 1-13. Department of Fisheries, Malaysia.

Siow, K.T. and E.O. Moll. 1982. Status and conservation of estuarine and sea turtles in West Malaysian waters, p. 497-502. *In* K.A. Bjorndal (ed.) Biology and conservation of sea turtles, Proceedings of the World Conference on Sea Turtle Conservation. Smithsonian Institution Press, Washington, DC, USA.

Sukarno, W. and H. Omar. 1989. Kematian penyu disebabkan kegiatan menangkap ikan. Paper presented at the Seminar Penyelidikan Perikanan, 20-22 June 1989, Melaka, Malaysia.

Sukarno, W., A.A.K. Khalil and A.L. Razak. 2003. Overview on country policies, programs, experiences with artificial reefs, stationary fishing gear establishment of marine protected areas in Malaysia, p. 47-55. *In* Proceedings of the First Regional Workshop on Enhancing Coastal Resources: Artificial Reefs, Stationary Fishing Gear Design and Construction and Marine Protected Area, 30 September – 3 October 2003, Bangkok, Thailand.

Sukarno, W., D.S.K. Sharma and H.C. Liew. 2006. Socioeconomic linkages and impacts of fisheries on sea turtle population. *In* M. Ahmed, S. Wagiman, K. Ibrahim, S.C. Ho, H.C. Liew, B.H. Yeo, M.M. Lau, M.N. Basiron and D.S.K. Sharma (eds.) Charting multidisciplinary research and action priorities towards the conservation and sustainable management of sea turtles in the Pacific Ocean: a focus on Malaysia. The WorldFish Center, Penang, Malaysia. 106 p.

Suarez, A. and C. Starbird. 1996. Subsistence hunting of leatherback turtles, *Dermochelys coriacea,* in the Kei Islands, Indonesia. Chelonian Conserv. Biol. 2(2): 190-195.

Suliansa, M.S., P. Basintal and N.L. Chan. 1996. Impacts of fishery related activities on sea turtles. Paper presented at the National Seminar/Workshop on Marine Turtle and Terapin Management, 22–23 October 1996, Cherating, Malaysia. 6 p.

TUMEC-DOF (Turtle and Marine Ecosystem Centre-Department of Fisheries). 2000-2005. Turtle nestings. TUMEC-DOF, Dungun, Malaysia. (Unpublished).

Wetherall, J.A., G.H. Balas, R.A. Tokunaga and M.Y.Y. Yong. 1993. Bycatch of marine turtles in north Pacific high-seas driftnet fisheries and impacts on the stocks. *In* J. Ito, W. Shaw and R.L. Burgner (ed.) International North Pacific Fisheries Commission Symposium on Biology, Distribution and Stock Assessment of Species Caught in High Seas Driftnet Fisheries in the North Pacific Ocean. INPFC Bull. 5(3): 519-538.

Yatsu, A., K. Hiramatsu and S. Hayase. 1993. Outline of the Japanese squid driftnet fishery with notes on the by-catch. Bull. INPFC 53: 5-24.

Yeo, B. H., S. K. Syed Mohd. Kamil, K. Ibrahim, D. Squires, H. Gjertsen, T. Groves and R. Zulkifli. 2007. A socioeconomic study and survey of sea turtle-fishery interactions in Malaysia: case studies in Terengganu and North Pahang. Final report. Data collection on coastal fisheries and sea turtle conservation in Malaysia. The WorldFish Center, Penang, Malaysia.

Zulkifli, T., A. Ahmad, K.Y. Ku-Kassim and M.I. Mahyam, Editors. 2004. Conservation and enhancement of sea turtles in the Southeast Asian Region. Marine Fishery Resources Development and Management Department, Southeast Asian Fisheries Development Center, Kuala Terengganu, Malaysia. 141 p.

Appendix 1: Survey Questionnaire

Research Questionnaire
The Fishers' Socioeconomic Status and Their Perceptions of the Importance of the Environment

Interviewer's Instructions

1. Please ensure that the respondent is either a boat owner or a captain who is still active in fishing activity.
2. Please fill N/A or (-) for questions that are not related to the respondent, and "NO" (No information) if the respondent is unable to answer the question.
3. Do not leave the open-ended questions blank. (especially A7, A10, A11, A12, A13, A14, B1-B7, C1, C2b, C2c, C3, C4, C5, C7, D1, D4, D9).
4. If the respondent is unable to provide an answer in the specified unit, please state (write down) the possible units that can be given by the respondent. The Interviewer will then need to convert it to the specified unit after the interview. (especially C1, C2, C3).
5. "*" is a note for the interviewer.

