A CASE STUDY OF COSTS AND EARNINGS OF THREE GEARS IN THE TRENGGANU FISHERY, MALAYSIA

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I. INTRODUCTION

CAPTURE fisheries in Peninsular Malaysia may be divided into two classifications: (i) a small-scale or artisanal fishery, employing labor-intensive techniques and gears for harvesting inshore resources; and (ii) a large-scale or commercial fishery which employs more capital-intensive fishing technology for the exploitation of mainly demersal and deep sea resources. The two fisheries can further be differentiated on the basis of geography as well as by factor intensity and scale: the small-scale or artisanal fishery is more widely represented on the east coast whereas the large-scale or commercial fishery is predominantly located on the west coast. Another manifestation of dualism lies in the degree of access of the two sectors to the organized money market. The commercial fishery enjoys easier access at lower effective interest rates than the small-scale sector; the latter generally has to place greater reliance on the unorganized money market in order to secure credit facilities. In spite of its small-scale nature, however, fishing as a subsistence economic activity has gradually disappeared from the artisanal fishery as the bulk of the fishermen's catch is sold for cash.

It has been observed that historically technological development in the fishing industry of Peninsular Malaysia has taken place through four main phases: firstly, the establishment in the early 1900s of purse seine fishing for harvesting pelagic resources; secondly, the introduction of powered engines in the 1930s; thirdly, the introduction and utilization of synthetic materials for nets in the 1950s; and lastly, in the 1960s, the introduction of trawler fishing for exploiting demersal resources [6]. Such innovations in production methods and gears have not been evenly adopted by the commercial and small-scale sectors and a substantial proportion of small-scale fishermen still employ "traditional" methods of fishing, for example, line and hook, gill nets, lift nets, and other gears which are labor-intensive. Many of the powered boats used by small-scale fishermen utilize engines of less than 15 horsepower.

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The use of labor-intensive "traditional" gears by the small-scale fisheries sector has, inter alia, meant that the fishing industry is an important source of rural employment. The geographical concentration of the industry in the east coast of the peninsular and on islands off the west coast such as Pulau Ketam and Pulau Pangkor is also significant since these are localities where generally there is a lack of alternative employment opportunities. The fishing population of Peninsular Malaysia represent about 3 per cent of the economically active population while if employment in ancillary industries (ice manufacture, boat building and repair, fish marketing and processing, etc.) is taken into account, the percentage rises to about 4.3 per cent of the total labor force [6]. In terms of employment, the fishing industry is more important than mining or quarrying which employ 2.5 per cent, or the construction industry which employs 2.9 per cent of the economically active population [3].

The small-scale fishery sector is a priority target for poverty amelioration since there is a high incidence of poverty among fishing households.[1] In 1975 some 63 per cent of fishing households were classified as living in poverty and while there has been a reduction in the absolute number of fishing households in poverty from 26,200 in 1975 to 23,200 in 1978, more than half of fishing households still remain in poverty. The majority (68 per cent) of these are on the east coast fishery and the high incidence of poverty in the east coast region has been attributed to low levels of investment, the non-ownership of productive assets and the lack of market power.[2] Since small-scale fishermen in the east coast fishery are the main poverty group, it is not surprising that they represent the principal target group for fishery development policies.

It is reasonable to surmise that the activation of optimal fishery development policies requires a sound data base, but unfortunately there is a paucity of published studies of costs, revenue, and profitability of the main gears used in the east coast fishery. This has led two researchers to deduce that the lack of information pertaining to economic aspects and methods of operation of the small-scale fishery has not been conducive to effective planning in fisheries development [9]. Future fisheries management and development strategies also require to be based on detailed economic research as well as effective monitoring.[3] This localized case study, while preliminary and tentative in nature, aims to provide empirical data on the costs, earnings, and profitability of three of the principal gears used in the east coast fishery. It is to be hoped that this study will be the precursor of further, more detailed studies.

II. OBJECTIVE AND DATA SOURCES OF THE CASE STUDY

It is the contention of the writers that until relatively recently the development

[1] Poverty is measured by a poverty-line approach in Peninsular Malaysia. The poverty line is defined as the income needed to maintain a family in good health and provide for minimum conventional needs for clothing, household management, and transport. The poverty datum line for a family of five in 1970 was assessed at M$160 per months; in 1972 it was raised to M$210 per month.

[2] See, for instance, [8].

[3] Fisheries management policies are examined in [3].

of the capture fisheries in Peninsular Malaysia has been focused largely on the modernization of commercial fishing as a means of increasing output and productivity. Insufficient attention was accorded the small-scale sector which is of crucial importance in terms of the provision of employment and the supply of animal protein. The socioeconomic significance and potential of small-scale fishing and aquaculture is now being more generally recognized and the Malaysian government is currently formulating policy guidelines and activating programs aimed at the development of small-scale fishing communities. The effectiveness of planning and development programs, however, depend in no small measure on knowledge of relevant parameters which depends on the availability of socioeconomic data pertaining to the small-scale fishery. As has been indicated, there is a dearth of empirical data relating to the marine fisheries in Peninsular Malaysia and costs and earnings surveys of specific fisheries, such as the east coast fishery, are especially lacking. This case study aims to provide data on the costs and earnings of the Trengganu fishery, and is thus intended to help fill a gap that exists in studies of the small-scale sector. Specifically, this study sets out to provide information regarding costs, earnings, and profitability of three selected gears which are considered to be broadly representative of the Trengganu fishery. The three gears selected were small trawl nets, gill nets, and hand lines.[4]

Data were derived from a two-phase survey carried out in various fishing villages situated in the Kuala Trengganu district of the state of Trengganu; the first phase entailed the detailing of a capital inventory while the second phase of the survey recorded costs and earnings of these gears on a weekly basis for two months continuously. The methods used in the investigation of costs and earnings of three main gears in this study were the "interview" and "continuous account" methods. The choice of method, to a great extent, depends on funds and personnel available, the objectives of the study, and the time in which it must be completed. The advantage of the survey method is that it provides policy guidelines in a very short time. The most serious disadvantage of this method, however, is that it lacks accuracy and it does not provide any clues on trends. Since very few fishermen are accustomed to keep accounts of any kind, it is impossible to obtain in an interview a precise statement of expenditures and receipts. Accurate data of this kind may be obtained only from a record maintained continuously throughout the year. However, given the time and budget constraint, the method adopted in this study is the next best alternative.

The survey was conducted over the period March to August 1979 and local enumerators were utilized. For each gear analyzed in this case study, a total of ten samples have been taken. While it is appreciated that statistically the total sample ($n=30$) is small and the case study is highly location-specific, the methodology adopted of recording costs/earnings on a weekly basis necessarily precluded either a large sample or widespread geographic coverage. We also consider that some caution needs to be exercised in drawing policy conclusions

[4] Excluding seines, which are more representative of the commercial fishery than the small-scale fishery, these three gears are the most significant in terms of their contribution to marine fish landings in Trengganu. Small trawl-net boats are defined in this study as vessels under 15 gross tons.

from the production cost estimates presented since there may be regional variations in input costs. Revenue data similarly should be interpreted cautiously because of variations that exist in catch per vessel (and species) between fisheries and even within a single fishery. Nevertheless, it is considered that a preliminary case study of this nature remains relevant, given the importance of the acquisition of basic data relating to costs and earnings of the small-scale fishery and the dearth of empirical evidence relating to its profitability.

III. THE TRENGGANU FISHERY

Trengganu, which is situated on the east coast of Peninsular Malaysia, is an important fishing state in terms of its share of total fishing population, licensed fishing boats, and landings. The fishing industry in Trengganu provides direct employment to about 12,550 fishermen representing some 16.6 per cent of the total number of fishermen in Peninsular Malaysia in 1977 [7, p. 1]. It ranks second after the state of Perak with a comparable figure of 14,842 fishermen to represent 19.6 per cent of the total number of fishermen. As with the other states on the east coast, the Trengganu fishermen are predominantly Malays.

