



SCOPE AND ECONOMICS OF INLAND FISH FARMING IN NASIRABAD AND JAFFARABAD DISTRICTS OF BALOCHISTAN

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ABSTRACT

Fish farming has a substantial potential to improve the livelihood of people in the Nasirabad division, Balochistan, this division has the only canal irrigated areas that connects with Sindh province. This study is based on cross sectional data collected in the year 2020 for the calendar year 2019 from 67 fish farmers of the Nasirabad and Jaffarabad districts. The study aimed at the economic analysis of the fish culturing best on the size of the farm, as a standard for farmers' ability to invest in and manage the fish farming business. Fish production and marketing issues faced by the farmers have also been highlighted, and appropriate actions were suggested for public sector departments. The fish producers used in a mix species and they grow 72.56 % more than two fish varieties in our fish farms. The average cost of fish production and net return was conculated Rs. 238274 and 116511 respectively. The findings of the study showed that, modern aquaculture can effectively improve the socio-economic conditions of the farming community in the study area. Fish farming generates considerable financial gains for the farmers with a benefit-cost ratio of 1:1.96. This cututring is an economical and viable business activity, with more chances of empolyeement from culturing to marketing. The activity may be boosted to enhance livelihood and socioeconomic conditions in the study area.

Keywords: cost-benefit analysis, Balochistan, fish farming, Pakistan, sustainable

INTRODUCTION

Fish is the main source of animal proteins for the peoples around the world. WHO 2020, reported that 20% population of the world grown at least one-fifth of its animal protein intake from fish, and island states of some parts depend on fish. Similarly, a fishery plays an important role in the Pakistan economy and the main source of the livelihood for the peoples of the coastal area. Some parts from inland and marine fisheries based in lakes, ponds, rivers, and dams are also important livelihood activities in the country. The share of inland fisheries is about 32% and 68% comes from marine water in total fish production (GoP, 2019). Fish and fisheries products have special importance in the diet of people and serve as the primary source of high-quality protein. The (GoP, 2020), reported a share of

the fishing sector of 2.06% in agriculture value addition and GDP of 0.40% with a growth rate of 1.63% per annum.

Pakistan is a lower middle-income country having 2.6% of the world population and a per capita GDP of 13.9% of the world average. The country has 0.13% of the total coastline length of the world and annual renewable water resources of a total of 0.45% of the world. Aquaculture production is composed of primarily freshwater fish farming in inland waters, 99.3, 89 and 44% share of total inland fish production in Pakistan, the South Asian region, and the global level respect. However, total protein consumption increased from 59.4 to 65.5 g/day per capita from 1993 to 2013 in the country; the total protein increased share from 33.4 to 41.6% of animal protein, however, of fish and seafood declined share from 1.3 to 0.9% (FAO, 2019). In 2013 fish contribution to animal protein

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consumption was lower than the South Asian 13.7% and the world averages of 16.3% (FAO, 2019). The fast-growing contribution of aquaculture to food security is widely recognized at the international level. The farm-reared fish offers a new alternative to agrarian crop production and can be a potential replacement for crop farming that exhibits declining profitability over time. The fish healthy farm reared free of disease, pesticide residues, and other toxicants is a more desirable substitute for those from the potentially polluted waters. Many studies indicate that fisheries production from capture and aquaculture support the national economy, food, secure livelihood and generates employment (FAO, 2020; Costello *et al.*, 2012 Godfray *et al.*, 2010).

In our country, the main fish harbors are Karachi Korangi, Pasni, and Gwadar. The Karachi fisheries harbor exports fish products of about 90 and 95% of fish and sea food caught respectively (Rafiq, 2017). The study findings of (Jarwar, 2008), indicated that the marine fish fauna contains about 250, 15, 50, 15 and 20 demersal fish, species of shrimp, small, medium, and large pelagic fish respectively, and about 12 squid/octopus/cuttlefish and 5 lobsters species are commercially important in Pakistan. The most fish farming producers made ponds on uncultivated land, not suitable for cropping purposes and groundwater is brackish. In Pakistan along with Balochistan the trend of fish production (inland and marine) has been slowly increased year by year in (Table 1). This fluctuated trend is due to the lack of financial investment, un-availability of seed, high price of seed and un-suitable fish marketing system. Further fish farmers reported that the finance is the main problem for development of the new fish pond and even though the repair of the old farm.

