# SUMMARY

India is one of the world's mega biodiversity countries, ranking ninth in terms of freshwater mega biodiversity. In 2006, global catch fisheries output was around 82 million tonnes from marine waters and a record 10 million tonnes from inland waters. India has significant aquaculture growth potential. The country has a 7,517-kilometer-long coastline and a 195.210-kilometer-long river and canal system that includes 14 major rivers, 44 medium rivers, and several small rivers and streams. Furthermore, 2.36 million hectares of pond and tank resources are predicted. These freshwater resources provide as a heaven for a diverse, rich, and many rare and endemic fish fauna. Wetlands are among the most productive ecosystems on the planet, producing water and food for countless plant and animal species. Wetlands provide numerous socioeconomic benefits, and if the system is adequately managed, capture and culture fishing activities may be carried out efficiently in these types of water-logged sites. Wetlands provide an important source of water not only for groundwater recharge but also for a variety of other activities such as laundry and cattle bathing. In India aquaculture practice has developed from extensive to intensive level mainly by increasing the stocking and by changing the supplementary feed management. At present the Indian aquaculture production has reached to 3.9 million tons. Moreover, India has abundant fresh water and brackish water resources and there is a considerable scope for improving aquaculture production.

There are around 21,730 fish species in the globe, with Indian waters hosting 11.7% of them. There are 73 (3.32) species found in cold freshwater regimes, 544 (24.73%) in warm freshwater regimes, 143 (6.50%) in brackish water, and 1440 (65.45%) in marine environments out of the 2546 species known to date. The economic production perspective has been used to assess India's freshwater resources. They will receive sewage and industrial waste, provide irrigation, urban-industrial water supply, or hydropower, and may also produce edible fish.

Gujarat is one of the leading aquaculture states in India. According to a report by the Government of Gujarat's Department of Fisheries, 4.10 lakh ha of water area is suitable for aquaculture. According to a survey of the literature, several researchers have examined the taxonomy, biodiversity, and distribution of freshwater fishes from various rivers in India.

In developing countries, fisheries and aquaculture play a vital role in ensuring food security and offering alternative livelihoods. Aquaculture is the fastest expanding sector of the food production sector, accounting for 52% of fish for human consumption. Aquafarming has potential for growth in India, owing to increased awareness among farmers and entrepreneurs about the benefits of aquaculture and the growing demand for food production. With nearly 2,400 species, Cyprinidae, also known as carps, is the biggest family of freshwater fishes. Indian Major Carp (IMC) is considered to be the major aqua-crop species in tropical countries, contributing to about 97% of the total freshwater aquaculture production throughout India. The Indian Major Carps (IMCs) are fastest growing fishes reared in the artificial and natural ponds fertilized with organic and inorganic manures. Farmers usually rear these three species Catla, Rohu and Mrigala for 3 or 4 years in polyculture in static water earthen ponds. Indian major carps Catla (*Catla catla*), Rohu (*Labeo rohita*) and Mrigal (*Cirrhinus mrigala*) as well as three exotic carps silver carp (*Hypophthalmichthys molitrix*), Grass carp (*Ctenopharyngodon idella*) and Common carp (*Cyprinus carpio*) form the basis of carp culture systems.

Disease has emerged as a significant barrier to the cultivation of many aquatic species. Traditional treatments, synthetic chemicals, and antibiotics have been used to control disease in the aquaculture business. The disease is becoming a major impediment to the cultivation of many aquatic species. Disease is a major cause of fish death, especially in young fish. They have become an important obstacle to aquaculture output and commerce, negatively impacting the country's socioeconomic situation. Fish that can reduce the effects of diseases and parasites through behavioural or biochemical means have a reproductive advantage. Correct early pathogen identification, as well as an understanding of pathogenic processes, are critical for disease management in aquaculture. Among the diagnostic tools available, electron microscopy (EM) and standard histology techniques continue to be the most significant for determining pathogen etiology during illness conditions.