Name of interviewer : _____ Village : _____

District : _____

Port / jetty : _____ Ending time : _____

Starting time : _____

Please complete the following:

a) Membership:
(Allowed to choose more than one.)
- ☐ 1 – Fishers' Association
- ☐ 2 – Fishers' Economic Group (KEN)
- ☐ 3 – Nonmember
- ☐ 4 – Petanda (member of Trawlers' Association)
- ☐ 5 – Others (specify:_____)

b) Boat ownership:
(Please choose only one.)
- ☐ 1 – Owns and operates boat
- ☐ 2 – Owns but do not operate boat
- ☐ 3 – Operates but do not own (captain or renter)
- ☐ 4 – Does not own or operate *(awak-awak)*
- ☐ 5 – Others (specify:_____)

c) Type of boat license:
- ☐ 1 – Fiber boat (unlicensed)
- ☐ 2 – Fiber boat (licensed)
- ☐ 3 – License Zone A
- ☐ 4 – License Zone B
- ☐ 5 – License Zone C
- ☐ 6 – Small wooden boat *(sampan)*

d) Type of gear licensed:
- ☐ 1 – Trawl net
- ☐ 2 – Seine net
- ☐ 3 – Drift net
- ☐ 4 – Hook and line
- ☐ 5 – Bubu (trap)
- ☐ 6 – Others (specify:_____)

Date : _____

A. Profile of the Respondent

1) Race: ☐ 1 – Malay ☐ 2 – Chinese ☐ 3 – Others (specify: _____)

2) How long have you lived here? _____ years

3) Have you undergone any formal education?

If **YES**:

☐ 1 – Primary school (up to standard _____)

☐ 2 – Secondary school (up to form_____)

☐ 3 – Others (specify: _____)

If **NO**:

☐ 1 – No education (cannot read or write)

☐ 2 – No formal education (can read and write)

4) What is your marital status?

☐ 1 – Single ☐ 3 – Divorced

☐ 2 – Married ☐ 4 – Widower / widow

5) Is fishing your primary occupation?
☐ Yes ☐ No, please state your primary occupation _____

6) How long have you been a fisher? _____ years

7) Please provide the following information (for respondents who are married):
*** Please write "0" or "-" for c and d if there is no studying / working family member living with you.**

☐ a – Wife's occupation = _____

☐ b – Family size (including respondent) = _____ number of people

☐ c – Number of family member(s) who are still studying and living with you = _____ number of people

☐ d – Number of household member(s) who are working and living with you = _____ number of people

8) What is the main reason for being a fisher? **(choose one only)**

☐ 1 – Family tradition

☐ 2 – Provides good income

☐ **3** – Only income choice (no other alternatives)

☐ **4** – Side income

☐ **5** – Others (specify: _____)

9a) Please indicate the catch (peak, lean or none) of the respondent (based on last year's experience). Please mark (✓).***Ensure that you obtain the answer for all the 12 months.**

	Oct 04	Nov 04	Dec 04	Jan 05	Feb 05	Mar 05	Apr 05	May 05	Jun 05	Jul 05	Aug 05	Sep 05
Peak												
Lean												
None												

9b) How much can you get in a single trip (the most and the least)?

No.		Quantity (Please circle the unit used)	Total income
(i)	Most	kg / t	RM
(ii)	Least	kg / t	RM

***Please state the price per kg / t if the respondent cannot remember the total income received.**

9c) During months when fishing is NOT carried out, what other activities do you undertake?**(You may choose more than one answer.)**

☐ 1 – Side jobs **(please answer question No. 11b)**

☐ 2 – Rest

☐ 3 – Repair fishing gear and boat

☐ 4 – Others (specify: _____)

10) If the respondent undertakes side jobs:

No.	Type of side job	Which months is job carried out
(i)		
(ii)		
(iii)		
(iv)		

11) State the estimated **MONTHLY** income from the following sources:

Source	RM / Month
a. Primary occupation	
b. Secondary occupation (occupation other than primary occupation)	
c. Wife's occupation	
d. Contribution from family member(s) / children (who are living with you)	
e. Contribution from family member(s) / children (who are living with you)	
f. Contribution from other side activities that are carried out when there are no fishing activities	
Total	

12) If given an opportunity to be other than being a fisher, would you be interested? **(if yes, please answer question 12a; if no, please answer 12b)**

☐ 1 – Yes ☐ 2 – No

12a) If **YES**, what kind of occupation would you like?