The significance of the fishing industry in Trengganu can also be seen from its share of total boat population in the country. There were altogether 3,111 licensed fishing boats in Trengganu, accounting for some 12.9 per cent of the total boat population in Peninsular Malaysia in 1977 [7, p. 1]. The fishing boats were generally small as indicated by their gross tonnage, dimension length, and engine horsepower. For example, about 85 per cent of the total licensed boats in Trengganu were found to be less than 15 gross tons while the percentage in the above 50 gross tons category was relatively insignificant. In terms of dimension length, it was found that nearly three-quarter of the total licensed boats in Trengganu were less than 40 feet long. However, the majority, i.e., nearly 80 per cent, of these boats were powered either with inboard or outboard engines. Of the total inboard-powered boats, some 90 per cent were fitted with engines of 40 horsepower and less. All the above statistics pointed out to the fact that fishing in Trengganu, as in most parts of the country, is essentially small-scale employing small vessels and traditional hand-operated gears which could only be operated in inshore waters.

Lastly, the importance of the Trengganu fishery can be gauged from its contribution to total landings in the country. In 1977, marine landings in Trengganu accounted for nearly 15.6 per cent of total annual landings in Peninsular Malaysia to form the third largest fish-producing state after Perak (28.7 per cent) and Selangor (21.3 per cent) respectively. As far as the east coast is concerned, Trengganu is the single most important fish-producing state since it accounted for nearly 65 per cent of total marine landings on the east coast in 1977. There has been a considerable increase in marine landings in Trengganu over the last ten years which was largely brought about by increased fishing effort (fishing boats and fishermen). However, the tremendous increase in landings was largely due to increasing proportion of trash fish landed while landings of food or commercial fish continues to decline over the years.

The Trengganu fishermen employ a large variety of fishing methods and techniques ranging from traditional hand-operated gears, such as hand lines, traps, gill nets, and push nets to more modern capital-intensive gears like purse seines and trawl nets. The design and mode of operation of each gear type are very much influenced by the types of species to be caught, natural behavior of the fish, the physical surroundings of the fishing grounds, and tide movements. Generally, however, there are two broad categories of fishing gear, viz., those utilizing the "specific technique" and those utilizing the "multiple technique."[5] Specific technique, fish are singly caught with special equipment like hooks and lines, snares, lances, spears, and harpoons, with or without the use of baits. Sometimes, several units of the gear can be used simultaneously as with long lines and trawl lines. These traditional modes of fishing are becoming less popular amongst fishermen, with the exception of hand lines (*mengail*) and long lines (*rawai umpan*). In the multiple technique, nets are so designed as to entrap, entangle, or encircle fish during fishing operations. Examples of these gears are the gill net (*pukat jaring*), drift net (*pukat hanyut*), trawl net (*pukat tunda*), and encircling gill net (*pukat dalam*).

Besides the above gears, another type of fishing technique involves a stationary entrapping gear which allows the fish to swim freely into it but prevents their exit. *Pompang, ambai, gombang,* and *bubu* are some examples of such entrapping devices. These traps are either placed in shallow waters to be retrieved by the fishermen on alternate days, or in deeper waters and retrieved only once or twice a week. An example of the latter is *bubu*, a popular fishing gear in Trengganu, which are sometimes placed in deep waters as far as fifty kilometers from the shore and are retrieved by the fishermen only twice a week.

One significant feature of fishery on the east coast, Trengganu included, is its seasonality. About two to three months in a year, i.e., between November and January, fishing is interrupted by the northeast monsoons. During the period, fishing activities literally come to a standstill due to the strong winds and stormy seas. However, once the monsoons blow over, fishing activities picked up again reaching its peak season sometimes between the months of June to August. Fishing is normally carried out in inshore waters within fifteen miles off the Trengganu coastline and around adjacent islands such as Pulau Redang and Pulau Kapas which provide rich fishing grounds to the fishermen. Fishing trips by most gear types rarely exceed two days with the exception of *bubu* fishermen who sometimes spent as long as four to five days per fishing trip.

IV. SAMPLE CHARACTERISTICS

The fishing boats, for the purpose of this study, are classified according to gear type, length of vessel, hull tonnage, and engine horsepower. Classification as to gear type is based on fishing technique, viz., trawling, gillnetting, and lining which represent three important fishing gears in the study area. Classification by length is based on overall length of the boat and the category in our present study range

[5] See [1].

TABLE I

PERCENTAGE DISTRIBUTION OF SAMPLE BOATS BY GEAR TYPE, LENGTH OF VESSELS, TONNAGE, AND HORSEPOWER: KUALA TRENGGANU, 1979

Characteristics	Distribution of Samples (N=30)				
	Trawl Nets	Gill Nets	Hand Lines	Total	%
1. Length of vessel (feet)					
0–30	1	5	0	6	20
31–40	1	3	0	4	13
41–50	8	2	10	20	67
	10	10	10	30	100
2. Tonnage (gross tons)					
0–10	2	5	1	8	27
11–15	3	4	1	8	27
16–20	5	1	8	14	47
	10	10	10	30	100
3. Engine horsepower (horsepower)					
0–20	1	7	0	8	27
21–30	2	1	1	4	13
31–40	4	2	9	15	50
41–70	3	0	0	3	10
	10	10	10	30	100
4. Age of vessels (years)					
0–2	2	4	6	12	40
3–5	6	3	3	12	40
6 and above	2	3	1	6	20
	10	10	10	30	100

from 25 feet to 50 feet. Hull tonnage is another useful basis for size—classification of the boats and three categories have been chosen for this purpose, viz., 10 tons and less, 11 to 15 tons, and 16 tons and above. Lastly, classification of the sample boats on the basis of engine horsepower can be grouped into four, viz., 20 horsepower and less, 21 to 30 horsepower, 31 to 40 horsepower, and 41 horsepower and above. Despite their heterogeneous characteristics, all boats used in the sample are classified as small as opposed to the larger and more capital-intensive boats of the commercial sector.

In addition to the above characteristics, it is also important to note the age of the boats. For all gear types under study, none of the boats has exceeded ten years which is the estimated economic life span for both the hull and engine. It must also be noted that all the boats in the sample are constructed to *chengal* wood and fitted with Yanmar engines. Similarly, the nets used for all three gears are made of synthetic nylon with mesh size ranging from 2.25 inches in the case of gill nets to 2.5–5 inches for trawl nets.

From Table I, which gives the percentage distribution of the samples by gear type, it can be seen that there is a wide variation in the length, tonnage, engine horsepower and age of the sample boats. In terms of boat length, it is shown

that nearly 67 per cent of the total sample boat is 41 to 50 feet long. By tonnage classification, nearly 47 per cent of the total sample belongs to the 16 to 20 tons category, but, not one single boat in the sample exceeds 20 tons. Likewise, the engine horsepower is relatively small with nearly 50 per cent of the total sample being in the 31 to 40 horsepower category, while some 27 per cent is in the 20 horsepower and less category. A comparison of size classification of the sample by gear type seems to indicate that hand-line boats are the largest, followed by trawl-net boats and gill-net boats respectively. By age classification, some 80 per cent of the total is about five years and less while the remaining 20 per cent is in the five years category and more. However, no single boat in the sample is older than ten years of age.

Another pertinent point to note in this discussion of sample characteristics is the crew size. As with the other characteristics, the number of crew per boat varies with the size of boat and the type of gear being operated. It has been calculated that the average crew size per boat in the sample is highest for gill nets (6.9 persons) followed by hand lines (3.7 persons) and trawl nets (3.6 persons) respectively. However, this average may vary with each fishing trip. This and the other characteristics of the sample described earlier adequately reflect the actual situation of a typical small-scale fishery in Trengganu.

V. COSTS

Traditionally, costs for any fishing operation are divided into (i) initial capital investment costs and (ii) operating costs. While the former constitutes all expenditures on assets (hull, engine, gear, and other fishing accessories), the latter constitutes expenditures incurred for the operation and maintenance of the fishing enterprise.

A. *Capital Costs*

The essential capital items of a fishing unit is the boat hull, engine, and nets. Each item should be treated separately when dealing with the capital investment costs of the three gears under study.

1. *Hull*

The capital cost of hull, in large measure, depends on its size and the type of wood used. Since all the boat hulls in the sample are constructed of *chengal* wood, the only other factor affecting the cost is the size of the hull. From the sample drawn for this study, it can be seen that the cost of a new hull ranges from M$1,200 for a 10-ton trawl-net boat to M$12,000 for a 17-ton boat of the same gear type. This, however, does not take into consideration the time of purchase of the hulls. The tonnage-cost relationship for the rest of the sample for all gear types can be seen in Table II.