The physicochemical condition of water has been proven to have a major influence on fish health and disease development, primarily on fish resistance to pathogens and parasite fauna. Water quality degradation is the primary cause of the proliferation of pathogenic organisms known to influence carp growth and induce illness development. As parasitic diseases, this disease encompasses protozoan, viral, and bacterial infections, among others. Protozoan illnesses are more harmful in that they cause abrupt mortality of the host fish as well as spreading and harming livestock affecting the aqua culturists' economy. In contrast to bacterial and parasitic diseases, only a few fungal species have been identified as pathogenic to fish. Whereas parasites are most commonly found on the host fish's exterior surface, they have also been observed parasitizing in the mouth (replacing the tongues, for example, the Cymothoids: Isopods) and gill arches, generating pressure on the gill surface and so decreasing the efficiency of respiration. Although the infestation did not result in immediate death, it did interfere with the normal growth of the host fish and most likely contributed to the high levels of secondary infections. The current study focuses on the number of water sheets that are suitable for aquaculture practices with their Ichthyofaunal diversity, which outnumber the total number of ponds in the study area, as well as an inventory of fish disease and parasitology.

Biodiversity is an essential component of ecosystem functioning and defines its resilience to various stresses, yet it is declining globally. If we want to maintain or manage biodiversity, we must first understand the species involved, their distribution, habitats, ecology, and so on. The first step towards conservation is being able to identify all species that occur in a given area unambiguously. Exotic invasions are frequently cited as one of the leading causes of global biodiversity loss, although the mechanisms and consequences of species invasions may differ across ecosystems, taxa, and spatial scales. Competition from invasive species can act as an additional filter for native species, sometimes stronger than environmental gradients. Exotic species are a major contributor to the Mediterranean region's loss of biological diversity, particularly in freshwater habitats. The functional structure of Mediterranean freshwater fish communities is relatively uncharted, and an ecological trait characterization of native and exotic fish species has only been recently defined for some areas. Finally, this allows for more investigation into the relationships between biological invasions, functional diversity, and the environment. However, invasions appear to be a major cause of biodiversity loss in some systems. According to a correlative analysis, introduced species, rather than habitat change, are the principal cause of population decreases and extinctions in California freshwater fishes.

Inland waters and freshwater biodiversity are a rich natural resource in terms of economics, culture, aesthetics, science, and education. Conservation and management of these species are vital to the interests of all humans, nations, and governments. Throughout the world, streams and rivers face a variety of environmental issues, the majority of which are caused by anthropogenic activity in their catchment areas. The Indian contribution to the global fish community is approximately 3500 species, of which 2500 have been recorded. The Indian species account for around 8.9% of all known fish species worldwide. In terms of biological resources, India is one of the 17 mega biodiversity hotspots, accounting for 60-70% of total worldwide biodiversity and ranking third in total fish output, accounting for 11.72% of total global fish biodiversity. Fish diversity and distribution have been intensively examined in the Kerala region of the Western Ghats. There are 930 freshwater species in India, out of a total of 2500. In an annual report by the Zoological Survey of India, Devi and Indra (2012) identified 667 species classified into 12 orders, 35 families, and 149 genera (Mankodi, 2018). The study on Anjanapura reservoir in Karnataka found 25 species of fish belonging to four orders and nine families. 14 fish species belong to the Cyprinidae family, three to the Siluridae family, and one each to the Bagridae, Claridae, Heteropneustidae, Ambassidae, Gobidae, Channidae, Mastacembelidae, and Notopteridae. In total, 140 fish species have been identified in the Ganga. However, it has been confirmed that over 69 fish species exist in the comparatively short section of the Ganga River between Kanpur and Ballia. The study of the alien species' impact has revealed a consistent drop in the capture of local fishes, particularly Indian major carps and others. The risks and ecological implications of foreign fishes in the Ganga River are especially concerning considering global concerns about fish biodiversity conservation. Introduced alien fish have resulted in significant community alterations in aquaculture and other naturalized ecosystems. However, many species remain to be dealt with in terms of molecular aspects.

As freshwater aquaculture grows in India, it is necessary to check the cultures for infectious and parasitic illnesses. The farmers' interviews revealed that they were tormented by white spot problems in the skin caused by *Ichthyophthirius spp.* Mostly in all season, and the value of the fish decreased when the white spots appeared. Another issue they encountered was the inability of the fish to grow due to intestinal parasites. The occurrences of the pathogens were high in summer and autumn months and low in winter months. Suitable preventive and control methods must be developed based on the occurrence of diseases and the economic losses they cause. Contaminated aquaculture units have resulted in lower aquaculture productivity, disease outbreaks in aquaculture organisms, economic loss, human health issues, and contamination of natural water bodies such as oceans and rivers when discharges from aquaculture units are released. Vibriosis, skin ulceration, albino derma, erythroderma furunculosis, and vertical scale disease are all frequent bacterial infections in Indian ponds.  Henceforth, the aim was to study the Freshwater resources of Central Gujarat with special reference to Ichthyofaunal diversity and Parasitology.

