

**Socio-Economic Impact of Fish Farming in Indigenous Communities,
Phewa Lake, Pokhara, Nepal**

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DEDICATION

This thesis is dedicated to my parents for thier love, support and dedication.

I love you mom and dad

ABSTRACT

In Nepal fish farming in Phewa Lake has become the alternative way of income for the communities residing around the lakes, rivers and reservoirs. In areas close to water bodies, only communities of untouchables, poor, and indigenous have a tradition in fisheries. So, to increase the economic and social status of the poor, untouchable and indigenous people, fish farming was introduced. After the introduction, fish farming has become increasingly important source of income for the marginalized and indigenous communities especially in Pokhara valley. Before, the development of fish farming activities started, there was social discrimination of the indigenous and untouchables people. However, now the things have changed, these communities are producing fish that other people buy from these communities. These communities are benefitting from fish farming and fish related activities and poor are now able to send their children school. After the successful introduction of fish farming in the lakes of Pokhara valley, the same technique was adopted in the Kulekhani reservoir, for the settlement of the people of the communities that was displaced by the development of hydropower in Kulekhani area. Thus, Fish farming and fish related activities have helped the poor, indigenous and marginalized communities by providing income, food, security and a healthy environment, where they now live without being discriminated. The cooperative organization has played a significant role in helping the untouchable and poor communities with fish and fish related activities. With the development of fish farming: Community participation, group cohesiveness, community mobilization are among the things that have contribute a positive change for the untouchable people. An awareness program for the preservation of the wetland and indigenous fish species, fingerling supply for the poor people and removal of the weed from the water are the main important activities of the cooperative. Besides, the cooperative has helped the fish farmers, with buying and providing the necessary inputs and to secure good prices for the fish. Fisher's cooperative and the Government organization are putting its effort to enhance the aquaculture development throughout the country. Government organizations are providing training for the new comers in fish farming activities and providing free fingerlings to the poor people. This has

helped in enhancing aquaculture development and attracts people to the fish farming business and fish related activities. It also contributes to country's economy.

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ABBREVIATIONS

CBS	: Central Bureau of Statistics
DFID	: Department For International Development
DOFD	: Directorate Of Fisheries Development
FAO	: Food and Agriculture Organization
FRC	: Fisheries Research Center
IAAS	: Institute of Agricultural and Animal Science
ICIMOD	: Interational Center for Integrated Mountain Development
IRDC	: International Research and Development Center
LI-BIRD	: Local Initiatives for Biodiversity and Research Development
MoAC	: Ministry of Agriculture and Cooperatives
NARC	: Nepal Agriculture and Research Council
UNDP	: United Nation Development Program

CHAPTER - I

1.0 Introduction

The aim of this paper is to study the potential of the fish farmer to raise their living standard by developing fish farming in the lakes, reservoir and the pond. This study also focus on the people who are marginalized from the community so called “untouchable” in Nepal and those do not have any kind of other sources of income rather than fishing. This study mainly focuses on the social aspects related to the fish farming and aquaculture development in Nepal. Nepal has rich water resources and most of the people who do not have any other sources of income depend on the wetland. Traditional fishing and subsistence fishing exists in Nepal. According to the Gurung (2003), about 142000 males and 223000 females are engaged in subsistence fishing in lakes, reservoir and other sources of water. Therefore, traditional and subsistence fishing as well as Sport fishing in all water resources also exists in Nepal (S.K,Wagle. et al, 2007).

The study area of this thesis is the Khapaudi area, Pokhara valley, Lake Phewa, which is located in the Kaski district and situated in 82.5° E and 8.1° N and 742m above the sea level (see fig.1). Pokhara valley is regarded as the most beautiful city in Nepal, rich in natural beauty and a popular the destination for tourists.

This study aims towards a better understanding of how fish farming can benefit for local people and communities. The study explores what kind of obstacles does potential fish famers meet in terms of access to water bodies, capital, technology, and knowledge The questions are addressed through a qualitative study, based on observation, literature studies and interviews with local people. It also focuses on the importance of cooperative organization and participatory management created by the fish farmer and the people in the communities residing near the areas of the lake. Cooperative organization and participatory management techniques are important in the management of the lake ecosystem to control the human activities in the lake.

Fish farming has the potential to become an important source of income for the marginalized and indigenous communities. It can also be an important industry for the country's economy. Pokhara valley is rich in water resources, which is an advantage for the people living around the lake . Beside fishery, lake is used for the tourist businesses like boating, kayaking and sight seeing also.

The demand for fish in Nepal is high but supply of the fish to the local fish market is not high enough to meet the demand. Therefore, fish is imported from India without quality assurance. There are few alternatives to imported fish. There is no any statistics that shows how much fish in imported to Nepal from India (FAO, 2005). Therefore, it is difficult to make an exact estimate of the potential fish market in Nepal. The indigenous and untouchable groups of people have limited or no access to the land for agricultural activities (FAO, 2005), and with Nepal as a landlocked country development in income and food supply will depend on fish from lakes, rivers , reservoir and ponds. The water bodies have contributed significantly to sustaining livelihood and survival for those who live close to these water resources. In recent years, it is recognized that these water resources are not only important for household use and irrigation, but they can be the basis for income generation. Fish farming in lakes, reservoir and river, using cage culture technique is gaining importance in Nepal. Hence, there is a possibility of expanding the fish farming in the lakes for the benefit of the poor, marginalized and indigenous people, who do not have any other sources of income. Expansion of fisheries in the whole country will helps to raise socio-economic status of the people as well as the country's economy.

1.1 Objective of the study and Problem statement

The objective of the study is to describe and analyze the present situation of fish farming in selected communities in Nepal. More specifically, the study describes the development and the organization, and points out, some obstacles and possibilities. In particular, the study focuses on access to knowledge, technology and capital and the role cooperative organization

play in this respect. Moreover, the relationship between fish farmers and the authorities are explored.

1.2 Chapter outline

The study is organized in following way: chapter one is the introductory part, provides the background, objective and problem statement, and limitation of the study. Chapter two is about methodology and data collection. Geographical background comes in third chapter which shows the relation to the climatic and ecological condition of Nepal, it further describes about the socio-economic of the ethnic and untouchable community, caste system in Nepal and Nepalese aquaculture and enhancement. In chapter four, the impact of fish farming is explained. Discussion and Conclusion is in chapter five.

1.3 Limitation of the study

The focus of the study is to find out the contribution made by the fish farming for the communities who are marginalized and does not have any other source of income and changing their social status. This study shows the fisheries and aquaculture activities that are being held in Phewa Lake and the status of the people living near to the lake but not the whole picture of the Nepalese fisheries.

Chapter- II

METHODOLOGY AND DATA COLLECTION

2.0 Description of the study area at Lake Phewa, Pokhara

Pokhara valley is the most beautiful city in Nepal, located in Kaski district of Gandaki zone. It has a subtropical climate and lies in altitude of 900 m. Pokhara has own the most of the biggest lakes in Nepal and Pokhara is also known as the “ City of Lakes”. Phewa Lake is situated in 742 m and is the second biggest lakes in the country. The inlet to the Phewa Lake is from the Harpan khola and Andheri khola and has a single outlet to the Pardi khola that flows towards down to Seti khola . Although, there are many lakes in Pokhara valley but fish culture existed only three lakes Phewa, Begnas and Rupa.



