

**TOPIC AREA:  
MARKETING, ECONOMIC RISK ASSESSMENT & TRADE**



**VALUE CHAIN ANALYSIS OF CARP POLYCULTURE SYSTEMS IN  
SOUTHERN NEPAL**

Marketing, Economic Risk Assessment & Trade/Activity/09MER11UM

**FINAL INVESTIGATION REPORT**

Madhav Shrestha  
*Institute of Agriculture and Animal Science  
Tribhuvan University  
Rampur, Chitwan, Nepal*

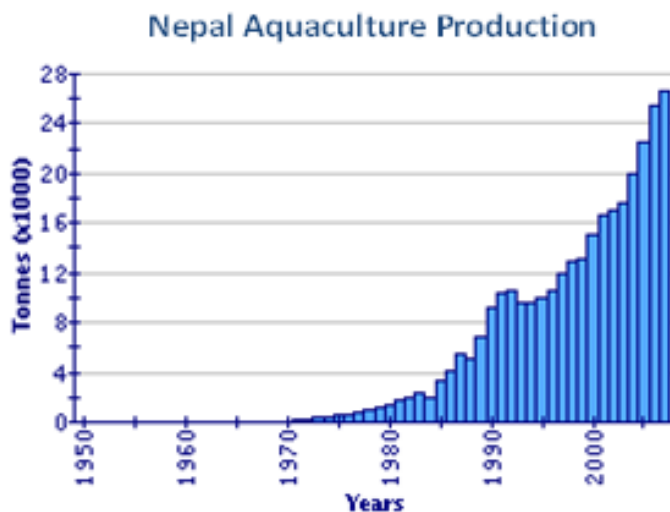
Zachary Stepan and James S. Diana  
*School of Natural Resources and Environment  
University of Michigan  
Ann Arbor, Michigan, USA*

**ABSTRACT**

The objectives of this study were to develop a Value Chain Map of carp polyculture in the Chitwan District of Nepal, and to identify areas for improvement and further research of the aquaculture sector in Nepal. This study primarily covered the Chitwan District. Interviews were performed in July 2012 with 3 hatchery and nursery owners, 31 fish farmers, and 10 market sellers, including the majority of sellers at local markets. Small-Scale Farmers (n = 22) were those who produced 100 kg or less of fish per year and did not sell any fish to markets, while Commercial Farmers (n = 9) produced greater than 100 kg fish per year and sold fish to markets. Among Small-Scale Farmers, 55% of all fish produced was consumed by the farmer's family, while 45% was sold to neighboring households. Among Commercial Farmers, 46% of fish produced was sold to local markets, 32% kept for home consumption, and 22% sold to neighboring households. Local Market Sellers prepared and sold the fish in the market, purchased it directly from the farmer, and transported it by way of bicycle or motorbike. In this study, Small-Scale Farmers were found to be largely content with the production of fish for home consumption. However, 20 of the 22 farmers also wanted to increase the size of their existing pond or build additional ponds in order to produce more fish to sell. All nine commercial farmers interviewed also desired to increase production and ship fish to distant markets, such as those in Kathmandu. There is high demand for fish in Kathmandu, and a preference for fresher, Nepali-raised fish. Among the Private Hatchery, Private Nursery, and Government Hatchery personnel interviewed in this study, only the latter reported to have a successful, self-sustaining business. In order to maintain a Chitwan-run, prosperous aquaculture sector, improvements must be made through training of private hatchery owners by Government Hatchery personnel. Currently, the Government Hatchery aims to help local fish farmers by raising and selling fingerlings at a price lower than that of the private hatcheries, which creates incentive for farmers not to purchase fingerlings from private sellers. Additionally, the Government Hatchery was reported to raise over 1000 kg of full-grown fish every year, which it also sold to consumers at a lower price than fish sold at local markets, again out-competing local fish farmers.