For the first objective, the number of inland water resources (water sheets) data of the Central Gujarat area was collected from the Government Fisheries Department and Google maps. For study sites, six districts (Anand, Nadiad, Kheda, Vadodara, Panchmahal, Dahod) of the central Gujarat area were selected. The Watersheets data was then primarily surveyed and confirmed for its aquaculture use. An Excel sheet was formed of each districts containing the details of the Watersheets with their Names, Geolocations, Area (in hectares), their potential of ongoing Aquaculture activity or not. Then the Watersheets were classified and distinguished according to their area as large freshwater lakes, medium size lakes and small lakes. Also a list of the Aquaculture and Non-Aquaculture ponds is prepared with the aquaculture species diversity.

Secondly, the fishing activity was carried out for sampling of fishes and for diversity study, 3 samples of each species were collected and rough identification was done on the spot, based on morphology. Here random sampling method is used as the different species are collected. The samples were then brought to the laboratory for further identification studies. Immediate images of each fish were taken, and the fish are preserved at -20°C. The Morphometric and Meristic features were noted for species level identification, using appropriate identification keys by Day Francis (1994) and FishBase (Froese and Pauly, 2023).  Further, Molecular confirmation was done using Phenol-Chloroform method for DNA extraction, followed by Sanger Sequencing. Phylogenetic relationship will be established. A fact sheet containing all details related to biology and fishery aspects of identified fishes has been created.

For the third objective, the fish diseases and parasitology study, the sampling sites were visited and the fish samples were analysed for were examined for Ecto-parasites. Gills arches were examined individually immediately after the fish are taken out of water. The buccal cavity, opercula, and eyes were examined separately. The external surfaces of the internal organs were inspected for free or encapsulated parasites, and then separated and examined individually. The digestive tract was opened longitudinally to examine for Endo-parasites. Infections parameters that have been utilized are those proposed by Bush *et al*., 1997, that is, prevalence (% infected) and mean intensity of infection (number of parasites per infected fish). Event of fish diseases or mortality due to such reasons was documented with required material and information. The parasites samples were then preserved some in 70% alcohol (for molecular confirmation) and others in 10% formalin. The further species confirmation of the parasites was done by using specific primers. The different kinds of endo- and ecto-parasitic diseases according to my findings were further referred too.

The Central Gujarat region includes the districts of Anand, Vadodara, Ahmadabad, Kheda, Nadiad, Gandhinagar, Panchmahal and Dahod. Majorly covering the area between Mahi and Narmada River. The total geographic area of the region comprises 34.13 lakh hectares. From this, we have selected six districts as Anand, Kheda-Nadiad, Vadodara, Panchmahal, Dahod and Narmada for sampling. The Mahi and Narmada river give rise to many small tributaries flowing in the study area. The study sites were surveyed for the data collection of ponds, lakes, dams or reservoirs, with their geolocations and area (in hectares) along with their Aquaculture status. For each districts, the total inland surface water area was calculated. The mapping of the study area along with the ponds and their aquaculture status were depicted. The ponds were then distinguished on two bases; Firstly, depending upon their sizes into small, medium or large and secondly on their aquaculture and non-aquaculture status.

The study site for the Anand district is shown. Anand is located at 22.57°N 72.93°E. It has an average elevation of 39 m (128 ft.). The district consists of 145 ponds of different sizes, belonging to large, medium, and small categories. 94 ponds are continuing with the aquaculture activity of IMC (Indian Major Carp) fishes, whereas the remaining 51 ponds didn’t have any aquaculture activity and some were beautified by the state central government under the smart city Project. This city has more number of small ponds. The decrease in the aquaculture activity is highly related or directly proportional to the decreaing number of ponds due to urbanization and development in the cities. Which leads to the loss of biodiversity. Many ponds in Anand were used as a dumping waste site.

