PISCINE DIVERSITY IN THE WATERS OF NORTHERN KARNATAKA, INDIA

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Abstract

Reservoirs are considered to be the growing resources in India with enormous fish yield potential and are meant to support fishing activity. Such water bodies are complex systems that exhibit wide range of ecological interactions. India is endowed with vast water bodies possessing ecological heritage and rich biodiversity. Only a countable fish species is being utilized for the purpose of culture practices whereas there are other commercial fishes which inhabit the vacant niches that could be tapped for better yield in captivity on a commercial scale without harming the ecological diversity within the aquatic ecosystems. The food resources can be supplemented with inland fish culture or capture fishery practices. Altogether 112 fish composition is reported from waterbodies of Northern Karnataka, India. The IUCN conservation status showed 6 Endangered, 12 Vulnerable, 5 Near Threatened, 76 Least Concerned and 13 Data Deficient. Continuous monitoring and adopting new strategies in increasing the fish yield is the need of the time.

Key words: Pisces, Diversity, IUCN, Karnataka, India

1. Introduction

Water is the elixir of life. Life exists on planet earth is only because the water exists in liquid form. Freshwater habitats occupy a relatively small portion of earth's surface when compared to terrestrial and marine habitats. Freshwater is a critical, finite, vulnerable renewable resource essential for life activities. The freshwater bodies available in any country is useful to mankind

in many possible ways viz., potable, washing, bathing, recreation, gaming, agriculture, industry and even for aquaculture purpose. United Nations had declared the year 2003 as the International Year of freshwater to focus the issues of emerging water crisis globally. The lotic and lentic water ecosystems play a vital role in balancing the natural environment. Manipulation of large water bodies by anthropocentric activities such as setting up hydro-thermal power plants, installation of water purifiers, discharge of industrial sludge and other such socio-economic and commercio-domestic interventions disturb the natural habitats. Freshwater ecosystems may be classified into various categories based on their size and status, they are; tanks, basins, ponds, swamps, rivers, streams, lakes, lagoons, estuaries, backwaters, brackish waters, bheris, wetlands, marshes, reservoirs etc.

In Indian context, there are over 1500 large reservoirs covering more than 1.45 million hectares of land and more than one hundred thousand medium and small sized reservoirs. Such reckoned reservoirs erected against the river could be used for capture fishery, culture fishery and even to generate hydroelectric power. But by such manipulations disturb natural habitats. Water quality is now a global issue and its deterioration not only affects the functioning of ecosystems but contamination might lead to pollution of ground water [27].

Tanks and reservoirs are considered to be the growing resources in India with enormous fish yield potential and are meant to support the fishing activities. Such water bodies exhibit wide range of ecological interactions [29]. Habitat variability and productivity may be attributed to climatic, morphometric and hydro-edaphic features. Wetland habitats which are partially submerged by water and include the habitats such as marshes, swamps, ponds, lakes and reservoirs may function as ecotones, the transitions between different habitats and have characteristics of both terrestrial and aquatic ecosystems. Such habitats support diverse flora and fauna and are highly productive ecosystems akin to the tropical rainforest in terrestrial ecosystems [30]. In order to maintain a healthy population of reservoir fisheries, it is necessary

to monitor the hydrological parameters, plankton analysis, periodic bioassay and other environmental variables influencing the fish commodity [7].

1.1 Deccan Plateau

Karnataka is the eighth largest state in India covering an area about 1,91,791 square kilometers comprising of 5.83% by land. Karnataka comprises of two macro regions of the Indian subcontinent; the Deccan Plateau and Coastal Plains. There are seven riverine systems with tributaries flowing east and west. They are, Cauvery, Godavari, Krishna, North Pennar, South Pennar and Palar. However, Krishna, Godavari are the major lotic water systems flowing east in the North Karnataka province. Northern Karnataka shares its border with the neighbouring states such as Maharashtra, Telangana and Goa. Meteorologically North Karnataka is divided into three sub-divisions, namely;

i. North Eastern Transition Zone includes Bidar district.
ii. North Interior Karnataka Zone includes Belagavi (formerly Belgaum), Bidar, Bagalkote, Vijayapur (formerly Bijapur), Dharwad, Haveri, Gadag, Kalburgi (formerly Gulbarga), Koppal and Raichur.
iii. North Eastern Dry Zone includes Raichur, Kalburgi, Ballari (formerly Bellary), Yadgir and Koppal.