From Table II, it can be inferred that the cost of hull is positively correlated to its tonnage. On comparing the average hull cost for all three gears, it is found to be highest for hand-line boats at M$9,940 per unit followed by trawl-net and

TABLE II
HULL TONNAGE-COST RELATIONS OF SAMPLE BOATS BY GEAR TYPE: KUALA TRENGGANU, 1979

Sample No.	Trawl Nets		Gill Nets		Hand Lines	
	Tonnage (Tons)	Cost (M$)	Tonnage (Tons)	Cost (M$)	Tonnage (Tons)	Cost (M$)
01	14	9,000	14	6,000	16	7,000
02	17	6,700	8.6	5,000	7	5,800
03	17	8,500	6.2	6,500	16	8,500
04	12	3,000	14	8,000	16	11,000
05	16	6,000	9	2,800	14	6,000
06	16	4,000	6	3,000	16	13,000
07	10	1,200	10	3,000	20	12,800
08	17	12,000	12	3,000	18	13,000
09	8	6,000	16.5	4,000	16	12,500
10	15	6,000	14	4,000	18	9,800
Total	142	62,400	110.3	45,300	157	99,400
Mean	14.2	6,240	11.0	4,530	15.7	9,940

gill-net boats with an average cost of about M$6,240 and M$4,530 respectively.

It must be noted, however, that the price variation of hull presented in Table II is not representative for any given tonnage or any particular gear. Besides tonnage, the investment cost on a new hull is also dependent on two other secondary factors, that is, time and place of construction. To illustrate the effect of time on cost, it can be cited that a 15-ton boat hull now costing M$10,000 could have been bought for M$5,000 about ten years ago. The inflationary trend of the general price level in the country over the last ten years has pushed up cost of material and construction in the fishing industry. This has been aggravated by the rapid increase in demand for boat hulls, especially with the expansion of trawling while the existing boat-building yards do not have sufficient capacity to cope with the increasing demand. As with time, the place where the hull is being built also affects price. It has been generally recognized that because of higher cost of material, boat hulls built on the east coast more than those constructed on the west coast. Lack of boat-building yards in this region result in a sellers' market; hence higher costs. Lastly, the east coast boat hulls are reputed to be superior in quality and have greater built in strength since they have to face the rough seas during the monsoon. This tends to inflate the cost of a new hull built on the east coast.

2. *Engine*

In a typical small-scale fishery as in Malaysia, the choice of engine is very haphazard and mainly based on availability of cash or credit, popularity of the brand, and recommendations from friends or boat builders. The choice is rarely based on the scientific principle of matching the engine horsepower to hull size so as to obtain the correct power ratio. Engine cost increases proportionately with horsepower as indicated by the size-cost relations of the sample boats (Table III).

TABLE III
ENGINE SIZE-COST RELATIONS OF SAMPLE BOATS BY GEAR TYPE: KUALA TRENGGANU, 1979

Sample No.	Trawl Nets		Gill Nets		Hand Lines	
	Horse-power	Cost (M$)	Horse-power	Cost (M$)	Horse-power	Cost (M$)
01	45	17,000	22	n.a.*	33	9,000
02	37	12,000	37	8,500	37	14,000
03	45	13,400	16	7,000	37	11,500
04	24	6,000	37	n.a.*	37	11,000
05	37	11,000	16	3,800	24	6,000
06	33	7,000	16	5,000	37	13,000
07	12	1,500	16	3,800	37	12,800
08	68	25,000	16	4,000	37	13,000
09	24	4,000	16	6,000	37	12,500
10	37	2,000	16	3,700	37	9,800
Total	362	98,900	208	41,800	353	112,600
Mean	36.2	9,890	20.8	5,225	35.3	11,260

* As these are subsidy engines, their values are not known.

From Table III, it has been calculated that the engine size in terms of average horsepower is highest for trawl-net boats (36.2 horsepower) followed closely by hand-line boats (35.3 horsepower) and gill-net boats (20.8 horsepower) respectively. On the contrary, hand-line boats has the highest average cost of engine of approximately M$11,000 while the average engine cost for trawl-net and gill-net boats are M$10,000 and M$5,000 respectively.

Variation in the cost of engine is also due to different brand, time and place of installation. However, in our estimates of engine cost, the age, time and place of installation of the engines in the sample boat were not taken into consideration.

3. *Nets*

Cost of fishing nets constitutes a fairly significant proportion of initial investment cost, especially in the case of purse seines. The life span of the nets depends on the frequency and quality of repairs and maintenance. On average, however, the nets can last between three to four years. It is a common practice for fishing boats to carry more than one set of nets so that in the event of one net being completely lost or torn the boat can quickly switch to the other set so that no fishing time is lost. All the trawl-net boats in the sample carry at least two sets of either fish or prawn trawl nets, or both, so that at times when prawns are scarce the fish trawl nets are quickly put to use or vice versa. Owing to its larger size and hence higher cost, none of the gill-net boats carry more than one set of net during each fishing trip. In the case of hand-line boats, no costs are incurred in buying nets since only hooks and lines are used in such fishing method. The investment cost on these items are too small to be included in the estimate of initial investment cost. The average cost estimates of nets for trawl-net boats and gill-net boats are given in Table IV.

From Table IV, it is apparent that gill nets being larger and having longer life

TABLE IV
AVERAGE COST OF TRAWL NETS AND GILL NETS OF SAMPLE BOATS: KUALA TRENGGANU, 1979

Sample No.	Trawl Nets		Gill Nets	
	Number of Units	Value (M$)	Number of Units	Value (M$)
01	3	1,200	1	3,500
02	3	1,200	1	3,000
03	4	800	n.a.	n.a.
04	2	600	2	6,000
05	2	600	1	1,500
06	3	1,350	n.a.	n.a.
07	2	1,000	1	2,000
08	2	1,800	1	700
09	2	1,000	1	3,000
10	2	800	1	3,500
Total	25	10,350	9	22,700
Mean		414		2,522

TABLE V
AVERAGE TOTAL CAPITAL INVESTMENT COSTS PER FISHING UNIT BY GEAR TYPE: KUALA TRENGGANU, 1979

Capital Item	Trawl Nets		Gill Nets		Hand Lines	
	M$	%	M$	%	M$	%
1. Hull	6,240	36	4,530	37	9,940	47
2. Engine	9,890	57	5,225	42.5	11,260	53
3. Nets*	414	7	2,522	20.5	—	—
4. Accessories†	700		—	—	—	—
Total	17,244	100	12,277	100.0	21,200	100

* The net cost is based on the average of one set. It is a normal practice for trawl-net boats to carry more than one net during every fishing trip.

† Accessories are only found in trawl-net boats and they include items like windlass and trawl ropes.

span are more expensive than trawl nets. Although the investment cost on trawl-net boats appear to be low in comparison to other boats, it does not take into consideration investment on other trawling accessories such as generators, windlasses, and trawl ropes. Among these three items, windlasses and trawl ropes are more commonly used by trawl-net boats in the sample. If the cost of these accessories are taken into account, the initial investment cost of trawler will increase accordingly as shown in Table V.

The average total investment cost by gear type is summarized in Table V. On average, it has been calculated that the total capital investment ranges from as low as M$12,000 for a gill-net boat to as high as M$21,000 for a hand-line boat. A breakdown of the total investment by item shows that engine forms the largest single important component accounting for nearly half (43 to 57 per cent) of

the total capital costs followed by hull (36 to 47 per cent) and nets/accessories (7 to 21 per cent) respectively.[6]

B. *Operating Costs*

The operating expenditure in any fishing enterprise comprises the following items:

(1) Running costs—fuel, lubricant, ice, food-at-sea, and general stores;

(2) Maintenance and repair costs—daily upkeep, servicing and repairs of hull, engine, nets, and other fishing accessories;

(3) Shore costs—marketing commission, landing fees, administrative charges, etc.; and

(4) Crew costs—wages to the crew.

In this study, however, only running, maintenance and repair, and crew costs are analyzed as no shore costs were incurred for any of the boats in the sample.