Kheda is one of the oldest districts in Gujarat. The district covers 3958.84 square kilometers. The district is bounded by two important Gujarati rivers. Sabaramati on the west and Mahisagar on the east. The district has nine important rivers: Mahi, Sabarmati, Meshwo, Khari, Luni, Varasi, Sehar, Vatrak, and Shedhi. Nadiad is located at 22.74 °N, 72.86 °E. The city is the administrative center of the Kheda district. The Kheda district has less number of ponds so to compensate it Nadiad was taken into consideration. Where a total of 16 water sheets were surveyed out of which 10 watersheets had Aquaculture practices. As the city is still developing, proper management practices can be developed.

Vadodara, also known as Baroda, is a major city of Gujarat. It is located at 22.30 °N, 73.19 °E on the banks of the Vishwamitri River. The district has good amount of watersheets. A total of 156 surface watersheets were surveyed out of which only 94 watersheets showed Aquaculture practices. The district is surrounded by Major reservoirs as Timbi, Ajwa, Javla, Muval, Vadadla, etc. The ponds where further classified according to their area in hectares as in and were also looked for Aquaculture activity. The number of ponds have been decreased since last decade due to urbanization and also the beautification of ponds, which has certainly lead to the Habitat destruction and biodiversity loss.

Dahod is a city on the banks of the Dudhimati River at 22.83 °N, 74.26 °E, covering an area of 3642 sq km. The city features a large pond known as Chab Talav, which has recently been beautified and developed by the Municipal Corporation for public entertainment purposes. The Dahod district is the city that shares borders with two states, Rajasthan and Madhya Pradesh. The city has less number of ponds, surveyed were 5. The aquaculture practice was ongoing only in the ponds at village. Very less number of ponds had on going aquaculture activity. City also has some large ponds with beautification projects for entertainment purpose famously known as Chab talav. Also the district has some major reservoirs as Kali dam, Dungri dam, Muvalia dam, etc.

The city is located at 22.80 °N, 73.60 °E in the Western Gujarat. The term "Panch-mahal" refers to the five sub-divisions handed to the British by Maharaja Jivajirao Scindia of Gwalior State: Godhra, Dahod, Halol, Kalol, and Jhalod, Devgadh Baria. Dahod was formerly part of Panchmahal, but it is now an independent district. A total of 65 ponds were surveyed for sampling. Out of 65 only 52 watersheets showed the active aquaculture practices. The species diversity was also good in this area. The main reason could be the number of Reservoirs and Dams, surrounding the district along with the flowing river. The Major Dams are Panam Dam, Dev reservoir, Wankleshwar dam, Hadaf dam, Kadana Dam, etc. And as the previous literature suggested that the small reservoir has a higher estimated average fish yield per hectare (49.9 kg/ha), followed by the medium reservoir (12.3 kg/ha) and the bigger reservoir by Sugunan and FAO, (1995). Similar results are observed.

The district is situated on the eastern corner of Gujarat state at 21.76 °N, 73.65 °E, on the banks of Narmada. District now has 5 talukas and 1 municipality. Total five watersheets were surveyed for this district, out of which three were reservoirs with good species diversity, whereas one was Non-Aquaculture and other one was medium sized pond, with a regular ongoing fishing. The Narmada city being favoured by River Narmada showed the higher species diversity added by the migratory fishes mainly.

A total of 404 Freshwater water sheets were surveyed for the study, out of which the Aquaculture activity is continuing only in 264 water sheets. The Aquaculture status of the Districts with percentage depending upon the number is depicted in Fig.15, where the Narmada district has 100% Aquaculture activity among less number of pond i.e, contributed by rivers, followed by Dahod with 95%, as the Dahod district is surrounded by most of the Reservoirs, they contribute to the fisheries data. Similar result is with Panchmahal district as it has contribution of large number of Dams, i.e. Kadana, Panam, Sukhi, etc. Then the aquaculture activity is decreasing as we move towards cities Kheda-Nadiad, Anand, Vadodara. Ponds are highly vulnerable to mounting land-use pressures (e.g., urban expansion, and agriculture intensification) and environmental changes, leading to degradation and loss of the pond ecosystem.

