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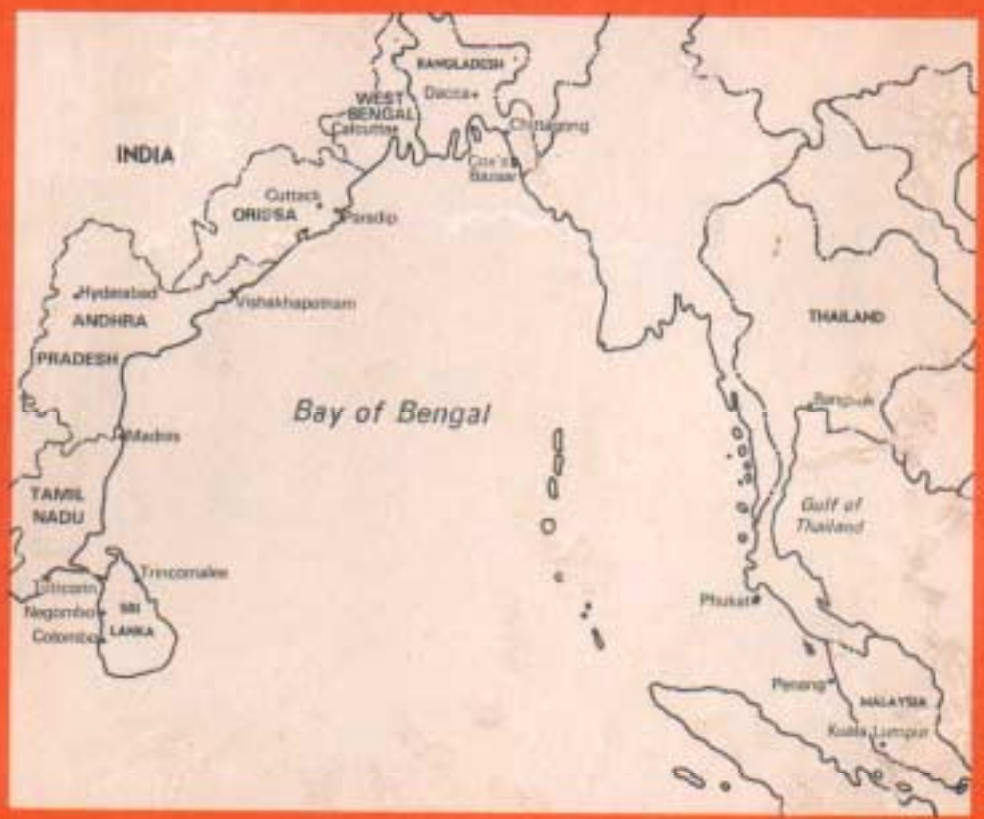
Motorization of Country Craft, Bangladesh



SIDA SWEDISH INTERNATIONAL DEVELOPMENT AUTHORITY

FOOD AND AGRICULTURE ORGANIZATION
OF THE UNITED NATIONS

MOTORIZATION OF COUNTRY CRAFT, BANGLADESH

Executing Agency :

Food and Agriculture Organisatron of the United Nations

Funding Agency :

Swedish International Development Authority

Development of Small-Scale Fisheries in the Bay of Bengal,
Madras, India, August 1984

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This paper discusses the rationale, execution, findings and follow-up strategy of a pilot project to motorize the traditional Hilsa-fishing Chandi boats of Bangladesh with small, low powered long-tail diesel engines. Experimental fishing for the project was done for 13 months from December 1980 near Bhola island in Barisal district,

Four Chandi boats were used during the trials. The BOBP provided the expertise, the engines and the fishing gear; the local cooperating agency, the Bangladesh Fisheries Development Corporation (BFDC), provided the services of an official to assist in the conduct of the trials and in monitoring of data. The Swedish Free Mission provided workshop facilities for the trials at Bhola and Radhavallabh. The technical specifications for the trials were drawn up with the assistance of a consultant, Mr. Tong Nadgratok, Chief of the Fishing Vessel Section, Department of Fisheries, Thailand. Monitoring, supervision, and reporting were handled by BOBP's naval architect, Mr. R. Ravikumar.

The Chandi motorization project is an activity of the Project for Small-Scale Fisheries Development of the Bay of Bengal Programme (BOBP). It is funded by the Swedish International Development Authority (SIDA) and executed by the Food and. Agriculture Organization of the United Nations (FAO). This regional project began 1979 with headquarters in Madras. It covers five countries that border the Bay of Bengal : Bangladesh, India, Malaysia, Sri Lanka **and Thailand. Its main aims are to develop, demonstrate and promote appropriate technologies and methodologies to improve the conditions of small-scale fisherfolk and increase the production of fish from the small-scale sector in member-countries.**

This paper is a technical report and has not been officially cleared by the government authorities concerned or by the FAO.

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1. INTRODUCTION

in the marine and estuarine fisheries of Bangladesh, *Hilsa* (shad) is the most important species. For the most part, the fishery is artisanal and investment is low. Although there are a few motorised boats operating from harbours and creeks, the majority are traditional craft operating from the many fishing villages scattered in the coastal districts.

