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Research Note

PRODUCTION TECHNOLOGY AND PROFITABILITY OF SMALL-SCALE MARINE FISHING IN BANGLADESHI

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ABSTRACT

This paper examines the profitability of three major production technologies used in small-scale marine fishing in Bangladesh: gillnet, longline and setbag net. Net profit was positive in all technologies. But the profitability does not differ significantly among gears as indicated by the benefit-cost ratio.

1. INTRODUCTION

In Bangladesh, there are two sources of fisheries - inland and marine. The inland fisheries again include capture fishery and culture fishery. Of these sources, capture fishery is the most important because still the major share of fish production is contributed from this source. In 1991-92, 51%, 24% and 26% of total catch were obtained from capture fishery, culture fishery and marline fishery respectively (DOF, 1993). But it is alarming that production of inland open water capture fishery has declined because of, for example, overfishing, largescale sedimentation and implementation of flood control, drainage and irrigation development project (Ali 1991, World Bank 19r)1). On the other hand, the production of culture and marline fish has increased steadily during the last few years for which the total fish production has slightly increased in every successive year. However, there is good prospect and potentiality in culture fishery but expand fish production may also come from the marine source which has unexploited potential.

Thus, in the present context, along with the culture fishery, more attention should be focused on marine fishery development, particularly the small-scale marine sector which accounts for 95% of total marine catch. Economic studies on small-scale marine fishery in Bangladesh is scanty. A few surveys were conducted to investigate the types of craft and (year used in marine fishing, harvesting, processing and marketing (FAO and UNDP 1972, Jabbar and Karim 1979, Sabur and Rahman 1989 and BFDC 1972). The main objective of this study

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was to examine the profitability of different production technologies or methods used in small-scale marine fishing. The study was limited to an analysis of three major gears or production technologies such as gillnet, longline and setbag net.

Section II of this paper briefly discusses the fishing technologies and their characteristics. Section III discusses the sources of data and method of analysis. Profitability of small-scale marine fishing s discussed in Section IV. Conclusions are given in the final section.

II. PRODUCTION TECHNOLOGIES AND THEIR CHARACTERISTICS

The marine fishery comprises of two sub-sectors-artisanal fishery and industrial fishery. Small-scale artisanal fishing is carried out mostly by traditional mechanized boats and industrial fishing is done by trawler. Small-scale marine fishermen with their boats fish close to the shore. The -car they use are mainly locally developed. Generally three types of gear or production technology are used in small-scale marine fishery and they are gillnet, longline and setbag net. A brief description of all these gears is presented below.

Gillnet

This is a rectangular net. The mesh types used for fishing depend on the size of fish caught. The net may consist of one sheet or two in which the fish are trapped by gills as they try to swim through, or several sheets of various mesh sizes in which they become entangled. The top of the net is seized to a float or corkline and the bottom to a leadline. The combined action of the floats and weights maintain the vertical stretch of the net.

Longline

In this method, the gear is a long length of line, often several kilometers. One end is held by a heavy anchor and the other end marked by a flag which is held in position by heavy weight. The line carries baited hooks which are attached every one to two meters. The hooks are baited with prawns, crabs and entrails of fish. The fish are attached by the bait, hooked, and field by the mouth until they are brought aboard the vessels hauling the gears. The lines are checked from time to time and fish are removed. No winches are used from hauling the line.

Setbag net

Setbag nets are pocket type net. Each net has a large mouth and narrow tail. Mesh size reduces from die mouth to the tail. The nets are kept fixed in one place in selected current for 5 to 6 months by using bamboo nd wooden pillars. The crews stay in the fishing place with their boats and collect fish from nets time to time. Under each boat there are 3 to 5 nets. Fish are taken to fish landing centre by using separate boats.

Characteristics of gillnet, longline and setbag net boats

Gillnet, longline and setbag nets generally catch different types of fish. However, the overall catching capacity per boat was higher for gillnet boat compared to longline and setbag nets fishing boat (Table 1). Average engine power of gillnet boat was 38.24 hp which is also higher than other types of fishing boat. A gillnet boat with high powered engine is able to go

further out to sea in search of more productive fishing grounds. Longline fishing boats usually catch fish near the sea shore. The average return trip made by longline fishing boat was 3.13 days and 49.12 trips operated per year. For gillnet boat, the corresponding figures were 6.91 days ad 32.48 trips respectively.

Table 1. Major characteristics of gillnet, longline and setbag net fishing boat.