A total of 42 species were found in the different water sheets of the study area. The diversity among the freshwater ponds was mostly the same as having one or two other species due to the water entering the pond or the region and favorable conditions. Below provided is the list of species diversity along with its classification and frequency of occurrence. A total of 42 species are recorded from the different freshwater resources belonging to 11 orders, 19 families, and 35 genera. Among them, Cypriniformes was dominated by 4 families and 20 species, Siluriformes, which consisted of 4 families and 6 species, and Anabantiformes, with three families and four species. Ovalentaria, Cichliformes, and Osteoglossiformes orders were represented with one family each and 3, 2, and 2 species respectively. Order Gobiiformes, Beloniformes, Synbranchiformes, Characiformes, and Carangaria represent one family with one species.

In addition to morphological identification, the species were also considered for molecular confirmation to ensure taxonomic accuracy. DNA extraction was performed using the manual Phenol Chloroform method. Subsequently, the extracted DNA underwent PCR amplification, and the resulting product was sequenced using the Sanger sequencing method. Here the sequence data of 11 species is obtained, which was further uploaded on NCBI and the accession numbers were generated. The phylogenetic analysis is valuable for studying the genetic diversity, evolutionary biology, and ecological interactions among these fish species. the Phylogenetic related among the species was calculated using the Mega X software. Closely related sequences are grouped. For instance, *Ctenopharyngodon idella* and *Hypophthalmichthys nobilis* being carps share a branch with a 62% support value, suggesting a closer evolutionary relationship between these two species.

Fish farming is a highly risky business for fish farmers mainly due to the disease problems because insidious diseases pose a major threat to the fish population. In general, it is believed that the parasite ecology of marine fishes is more diverse and abundant than that of freshwater species. Fish production is often reduced due to diseases and parasites by affect the normal physiological condition of fish and it can result in mass mortalities. A rise in intensification, which leads to greater stress levels in the cultured animal and their surroundings, is associated with the likelihood of aquatic animal disease propagation. Death or mortality due to such diseases can account for 10-15% loss. Disease is one of the major constraints to aquaculture and a limiting factor for socio-economic development in India and as in many other countries of the world. Fish diseases are classified based on causative agents as (a) Non-Parasitic infection by environmental stressors e.g. Gas diseases and (b) Parasitic infection by Fungi, Bacteria, Protozoa, Worms, and Crustaceans.

Fish in aquaculture ponds are generally affected by diseases of parasitic, fungal, and bacterial in origin. Above all, parasitic infestations are frequently encountered; however, they are studied to a limited extent in some regions of the world.

Unlike bacterial and parasitic infections, only a few fungal species are known to be harmful to fish. Fungal spores are routinely detected in fish culture water under normal circumstances and do not cause fish diseases. Healthy fish have a protective mucus layer that protects them from fungal spores. The protective mucus is degraded in a poor aquatic environment due to low water quality, rough handling, fighting, or physical injury, resulting in an epidemic of fungal diseases. Fungal infections are second to bacterial diseases of economic importance and are generally restricted from chronic to steady losses. The most common fungal diseases of fish are Saprolegniasis, a disease caused by *Achlya*, Branchiomycosis, Epizootic Ulcerative Syndrome (EUS), and *Ichthyophoniasis*. Branchiomycosis is a fungal disease commonly known as ʹGill Rotʹ disease (majorly involving the gill tissues), affects freshwater fishes, manifested by necrosis of the gills, and high incidences of mortality. Branchiomycosis develops in eutrophic conditions with a high organic matter content and temperatures exceeding 20°C. Infection is usually confined to the gills and leads to damage by colonizing gill vessels and capillaries.

Showing the clinical signs of the acute respiratory disorder leading to high mortality, because of anoxia that has been similar as reported in previous works of literature. There are primarily two species of *Branchiomyces* that are responsible for this disease and include *B. sanguinis* and *B. demigrans*. Both species produce branched, non-septate hyphae. Both *Branchiomyces* species cause similar pathology, except that *B. demigrans* affects the entire gill, with hyphae penetrating through blood vessel walls into the lumen, while *B. sanguinis* is restricted to gill blood vessels. *Branchiomycosis* is caused by the fungi *Branchiomyces sanguinis* in carps and tench and by *Branchiomyces demigrans* in pike, largemouth bass, striped bass, and tench. It has been reported several times in carps. High mortalities are often associated with this infection.