Hilsa fishing is mostly restricted to the rivers and estuaries during the monsoon season (when the fish come in to spawn) ; during the calm winter months it takes place in the open sea. The two traditional types of boats used are the big Chandi boat and the smaller Kosha. The former is round bottomed and the latter is a flat bottomed skiff. These boats rely on oars and sail for propulsion. Because of strong tidal and river currents rowing is hard work and this restricts the fishing effort. The larger boats spend up to a fortnight on one fishing trip.

Most boats use nylon multifilament gillnets. Catches are usually sold at or in the proximity of fishing grounds to carrier boats, which in turn dispose of the catch at the main landing centres.

To increase the amount of time available for fishing and thereby improve the profitability of the operation, the Bay of Bengal Programme embarked on a pilot project to motorize traditional boats with small, low-powered diesel engines. The first task was to demonstrate technical and economic feasibility. An initial survey mission was undertaken in December 1979 and commercial fishing trials began in December 1980 on two motorised Chandi boats.

2. TECHNICAL CONSIDERATIONS

2.1 The Chandi boat

The Chandi boat is a round bilge carvel-planked open boat with a high sheer aft. It is usually built in 'Sundari'wood though a few are built in *'Jarul'* or 'Gurjan' to reduce cost. The shell is built up by stapling individually shaped planks and the framing nailed in after the hull is built up. Appendix 1 shows (a) construction details (b) overall appearance and (c) pictures from Bhola. The whole length of the boat is decked with split bamboo. A thatched bamboo shelter is situated slightly forward of amidships. Boats vary in length from 10 to 12 metres.

Built for rowing, these boats are fairly narrow, keel-less and easily manoeuvrable. A steering oar of substantial size is used for steering and sometimes sculling.

Square sails are usually used for down-wind sailing, although a few Chandis are sprit-rigged. No centre board or lee board is used.

2.2 Options for motorization

Motorising Chandi boats is possible in the following ways:

(a) Outboard motor.

(b) Inboard diesel engine installation with conventional sterngear.

(c) Long-tail diesel engine installation

An advantage of the outboard motor is its light weight and portability: another is the positive steering with the unit. But these engines are mostly of the two-stroke type, running on gasoline or gasoline/kerosene mix. With the high price of gasoline/kerosene compared to diesel (petrol 64 Tk/gal, diesel 32 Tk/gal, kerosene 32Tk/gal. September 1982) and the higher specific fuel consumption of two-stroke outboard motors compared with diesel engines of the same

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HP (approximately 3 times), running costs are higher. The constant need for maintenance is also well known.

To install a diesel engine inboard would require structural alterations and additions to the typical Chandi boat. A keel would probably have to be provided and the hull strengthened to reduce or withstand vibration. A few boats that have been motorised have had problems with the planking springing loose.

The long-tail arrangement with a diesel engine has the advantages of the outboard, being retractable for shallow water operation and for beaching. With the advent of high speed industrial diesels and light alloy construction, weight is not the problem it formerly was. The use of thousands of such engines in the agricultural sector ensures availability of spares and repair skills even in remote villages. The main disadvantage is the exposure of the engine to water spray; these engines are not designed for marine applications. But since the fishing operations for the most part are confined to the river or estuary, it was felt that such an installation would be best suited for the application since it involves only minor structural additions to the boat.

2.3 Long-tail Installation

For the Chandi boats of about 11 metres with a displacement of 2 tonnes (approx.) engines developing 8 to 10 hp were deemed suitable. For the demonstration trials, two popular makes were chosen.

(1) Deutz FIL, 208, 8.2 hp at 3000 rpm

(2) Yanmar TS 105C, 9 hp at 2200 rpm with 2 : 1 reduction.

Appendix 2 shows pictures of the engine installation.

A side installation was necessary to attain good propeller immersion without too much inclination. The engine was placed about one quarter of the loaded waterline length from the stern end. A wooden beam 200 x 100 mm was through-bolted to the existing deck beam (thwart) and connected to the floor with two 75 x 35 mm uprights. The beam was extended out from the port side by 350 mm to take the engine bracket.

The long-tail installation was limited only to up and down motion (to retract or lower the propeller) and was not used for steering because the keel-less craft, with hardly any lateral plane, would have been very difficult to control. Steering was by means of the usual large oar, also on the port side; with the blade behind the propeller, substantial steering forces could be developed. The propeller was protected by the usual guardring common in long-tail installations.

On trials the Deutz 8 hp installation gave an average speed of 5.5 knots (after correction for current) with a fuel consumption of 1.25 I/hr. The Yanmar installation gave a speed of 6 knots as a result of the better propeller efficiency conferred by the 2: 1 reduction gear. It had a fuel consumption of 1.5 I/hr.