Figure 1: Map of Nepal showing study area (Pokhara) and Phewa Lake

The lake covers the area of 5.23 Km² and watershed area of 110Km² it has the length of 17 km and width of 7 km. The lake has the depth of maximum 24m and minimum depth of 7m (Rai et al, 1995). The Phewa Lake has a number of uses like fishing, boating, hydro electricity and irrigation.

Phewa Lake is known for its scenic beauty in one hand and in the other it is the home for the many aquatic organisms because the lake contains chlorophyll and phosphorus and is the food for the animals. The main species that are cultured in the cages of the Phewa Lake are Planktivorous big head carp (*Aristichthys nobilis*), zooplankton feeding silver carp (*Hypophthalmichthys molitrix*). Rohu are placed in the cages of with this species of fish as a cleaning agent (Wagle, S.K. et al, 2007). These species are the most preferable fish species that are kept in the cages, because this species do not rely on external feed, are totally extensive and live on available plankton in the water. Thus, this species are targeted for fish farming to help the poor people and to alleviate poverty. The introduced aquaculture technique is the floating cages in the lakes of Pokhara valley mainly on Phewa Lake with the big head carp and the silver carp. Eventually, people living near to the Rupa Lake and Begnas Lake adopted cage culture technique for income generation and survival.

2.1 Nature and Sources of data

There are two types of methodology that can be used in scientific research and that is qualitative and quantitative. Here in this paper qualitative method is used considering the nature of the problem. The problem is to find out the contribution made by the fish farming in the indigenous communities. So, in this case, interviews, conversation and participation of the people is important to be defined by themselves about the impact of fish farming in their lives. Therefore, this is a social phenomenon so qualitative method of study seems reasonable in this paper.

2.2 Data sources and data collection

Data collection is the important part in the research. There are two types of data used in the research: primary data and the secondary data. In this paper both primary and secondary data are used. The interviews, conversation, observation are the primary data for this paper and newspaper articles, journals and article are the secondary data that are used in this study.

Interviews techniques are used with the farmers for the collection of data for this study in Pokhara valley, Khapaudi village. The main aim of choosing this village is because the first fish farming culture was started from this village in order to provide the alternative way of income generation for the people living in this village suffering from the nomadic life. So, choosing this site will provide the answer to the problem of the study. Answers from people of this area helps in analyzing the situation of the fish farming in Nepal. Moreover, the contribution made by the fish farming could be analyzed from this chosen site (field visit, 2013)

Interviews were conducted with all the fish farmers in the village, the head of the cooperative (Harpan Phewa Matsya Sahakari Sanstha Limited), the chairperson of the village and government officers from Fisheries Research Center Pokhara. All the information was collected using the interview technique. Semi-structured and unstructured types of interview techniques were used for the collection of the information for the study.



Figure 2: Cage fish farming in Khapaudi village, Phewa Lake

Field visit, 2013

The interview was successful to gather most of the information from the respondents like, the contribution of the cooperative and research station Pokhara in helping fish farmers, the number of cages per family and income earned through the fish farming and changing their livelihoods, fishing activities and management measures and access to the funds and free fingerlings to the fish farmers. Before the interview was conducted with the fishers and the government officials, the purpose of the interview were explained to them. The fish farmers and the government officials were very much cooperative and helpful and provided the necessary information that was in need for the study.

The information collected through the interviews were validated with the published and unpublished reports. The aquaculture reports, survey to the site previously were gathered, annual reports and aquaculture policy are obtained from the Internet.

Chapter III

BACKGROUND INFORMATION

3.0 Geographical, Climatic, Ecological, Socio-economic and Political conditions

Nepal is a land-locked country located in South Asia between China in the north and India in the south, east and west. The border between Nepal and India in open and business activities takes place across the border.

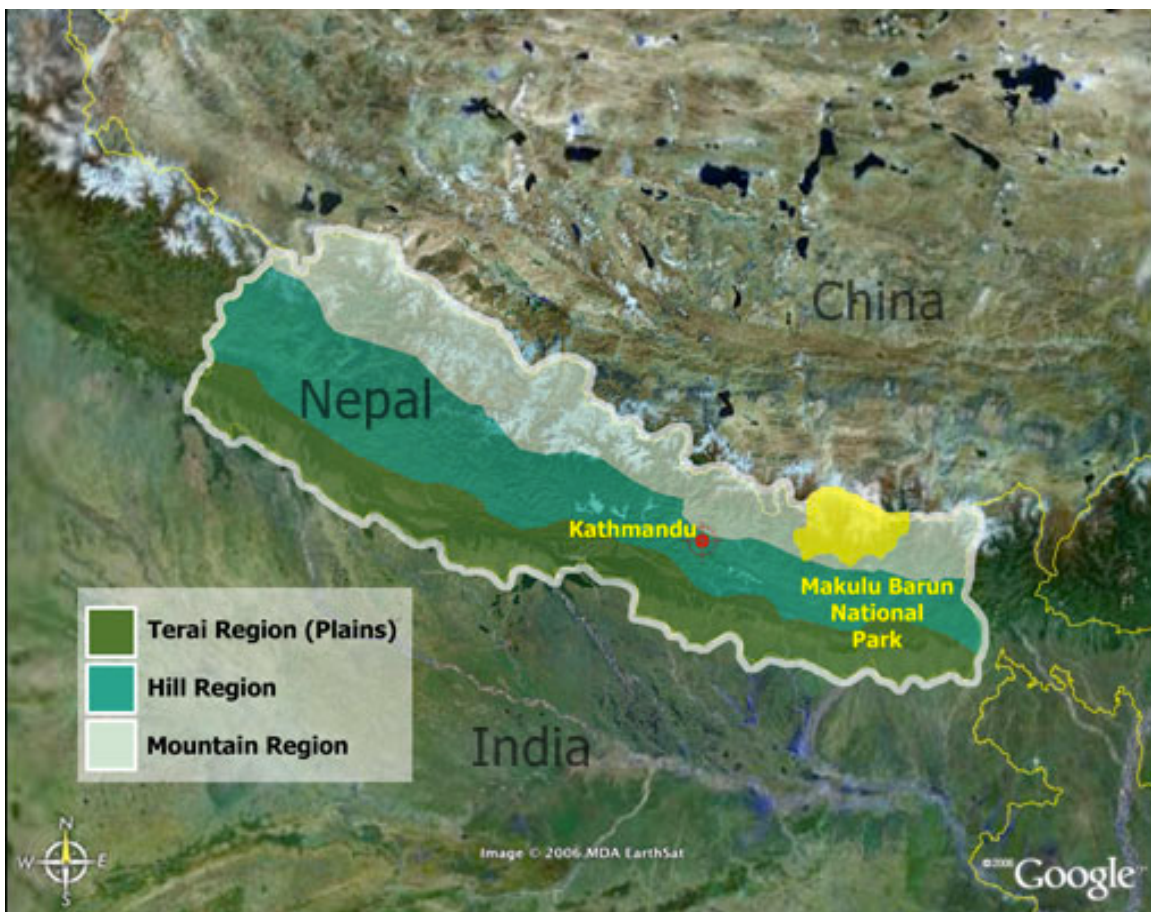


Figure 3: Map showing the Ecological regions of Nepal

Source: International Center for Integrated Mountain Development (ICIMOD)

The total land area of Nepal is 147,181 sq. km including water area of the country that is 3,830 sq. km. Nepal's ecological zones run east to west about 800 km along its Himalayan axis, 150 to 250 km north to south, and is vertically intersected by the river systems. The

country is divided into three main geographical regions: Himalayan region, mid hill region and Terai region. The highest peak in the country is Mount Everest (8,848 m) while the lowest point is in the Terai plains of Kechana Kalan in Jhapa (60 m).