## INTRODUCTION

Although aquaculture has been practiced in Asia for thousands of years (FAO, 2012), it is fairly new in Nepal. It was not until the 1940s that the country began raising fish, and an additional 40 years passed before any significant progress was made in the field (FAO, 2012). Considering Nepal's late start in aquaculture practices, it is no surprise that the country has yet to contribute substantially to the huge volume of Asian aquaculture production (Asia produced 92.5% of the world's total aquaculture in 2008) or benefit largely from the economic improvements aquaculture has created (FAO, 2010). Recently, however, Nepal has shown marked increase in aquaculture production (Figure 1). Carp polyculture has been developed as the most popular system in the country, and research has been made into cage fish culture, rice-fish culture, and the production of cold-water cultures of species, such as snow trout and rainbow trout at higher altitudes (FAO, 2012). Additionally, aquaculture in Nepal has been shown to benefit rural communities by providing an important supply of protein and additional income generation, and by empowering women who care for fish ponds (Bhujel et al., 2008).



*Figure 1. Reported aquaculture production in Nepal since 1950. Figure copied from FAO.org.*

Because aquaculture in Nepal has recently expanded, little is known about the activities responsible for bringing cultured fish from creation in the hatchery to ultimate disposal by the consumer. In order to determine the manner in which the Nepali carp polyculture industry has developed, and to gain insight into specific ways it can be improved, an assessment must be carried out. This can be done through a value chain analysis, which will investigate the relationships between the stages of production, processing, and distribution in the system, in turn providing valuable information regarding areas for improvement within the market flow of the product. This study will focus on carp polyculture systems in the Chitwan District, which is a small area that acts as a representative of Nepal carp polyculture systems throughout the country.

## OBJECTIVES

1. Develop a Value Chain Map of carp polyculture in the Chitwan District of Nepal.
2. Identify areas for improvement and further research of the Nepal aquaculture sector by analyzing the results of interviews on the carp polyculture value chain conducted in the Chitwan District of Nepal.

## MATERIALS AND METHODS

### **Study Area –**

This study primarily covered the Chitwan District in the southern Terai region of Nepal. Chitwan is made up of a number of villages (called Village Development Committees or VDCs) that rely on agriculture for their primary source of income. Many villagers in Chitwan also practice aquaculture. The locations of Kathar, Khairahani, and Phaphaini contain the highest concentrations of aquaculture ponds in the region, and were therefore the focus of this study.

In cases where the product was traced outside of Chitwan, interviews were conducted beyond the District's borders. This included the locations of the Kalimati and Paknajol Markets in Kathmandu.

