Qualitative and quantitative analysis of fish population in Valsad district

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Abstract

The study aims to assess the qualitative and quantitative aspects of ichtyofauna populations in the Valsad district, focusing on species diversity, abundance, and ecological significance. Data collection was conducted through field surveys, sampling, and interviews with local fishers, covering the coastal ecosystems. Qualitative analysis involved the Taxonomic richness and diversity of ichthyofauna population. It revealed that 31 taxa were identified, divided into 28 families, 16 orders, 4 classes (Actinopterygii, Malacostraca, Cephalopoda, and Gastropoda), and 3 phyla (Chordata, Mollusca, and Arthropoda). The quantitative approach included population density estimation, the relative abundance. It showed that 197 species or 100 % of ichtyofauna was recorded at Valsad station and the most dominant species is Brama Brama with 22%.

Keywords: Fish diversity, population density, Qualitative, Quantitative, fisheries, conservation.

1. Introduction

The Valsad district, located in the coastal region of Gujarat, India, is the most populated among the **25 districts**, with a population of **1,703,068**, and is an important area for fisheries due to its rich aquatic biodiversity.

 Gujarat state has the longest coastline of all the maritime states, at 1600 km. Out of 0.506 million square kilometers of total continental shelf area, the state of Gujarat has the highest continental shelf area, amounting ~~to about~~ **184,000 square kilometers** **(Anonymous., 2020).** The coastal marine fishery resource plays a vital role for coastal States in terms of livelihood, food security, employment, and foreign exchanges through export. The fishery sector plays an important role in the Indian economy. It contributes to the national income, exports, rural and livelihood development, domestic nutritional security, and employment generation **(Faruque, 2007)**. Furthermore, this ichthyofaunal biodiversity is under pressure, leading to the loss of some species and the shifting of other species. High-value species are being decimated by overfishing, and the production of low-value fish for oil and fishmeal for fish iJol accounts for 25% of the total catch **(FAO, 2007b).**

Recent studies have emphasized the need for comprehensive assessments of fish populations in coastal regions to understand species distribution and abundance patterns **(Jhingran, 2019).** Such studies help identify factors affecting fish habitats, including water quality, temperature variations, and human interventions **(Sarkar & Bain, 2007).** Despite this, limited research has been conducted in the Valsad district to evaluate the status of fish populations and the environmental pressures they face. This study is aimed at analysing quantitatively and qualitatively the ichthyofaunal diversity of Valsad District.

2. Materials And Methods
1- Study area

This research was carried out in Gujarat's Valsad. Situated at **N 20°27.263'E 072°50.324'**, Valsad is located south of Navsari and shares border with Maharashtra and the union territories of Dadra and Nagar Haveli and Daman and Diu in the south. He is an industrial base for sectors such as chemicals, textiles, and paper & pulp industries**.(Figure 1)**