Nepal is so called “waters towers of South Asia” with its 6,000 rivers, which are snow-fed or dependent on rain. The major rivers include Mahakali, Karnali, Narayani and Koshi rivers originate from the Himalayas. Medium-sized rivers like Babai, West Rapti, Bagmati, Kamla, Kankai and Mechi originate in the Midlands and Mahabharata range. A large number of seasonal streams, mostly originating in Siwaliks, flow across the Terai.

3.1 Climate in Nepal

There are huge, seasonal, and geographical variations in climate in Nepal. Temperature exceeds up to 45 degree in the south in summer and 19-20 degree in winter. In the north the lowest temperature is 0 degree in winter and 20-25 in summer. There are five seasons in Nepal: summer, winter, monsoon, autumn and spring. The temperature drops 6 degree in every 1000 m gain in altitude. The climate of Pokhara (study area) is sub tropical. In summer the average temperature is 25- 35 degree and in winter it goes below to 0-15 degree.

3.2 Ecological conditions

Nepal has a rich ecological diversity. About 80% of the land covered by hills and mountains higher than 500m above the sea level, while Terai region (plain land) covers the remaining 23% of the land. This broad division of the land in to ecological zones is based on the altitude, crops and the livestock production system.

Terai is defined as the plain land with the elevation of less than 500m above the sea level. This region is rich with fertile land and forest areas. Because of the plain landscape and fertile soil, Terai areas are known as the most productive areas in Nepal.

The hilly areas in Nepal covers, 42% of the land in the altitude ranging from 500m to 2500m. The geology of this region consists of mudstone, sandstone, siltstone and conglomerate. The land in this region is very fertile, due to the disposition of the sediment by the rivers in this region.

Mountainous area covers 35% of the land area, with an altitude of 2500m and above. The fertile soil and the road to the Tibet make this area more populated. Environment degradation is the main problem of this area in recent years, because the capital city is located in this region. This region is the centered point for education, business, health and all sorts of facilities. The middle mountainous area located in this region is occupied with high steep slopes with the low productive areas characterize this region. The Himal zone located in this region is covered with snow. This region is the boundary for Nepal and Tibet to the north.

3.3 Inland water resources: Fresh water resources

We live in a planet of water; the water covers almost 70% of the surface of the earth but only 2.5% of the water on the earth is fresh water. Rain, snow and glaciers are the source of the fresh water. Freshwater ecosystems have a higher species density than any other terrestrial or marine habitat. 2.4% of globally known species live in fresh water (PRC, 2007).

The fresh water in Nepal is coming from the glaciers and snow in Himalayas and from the rain. Nepal has only inland water like lakes, rivers, ponds, dams, and irrigated rice fields, swamps. Fresh water covers 5% of the surface area of Nepal.

People in Nepal use the water resources like lakes, man made ponds, village ponds, rice fields, swamps, reservoir for aquaculture. Natural lakes and rivers are estimated to offer various aquaculture developments in Nepal. Total water resources of 818000 (ha) only 400000 (ha) of are available for the fish production (Swar, Pradhan 1992). Village ponds in the plain region are used in aquaculture activities but no natural waters are made available for the aquaculture activities (Swar, Pradhan 1992).

Table 1: Estimated Water surface area in Nepal

Resource Details	Estimated Area (ha)	Coverage Percent	Potential for Fisheries (ha)	Remarks
Natural Waters	401500	48.8	-	-
Rivers	395 000	48.0	-	-
Lakes	5 000	0.6	3 500	-
Reservoirs	1 500	0.2	78 000	Estimated to be developed in the future
Village Ponds	6 735	0.8	14 000	Projected to be added
Marginal Swamps	12 500	1.4	12 500	
Irrigated paddy Fields	398 000	49.0	100 000	It is increased to 1 million hectares (2007/08, DoA)
Total	818 500	100		

Source: Directorate of Fisheries Development (DoFD, 2002)

The water resources in Nepal are uncontrolled and unmanaged. The human intervention in the water like washing, cleaning, construction of power project, disposal of industrial chemicals has altered the habitat of the aquatic animals. The major rivers supporting the habitat of aquatic life are Koshi in the east, Karnali (the longest river in Nepal) in the western part of Nepal and Gandaki in the central region.

3.4 Socio-economic condition of marginal groups in Nepal

Religion and caste system has a great influence in Nepal. Caste and religion is structured in a pyramid model. Brahmin is in the top of the pyramid whereas, the untouchables (Dalit) at the bottom level.

Hindu caste system is categorized as: four main castes and thirty-six varnas in Nepal. The four castes include Brahmin, Kshatriya, Shudra and Vashiya and the thirty-six castes are categorized by the profession they do.

However, the caste system is divided in to three categories: Tagadhari (twice born), Matwali (liquor drinking) and Pani nachalne (untouchables or Dalits). Tagadhari includes Brahmin, Kshatriya and Thakuri: one of the highest castes in Nepal. Matwali includes most of the Tibeto- Burman and indo- European tribal groups.

The caste system in Nepal was earlier incorporated in the National law in order to incorporate people of different origin and bring them under an umbrella. Each caste has its set of family names given to the members of its community according to their professions. Brahmin and Kshatriya have lands, power and authority. Vaishya are those who do business and gain wealth. Sudras are those who work for the higher castes, they are servants and farmer, farming and earning for the higher castes. The last comes the untouchables, communities that falls under this group are mostly laborers, they do not have their own caste. Their castes are identified from their profession. For example, Kamis (Iron-smiths), Sunars (Gold-smiths), Lohars (Iron smiths), Vishwakarma (Drivers), Nepali (ancestry unfounded), Sarki (Cobbler), Damahi (tailor/musician) etc .

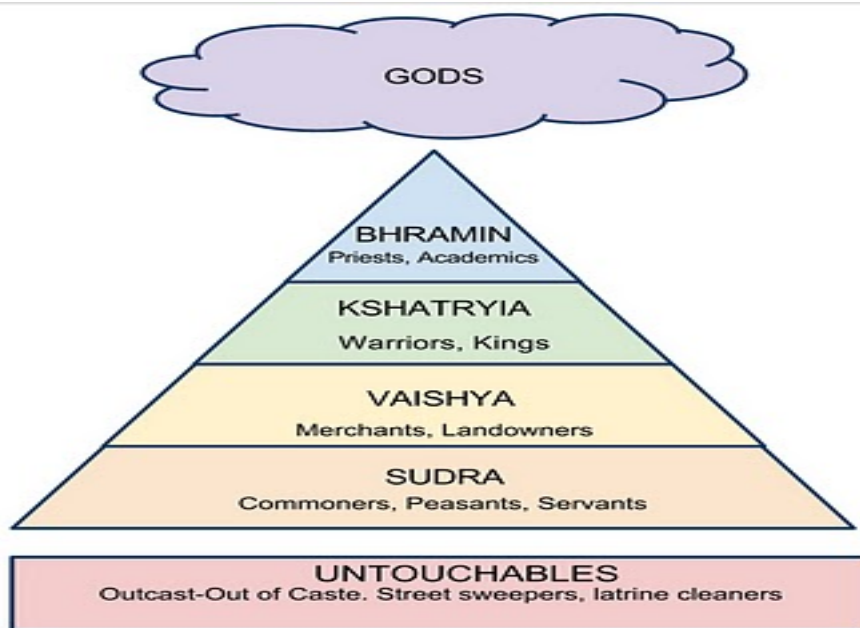


Figure 4: showing Hindu caste system from top to bottom
Source: (Peart, 2011)

Since, Land is the main asset in Nepal, the lack of possession of land poses many difficulties for the untouchables. Most of the untouchables are landless or marginal cultivators, so they seek an alternative way of income: working in construction site, wage earners, seeking employment to abroad and fishing. The problem caused by the landless is difficulty in obtaining the citizenship in Nepal. Land ownership proves that the person is citizen of Nepal. However, without citizenship it is impossible to buy land and get the land ownership.

