

## Fish Farming in Nepal: Trend and Consumption Level

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Received: July 19, 2018; Published: August 29, 2018

### Abstract

The abundant availability of water resource is boon to Nepal and different fresh water habitat makes the Nepal potential for different fisheries and aquaculture activities. In the last 15 years, there has been an increase of more than 23000 mt of fish production in Nepal compared to that of the base year 1999/00 with 37427 mt production in the year 2013/14. The terai, especially the eastern terai is the main region for fish production however cold water species culture is developing in hilly districts. Although the fish production activities exhibited a very positive growth, overall productivity had not been satisfactory in terms of marketing management and its institutional capability. There is a long marketing channel and most serious marketing problems are lack of transportation, fish diseases, lack of financial facilities, frequent strikes, fish theft, lack of research about fish marketing, unhygienic storing condition, lack of specialized fish marketing manpower and lack of adequate marketing infrastructure. Rohu, followed by Bachuwa (Pangasius), Naini, Catla and Magur are the fishes which are mostly consumed in Nepal. Fish consumption per capita in 2013 was 2.10 kg in Nepal. There are several fish and fishery product that are consumed by the consumer. In the market mostly live fishes, iced fishes, frozen fishes, dried fishes and canned fishes are consumed. Beside these fishes are also keep in aquarium for recreational purpose. Though Nepal is potential for fish farming, the production is still not satisfactory so we recommend Nepal government to address the problems faced by the farmers to improve fish farming in Nepal.

**Keywords:** Fish Farming; Water Resources; Marketing Channel; Consumption Level

### Introduction

Aquaculture is fairly new activity in Nepal. Nepal being small land lock mountainous country, richest among in terms of water resources which makes Nepal a country with a potential fish farming. There are about 12500 ha of such area available in the country of which approximately 1225 ha are currently being used for aquaculture. In Nepal, 200 fish species are available in which around 190 are indigenous species and remaining are exotic species [1]. The formal types of fish farming begin in Nepal from 1947 for economic purpose. There are 29,270 fish ponds in the country. The Terai plain alone contain 95% of total fish ponds and the area dedicated to fishery amounts to more than 10,718 hectares with the total fish production reaching 65,770 tonnes in this fiscal year [2]. Nepal has aquatic resources which is located in different altitude and climatic zones. So due to the different fresh water habitat there is a potential for different fisheries and aquaculture activities in Nepal.

In Nepal fishery has its own history. Fish is considered as sagun (good luck). There are many tribes which have been traditionally practiced fish farming since ancient time which are Tharu, Majhis, Kumal, Kewat, Mushar, Bote etc. They were mainly depends on capture fishery for their livelihood which is common practice throughout the country. "Majhi" used to inhabit the Nepal's biggest river like Saptakoshi, Indrawati which was their only of livelihood [3]. "Tharu" community also considered fish and rice as main food, especially Tharu women catch fishes from rivers, stream and swamp for their livelihood [4]. Culture fishery is relatively new in Nepal which was initiated in a small scale with the introduction of Indian major carp [5]. However, the actual development of commercial fish farming in Nepal began with the implementation of Aquaculture Development Project under the support of Asian Development Bank (ADB) and United Nations Development Program (UNDP) after 1980. Mostly Indian major carps, Chinese major carp and cat fish are cultured

in Nepal. They are cultured in earthen ponds, cemented ponds in intensive or semi-intensive way. Besides these, cage culture, pen culture and paddy cum fish culture are also under practice. Now Cage culture is being practiced in the Phewa lake Rupa lake, Begnas lake etc. but preliminary Cage culture in lakes and reservoirs with herbivorous carps (major species: silver carp and bighead carp) was initiated with the support of FAO/UNDP and later the International Development Research Center (IDRC) Canada in the 1970s. Paddy cum fish was started since 2021 BS for the purpose to utilize the paddy field and enhance production. In 2044/45 BS the egg of rainbow trout was introduced in Nepal and reared in Godavari research station from Japan for the purpose to start the culture fishery in cold water resources of Nepal. The interest of farmers towards fishery and its production have a positive growth. Activities like genetic improvement of carps, successful induced breeding of three major carps, rohu (*Labeo rohita*), catla (*Catla catla*), mrigal (*Cirrhinus mrigala*) helped in the development of fish farming. The Nepal Agriculture Perspective Plan (APP) has categorized fisheries and aquaculture as a small but important and promising sub-sector of agriculture which contribute about 2.47 per cent of agricultural gross domestic product (AGDP). For poverty reduction the government of Nepal has identified fisheries as one of the prominent sub-sector and has targeted Nepal to make a self sufficient country in fish production in the next three year on the budget speech of the current fiscal year 2073/2074 BS [6].