2- Data collection

A detailed questionnaire was prepared to collect ichthyofauna population of Valsad district. The questionnaire covered various aspects including: type of fish, name of fish in local language, the size of fish, the income, the types of boat, the frequence of fishing, socio-economic conditions of the fishermen,….
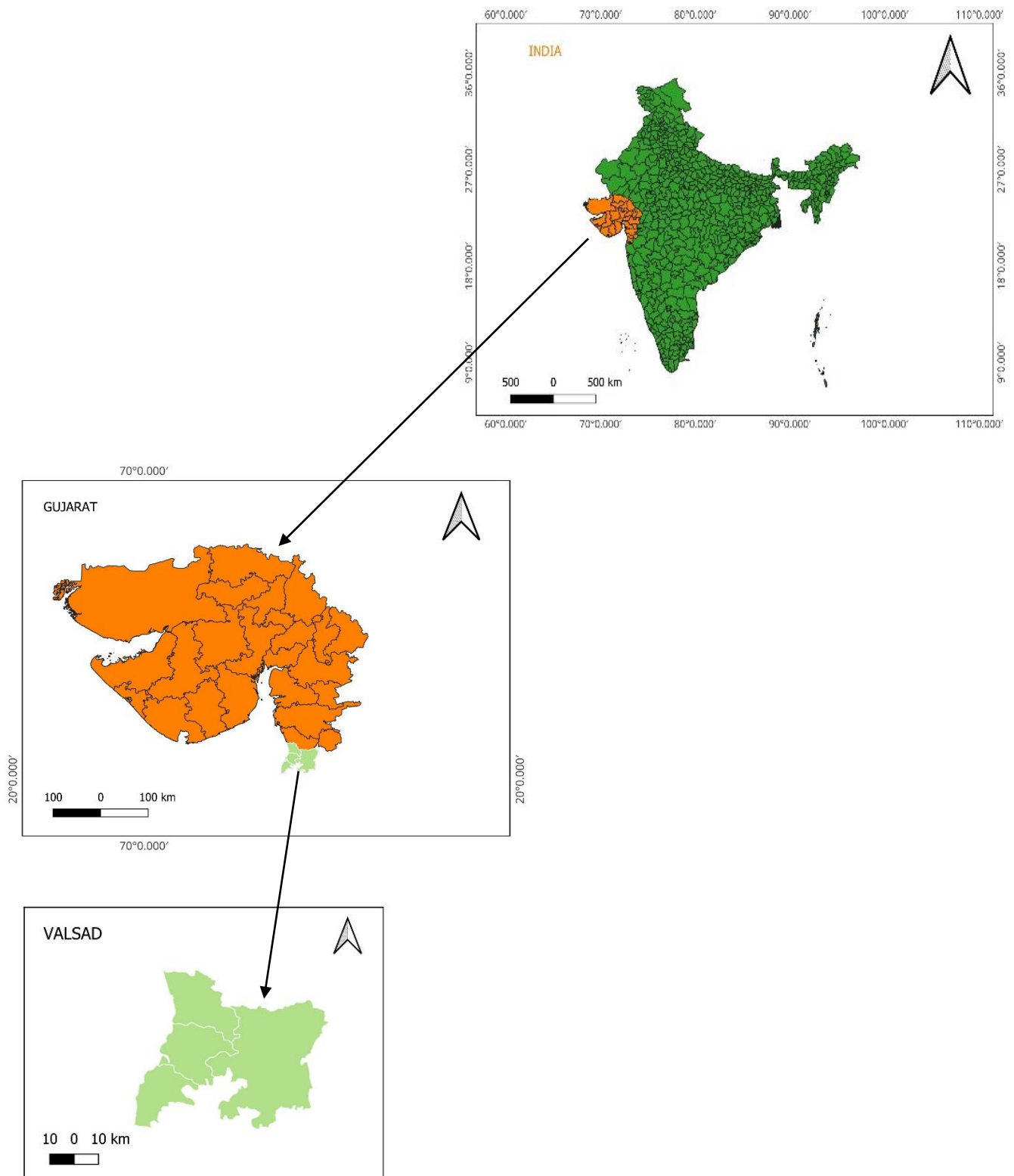
Figure 1: Valsad's carte

3- Data analyses
1- Taxonomic richness

Taxonomic richness is the total number of taxa collected in an environment. According to **Aliaume *et al*. (1990)**, taxon richness is an excellent indicator of an environment's carrying capacity of an environment.

2- Relative abundance (N)

Abundance is an important parameter for describing a stand. It's the number of individuals of a species or taxonomic group in a given sample over a given area, divided by the total number of individuals and multiplied by one hundred. Relative Abundance is calculated following formula below:

$$RA: \frac{\text{Number of sample of particular species x 100}}{\text{Total number of samples}}$$

I- Results and discussion
1- Qualitative analyses
- **Taxonomic richness**

A total of **31 taxa** were identified, divided into **28 families**, **16 orders**, **4 classes** (Actinopterygii, Malacostraca, Cephalopoda, and Gastropoda), and 3 phyla (Chordata, Mollusca, and Arthropoda) **(Table I)**.

The phylums of Arthopoda and Mollusca have respectively 1 classe, 1 order,2 famillies; 2 classes, 2 orders and 2 famillies. The Chordata phylum has 2 classes, 13 orders and 25 famillies. The last phylum is covering the most famillies with 86 % and 85 % of taxa. He is following by the Arthropoda and Mollusca with respectively 7% of families and 6% of taxa; 7% of families and 9% of taxa **(Figure 2)**.

The Cephalopoda and Gastropoda classes have 1 family and 1 order. Moreover, the class of Malacostraca has 1 order and 2 families. The Actinopterygii class has 13 orders and 25 families**.** The Actinopterygii is the class that is richer in terms of family with 86% and in terms of taxa with 85%. It is followed by the Malacostraca and Cephalopoda classes with 6% of taxa each, and the classes of Gastropoda with 3% of taxa **(Figure 3)**.