Social discrimination of untouchables still exists in some rural areas of Nepal. The untouchables are not offered to enter the temples. They are not allowed to drink the water from the common tap in the villages. Moreover, untouchables are not allowed to practice the Hindu culture and norms as the higher castes like Brahmins do.

The economic status of the untouchable is very poor. Majority of untouchables lives below the poverty line in Nepal. According to the World Bank/ DFID, between 1995 and 2003, untouchables are in worst situation of poverty than compared to other castes like Brahmin, Kshatriya and Vaishya. The UNDP 2009, assessment indicates, 95.5% of poor people live in rural areas and the condition of the poor is higher than in the urban areas (Stiftung, 2012). But in the recent years the things have changed. The government of Nepal has granted a political representative to represent the untouchables in Nepal. There are now established many project aiming to raise the living standard for the people in the untouchable communities. The government of Nepal has also reserved a seat for untouchables in government organizations and scholarships in educational sector.

As an example, in Pokhara valley, the Pode and Jalal are the most deprived untouchable community. They live near to the Phewa Lake and their main occupation is fishery. Before the resettlement that followed with the construction of hydropower plant in Kulekhani, they migrated between different places in search for work and a new fishing places. Due to the decline of fish in lake Phewa, because of excessive fishing and eutrophication in the lake (Wagle, S.K. et al, 2007) . The Pode community went to Begnas area for the settlement and people of Jalal community was resettled around Phewa Lake. The main Income for the Jalal people today is through fish farming and capture fishery by the Jalal and for the people of

Pode community, income is generated from capture fishery, which, is dominant in Begnas lake by the Pode communities. As discussed and reported by the fish farmers in Pokhara valley, most of the income are generated by the fish produced in the lake. The major benefit from the fish farming realized by the farmers in recent years is better nutrition and increased household income.

3.5 History of fishing and fish farming in Nepal

Traditionally people in Nepal has used the water resources for drinking, washing, household use and fishing. Fishing was mainly for subsistence and for recreation. . Fishing is the traditional occupation of the people living near to the water resources in Nepal. For poor people living near to the lakes, fishing in the lakes have been an important activities for livelihood and survival of the poor, untouchable and indigenous people with limited or no access to land.

In the past, people used to catch fish with both conventional and non-conventional methods. Use of cast net, bamboo traps, rod line and looping comes to the conventional methods of fishing and use of explosives and poisoning in non-conventional methods (Petr, 1999). Most of the people in Pokhara valley use to carry cast nets and dragnets to catch fish in lakes of Pokhara valley.

Capture fishery, as the main activity carried out by the several communities in Nepal. Hence, there is not any rules and regulation that is implemented for the capture fishery. Capture fishery is only one important activity for the source of animal protein for the poor and rural people (Swar, 2002). The major rivers for Capture fisheries are: Arun river, Sunkoshi river, Narayani River, Trishuli River, Saptakoshi and Karnali river. The traditional fishing communities also capture fish from man-made pond and from the natural water, as fishing is a traditional way of feeding the families and supporting their livelihood (Swar, 2002).

Reservoir fisheries are another source of income and animal protein that can be found in Nepal. The reservoirs are not built for the fishery activities, but people started to fish in

lakes and reservoir for their consumption and income generation (Shrestha et, al., 2002).. However, there is still no any proposed plan from the government to make the reservoir for dual uses, fishery and hydropower . The management and development of the fisheries can be easily be handled in reservoir and lake fisheries because of the nature of the water and therefor these water bodies can have a great production potential.

There exist two types of reservoir in Nepal, one with the running water and traditional reservoir. The number of running- water reservoirs is small compared to the traditional type reservoirs. Running water reservoirs are mainly for irrigation purposes and hydropower generation. There are many reservoirs in Nepal for production of hydro-electricity, of which the Kulekhani reservoir (220 ha) is the most important (Gagan B.N. Pradhan, 2009). Kulekhani (Indrasarowar) reservoir is the first man made reservoir in Nepal. In addition to the hydro-electricity production, the Kulekhani reservoir is important for fishery and aquaculture fort the local people

In connection to the resettlement of the communities displaced by the Kulekhani hydropower project, fish farming techniques was introduced and the experiences showed that , reservoirs could be used for fish production and to support the local peoples livelihood (S.K. Wagle et, al, 2010).

In addition to these experiences, in an attempt to raise the social and economic status of the people living near to the shore of the lakes, the Government of Nepal in 1960 introduced new fish farming techniques in Phewa Lake based on cage culture. This was not the first experiences with aquaculture, as it will describe later, the history of aquaculture dates back to the 1940s. However, the introduction took time and the development did not speed up before 1972 (Swar and Pradhan, 1992). After the introduction of the cage culture technique, the same technique spread to other parts of the country, and people in Pokhara; people living in the shore of the Begnas and Rupa Lake also started to use cage fish farming. They adopted the methods and change practices from traditional fishing techniques to modern aquaculture (Sharma, 1979).



Figure 5: map showing major rivers with catchment area

Nepal is the world's second richest country in the fresh water resources. There are many lakes, rivers, ponds and dams, which covers the 48.8% of water surface in Nepal with 49% paddy fields, 1.4% swamps around irrigated fields and 0.8% village ponds. This all water resources covers around 3% of the surface area of Nepal (Petr, 1999).

As far the fisheries in Nepal, the water ecosystem provides the healthy environment for the 186 indigenous and 11 exotic fish species and those are of high economic, environmental and academic value (Swar, 2002). Most of the fish that lies in the category of the indigenous species, among 59 of them are the cold-water species. Sahar (tor spp), katle (*Neolissocheilus hexagonolepis*) and snow trout (*schizothoraichthys spp schizothorax spp*) are the fish species, which have the high economic value and are important species for the sport fishery and recreational activities and rest of them are fished for the livelihood and for the income generation (Swar, 2002).

The introduced cage culture fish farming technique in Pokhara valley (study area) and later adopted in Kulekhani reservoir, has become more popular in recent years in the whole country. To help the poor and landless people the government of Nepal and UNDP jointly

approached to the new project called “Integrated fish culture and fish development project”. The aim of the project is to search potentiality for the fish production through fish culture in cage, ponds, lakes, reservoirs and paddy fields (Aguru, 1981). There is increasing demand of the fish in but the entrepreneurs and fish farmers are unable to fulfill the demands of the fish. So, to increase the fish farms and meet the demand of the fish, the government of Nepal has put a way forward by establishing fishery development centers in different parts of the country (Aguru, 1981). This has helped by providing seedling to the farmers for fish farming, giving training in selection of the site, construction of the ponds, maintenance of the ponds and pond management (Aguru, 1981). This has helped not only the private fish farmers but also the poor and landless people to start fish farming in different parts of the country (field visit, 2013).