Characteristics	Gillnet	Longline	Setbag net
Capacity of boat (ton)	14.60	9.75	11.97
Length of boat (meter)	15.11	11.35	14.35
Breadth of boat (meter)	3.29	2.87	3.32
Depth of boat (meter)	1.99	1.59	1.71
Gear weight (kilogram)	882.45	42.64	151.53
Mouth of net (meter)	-	-	347.83
Length of gear (meter)	2146.03	2550.67	42.84
Number of hooks	-	4264.00	-
Mesh size (Centimeter)	6.62	-	4.05
Engine power (horse Power)	38.24	23.65	27.37
Number of crew	15.20	13.44	10.74
Number of trip at sea	32.48	49.12	-
Fishing duration per trip (days)	6.91	3.13	-

Note : ton = t, meter = m, centimeter = cm, horse power = hp.

III. SOURCES OF DATA AND METHOD OF ANALYSIS

The coastal line of Bangladesh is about 480 km long and the continental shelf extends over an area of about 66400 km^2 of which about 37000 km^2 is within the 50 m depth zone which is considered as a good fish resource. In Bangladesh, marine fishing is carried out by traditional boats and small motorizwd boats and deep sea fishing by trawlers. The Third Five Year Development Plan (TFYDP) estimated that the number of small-scale fishing fleet was 12000 boats, of which about 3317 were registered (BBS 1991). However, within the marine zone, the fishing boats are engaged in small-scale marine fishing. Marine fish are available along the coastline of the Bay of Bengal in Bangladesh but it was learned while collecting data that the boat owners and other fishermen are concentrated mostly in Cox's Bazar district. Therefore, Cox's Bazar district was selected to collect data and information for this study.

According to the availability and distribution of the gears, 193 fishing firms were selected, of which 80 used gillnets, 75 longline and 38 setbag nets. Boat owners were interviewed to collect data on catch, costs involvement and income earned from fishing. Several visits were made to collect correct and accurate data and information. The collected information were checked by the head crew of each boat of respective gear. Data were collected for the period from January to December 1991.

The main objective of this study was to determine the profitability of small-scale marine fishing under different gears or technologies. Profitability of fish firms can be measured through several economic methods such as partial measures, production function, profit function and linear programming. Profit function and linear programming are the analytical techniques which provide superior results. However, in this study simpler analytical technique viz., partial measures were used. There are two types of partial measures which estimate the size and economic returns of fish firms i.e., aggregative and ratio methods. The aggregative method was used to determine the gross revenue and net profit of fish firms under different technologies. On the other hand, ratio method was used to measure the rate of return on investment of fish firms.

IV. PROFITABILITY OF SMALL-SCALE MARINE FISHING

The profitability of marine fishing under different fishing technologies depends mainly on cost incurred for different fishing inputs and revenue earned from fish caught. Cost items can be broadly classified into capital costs and operating costs.

Current Value of Capital Assets in Small-Scale Marine Fishing

Capital assets used in small-scale marine fishing were divided into four groups which are hull, engine, gear and others (Table 2). The current value of these capital assets were estimated from their purchase values.

Table 2. Current values[1] of capital assets of different fishing technologies.

Fishing assets	Gillnet	Longline	Setbag net
Hull	334.50	93.47	123.53
	(44.11)	(45.34)	(32.24)
Engine	259.00	96.61	139.24
	(32.83)	(46.87)	(36.81)
Gear	143.60	7.27	105.87
	(18.94)	(3.53)	(27.99)
Others*	31.25	8.78	9.66
	(4.12)	(4.26)	(2.55)
Total	758.35	206.13	378.30
	(100.00)	(100.00)	(100.00)

Note: Figures within parentheses represent the percentage of capital values.

* Related boat materials, different types of container, utensils, etc.

The exchange rate between Bangladesh currency Tk. (Taka) and US dollar was US 1$ = Tk 35 in 1991.

1 The current value of a capital asset was calculated as :
Current value = Purchase value - value used up + Salvage value.
Value used up = (purchase value / economic life of the asset) x age of the asset.

Table 2 shows the current value of capital assets of mechanized fishing boats in three types of gears. Total investment cost was the highest in gillnet and lowest in longline. The average total values per boat investment costs in gillnet, longline and setbag net were respectively Taka 758350, Taka 206130 and Taka 37830. This means that investment costs in gillnet was 3.68 times higher than longline and 2 times higher than setbag net.

Capital investments on fishing assets were different in different gears. Hull accounted for the major investment cost in gillnet while engine accounted for the major investment cost in longline and sretbag net. The importance of gear also varied significantly. It constituted only 3.53% of the total investment cost in longline but in case of setbag net and gillnet, this percentage was much higher.