In the Actinopterygii class, the Perciformes order covers 7 families with 33%. Then he is followed by the clupeiformes and carangiformes with 3 families or 14%. The Acanthuriformes, Decapoda, have 2 families or 10%. Finaly, we have Siluriformes, which has 2 families, or 9%, and Scombriformes and Octopoda, which have 1 family, or 5%.

Table I: List of Valsad's Ichthyofauna in February 2023

Phylum	Classes	Order	Family	Taxa	Code
Chordata	Actinopterygii	Aulopiformes	Synodontidae	*Harpadon nehereus*	Har
		Siluriformes	Clariidae	*Clarias batrachus*	Clar
			Bagridae	*Sperata seenghala*	Sper
			Engraulidae	*Stolephorus indicus*	Stol
		Clupeiformes	Clupeidae	*Tenualosa ilisha*	Ten
			Pristigasteridae	*Pellona ditchela*	Pell
			Bramidae	*Brama brama*	Bra
			Haemulidae	*Parakuhlia macrophthalmus*	Par
		Perciformes	percinidae	*Carassius auratus*	Car
			Gobiidae	*Awaous guamensis*	Awa
			Scorpaenidae	*Scorpaena maderensis*	Sco
			Carangidae	*Apolectus niger*	Apol
			Percidae	*Perca sp.*	Perc
		Scombriformes	Scombridae	*Rastrelliger kanagurta*	Ras
				Spanish mackerels	Spa
				Scomberomorus guttatus	Scom
		Tetraodontiformes	Balistidae	*Balistoides viridescens*	Bal
		Acanthuriformes	Sciaenidae	*Protonibea diacanthus*	Pro
		Characiformes	Characidae	*Salminus sp.*	Sal
		Carangiformes	Latidae	*Lates calcarifer*	Lat
			Polynemidae	*Eleutheronema tetradactylum*	Eleu
			Carangidae	*Caranx ignobilis*	Caran
		Myopsida	Loliginidae	*Uroteuthis duvaucelii*	Uro
		Cyprinodontiformes	Poeciliidae	*Gambusia affinis*	Gam
		Centrarchiformes	Terapontidae	*Leiopotherapon plumbeus*	Leio
		Mugiliformes	Mugilidae	*Valamugil speigleri*	Vala
Arthropoda	Malacostraca	Decapoda	Homaridae	*Brachyura sp.*	Bra
			Penaeidae	*Fenneropenaeus indicus*	Fen
Mollusca	Cephalopoda	Octopoda	Octopodidae	*Octopus Vulgaris*	Oct
				Loligo duvauceli	Lol
	Gastropoda	Littorinimorpha	Strombidae	*Lambis lambis*	Lambi
3	**4**	**16**	**28**	**31**	
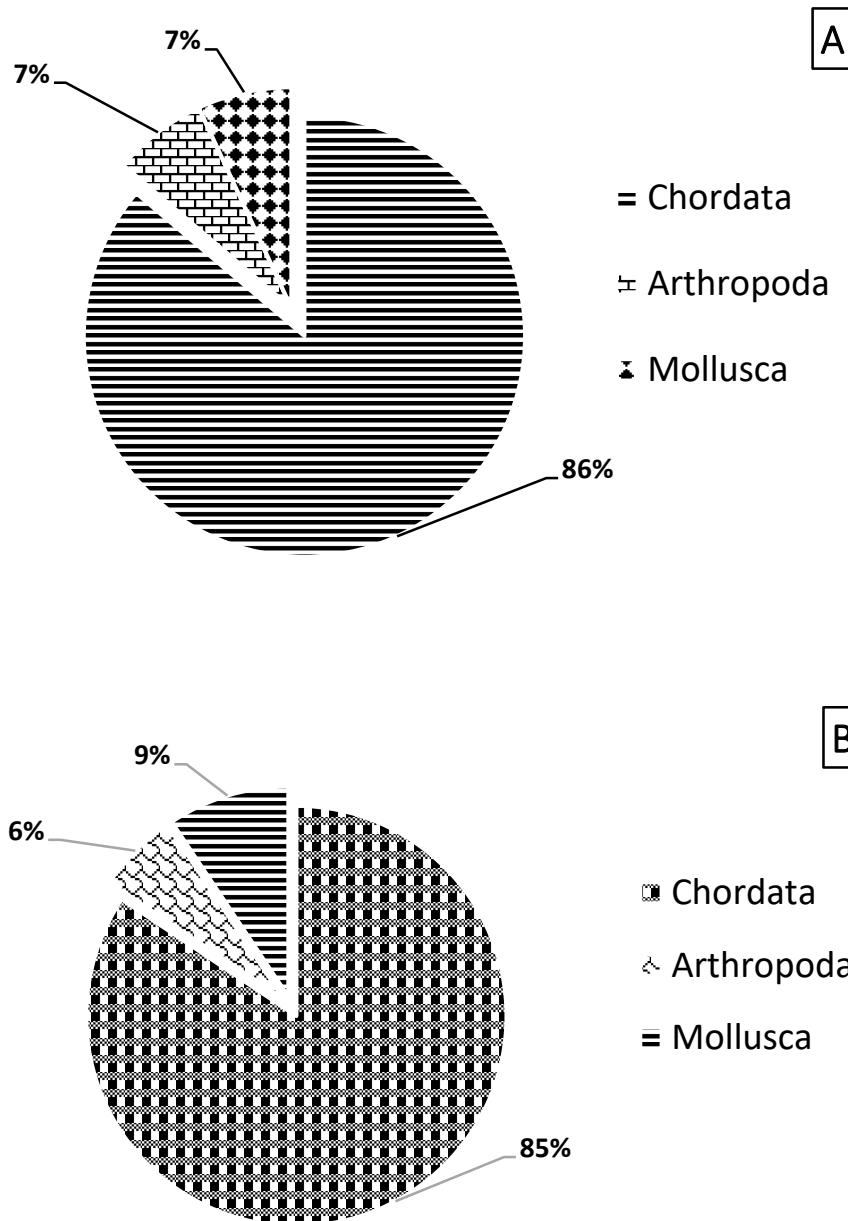
Figure 2: Percentage of Phylum of Valsad's Ichthyofauna