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3. TRIAL ARRANGEMENTS

Bhola Island in the river Meghna in Barisal district (Appendix 3) was chosen as a good area in which to carry out the fishing trials as it had a large number of traditional boats engaged in *Hilsa* gillnetting from several villages. One of them, Amani Bazaar, was chosen as the venue. The main activities in Bhola are agriculture and fishing; about 40,000 people are engaged in tha fishing industry. Only some parts of the island boast an electrical supply.

Four Chandi boats of an average size of 11 m were chosen. Two were motorized and the other two served as controls. All boats were equipped with the same complement of fishing gear. Names of the four leaders are given below:

Boat C1 with Deutz LTOM	–	Motiur Rahman Maji
Boat C2 with Yanmar LTOM	–	Ali Akbar Maji
Boat C3 non-motorized	–	Raza Mia
Boat C4 non-motorized	–	Abdul Rashid

The four leaders were to conduct commercial fishing with these boats and provide details of catch, earnings and expenses. All expenses were to be met by them, including running costs.

The BOBP provided the two engines, supervised the installation and provided the Hilsa gillnets.

The Bangladesh Fisheries Development Corporation provided the services of Mr. S. K. Sharif Ahmed to assist in installation, maintenance and repair and in data collection.

Each boat was equipped with 130 pieces of 14 m to 18 m long nylon gillnets of 90 - 15 mm mesh size complete with bamboo floats and clay sinkers (Appendix 4).

4. RESULTS OF COMMERCIAL **TRIALS**

The trial period lasted for 14 months from December 1980 till January 1982. One of the motorized boats was operational for 13.5 months and the other one for 10 months. Over the entire period the motorized boats landed, on an average, twice as much fish as the two non-motorized craft being monitored. Since there was no difference in price, the earnings too were twice as high for the motorized craft. In summary the result is as follows :

	Non -motorized	*Motorized*
Landings (kg/month)	525	1100
Earnings (Tk/month)	5613	11786
Fuel cost (Tk/month)	–	457
Fishing days (no/month)	24.3	23.8
Crew (no)	11	10
Crew wages (Tk/month)	3529	5144

The monthly record of catch and earnings is given in Appendix 5.

The increased catch for the motorized boats is mainly due to fishing on richer grounds inaccessible to non-motorized boats because of adverse currents, wind and distance. Another important advantage is that the crew are not fatigued on arrival at the fishing ground.

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The fishing is reasonably good throughout the year, as can be seen in Appendix 5. The best season is September-November.

The catch consisted almost exclusively of Hilsa. The average price in 1981 was about Tk 11 per kg at the fishing ground. No commission is paid for marketing as the catches are usually off-loaded to carrier boats operated by *Beparis* at the fishing grounds. The *Beparis sell* the fish at landing centres to traders or to a retailer with a margin of 25% to cover their costs. The retail price of the fish could be anywhere between 50% to 200% more than the price at which the fisherman sold his catch.

The cost of diesel amounted to less than 4% of the gross earnings. The unit price went up by about 40% in 1982 and further rises are of course expected. But even so the relative cost of fuel for this fishing is low.

No difficulties were encountered with the running of the engines. Except for changing the oil and the filter elements and cleaning the nozzles, the engines were not interfered with. No estimates were therefore obtained for maintenance and repair costs.

On the Deutz FIL 208 long-tail, the shaft tube fractured at about mid-length due to shaft whip and abrasion. This was remedied by inserting an intermediate bush to reduce the distance between bearings. No problems occurred on the Yanmar installation except for wear on the bushes in the sterntube.

The number of fishing days per month for both motorized and non-motorized craft was about 24. The motorization had thus no positive or negative effects on the fishing intensity. Remarkable is the high number of fishing days (about 300) throughout the year.

The fishermen in the motorized boats earned about 60% more than their colleagues in the non-motorized boats. The remuneration system is based on a fixed daily wage plus food for the fishing trips. Crews received 50% bonus in wages for those months when the earnings exceeded Tk 5000. When a share system is used, the most common practice is to deduct the cost of food for the crew from the gross proceeds of catch and to divide the balance equally between the boat owner and the crew. There are also instances when a boat is hired by a fisherman who has only nets, at a rate ranging from 400 to 500 Tk per month. Here the catch is shared by the crew at the rate of one share per crew member and five shares for the net owner after deducting boat hire.

The success of the motorized boats has aroused much interest in the fishing community. However, this traditional fishing community, like similar communities in most other developing countries, does not have easy access to capital, and the introduction of engines is likely to require some injection of loan capital on easy terms.

5. CONCLUSION

Engines up to 10 h.p. seem adequate to power Chandi boats of 11-12 m in length. The importance of reducing propeller r.p.m. and increasing the diameter, thereby increasing the efficiency and reducing fuel consumption, should be borne in mind. A simple reduction of at least 2:1 by means of chain and sprocket as used in the Yanmar installation is satisfactory. No clutch or forward/reverse arrangement is necessary. It might be worthwhile to try a gearbox with straight spur gears enclosed in a housing incorporating a thrust bearing.

Several thousand diesel engine driven pumpsets of similar size are operating in the agricultural sector. If a large-scale introduction of long-tail diesels is based on makes of engine popular in this application, there should be no problems with availability of spares and repair skills.

