ECONOMICS OF TROUT FISH FARMING IN THE NORTHERN AREAS OF PAKISTAN

Abdul Hassan*, Muhammad Ishaq**, Arshad Farooq** and Shaukat Hayat Sadozai*

ABSTRACT
This study was undertaken in Northern Areas of Pakistan during 2004 to estimate the cost of trout fish farming and its profitability. The results of the analysis show that total cost (capital and variable costs) of Rs.234 was incurred to produce one kilogram of trout fish and its selling price was Rs.310. The net revenue came to Rs.76 per kg of fish. It shows that trout fish farming provides a great opportunity for exploiting the abundant source of cold water in Northern Areas and would be a major income generating activity, if rural people were made aware of the trout fish farming and proper market established in the area.

INTRODUCTION
Fishery plays an important role in Pakistan’s economy and is also considered to be an important source of livelihood for the coastal inhabitants. Apart from marine fisheries, inland fisheries (based in rivers, lakes, ponds, dams etc) is also very important activity throughout the country. Though, the share of fisheries in GDP of the country is small but it does contribute to the foreign exchange earnings through export. The nutritional value of fish is very high, with protein content of 15 to 20 percent, low cholesterol content and many useful dietary supplements. During 2004, a total of 90,225 M. tons of fish and fishery products were exported, earning Rs.7.6 billions. During the year 2004-05, the total marine and inland fish production was estimated to be 573,600 M. tons of which, 403,500 M. tons was marine production and remaining 170,100 M. tons came from inland waters while during 2003-04, the total marine and inland fish production was 566200 M. tons. Out of which 400500 M. tons were marine production and 16700 M. tons were inland fish (Govt. of Pakistan, 2004-05).

Nature has bestowed Northern Areas (NAs) with cold-water resource, with a variety of habitats, best suited for trout fish farming. Therefore, trout fish farming is an important natural resource and a potential source of income in NAs. There are 45 lakes in Northern Areas, of which 12 are stocked with trout, but most have indigenous fish. Two species of exotic trout i.e., brown trout (Salmo trutta) and rainbow trout (Oncorhynchus mykiss) have established themselves in the rivers of the area. Beside this, of the total length of 2100 km of streams and rivers, about 350 km contain brown trout. The body of brown trout is short but stout and suitable altitude for its culture is about 1000 meter above sea level. It is not recommended for commercial farming because of slow growth compared to rainbows. Rainbow trout can tolerate high water temperature, less carnivorous and grows faster than brown trout.

The study in hand is an effort by the researchers to estimate the total cost of the infrastructure for commercial trout fish farming and to determine the profitability of this enterprise in Northern Areas.

MATERIALS AND METHODS
This research study was conducted during 2004 in the whole of NAs of Pakistan where trout fish farming is carried out on commercial basis. The study is based on primary data; however, secondary data were also collected from various published and unpublished sources, wherever deemed necessary. The primary data were collected through face-to-face interview using a pretested comprehensive interview schedule, designed in the light of preset objectives and review of literature.

Sample Design
From secondary data and field observations, it was revealed that there were only eight fish farms established by the area farmers in which four farms had started trout fish farming on commercial scale. Only one fish farm at Government sector, Trout Fish Research and Multiplication Centre (TRMC), a research component of Karakoram Agriculture Research Institute for Northern Areas (KARINA) at Jaglote, District Gilgit was established, where Research for the development of trout fish farming is being carried out. The whole of the population (where trout fish were reared for commercial purposes and the govt. farm) were selected for data collection purposively in order to get the exact estimated costs required for commercial trout fish farming.

* PARC, Technology Transfer Institute, Gilgit, Northern Areas Pakistan.
** PARC, Technology Transfer Institute, Tarnab, Peshawar – Pakistan.
Data Analysis
The collected data was analyzed using SPSS for calculation of averages, percentages and cross tabulation. Furthermore partial budgeting techniques was also applied to arrive at the benefits and cost of fish farming.

RESULTS AND DISCUSSION
Farmers Characteristics:
Education, Age, Family Size and Farming Experience of Sample Respondents
Studies in different parts of the world (Perration et al., 1981; Ram, 1980) have reported that literacy status of farmers is an important variable, which influences farmers’ receptiveness to innovation and resources allocation efficiency.

Although the literacy rate plays a significant role in the overall development of human resources, it does not truly reflect the developmental stage of society. Thus the level of human capital formation is generally measured through the mean number of schooling years (Herath, 1980; Sharif, 1983). The data on average years of schooling completed by the sample respondents reveal that one farmer was illiterate, one had education upto five years of schooling, one upto eight years and one farmer had above ten years of schooling.