A: by number of families and B: by number of taxa
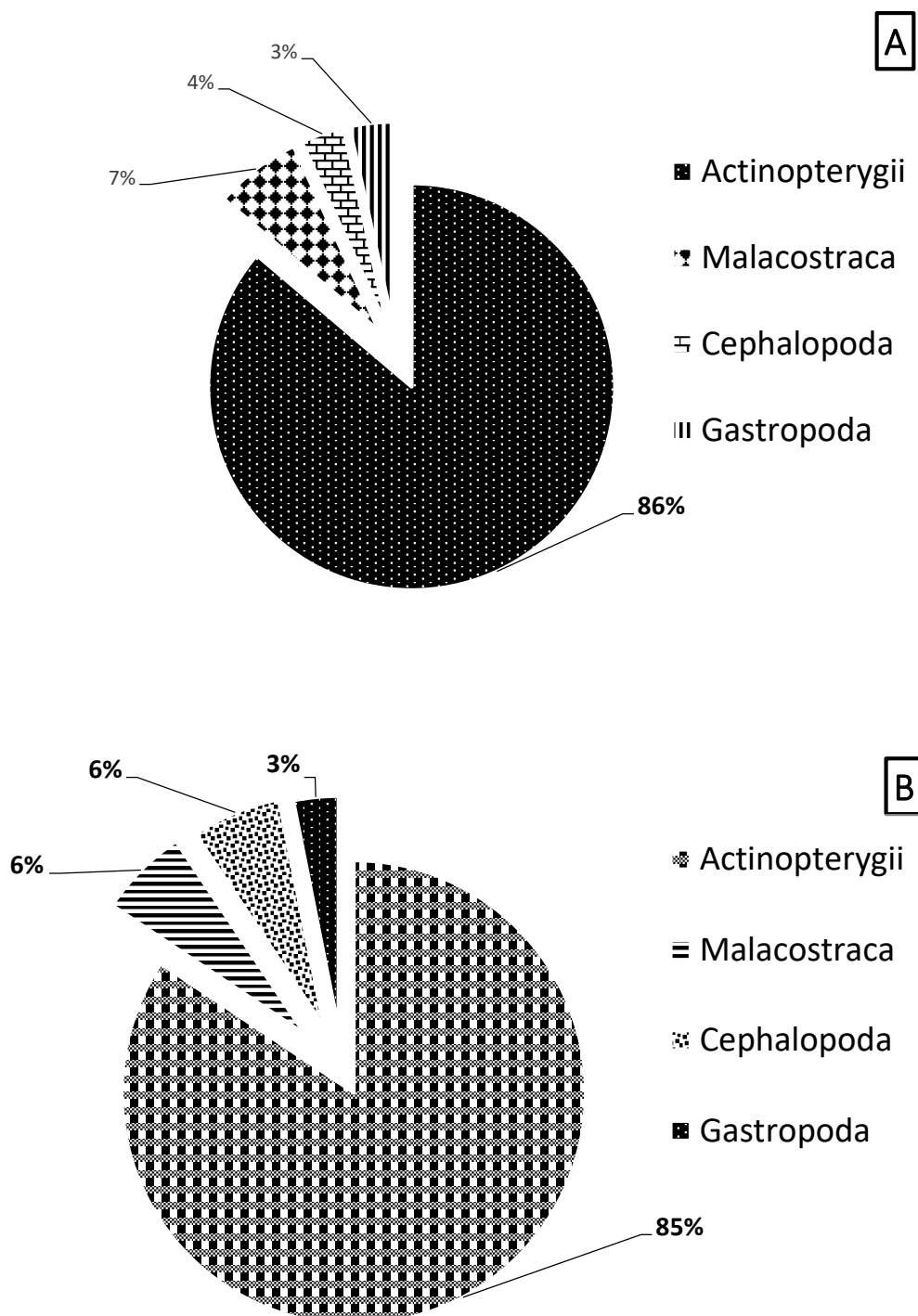
Figure 3: Percentage of classes of Valsad's Ichthyofauna