Costs in Small-Scale Marine Fishing

The major cost items including both capital and operating cost were identified in this study which are shown in Table 3. Capital cost is defined as include the depreciation cost of the capital assets listed in Table 2. Using the straight line method, the annual depreciation cost was calculated by dividing original investment cost less salvage value by the economic life of these capital assets. Operating costs include the expenses for fuel, lubricant, ice, salt, bait, crews and miscellaneous variable expenses. All these cost items were aggregated and annual interest at bank rate was calculated on it.

Table 3 shows that, fuel was the most important cost item for fishing operation specially for gillnet and setbag net. The shares of fuel in these boats were respectively 29.46% and 49.38%. For longline, the corresponding figure was only 12.44% due to less movement of fishing vessels. It was observed that the cost of lubricant was relatively low for all fishing gears. The cost of crew constitutes the most important item in longline fishing which was 73.26% of the total cost but in case of gillnet and setbag net, cost of crew was much lower. For the preservation of fish, ice was used only in gillnet fishing and it made up 11.54% of total cost. For preserving fish from rottening, long liners use salt, while setbag netters dry up fish. However, the costs of salting and drying were observed to be relatively low in respective gears. Maintenance and repair costs were exceptionally high for gillnet fishing compared to the other two fishing methods and accounted for 14.17% of the total cost. This is because gillnetters usually used to go out to deeper water for fishing resulting in greater wear and tear of the boat and other fishing assets. In the case of longline and setbag net fishing, this cost was relatively low, because with these two methods the fishing boats do not move so frequently.

Table 3. Annual cost of gillnet, longline and setbag net fishing.

Tk. 000

Items of cost	Gillnet	Longline	Setbag net
Fuel	293.43	173.61	305.93
	(29.46)	(12.46)	(49.38)
Lubricant	14.39	4.91	25.08
	(1.44)	(0.35)	(4.09)
Ice	114.93	-	24.92
	(11.54)		(4.02)
Salt	-	18.79	-
		(1.35)	
Bait	-	35.61	-
		(2.55)	
Crew	278.51	1022.47	168.34
	(27.96)	(73.26)	(27.16)
Maintenance and repairs	141.10	12.50	8.84
	(14.17)	(0.90)	(1.43)
Miscellaneous	20.55	9.69	13.49
	(2.06)	(0.69)	(2.17)
Interest on operating capital	63.96	97.20	43.36
	(6.42)	(6.96)	(6.67)
Depreciation	69.13	20.84	31.51
	(6.94)	(1.49)	(5.08)
Total	996.00	1395.62	619.47
	(100.00)	(100.00)	(100.00)

Figures within parentheses indicate the percentage of total.

The depreciation cost depends mainly on the value of capital assets and longevity of the capital assets. Considering all capital assets, the annual depreciation costs were Taka 69130, Taka 29840 and Taka 31510 respectively for gillnet, longline and setbag net which represent about 2 to 7% of the total cost for different gears.

Revenue and profits in Small-Scale Marine Fishing

The annual revenue is the sum of catch of different species times prices of fish of different species. The marine catch comprises large variety of known and undescribed species.

The maximum number of species recorded was 30, of which some were common to all boats. some of the species were found unsuitable for human consumption. The composition and revenue earning for gillnet, longline and setbag net fishing are presented in Table 4. The common species caught by gillnet are: Hilsa, Pomfret, Catfish and Mackerel. Longliners usually catch Jewfish, Indian Salmon, Catfish and Shark. Through setbag netting mainly Ribbon fishes are caught, which comprises about 90% of the total revenue. Under all these fishing gears other fish such as Skates, Bombay duck, Eel, Cock-up, Tuna, Scad, etc., were also caught in small quantities.

Table 4. Catch composition and percentage of revenue earned from different fishing technologies.

Species	% of total revenue
Gillnet	
Hilsa (Hilisa ilisha)	80.00
Promfret (Pampus chinensis)	3.10
Catfish (Techysurus thalassinus)	2.10
Mackeral tuna	14.00
Others*	0.80
All Species	100.00
longline	
Jewfish (Jahnius aregenitatus)	66.50
Indian salmon (Polynemus inidcus)	4.50
Catfish (Tachysurus thalassinus spp.)	16.50
Shark (Carchrhinus spp.)	2.00
Others*	10.50
All Species	100.00
Setbag net	
Ribbonfish (Trichiurus leptrus)	90.00
Others *	10.00
All species	100.00

* Others included Skates (Rhynehobatus djetdensis), Bombay (Harpdon nehereus), Cocsk-up (Lates calcarifer), Shads (Hilsa ilisha), Red snapper (lutjanus johnii), Round scad (Decapterus maruadsi).