Table 1. Trend of fish production (inland and marine) (000 Tonnes)

Year	Balochistan	Pakistan
2008	138	685
2009	140	694.5
2010	143	704.2
2011	144	712.4
2012	145	725
2013	145.5	729
2014	147	735
2015	149	747
2016	156	788
2017	157	797
2018	160	807

Source: Agricultural-Statistics of Pakistan 2017-18

The Jaffarabad and Nasirabad districts are large areas fallow where not suitable production for field crops and quality of fish products can be raised. The study areas have been suitable for inland fish farming along with climatic conditions and farmers are expected to enter into fish farming. Keeping this in view, this study was planned to investigate, the profitability of fish farming in the area. Our main research question is that, does fish farming the alternate source of income in the area? This study can provide a baseline information regarding profitability of fish farming in these districts of Balochistan. These results may be beneficial for farming community and policy makers for sustainable growth of this sector. Furthermore, the improvement of fish farming ultimately increase the livelihood status of farming community.

RESEARCH METHODOLOGY

Primary data for the study was collected in the year 2020 for the calendar year 2019 from 67 fish farmers of the Nasirabad and Jaffarabad districts of the division. The secondary data was collected from the fisheries department and different organizations to substantiate findings obtained by analyzing primary data. The questionnaires used for the study covered information relating to socio-economic and farm characteristics, capital inputs, production practices, physical products, and other related variables. The scientists clarified the purpose of the study before starting the interview at their farms. The respondents assured that all information would be kept confidential and only be used for research purposes. A representative sample of fish farmers, market intermediaries, and other stakeholders was selected for the collection of primary data. Selected respondents were interviewed by using a set of detailed, pre-tested, and finalized questionnaires. Suitable quantitative analytical techniques have been used to achieve the objectives of the study. The farmers were randomly selected during the survey time.

Data editing, entry, and analysis

When finalizing the field survey, the collected data was edited and data were analysed by employing the descriptive statistics as well as standard economic techniques. Economic analysis of fish farming by farm size categories was done, as it helps investigate a wide range of issues (Gall, 1996). Thus, sample farmers were categorized into three types based on farm size

to capture differences in resource endowment, cost of production, and profitability per unit area.

Farm costs and returns analysis

The study results deliver a comparison of the total cost and return of different fish breeds. To examine the performance of fish farmers adopted the following procedure.

Total costs

Total cost is the entire amount of money that must be spent on something to produce, maintain, or own it and related costs commonly used like.

Total fixed costs

The sum of all costs that never change, while waiting for new money costs are required as the level of production increase or decrease. For example, somebody who pays rent will pay a similar amount of rent each month; this is a fixed cost.

Total variable costs

The components of variable costs are the costs that the differences concerning sales volume and are called the cost of goods sold.

Opportunity costs

The term economics opportunity cost is that mentions the value of what you have to give up in order to consume something else. For example, the farming land and labor his own he could receive by renting it to someone else (Hofstrand, 2005).

Total revenue

The producer received an amount from the sale of any quantity of production. The Biz, 2002, indicated the total income is calculated by taking the price of the sale times the quantity sold.

Economic profits

Economic profit or loss is the difference between the revenue received from the sale of an output and the costs of all inputs used except opportunity costs have been deducted from gross income.

Gross margin

Gross margin equates to net sales minus the cost of goods sold. Gross margin can also be called gross profit margin, which is gross profit divided by net sales.

RESULTS AND DISCUSSION

Fish farm size distribution

The size of ponds may vary in different locations due to physical and socioeconomic conditions. Results showed that 80.6% have less than 12.5 acres, 16.4% have more than 12.5 but less than 25 acres, and 3.0% with more than 25 acres of ponds (Figure 1).