A: by number of families and B: by number of taxa

In terms of taxa, it's the Perciformes order that has the most taxa, with 7 taxa (29%). He is followed by the Scombriformes, Clupeiformes, and Carangiformes with 3 taxa (13%). Finally, we have the Siluriformes, Octopoda, and Decapoda orders that have 2 taxa (8%) **(figure 4).**

### 2- Quantitative stand analysis
❖ Relative abundance

A total of **197 species** or 100 % of ichtyofauna was recorded at Valsad station. The class of Actinopterygii is the most abundant with 73%. He is followed by Malacostraca, Cephalopoda and Gastropoda respectively with 24%, 2% and 1% **(Figure 5 A)**. The richest orders are the Perciformes and Decapoda (30%). They are following by the Clupeiformes (17%), Scombriformes (7%), Carangiformes (6%) andSiluriformes (10%). The others orders (Aulopiformes, Tetraodontiformes, Acanthuriformes, Characiformes, Myopsida, Cyprinodontiformes, Centrarchiformes, Mugiliformes, Octopoda, Littorinimorpha) are weakly represented under 5% **(Figure 5 B)**. The Bramidae is the richest family with 21%. He is following by the Homaridae (19%), Panaeidae (17%), Pristigasteridae (13%), Bagridae (10%), Scombridae (8%), Mugilidae (7%) and Engraulidae (5%). The others families with weak percentage are Synodontidae, Clariidae, Haemulidae, percinidae, Gobiidae, Scorpaenidae, Carangidae, Characidae, Percidae, Balistidae, Sciaenidae, Latidae, Polynemidae, Carangidae, Loliginidae, Poeciliidae, Terapontidae, Octopodidae, Strombidae, Clupeidae **(Figure 5 C)**. Eight species are dominant in the ichtyofauna in Valsad: *Brama Brama* (22%), *Brachyura sp*. (20 %), *Fenneropenaeus indicus (18*%), *Pellona ditchela* (13%), *Sperata seenghala* (10%), *Valamugil speigleri* (7 %), *Stolephorus indicus* (5%) and *Balistoides viridescens* (5%) **(Figure 5 D).**