1. *Running costs*

The principal component items of running costs are fuel, lubricant, ice, food for the crew at sea, and general sea-going stores. The data for these cost items were collected for two months continuously during the period of study. However, to obtain a more realistic picture of the running costs incurred, the average for the two months are taken and expressed in terms of per boat per fishing day for all three gears concerned as given in Table VI.

The daily average total running costs of the boats in the sample and the percentage distribution of the various cost items are summarized in Table VII. Fuel cost is the largest single factor accounting for about 79 per cent of the total running costs in trawl nets, 58 per cent in gill nets, and 58 per cent in hand lines. The exceptionally large proportion of fuel costs in the case of trawling is due to the greater power needed by trawlers' engines during its dragging operations and hence higher fuel consumption. On the basis that fuel costs about M$1.80 per gallon in the study area and given the average fuel cost incurred, it can be calculated that the requirement per boat per fishing day is some 15 gallons for trawl-net boats, 10 gallons for gill-net boats, and 12 gallons for hand-line boats. The fuel costs, it must be noted, increase linearly with the number of fishing days or fishing trips made. The recent hike in the price of diesel also tends to push up fuel costs.

Ice, which is the next important component, accounts for about 23 per cent of the total running costs of the hand-line boats. It is essential for the hand-line boats to carry ice in order to keep fish fresh during its long fishing trips. Surprisingly, however, the other two gear types in the study do not carry ice during their fishing trips. This is partly because their fishing trips are shorter and the boat owners do not wish to incur extra costs on ice since they feel that the fish

[6] In a preliminary study of this nature, it was considered appropriate to exclude depreciation since data acquisition and estimation on the actual value of depreciation cost of the capital items (hulls and engines) could not be undertaken. Furthermore, the short duration of this survey also militated against any realistic estimation of depreciation cost.

TABLE
AVERAGE RUNNING COSTS PER BOAT PER FISHING

Sample No.	Trawl Nets						
	Fuel	Lubricant	Ice	Food	Total	Fuel	Lubricant
01	23.00	1.20	—	3.00	27.20	9.00	1.20
02	18.00	1.40	—	4.00	23.40	17.00	0.90
03	36.00	2.50	—	5.00	43.50	16.00	1.20
04	22.00	1.40	—	4.50	27.90	30.00	0.80
05	18.00	1.50	—	4.00	23.50	25.00	0.50
06	27.00	1.30	—	4.00	32.30	16.00	0.80
07	27.00	0.20	—	4.50	31.70	16.00	0.40
08	54.00	3.70	14.00	6.00	77.70	15.00	1.00
09	13.00	0.90	—	2.00	15.90	—	—
10	25.00	1.30	—	3.00	29.30	—	—
Total	263.00	15.40	14.00	40.00	332.40	144.00	6.80
Mean	26.30	1.54	1.40	4.00	33.24	18.00	0.85

TABLE VII
SUMMARY OF AVERAGE TOTAL RUNNING COSTS PER BOAT PER FISHING DAY BY GEAR TYPE: KUALA TRENGGANU, 1979

Items	Trawl Nets		Gill Nets		Hand Lines	
	M$	%	M$	%	M$	%
1. Fuel	26.30	79	18.00	58	21.30	58
2. Lubricant	1.54	5	0.85	3	1.46	4
3. Ice	1.40	4	—	—	8.25	23
4. Food	4.00	12	12.27	39	5.55	15
Total	33.24	100	31.12	100	36.56	100

can still retain its freshness for several hours without ice before the boat returns to base. Monopolistic prices, inadequate supplies, and inavailability of ice at many remote fishing villages are probably some of the other reasons why the trawl-net and gill-net fishermen did not use ice during the fishing trips.

Lubricants or cylinder oil for the engines, food for the crew while at sea and other miscellaneous supplies constitute the remaining items of the running costs. The average cost of lubricant as can be seen from Table VII, is very minimal ranging between M$1.00 and M$1.50 per boat per day for all three gears. In terms of percentage, it accounts for 3 to 5 per cent of the total running costs. By comparison, the food costs for the crew form quite a substantial portion of the running costs. However, there is a wide variation in the cost of food from boat to boat depending on the generosity of the owner. On average, it ranges from M$4.00 per boat per day in the case of trawl nets to approximately M$12.00 for gill nets to form some 12 per cent and 39 per cent of the total running costs respectively. The average food cost for hand-line boats, on the other hand, is about M$5.55 per boat per day or some 15 per cent of the total running costs. The food costs increase correspondingly with crew size. Given the average crew

VI
DAY BY GEAR TYPE: KUALA TRENGGANU, 1979

(M$)

Gill Nets			Hand Lines				
Ice	Food	Total	Fuel	Lubricant	Ice	Food	Total
—	6.60	16.80	16.00	1.70	6.50	6.00	30.20
—	10.20	28.10	24.00	0.50	10.50	9.50	44.50
—	13.60	30.80	29.50	2.20	8.00	7.00	46.70
—	13.30	44.10	26.00	2.30	9.00	7.00	44.30
—	13.00	38.50	17.50	1.30	7.00	4.00	29.80
—	14.20	31.00	18.00	1.40	7.50	3.50	30.40
—	13.30	29.70	21.00	1.20	8.00	4.00	34.20
—	14.00	30.00	14.00	1.10	8.00	4.00	27.10
—	—	—	23.00	1.20	9.00	5.00	38.20
—	—	—	24.00	1.70	9.00	5.50	40.20
	98.20	249.00	213.00	14.60	82.50	55.50	365.60
	12.27	31.12	21.30	1.46	8.25	5.55	36.56

size of 3.5 persons for trawl nets, 7 persons for gill-nets, and 4 persons for hand lines, the average food cost per person is found to be approximately M$1.10, M$1.80, and M$1.40 for the three gears respectively. Thus, the higher average cost of food incurred in gill-net boats relative to the other gear types is due to its larger crew size.

2. *Maintenance and repair costs*

Maintenance work on the fishing boats is considered routine and involves regular upkeeping and care of the hull, engine, nets, and other accessories. Repairs, on the other hand, are carried out only as and when required and can be quite costly depending on the frequency of breakdowns and extent of damage. In practice, it is rather difficult to separate the maintenance from the repair cost as they are often treated as one. It must be admitted here that collecting cost estimates of maintenance and repairs in the course of the study proved to be quite problematic as the fishermen did not keep proper account of these costs. Furthermore, since the study was conducted for two months only and during which time no major repairs were undertaken for some of the boats, the average maintenance and repair costs presented here are slightly underestimated.

Unlike running costs, the average cost of maintenance and repair cannot be calculated on a per day basis as they are not incurred everyday or for every fishing trip. Similarly, it seems pointless to calculate the average for each boat as the variation is too wide. Table VIII, therefore, gives mere estimates of total maintenance and repair costs for two months of fishing.

Comparing all three gears, trawl-net boats appear to have the highest maintenance and repair costs. Since no hull repairs were undertaken for any of the boats, only engine and net repair costs were taken into account. Of these two items, the cost to repair fishing nets appears to be more significant. The high maintenance and repair costs of trawl nets are mainly due to its rapid wear and

TABLE VIII
AVERAGE MAINTENANCE AND REPAIR COSTS BY GEAR TYPE: KUALA TRENGGANU, JUNE/JULY 1979

(M$)

Sample No.	Trawl Nets			Gill Nets			Hand Lines		
	Engine	Net	Total	Engine	Net	Total	Engine	Net	Total
01	27.00	7.00	34.00	—	—		—	—	
02	35.00	119.00	154.00	—	—		140.00	—	140.00
03	0	228.00	228.00	—	—		40.00	—	40.00
04	60.00	10.00	70.00	—	—		—	—	
05	40.00	106.00	146.00	30.00	20.00	50.00	146.00	—	146.00
06	45.00	110.00	155.00	12.00	71.00	83.00	—	—	
07	0	11.00	11.00	—	—		50.00	—	50.00
08	0	117.00	117.00	—	—		—	—	
09	500.00	50.00	550.00	—	—		—	—	
10	—	—		—	—		—	—	
Total	707.00	758.00	1,465.00	42.00	91.00	133.00	376.00		376.00
Mean	78.56	84.22	162.78	21.00	45.50	66.50	94.00		94.00

tear compared to other fishing methods. The cost of engine repairs in trawl-net boats varies between M$30 to M$500 for all boats in the sample.

