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Diversity of Ornamental Fishes in Lalitpur, Nepal

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Abstract

Lagankhel, Patan, Satdobato and Jawalakhel of Lalitpur. The objectives of this report were to list and compare the diversity of ornamental fishes with the comparison of the abundance of ornamental fishes. Field survey was conducted for four months. The questionnaire method was done within nine shops. The data were analysed in Microsoft Excel, focusing on the Shannon index, Evenness and Species Richness of ornamental fishes in local shops of Lalitpur. This survey shows that a total of 1581 individual ornamental fish species were recorded belonging to eight different families and 21 species, where 19 of them were exotic where species like Carassius auratus, Gymnocorymbus ternetzi, Poecilia reticulata, and Pterophyllum scalare are dominating. Where Amphilophus hybrid is the least dominanting with only five in number. Which are imported mainly from India and Thailand. Only two Puntius conchonius and Danio rerio were found native to Nepal in Lalitpur.

The calculated Shannon Diversity index (H') 2.65309, Evenness (J) 0.8418 and Species Richness of 21 shows that a moderately high biodiversity of ornamental fishes in the market of Lalitpur that has a stable, diverse and well-stocked community of ornamental fish in Lalitpur.

In conclusion, this study provides meaningful analysis of diversity of ornamental fish in Lalitpur. Also shows that despite the dominance of exotic fish species, native species remains under utilized, showing an opportunities for sustainable, indigenous alternatives. A viable shift for cultivating native ornamental fish species could reduce dependency on imports and enhance local aquaculture in Nepal, minimizing the risk driven by exotic fish species arising from aquarium trade.

Keywords: Shannon index, Diversity, Microsoft Excel, *Poecilia reticulata, Danio rerio*

Introduction

Ornamental fishes are the fish species that are found in a wide variety of colours and patterns having attractive and various characteristics which are kept in a particular small space like aquariums or garden pools for fancy and fun (Rajbanshi, 2012). Ornamental fishes are popularly known as “Aquarium fish” as they are kept in a glass aquarium. These are one of the important types of fish in the market both nationally and internationally for their commercial values. Diversity of ornamental fishes simply refers to the variety and abundance of species which are kept for their aesthetic appeal in aquariums or ornamental ponds. About 230 native fish species comprising 104 genera, 34 families, and 11 orders have been supported by freshwater ecosystem of Nepal (Rajbanshi, 2012). Among these,

some of the native fishes also have values as ornamental fish and about 15 native fishes have potential for ornamental values because of their great vibrant colour (Husen, 2019). In Lalitpur, about 57 ornamental fish species of both native and exotic varieties were documented where 53 of these are exotic imported from other countries while only 4 are native to Nepal: *Puntius conchonius* (Rosy barb), *Puntius sophore* (Olive barb), *Danio devario* (Devario), and *Danio rerio* (Zebrafish) (Baniya and Mishra, 2024). Some exotic fish species such as *Carassius auratus* (Goldfish), *Poecilia reticulata* (Guppy), *Ciprinus rubrofuscus* (Fancy carp), and *Xiphophorus helleri* (Sword tails), and some native fish like *Colisa* spp., are raised for breeding purposes in the fishery research station, Begnas, Pokhara (FRS, 2018).

In the Lalitpur there are over 40 varieties of exotic ornamental fish are traded from suppliers that includes Thailand and India as for exotic fish and domestic breeders for the native fish that are found in the local aquarium shops (Jha and Prasad, 2015). This trade includes a greater number of exotic imports such as Tetras, Guppies, Goldfish varieties (Oranda, Comet, Fantail, Black Moor etc.), Sharks (Silver shark, Rainbow shark), and Cichlids (like African cichlids, Electric yellow cichlid) while there are only a few native fish species like Rosy barb and Zebra fish are available (Jha and Prasad,2015). Which shows that this market is highly biased towards exotic fish species, where a small part of native fish is traded. By listing these ornamental fish species available in Lalitpur's market, which provides a better understanding of the customer's preferences and according to this the trade of ornamental fish (Husen, 2019; Jha and Prasad, 2015). It also shows the diversity of ornamental fish species and biodiversity of ornamental fish species present in the Lalitpur's market. Our country has a rich and unique biodiversity with a variety of ornamental fish. But this resource has not been properly exploited. All the fish found in our country is freshwater.