3. Discussion

The Valsad district collected a total of **31 taxa**, demonstrating the richness of taxonomy. These taxa are the majority of 26 Actinopterygii (26 taxa), 2 Malascostraca (2 taxa), 2 Cephalopoda (2 taxa), and 1 Gastropoda (1 taxa). The Perciformes order is the richest. These results corroborate those of **Kodeeswaran et al. (2020)** and **Katira and Kardani (2017)**. During their studies, they revealed that the Perciformes is the order the richest with respectively 47% and 58%.
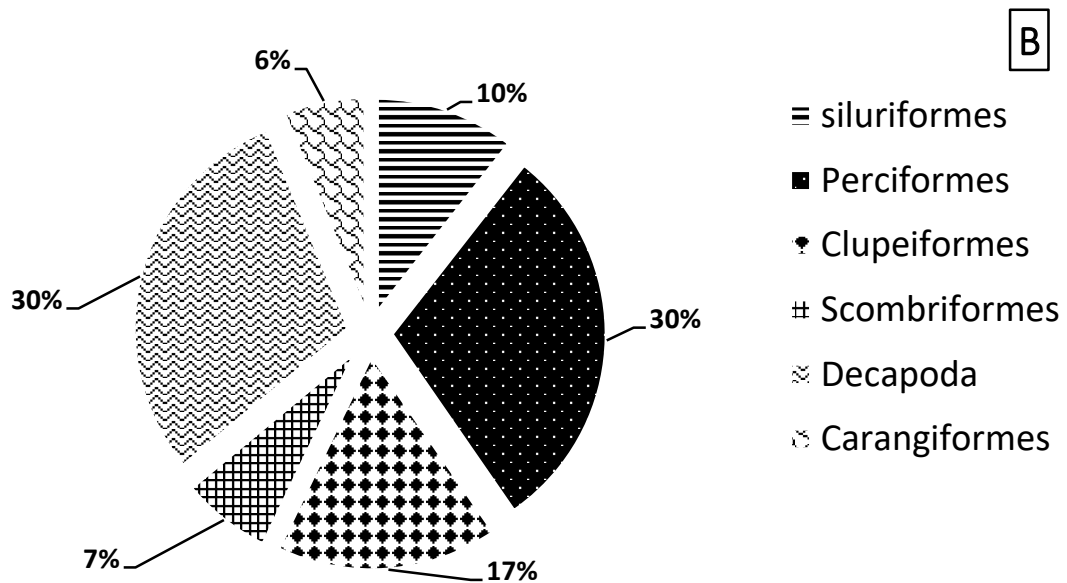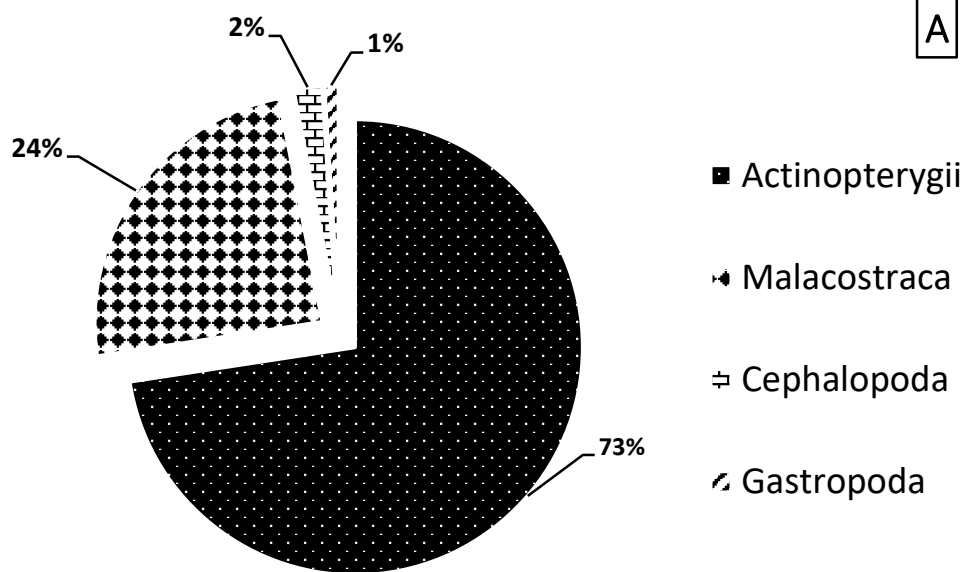
