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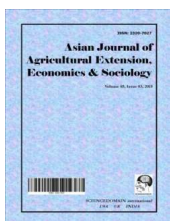
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Livelihood Analysis of Ornamental Fish Producers in Mumbai and Thane Districts of Maharashtra State

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Authors' contributions

This work was carried out in collaboration between both authors. Authors BY and AS designed the study, performed the statistical analysis, wrote the protocol and the draft of the manuscript. Both authors read and approved the final manuscript.

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ABSTRACT

The present study was conducted to assess the livelihood status of ornamental fish producers in the Mumbai and Thane districts of Maharashtra. A total of 30 ornamental fish producers were taken as the sample out of 90 for present study of which 22 are men and 08 are women. The semi-structured interview schedule was prepared as per the livelihood profile of the Department for International Development (DFID) framework. The socio-economic status indicates that the majorities of the producers were literate, middle-age group and had more than 05 years of experience. The sustainable livelihood framework indicates five type of capital i.e. natural, physical, financial, human and social capital with 05 indicators each. Primary data were collected through surveys using semi structured interview schedules and stakeholder meetings. Altogether 30 ornamental fish producers out of 90 as per MPEDA (2012) from Mumbai and Thane districts were interviewed once during the study. The study revealed that the normalized mean score of natural, physical, human, financial and social capital was 0.31, 0.70, 0.56, 0.39 and 0.49 respectively. Further, the pentagon diagram of the DFID model indicated the higher score of physical and financial capital in the districts signifies that

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the location advantage as Mumbai is metropolitan city and Thane is rapidly developing adjacent to Mumbai with high demand for ornamental fishes. It can be seen that natural, human and social capital relatively plays a lesser role in the production activity. For improving social capital, the formation of cooperative societies of the ornamental fish producers as well as SHG's or producer's company will be most appropriate measure. Human capital can be improved by organizing training in sector of ornamental fisheries like breeding, feeding, disease management and marketing and export for entrepreneurs, technicians and skilled and unskilled labor which will also increase the income of the producers.

Keywords: Ornamental fish producers; livelihood analysis; DFID model; Maharashtra.

1. INTRODUCTION

Ornamental fish breeding, rearing and production have become emerging and lucrative aquaculture venture. With the increase in demand for ornamental fishes especially in USA, Europe and Japan, many countries in Asia have started capturing and culturing ornamental fishes. Estimate shows that nearly 60% of the international trade in ornamental fish originates from developing countries mainly from Asia [1,2]. The entire industry, including accessories and fish feed, is estimated to be worth more than the US \$14 billion. More than 2,500 species are traded globally and some 30-35 species of freshwater fish dominate in the international market [3].

However, India's share in ornamental fish export is negligible and mainly dominated by wild varieties of fish from North Eastern states. There is a vast opportunity for growth of ornamental enterprise in domestic trade. As per studies, the domestic trade of aquarium is reported to grow at 20% annually [4]. The government body with the mandate to encourage the breeding and export of fish from India has named the innovative endeavor 'Rainbow Revolution'. Marine Products Export Development Authority (MPEDA), National Bank for Agricultural and Rural Development (NABARD) and National Fisheries Development Board (NFDB) along with Indian Council of Agricultural Research (ICAR), Central Institute of Fisheries Education (CIFE), State Agricultural Universities, College of Fisheries Sciences in respective states, Krishi Vigyan Kendra (KVK) and NGO'S are the agencies working for development of ornamental fish enterprise.

There are few studies which have shown how the ornamental fisheries are taken up as an enterprise and resulted in improved livelihoods of people. Shaleesha and Stanley studied the involvement of rural women in ornamental fish

farms in Tamilnadu and found that it is preferred largely due to its location adjacent to the homes and earning a regular income [5]. They also suggested that by linking the women with credit, technology, infrastructure, training and trade, such enterprises can become a powerful tool in improving the livelihoods and economic security of the rural poor. Abenakyo has reported about the relationship between social capital and livelihood enhancing capitals among smallholder farmers in Uganda and found that there was a positive relationship between level and dimension of social capital and access to livelihood assets implying that strengthening social capital is a powerful way to improve communities and requires consistent and effective approaches to build and reinforce the social and human capital [6]. Swain has reported about a project of an ornamental fish enterprise for livelihood security for Self Help Group (SHG's) for women in Odisha [7]. Studies by Remeshan and Shaktivel have reported about the development of ornamental fish enterprise through KAVIL (Kerala Aqua Venture International Limited) and stressed towards creation of SHGs and special schemes for unemployed women [8].