3.6 Fishery and Aquaculture Governance

Fisheries and aquaculture activities are governed by the Directorate of Fisheries Development (DoFD) in Nepal under the Ministry of Agriculture and Cooperatives (MoAC). There is no specific policy implemented for the aquaculture activities in Nepal due to the unstable government in present time and the lack of rules and regulation.

There are three government organizations working for aquaculture development in the country, Institute of Agriculture and Animal Science (IAAS) of Tribhuvan University, Fisheries Research Division of Nepal Agricultural Research Council (NARC) and Directorate of Fisheries Development. These organizations are similar and overlapping, and they work in competitive way instead of working in a cooperative way stating the clear vision and policy. Due to the lack of more general governance framework.

The policy and rules implemented for the wetland conservation have some extent worked for the management of the aquatic species. However, fresh water fishes are not given priority for conservation in Nepal and resulted in declining of the fish. There are more than 200 native fish species weighing 40-50 kg that are documented in 2008 (Gurung, 2013). Fisheries in Nepal are scattered from plain land Terai (southern belt) to thousand meters above the sea

level. People in plain land usually fish on village ponds but no natural water resources are utilized. People in high land use lakes for aquaculture activities but capture fishery in rivers are now have decreased. Such activity led to decline of the native and indigenous fish species. So to conserve the fish species and maintain the water ecosystem, the government of Nepal had passed “ Jalchar Samrachhan Ain 2017”(Aquatic Animal Conservation Act 1961 amended and revised in 1999). The Act, prevents the killing of aquatic animal by unconventional methods and according to the revised Act, construction of dams and reservoir should be merge with the fish hatcheries to save the fish species from declining.

Fisheries in Nepal are artisanal type. People used to fish only for subsistence a years ago. The government as well as the private organization are supporting for the fisheries sector by helping the fish farmers and the people who are new in this sector. The vision of the aquaculture policy is to change the traditional subsistence type of fisheries in to competitive commercial fisheries sector.

To achieve the food security, poverty alleviation and sustainable development in the country and transformation of small aquaculture in to competitive and commercial sector, the government of Nepal has made it effort to support the inland fishery enhancement. The government organizations are providing training to the farmers about the fish farming techniques and this has shown a better result in recent years. A decade ago, fish farming was only concentrated in the southern part of Nepal but now the people in different parts of the country are utilizing the available water resources for fish farming. Fisheries are important source of animal protein, food and income for the poor people. It is estimated that 2% of the people in Nepal are dependent of the fish and fishery activities. As a part of fishery enhancement in inland water, the government started cage culture in joint effort of International Development Research Center Canada (IDRC) for the resettlement of the communities displaced by the hydropower project in Kulekhani. 500 families were displaced during the construction of the project, 231 families adopted cage culture in Kulekhani and remaining others are engaged in fishery activities.

The indigenous and ethnic people of Nepal living around the shores of Phewa lake lived nomadic life due to decline of the fish in the lakes of the Pokhara valley. Their life was hard to sustain. So the Government of Nepal started resettlement for the communities that are homeless, landless and had no any alternative way of income. With this supporting program was successful with the introduced cage culture in Phewa lake.

Capture fisheries here as mentioned also a part of old tradition in Nepal, but currently people and government are not paying much attention to the capture fisheries. As results tradition and culture becomes weaker and has a negative effect in the aquatic ecosystem. Survey and feasibility studies conducted in the rivers for the hydroelectric projects purposes but no attention is given for the aquatic organism in the water (Upadhyaya, 2002). In recent year fisheries surveys are carried out in the major rivers (Koshi, Karnali and Gandaki) of Nepal, which reports capture fishery is estimated to be 215000 tons contributing 44% of the total fish production in the country. But in recent years the yield from the capture fishery has decreased (Upadhyaya, 2010). However, it is predicted that production from aquaculture and capture fishery will be doubled by 2018 through aquaculture promotion and conservation. Fishery contributes 2.72% of the Agricultural Gross Domestic Product (GDP) and 1% percent of the National GDP (Gurung, et al , 2009).

3.7 Establishment of Fisheries Development Centers and Cooperativess

Gill net seining was introduced in 1960's in Pokhara valley. Before the gill net was introduced people of Pokhara valley used cast net for fishing. The fish in the Phewa lake decline due to the over exploitation through use of gill nets. This led the subsistence fisher's to live nomadic life after the depletion of fish resources in Phewa lake. To help and improve the lives of ethnic communities, the establishment of Fishery Research Center was initiated in 1962. The Fishery Research Center Pokhara was responsible for raising the living standards of the ethnic communities through aquaculture development and sustainable fisheries in the valley. Later, The cage culture was started in Phewa lake for the further development of aquaculture activities in 1972 with the help of UNDP and Government of Nepal.

Only establishment of cage culture technique was not enough for the people to understand the fisheries at that time. The fisheries development committee lacks the law, values, norms and beliefs which is called institution. In the absence of these rules, regulation, values and system, fisheries sector or any sector may not reach in to its objectives until and unless the concept of institution is understood. So the necessity of institution was identified for the fisheries development in Nepal at that early stage.

There are many cooperatives established by the farmer's communities in Phewa lake. For the better participation from the fishers and to organize the local fishers, the Phewa Fish Entrepreneur Committee and Begnas Fish Entrepreneur Committee was established. The cooperative also provides the training to manage cage fish culture in the lake. The cooperatives established in this area helps people to carry out their tasks, raising income, fishing, providing training, processing fish and marketing. This institution also helps in negotiating with the government, organizing, leading, managing and governing the people and communities for their better future.

In past years, there were no effective management measures to preserve the lake. However, now the scenario has changed with the time. The farmers and the members from the cooperative are engaged in managing the water resources in the Phewa Lake. Each fish farmers are providing some sum of money (Npr 5000) to help, protect the water of the Phewa Lake. Those who are not able to provide this sum of money are engaged in cleaning activities, like removing the weeds from the lake, involving with the other organization like Li-BIRD, Bhattraai Trust, Seed Foundation and World vision. This organization also helps in cleaning the cage and providing the cage material for the farmers (Wagle,S.K. et al, 2007). The capture fisheries are almost in declining stage in Phewa Lake. The fish grower association of Phewa Lake has regulated the Khapaudi village as non-capture fisheries area. Only member of the cooperative are allowed to engage in capture fisheries.

Fishers have organized themselves and formed a group to preserve the native species in the lake and control illegal fishing. They are also engaged in removing algae from the lake. Cooperative members are involved in restocking of the fish in natural waters annually.

Fishery Research Center Pokhara was the only one government organization helping and providing fingerlings to the farmers of Phewa lake. Later, Harpan Phewa Fish Cooperative Limited was established in 2005 (see fig. 6) as to help the local fishers to collect and sell the fish in the market. This cooperative also provides the financial assistance in purchasing the fingerlings and cage material for the fishers.



Figure 6 : Harpan Phewa Fish Cooperative Limited (Collection and Sales Center)
Field visit, 2013.