However, this taxonomic richness is lower than those recorded in Sikka Coast **(102 taxa)** by **Katira and Kardani (2017)** and in Chennai Fishing Harbour (**156 taxa**) by **Kodeeswaran *et al.* (2020).** Those differences can be due to the methodology of conservation. Indeed, in this study, the ichthyofauna was identified on the site, while the late works show two methods: first, it used 5% formalin on the ichtyofauna and brought it to the laboratory for identification, and the second brought the ichthyofauna to the laboratory in ice boxes and kept it deep-frozen for identification.
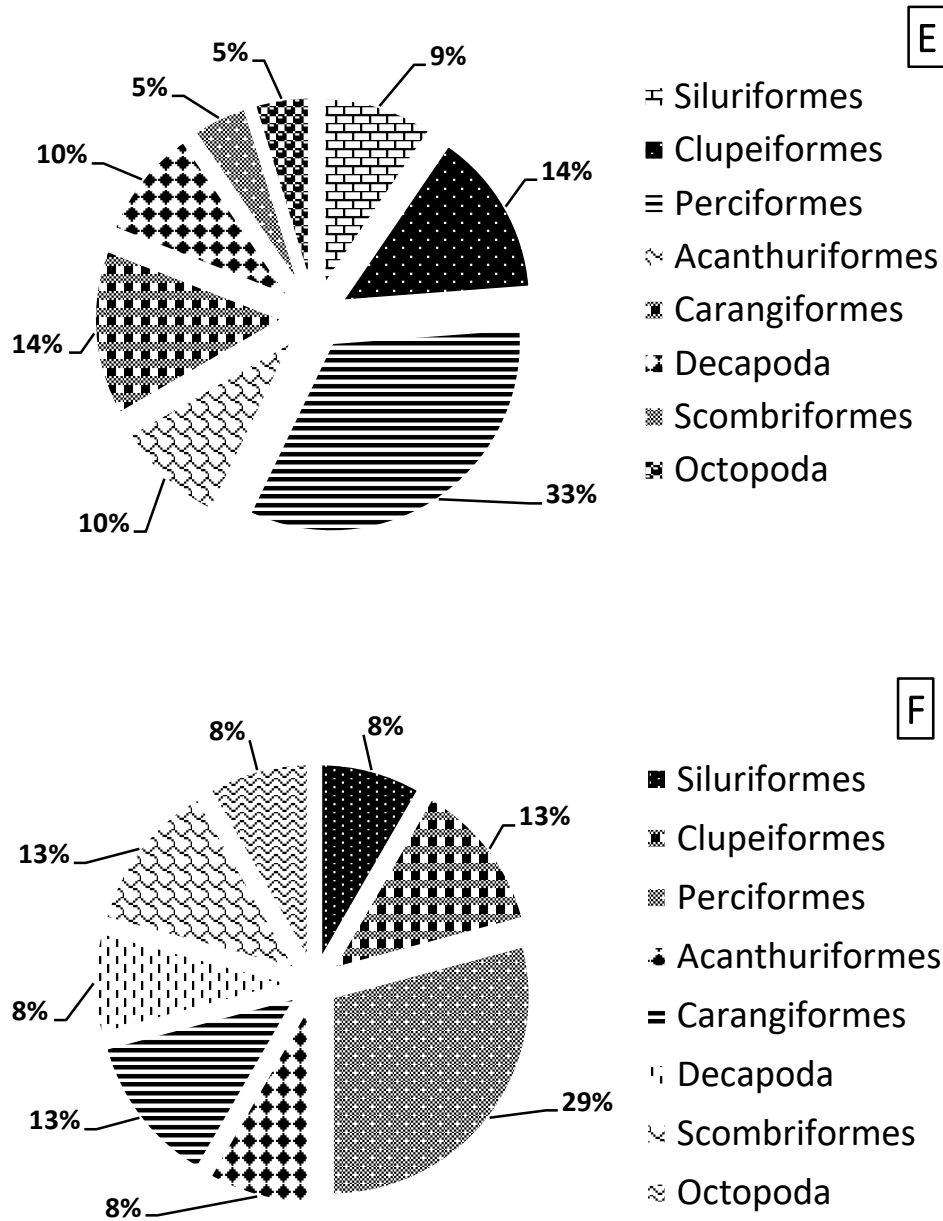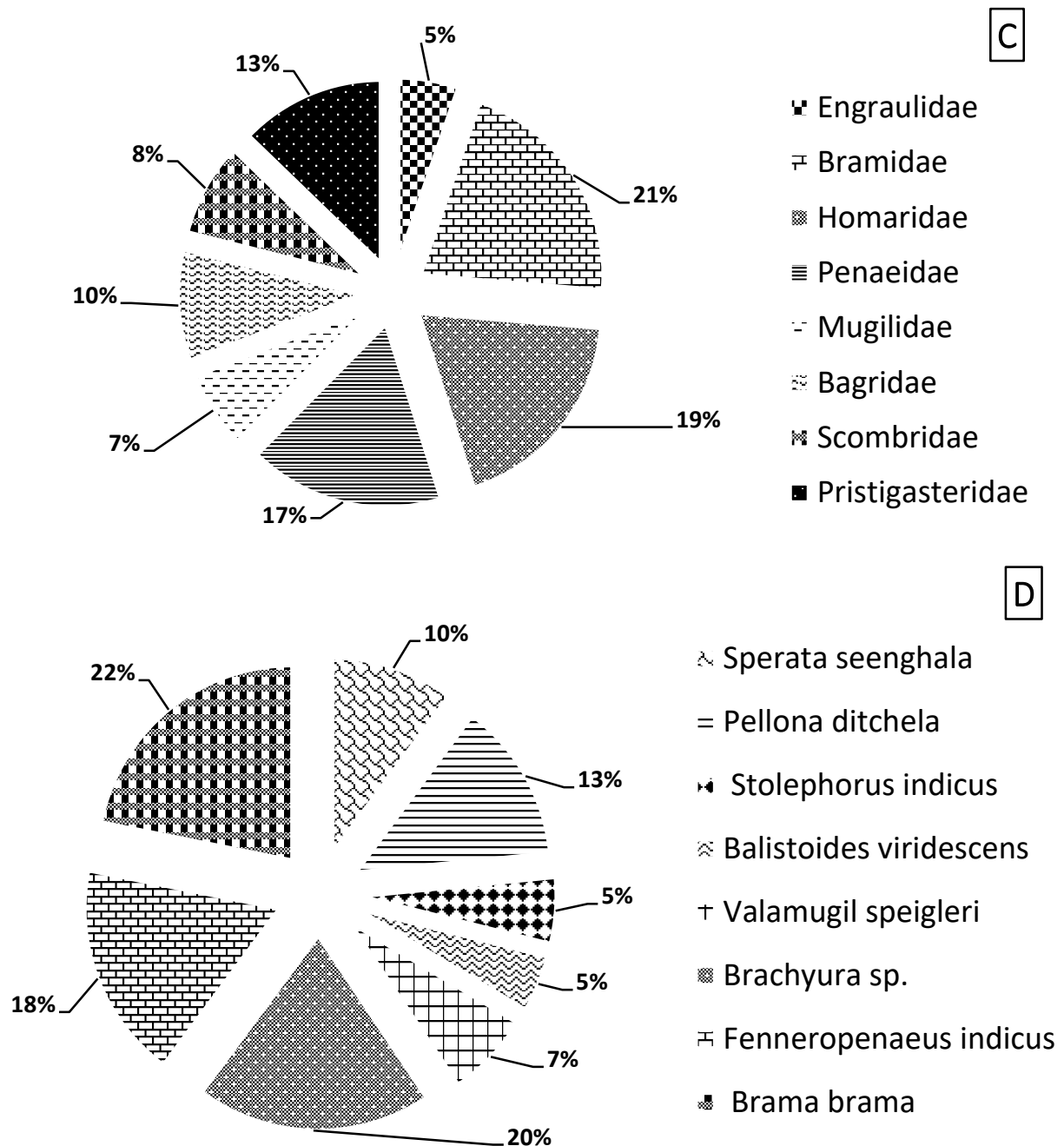
Figure 4: Percentage of orders of Valsad's Ichthyofauna