Geographically Northern India includes 13 districts namely; Bagalkot, Vijayapur, Gadag, Dharwad, Haveri, Belagavi, Ballari, Bidar, Kalburgi, Koppal, Raichur, Vijayanagara and Yadgir.

1.2 Food value of fish

Fishes are said to be well known for their cheap and chief food resources which contain increased levels of proteins, minerals which are essential for human consumption [24]. Depending upon the type of food ingested by the fishes, the nature as well as the quality of the

fishes are decided. Understanding the proximate composition of the fishes is important in estimation of nutritional value of these fishes. The major chemical composition of fish is moisture, Proteins, Carbohydrates, Fats, complex organic compounds as well as the minerals.

The overall study of proximate composition of fishes helps to understand the nutritional value. Difference in the chemical composition of fishes varies from species to species due to their habitat, feeding habits, size, shape and other climatic conditions. The main reason that leads to difference in these fishes is the diet and the reproductive cycle. Even the trash fishes are important due to its enriched nutritional values that need to be explored. The awareness towards the maximum utilization of such trash fish is yet not clearly known.

In the coastal areas, small fishes or trash fishes are constantly dried and used as a food products by the coastal people. Although certain fishes are not directly used as food but can be used as bait or bye products. Such fishes are managed to be utilized as poultry feed or other animal husbandry food. The principal mineral component of the fish includes Sodium, Chloride, Iron, Phosphorus, Manganese, Magnesium, Silicon, Copper, Iodine, Calcium, Zinc, Arsenic and Sulphur. Such composition may also be attributed to the habitat conditions. The feeding habits of the fish vary from one species to other, but all the fish require protein rich plankton for their growth, breeding and ultimate survival [25].

Fish mainly accumulates proteins in its muscles and has high biological growth promoting values and is highly digestible. It is essential to know and collect the data regarding the chemical composition of fish to improve fish processing techniques and other fish products. Other than the commercially important fishes, trash fish can also be used as the potential food resource. So far only few trash fishes are being used as a traditional animal food source, as salted, smoked, dried, fresh or as sauce.

2. **Methodology**

A survey on the geographical locations was made during the recent times. The approximate measurement of the major waterbodies was carried out by remote sensing applications using the recent tools and techniques. Alamatti reservoir, Narayanapur dam and Tungabhadra reservoir are the chief water bodies where large-scale fish production is carried out (Fig. 1) Neighbourhood of the Tungabhadra reservoir located at 76° 21' 10" East Latitude and 15° 15' 19" North Longitude, adjoining to Mallapur village about 5 kilometers away from Hospet town, of Bellary district, Karnataka is situated the carp seed hatchery run by the Dept. of Inland Fisheries. The hatchery artificially breeds the major carps and the seeds are marketed and also released into the large reservoirs for natural growth and development for domestic use. River Tungabhadra is the largest tributary of the river Krishna, contributing an annual discharge of 14,700 million m^3 of water at its confluence point to the main river. The river stretches over an area of 48,827 km^2 in both the riparian states of Karnataka (38,790 km^2) and Andhra Pradesh (9,037 km^2) and finally joins Krishna that flows into Bay of Bengal. At the full level of 497.7 m above MSL. It has an extensive catchment area chiefly fed by the southwest monsoon.

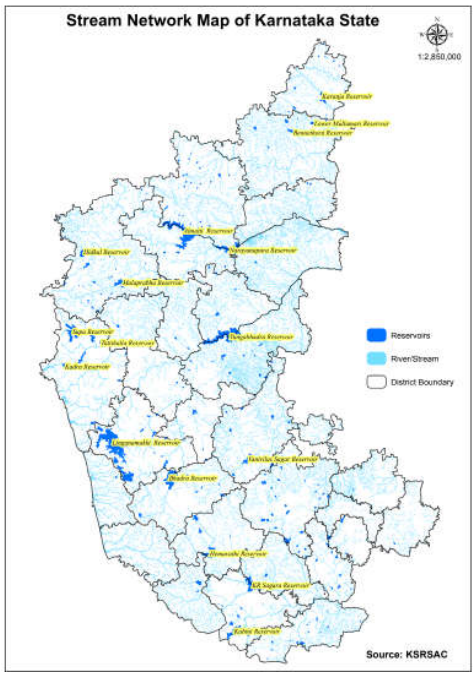

Fig.1. Reservoir stretches in the state of Karnataka, India

Tungabhadra covers seven districts from its source such as Chikamagalore, Shimoga, Davanagere, Haveri, Ballari, Koppal and Raichur; twenty eight taluks namely Chikamagalore, Tarikere, Koppa, Sringeri, N.R.Pura, Shimoga, Bhadravathi, Channagiri, Harihar, Honnali,

Ranebennur, Hirekerur, Haveri, Hospet, Siruguppa, Ballari, Koppal, Gangavathi, Sindhanoor, Manvi and Raichur in Karnataka and four districts in Andhra Pradesh; Mehaboob Nagar, Kurnool, Ananthpur and Cuddappah. This basin is mostly rainfed, dominated by red soils.