Most of the studies and projects which have been taken up concerning ornamental fisheries have reported improvement in livelihoods of the people. However, these studies have credited the success largely due to the increased and regular incomes this business provided. It is true that financial capital is a major component in the context of livelihood. But, as per Chambers and Conway livelihood is not just financial component but comprises the capabilities, the assets i.e., natural, physical, human, financial and social capital, the activities and the accesses to these mediated by institutions and social relations that together determine the living gained by the individual household [9]. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or

enhance its capabilities and assets both now and in future, while not undermining the natural resource base [10].

The Government of India has identified ornamental fish sector as one of the thrust areas for generating employment opportunities and augmenting our foreign exchange earnings. The Government of India through Marine Product Export Development Authority (MPEDA) has identified Maharashtra state for development of Rainbow Revolution because of favorable climatic conditions along the Western Ghats and huge domestic market in Mumbai metropolitan area as well as facilities for export and import trade. The total potential freshwater area in Maharashtra is 3.0 lakh ha.

With this premise it is necessary to explore and assess different livelihood capitals i.e., natural, physical, human, financial and social of the people involved in the ornamental fish production enterprise. Accordingly, this study has been taken up to analyze the livelihoods of ornamental fish producers of Maharashtra state as a major objective.

2. MATERIALS AND METHOD

The study was carried out during the period November, 2014 to January, 2016, in the northern coastal districts of Maharashtra, viz., Mumbai and Thane. Primary data were collected using semi structured interview schedule and stakeholder meetings. A total of 90 ornamental fish producers are registered in Thane (n=32) and Mumbai (n=48) with MPEDA as per its report of 2012. Out of these, 1/3rd of the ornamental fish producers were selected randomly from Thane (n=12) and Mumbai (n=18) districts.

The livelihood analysis was conducted as per the DFID livelihood framework and each livelihood capital was assessed on 5-point Likert scale for its presence and availability by the ornamental fish producers. Each capital had five indicators

as follows. Natural capital (Land, water source, natural live food, environmental conditions and access to natural ponds and rivers), Physical capital (General physical facilities: education, health, market, drinking water, electricity; Fisheries facilities: Water supply for fisheries, transportation, input suppliers, market for fish selling, electricity), Financial capital (income, credit, expenditure, savings, assets), Human capital (educational status, technical knowledge in ornamental fisheries, training and extension services, skilled labour, casual labour) and Social capital (organization participation, social status, occupational status, participation in social activities, information access).

All the components related to natural, physical capital were assessed for their availability on 5 point Likert scale ranging from no availability (score 0) to very high availability (score 4) [11]. The components of human and social capital were assessed on whether they were very low (score 0) to very high (score 4) along with some components of financial capital viz. income, expenditure and assets. With this, a average maximum score of 120 (4 x N i.e. 30) for each respondents could be achieved. The score given by each ornamental fish producers were summed up to have score of 30 ornamental fish producers.

The primary data obtained was normalized and rescaled from 0-1 using the formula;

$$IndexS_i = \frac{S_i - S_{min}}{S_{max} - S_{min}}$$

Where,

- IndexS_i = normalized value of an indicator
- S_i = actual value of same indicator
- S_{min} = minimum value of same indicator
- S_{max} = maximum value of same indicator

Thus, the index for livelihood capitals study ranged from 0 (very low) to 1 (very high) as follows;



To study the relation between different livelihood capitals correlation between the different capitals was computed using Pearson correlation coefficient. Pearson product-moment correlation coefficient, also known as *r*, *R*, or Pearson's *r*, a measure of the strength and direction of the linear relationship between two variable that is defined as the (sample) covariance of the variables divided by the product of their (sample) standard deviations. Pearson's *r* can range from -1 to +1. An *r* of -1 indicates perfect negative relationship between variables, an *r* of +1 indicates a perfect positive relationship between variables and *r* of 0 indicates no linear relationship between variables.

The working formula for *r* is given by,

$$r = \frac{n\sum x_i y_i - \sum x_i \sum y_i}{\sqrt{n\sum x_i^2 - (\sum x_i)^2} \sqrt{n\sum y_i^2 - (\sum y_i)^2}}$$

Where,

x and *y* = measurement on variables *x* & *y*.
n = no. of pairs of observation, i.e. sample size

To test the hypothesis if there was a significant difference between means of the all the capital of livelihoods t- test was done. The working formula for t-test is given by

$$t = \frac{\bar{x} - \bar{y}}{s \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

The statistical decision was taken If calculated value of *t* is greater than or equal to the table value of *t* at the specified level of significance, reject the null hypothesis or accept the alternate hypothesis at that level, otherwise accept it.