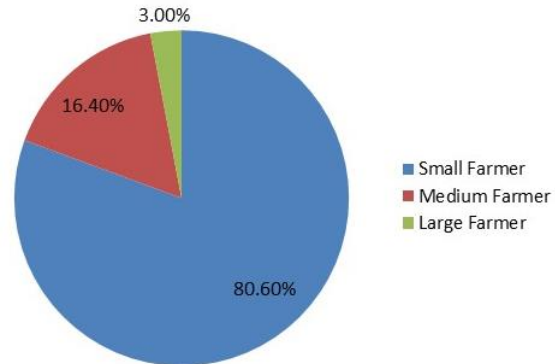


Figure 1. Fish farm size distribution

Fish species' composition and number of fish species grown by sample fish farmers

Misachi, (2017) reported both native and exotic fish species, where 25 native and 3 exotic fish species were restricted to the northern area of Pakistan. Grass and silver occupy 30% of the water resources and like to live in the upper layer of the pond, Rahu is dominant over all other species and mostly live in the middle phase of the pond water which is 40% of the total, whereas Mori and common carp like to live in the lower portion of the Pond (Khan *et al.*, 2018). Another study finding mentioned the fish species Rahu, Thaila and Moraka species are used in a ratio of 40, 30, and 30% respectively (SMEDA, 2011). In our research study the main species are Silver, Grass, Rahu, Mori and common Carp are used for culturing in the study area (Figure 2). The water resources of a pond are divided into three broad layers and each species of carp happily lives in its environment. All fish farmers using the mixed culture of farming and main species were Thaila, Rahu/Kuriro/Dambhra, and Moraka followed by other local fish species. The survey result indicated that these species are used in a mix of Thaila, Rahu, Moraka, Gulfam, Hybrid, Gross, and Silver was 45.46, 22.72, 13.64, 4.55, 4.55, 4.55 and 4.55% respectively.

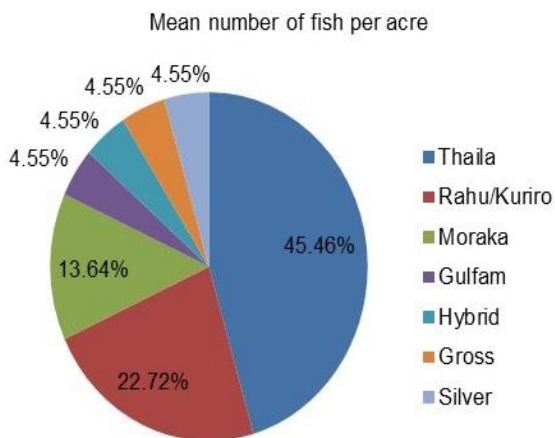


Figure 2. Fish species composition on sample farm

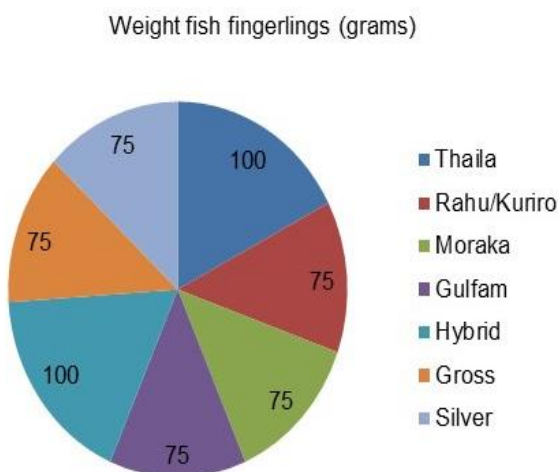


Figure 4. Weight fish fingerlings (grams)