The production from culture system is remarkably hampered by the infestation of various fish parasites. Argulus is an ectoparasite commonly known as Fish lice. About 129 species of Argulus have been reported worldwide. It has a complex life cycle involving several metamorphic stages. Argulus species create skin lesions on the host using their suckers and proboscis when eating. These lesions frequently cause subsequent infections with bacteria and fungus. The infection also causes reduced appetite, weight loss, and anaemia in fish. Argulus serves as a vector of some viruses and parasitic nematode larvae. The collected Argulus sp. from carp were of different sizes, with females larger than males. Morphological identification of Argulus spp. is mostly based on distinguishing features of an adult male such as carapace and abdominal length or width, dorsal ridges of the carapace, respiratory areas, leg pigments, abdominal lobes and incision, and the presence of a small coxal at the swimming appendages. The challenge for species identification was amongst the most common two species A. japonicas and A. foliaceus, which was confirmed using the recent available literature. Based on the morphological characters such as dorsal ridges of the carapace, respiratory areas, teeth on the basal plate of 2nd maxillae, presence or absence of bilobed protuberances on 2nd swimming appendage in male and position, shape of peg and boot-shaped lobe on 4th swimming appendage in male and female, the parasites were identified as *Argulus japonicas*.

The incidence of infection in cultivable fishes from freshwater reservoirs (25.22%) with an abundance of infection at 1.59 was significantly less than ornamental fishes (49.50%) with an abundance of infection at 2.50. Ornamental fishes found maximum number of parasites mainly the gold fishes (*Carassius auratus*) and minimum in *Siamese splendensis.* Fresh water fishes showed maximum number of parasites in Rohu (*Labeo rohita)* and minimum *Cyprinus carpio. L. rohita* had the highest infection, while other species had lower than *L. rohita*. Carps were more suitable host for *Argulus*. Infestation was noticeable in Rohu. In ornamental fish, major incidence and abundance (number of parasites) was higher in *Carassius auratus* (Gold fish), *Carassius auratus* (Black moor) and *Siamese splendensis* (Fighter fish), respectively. Researches carried out on goldfish and Koi confirms the *Argulus* as the most prevalent parasite. In both, black moor and fighter fish, the infection rate was low as compared to Goldfish which are similar to observations and descriptions given by Iqbal *et al.* (2013). These observations indicate that *Argulus* is present in noticeable population of fish from freshwater reservoirs and aquarium shops. *Argulosis* disease is a serious threat in IMCs as well as ornamental fishes which can be extensively harmful to the yield of fishes. The observations recorded in the present study provides pioneer and baseline data on existing occurrence and abundance of *Argulus* which can be utilized for further research on disease investigation and pathological impacts of this parasite in fish. Chemical treatment of externally parasitized fish is possible and concerned fishermen/shop owners can be advised accordingly to treat fishes and prevent economic losses when such parasites are identified in different regions.

Lernaeosis is a fish illness caused by Copepod ectoparasites of the genus *Lernaea*. These Ectoparasites attach to all exterior parts of the fish, including some internal parts such as the mouth, gills, gill filaments, or even the eyes. Lernaea is commonly associated with considerable mortality in aquaculture, and the impact is severe, as fish death can occur in large numbers. Due to the widespread introduction of tropical fishes such as cyprinids, *Lernaea cyprinacea* has become the most pervasive lernaeid. Lernaeids commonly known as ‘anchor worms’ are crustacean copepod parasites infecting various wild-caught and pond-raised freshwater fishes. The microscopic image of *Lernaea sp.*, with the naked eye and under stereo microscope. Approximately, 110 Lernaeids species have been reported under the genus. They mate during their final free-swimming stage of development. Following mating, the female burrows into a fish's flesh and turns into an unsegmented, wormlike shape, usually with a section hanging from the fish's body, leaving only the body and tail visible. Female Lernaeids are believed to be more parasitic as they attack the body surface of fish and penetrate deep into the tissues after consuming fish scales, causing deep lesions.