Ichthyofaunal diversity and composition of fish were obtained from the commercial fish landing centers close to the sampling stations along the banks of the reservoirs. The fish gears used for fish collection includes alavi net, cast net, seine net, drag net and hook & line. Identification of the fish species is made easy using the key characters, free online resources and based on the morphological and morphometric characteristics [11] [09] [14] [15] [19] [20] [21] [22]. IUCN Red Data Book was consulted for categorizing the conservation status of the fin-fish.

3. Results

Aquaculture fisheries play important role in terms of proteinaceous food resource and also generated income as well as employment. Due to ever increasing demand for fish as a chief source of white meat, aquatic ecosystems need to be depended upon for the continuous supply of fish for domestic and commercial purpose.

3.1 Riverine system in Northern Karnataka

The rivers originating in the Western Ghats at an altitude of 1337 m from MSL run eastward into major Krishna River whose tributaries are Doodhganga, Ghataprabha, Malaprabha, Bhima and Tungabhadra flowing in the northern districts of Karnataka from the Maharashtra state and continue into the state of Telangana. Another major Godavari River whose tributary Manjira passes through Bidar district.

3.2 Waterbodies in the Northern Karnataka

Bagalkot has Alamatti dam with the huge water spread area with the water holding capacity of 123.08 TMC (Thousand Million Cubic feet) capacity along Krishna River and Malaprabha

river with 27.42 TMC. Belagavi district has Markandeya and Ghataprabha river with Hidakal Dam with the capacity of 51.16 TMC. Ballari has Vedavathi, Hirehalla with 2.27 TMC, Maskihalla, Hagari river and Narihalla with 23 TMC. Bidar district has the Godawari basin showing Manjara, Lower Mullamari dam and Upper Mullamari dam of 0.75 TMC, Chandrampalli dam with the water spread area of 8763 hactares and Karanja reservoir with 7.69 TMC. Bijapur has Ramanahalli tank, Boothanalkere, Nayanapura dam and Don River. Dharwad district shows Rayanal kere, Devaragudiyala kere and Neerasagara dam with less water. Gadag has Bennehalla waterbody and Koppal as well as Raichur have a few small tanks. Haveri has Varada River. Kalburgi district experiences Bennithora dam with the waterspread area of 162.5 sq. km and Amajra dam, Bhima River, Kagna river and Mullamdri waterbodies. Yadgir has Hattikuni dam and Soudagar dam. Vijayanagara district possesses Tungabhadra reservoir of 133 TMC with its small tributaries.

3.3 **Reservoir fishery**

Government of India has defined reservoir as man-made impoundments created by regulating the surface flow by erecting a dam of any description on a river, stream. However, water bodies less than 10 ha in areas have been excluded from the preview of this definition. The ministry of agriculture, government of India, has classified reservoirs as small (less than 1000ha), medium (1000 to 5000 ha), and larger (greater than 5000 ha) for the purpose of fishery management. India has 19,370 reservoirs covering 3,153,366 ha. TBR is the large reservoir in the north eastern plateau of Karnataka.