_____

_____

12b) If **NO**, why? _____

_____

13) Would you want your children to be involved in fishing activities in the future?
(if yes, please answer question 13a; if no, please answer question 13b)

If **YES**, why? _____

If **NO**, why? _____

B. General Information on Fisheries

Instructions: The following information requested from you should be based on the LATEST TRIP.

1) Please provide the distance from the shore / jetty to your fishing ground during your latest trip.
_____ nautical miles (nm) or _____ km

2) How much time is required to arrive at your fishing ground?
_____ minutes or _____ hour

3) Does your trip take less than a day?

☐ 1 –Yes ☐ 2 – No

a) If **YES** (trip within one day)

i) Time out = _____ am or _____ pm
ii) Time back = _____ am or _____ pm

b) If **NO** (more than a day's trip)

i) Date out =_____ Time out = _____ am / pm
ii) Date back =_____ Time back = _____ am / pm

4) How many fishers were there on the same boat during your most recent trip? (including respondent) = _____ people

5) How many times do you go out to sea in a **MONTH** (approximately) = _____ times

6a) Do you use any electronic device at sea?

☐ 1 –Yes ☐ 2 – No (proceed to question 7)

6b) If **YES**, please √ and indicate the year when you started using it

Device	Year started using
1 – Global Positioning System	
2 – Mobile phone	
3 – Radio (walkie-talkie)	
4 – Echo sounder	
5 – Sonar	
6 – Others (specify: _____)	

7) Have you ever joined any training or workshop for fishers?

☐ 1 – Yes ☐ 2 – No (proceed to question 8)

7a) If **YES**:

i) What were the courses? _____

_____

_____

ii) Who organized the courses? _____

_____

_____

C. Economics

Instruction: Information needed for questions 1 - 4 should be based on the most recent trip.

1) What type of boat do you use to fish? (Please provide the most frequently used boat.)

Type*	Length (m)	Width (m)	Horsepower (hp) (for boat with engine only)	Gross tonnage (GRT)

* Wooden, fiber or metal.

2a) Please state the type of gears used in the most recent trip.
(You may choose more than one.)

- ☐ 1 – Trawl net
- ☐ 2 – Seine net
- ☐ 3 – Drift net
- ☐ 4 – Kaya net (a type of drift net with less than 3 in net mesh size)
- ☐ 5 – Bubu (trap)
- ☐ 6 – Others (specify: _____)

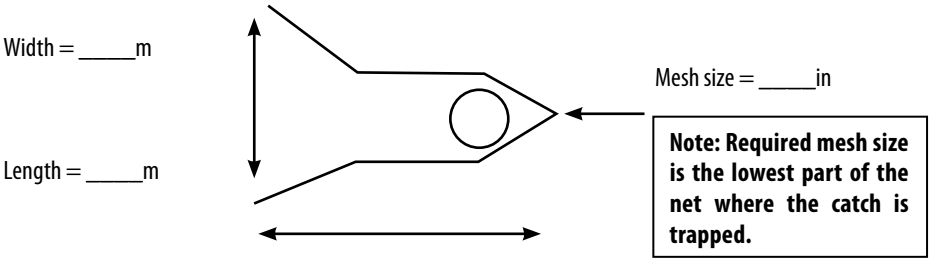
2b) How often were the specified gears hauled onto the boat during the most recent trip? **(if more than one net)**

Gear	How many times were the gears hauled during the most recent trip?	Time between each hauls (hour)
(i)		
(ii)		

2c) Please obtain the size of the gear used during the most recent trip.
If a **trawl net** was used **(proceed to i)**
If a **seine / drift or *kaya* net** was used **(proceed to ii)**

***If the respondent used more than one but the same type of gear during the most recent trip, please write down the details of the most frequently used gear. If the respondent is unable to provide answer in the specified unit, please state (write down) the possible units that can be given by the respondent. Interviewer will need to convert it to the unit set after the interview.**