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The commercial trials indicate that the motorization is highly profitable for the investor and remunerative for the crew. A comparative costs and earnings estimate is furnished in Appendix 6 in which the following assumptions have been made.

— The earnings are based on the averages attained during the trials.

-The number of fishing days is 285 per annum.

— The cost of the engine (Tk 48,000) includes cost price, sales tax or customs duty, installation charge, one lot of running spares costing Tk 6,750 and cost of transporting engine and spares to site, at prevailing rates and prices.

-The remuneration to crew is calculated on a share basis-in the case of traditional boats, the most common share system; and in the case of the motorized boats, a system that is beginning to be adopted by the latter.

— A crew of 10 is assumed for both the boats.

The motorization doubles the profitability, and what is perhaps more important, generates higher earnings in the order of 50% for the crew and provides better working conditions.

6. FOLLOW-UP

At the end of the commercial trials the boat owners participating in the trials were offered the engines provided they reimbursed BOBP the full cost of the same. They did so willingly and continued to operate them. Because of the good commercial results and the positive response from the fishermen BOBP arranged for four more engines to be issued to boatowners at full cost to test the demand. These engines too were easily disposed of.

In order to introduce the motorization on a larger scale the BFDC prepared a project proposal for the issue of 250 engines. The proposal was taken up for consideration by the UNCDF (United Nations Capital Development Fund)-for which BOBP, on request, prepared a full project report.

While it would be possible to issue a smaller number of engines against cash payment, an introduction of 250 units would require credit facilities. Credits will also make it possible to reach less affluent fishermen as beneficiares. In the prevailing social context cooperative ownership is not considered feasible; the boat owner would obtain his benefit as return on his investment and the crew members theirs in the form of shares of the earnings.

A project for large-scale introduction should include components for engine repair and maintenance during the introduction phase. Loss of fishing days due to breakdowns and lack of spares and repair facilities may quickly erode the profitability without increasing the number of nets.

The motorization results in doubling the catch. This will undoubtedly, as the motorization expands, affect the catch rates of non-motorized boats and eventually, of the motorized boats themselves. To what degree this will happen is dependent on the size of the Hilsa stock and the concentration of fishing units. No data are available to even attempt any prediction of the possible effects.

Judging by the estimates of landings and number of boats engaged in the fishery, several hundred motorized units could probably be introduced without measurable effects if there is no heavy concentration at a single place. It is advisable though that any investment scheme be accompanied by a system of close monitoring in order to gauge the impact on the resources.

Another negative effect the fishermen might experience is a reduction in prices. Since Hilsa is a high-priced variety for which there is big demand, such effect would only be felt in cases of extremely high localized landings.

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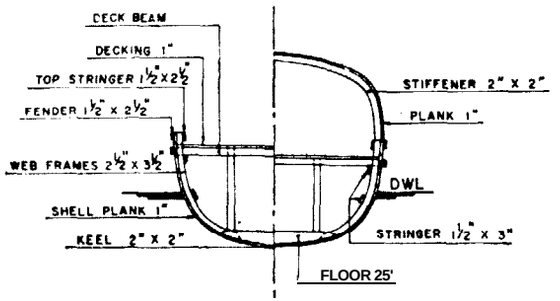
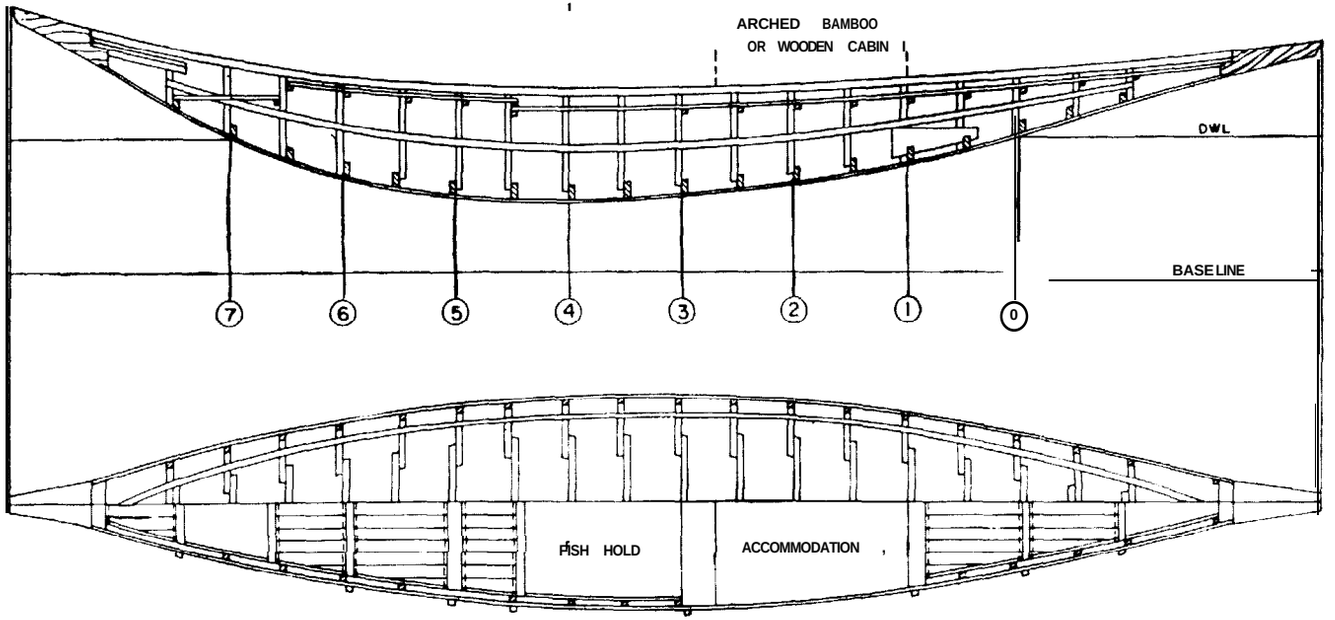
Appendix 1 A