On the contrary, it is noted that the incidence of maintenance and repairs among gill-net and hand-line boats is relatively low. Only two gill-net boats in the sample have incurred some repair costs on their engines and nets. As for the hand-line boats, only four are involved in engine repairs while cost to repair fishing gears (hooks and lines) is virtually nil.

3. *Shore costs*

The largest single item of shore costs is usually the commission or marketing fees paid on sales of fish to the wholesalers or other fish agents. Other components in the shore cost include fees for the use of landing jetties, rentals, and administrative charges (fines, insurance, etc.). However, none of the above costs was incurred for all boats in the study and for all three gears concerned.

4. *Crew costs*

Wages which represent remuneration of the crew poses a particular difficulty. Since the remuneration consists of part of a share in the proceeds from the sale of fish and since the crew participates in the risks of entrepreneurship and shares certain costs, it really cannot be considered as an expenditure. Wages or crew costs in a fishing enterprise is actually net return to labor. In practice, however, boat owners regard the crew share entirely as costs as long as it is debited as an expenditure. For our present purpose too, remuneration of the crew is regarded as crew costs and constitute an important item in the total operating costs.

Given the crew costs and number of fishing days, the average crew cost per boat per day of all three gears is derived as shown in Table IX. There is a wide variation in the average crew cost from boat to boat and from gear to gear.

TABLE IX
AVERAGE CREW COSTS PER BOAT PER FISHING DAY BY GEAR TYPE: KUALA TRENGGANU, 1979

(M$)

Sample No.	Trawl Nets	Gill Nets	Hand Lines
01	33.00	50.00	59.00
02	43.00	58.00	57.00
03	63.00	84.00	44.00
04	27.00	—	58.00
05	44.00	30.00	42.00
06	47.00	81.00	36.00
07	32.00	22.00	57.00
08	46.00	14.00	64.00
09	42.00	—	53.00
10	30.00	—	57.00
Total	483.00	339.00	527.00
Mean	48.30	48.42	52.70

The average crew cost is highest among the hand-line boats at M$53.00 per day while the trawl-net and gill-net boats average at M$48.00 per day each. These averages are not necessarily representative of other fishing methods since crew requirements vary from one gear to another and the opportunity cost of labor varies with locations.

C. *Distribution of Operating Costs*

From the above analysis of the operating costs incurred in a fishing enterprise, it can be summarized that fuel and crew costs accounted for almost two-thirds of the total operating expenditures. The remaining one-third is shared between maintenance and repair costs and other shore costs. In the case study, however, repair cost especially to engines appears to be the major cost here amounting to some 10 to 15 per cent of all costs. But it varies considerably between boats and from period to period as can be seen from the sample. It is important to note that small boat owners, unlike their larger counterparts, are able to economize on costs. For instance, it is a common practice for the boat owner to man his own boat as captain and employing his immediate family as crew. He personally supervises the sorting, packing, and marketing of the catch and thus saving onshore costs to pay hired workers to undertake these tasks. Owing to the small-scale nature of his operation his overheads are small and he undertakes to repair and maintain the boat with the help of family labor, thus minimizing repair and maintenance costs. In other words, a sea-going owner will do anything to reduce his costs in everyway possible.

VI. EARNINGS

In the fishing enterprise, net earnings are represented by total receipts from sales of fish, less operating expenses and depreciation. These earnings are dis-

TABLE
AVERAGE TOTAL CATCH VALUE PER FISHING DAY PER

Sample No.	Trawl Nets				
	Total Catch		Number of Fishing Days	Average Catch (M$/Day)	Total
	Weight (Picul)*	Value (M$)			Weight (Picul)
01	202.5	3,135.00	44	71.00	46.0
02	212.5	3,785.00	42	90.00	49.0
03	238.0	6,428.00	46	140.00	59.0
04	187.0	2,937.00	44	67.00	15.5
05	229.5	4,150.00	44	94.00	22.0
06	214.0	4,458.00	44	101.00	49.0
07	199.5	3,603.00	44	82.00	19.5
08	102.0	6,670.00	46	145.00	12.0
09	227.0	3,508.00	48	73.00	—
10	207.5	3,329.00	45	74.00	—
Total	2,019.5	42,003.00	447	937.00	272.0
Mean	202.0	4,200.30	45	94.0	34.0

* 1 metric ton=16.53 picul.

tributed between the "net cash crew share" and "net earnings of boat share," i.e., wages and profits respectively. If the boat owners are also members of the crew, they, of course, are entitled to both wages and profits. The total receipts from sales of fish are dependent on prices at landing points which may vary greatly from species to species, place to place, and even according to the different times the catch is landed.

1. *Net earnings of labor and capital*

From the records of landing values collected over two months continuously during the study period, the net returns (both to labor and capital) of all the boats can be calculated. Given the landing values and number of fishing days of each boat, the average catch value is calculated and again expressed as per boat per fishing day so as to obtain a meaningful comparison between boat and gears as shown in Table X.

There is wide variation in total catch, both in terms of weight and value, among the boats in the sample and for all three gears. It must be realized, however, that the larger landings from trawl nets, by comparison with gill nets and hand lines, are due to the large component of low commercial-value trash fish. It has been estimated that 70 to 80 per cent of the total catch by trawlers comprised trash fish. On the other hand, all landings by gill-net and hand-line boats consisted of high value commercial species. Thus, although landings by weight is highest for trawl-net boats, the average catch per boat per fishing day for all three gears seems to be fairly constant (Table X).

Having calculated average total catch value per boat per fishing day of trawl nets, gill nets, and hand lines (Table X) and their average total running costs (Table VII), it is now possible to derive the average net catch value (net earnings) of an average boat for a typical fishing day for all three gears concerned as shown

X

BOAT BY GEAR TYPE: KUALA TRENGGANU, JUNE/JULY 1979

Gill Nets			Hand Lines			
Catch	Number of Fishing Days	Average Catch (M$/Day)	Total Catch		Number of Fishing Days	Average Catch (M$/Day)
Value (M$)			Weight (Picul)	Value (M$)		
4,415.00	48	92.00	36.0	2,853.00	30	95.00
4,600.00	39	118.00	75.2	3,315.00	30	110.00
6,018.00	36	167.00	40.5	3,035.00	32	95.00
1,600.00	30	53.00	52.5	3,475.00	31	112.00
2,237.00	29	77.00	47.5	3,136.00	37	85.00
5,704.00	36	158.00	54.3	2,170.00	32	68.00
1,887.00	30	63.00	73.5	3,010.00	31	97.00
1,720.00	30	57.00	64.0	2,450.00	32	76.00
—	—	—	71.6	2,910.00	30	97.00
—	—	—	37.0	3,007.00	29	104.00
28,181.00	278	785.00	552.1	29,361.00	314	939.00
3,523.00	35	98.00	55.0	2,936.00	31	94.00

TABLE XI

AVERAGE NET CATCH VALUE PER BOAT PER DAY BY GEAR TYPE: KUALA TRENGGANU, 1979

(M$)

	Trawl Nets	Gill Nets	Hand Lines
Average total catch value (gross sale receipts)	94.00	98.00	94.00
Less Average total running costs	33.00	31.00	37.00
Net catch value (net earnings)	61.00	67.00	57.00
Distributed into:			
Net cash owner share	30.50(50%)	16.75(25%)	14.25(25%)
Net cash crew share	30.50(50%)	50.25(75%)	42.75(75%)

in Table XI. It is clear that there is no significant difference in the net catch value per boat per day between the three gears. This net receipt (total catch value less running costs) represents net earnings to the boats before deducting for maintenance and repair costs and depreciation which are customarily borne by the boat owner alone. The net earnings are then divided into two or three equal portions depending on the share system of each particular gear. For instance, in trawling the net earnings are shared equally between the boat owner and crew, that is 50 per cent boat owner's earnings and 50 per cent crew's earnings. On the contrary, gill-net and hand-line boats adopt different share systems whereby only 25 per cent of net earnings accrues to the boat owner and the remaining 75 per cent goes to crew's share. It must be noted that for all gears a certain percentage of the boat owner's share is also given away as commission to the captain (*taikong*).