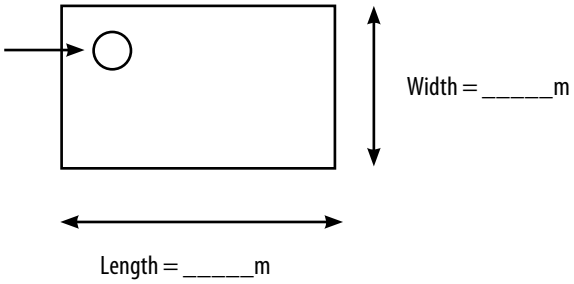
i) If a trawl net was used



ii) If a seine / drift or *kaya* net was used

Mesh size (*)

Smallest = _____ in
Largest = _____ in



Note: (*) If there are a few sizes of mesh size, write down the smallest and the largest sizes.

3) Operational cost for the **most recent trip: (Please complete the following table.)**

Code	Input	Unit (encircle unit used)	Quantity (per trip)	Total cost (RM)
(i)	Diesel	liter / tin	liter	
(ii)	Petrol	liter / tin	liter	
(iii)	Lubricant oil	liter / tin	liter	
(iv)	Ice	block	block	
(v)	Bait (unit) kg	kg / packet	kg / packet	
(vi)	Labor (captain, crew, etc.)	person	person	
(vii)	Food (including respondent)	person / day	person / day	

***Note: If the respondent is unable to provide the cost for each trip, especially the cost for petrol, please write down the price per liter for the particular item and estimate the quantity used in each trip.**

4a) Catch from the most recent trip:

Total catch (kg)	Average selling price (RM / kg)	Total income (RM)

***Note: State both the average selling price per kilogram and the total income. If the respondent is unable to provide the average selling price per kilogram, please write down the total income.**

b) During the most recent trip, what were the species that were caught most?
(Please state 3 main species.)

_____

Example of types of catch : tuna, skipjack tuna, indian mackerel, round scad, threadfin bream, spanish mackerel, yellowtail scad, hardtail scad, red snapper, grouper, emperor, yellow-banded scad, croaker, squid, tiger prawn, crab, etc.

5a) Please provide information about the type of gears used in your most recent fishing activity:

No.	Type of gear *	Quantity (unit)	Price per complete unit (RM) **	Bought for how many years?	For how long will the gear last ? (year)	What will happen at the end of gear's lifespan? ***
(i)						
(ii)						
(iii)						
(iv)						

* Trawl, seine, drift net *bubu* (trap) and others.
** Include cost for wood, rope, etc.
*** Thrown, sold (at how much, in RM), repaired and others.

5b) Please provide information about the type of equipment used in your fishing activity:

No.	Equipment	Quantity (unit)	Price (RM)	Bought for how many years?	For how long will it last? (year)	What will happen at the end of its lifespan? *
(i)	Motorized boat					
(ii)	Nonmotorized boat					
(iii)	Others _____					

Note the cost for repairing the damaged nets or describe the extent of repair, if the exact amount cannot be estimated. (Respondents may estimate the cost if they repaired the nets themselves.)
* Thrown, sold (at how much, in RM), repaired and others.

5c) (i) Do you use a net hauler / robot?

☐ 1 – Yes ☐ 2 – No (proceed to question 6)

(ii) If **YES**, what is the cost of the net hauler? RM _____

(iii) Why did you use the net hauler? **(You may choose more than one answer.)**

☐ 1 – Encouraged by authorities

☐ 2 – Given subsidies (state source _____)

☐ 3 – Cost-saving

☐ 4 – Difficult to find labor

☐ 5 – Others (specify: _____)

(iv) When did you start using the net hauler? year _____ (start using)

(v) Please state the number of crew (including respondent) needed:
Before using the net hauler = _____ person / s
After using the net hauler = _____ person / s

6) **If the respondent is the captain but not the owner, please proceed to question 6a. If the respondent is the boat owner, please proceed to question 6b.**

6a) What is the mode of payment for the use of the boat?

☐ 1 – Cash

☐ 2 – Fixed percentage of the catch

☐ 3 – Both of the above

6b) What is the mode of payment for the crew of the boat?

☐ 1 – Cash

☐ 2 – Fixed percentage of the catch

☐ 3 – Both of the above

6c) How often or when is the payment for the use of the boat made / received?

☐ 1 – After each trip

☐ 2 – Everyday after work

☐ 3 – Fortnightly

☐ 4 – Monthly

☐ 5 – Others (specify: _____)

7a) Division of catch reflects:

☐ 1 – Net total (after deducting the cost of petrol, etc.)