The study results show that three farmers of the selected sample farmers were in the young age group i.e. between 18 to 50 years and the remaining one was above 50 years. The average age was found to be at 47.5 years. Average family size in the study area was 17 persons comprising 8 male and 9 female members in each household.

One farmer had eight years of trout fish farming experience; three farmers had upto 3 years of farming experience. These farmers have just newly started fish farming.

Income
Data regarding occupation and income sources (on-farm and off-farm) shows that three farmers had private business and one farmer was retired government servant. The farmers were classified on the basis of their monthly income. The data show that two households fell in the income group ranging from Rs.10,000-20,000 and the remaining two fell in the range of Rs. 20,000-35,000 per month.

Farm Characteristics
Land, Water Quality and Quantity
Land site is a key factor for fish farming, where ponds and hatchery are to be constructed. The soil should retain water and suitable for construction of ponds. Continuous supply of clean and quality water, quick draining and easy filling of ponds are the pre requisite for trout fish farming. Yamaha (1991) stated that for expansion of trout culture, adequate year-round supply of quality water should be made available. Rainbow trout culture requires a permanent supply of water with temperature ranging from 10 to 20°C, and optimum temperature of 15-18°C (Yamazaki, 1991).

In the study area, water quality and temperature is favourable round the year for fish raising. Beside this, land owned by the farmers also fit for construction of ponds.

Hatchery
Size, capacity and the type of hatchery depend on the quality and quantity of water and demand for fry to produce the table fish. Silt-free, clean and cold water are necessary in the hatchery for incubation of eggs and rearing of the fry.

In the study area, TRMC and one respondent had spring water sources due to which they raised eggs, fry or fingerlings. However, no local dealer was available for providing eggs and fry fingerlings and only TRMC was the reliable source for providing fingerlings.

Ponds
Culture ponds must have good circulation of water and easy to clean. The shape of the pond varies from elongated rectangle type to circular type and irregular type. However, the elongated rectangular type involves low construction cost and efficient use of water and easy to clean compared to any other type of ponds (Yamaha, 1991).

In the study area, one farmer constructed earthen pond with the justification that incidence of disease attack were low in the said ponds. Other ponds of the sample respondents were made of concrete and rectangle shape with good water circulation.

Feeding
In the study area there was no reliable source of feed and farmers relied on their own prepared feed pallets. In addition to this, all the farmers practiced manual feeding. It was noted during the survey that only TRMC had some required equipments for trout fish culture otherwise all the respondents were lacking the equipments required for fish culture.
Fingerlings Availability
The breeding season of trout is from December to February. In the study area, TRMC was the only source of fingerlings for the farmers while a farmer in Gilgit also produce fingerlings for his own farm. The price of fingerling of average size upto 3 mm with 1 gram weight was Rs.2.00/fry (available from mid February to mid March) while fry of 5 gm weight was Rs.3.00 (available from mid March to April end).

Market
Access to market is one of the factors to be kept in mind before initiating any economic activity. Rainbow trout is widely accepted as food fish of high quality (Martyshev, 1983). The farmers were of the view that in area, demand for trout fish is high. However, due to the absence of established market in the area, the farmers brought their fish to the roadside markets and sold to the consumers.

Fish Disease
The sample respondents were of the view that the climate is favourable for raising fish and the disease incidence is lower in fish ponds. However, if there is outbreak of any disease then the area lacks the diagnosis facility

Cost and Benefit Analysis
Capital Fixed Cost
The initial capital requires to start trout fish farming was estimated at Rs.136,500/- having the capacity to produce 1130 Kgs of fish per year. However, the capital cost was depreciated by dividing on economic life of each asset and the capital cost came to Rs.20,250/- (8% of the total cost). The major components of capital cost includes raceway construction, land rent, water system/pipe, store/workshop etc (Table I).

Variable Costs
Variable cost of the trout fish includes feed, watch and ward, fry/fingerlings, maintenance, fuel/electricity etc. (Table I). The total variable cost to produce 1130 Kgs of trout fish was estimated at Rs.244,026/- (92% of the total cost) per annum. The watch and ward constitute the major component of the variable cost (29% of the total cost) followed by feed (28% of the total cost), maintenance and fingerlings (10% each of the total cost). The total cost (fixed cost + variable cost) accounted for Rs. 264,277/- to produce 1130 Kgs of fish per annum. The total revenue from the sale of 1130 Kgs of fish per year was estimated at Rs. 350,300/- and the net revenue came to Rs.86,023/- per annum.