A 11.5m CHANDI BOAT: CONSTRUCTION DETAILS



PRINCIPAL DIMENTIONS

LENGTH OVERALL	38' · 6"
LENGTH DWL	23' · 3 ½
BREADTH MOULDED	6' - 6'
DEPTH MOULDED	2 ' - 11½
DRAFT (AFT)	1' - 7'
DISPLACEMENT	2 40 L TONS
PROPOSED ENGINE	8 -12 H P



11.50m CHANDI BOAT

COSTRUCTION

SCALE : 1 : 20	DRG. NO.
DESIGN :	
DRAWN :	

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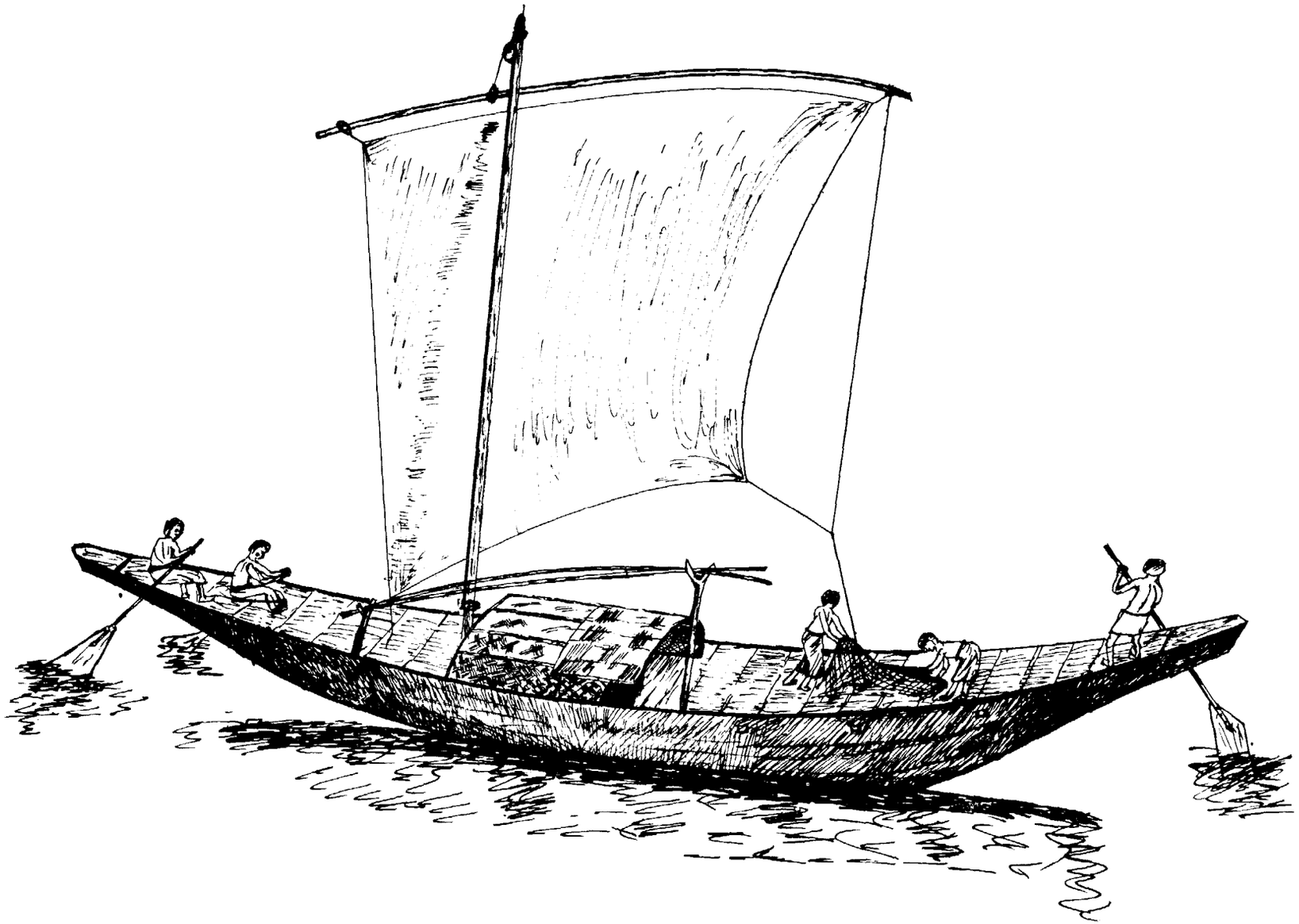
Appendix 1 B