The Harpan Phewa fish cooperative was established to strengthen the farmers in capacity building and providing assistance to the farmers. In order to help the farmers and to provide better amount of the fish, the cooperative collect harvested fish from the farmers and sell it to the market for the farmer. Even though, fish farmers are facing the problems related to fingerlings supply, cage material, and high mortality of the fingerlings.

However, to overcome above problems, meanwhile, the Fisheries Research Centre Pokhara has developed fish seed production facilities, helping communities in expanding the aquaculture and lake fisheries through research facility. This organization has launched awareness campaign for preserving the lake, cleaning the aquatic weeds, protection of habitat and spawning of aquatic organisms. There are 300 members in Fish Growers Association in lake Phewa and 739 members that are listed in “Lake Restoration and Fish Cooperative” in Rupa lake. Due to the establishment of the cooperative in the Phewa Lake and the in Rupa Lake, the preservation and restoration of the lake has been successful and the existing problem of fisher’s have been solve in recent years. The cost of the cage material, maintain cost of the cage and cage construction costs are decreased.

The Harpan Phewa Fish Cooperative Limited has restricted the fishing areas for other fishers for those who are not the member of the cooperative. Fishing and fish related activities are prohibited within 100 meter of Ratna Temple and Barahi Temple. Fish culture can only be set in Khapaudi and Sedi area in Phewa lake. This rules and regulation in Phewa lake is imposed through the cooperative and jointly effort of the stakeholders in Pokhara valley. The role of cooperative in addressing the problem of food security, raising living standards of the ethnic and indigenous communities, management of wetland diversity is a good example of Phewa lake. The success of fish farming in Pokhara valley shows the prospects of fish farming in the country and is widely accepted.

3.8 Development of Aquaculture in Nepal

Aquaculture was a new activity in Nepal a decade ago, but now a days, it is the most important sector. Aquaculture was started in Nepal with the introduced Indian major carps in 1940. After the success of the Indian major carps for the fish culture another exotic species of carp was introduced and this helps expanding of fish culture in Nepal. The use of polyculture gained success and it is expand throughout the country in 1970. The common species of carp was introduced (silver head and big head) Nepal to help the poor people and to alleviate the poverty because this species of fish does not need any intensive feeding and rely on available plankton and algae in the water. People are engaged in cage culture that was first introduced in Phewa

lake of Pokhara valley. This has helped many poor people in generating income and feeding their families. The limited cost of investment or no investment of carp has gained popularity in Nepal. However, now there are other species like Asala (*Schizothorax* spp.), Katle (*Acrossochielus* spp.) and Mahseer (*Tor* spp.) that has been cultured in Nepal.

Moreover, now people have changed traditional extensive fish farming into semi intensive and semi intensive to more intensive. The establishment of the fish feed and fish seed industry has played a significant role in aquaculture production in the country. According to the DoFD (2004/2005) 8.56 million fish seed were produced in 2004 and out of which 73% had produced by the private organizations in the country.

Aquaculture was started in Nepal as a strategy to alleviate the poverty and this principle of reducing poverty through aquaculture has been successful to some extent. The aquaculture technique of fish farming in Nepal was first started in 1970 in lakes of Pokhara valley. The joint initiation of Government of Nepal and UNDP and International Development Center Canada introduced common carp fish farming in Pokhara (FAO, 2005). The cage culture introduced in Phewa Lake was mainly for the Jalari's community living near to the shore of the lake. 74 farmers used cage culture in 1987 and in 2012 there were 97 farmers farming in the lakes. The total volume of the cage has reached 14948 m³. The fingerlings for the farmers are supplied by the Fisheries Research Center, Pokhara, a government organization helping the poor people in Pokhara valley. The average production of the cage has reached 58800 in 2012 (Bastola, 2012).

The cage fish culture in Pokhara valley has increased rapidly in recent years. There are private and governmental fingerlings stocking organization. At first cage culture was started to help the poor and landless people but now this has been for a commercial use also. People are adopting fish farming and investing in fish farming because this is the most profitable business in Nepal and much more demanding.

This recent development has served many landless people and provided an alternative way of income for the people. There are around 500 people living in Khapaudi area and are directly benefited from the fish farming in the lakes. There is no limitation for setting the cages in the lake. They can place as much as cages in the lake. There are around 7 cages per family in the Khapaudi village in Pokhara.



Figure 7: Mr. Jalal:

Source field visit, 2013

As an example, interviewing Mr. Jalal has owned only 6 cages in the lakes and it is enough for him to feed the families from the income made from the fish. As, he mentioned, there are around 7 million Nepalese rupees in the cooperative established by the farmers themselves. This cooperative is helping the farmers to sell the fish they produce and providing the fund for buying fingerlings and if needed they also provide the fund for construction of houses for the member of the cooperative and the people in the community. Mr. Jalal was provided a bit sum of money to build his house from the cooperative. Not only in Pokhara valley, but also in every part of the country, the use of fish farming is helping the poor and landless people.

3.9 Fish market in Nepal

Nepal is a small country and the fish produced in the country is not able to meet the demand of the consumer. Fish in Nepal are generally consumed fresh and dried. Frozen fish are acceptable in big cities like in Kathmandu Valley and other big cities where the supply of the local fish is low.

There is no fish freezing technology in Nepal. However, people transport fish from one place from another place in insulated van or in icebox to the capital city. This deteriorates the quality of the fish, but fortunately, the demand is high so all the fish is sold after arrival to the capital city. Fish farmers have three choices to sell their fish: sell it to the wholesaler directly, selling it directly to the local market or selling it to the Indian agent. Generally, there are two types of traders involved in marketing of the fish: Indian traders and Nepalese traders. The traders from India have uniformity in size and supply of the fish compared to Nepal. But the fish in Nepal are of high quality and freshness. Fish markets are in some extent organized in Nepal. The collector collects the fish and the middleman sell in to the whole-seller and whole-seller to retailer. The retail market is an open shop where fish are kept in the basket or on the footpath. The fish prices are high in Nepal due to the huge demand but less supply. The average retail price per kg fish in capital city is Nrs 200 for Fish produced in Nepal; the Indian fish cost Nrs 150. There is a huge consumption of the Fish imported form India due to low price than compared to fish produced in Nepal.

There is no any organized database that shows how much fish is imported to Nepal and how much fish is consumed in Nepal. Fish market infrastructure has been developed in many parts of the country but still better transport, freezing technology and hygienic condition of open retail markets are lacking. The major problem is labeling and certification of the fish product has not been developed. As an example Central Food Laboratory found harmful chemical like formalin and histamine in the fish that was being sold in the market (Himalayan News Service, 2012).

Chapter –IV

4.0 Fish Farming –As a Poverty Alleviation Strategy

Poverty is the main problem in Nepal. There is 25.16% of Nepalese population who are living under the poverty line. However, the survey carried out in 2003-2004 reported 30.85% people come down from poverty line, but still there are 8.72% of people living in hilly cities are under poverty line (CBS, 2011). Providing financial assistance for agricultural farming, providing training for fish farming, livestock farming and making strict rules for social discrimination are important strategies of the Government in Nepal, in poverty alleviation. The challenge is formidable, as poverty varied in nature. There is poverty in both rural and urban areas and it is related with ethnicity or minority, the place they live within is economically strong or not and they have been helped for long or neglected. So, the government has to understand the causes of poverty before to alleviate it.