TABLE XII

AVERAGE MONTHLY FISHING INCOMES BY GEAR TYPE: KUALA TRENGGANU, 1979

Items	Trawl Nets	Gill Nets	Hand Lines
1. Average net catch value (M$/day)	61.00	67.00	57.00
2. Average fishing days (days/month)	22.5	17.5	15.5
3. Average net earnings of boat (M$/month)	1,373	1,173	884
4. Average owner net income* (M$/month)	687	293	221
5. Average crew net income* (M$/month)	687	880	663
6. Average crew size (persons/boat)	3.6	6.9	3.7
7. Average net income per crew (M$/month)	191	128	179

* The distribution of boat owner's share: crew share is an accordance with the normal practice of the respective year, that is, 50:50 in the case of trawl nets and 25:75 for gill nets and hand lines.

2. *Crew remuneration*

The part accruing to the crew is in turn divided into several shares and each crew member receives a varying number of shares depending on his responsibility in the boat. A *taikong* normally gets more shares in this division as he plays a key role in the entire fishing operation. In instances when he gets the same number of shares as the other crew members, he will normally receive a commission of 15–20 per cent of the boat owner's share every month. It is a common practice among non-sea-going boat owners to provide such commission as an incentive to his *taikong*. Depending on one's generosity, the *taikong* will occasionally share a small percentage of his commission with deserving crew members. Besides the *taikong,* other members of the crew performing special functions, such as the diver (*juruselam*), net man (*jurupukat*) and engine man (*juruenjin*), also receive larger individual shares than the ordinary deckhands (*awak-awak*).

Remuneration to the crew is an important aspect of any costs and earnings study since from it we can obtain some income estimates. Estimates of the average net fishing income per boat per month and average income to each member of the crew are given in Table XII. Monthly fishing incomes are estimated using the average number of fishing days per month while net income to each crew member is based on the average crew size for each gear type.

The income estimates of this study must be used with the utmost caution due to the assumptions upon which they were estimated. For example, the calculation on average net income per crew member does not take account of the varied individual shares received by the *taikong* and *awak-awak*. The average income is computed on the basis of one share each for every crew member regardless of their responsibility in the boat. Thus, the income estimate is slightly understated for *taikong*s who normally receive larger individual shares than the rest of the crew. To show the effect of "responsibility" variation on fishing incomes, however, a 15 per cent commission of the owner's net income is added to the *taikong*'s shares as is customarily practiced for all three gears in the study. On this basis the *taikong*'s net income for each gear type becomes M$294, M$172, and M$212 for trawl nets, gill nets, and hand lines while net income for ordinary crew members remained at M$191, M$128, and M$179 respectively. On average,

TABLE XIII
AVERAGE MONTHLY INCOME STRUCTURE BY FISHERMAN'S STATUS AND GEAR TYPE: KUALA TRENGGANU, 1979

(M$)

	Trawl Nets		Gill Nets		Hand Lines	
	Tai-kong	*Awak-awak*	*Tai-kong*	*Awak-awak*	*Tai-kong*	*Awak-awak*
A. Cash income from:						
(a) individual shares of crew's earning	191	191	128	128	179	179
(b) 15% commission of owner's share	103	—	44	—	33	—
	294	191	172	128	212	179
B. Income in kinds (imputed value):						
(a) *ikan lauk*	67.50	67.50	52.50	52.50	46.50	46.50
(b) food-at-sea	25.00	25.00	31.50	31.50	23.00	23.00
Total income/fishermen	386.50	283.50	256.00	212.00	281.50	248.50

trawl-net fishermen enjoy higher income in comparison to both hand-line and gill-net fishermen. But it must be noted that the higher income obtained by trawl nets is mainly as a result of a larger number of fishing days whereas in the case of gill nets and hand lines, fishing is primarily carried out only during the dark phase of the moon. Hence, the number of fishing days is substantially reduced for the two latter gears and thus affect incomes. Since the survey was conducted during the normal fishing season, the effects of seasonality over incomes are again not considered. Therefore, it is not appropriate to extrapolate the fishing incomes to a twelve-month period as is commonly done in some costs and earnings studies.

In analyzing the fishing incomes earned by the fishermen of all three gears, it is also useful to consider income in kind which can be given imputed dollar-value. By tradition, fishermen are allowed to take home a small proportion of the catch for their family consumption (*ikan lauk*). Occasionally, the *ikan lauk* is sold to neighbors and friends in exchange for cash. It has been estimated that the imputed value of *ikan lauk* for all gears is about M$3.00 per crew, per fishing trip, or per fishing day. Given the average number of fishing days per month, the monthly imputed value of *ikan lauk* per crew amounts to about M$67.50 for trawl nets, and M$52.50 and M$46.50 for gill nets and hand lines respectively.

Another source of income in kind is the food consumed by the fishermen while out at sea. Although food costs are charged to the running costs, nevertheless, it is still useful to include it in the estimation of incomes to the fishermen. The average value of food-at-sea per crew member per fishing day is estimated to be M$1.10 for trawl net, M$1.80 for gill net, and M$1.40 for hand lines or M$25, M$31.50 and M$22 per month for the three gears respectively.

To sum up, the fishing incomes of three main small-scale gears can be meaningfully compared by constructing the average monthly income structure by gear type and by fishermen's status and responsibility as shown in Table XIII. Since

TABLE XIV
AVERAGE MONTHLY NET RETURNS TO BOAT OWNER BY GEAR TYPE: KUALA TRENGGANU, 1979

(M$)

	Trawl Nets	Gill Nets	Hand Lines
Average owner net income	687	293	221
Less			
15% *taikong*'s commission	103	44	33
Average repair/maintenance cost	81	33	47
Average monthly net returns to boat owner	503	216	141

the interview was conducted over a period of two months, only cross-sectional and not time series data can be obtained for the income estimates. By gear types, income earned by trawl-net fishermen is the highest followed by gill-net and hand-line fishermen respectively. By "status" of fishermen, *taikong*s receive larger income than the ordinary *awak-awak* for all gears. These estimates, though preliminary in nature, can be taken to be consistent with the actual situation.

3. *Profit to the entrepreneur*

Profit to the entrepreneur represents the compensation to the boat owner for the risks he takes in fishing investment as well as net returns of capital ownership. It has been calculated that average net income to owner (i.e., gross sales receipts, less operating costs and crew remuneration) during the study period amounts to about M$687 per month for trawl nets compared to only M$293 and M$221 for gill nets and hand lines respectively (Table XII). Clearly, therefore, a trawl-net boat owner receives larger returns to his capital than the other two gear operators. This is largely due to the difference in profit-sharing system of each gear type. While the owner's share constitutes some 50 per cent of the boat's net earnings in the case of trawl-net boats, only 25 per cent of the earnings is accruable to owners of gill-net and hand-line boats. It must also be remembered that this percentage does not represent net returns to the boat owner since the *taikong*'s commission, repair and maintenance, and other shore costs incurred are also deducted from here. If all these costs are taken into account, the owner's return or profit will be reduced as can be seen from Table XIV.

A few brief explanatory remarks are required here. In practice, the 15 per cent *taikong*'s commission may vary from gear to gear and even from boat to boat depending on the owner's generosity. However, for simplicity and convenience, it is fixed at 15 per cent for all gears for this particular purpose. Secondly, the repair and maintenance cost is based on the average of two months interview, that is, the duration of the survey period. Thus, it is not reflective of the repair/maintenance cost incurred for the whole year. Since there are fewer observations on repair/maintenance costs for gill nets and hand lines, the value given here may be slightly understated. Nevertheless, since the survey was conducted during a period of the "normal" fishing season the results are sufficiently representative of a typical case.