THE CHANDI: AN ARTIST'S SKETCH



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Appendix 1 C

THE CHANDI IN BHOLA

Above: A traditional Chandi boat of Bhola island with its fishing gear (the Hilsa gillnet).
Below: Out at sea. Four Chandi boats, two traditional and two fitted with engines, engaged in commercial trials for 14 months during the Chandi motorization project.

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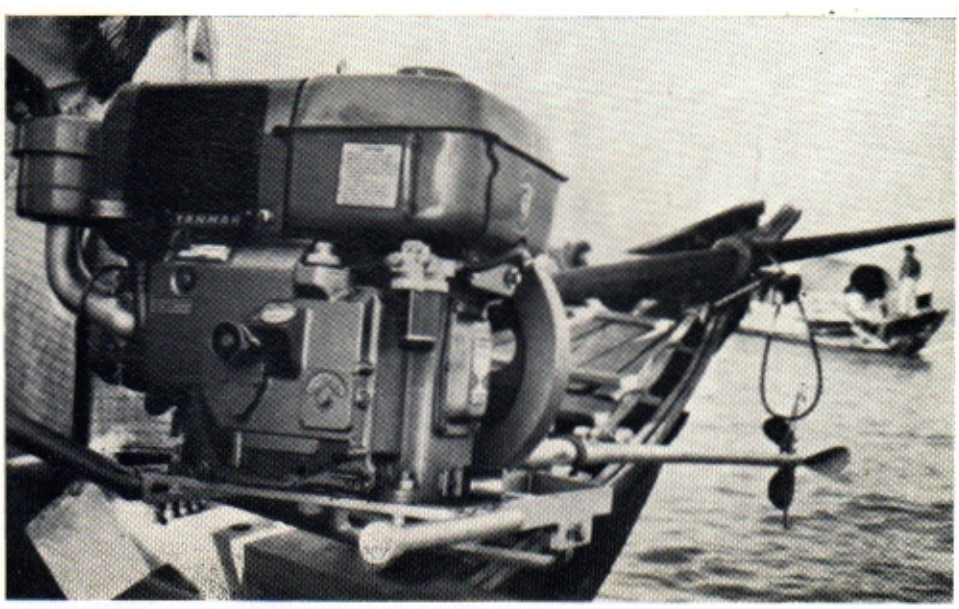
Appendix 2

ENGINE INSTALLATION

Above: One of the first trial runs of a Chandi boat motorized with a Deutz engine.

Left: Operating the Deutz engine.

Below: A close-up of the Yanmar engine fitted to the Chandi.