☐ 2 – Gross total (before deducting the cost of petrol, etc.)

7b) Division of catch:

No.	Division of catch	Percentage (%)	(or) Ratio
1	Boat owner		
2	Captain		
3	Crew members		
4	Helmsperson		
5	Others, specify: _____		
	Total	**100%**	**1**

*** Note: If the respondent is unable to provide a response in terms of "percentage", please write down the answer in terms of "ratio".**

7c). To whom was the catch sold?

☐ 1 – Boat owner

☐ 2 – Middleperson

☐ 3 – Directly to customers

☐ 4 – Fishers' Association

☐ 5 – LKIM

☐ 6 – Others, specify: _____

D. The Relationship and Importance of the Environment

The presence of sea turtles on the East Coast of Peninsular Malaysia is a unique attribute rarely found in other states in this country. If properly managed, this treasure will contribute to the local economy in the future.

Instructions: The following are turtles that are found in Malaysia (show picture).

1a) In your opinion, is there any difference on the population of sea turtles in this area between now and 20 years ago ?
(Instruction: answer the known species only.)

No.	Turtle species	> 20 years ago (Instruction: choose one only)				Present (Instruction : choose one only)			
		High	Medium	Low	None	High	Medium	Low	None
1	Green								
2	Leatherback								
3	Hawksbill								
4	Olive ridley								

1b) In your opinion, has the sea turtle population decreased compared to 20 years ago?

☐ 1 – Yes ☐ 2 – No (proceed to question 2)

If **YES**, please state the reason: _____

1c) In your opinion, what are the main reasons for the decline?
(You may choose more than one answer.)

☐ 1 – Coastal development

☐ 2 – Unplanned tourism activities

☐ 3 – Collection of turtle eggs

☐ 4 – Loss of turtle habitat

☐ 5 – Fishing activities

☐ 6 – Others (specify _____)

2a) Please state if you agree or disagree with the following statements:

No.	Statement	Agree	Disagree	No comment / do not know
1	The presence of turtles in this area is important in promoting the local economic activities and tourism.			
2	The conservation of turtles is important for the sustainability of the environment.			
3	The existence of sea turtles is important for the future generation.			
4	Turtle eggs are an important food source.			
5	The existence of turtles is an important heritage and representation of the East Coast.			

2b) In your opinion, which of the statements (**refer to question 2a**) is the **most important**?
Please state **one** choice from those statements that you agree with: _____

3a) Have you seen these turtle species?

☐ 1 – Yes ☐ 2 – No (proceed to question 4)

3b) Turtle information table

No.	Species (answer the species that you have seen only)	Where was it found (you may choose more than one answer)			Location (provide name or distance from the shore)
		By the beach	By the island	In the water	
1	Green				
2	Leatherback				
3	Hawksbill				
4	Olive ridley				

4a) Have you **seen** any turtles accidentally trapped?
i) this year
ii) in previous years, state what year_____
iii) no (proceed to question 6a)

4b) If YES:
i) Was the turtle accidentally trapped in your own net?

☐ 1 – Yes ☐ 2 – No

ii) Was the turtle accidentally trapped in other fisher's net?

☐ 1 – Yes ☐ 2 – No

4c) Please complete the following table.

No.	Species (state species) *	Month (s)	Where trapped **	No. of turtles in that year	Condition of the turtle ***	Age / size ****	Location (name or distance from shore)
1							
2							
3							
4							

* Green, leatherback, hawksbill or olive ridley.
** Own net or other fisher's net.
*** Alive, dead, or some alive and some dead.
**** Adult, young, juvenile or others (respondent may choose more than one answer).

4d) What is the impact on the gear when turtles are trapped ?

No.	Species *	Gear involved **	Impact ***	Estimated cost to replace or fix gear (RM)	Time taken to release a turtle (minutes / hour)
1					min / hr
2					min / hr
3					min / hr
4					min / hr

(Note: Name of the turtle species is crucial for the analysis.)
* Please provide information for trapped cases only.
** State the most frequent gear first.
*** Damaged gear and it cannot be used again; damaged gear but it can be used again when fixed; and no impact.

5) Usually, what is the action taken if a turtle is accidentally trapped in a net?
(You may choose more than one answer.)