According to Schiller (1989) the absence of necessities like basic food, shelter, security medical safety and other human need can be defined as poverty. However, the necessity for one person may not be necessity of others. Valentine (1968) states, “the essence of poverty is inequality”. In Nepal, poverty is defined as, an income required for buying a package of nutritionally defined food items and other services. Therefore, people who cannot afford to buy nutritional food, falls under this category as poor and said to live “below the poverty line”.

Nepal is a country where culture of discrimination and inequality exists. This is a consequence of the caste system, which in fact, an institutionalization of discrimination and inequality. This tradition and the culture of discrimination that follows the tradition are causing many difficulties and problems for poor and untouchable people. The poverty cannot be reduced if the culture of discrimination is allowed to continue to exists in the society. In Nepal, the main cause of the poverty is this cultural belief system that supports sub-culture of poverty. The young generations are absorbing the basic attitudes and values of the culture. Therefore, they resist change of the changing condition and became unable to grab the opportunities that may develop in their lifetime.

So in order to alleviate the poverty caused by the cultural beliefs, the government and community development committee has to focus on providing the trainings for new businesses and provide education to the children. Education to the children may provide an alternative socialization to reduce poverty in future and will be able to cope in the changing condition. However, the level of income also has to increase. Hence, the government of Nepal is focusing on fish farming, a new business to help the poor people to reduce poverty.



Figure 8: Showing fish farming using cage culture techniques as the means of livelihood

Field visit, 2013

The government of Nepal and the supporting organization like NARC is focused on fish farming to help the poor people and are indeed succeed . The fish farmers from Pokhara valley reported that, their income are generated by the fish produced in the lake through farming. The major benefit from the fish farming is the nutrition and household income as realized by the farmers in recent years. In the past years, the price of the meat and fish has increased enormously when the farmers had to buy this item from the market but now, the availability of fish in their cages had made life more easier rather than in the beginning. The recent news

says, fisheries in Nepal has increased by 23% .The statistics from the Ministry of Agriculture reports, more than 30000 metric tons of fish production is recorded in fiscal year 2011/ 2012 from 24295t recorded in 2007/2008 (Republica, 2013). So, fish farming plays an advantageous role in improving food and nutrition of the rural livelihoods as well as contributing in income generation and alleviating poverty (Pant et al., 2012).

4.1 Importance of Fish Farming for Food and livelihood:

FAO (2012) states, fish and fish products are the important source of animal protein easily available and are healthy diets. Fish and fish products are rich in protein that provides 33 calories per day. An adult man requires 50-60 % of daily protein and that can be gained by the fish products rather than from vegetables. Most of the people from least developing countries are deprived of proper nutrition so as Nepal. Fish consumption pattern of Nepalese people are in increasing rate. As recorded by the FAO (2012) annual per capita consumption of fish has increased to 17 kg in 2009. The recent article in Himalayan times (National daily news paper) states, the imported 30000 kg of fish was consumed in 3 days in Kathmandu valley due to the price hike in other meats (Joshi, 2013).

Fish farming has played a significant role in raising the living standards of the communities living near to the water bodies of Pokhara valley. According to Swar and Pradhan (1992) the cages used for fish farming by the farmers are 50m³ and this helps to sustain the livelihood of one fisher family in Pokhara valley. Fish farming in lakes of Pokhara valley, mainly in Phewa Lake and Begnas has the highest production of 123 metric ton of fish supporting the livelihood of 134 fisher's family. Fish farming in Pokhara valley including all three lakes Phewa, Rupa and Begnas has provided the best use of water resources from fish farming and fish related activities.

The ethnic and indigenious communities of Pokhara valley are successful in producing 3000-4000 kg of fish annually (Gurung et al, 2003). The Jalari's households reported that they are able to eat good food and live better life than in the past. These communities from the Pokhara valley are happy with the fish farming techniques they learn and are able to support their

family livelihood through fish farming. The income from the fish farming and capture fishery shares 75% of the total income of fish communities (Gurung et al. 2007). Their standard of living is dependent on the disposable income, household size and public services. The fishery covers 30% of the poverty of the fisher's household in Pokhara valley. The fisher communities do not have to pay much more tax from their income and taxes are insignificant. The tax rate is Nrs 2 for per kg of fish for fish farming and Nrs 1 per kg have to pay from capture fishery to the District Development Committee (Gurung et al. 2007).

The living standards of the fisher household have improved with the adoption of the fish farming techniques in Pokhara valley. In recent years, with the adoption of the fish and fish related activities, most of the fisher's own land in Phewa Lake. The remarkable changes can be seen in the fisher household in Phewa Lake. The life of fisher communities in Phewa Lake has changed dramatically. The present study has revealed that, 150 numbers of ponds in Kaski district (where Phewa lake is located) has produced 49100 kg of fish with the 2046 kg of yield (Khanal, 2012). The people living around Phewa Lake advocated that they have benefited from the fish farming using the cages in the lake. This helps them not only from starving but they are also able to send their children to the schools and sending youth to abroad in working visas. The fish farmers are directly benefited from the fish and fishing activities, however, the traders and the mediator are engaged in marketing, transport, fingerling supply and cage material, indirectly benefited from the fish production in Pokhara valley.

Table 2: Living standards of fisher communities in Phewa and Begnas Lake

Indicators	Phewa lake	Begnas lake
<i>Income and savings</i>		
Annual income (NRs)/household	153850.4	130623.2
Annual expenditure (NRs)/household	88655.0	75468.0
Savings (NRs)/household	65195.4	55155.2
Engle's coefficients (savings included in expenditure) (%)	23.6	29.2
<i>Indicators of living standard (% household)</i>		
Housing land	81.3	44.4
Concrete and tin-roofed houses	100.0	95.0
Access to potable water	100.0	93.2
Access to public health services	97.6	93.2
Use of water sealed toilets	21.8	10.1
Energy use (LPG gas and electricity)	94.6	53.8
Use of mass media (radios, televisions and newspapers)	83.2	75.3
Use of own automobiles	10.2	7.7

Source: (Wagle, S.K. et al, 2009)

4.2 Increased income:

Aquaculture is the best, possible and easiest way of earning income for the rural people. Fish farming has played a significant role in alleviating the poverty in rural areas of Nepal. Talking about the indigenous and ethnic people of Pokhara valley, most of the Jalari people are engaged in fish and fish related activities. They received more than 75% of income from the

fish farming like cage fish culture and capture fishery and rest of them from wage employment and small businesses . 27.3% of income was generated annually from the cages in Phewa lake with an investment of 125.2% (Wagle, S.K., et al, 2009). Most of the Jalari's reported that, they use this income in household expenses, sending their children to school buying nets and resources needed for the fish farming. Beside this, they are able to buy a piece of land for growing crops and vegetables. They are also managed to save some money in the bank for future use.