Fish and fishery product represents valuable source of nutrition such as omega-3 fatty acids, fat soluble vitamin D and high protein. These essential nutrient keep our heart and brain healthy. Fish can be used as daily diet to meet the essential nutrient required by body. In some of the country it is taken as staple food after rice. The Government of Nepal has recommended at least 30g per day fish or animal protein diet but fish intake is still far below than the recommended amount. The fish production and consumption of fish and fishery product have a positive growth. Although there is a positive growth in fish production activities, marketing management is not so satisfactory. The marketing channel of Nepal is long which is the main reason for increased marketing cost. There are few farmers who directly sell their fish in local market whereas, other follow long marketing channel. Farmers get 45 - 55% of the consumer price rest are absorbed by the traders. Demand of fish and its product is increasing. Nepal alone can't meet its demand. According to the member secretary of the 3<sup>rd</sup> fish festival in Kathmandu, 77,000 tons of fish is produced annually in Nepal but local production can meet only around 30 per cent of the demand, so the

country imports fish worth around Rs 3 billion from India alone and it was 7,882 tons of fish compared to 11,176 in 2014/15 [7]. In the market mostly live fishes, iced fishes, frozen fishes, dried fishes and canned fishes are consumed by consumers among which live fishes have high demand.

### Objective of the Study

The objective of this article is to review the fish farming trends and the consumption level of fish in Nepal. Moreover it will analyses the fish production trend, water resources availability, marketing channel and discuss the consumption level of fish and fishery products in Nepal.

### Materials and Methods

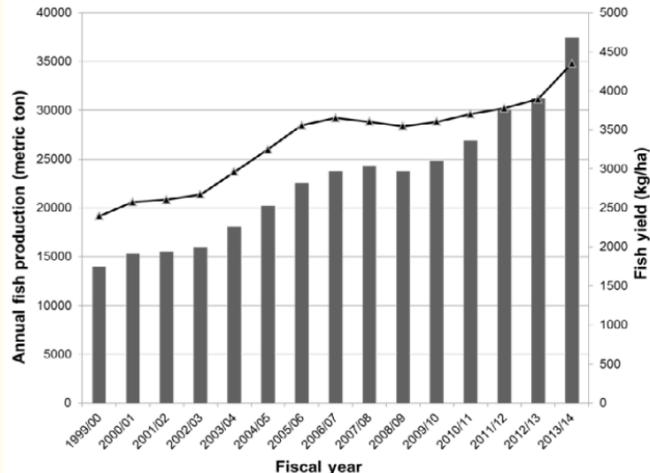
Data for annual fish production and water resources were obtained from the annual publication of the Directorate of Fisheries Development (DOFD), the Ministry of Agricultural, land management and cooperatives department of Nepal government. The information and data for the marketing trends and consumption of fishery product is obtained by visiting some of the important market and supermarkets of Nepal like Kathmandu, Chitwan, Butwal, Biratnagar, Malekhu, Janakpur, Jhapa Dhankuta and Karnali through direct observation and questionnaires. In addition to these different related material and articles were viewed regarding to production, marketing problems, consumption. Relevant information found was compiled and summarized.