The ornamental fish market in Lalitpur is composed of both native and exotic fish species, where exotic fish dominates native species with a small amount of native traded and present in the market that have significant role on ecology and commercial sector aiding on Nepal's economy (Husen,2019; Jha and Prasad, 2015). This study aims to compare the native and exotic ornamental fish species based on their origin, adaptability, breeding potential and their conservation practices. Over 50 exotic species dominate the market that includes *Carassius auratus* (Goldfish) varieties, *Poecilia reticulata* (Guppy) varieties, Tetras, *Puntius tetrazona* (Barbs), and Cichlids, *Betta selendens* (Betta), Sharks and *Poecilia sphenops* (Molly) that are visually appealing and require controlled environments and may pose ecological risks (Husen,2019). Only four native ornamental fish species are commonly found: *Puntius conchonius* (Rosy barb), *Puntius sophore* (Olive barb), *Danio devario* (Devario) and *Dani rerio* (Zebrafish) that are well suited to Nepal's freshwater ecosystem where consumer preferences are low due to limited variety (Chand *et al.,* 2022).

The ornamental fish market in Lalitpur witnessed the high growth in recent years which is increasing interest in aquarium as hobby and decorative practices (Shrestha, 2025). The market also offers variety of accessories like filters, artificial plants, and decorative stones that help in the growth of consumer preferences in Lalitpur shows they are more like vibrant

and active species due to coloration and body shapes (Shrestha, 2025; Jha and Prasad, 2015). Most consumers maintain the medium-sized aquarium with aesthetic appearance and lifestyle of ornamental fish species. A survey done in 2015 showed that Lalitpur hosts a handful of aquarium shops which is dominated by Goldfish imports, with artificial feeding, ornaments like stones, grass, etc. However, national data from 2009-2017 reveal an increase in ornamental fish imports (from 318 to over 1233 tons annually), yet only about 27 exotic species were present in valley shops (Husen, 2019).

Materials and Methods

Study area

The study was conducted in different areas of Lalitpur, Nepal, near Patan, Lagankhel, Jawlakhel, and Satdobato. Lalitpur is situated at a latitude 27°32′53.88″ North, longitude 85°20′15.00″ East. Lalitpur, also known as Patan, is a significant cultural, historical, and urban area with a growing interest in agricultural and business enterprises, including ornamental fish farming. This district is located near the capital city, which provides access to both local and international markets, making it an ideal location to explore the potential of ornamental fish farming (Shrestha, 2022).

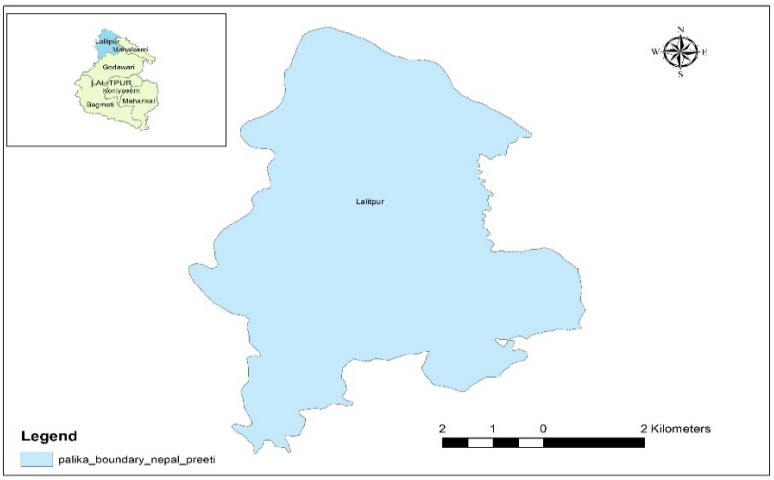

Figure 1: Map of Lalitpur

3.3 Method

This project was conducted in the month of Falgun, 2081 B.S. , in different places of Lalitpur, Nepal, using different methods. At first 9 different aquarium shops and pet shops were visited to record and observe the available ornamental fish species. During those field visits, various interviews and questionnaires were used to collect the information of the

ornamental fish specis from the shop owners regarding their species origin (native or exotic), popularity, and their patterns of trades. Fish species were identified based on their morphological features with the help of shop owners and also with the help of google lens for further identification. Some photographs of the ornamental fish species were photographed with the help of mobilephones. Then the gained data was recorded in tables with their scientific name, common name and whether the species are native or exotic along with their abundance in number available in those particular shops. The map of study area was constructed on Arc. Gis software with the instructions from the expert of that field.