### **Data Collection –**

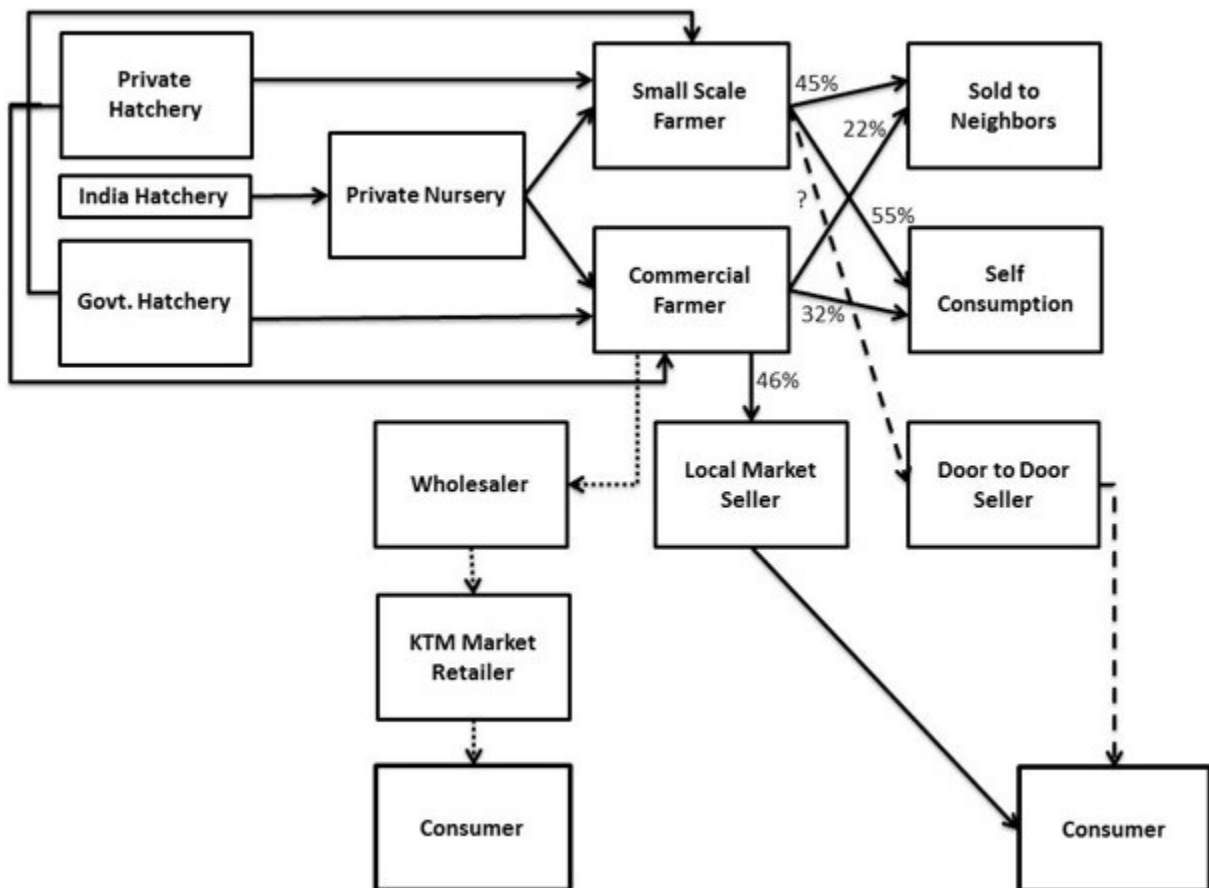
Interviews were carried out with hatchery and nursery owners, fish farmers, and market sellers for approximately three weeks in July 2012. In order to determine the stages of the value chain, interviews were first initiated with fish farmers. Information was obtained from this group regarding the movement of hatchlings and adult fish, and additional interviews were then conducted with hatchling managers and fish sellers. The total number of fish ponds in the villages of Kathar, Khairahani, and Phaphaini were unknown. We decided that interviews of ten farmers from each location would serve as a valid representation of each respective locality. Regarding fish sellers, a majority of those present at each Chitwan market (Parsa, Thadi, and Narayanghar) were successfully interviewed. This included three of four sellers in Parsa, two of three sellers in Thadi, and two of three sellers in Narayanghar. In Kathmandu, the majority of sellers approached would not consent to an interview. In this area, all of those who agreed to conversation were included. This was a total of three individuals (two from the Kalimati Market and one from Paknajol). Table 1 summarizes the total number of respondents from each location in the study.

**Table 1.** Number of respondents

Location	Kathar	Khairani	Phaphaini
Fish Farmers	10	10	10

Location	Parsa	Thadi	Narayanghar	KTM Kalimati	KTM Paknajol
Fish Sellers	3	2	2	2	1

Location	Kathar	Bhandara
Hatchery	1	1
Nursery	1	0



**Figure 2.** Value Chain Map of carp polyculture systems in Chitwan, Nepal. Dashed lines represent activities known to occur for which data was not obtained. Dotted lines represent market flow still under development

**Data Analysis** – Data from each respondent was collected through personal interviews that asked questions regarding such topics as the expenses, profits, and challenges in each respective business. For Value Chain Mapping, hatchlings were considered the major input to the system, and their movement was traced among different actors in the chain. Small-Scale Farmers (n = 22) were considered all those who produced 100 kg or less of fish per year and did not sell any fish to markets. Commercial Farmers (n = 9)

were considered all those who produced greater than 100 kg fish per year and sold fish to markets. Percentages of marketable fish moved (consumed, sold, etc.) by Small-Scale and Commercial Farmers were determined by averaging the responses given by each farmer regarding the flow of products. Percentages of the movement of hatchlings from the Private Hatchery, Government Hatchery, and Private Nursery could not be determined because hatchery and nursery owners did not keep data regarding the size of farm to which hatchlings were sold. Hatcheries were distinguished from nurseries because the latter did not possess their own broodstock.