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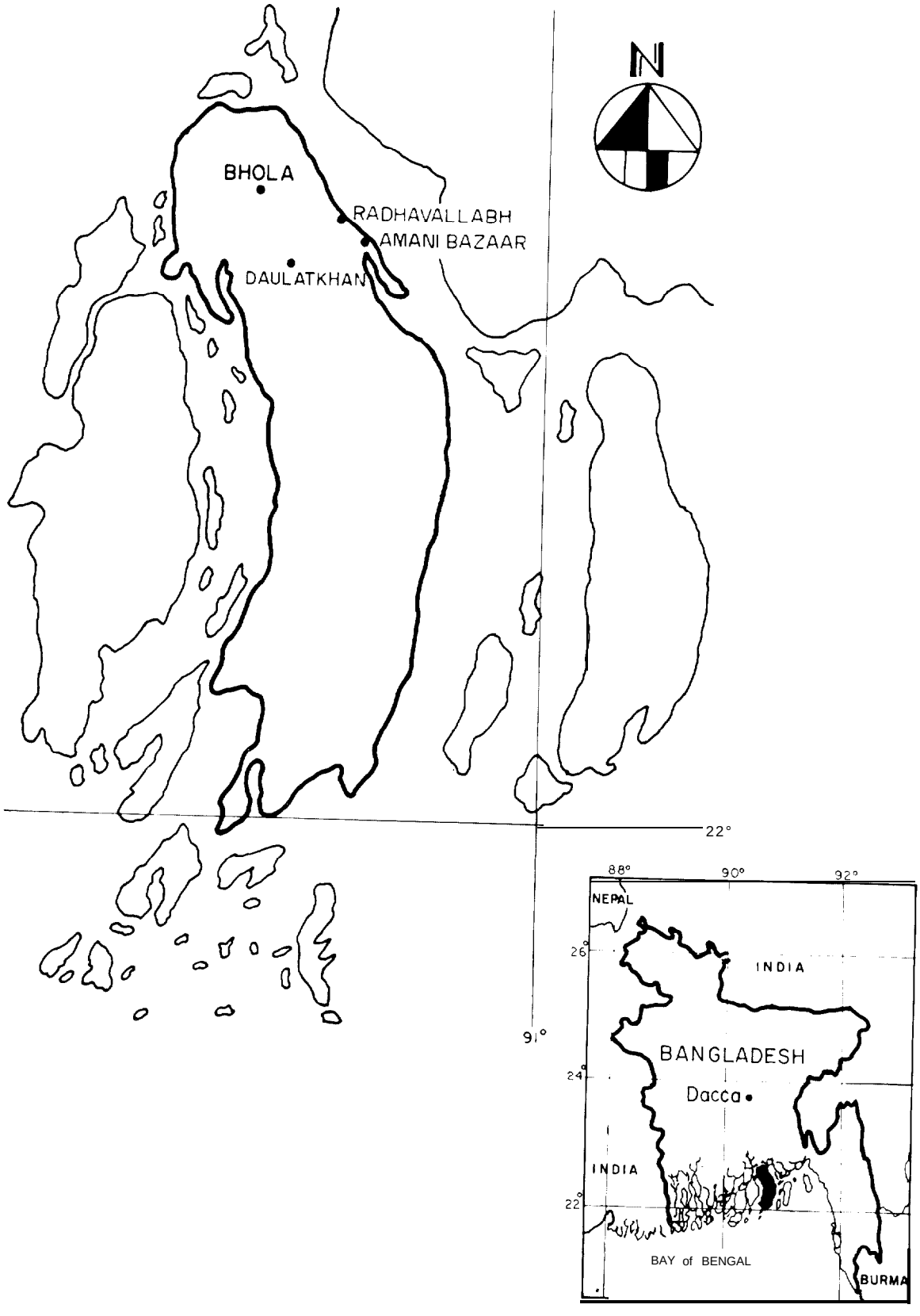
Appendix 3

PROJECT LOCATION (BHOLA IN BARISAL DISTRICT)



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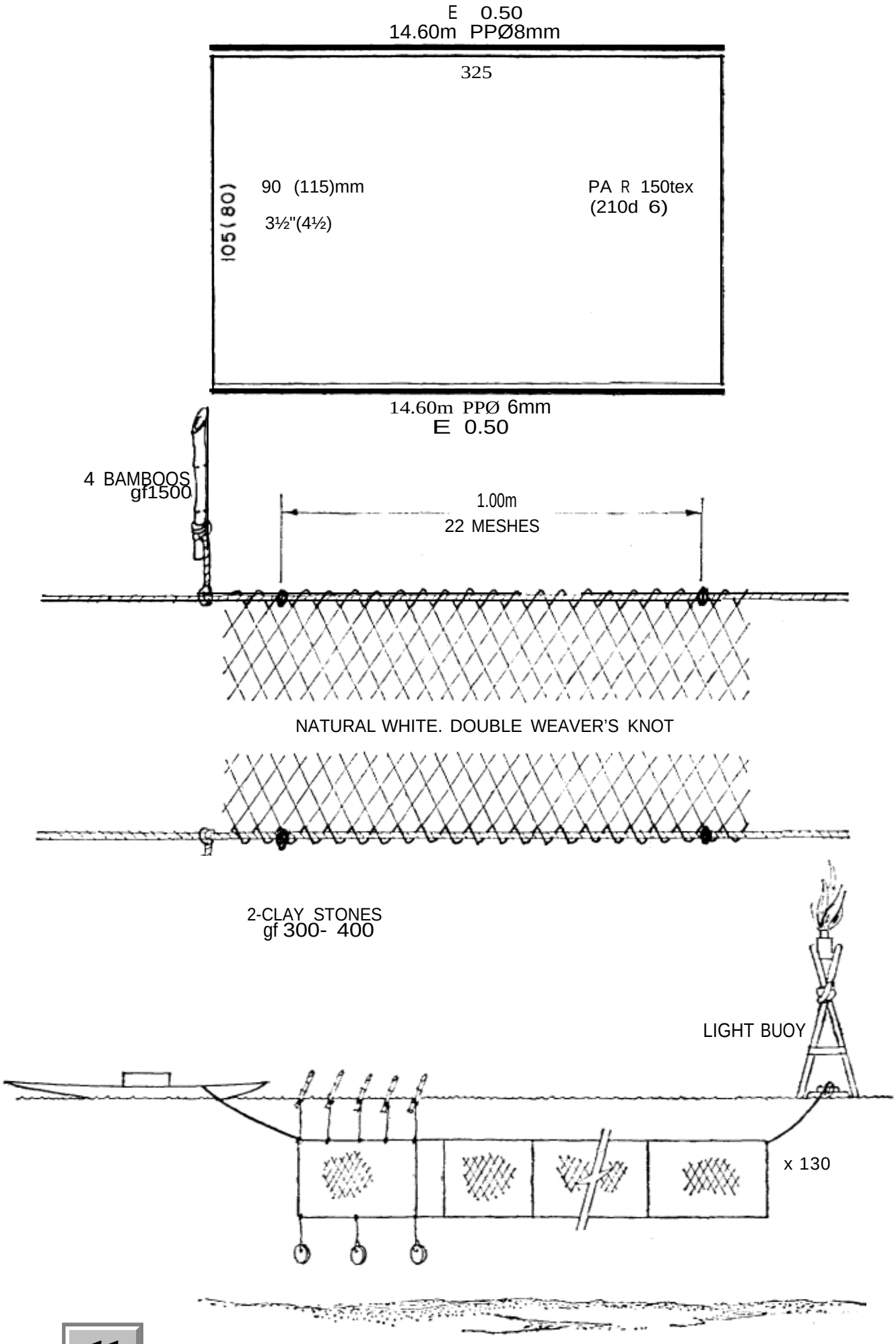
Appendix 4:

THE HILSA GILLNET



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Appendix 5

MONTHLY FISH CATCH AND GROSS INCOME OF CHANDI BOATS- MOTORIZED AND NON-MOTORIZED

Month	Year	Boat Cl (motorized)		BoatC2 (motorized)		BoatC3 (non-motorized)		BoatC4 (non-motorized)	
		Quantity of catch (Kg.)	Gross value of catch (Tk)	Quantity of catch (Kg.)	Gross value of catch (Tk)	Quantity of catch (Kg.)	Gross value of catch (Tk)	Quantity of catch (Kg.)	Gross value of catch (Tk)
December (½)	1980	254	2330	—	—	258	2335	—	—
January	1981	1310	11770	—	—	1090	6800	410	2800
February	1981	1005	10520	-	—	544	5215	420	3910
March	1981	779	8900	1129	11485	426	4980	233	2375
April	1981	666	9875	766	9815	367	4645	183	2363
May	1981	1054	12158	549	9578	440	8086	228	3928
June	1981	931	12138	800	9099	278	3535	338	4048
July	1981	812	10406	1290	17856	420	9662	543	7025
August	1981	719	8110	1322	16464	298	4415	307	4557
September	1981	1342	12817	2494	20110	776	8279	608	6539
October	1981	1674	13301	1651	14615	459	3688	858	7752
November	1981	1332	16513	-	-	1425	12348	445	4450
December	1981	926	9805	431	4637	361	3859	746	8052
January	1982	1400	13376	1226	11297	689	7127	732	5977
Total		14204	152019	11658	124956	7831	84974	6051	63776
Average/month		1052	11260	1166	12496	580	6294	465	4905

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Appendix 6

COSTS AND EARNINGS ESTIMATE FOR TRADITIONAL AND MOTORIZED CHANDI BOATS

	Traditional Chandi boats	Motorized Chandi boats
Earnings		
Landings of Hilsa (kg)	6300	13200
Value of landings (Tk)	69300	**145200**
Investment (Tk)		
Craft	30000	30000
Engine	–	48000
Nets	35000	35000
Total	65000	114000
Operating costs (Tk)		
Fuel and oil	–	11350
Food (5 Tk/day/man)	14250	14250
Crew share :		
(Gross earning – Food) X 0.5	27525	–
(Gross earning – Food -- Fuel) X 0.375	–	44850
Gear repair/replacement	11000	11000
Engine repair	–	4500
Hull repair	3000	3000
Total	55775	88950
Capital costs (Tk)		
Hull (IO years)	3000	3000
Engine (6 years)	–	8000
	3000	11000
Total costs (Tk)	58775	99950
Return (Tk)	10525	45250
Rate of retun(%)	16	40

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3. Improvement of Large-Mesh Driftnets for Small-Scale Fisheries in Sri Lanka. G. Pajot. Madras, India, June 1980.

4. Inboard Motorisation of Small G.R.P. Boats in Sri Lanka. Madras, India, September 1980.

5. Improvement of Large-Mesh Driftnets for Small-Scale Fisheries in Bangladesh. G. Pajot. Madras, India, September 1980.

6. Fishing Trials with Bottom-Set Longlines in Sri Lanka. G. Pajot, K. T. Weerasooriya. Madras, India, September 1980.

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10. Fishing Trials with High-Opening Bottom Trawls in Tamil Nadu, India. G. Pajot, John Crockett. Madras, India, October 1980.

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12. Trials in Bangladesh of Large-Mesh Driftnets of Light Construction. G. Pajot, T. K. Das. Madras, India, **October 1981.**

13. Trials of Two-Boat Bottom Trawling in Bangladesh. G. Pajot, J. Crockett. Madras, India, **October 1981.**

14. Three Fishing Villages in Tamil Nadu. Edeltraud Drewes. Madras, India, February 1982.

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18. **Review of Brackishwater Aquaculture Development in Tamil Nadu. Kasemsant Chalayondeja and Anant Saraya of the Department of Fisheries, Thailand. Madras, India, September 1982.**

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