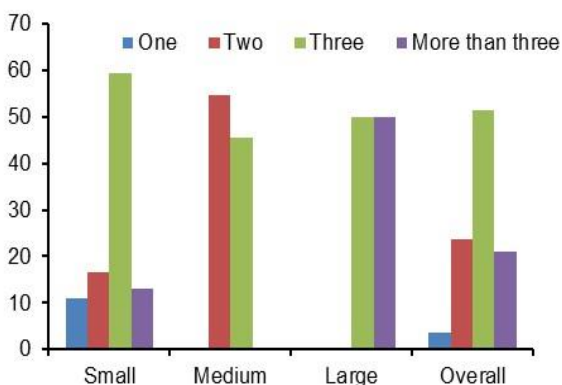


Figure 3. Number of fish species grown by fish farmers

Number of fish species grown by fish farmers:

A little more than half of the sample farmers (51.57%) reported growing three fish species, followed by two species per farm (23.74%), and

more than three species per farm (20.99%), while the remaining farmers (3.70%) reported raising just single fish specie at their farms (Figure 3). It can be noticed from the findings presented in the Table that medium and large farmers generally grow more species than small farmers to minimize risk and to make better use of labour, water, and other production resources.

Sources of fish seed of specific species

The fish producers reporting the quality of fish seed is the main fish farming input for achieving high production and they use pure, clean, and disease-free seed to gain ideal production. The main fish seed source is its farm, fellow farmers, Fisheries Department Balochistan and fish farmers from Sindh province. It is found that fish farmers usually fish seed purchase 78% from neighboring province Sindh (Table 2). This indicates that Fisheries Department, Balochistan is required to increase its capacity to distribute fingerlings to the fish farmers. Some farmers reported the quality of seed was poor and sale price high supplied by private hatcheries and finally less growth, production, and profitability (Figure 4). The small farmers are a severe high problem and do not have nursery ponds and are to rely on other sources for fish seeds.

Table 2. Seed source of fish farmers (n=67)

Fish seed sources	Farm size groups			Overall
	Small (< 12.5 acre)	Medium (>12.5-25 acre)	Large (>25 acres)	
Own farm	3.70	9.09	0	4.26
Fellow farmer	24.07	18.18	0	14.09
Fisheries Department, Balochistan	1.85	9.09	0	3.65
Fish farmers from Sindh Province	70.37	63.64	100	78.00

Source: Survey data, 2019-20

Variable and fixed fish farming costs

Cost production is measured with the help of review data and some costs are fixed and change in the short run whereas long run, all costs come to be variable, and costs that were fixed in the short run inspire the judgment to stay production. The active farmers kept proper records regarding the fish farming of all input costs, gross and net income, etc.

The total variable cost of fish farming was Rs.87849 and large farms' cost was higher followed by other farm size categories in (Table 3).

Table 3. Cost of fish production

(Rs. /Acre /Annum) (n=67)

Farm Size					
Particulars	Small	Medium	Large	Overall	Share (%)
I. Variable costs					
Pond cleaning cost	4000	5000	5000	4667	5.31
Seed with transport cost	16750	16000	15000	15917	18.12
Fertilizer + feed cost	8000	6550	7000	7183	8.18
Material cost (nets)	3000	4000	5000	4000	4.55
Irrigation charges	6000	5000	6200	5733	6.52
Production labor cost	6000	7000	7500	6833	7.78
Harvesting labor cost	11500	14000	15500	13667	15.56
Marketing cost	24414	29304	35830	29849	33.98
Total variable cost	79664	86854	97030	87849	100.00
II. Fixed costs					
Rent of land	25000	20000	15000	20000	46.07
Markup investment @ 3.25%	19301	19458	19482	19413	44.72
Canal irrigation / Cleaning charges (Rs./ season)	3000	4000	5000	4000	9.21
Total fixed cost	34301	33458	33982	33913	100.00
III. Total cost	113965	120312	131012	121763	-

Source: Survey data, 2019-20

The share of various cost items in the total variable cost of fish farming in the study area indicates that marketing cost is the main cost item as it shared about one-third of the total cost of 33.98%. The marketing cost is quite high in the study area, as farmers usually market their produce in the adjoining districts of Sindh province due to the under-developed marketing system in the study area. Labour cost and seed cost are other major expenditures in fish farming. Labour cost and seed along with transportation cost shared 23.34% and 18.12% in total variable cost, respectively.