## RESULTS AND DISCUSSION

Figure 2 summarized the Value Chain derived from our interviews. All fish farmers interviewed in Chitwan were found to obtain fingerlings from a privately owned hatchery, the government-run hatchery in Bhandhara, or a private nursery within the District. The nursery owners obtained hatchlings from Calcutta, India, which they believed produced higher quality fish than local hatcheries. The nursery raised hatchlings until they became fingerlings, at which point they were sold. Each hatchery had its own broodstock. The government hatchery was operated as a branch of the national government, the Nepal Agricultural Research Council (NARC), which serves to “conduct agricultural research in the country to uplift the economic level of the people.” (NARC, 2013).

Fish farmers were found to buy fingerlings from different hatcheries for different reasons. In Kathar, for example, all ten farmers interviewed reported to have purchased fingerlings from the Government Hatchery because it sold fish for the lowest price. In Khairahani and Phaphaini, however, all of the farmers reported to have purchased fingerlings from the private hatchery or nursery because quality of fish was higher at these locations.

Among Small-Scale Farmers, it was found that 55% of all fish produced was consumed by the farmer and the farmer’s family, while the remaining 45% of fish produced was sold to neighboring households. Among Commercial Farmers, 46% of all fish produced was sold to local markets, 32% was kept for home consumption, and 22% was sold to neighboring households. In the case of the Local Market Seller, the same individual who prepared and sold the fish in the market bought it directly from the farmer and transported it by way of bicycle or motorbike. Some percentage of fish raised by Small-Scale Farmers was purchased by bicycle sellers, who then rode door-to-door throughout villages making sales (Door-to-Door Seller). These individuals were also known to take purchased fish directly to local markets for sale. Farmers did not have information regarding the location of the ultimate sale of fish purchased by individuals on bicycles, but unanimously reported that all such transactions resulted in sales at the market. Because it was known that this was not always the case, movement of fish to the Door-to-Door Seller within the Value Chain Map is represented by a dashed line, and the percentage of fish sold in this manner is denoted by a question mark.

Dotted lines in the Map represent a series of transactions that occur in Chitwan aquaculture, but have not yet been quantified. All of the cultured fish sold in Kathmandu was reported to have come from India, where purchase and transportation were said to have been organized by a single individual (the Wholesaler), who then sold to individual retailers of the market. However, several farmers in Chitwan claimed to have been in the process of selling their fish in the Kathmandu (KTM) Market. Similar information was given in relation to the Pokhara fish market, but this site was not visited in this study and was therefore not included in the Map. Because the sale of these fish at Kathmandu is in question, no proportions of sales could be defined for this transaction.

Many aquaculture ponds in the Chitwan District were constructed through international development projects focused on providing fish — an important source of high quality animal protein — to low-income families with limited diets. It is therefore no surprise that the majority of fish farmers in Chitwan

raise fish in small ponds and keep most of what they harvest for home consumption. Such small-scale subsistence aquaculture has been viewed as a success in the region, not only because it has succeeded in providing fish to families, but it has also led to empowerment of women and increased income generation (Bhujel et al., 2008). In this study, small-scale farmers were found to be largely content with the production of fish for home consumption. However, 20 of the 22 farmers also stated that they wanted to either increase the size of their existing pond or build additional ponds in order to produce more fish for the purpose of selling. An analysis of the demand of neighbors without fish ponds (45% of cultured fish from small-scale farmers were sold to neighbors) was not quantified in this study, so it is uncertain if an increase in production of fish by these farmers could be sold to neighbors. Regarding the possibility that increased production from this group could be sold at local markets, all sellers at local markets stated they were meeting consumer demand with the current supply of fish, so it is unlikely that increased production of fish could be sold at this venue, given current market trends. In order to determine if increased production from small-scale farmers could be sold for profit, further research must be conducted on market demand.