### Result and Discussion

#### Fish production in Nepal

Nepal is the land lock country which lies between India and China. It has three eco-zones, terai in the southern plain, hill in the middle and the mountains in the north. The country touches with India at its southern, western and eastern borders, while the northern boundary is with China. In the south the altitude is about 50 metre above sea level, while at northern end the elevation goes up to the highest peak 8848 m (Mt. Everest) of the world. It has different aquatic habitat thus support the different fish and aquaculture activities Terai is the main zones for fish production. During these past 15 years, the lowest production was 14000 mt in the year 1999/00 and the maximum production was 37427 mt in the year 2013/14 and the average annual fish production from fiscal year 1999/00 to 2013/14 in Nepal was 22929.1 metric tons (mt). The trend of annual fish production showed that fish production increased each year, with the exception in 2008/09 (Figure 1). In the last 15 years, there has been an increase of more than 23000 mt of fish produc-

tion in Nepal compared to that of the base year 1999/00. The top ten district with the highest production are Bara (18.5%), Saptari (10.3%), Chitwan (8.6%), Dhanusha (8.6%), Rupandehi (8.4%), Rautahat (7.4%), Parsa (5.5%), Siraha (4.6%), Morang (3.6%), and Sarlahi (3.5%) [8]. According to province, the highest production i.e. 6258 kg/ha is in province 3 and the lowest production i.e. 1112 kg/ha is in province 7 (Figure 2).



**Figure 1:** Annual fish production (metric ton) and fish yield (kilograms per hectare) in Nepal from 1990/00 to 2013/14.

**Figure 2:** Top 10 most fish producing district in metric tons (Source, Nepal Fishery Survey 2072, National planning commission, Central bureau of statistics).

It is found that terai is the main region for fish production. Eastern terai has higher production and yield compared to western terai. Hills contribute moderately to total fish production. Increase in production of high-value cold water fish species such as the rainbow trout makes the hill a potential area for cold water fisheries. The culture of Rainbow trout has been done in eleven hilly districts

[9], which can be easily extended to other hilly districts with collaborative efforts from Nepal government and the private sector. The reason for the increase in production as compared to past may be due to increase in the level of knowledge among farmers in fish farming, and increased availability of quality fingerlings and fish feed. However, it needs to be increased in current fish production by three- or four-fold to be comparable with neighboring countries [10].

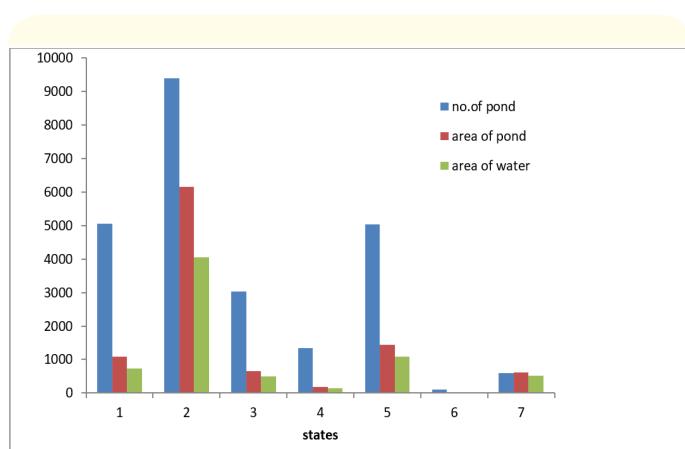
**Figure 3:** District-wise fish production (metric ton) and yield (kilograms per hectare).

#### Major fish species cultivated in Nepal

Indigenous and exotic fish species are farmed in Nepal. Terai is the site for carp, tilapia and catfish. Among carp the three major Indian carps commonly farmed are Rohu (*Labeo rohita*), Catla (*Catla catla*) and Mrigal (*Cirrhinus mrigala*). In addition, exotic carps namely Common carp (*Cyprinus carpio*), and Chinese carps: Grass carp (*Ctenopharyngodon idellus*), Silver carp (*Hypophthalmichthys molitrix*) and Bighead carp (*Aristichthys nobilis*) have been cultured since 1955/56. Among catfish mostly *Clarias batrachus*, *Clarias gariepinus* and *Pangasius pangasius* are cultured. Recently goldfish (*Carassius auratus*) was introduced as a recreational species in Nepal [11]. In lower mid-hill or in cold water zone, carp along with cool-water fish species such as Mahseer (*Tor* spp) and Katle (*Acrossocheilus hexagonolepis*), Asia or cold water cyprinids (*Schizothorax* spp) and rainbow trout (*Oncorhynchus mykiss*) can be cultivated. In Nepal rainbow trout (*Oncorhynchus mykiss*) was introduced from India in 1968 and 1971 and from Japan in 1988. Recently, Nile tilapia (*Oreochromis niloticus*), Java barb (*Barbomyrus gonionotus*) and giant river prawn (*Macrobrachium rosenbergii*) have been introduced to study the potential of their commercial production [11].

