

INPUT - OUTPUT RELATIONSHIP IN CAPTURE FISHERY : A CASE STUDY IN ORISSA COAST*

KAMAL KUMAR DATTA AND S. S. DAN**
Central Soil Salinity Research Institute, Karnal-132 001

ABSTRACT

The purpose of this paper is to assess the productivity of different inputs in capture fishery along the coast of Orissa during 1985-'86. Specifically the paper provides the information regarding :

(i) Costs and returns of different craft-gear combinations, (ii) productivity of capital and labour both in volume (kg) as well as value (Rs.) and (iii) to fit the production function in fishery economy and (iv) recommendation for policy prescription.

Field survey shows there is a greater diversification of craft-gear use pattern between south and north Orissa. Results exhibit that eventhough there was not a strong degrees of correlation, there was a positive relationship between capital intensity and capital productivity in value terms. A positive relationship was also found between capital intensity and labour productivity, there was also a positive relationship between capital and labour productivity.

Factor productivities are an important measure of the cost-effectiveness. Different functional forms were tested in order to find out an appropriate production function in capture fishery. Data shows that linear production function given us the best (on the basis of R^2 value) functional form. Attention has been drawn in order to avoid inefficient use of labour and capital in due course, because of its indiscriminate use. Rational exploitation and conservation must go hand in hand in order to ensure optimum sustainable yields which will bring perpetual benefit.

INTRODUCTION

THE FISHERMEN are guided by their economic motive rather than fishery stock in a particular ground. Their economic motive is to maximise the net economic yield which is guided by two major economic factors (a) monetary return out of the catch and (b) cost of production *i.e.* fishing costs.

The purpose of this paper is to assess the productivity of various types of craft-gear combinations in Orissa. This paper deals

with (i) costs and returns of different craft-gear combination, and (ii) productivity of resources.

The information is important for planning and developmental purposes of capture fisheries. It can help fishing units in the efficient use of resources to achieve their goals.

MATERIALS AND METHODS

Central Marine Fisheries Research Institute conducted a socio-economic survey throughout the coastal area of Orissa during 1985-86. Data were derived from the survey to determine the cost and returns of different craft-gear combination. The sample boats were taken randomly from Talsari, Bahabalpur Balaram-

* Presented at the 'Symposium on Tropical Marine Living Resources' held by the Marine Biological Association of India at Cochin from January 12-16, 1988.

** *Present address* : Field Centre of Central Marine Fisheries Research Institute, Contai, Midnapur, (W.B.).

guri in Balasore District and Paradeep, Badapadia from Cuttack Districts. The owners of the boat as well as crew were personally interviewed and questioned about sources of finances, purchase year of craft-gear, cost of craft-gears, contract arrangement between owner and crew. A total of 141 samples were used in this analysis.

In addition to data from the survey, information from Fishery Department of Orissa was also used.

CRAFT-GEAR CHARACTERISTICS

Due to cultural, ethnic background of the fishermen, professional skills as well as species availability, there is a diversification of craft-gear use pattern between South and North, Orissa. Mechanisation in craft-gear is faster in northern coastal part as compared to southern part. Mainly because of harbour and other infrastructural facilities available. Mechanised units mainly consists of motorised gillnets boats and trawlers. Maximum number of trawlers are operating at Paradeep in Cuttack District. During 1983, there were 395 trawlers in this State of which 203* were in Cuttack District. An increase in the number of motorised gillnetters was also observed with a major concentration in Balasore District. During 1980 the number of motorised gillnet units were 102† which increased to 278 in 1983.

The availability of quality fishes like prawn, hilsa and pomfrets are an incentive for rapid mechanisation at Balasore District.

In the non-mechanised sector, plank-built canoes which are locally called Nava and Tappa are the major crafts in the Cuttack District. They mainly operates different mesh size gillnets, according to the availability of species.

* Artisanal Marine Fisheries in Orissa: A technodemographic study (BOBP/WP/29/83).