Table 5 presents the gross revenue, net profit and rates of return from capital investment on three different gears. The average annual gross revenue from gillnet, longline and setbag net fishing were found to be Taka 1301340, Taka 1825890 and Taka 845780 respectively. Net profits were calculated by deducting all costs from the total revenue. It was positive for all fishing gears. It may be noted here that gross revenue, net profit and rate of return on

operating investment (RROI) varied widely among the fishing gears. Returns were higher in longline fishing than other two type of gears. The rate of return on capital investment (RRCI) was Taka 87.61 for longline while it was only Taka 26.84 and Taka 18.82 for setbag net and gillnet respectively. On the other hand, rate of return on operating investment and total investment (BCR) were slightly higher for setbag netting than other two methods of fishing. From this analysis it is clear that both the cost and return were lower in case of setbag netting but the BCR was higher compared to other two types of fishing methods. On the other hand, longline fishing had the highest gross revenue and RRCI but its BCR was lower.

Table 5. Net profit and annual rates of return from investment on different fishing technologies.

Cost and rate return	Gillnet	Longline	Setbag net
Gross revenue (Taka in ,000)	1301.34	1825.89	845.78
Total Cost (Taka in ,000)	996.00	1395.62	625.40
Net profit (Taka in ,000)	305.34	430.27	221.38
Rate of Return on Operating Investment (RROI)	1.40	1.33	1.44
Rate of Return on Capital Investment (RRCI)	18.82	87.61	26.84
Benefit Cost Ration (BCR)	1.31	1.31	1.35

Note : $RROI = \frac{\text{Gross revenue}}{\text{Operating capital}}$

$RRCI = \frac{\text{Gross revenue}}{\text{Depreciation}}$

$BCR = \frac{\text{Gross revenue}}{\text{Total cost}}$

Operating capital = Total cost -Depreciation.

IV. Conclusions

The main objective of this study was to examine the profitability of small-scale marine fishing by technologies. The study shows that there were significant differences in net profit and RRCI per boat among technologies. Net profit per boat was the highest in case of longline while it was the lowest in case of setbag net. RRCI was the highest in case of longline and the lowest in case of gillnet. However, profitability examined by the RROI and BCR does not show much differences. It may be mentioned that a greater proportion of fishing boats use gillnet technology (Islam and Elahi 1993), the reasons appear to be non-economic. The gillnet technology is old which can cover wide areas. It is also easily manageable.

REFERENCES

Ali, M. (1989): *Environment, Conservation and Fishery Resources in Bangladesh.* Inland Fishing Management in Bangladesh: Proceedings of the Workshop on Experiment in New Approach to the Improve Management of Open water Fisheries in Bangladesh. January 9-10, Dhaka, 36-52.

BBS (1991): *Statistical pocket book of Bangladesh.* Bangladesh Bureau of Statistics, Statistical Division, Bangladesh Government, Dhaka.

BFDC (1972): *Report of the Marine Fishing Village Identification Survey in Bangladesh, 1967-69.* UNDP Project Publication No. 2, Dhaka.

DOF (1993): *Fish Catches Statistics.* Directorate of Fisheries, Bangladesh Government, Dhaka.

FOA (1972): *Technical Report on the Survey for the Development of Fisheries in Bangladesh.* Project No. WNSF/Pak-22, Rome.

Islam, M. S. and Elahi, K. Q. (1993): *Small-scale Marine Fishing in Bangladesh- A Socioeconomic Analysis.* Research Report No. 23, Bureau of Socioeconomic Research and Training, Bangladesh Agricultural University, Mymensingh.

Jabbar, M. A. and Karim, M. (1979). "Economics of Alternative Technologies for Harvesting and Processing of Marine Fish in Bangladesh", *Bangladesh Journal of Agricultural Economics,* 2 (1): 75-94.

Planning Commission (1990): *The Fourth Five Year Plan 1990-95.* Planning Commission, Ministry of Planning, Bangladesh Government, Dhaka.

Sabur, S. A. and Rahman, L. (1989). "Marine Fish Marketing in Bangladesh", *Bangladesh Journal of Agricultural Economics,* 2 (1) : 91-107.

World Bank (1991): *Bangladesh Fisheries Sector Review.* Document of the World Bank, FAP 12/13 Project, Report No. 8830-BD.