3.4 Data analysis

Statistical analysis was carried out in Microsoft Excel software and species diversity was calculated by using the Shannon index (also known as Shannon-Wiener Index) and evenness by Pielou's Evenness index.

It is a mathematical measure of biodiversity in a community that accounts for both :

- Species richness (the no. of species present) and,
- Species evenness (how evenly the individuals are distributed among the species)
- Shannon-Wiener diversity index is denoted as H′, which is calculated as:

$$H' = -\Sigma pi.\ln(pi)$$

Where, pi= ni/N (Proportion of each species in the sample)
ni= Number of individuals of a species
N= Size of whole community (Total number of individual species observed)
Σ= Number of species
ln= The natural log

To find the Evenness of species: Evenness of species was calculated using Pielou's Evenness Index, given by;

$$J = H'/\ln(S)$$

Where, $H' = -\Sigma pi.\ln(pi)$
H′= Shannon-Wiener Diversity Index
S= Species Richness

The value of J ranges from 0 to 1. Lesser the variation in the communities between the species the higher the value of J.

Result

Ornamental fishes found in the market

A total of 1581 individual ornamental fishes were recorded belonging to eight families and 21 genera. Among them *Gymnocorymbus ternetzi* (Mixglow tetra) was the most abundant with 213 individuals and *Callopleslops altivelis* (Commet) *and Amphilophus hybrid* (Flowerhorn) were least dominant with 25 and five individuals each.

Table 1: List of ornamental fishes found in the market.

S.N.	Scientific Name	Common Name
1	*Poecilia reticulata*	Guppy
2	*Betta selendens*	Betta
3	*Pseudotropheus spp.*	African Cichlid
4	*Pterophyllum scalare*	Angel fish
5	*Melanotaenia boesemani*	Rainbow fish
6	*Labidochromis caeruleus*	Electric yellow cichlid
7	*Cyprinus rubrofuscus*	Koi carp
8	*Epalzeorhynchos frenatum*	Rainbow shark
9	*Balantiocheilos melanopterus*	Silver shark
10	*Corydoras spp.*	Corry catfish
11	*Amphilophus hybrid*	Flowerhorn
12	*Puntigrus tetrazona*	Tiger barb
13	*Boehlka fredcochui*	Blue tetra
14	*Gymnocorymbus ternetzi*	Mix glowtetra
15	*Callopleslops altivelis*	Comet
16	*Carassius auratus*	Goldfish
17	*Hemichromis bimaculatus*	Jewel fish
18	*Paracheirodon innesi*	Neon tetra
19	*Poecilia Sphenops*	Molly
20	*Puntius conchonius*	Rosy barb
21	*Danio rerio*	Zebrafish

Diversity of Ornamental fishes

The species diversity, evenness and species richness were calculated using Shannon Diversity Index and Evenness Index. The calculated Shannon Diversity index (H′) 2.65, Evenness (J) 0.87 and Species Richness of 21 shows that the ornamental fishes present in the market of Lalitpur has a moderately high biodiversity as shown in the Table 2.

Table 2: Diversity representing the ornamental fish community in Lalitpur, Nepal.

Indices	Value
Shannon-Diversity Index (H′)	2.65
Species Evenness (J)	0.87
Species Richness	21

Family composition of Ornamental fishes

The total of eight families were found among 1581 individuals ornamental fish species recorded as shown in pie-chart. Among the eight families the most abundant family was Cyprinidae with 33% and the least abundant families were Callichthyidae, Melanotaeniidae, Oshpronemidae and Plesiopidae with 5% each. The following pie-chart shows the family composition of Ornamental fishes recorded in the market of Lalitpur, Nepal.