† Marine Fisheries Information Service, 30,

The extreme range of investment levels and degrees of capital intensity that prevail in these two coastal districts are given in Table 1. The initial investment varies from 1.66 lakhs to 7.5 thousand depending on the craft-gear combination.

TABLE 1. Initial investment of different craft-gear combinations in Balasore and Cuttack District (Orissa) during 1985-86

Type of craft	Craft	Investment (in Rs.)		Total
		Type	Gear	
Trawler (32 ft. length, 65 H.P.)	150,000	TN	5,000	155,000
Motorised boat (32 ft. length, 60 H.P.)	60,000	GN	20,000	80,000
Non-motorised (30' × 7' × 6')	10,000	GN	13,000	23,000
Tappa (8.3 m × 1.5 m × 0.5 m)	7,000	GN	5,000	12,000
Nava (3.5 m)	4,000	GN	3,500	7,500

TN = Trawl net; GN = Gill net.

COSTS AND RETURNS FROM DIFFERENT CRAFT-GEAR COMBINATIONS

Gross returns in the money received from total catch during the survey year (1985-86). The estimated gross returns from trawler was considerably higher than fishing income from other types of fishing units (Table 2). The average gross returns of a trawler in Balaramguri was higher (Rs. 1,80,401) as compared to Paradeep base trawler (Rs. 1,73,306). This may be attributed to the fact that the fishing ground is more lucrative in Balaramguri as compared to Paradeep. But trawling intensity is much more at Paradeep due to jetty and harbour facilities.

The estimated gross returns from a gillnet unit with motorised boat was higher at

TABLE 2. *Estimated annual gross income of different craft-gear combinations in the selected centres in Balasore and Cuttack during 1985-86*

District	Centres	Craft-gear combination	Estimated annual income (in Rs.)
Balasore	Talsari	Motorised boat with gillnet	59,963
	Bahabalpur	Motorised boat with gillnet	68,158
	Talsari	Non-motorised boat with gillnet	15,807
	Bahabalpur	Non-motorised boat with gillnet	24,956
	Balaramguri	Trawler	1,80,401
Cuttack	Paradeep	Trawler	1,73,306
	Badapadia	Tappa with gillnet	31,751
		Nava with gillnet	13,958

TABLE 3. *Estimated annual fixed and variable cost (in Rs.) of different craft-gear combination in the selected centres in Balasore and Cuttack during 1985-86*

	motorised boat with gillnet		non-motorised boat with gillnet		Trawler		Tappa with gillnet	Nava with gillnet
	Talsari	Bahabalpur	Talsari	Bahabalpur	Balaramguri	Paradeep	Badapadia	
<i>(a) Fixed Cost</i>								
Depreciation on boat/engine ..	6,000	6,000	1,000	1,000	15,000	15,000	700	400
Depreciation on gear ..	5,000	5,000	3,250	3,250	1,250	1,250	1,250	875
Interest on initial investment ..	9,600	9,600	2,760	2,760	18,600	18,600	1,440	900
Total ..	20,600	20,600	7,010	7,010	34,850	34,850	3,390	2,175
<i>(b) Variable Cost</i>								
Fuel ..	13,655 (40)	15,655 (40)	—	—	61,406 (53)	54,896 (52)	—	—
Share/wages for crew ..	11,045 (32)	12,620 (33)	3,737 (53)	5,541 (46)	27,804 (24)	29,118 (28)	7,919 (60)	2,978 (43)
Food for the crew ..	4,282 (13)	4,697 (12)	1,407 (20)	2,595 (22)	12,281 (11)	9,372 (9)	2,517 (19)	1,652 (24)
Repairing of craft gear	1,736 (5)	1,826 (4.72)	1,776 (25)	3,568 (30)	7,895 (7)	5,337 (4)	2,838 (21)	2,378 (33)
Ice	1,852 (5.4)	2,087 (5.28)	—	—	6,141 (5)	6,100 (5)	—	—
Landing/harbour charges ..	1,620 (4.6)	1,826 (5)	168 (2)	324 (2)	—	540 (1)	—	—
Total ..	34,190	38,711	7,088	12,028	1,15,527	1,05,363	13,274	7,008
Total annual expenditure (a+b)	54,790	59,311	14,098	19,038	1,50,377	1,40,213	16,664	9,183

Figures in the parentheses are the percentage of total operating cost.