E:by number of families and F; by number of taxa

A

- Actinopterygii
- Malacostraca
- Cephalopoda
- Gastropoda

2% 1% 24% 73%

B

- siluriformes
- Perciformes
- Clupeiformes
- Scombriformes
- Decapoda
- Carangiformes

6% 10% 30% 30% 7% 17%

C

- Engraulidae
- Bramidae
- Homaridae
- Penaeidae
- Mugilidae
- Bagridae
- Scombridae
- Pristigasteridae

D

- Sperata seenghala
- Pellona ditchela
- Stolephorus indicus
- Balistoides viridescens
- Valamugil speigleri
- Brachyura sp.
- Fenneropenaeus indicus
- Brama brama

Figure 5: Relative Abundance of Valsad's Ichthyofauna

A: of classes; B: of orders; C: of families and D: of species

These methods can see a lot of fishes captured that constitute a good point to obtain a large number of the ichthyofauna.

About the Relative Abundance,197 species was recorded. The Actinopterygii is the most abundant with 73% or 26 species. These results corroborate those of **Parmar *et al*. (2022**) who indicate that the Actinopterygii is the richest class with 100 species.

This result produces an important information about ichthyofauna population in Valsad, the composition of that population.

4. Conclusion

The qualitative and quantitative analysis of ichthyofauna population in Valsad district provide valuable insights into the region's aquatic biodiversity, population dynamics. The study reveals that the taxonomic richess mentions the presence of 31 taxa identified, divided into 28 families, 16 orders, and 4 classes with the Actinopterigii the richest class. About the Relative Abundance, we recorded 197 species or 100 % of ichtyofauna. The most dominant species is *Brama Brama* with 22%.

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