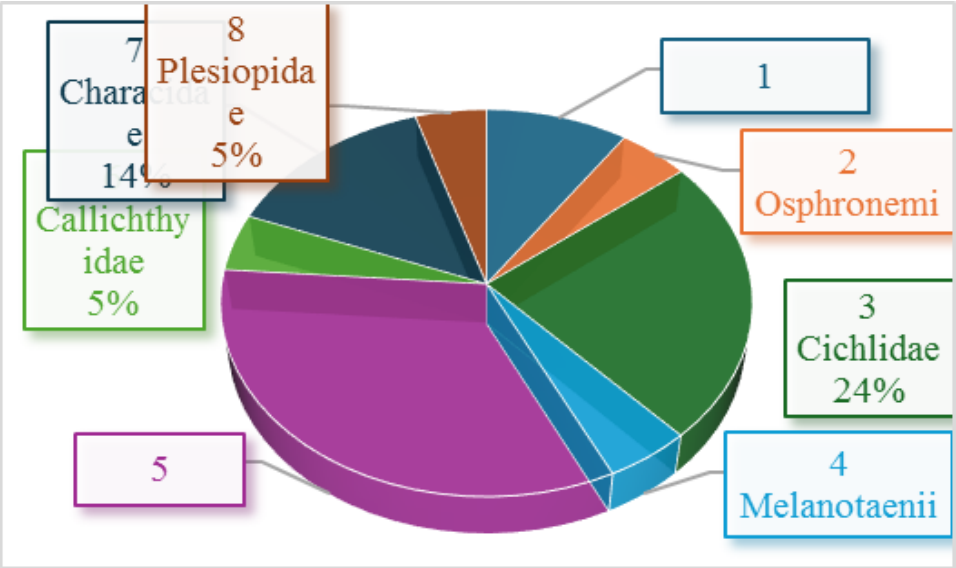

Figure 2: Pie-chart showing the family composition of ornamental fish.

Abundance of Ornamental fish species

Throughout the study period the total number of ornamental fish species recorded were 1581. There were 21 different species of ornamental fish, among them *Gymnocorymbus ternetzi* (Mixglow tetra) was the most abundant and *Callopleslops altivelis* (Commet) and *Amphilophus hybrid* (Flowerhorn) were least abundant as shown in below bar graph.

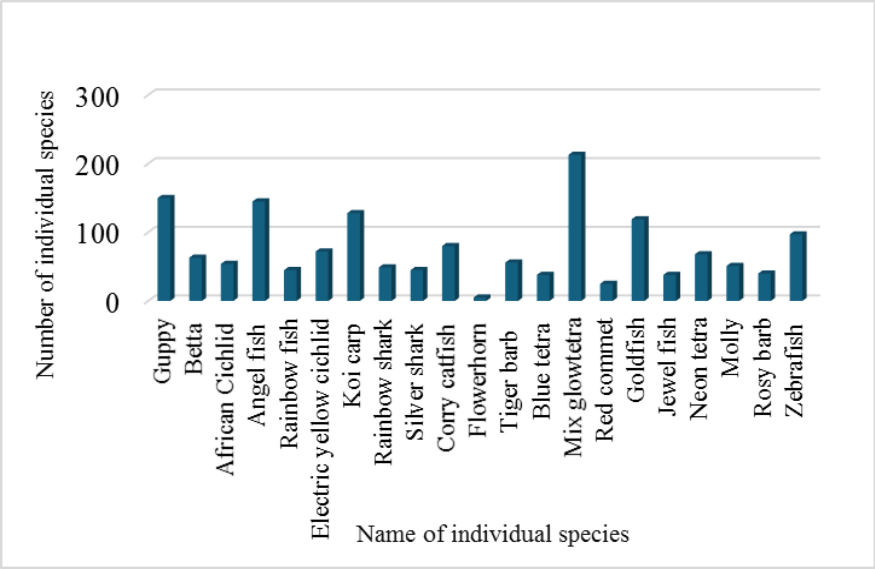

Figure 3: Bar graph showing the abundance of ornamental fishes.

Comparison between exotic and native ornamental fishes

The following pie-chart shows the comparison between exotic and native ornamental fishes. According to the following pie-chart which shows that exotic fish (90%) highly dominating the native fish that only found to be 10%.