Bahabalpur (Rs. 68,158) as compared to Talasari (Rs. 59,963). within the non-mechanised boat, Tappa unit earned the maximum (Rs. 31,751). Paradeep base trawler fetched higher value (Rs. 5.53/kg) followed by trawler at Balaramguri (Rs. 4.48/kg). The gillnetters at Bahabalpur fetched higher value both at motorised boat (Rs. 4.18/kg) and non-motorised boat (Rs. 3.64/kg).

The variation of value realisation in different units varied mainly because of percentage contribution of quality fishes like prawn, hilsa, pomfret, etc. as well as its size. It has been observed that 26% of the trawler catch mainly consist of prawn, but eventhough, value realisation per kg in trawling is greater because of high value of prawn. While the survey was being conducted the prawn value varied from Rs. 150 to 89/kg depending upon the size and quality in different landing centres.

The life expectancy of a boat and engine was about 10 years and for a gear it was about 4 years. The interest on initial investment was calculated at the rate of 12% per annum. Based on it the fixed cost of each unit was calculated (Table 3).

The estimated operating cost for the trawler at Balaramguri were Rs. 1,15,527 whereas at Paradeep it was Rs. 1,05,363 (Table 3). The variation may occur due to number of fishing days as well as fishing hours within those area.

In case of gillnetters, the estimated annual operating cost for a motorised boat were Rs. 38,711 at Bahabalpur and Rs. 34,190 at Talsari and within the non-motorised boat, the estimated annual operating cost was lowest at Badapadia it was Rs. 7,088.

Fuel is the major expenses that mechanised boats incur as operating cost. It was 52% for trawlers and 40% for motorised boat. As far as the non-mechanised boat, share/wages for crew are the major cost item, it ranges from

43% to 60% during 1985-86. The operating costs for trawlers were 3 times higher than production cost of motorised boat and 20 times higher than non-mechanised units. Labourers generally get real wages in terms of their daily food requirement as well as money wages in the form of 30% share from the net income.

In order to know the input-output relationship in different centres, different economic parameters were calculated (Table 4). Net cash flow over operating cost was higher both for motorised and non-motorised boat at Bahabalpur than at Talsari. The net unit income which was calculated by deducting depreciation from net cash flow was also higher at Bahabalpur (Table 4).

The ratio of operating expenses to the cash flow was higher at Talsari (1.33) as compared to Bahabalpur (1.31) within the motorised gillnet units.

Low operating cost and higher net cash flow at Paradeep base trawler resulted in low operating cost ratio (1.55) as compared to Balaramguri (1.78).

Annual profit was higher both for motorised and non-motorised boat at Bahabalpur (Rs. 8847 and Rs. 5,918) as compared to Talsari (Rs. 5,173 and Rs. 1,709) (Table 4).

Annual profit accounted for in about 126% of total investment for Tappa unit and 64% for Nava unit at Badapadia. In the trawler unit it was 21% at Paradeep and 19% at Balaramguri. Profit-investment ratio being comparatively less both for motorised and non-motorised gillnet units at Talsari (0.07) (Table 4).

PRODUCTIVITY OF THE FACTORS

In the non-mechanised sector, the Nava Unit used more labour per unit of investment capital. The investment capital per unit of

about is Rs. 1,875 (Table 5) which was lower than any other type of unit.