3. RESULTS AND DISCUSSION

Socio-economic characteristics of the respondents ornamental fish farmers are presented in Table 1.

The livelihood components score and indices of ornamental fish producer of Mumbai and Thane districts with reference to all 5 capitals are presented in Table 2.

It is clear from Table 1, physical capital scored high. Mumbai being a metro city and Thane being a neighboring city of a metro it was seen that facilities for education, health, drinking water, electricity had high scores. Even the fisheries related physical facilities like water supply for fisheries, transportation, and presence of input suppliers, market availability were scored high.

Table 1. Distribution of respondents based on their socio-economic characteristics (n=30)

Variables	Categories	Frequency	Percentage
Age (years)	21-30	1	3.33
	31-40	14	46.67
	41-50	12	40.00
	51-60	3	10.00
Education	Higher secondary	5	16.67
	Diploma	3	10.00
	Graduate	19	63.33
	Post graduate	2	6.67
	Fisheries graduate	1	3.33
Gender	Male	22	73.33
	Female	8	26.67
Family type	Joint	19	63.33
	Nuclear	11	36.67
Family size	< 4 members	17	56.67
	> 4 members	13	43.33
Occupation	Primary occupation	14	46.67
	Secondary occupation	16	53.33
Experience:	0 - 4 years	06	20.00
	5 - 8 years	18	60.00
	9 - 12 years	04	13.33
	12 - 16 years	02	6.67

Table 2. Livelihood capitals components and average scores

Capital	Components	Component score	Average component score	Inference
Physical	Educational facility like school	0.77	0.70	High
	Health facility- Primary health center	0.60		
	Market facility	0.70		
	Drinking water	0.64		
	Electricity	0.68		
	Water supply for aquaculture	0.62		
	Transportation facility	0.68		
	Presence input suppliers	0.78		
	Market availability for fish selling	0.76		
	Infrastructure like electricity and telecommunications	0.74		
Financial	Income	0.67	0.56	Medium to high
	Credit	0.50		
	Expenditure	0.53		
	savings	0.50		
Social	assets	0.60	0.49	Medium
	Organization participation	0.62		
	Social status	0.47		
	Occupational status	0.43		
	Participation in Social activities	0.55		
Human	Information access	0.37	0.37	Low to medium
	Educational status	0.59		
	Technical knowledge in ornamental fisheries	0.46		
	Training and extension services	0.47		
	Skilled labor	0.25		
	Casual labor	0.17		
	Training details of owner	0.30		
Natural	Land	0.43	0.31	Low to medium
	Water resource	0.39		
	Live food availability	0.23		
	Environmental/Climatic conditions	0.33		
	Access to natural ponds / rivers etc.	0.17		

With reference to financial capital the components included income, credits, expenditure, savings and assets. Income was scored high (0.67) followed by assets with score of 0.60. The other indicators like credit, expenditure and savings obtained score of 0.50, 0.53 and 0.50 respectively. Out of the ornamental fish producers studied, 46.67% reported that this was their primary occupation. However, 53.33% of them had this as secondary occupation. The most of the units established after Government of India floated the scheme 'Rainbow revolution scheme' implemented by MPEDA in 2007-08. The other indicators of financial capital like credit, expenditure and savings obtained medium scores and reveal that there is a need of developing institutional mechanisms to improve the access to credit. The

MPEDA does provide the post facto subsidy to the ornamental fish producers. The maximum amount of financial assistance eligible for the cluster units, small and large scale individual units is limited to 50% of the cost of setting up the unit. The initial investments for the construction of ornamental fish unit from own funds or bank or other financial institution which needs to be reviewed as maximum producers were not able secure credit from banks on the basis of project report.

The natural capital indicates the availability of land and the water source has been identified as a key indicator of natural capital with score of 0.43 and 0.39 respectively on 0 to 1 scale. Natural live food availability along with environmental conditions and access to natural

pond and river were scoring very less i.e. 0.23, 0.33 and 0.17 respectively. The role of natural capital in supporting natural capital is limited in the Thane and Mumbai districts because of the fact that Mumbai and Thane city is densely populated where natural resources like water and land are the most premium resources. Similar findings were recorded by Ahmed and Devi [12,13].