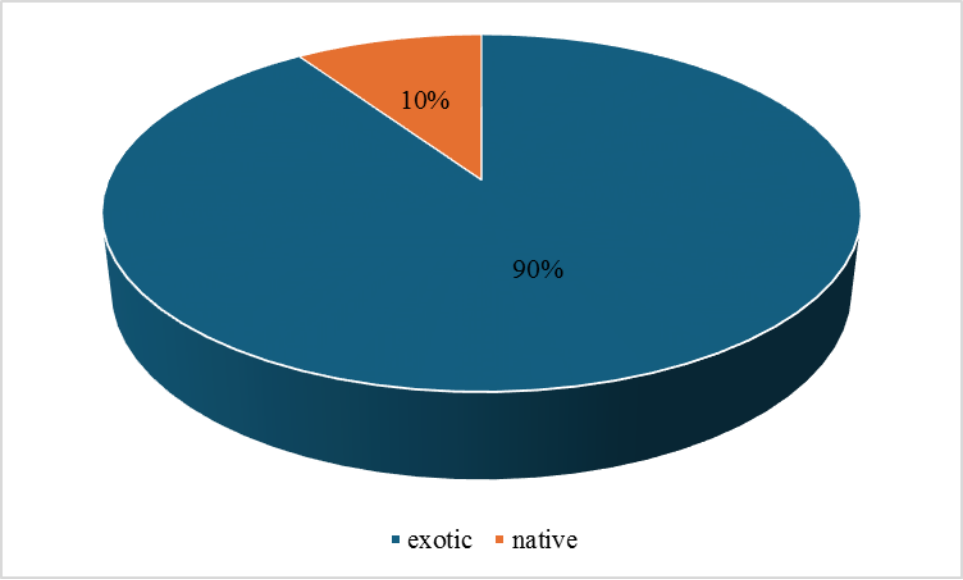

Figure 4: Pie-chart showing the origin of ornamental fish

Discussion

The ornamental fish market in Lalitpur shows a moderately diverse aquarium trade of ornamental fish by a wide range of species and family. The total of 1581 individuals were recorded which belongs to 21 species and eight families. It shows that the business of keeping decorative fish in urban areas like Lalitpur is growing interest where there is strong customer demand. The diversity of ornamental fish species was calculated by Shannon Diversity Index, Evenness Index resulting that Shannon Diversity ($H' = 2.65$) and Evenness Index ($J = 0.87$) which signal a moderately high diversity and relatively even distribution of species within the survey done in the market's shops. These values also suggest that although some species are more common, there is not an overreliance on just one or two. Which means there is a good variety of species influenced by what traders and consumers prefer.

Pie-chart showing the taxonomic perspective where the Cyprinidae family are the most abundant group with 33% of the total population in ornamental fish markets locally. Cyprinids such as Carassius auratus (Goldfish) and Cyprinus rubrofuscus (koi) are widely traded due to their adaptability and popularity. Families with lower abundance such as Callichthyidae, Melanotaeniidae, Osphronemidae, and Plesiopidae at 5% each could be less popular because of their pattern, price range and low rate of trade.

The Gymnocorymbus ternetzi (Mixglow tetra) represents the most abundant species with 213 individuals that suggest it is most popular among consumers and hobbyists. Because of its aesthetic appeal, adaptability with small aquarium tanks. In same way the low abundance of Callopleslops altivelis (Comet) and Amphilophus hybrid (Flowerhorn) with only 25 and five individuals respectively, shows that they need higher maintenance, high in cost and require more space also maybe because of their low aesthetic appearance as shown in the bar graph.

Comparison between exotic and native ornamental fishes

The overall species richness of 21 types of fish species highlights the accessibility of various ornamental fish options possibly facilitated by imports from neighbouring countries such as Thailand, India, and Singapore. Which shows that the ornamental fish market of Lalitpur is highly dominated by exotic fish (1444) over native fish (137) with a percentage of 90% and only 10%. These highly dependence on exotic fish imports raises a concern on environments like diseases, invasive species and harm to local ecosystems. The bar graph and pie-chart clearly show that the native species are underrepresented both in numbers and variety despite of being well adapted to local water and seasonal adaptation to the variation. The native species are also easy to breed in captive nature which makes them the perfect match

for the developing sustainable domestication of native ornamental fish species in the industries. To protect biodiversity of Nepal's freshwater and to reduce the over dependence on exotic fish, we need to promote native species through conservation breeding, and more proper documentation of those native species. With better awareness and sustainable practices, the balance economy with ecological responsibility in ornamental aquaculture sector should be grow**.**

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