### Water resources availability

Nepal has abundant water resources. For fish farming water resources available is may be about 500,000 ha [11]. Terai districts have higher surface water availability compared to hills and mountainous districts. Within Terai, eastern Terai has higher surface water availability. The average surface water availability at the district level was 114.7 ha. The maximum surface water availability was 945 ha in Bara district. The highest number of ponds (9397) and the surface water (4055ha) is present in province 2 and the lower number of ponds (101) and surface water (6 ha) is present in province 6 [8] (Figure 4).



**Figure 4:** No. of ponds, area of pond and area of water (in ha.) (Source, Nepal Fishery Survey 2012, National planning commission, Central bureau of statistics).

### Marketing channel of fish in Nepal

The concept of actual organized fish marketing was developed in 1981/1982 with the start of the Aquaculture Development Project. The fish marketing system seems to have evolved and is self-regulating with increasing production and demand but fish marketing channel has not been systematic in Nepal. The fish marketing channel is long. With increasing production, the marketing situation is becoming a serious obstacle to speedy development of fisheries in Nepal. Occasionally, fisherman are unable to sell their catches although the demand for fish is high in the market, this creates a feeling of insecurity. Commonly, fisherman and small scale fish producers sell their fish directly to the consumers. Medium and large scale fish farmers use different channels to sell their fish. They sell some of their fish directly to the consumers in local markets, or through agent or contractors to the middleman or wholesalers. 28% of the fish are consumed or given away by farmers, 30% are sold directly

to the consumers and 42% are purchased by wholesalers from contractors and distributed to retailers in major urban center [11]. In Nepal market, there are two groups of fish traders involved in fish marketing of Nepal; the Indian trader and those from Nepal. Fish traders at all levels from producers to collector to suppliers and wholesalers to retailers and vendors had developed and operated through organized marketing networks. So there is a long marketing channel and which is the main reason for increased marketing cost. Farmers get 45 - 55% of the consumer price rest are absorbed by traders.

### Marketing problems

Marketing system of Nepal is not so systematic which lack marketing infrastructure and marketing facilities. Although the fish production activities exhibited a very positive growth in the country, overall productivity had not been satisfactory in terms of marketing management and its institutional capability which is causing slow pace of transformation in agricultural production system [12]. Access to market is expensive due to lack of infrastructure like transportation that caused inaccessibility of locally produced commodity to domestic market. The major marketing problems in fishery sectors were lack of all weather roads connecting fish producing areas with assembly markets and consumption centers, absence of cold storage facilities/chilling rooms for holding the harvest and regulate supply, absence of insulated vehicles to prevent spoilage during sales. The most serious marketing difficulties occur in communities, which lack transport, ice, poor road facilities, fish diseases, lack of financial facilities, frequent strikes, fish theft, pond poisoning. Lack of research about fish marketing, unhygienic storing conditions, lack of specialized fish marketing manpower and lack of adequately marketing infrastructure are the problem which led to insufficiently and incompetent marketing of fish in Nepal [13].