*L. cyprinacea* was found on the scales and tail fins of fish, range from 10 to 13 millimeters. Lernaea's morphology revealed a tiny, semi-spherical cephalothorax connected to the first swimming limb located in the center of the holdfast system. The second and fourth leg segments were located in the neck and abdomen, respectively. The body is not segmented. The holdfast is separated into two branches, dorsal and ventral. Ventral branches appeared smaller and unbranched, while dorsal branches had two additional branches. A 1-2 mm long egg sac was discovered in the posterior area of female *L. cyprinacea*. The morphology coincides with the description of *L. cyprinacea* in the previous studies, which specifies that *L. cyprinacea* has a holdfast that branches into two pairs. *Lernaea sp.* Was the second most occurring parasite after Argulus. Hence, the prevalence data was calculated.

Spring viremia of carp (SVC) is a major disease of cyprinids. The disease is common in European carp culture, resulting in severe morbidity and death. The Office International des Epizooties has designated SVC as a notifiable disease. It is caused by a Rhabdovirus known as Spring Viremia of Carp Virus (SVCV). SVC primarily affects carp, goldfish, pike, roach, rudd, tench, and Wels catfish, causing numerous clinical indications such as belly enlargement, exophthalmos, petechial haemorrhages, and darkening of the skin. Affected fish display tissue death in the kidney, spleen, and liver, resulting in haemorrhage, loss of water-salt balance, and impaired immunological response. Water temperatures ranging from 10 to 17°C are associated with high mortality, particularly in the spring.

Tail and fin rot disease occurred in Indian major carp, catla (*Labeo catla*). The injured fish has lesions and erosion on its tail and fins. Infected farms saw a mortality rate of approximately 40%. Bacterial tail and fin rot is a common issue in young fish, often linked to both polluted and clean conditions in hatcheries. Although bacteria are the primary cause of this disease, pathogenic protozoans and fungi may also contribute. The infection can extend to the body surface as well. *Aeromonas* bacteria are the most frequent pathogens responsible for this troublesome infectious disease in fish, and they are typically found in the normal microflora and hydrobionts of fish habitats. The diseased fish showed loss of lamellar structure of gills and caudal fin, as shown in plate 25. Swab samples of the gills and tails were also collected for the screening and isolation of causative agents.

One of the most significant challenges in freshwater aquaculture is the parasite ciliate *Ichthyophthirius multifiliis* (Ich), which causes white spot disease. White spots (Ichthyophthiriasis) is a common ectoparasite disease that mostly affects farmed and aquarium fish. The morbidity rate owing to this disease can reach up to 100%, producing significant economic losses in fish farms. *Ichthyophthiriasis* has also been known as sand grain, gravel or Ich disease. This deadly ectoparasite mostly targets skin, fins, gills, and the buccal cavity, and is distinguished by the presence of white dots all over the external body surface. The clinical signs recorded in this study due to *Ich multifilus* infection (white spot disease) are coincide with those recorded by most researchers as (It a very common disease occurring in the ornamental fish, *Mystus cavasius* (Also called Freshwater shark). This disease is similar to SVC, non- treatable. The infected fish die soon. Many research is being conducted for its treatment. Generally, the $KMNO_4$ treatment is found effective but only for some time.

Blackspot disease in goldfish (*Carassius auratus*) is a common issue in aquariums. It can typically be treated effectively with antibiotics. One common cause of black spots on goldfish is high ammonia levels in the tank. Elevated ammonia levels can lead to chemical burns on the fish, which manifest as black spots. To prevent this, ensure the tank remains clean by regularly removing uneaten food, fish waste, and plant debris, and frequently check ammonia levels. Hence, it is concluded that the Gold fishes are more susceptible to this disease compared to other aquarium fishes.

However, five factors namely age, diet, abundance of fishes, independent number of a parasite within the fish and season, directly influence the parasite fauna of fishes. Fish with these parasites may exhibit a variety of symptoms, including respiratory distress, decreased appetite, weight loss, lethargy, skin discoloration, fin erosion, and increased susceptibility to other illnesses. Fish that are infected may display altered behaviour, such as more frequent scratching against objects or flashing actions. Fish health management techniques, such as good sanitation habits, regular monitoring, and suitable treatment options, can be put into place to avoid and manage parasite infestations. To reduce the parasite burden and enhance fish health in wetland environments, these techniques may involve the use of chemical treatments, biological control agents, or environmental alterations. It's worth noting that the specific prevalence and distribution of parasites can vary across different wetlands in India and may depend on factors such as water quality, fish species present, and environmental conditions.