Fixed Costs

In the short run, fixed costs are fixed in the variable or operational costs and farmers gave value to make the production of the economy. The lease value of land rent is considered the fixed cost and calculated as the rate of prevailing cash rental value per acre pond/land further markup on operating capital was calculated by taking into account the costs incurred on all field operations. The fixed cost per acre was Rs. 33913 per annum (Table 4). Land rent, followed by markup on investment is the main fixed cost component with a share in the total fixed cost of 46.07% and 44.72%. The total cost of fish farming was Rs.121763/ac/annum with little variation across farm size categories. The difference in the total cost across farm size categories was mainly due to marketing cost, as it goes up with a higher volume of fish production. Shares of variable and fixed costs in the total cost of fish farming were 72.15 and 27.85%, respectively.

Table 4. Marketing channels and costs by farm size

Farm size				
Marketing methods	Small	Medium	Large	Overall
Marketing channels (% farmers)				
Pre-harvest contracts	27.78	36.36	50.00	38.05
Fish markets	62.96	54.55	50.00	55.84
Pre-harvest contracts + Fish markets	9.26	9.09	0.00	6.12
Marketing cost (Rs/acre)				
Transportation cost	8694	10584	11718	10332
Material cost	1000	800	800	867
Commission charges	14720	17920	23312	18651
Total	24414	29304	35830	29849

Source: Survey data, 2019-20

Fish marketing and costs

Farmers reported to sell the fish produce directly in wholesale fish markets, to pre-harvest contractors, or both in fish markets as well as to pre-harvest contractors. Pre-harvest contractors either first finalize prices for different fish species by weight categories with the farmers and then whole fish produce is harvested and sorted by weight. It is scaled at the farm and payments are made to the farmers accordingly. Sometimes, the production of fish ponds is guessed through experimental netting by the contractors. Thereafter, the contract is finalized with the farmers by them. While in wholesale markets prices are determined by open bidding. It is found that half of the large farmers and more than half of the small and medium farmers marketed their fish produce directly in the markets. Farmers having marketing information and those from whom commission agents

charge concessional or no service charges prefer to market their produce in wholesale markets. Commission and transportation charges are the main fish marketing costs and these cost items shared 62.48 and 34.61% of the total marketing costs respectively (Table 5).

Table 5. Production and sale price by farm size

Farm size				
Particulars	Small	Medium	Large	Overall
Total production (kg/ac)	960	1180	1320	1153
Home consumption and gifts (kg/ac)	40	60	80	60
Total sale (kg/ac)	920	1120	1240	1093
Sale price (Rs/kg)	200	220	235	218
Gross return (Rs/ac)	192000	259600	310200	238274

Source: Survey data, 2019-20

Table 6. Total cost and economic net returns of fish farming (Rs/acre)

Farm size groups				
Particulars	Small	Medium	Large	Overall
Gross Revenue	192000	259600	310200	238274
Total variable cost	79664	86854	97030	87849
Total fixed cost	34301	33458	33982	33913
Total cost	113965	120312	131012	121763
Gross Margin	112336	172746	213170	150425

Source: Survey data, 2019-20

The size of fish is the main factor of price variation in net revenues amongst fish farmers. The mean sale price of the fish was Rs.218 per kg and gross revenue was Rs.238274/acre in Table 6. Large farmers received higher prices than their counter parts (Rs.235 per kg) as they reported to sell their fish produce in the Sukkur market. While small farmers received the lowest prices as they mostly sell their fish produce to pre-harvest contractors at their farms. Similarly, gross returns of large and small were highest and lowest respectively.