☐ 1 – Release it at the location where it was found

☐ 2 – Relocate it to a safer area

☐ 3 – Release it into the sea as it has died

☐ 4 – Inform the nearest relevant authorities if the turtle has died

☐ 5 – Others (specify: _____)

6a) In case a turtle is found dead, how often is the incident reported to the Department of Fisheries? **(Choose one answer only.)**

☐ 1 – Always

☐ 2 – Sometimes

☐ 3 – Rarely

☐ 4 – Not reported

☐ 5 – Do not know

6b) In your opinion, what is the reason for not reporting the incident of a dead turtle?
(You may choose more than one answer.)

☐ 1 – Does not know who or where to report to

☐ 2 – Too time-consuming

☐ 3 – Does not bring any benefit

☐ 4 – The existing law does not encourage the reporting of such cases.

☐ 5 – Others (specify:_____)

☐ 6 – No comment

6c) What would encourage the community to report the incident of a dead turtle? **(You may choose more than one answer.)**

☐ 1 – Provide incentive

☐ 2 – Inform the community about places where to report incident

☐ 3 –Increase relationship and cooperation among local community, fishers' association and government agencies as well as relevant nongovernment organizations

☐ 4 – Others (specify: _____)

☐ 5 – No comment

7a) What are the types of turtle eggs found in this area? **(You may choose more than one answer.)**

☐ 1 – Green turtle

☐ 2 – Leatherback turtle

☐ 3 – Hawksbill turtle

☐ 4 – Olive ridley turtle

☐ 5 – Others, _____

☐ 6 – Do not know

7b) What are the primary functions of turtle eggs? **(You may choose more than one answer.)**

☐ 1 – Traditionally used (as medication, for festivals), state _____

☐ 2 – Source of daily food

☐ 3 – Sold to increase household income

☐ 4 – Sold to relevant agencies for conservation purposes

☐ 5 – Others (specify:_____)

☐ 1 – Yes ☐ 2 – No

7c) In your opinion, can turtle eggs be replaced with other sources that are acceptable by the community?

☐ 1 – Yes ☐ 2 – No

i) If **Yes**, state the source(s) _____

7d) In your opinion, should we reduce the collection / consumption of turtle eggs?

☐ 1 – Yes ☐ 2 – No

i) If **Yes**, why? _____

ii) If **No**, why? **(You may choose more than one answer.)**

☐ 1 – Local tradition is difficult to change

☐ 2 – Turtle eggs are a food source that is easily obtained

☐ 3 – Turtle eggs contain more nutrients

☐ 4 – Others

8) Please provide suitable suggestion(s) / way(s) to increase the conservation of turtle to decrease the cases of turtles accidentally trapped in fishing gears.
(You may choose more than one answer.)

☐ 1 – Encourage the use of suitable gears which are acceptable by fishers

☐ 2 – Increase enforcement

☐ 3 – Increase awareness on the benefit of turtle conservation among fishers

☐ 4 – Increase cooperation and understanding among fishers and associations / agencies

☐ 5 – Others (specify: _____)

☐ 6 – No comment

9a) Are you aware of laws that are related to sea turtle conservation?

☐ 1 –Yes ☐ 2 – No (proceed to question 10)

9b) In your opinion, is the law effective?

☐ 1 –Yes (proceed to question 10) ☐ 2 – No ☐ 3 – No comment

9c) If **No**, why not?

_____

9d) If the law is not effective, please provide suitable suggestion(s) / step(s) to make it effective:

_____

9e) Does the imposed law affect the fishing activities in this area?

☐ 1 – Yes ☐ 2 – No (proceed to question 10a)

i) If **Yes**, from what aspect?
***Interviewer must get answers from the respondent before showing the choices to them. Please write down all the answers given by the respondent in the "Others" column.**

☐ 1 – Affect total catch

☐ 2 – Encourage use of illegal gears

☐ 3 – Increase awareness in maintaining sustainability of environment and turtle conservation

☐ 4 – Others (specify: _____)

10a) If there is program about turtle conservation, would you be interested to join?
(If the answer is NO, proceed to question 10c.)