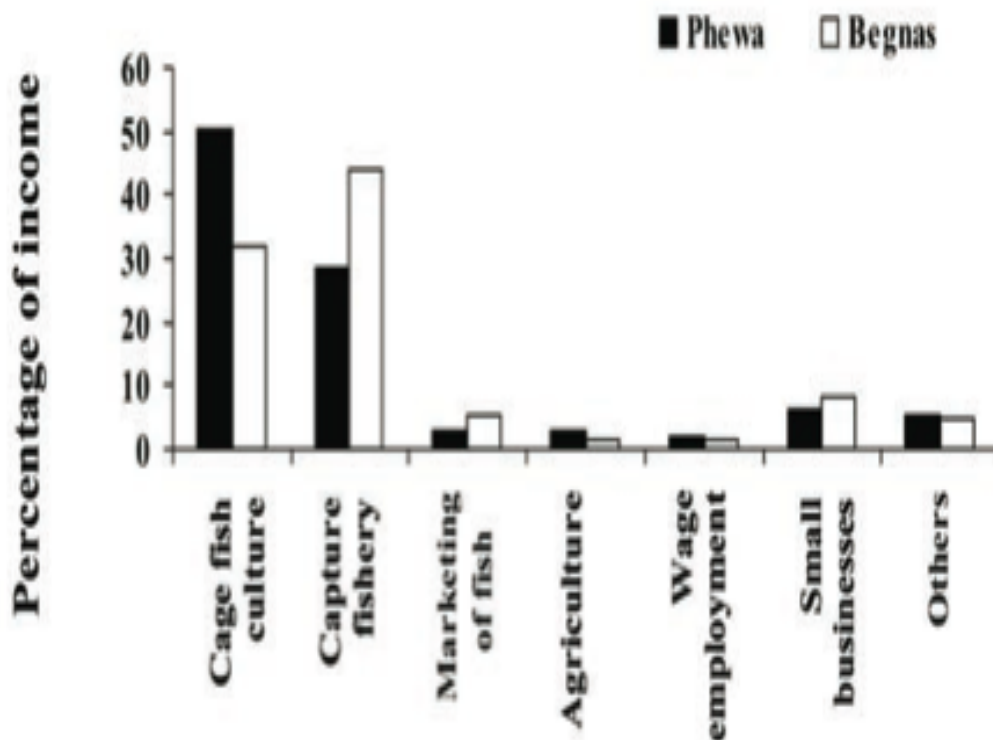


Fig 9: showing the annual income and income sources of fisher community

Source: (Wagle, S.K. et al, 2009)

Chapter V

5. Discussion and Conclusion

The development of the fishery sector in Pokhara valley is successful. Many indigenous, poor and untouchable people have been able to increase the income through fish farming and fish related activities. Cage fish farming in Phewa Lake has become a good alternative way of income to generate income for the poor, untouchable, marginalized and nomadic people living around the lake.

The Jalari's and the Pode are the only communities that have a tradition and skill in fishing but they are also living a nomadic life. So, they are the targeted group for the resettlement as fishermen in Phewa Lake and in Begnas Lake. However, time has changed now, people from every community either upper castes or lower castes are engaged in fish farming and fish related activities. There are many fisheries cooperatives and private organizations that are providing training for fish farming. Now, the people have understood the importance and potential of fish farming in the country. However, the government organizations are not still showing any interest in planning and organizing this sector. But there is slow development of the aquaculture industry in the country through different private and government organizations.

The main problem of social discrimination and the social exclusion of poor and untouchable people have nearly disappeared due to the strict rules imposed by the government. Fish farming has also played a vital role in abolishing social discrimination due to higher income in the society. Most of the fish farmers in Phewa Lake are untouchable like, Jalari and Pode, those depends on fish. But now things has changed, there are many other upper caste (Brahmin, Kshatriya) people involved in fish farming these days. More and more people are engaged in fish farming , because of increasing fish prices and good internal market opportunities. Both men and women are actively involved in fishery and fish farming. Jalari women are for example actively involved in fishing and fish farming, besides performing household activities. Fish farming contributes to women empowerment and gender equality in the country.

In terms of social participation and social cohesion to support collective actions for resource management, in Pokhara valley, we can find a number of success stories. The Fish Growers Association was established for better participation and community mobilization of the resource users. The aim of Harpan Fish Grower's Association is to increase economic benefits and collective resource management. The lakes are the main attractions for foreign as well as domestic tourists in the country. Hence, policy should be made for directing part of fish farmers savings into an appropriate area of the tourism industry because in their villages, there is little opportunity for investment in sectors other than fisheries.

There are still many problems that need to be solved to expand aquaculture in every corner of the country. The challenges and opportunities has to be addressed in the policy and strategies like quality assurance, supply and transport of fingerlings, marketing of fish, fish markets, cage material and fingerling mortality.

Cage fish farming is almost new activity in Nepal. So, in present time, people utilize the lake as common property resources. With the adoption of the cage fish farming and capture fisheries, the income level of the fisher community in Phewa lake have risen. However, with the shortage of the fingerlings, unavailability of cage material and cost of net used for the cage have impact on the productivity and production of the fisheries. So, there should be an established policy to learn and educate fish farmers about further economic benefits and potential income sources that can be earned in the long run. Unregulated entry, illegal and destructive fishing practices in the water bodies will lead to overexploitation of such resources. Policies, law and order should be introduced and enforced to ensure that the lakes and reservoirs are protected as basis for sustainable livelihood option for the rural resource-poor people.

The fisher communities in Phewa Lake lack the incentives in form of property rights to invest in management to avoid illegal fishing, destructiive fishing and to involve in conservation of the biodiversity of the aquatic resources . However, the findings showed that, people are engaging themselves in making the rules against illegal fishing and destructive fishing practices in the Lakes, reservoirs and rivers. Fishing and fish farming is banned in some

specific area near to the Barahi temple in Phewa Lake.

There may be a need for regulation - both to maintain the feasibility of access to cage culture by the people and to keep production level within the environmental capacity. Present experiences suggests the fact that in the future, fisheries research and development should be a part of any hydropower development and that lake resettlement programs for helping deprived and displaced communities should involve them in sustainable fisheries development.

The study also reveals the fact that, construction of massive hydropower projects has negative effects on the livelihood of the people living around the water bodies. So, the government should have to study and investigate, how the projects will affect the rural communities and also should clarify the mitigation measures to avoid negative effects. Integration of hydropower and aquaculture could provide better income for the local people and also for the community development committee. So, more dam construction means more reservoirs, which in fact, are positive for cage culture. Another important thing for fish farming is, to develop social cohesiveness that helps to establish institution and group participation.

The organizations supporting the fisheries sector should provide knowledge about the fish farming techniques and its pros and cons. Community mobilization and awareness campaigns for conservation of the native species, wetland, and habitat should be prioritized. The Fisheries Research Center and the Cooperative that has been established by the Fisher communities should provide formal education to the farmers about technologies and rapid sustainable growth of the sector. The Fisheries organization in Pokhara valley has increased its fingerlings production and is assisting in research for the community development in expanding the aquaculture development. Taking after the example of Pokhara valley, there is an increase of the fisheries sector in the other parts of the country as well. So the government should increase the effort in expanding the sector, not only for the poor and untouchable, but also to attract the youths of the country for fish farming.

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Appendices:

Income sources of fisher community in Phewa Lake and Begnas Lake ...

	Phewa lake		Begnas lake	
	Head	Member*	Head	Member*
<i>Fish- related job</i>				
Cage fish culture	76.7	48.4	86	32.3
Capture fishery	83.6	44.6	92	49.7
Pond fish culture	5.3	2.6	5.4	2.2
<i>Non-fishing job</i>				
Agriculture (including livestock)	32.7	26.2	16.3	10.1
Wage employment (public, private and foreign)	28.6	24.3	21.4	18.7
Small business (hotel, resturent, shop and tourism)	9.5	5.4	13.5	25.3
Others (driving and boat operation)	4.8	4.0	5.4	3.6