Table I  Cost and Revenue of Trout Fish Farming (Rs/Annum)

<table>
<thead>
<tr>
<th>S.No</th>
<th>Items</th>
<th>Per Kg Cost</th>
<th>Cost/Pond/1130 Kgs</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Land</td>
<td>2</td>
<td>2331</td>
<td>0.88</td>
</tr>
<tr>
<td>2</td>
<td>Raceway Construction</td>
<td>2</td>
<td>1867</td>
<td>0.71</td>
</tr>
<tr>
<td>3</td>
<td>Water System/ Pipe</td>
<td>1</td>
<td>804</td>
<td>0.30</td>
</tr>
<tr>
<td>4</td>
<td>Store/Workshop</td>
<td>1</td>
<td>1433</td>
<td>0.54</td>
</tr>
<tr>
<td>5</td>
<td>Net</td>
<td>1</td>
<td>1551</td>
<td>0.59</td>
</tr>
<tr>
<td>6</td>
<td>Graders/Balance/Tanks etc.</td>
<td>4</td>
<td>4717</td>
<td>1.78</td>
</tr>
<tr>
<td>7</td>
<td>Other (Tub, Bucket, etc.)</td>
<td>7</td>
<td>7548</td>
<td>2.86</td>
</tr>
<tr>
<td></td>
<td>Initial Capital Cost</td>
<td>18</td>
<td>20250</td>
<td>7.66</td>
</tr>
<tr>
<td>8</td>
<td>Feed</td>
<td>65</td>
<td>73704</td>
<td>27.89</td>
</tr>
<tr>
<td>9</td>
<td>Glassware/Chemicals</td>
<td>5</td>
<td>5273</td>
<td>2.00</td>
</tr>
<tr>
<td>10</td>
<td>Fuel/Electricity</td>
<td>6</td>
<td>6987</td>
<td>2.64</td>
</tr>
<tr>
<td>11</td>
<td>Oil/Medicine etc.</td>
<td>2</td>
<td>2001</td>
<td>0.76</td>
</tr>
<tr>
<td>12</td>
<td>Fingerlings</td>
<td>24</td>
<td>26998</td>
<td>10.22</td>
</tr>
<tr>
<td>13</td>
<td>Watch and Ward</td>
<td>68</td>
<td>77119</td>
<td>29.18</td>
</tr>
<tr>
<td>14</td>
<td>Maintenance</td>
<td>24</td>
<td>27247</td>
<td>10.31</td>
</tr>
<tr>
<td>15</td>
<td>Telephone/Communication</td>
<td>13</td>
<td>14805</td>
<td>5.60</td>
</tr>
<tr>
<td>16</td>
<td>Transportation</td>
<td>9</td>
<td>9892</td>
<td>3.74</td>
</tr>
<tr>
<td></td>
<td>Variable Cost</td>
<td>216</td>
<td>244026</td>
<td>92.34</td>
</tr>
<tr>
<td></td>
<td>Total Cost</td>
<td>234</td>
<td>264277</td>
<td>100.00</td>
</tr>
<tr>
<td></td>
<td>Total Fish Kg</td>
<td>1</td>
<td>1130</td>
<td>0.43</td>
</tr>
<tr>
<td></td>
<td>Total Revenue</td>
<td>310</td>
<td>350300</td>
<td>132.55</td>
</tr>
<tr>
<td></td>
<td>Net Revenue</td>
<td>76</td>
<td>86023</td>
<td>32.55</td>
</tr>
</tbody>
</table>

Source: Survey data, 2004
CONCLUSION AND RECOMMENDATIONS

This study was carried out at the Trout Fish Research and Multiplication Centre (TRMC), Jaglote and the private farmers ponds to estimate cost of and return from trout fish farms. The study concluded that Northern Area of Pakistan is technically sound for trout fish culture. With regard to economic feasibility, the preliminary analyses carried out, show very positive results from the private sector. Trout fish farming provides a great opportunity for exploiting the abundant source of cold water in Northern Areas. However, a market should be established before promoting trout production. The demand for trout fish exists in Northern Area and also in the other parts of Pakistan. At present domestic trout consumption is limited to certain hotels, restaurants and a few households of Northern Areas with higher living standards.

Based on the findings of the study and field observations the following recommendations are made:

i. Training in trout fish farming be imparted to the interested farmers/entrepreneurs.
ii. Availability of fingerlings in the area to the farmers.
iii. Availability of quality feed in the market be assured.
iv. Assuring the management of marketing system.
v. Research for the development of trout fish farming is the need of the time.

REFERENCES