The sales price is thus clearly the most important element to be assessed when analyzing the cost-benefit of fish farming in the study area. Even on one farm prices vary widely from one harvest to the next. The factors behind these wide differences in prices deserve a thorough investigation. About five percent of the produce is consumed at home or gifted to friends, while ninety-five percent of the produce is sold out. It is worth mentioning here that fish takes about eight months to gain harvest size, and farmers' profitability depends on their capacity to gain higher production as well as efficiently market fish produce within a few hours of harvest and fetch better prices. Thus, along with the production aspects of fish farming to obtain a higher yield, marketing aspects should also be kept in focus to gain higher net returns.

It is noticed that extension services are either non-existent for fisheries or just focusing on the production aspect of farming by assuming that fish produce can always be sold at reasonable prices.

Gross revenue, gross margins, and net returns

The fish farmers mostly like to gain more profit ending the variable cost of production. The pond-to-pond fish farmers' output differs due to variation in soil, quality of water, changing interval of freshwater, feed usage, and disease incidence. The mean fish production at the sample farms was 1093 kg per acre and large farmers received the highest productivity followed by other group farmers. The results of our study findings near the study of (Aslam et al. 2020), they were reported results shows that the average cost of production, gross income, and net returns was Rs.3,49,050, 2,29,009 and 120041 received per acre respectively and benefit-cost ratio was 1:1.52 of fish farming in Muzaffargarh and Khanewal districts of Punjab. Furthermore, fish farming is even more profitable than crop farming in the study area. The fish producers obtained gross revenue, margin and net returns were Rs. 238274, 150425, and 116511 per acre, respectively with net return of Rs.485/day and benefit-cost ratio of 1:1.96. Thus, fish farming is a beneficial enterprise in the study area that generates sustainable net returns ranging from Rs.78035 to Rs.179188 per acre (Table 7).

Table 7. Total cost and economic net returns of fish farming (Rs/acre)

Farm size groups				
Particulars	Small	Medium	Large	Overall
Gross Revenue	192000	259600	310200	238274
Total variable cost	79664	86854	97030	87849
Total fixed cost	34301	33458	33982	33913
Total cost	113965	120312	131012	121763
Gross Margin	112336	172746	213170	150425
Net Return	78035	139288	179188	116511
Net return (Rs/day)	325	580	747	485
BCR	1:1.68	1:2.16	1:2.37	1:1.96

Source: Survey data, 2019-20

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CONCLUSION AND RECOMMENDATIONS

The fish marketing system in the Nasirabad division of Balochistan is under developed which limits farmers' profitability and ability to invest in the business. Financial benefits for fish production have a direct relationship with farm size i.e. profitability of the business is high at large farms, followed by medium and small farms. The large farmers generally grow more species to minimize risk and to make better use of labor, water, and other production resources. They invest more in the business than their counter parts and are in a better position to market their produce in adjoining districts of Sindh province, particularly in the Sukkur. The limited capacity of the local fisheries department to produce fingerlings is another constraint in the up scaling of fish farming in the study area. Limited knowledge about technical aspects of the farming, inadequate water availability, role of middle man, transportation cost and high feed cost restrict farmers' capacity to upscale the business. The following measures has been suggested to make inland fish farming a sustainable venture for the farmers in the study area:

- The Fisheries Department of Balochistan is required to provide quality fingerlings of suitable species to the farmers.
- Technical trainings will be provided to the farmers for the improvement of their skills in fish production, specifically in cheap feed formulation by using local resources.
- Subsidized credit facilities for small-scale fish farmers are required to promote inland fish culture in the area.
- The suitability of different fish species for cultivation in the study areas is a researchable issue for bio-physical scientists.

AUTHOR'S CONTRIBUTION

J. K. Bajkani: Data collection, review of literature, wrote abstract, methodology, analysis, result and discussion and overall supervision of the research manuscript

A. Hussain: Data analysis, writing up, and technical input

A. H. Memon: Technical input and writes up

M. A. Gadehi: Data collection and technical input

S. Pasand: Data collection and technical support

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