### Consumption level

According to FAO stat the lowest fish consumption per capita was 0.150 kg in the year 1961 and the maximum consumption was 2.20 kg in 2011 whereas, Fish consumption per capita in 2013 was 2.10 kg in Nepal. China has accounted for most of the world growth with per capita fish supply of about 32.4 kg. Nepal has been ranked 144<sup>th</sup> within the group of 160 countries, 2 places behind the position seen 10 years ago (Figure 5). The per capita fish consumption is highest in Central Development Region (1730g), then in Eastern Development Region (1129g), Eastern Development Region (1037g), Mid-Western Development Region (762g), and least in Far-Western Development Region (354g) [14] (Figure 6). There are

several fish and fishery product that are consumed by the consumers in Nepal. Rohu, followed by Bachuwa (pangasius), Naini, Catla and Magur are the fishes which are mostly consumed in Nepal. The consumer in Nepal prefers fresh and healthy fish but fish packed in ice and chilled fish are also commonly acceptable.

live fish sell. The Kathmandu valley alone had more than 38 outlets selling live fishes. Prices of live fishes fetched high due to difficult to keep alive. Prices of different fishes in the markets like *Catla catla* (Bhakur) ranged at about Rs.600/kg and fishes like Rohu, *Ctenopharyngodon idella* (Grass carp), *Cyprinus carpio* (Common crap) ranges about Rs. 450/kg. Beside these other air breathing fishes like catfish are sell live.

### Iced fishes

Most of the fishes sold in the market are rohu, catla, buhari, bachuwa and other comes from India and some small fish like naini, rohu, catla comes from Janakpur, Birjung, Rajbiraj etc. Fishes imported from India are immediately packed in ice after harvest. The fish are packed in plastic boxes with fish and ice in equal ratio (50 - 50%).

### Frozen fishes

The frozen fish sector is smaller than the iced fish. The frozen fish is mostly imported from Calcutta consisting mainly fish fillets, shrimps, prawn, small quantity of cuttlefish, King fish, Lobster etc. Supply of frozen fishes seemed to be increasing specially during fes-tives and weeding season.

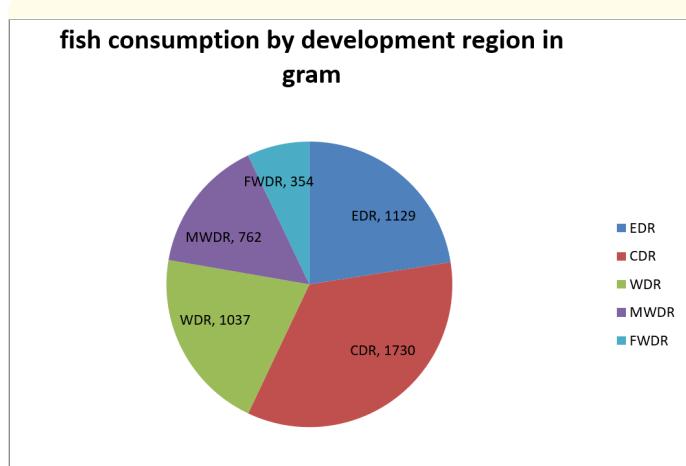
### Dried fish

Dried indigenous fish species in Nepal are kept in the market for selling in background of Malekhu Bazaar which was attached with highway. Excess of fish was sundried and kept in the market for selling. Fish species used for drying were Nakata (*Garra gotyla*), Buduna (*Garra annandalei*), Kabre (*Glyptothorax ssp*), Sahar (*Tor putitora*), Faketa (*Barilius ssp*), Sidra (*Puntius ssp*). Local newari people of Kathmandu were frequently using smoke fishes as token of auspicious item and offered during birth day, marriage, bhai tika etc. So, demand of smoke fishes was very high during Dashain, Tihar and throughout winter (marriage season). Among the dried fishes the demand of smoked fish approximately 50% higher than the sundried fish and 200% higher than salted fish.

### Canned and pickle

Canned fish from Europe, Asia is found in supermarket. Fish pickles of different brands are also sold in supermarkets. Canned fish mainly include tuna and sardine. Now a day Rainbow trout also sold in supermarket. Tunna fish were mostly consumed by tourist season in September to December months as fast food during track-

**Figure 5:** Fish consumption per capita in Nepal.



**Figure 6:** Per capita fish consumption (in gram) in a year 2014 in different development region.

### Live fishes

Live fish sale accounted around 10% and its demand is increasing. Fishes are sell live in different parts of the country like Chitwan, Kathmandu, Rupandehi, Biratnagar etc. Water tanks are used for

ing. The price of tunna fish was different and depended upon its flavor. Pickle of dry fish of prawn and other dry fish with peanut are also sold in supermarket which is consumed by Nepalese customers as snacks.