TABLE XV

SUMMARY OF RECEIPTS, EXPENDITURES, AND NET OPERATING PROFITS BY GEAR TYPE: KUALA TRENGGANU, 1979

(M$)

	Trawl Nets		Gill Nets*		Hand Lines	
	June	July	June	July	June	July
Total receipts from sales of fish	20,900	21,000	15,300	12,900	15,300	14,000
Less						
Direct running costs	7,500	7,400	4,700	3,500	5,700	5,800
Net earnings to labor & capital	13,400	13,600	10,600	9,400	9,600	8,200
Less						
Crew's share†	6,700	6,800	7,950	7,050	7,200	6,150
Owner's share	6,700	6,800	2,650	2,350	2,400	2,050
Less						
15% *taikong*'s commission	1,005	1,020	400	350	360	310
Maintenance & repair costs	980	480	40	130	225	150
Net profits to owners	4,715	5,300	2,210	1,870	1,815	1,590
Average net profit per boat	470	530	280	230	180	159
Ratio of profit to revenue (%)	2.2	2.5	1.8	1.8	1.2	1.1

* There were only eight observations for gill nets.

† Calculated as 50 per cent of net earnings in the case of trawl-net boats and 75 per cent each for gill-net and hand-line boats.

TABLE XVI

PROFITABILITY PER BOAT PER MONTH BY GEAR TYPE: KUALA TRENGGANU, 1979

	Trawl Nets	Gill Nets	Hand Lines
Total revenue (M$)	2,100	1,760	1,470
Total expenditures (M$)	1,600	1,500	1,300
Net profit (M$)	500	260	170
Ratio of profit to revenue (%)	23.8	14.8	11.6
Ratio of expenditures to revenue (%)	76.2	85.2	88.4
Mean investment cost (M$)	17,200	12,300	21,200
Return to capital (%)	2.9	2.1	0.8

4. *Profitability*

In a multi-species fishery like the small-scale fisheries of Peninsular Malaysia, it is rather difficult, if not impossible, to measure profitability using the common investment-appraisal tool such as net present value, internal rate of return, pay-back ratio, etc. Furthermore, the cost and earning data were collected over a period of only two months and do not allow us to make any meaningful extra-polations over the estimated economic life span of the boats.

In view of the above, any attempt at measuring the profitability of the boats can only be done by computing the monthly statements of operating profits (i.e., before depreciation and interest) for all thirty boats in the sample and by gear type. The results are summarized and shown in Table XV. It can be inferred that trawl nets is still the most lucrative gear in comparison to igll nets and hand lines. Comparing the net returns on a monthly basis (i.e., June and July), there

seems to be very small monthly variations for all three gears. However, it must be borne in mind that this does not apply during the monsoon period when fishing is considerably reduced and thus affecting incomes and profits.

From the summary of receipts, expenditures, and net profits of the boats, the average return to capital investment can be estimated as shown in Table XVI. The estimated average return to investment, as apparent from Table XV, confirms the earlier findings that trawling is more profitable than the other two gears. Hand-lines have the lowest average return to investment at 0.8 per cent compared to 2.9 per cent and 2.1 per cent for trawl nets and gill nets respectively. Similarly, the monthly net profit expressed as percentage of total revenues (profit : revenue) also suggests that trawl nets have the highest percentage at 23.8 per cent, followed by 14.8 per cent for gill net and 11.6 per cent for hand lines. On the other hand, trawl nets incurred the lowest cost on comparing total expenditures to revenues, and, thus explains for the higher profits enjoyed by them.

VII. POLICY IMPLICATIONS

The purpose of this paper is to provide information concerning costs, earnings, and profitability of the three most representative gears of the Trengganu fishery, viz., small trawl nets, gill nets, and hand lines. The data used in this research has come mainly from direct survey in Kuala Trengganu district and although statistically a small sample was taken, the research results provide useful descriptive empirical information and a number of prescriptions for policy purposes can be deduced.

The study indicated that trawl nets had the most number of fishing days compared to gill nets and hand lines; the latter gears are only operated during the dark moon phase of the lunar calendar and the number of fishing days were found to directly influence the earnings and profitability of boats. Surprisingly, however, the allegedly most "traditional" gear, hand lines, had the highest capital investment cost (M$21,200) which may be contrasted with trawl nets (M$17,244) and gill nets (M$12,277). A breakdown of the capital investments costs show that the hull accounted for about 30 to 40 per cent of the total value while the engine and nets represented 50 per cent and 10 to 20 per cent respectively.

It was noted that fuel was the single most important component item of direct operating costs; fuel, including lubricants, accounted for more than 84 per cent of total running costs per day of trawl nets, 61 per cent for gill nets, and 63 per cent for hand lines.[7] Given the crucial significance of fuel to mechanized fishing operations it is abundantly clear that any increases in fuel costs would adversely affect profitability. It might be thought prudent to consider revision of present policies whereby fishermen are required to pay industrial rates for fuel; this is currently M$1.80 per gallon in the study locations.

[7] This may be contrasted with an earlier study by Selvadurai and Lai Kwok Kong in the west coast fishery, their study showed fuel including lubricants, represented 73.9 per cent and 71.1 per cent of the total running costs of 30-ton and 50-ton trawl-net boats respectively. See [7].

Another component of running costs is ice which is utilized in order to maintain the fresh quality of the catch on board the boat. Despite its obvious relevance to the maintenance of freshness and quality of fish landings only hand-line boats used ice where it represented about 23 per cent of total running costs. While the extent of postharvest losses on board the boats is not known, it is likely to be considerable and economic losses occur through price reductions when fish becomes stale. It has been observed that the most effective intervention at the immediate postharvest stage concerns the improvement of storage conditions to reduce deterioration of fish prior to landings. Clearly, there is need for research and development in this important area. Low-cost cooling devices are especially useful and, although ice is preferable, even sea water cooled by several degrees can effectively retard spoilage of a number of species.[8]

On the basis of total value of landings, gill nets are marginally the most significant with an average catch value of some M$98 per boat per day compared with M$94 each for the other two gears. In volume terms, however, trawl nets are easily the most important with an average daily catch per boat of 202 piculs in contrast to the 34 piculs of gill nets and the 55 piculs of hand lines. The lower value obtained from a much larger volume of trawl landings can be attributed to the very large component of trash fish; it is probable that nearly 70 to 80 per cent of the total catch by trawl nets comprise trash fish which has a very low commercial value.[9] On the other hand, the landings of gill nets and hand lines consist of high-value commercial species, this can be deduced from data presented on landing prices of the catch. Average landing price varies from as high as M$100 per picul (gill nets) to as low as M$20 per picul (trawl nets); the average landing price for the catch of hand lines is about M$53 per picul.

Any synopsis of earnings would be incomplete without some analysis of fishermen's incomes. Average monthly fishing incomes by gear are presented in Table XII: this shows that trawler fishermen receive the highest net income of M$191, hand-line fishermen obtain M$179, and gill-net fishermen the least with M$128. In practice there is considerable divergence in the average net income between gears due to the influence of variables such as landing prices, operating costs, and the sharing system. It should also be noted that in addition to cash income, income in kind including the value of *ikan lauk* and food-at-sea, also constitutes an important part of total income. It is also pertinent to observe that higher average incomes obtained by trawler fishermen is primarily the result of a larger number of fishing days. Moreover, since the survey was conducted during the "normal" fishing season the effects of any seasonal abnormalities are not taken into account. Despite these caveats, broad orders of magnitude can be gleamed from a perusal of Table XIII, this affirms that after allowance is made for income in kind, average monthly incomes are highest for trawler fishermen (M$283.50), followed by hand-line fishermen (M$248.50) and lastly gill-net fishermen with M$212. Quite clearly the policy prescriptions that can legitimately be drawn from

[8] See [6].

[9] Large and rising catches of *ikan baja* or trash fish are often thought to be symptomatic of overfishing or the use of inappropriate fishing techniques. This has been a phenomenon of the west coast fishery in Peninsular Malaysia. See [3].

these estimates are only tentative and require validation (or refutation) from studies with a wider geographical coverage.

Contrary to the stereotyped view, net profits to boat owners (i.e., gross receipts, less operating costs) do not appear to be very substantial given the risks involved in fishing operations. The risks, moreover, are not evenly shared between the boat owner and crew as the latter do not have to bear the burden of the repair, maintenance, and other shore costs incurred. It was observed that trawler owners receive larger returns to capital than the other two gear owners but this phenomenon is largely due to differences in the profit-sharing systems of the various gear types. While the owner's share constitutes some 50 per cent of the boat's net earnings in the case of trawlers, only 25 per cent of net earnings accrues to owners of gill-net and hand-line boats.