Comparatively the mechanised unit used more capital as compared to labour. Investment capital per unit of labour is higher in

Productivity of labour and capital can be measured in terms of volume or value of catch. As prices vary, depending upon the species availability, measuring the productivity in value terms is preferable as it indicates the value added by capital and labour inputs. The

TABLE 4. Some of the economic parameters of capture fishery in Orissa (1985-86)

Economic Parameters	Talsari		Bahabalpur		Balaramguri	Paradeep	Badapadia	
	Motorised boat with gillnet	Non-motorised boat with gillnet	Talsari	Bahabalpur	Trawlers	Tappa with gillnet	Nava with gillnet	
a. Gross Income (Rs.)	59,963	68,158	15,807	24,956	1,80,401	1,73,306	31,751	13,958
b. Net Cashflow (Rs.)	25,773	29,447	8,719	12,928	64,874	67,943	18,477	6,957
c. Net Unit Income (Rs.)	14,773	18,447	4,469	8,678	48,624	51,093	16,537	5,60
d. Profit (Rs.)	5,173	8,847	1,709	5,918	30,024	33,093	15,087	4,775
e. Operating cost—flow ratio	1.33	1.31	0.81	0.93	1.78	1.55	0.72	1.00
f. Fixed cost—cash flow ratio	0.80	0.70	0.80	0.54	0.54	0.52	0.18	0.31
g. Profit investment ratio	0.07	0.11	0.07	0.26	0.19	0.21	1.26	0.64

trawlers. It was Rs. 31,000 during 1985-87. As can be seen from Table 5, capital intensity increases with the level of investment requirement per fishing unit.

TABLE 5. Capital, labour requirements and capital-labour ratios of different craft gear combinations in Balasore and Cuttack (Orissa) Districts during 1985-86

Craft-gear combinations	Investment cost in (Rs.) 1985-86	Average crew requirements	Capital labour ratio*
Trawler	155,000	5	31000 : 1
Gillnets			
Motorised	80,000	10	8000 : 1
Non-motorised	23,000	5	4600 : 1
Tappa	12,000	5	2400 : 1
Nava	7,500	4	1875 : 1

* Capital-labour ratio shows investment cost per unit of labour.

differences between volume and value measurement of factors can be seen in Table 6.

By spending one rupee, the entrepreneur of the non-mechanised units are able to catch more fishes compared to mechanised units. The plank-built canoe exhibited the highest capital productivity in terms of volume. In value terms also boat type Kattumaram (Tappa) and small canoe (Nava) contributed the greatest value added in the fishery. Although there was not a strong degree of correlation ($r = 0.1927$), there was a positive relationship between capital intensity (Table 5) and capital productivity in value terms. A positive relationship was also found between capital intensity and labour productivity in value terms ($r = 0.5992$). Finally in value terms, there was a positive relationship between the capital and labour productivities ($R = 0.06919$). These factor

TABLE 6. Productivity of capital and labour in Balasore and Cuttack Districts during 1985-86

District	Centres	Craft-gear combination	Annual		Cap. Product		Labour Product	
			Volume of catch per unit (in kg)	Value of catch per unit (in Rs.)	Volume per invested (kg)	Value per invested (kg)	Volume per labour unit (kg)/mm days	Value per labour unit (Rs.)/mm days
Balasore	Balaramguri	Trawler	40,282	1,80,401	0.26	1.16	68.27	305.76
	Bahabalpur	Motorised boat with gillnet	16,291	68,158	0.20	0.85	18.10	75.73
		Non-motorised boat with gillnet	6,860	24,956	0.30	1.09	18.29	66.55
	Talsari	Motorised boat with gillnet	16,612	59,963	0.21	0.75	20.76	74.95
		Non-motorised boat with gillnet	5,184	15,807	0.23	0.69	13.82	42.15
Cuttack	Paradeep	Trawler	31,311	1,73,306	0.20	1.12	57.98	320.94
	Badapadia	Tappa with gillnet	8,748	31,751	0.73	2.65	8.75	31.75
		Nava with gillnet	5,821	13,958	0.78	1.86	14.55	34.89

productivities are important to measure the cost effectiveness.

RECOMMENDATIONS

It is essential to give more emphasis on non-mechanised unit especially on Tappa and Nava units where investment is low and annual profit on total investment is higher.

In order to ensure optimum sustainable yield which will give perpetual benefit, rational exploitation and conservation must go hand in hand.

The infrastructure like Jetty, harbour, proper transport, marketing and credit specialities are essential in Orissa which are mainly hindering the growth of mechanised units.