### Ornamental fishes

It is supposed that keeping at glass aquarium started during the period of late king Tribhuvan. Ornamental fish demand is growing annually in the country, especially in Kathmandu valley. The business of ornamental fishes is flourishing year by year and new shops are opening annually in different places. Fish prices are ranged from species to species. The demand of fishes is variable but high demand for small size fishes is recorded in most houses. Fishes like Gold fish, Koi carp, Guppy, Bubble eye, Lion head, Rainbow shark, Red sword tail are kept in aquarium.

Beside these vacuum packed rainbow trout fishes are also sold in whole sale market. Trout fishes are cultured in cold water bodies like in Nuwakot district, kaski district etc. The average weight of marketable fishes are approximately 250 - 350g. In one packet 6 - 7 fishes are vacuum packed and preserved at 20°C and they are sold at 1100 per kg price. Live rainbow trout are also sold. For that they are stocked in cement tank where running river water is continuously supplied and out drained from the tank. The price of fish varied from 900 - 1000/kg.

Products	Availability
Sea fish (sardines)	Canned
Fish oil	Capsule
Fish fillet(vasa)	Plastic wrapped fillet
Dry fish	Plastic packed/open
Dry shrimp and fish meal	Plastic packed/open
Salted fish	Plastic packed/open
Fried fish	Plastic packed/open
Smoked fish	Open
Fish pickle	Plastic packed

**Table 1:** Some processed fish food products available in Nepalese market.

Exotic		
1	<i>Carassius carassius</i>	Gold fish
2	<i>Cyprinus carpio</i>	Koi carp
3	<i>Poecilia reticulate</i>	Guppy
4	<i>Xiphophorus hellerii</i>	Sword Tall
5	<i>Xiphophorus maculatus</i>	Platty
Native		
1	<i>Colisa lalia</i>	Kolisa

**Table 2:** Type of fish succeeded in artificial insemination and used in aquarium for decorative purpose.

(Source, DOFD, Fish statistics and annual progress report 2073/2074)

### Conclusion

The abundant availability of water resource and different fresh water habitat makes the Nepal potential for fish production. Although the terai is the main region for fish production cold water fisheries also have a great potential and need to extend fisheries programs in the mid hill. To ensure the increased production of fish modern techniques should be implemented to produce the seed as well feed and co-operative based fisheries is necessary. Public private partnership is also mandatory. Overall fish productivity had not been satisfactory in terms of marketing management and its institutional capability. All weather roads, Cold storage, insulated vehicle, offsite fish market, price control should be facilitated. Due to the long marketing channel the farmer have to deal with agents with minimum price of fish, confined to get only 45 - 55% of consumer price. Not only that due to open border fish market and its product are directly influenced by price and quality. Although locally produced products are small in size but they are good in quality so there is increase in their demand. Trend of live fish market is increasing and found in few places in few cities which should be increased as far as possible by taking the help of government as well. Fish are consumed as live fishes, dried/smoked fish, ornamental fish, fish fillets, canned fish (department stores), vacuum packed fishes (trout fish) etc. and Fish marketing has become very important in production and distribution of these products. Fish consumption per capita is very low this should be increased by raising awareness about fish nutrition. It is advisable to focus on school syllabus about fish diet, and also be advertised by government television, radio to intake the fish meat which is cheaper than other

meat in Nepal in order to meet the demand of protein uptake in the human body. There are many fishery policies to extend fishery programs, provide technical facility, provide banking loan, insurance and to provide leasing provision of common water bodies. Whose overall aim is to increase production and to make the country self-sufficient but it is recommend to Nepal government to address the problems faced by the farmers to improve fish farming in Nepal.

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**Volume 2 Issue 9 September 2018**

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