Profitability indexes, as calculated in the study, indicate that trawling is the most profitable of the three gears studied; the estimated average monthly return to capital amounted to 2.9 per cent for trawl nets. 2.1 per cent for gill nets and only 0.8 per cent for hand lines. Such estimated rates of return must be treated with great caution since they are preliminary in nature and are based on a short study period of only two months. It will also be apparent that rates of return on investment vary considerably with methods of investment calculation such as original book-value method, discount cash flow methods, etc. For simplicity and because of data limitations, we calculated returns to capital through the summation of receipts and expenditure and the determination of net profits per boat per month (see Table XVI). While such estimates must be regarded as tentative they do nevertheless reflect intra-gear differences in profitability and it is possible to infer that all three rates of return are lower than the market rate of interest.[10] Perhaps what is the single most significant policy implication is that the promotion of boat ownership per se may not be a sufficient condition for poverty redressal strategies in the east coast fishery. Improving the price "climate" of both inputs and outputs facing the fishing industry, reducing postharvest losses and effecting improvements in marketing and processing would probably rank as more cost-effective strategies.

[10] The market rate of interest in this context could be considered as equivalent at the "pure" rate of interest. A suitable rate might be the treasury bill rate or similar such riskless financial asset.

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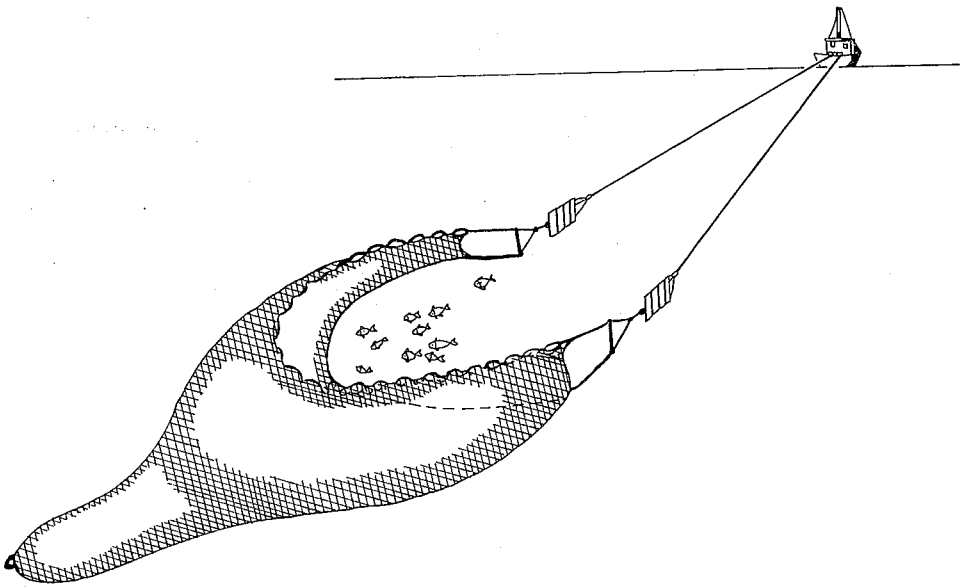
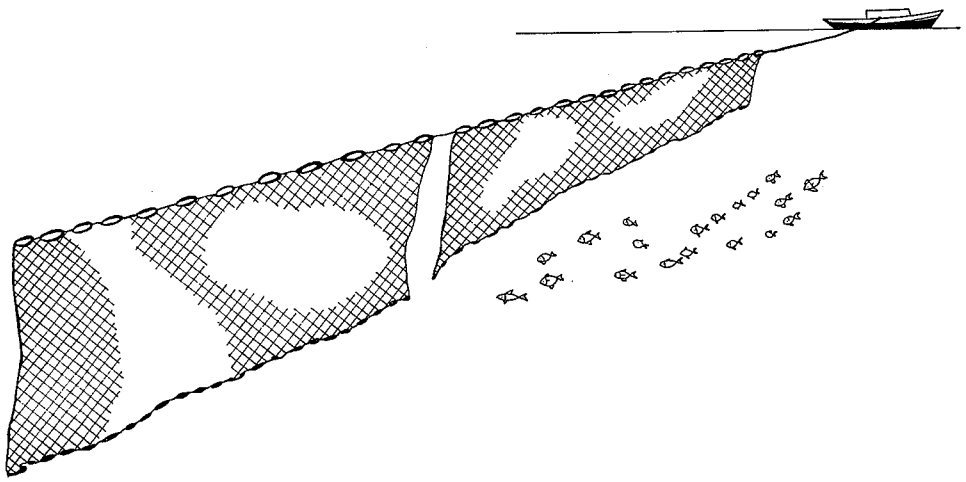
APPENDIX

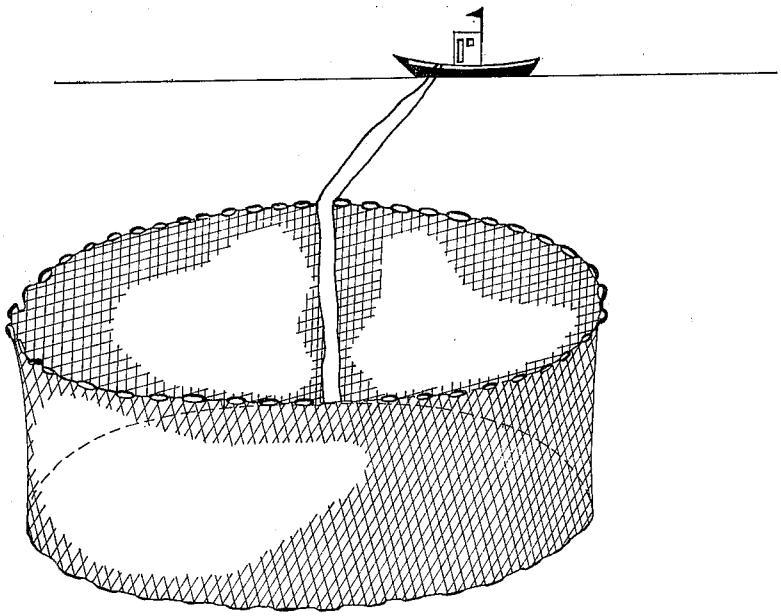
IMPORTANT FISHING GEARS IN TRENGGANU



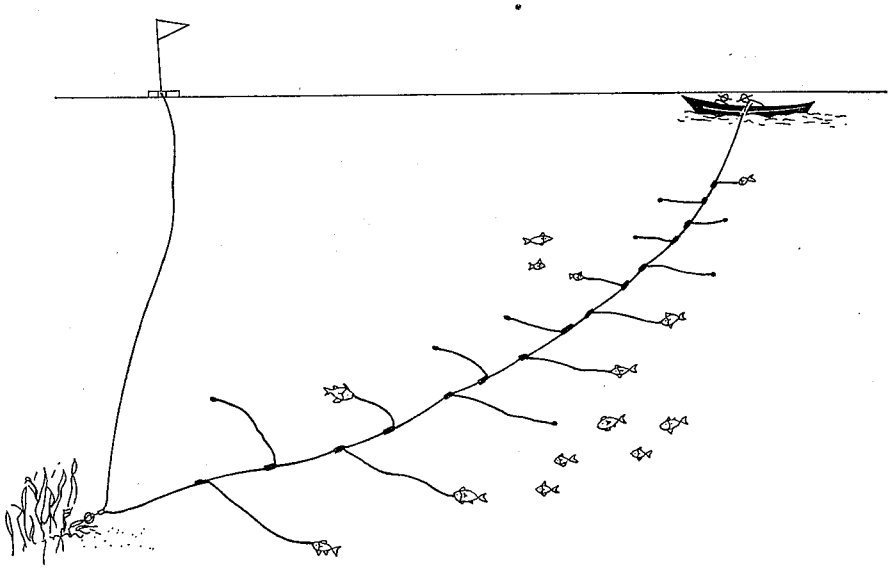
Trawl net (*pukat tunda*)



Drift net (*pukat hanyut*)



Encircling gill net (*pukat dalam*)



Long lines (*rawai*)