☐ 1 – Yes ☐ 2 – No

10b) What type of programs are you interested in? **(You may choose more than one answer.)**

☐ 1 – Community programs / activities (such as beach cleanup)

☐ 2 – Research activities (such as turtle population status and taking care of turtle sanctuary)

☐ 3 – Ways to release turtles that are accidentally trapped

☐ 4 – Programs related to ecotourism (such as tourist management)

☐ 6 – Others (specify: _____)

10c) If **NO**, why? _____

Focus Group Discussion
(Interviewer: Please circle Yes or No)

We will be planning focus group discussions on fisheries and environmental interactions with the local community. If the focus group discussion is to be held in your community, would you be interested to participate?

If **YES**, write down your name and contact number: _____.
Thank you.
If **No**, **thank you**.

MUST BE FILLED IN BY INTERVIEWERS (for cross reference and checking):

Please note level of interest of respondent:

☐ 1 – Interested and provided full cooperation

☐ 2 – Not fully interested

☐ 3 – Not interested at all

☐ 4 – Not interested to answer sea turtle questions

Other comments:

_____

Appendix 2. Summary of FGD Results

Main causes of turtle extinction/ decline	• Fishing gear-related, use of nonenvironment-friendly gears **(6)** • Fishing-related, invasion of trawlers into shallow areas **(1)** • Habitat-related (destruction, threats to nesting sites) **(5)** • Human consumption (eggs and meat by foreign fishers) **(2)** • Policy-related (lack of zoning system and unsuitable location of hatchery) **(2)** • Enforcement-related in terms of no effective patrolling and lack of law enforcement **(2)**
Number of turtles trapped and months caught	• March–August **(1)** • June–July (more than 20 turtles trapped in July, 4-5 turtles trapped in Kijal in June annually) **(5)** • December–January **(1)** • February (4 turtles) **(1)** • If turtle is trapped (gill nets) in beaches, it will survive; if trapped in middle of the sea, it will die.
Fishing gears that caught sea turtles	• Trawl nets **(9)** • Ray nets **(7)** • *Rawai/gerek* – (longlines) **(5)**
Suggestions to reduce sea turtle-fishery interactions	• Regulations related to zoning, fixed zones for gill nets and trawl nets to operate **(8)** • Use of appropriate fishing gears **(3)** • Increasing the number of artificial reefs **(2)** • Better law enforcement **(3)** • Develop a restricted area/closure season with compensation for fishers **(2)** • Hold up fish nets to release turtles **(1)** • Cut section of fish net where turtles are entangled **(1)** • Learn appropriate ways to resuscitate/release turtles **(1)**
Ways to increase support and involvement of local community in turtle conservation activities	• Conduct education and awareness programs **(3)** • Organize conservation activities (turtle hatchling program, etc.) **(4)** • Emphasize that turtles are the heritage and symbol of the East Coast **(3)** • Organize more group discussions with the locals like the present focus group meeting **(1)**

Note: The numbers in parentheses reflect the number of fishers from the focus group giving these responses.

Appendix 3. Case Study: Increasing Fishers' Awareness

Increasing fishers' awareness leads to decrease in turtle bycatch.
M. Hall (Inter-American Tropical Tuna Commission)

Fishers themselves are at the frontline of the fisheries bycatch battle. Increasing their awareness has already been demonstrated to have noteworthy positive results when it comes to reducing bycatch of sea turtles. The government and the fishing industry of Ecuador under¬took a major Fishermen's Education Effort starting in 2003 by joining forces with the Inter-American Tropical Tuna Commission, US NOAA, WWF, The Ocean Conservancy and Ecuadorian fishworkers' cooperatives and environmental groups. The program focuses on deriving solutions that will allow fishers to continue to earn a living from the ocean, while simultaneously protecting the marine environment for the long term. The program consists of four major components:

1. replacement of J-hooks with circle hooks and testing their efficacy in reducing sea turtle mortality;
2. provision of tools and training to fishers on techniques for releasing sea turtles;
3. an observer program to document the results; and
4. a continuous communications and outreach program to the fishing community to explain the problem and the proposed solutions; to garner the community members' feedback; and to evaluate the perfor¬mance of effort and gear.

Over 70 observer trips were completed during the 2003–2004 Ecuadorian tuna fishing season. The results showed a significant re¬duction in the hooking rates of sea turtles through the introduction of circle hooks, and in the types of hooking that lead to higher post-hooking mortality. It is estimated that the com¬bined effects of both those factors could lead to reductions in overall mortality of 70-90%. Attitude changes among fishers, resulting from the outreach program, are expected to generate even further reduction in sea turtle mortality.

Source: Mast et al. (2005).

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