In case of physical capital, the availability of basic physical facilities like educational facility (0.77), health facility (0.60), market facility (0.70), drinking water facility (0.64) and electricity (0.68) were showing higher score as both districts are falling in urban areas where these facilities are well developed. Fisheries related to physical capital like water supply for fisheries (0.62), transportation (0.68), presence of input suppliers (0.78), market availability (0.76) and other infrastructure like electricity and telecommunication (0.74) were shown higher score. This indicated that the physical facilities related to fisheries were available in these two districts.

Human capital represents the educational status, technical knowledge in ornamental fisheries, training and extension service, skilled labor and casual labor that enable ornamental fish producers to pursue their livelihood. The educational status has shown maximum score of 0.59 followed by technical knowledge and training and extension service with score of 0.46 and 0.47 respectively. Similar results were recorded by Sarwer *et al.* in the study of livelihood status of fish farmers in Naokhali, Bangladesh [14].

In the present study, seven categories used to determine the level of education. These categories are primary, secondary, higher secondary, Diploma, graduates, post graduates and fisheries graduates. Out of 30 farmers, all the farmers have been educated and maximum farmers have completed higher secondary education. It was observed that, maximum per cent of ornamental fish producers (63.33%) were educated up to graduates. This could be because Mumbai is a metropolitan city and adjacent to Thane districts. Similar results were documented by Devi *et al.* [13]. Majority of the men and women involved in the ornamental fish production and trade were middle-aged. The age group of 31-40 years consists of 46.67% of producers and age group of 41-50 years consists of 40.00% of the producer indicating the middle-

aged dominance in the ornamental fish production enterprise. Ali *et al.* [15] found that most of the fish farmers belonged to age group of 31-40 years in Bangladesh.

For the present study, families were classified into two types I) Nuclear family II) Joint family. In the study area, 63.33% farmers lived with joint families and 36.67% lived with nuclear families. Joint family was predominant in the study area which also corresponds well with the findings of Ali in Mymensingh district. The family size has considerable influence on the income and expenditure of the family. The family sizes having more than four members were 56.67% and less than four members were 43.33% was estimated and similar to the findings of Devi. The growth of the ornamental fisheries has a direct relationship with experience. In the present study, 60.00% of the farmers were having experience of 5-8 years, 20.00% farmers having experience of 0-4 years followed by 13.33% having experience of 9-12 years.

Social capital in form of organization participation, social status, occupational status, participation in social activities and information access have significantly helped in sharing experiences and knowledge and developing co-operation among the farmer for the livelihood of the ornamental fish farmers. It also plays important role in fostering social change and information sharing which is needed to achieve collective action and in sustaining a social and institutional environment that is ready to adapt and change. The organization participation has shown maximum score of 0.62 followed by participation in Social activities with score of 0.55. Social status, occupational status and information access were the other indicators of social capital with score of 0.47, 0.43 and 0.37 respectively.

The correlation analysis was done to check relation between different capitals and the results of the correlation analysis were presented in following Table 3.

It is clear from the Table 3 that, the financial capital has shown highly positive correlation with physical capital. Also the natural capital has positive correlation with human and social capital. The significance of correlation coefficient has been checked which showed that the correlation between the capital is significant. ($p < 0.05$).

For testing significant difference between the mean values of the various capitals of livelihoods, t-test used as sample size was less than 30. Statistical decision was taken If calculated value of t is greater than or equal to the table value of t at the specified level of significance, reject the null hypothesis or accept the alternate hypothesis at that level, otherwise accept it. The results of the t-test were presented in following Table 4;

It is clear from the Table 4 that, there is significant difference between the natural and physical capital, natural and financial, natural and social capital, physical and financial capital, natural and human & natural and social capital

as reflected by p-value. There is no significant difference between natural and human capital, financial and human capital, financial and social capital & human and social capital ($p < 0.05$).

The overall scores of the different capitals of livelihood which affects the livelihoods of ornamental fish producers are depicted using radar chart in Fig. 1.