Of the Private Hatchery, Private Nursery, and Government Hatchery representatives interviewed in this study, only the latter reported to have a successful, self-sustaining business. The Private Hatchery had to stop production for a year because of problems maintaining broodstock and managing finances, and the Private Nursery was reliant on Indian broodstock and hatchlings. In order to maintain a Chitwan-run, prosperous aquaculture sector, improvements must be made in private hatcheries. This can be done through training of private hatchery owners by the Government Hatchery, which is meant to aid local people. Currently, the Government Hatchery aims to help local fish farmers by raising and selling fingerlings at a price that creates no profit. This selling price is lower than that of the private hatcheries, which creates incentive for fish farmers to purchase fingerlings from the government instead of private sellers. By creating this relationship, the Government Hatchery is actually out-competing private hatcheries. Additionally, the Government Hatchery reported to raise over 1000 kg of full-grown fish every year, which it sells to consumers at a lower price than fish sold at local markets. Similarly, by selling at a lower price, the Hatchery is out-competing local fish farmers. If it is truly the goal of the Government Hatchery to aid the people, it must cease selling fingerlings and full-grown fish at discounted prices and begin to provide training for hatchery owners and farmers in need.

All nine of the commercial farmers interviewed expressed a desire to increase production and ship fish to distant, larger markets such as those in Kathmandu. There is high demand for fish in Kathmandu, and there is a preference for fresher, Nepali-raised fish over fish shipped from India. Because the majority of fish sold in Kathmandu is shipped from India, there exists a market for Nepali-raised fish in this location. The Wholesaler interviewed in Kathmandu reported to sell an average of 1,800 kg of fish every weekday. He expressed his preference for buying fish in Nepal, but stated that Nepal is currently not able to meet his demand. Additionally, he explained that there are few ice plants in Nepal that can easily and cheaply supply his business.

Although fish farmers in Nepal might not currently be able to supply enough fish to meet the demand of 1,800 kg/day, they would still be able to sell a significant amount of fish in Kathmandu if they were able to establish efficient methods of fish transport and develop working relationships with fish retailers in the city. Unfortunately, it will take time to develop this infrastructure. Data collected in this study suggests the greatest opportunity for economic expansion of the aquaculture industry in Nepal is for commercial farmers to sell greater volumes of fish in big-city markets like the Kalimati Market in Kathmandu. This would lead to a decrease in reliance upon Indian-raised fish to feed Nepali consumers, and it would create greater economic benefit in the Nepali aquaculture industry.

## REFERENCES

- Bhujel, R.C., M.K. Shrestha, J. Pant, and S. Buranrom. 2008. Ethnic women in aquaculture in Nepal. *Development*, 51:259-264.
- FAO. 2006-2012. Fisheries and Aquaculture topics. Statistics – Introduction. Topics Fact Sheets. In: *FAO Fisheries and Aquaculture Department*. Rome. Accessed 1/20/2013. [http://www.fao.org/fishery/countrysector/naso\\_nepal/en](http://www.fao.org/fishery/countrysector/naso_nepal/en)
- FAO/Network of Aquaculture Centres in Asia-Pacific (NACA). 2011. Regional Review on Status and Trends in Aquaculture Development in Asia-Pacific – 2010 FAO Fisheries and Aquaculture Circular. No. 1061/5. Rome.
- Nepal Agricultural Research Council. About NARC. 2003. Accessed 1/15/2013. [www.narc.gov.np/about/index/php](http://www.narc.gov.np/about/index/php)