The radar chart (Fig. 1) of the livelihood frameworks derived its values from Table 1 and each of the segments of chart describes the various forms of capital that depict the DFID model of livelihoods. The distance from the point

Table 3. Results of the correlation analysis among the scores of the livelihood capitals

Capitals	Natural	Physical	Financial	Human	Social
Natural	1				
Physical	-0.01	1			
Financial	0.27	0.86*	1		
Human	0.66*	0.43	0.51	1	
Social	0.75*	-0.16	0.33	0.33	1

* showed correlation between the capitals

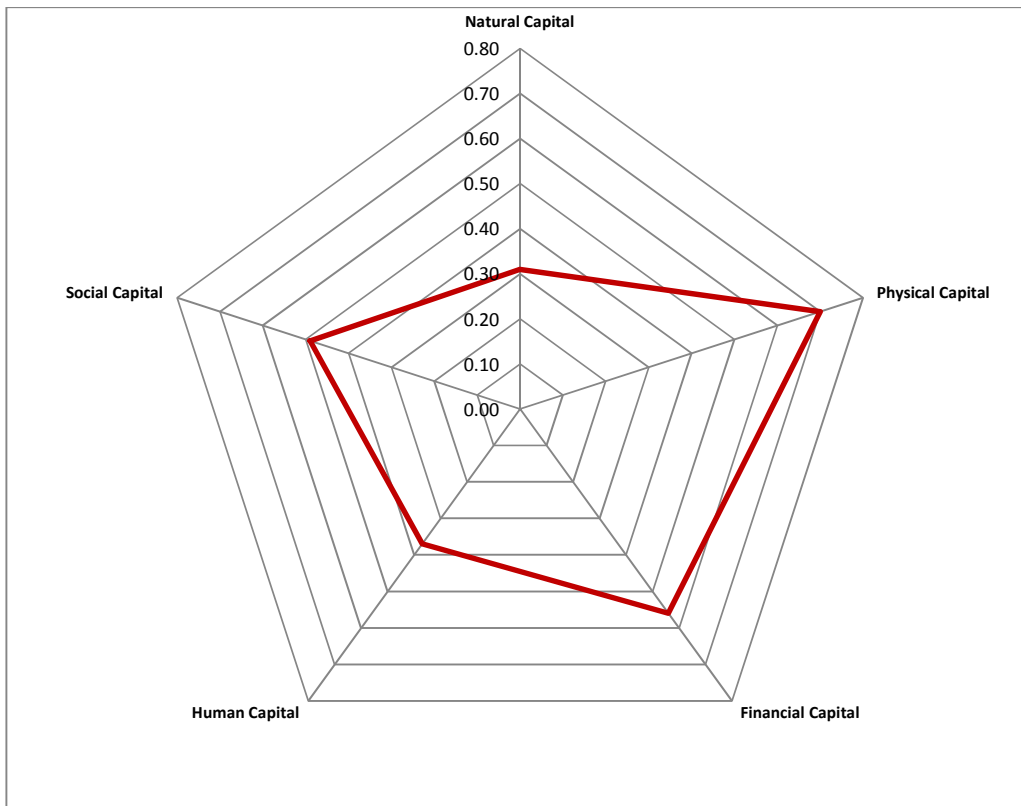


Fig. 1. Livelihood status of ornamental fish producers

Table 4. Comparison between different livelihood capitals

Parameters		t- stat	P-value	Remarks
Natural	Physical	-7.609	2.776	Reject Ho
Natural	Financial	-4.479	2.776	Reject Ho
Natural	Human	-0.627	2.364	Accept Ho
Natural	Social	-2.793	2.446	Reject Ho
Physical	Financial	3.577	2.364	Reject Ho
Physical	Human	4.803	2.446	Reject Ho
Physical	Social	5.390	2.570	Reject Ho
Financial	Human	2.015	2.570	Accept Ho
Financial	Social	2.015	2.570	Accept Ho
Human	Social	-1.810	2.364	Accept Ho

of origin represents the relative importance of the various forms of capital involved in the livelihood framework in the particular location. From Fig 1, it can be seen that natural capital, human capital and social capital relatively plays a lesser role in the ornamental fish production activity in Mumbai and thane district of Maharashtra compared to greater role played by the financial and physical capital.

4. CONCLUSION

In the present study, the analysis of livelihood capital and their indicators signify the livelihood status of ornamental fish producers in two districts of Maharashtra i.e. Mumbai and Thane which clearly indicates the role of each capital asset in development of an enterprise. The radar chart indicates the higher score of physical and financial capital in the districts signifies that the location advantage as Mumbai is metropolitan city and Thane is rapidly developing adjacent to Mumbai with high demand for ornamental fishes. The more emphasis needed to be given on improvement of social and human capitals in Thane and Mumbai ornamental fish sector. For improving social capital, formation of cooperative societies of the ornamental fish producers as well as SHG's or producer Company will be most appropriate measure. Training in different sector of ornamental fisheries like breeding, feeding management, disease management and marketing and export for entrepreneurs, technicians and skilled and unskilled labor which will increase the socio-economic conditions of the ornamental fish producers.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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