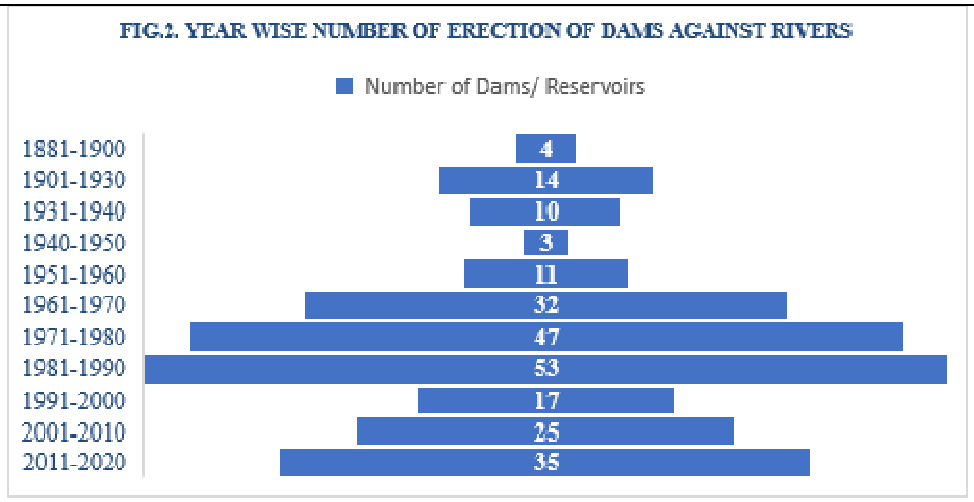

Fig.2. Year wise number of erection of dams against rivers in Northern Karnataka region.

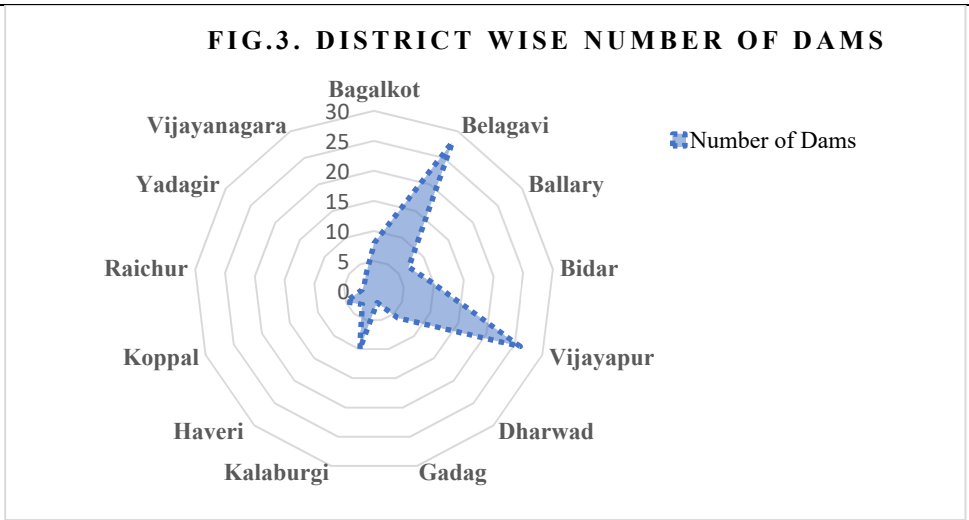

Fig.3. District wise number of dams erected till 2020.

3.4 **Diversity of Ichthhyofauna**

The reservoirs of Northern Karnataka have witnessed a total of 112 fish species belonging to 24 families. Major fish composition is recorded in Alamatti reservoir and Tungabhadra reservoir whereas a few fish representatives are reported from the rest of the reservoirs systems. Four from Ailiidae family, two from Ambassidae, one each from Anguillidae, Apochelidae, Belonidae, Cupeidae, Horabagridae, Nemacheilidae, Notopteridae, Osphronemidae,

Pangassidae and Xenocyprididae families, ten from Bagridae, two from Balitoridae, two from Cariidae, two from Cichlidae, three from Channidae, four from Cobitidae, fifty-seven from Cyprinidae, five from Danionidae, four from Gobiidae, two from Mastacembellidae, three from Siluridae and two from Sisoridae families (Fig.4). The conservation status and the composition of fish are depicted in the Table -3. IUCN conservation status showed 6 Endangered, 12 Vulnerable, 5 Near Threatened, 76 Least Concerned and 13 Data Deficient are shown in Fig.5.

Sl. No	*District*	*River/ Dam/ Reservoir*	*Capacity*
1.	Bagalkote	Almati dam	123.08 TMC
		Krishna River	--
		Malaprabha	1,96,132 Ha
2.	Belagavi	Markendaya	14448 ha
		Hidkal Dam	51.16 TMC
		Ghataprabha	3,10,823 Ha
3.	Ballari	Tungabhadra	133 TMC
		Maski halla	--
		Narihalla	23 TMC
		Hirehalla	2.27 TMC
		Vedavathi	--
4.	Bidar (Godavari basin)	Karanja reservoir	7.69 TMC
		Manjra	--
		Upper mullamari dam	0.75 TMC
		Lower mullamari dam	2.61 TMC
		Chandrampalli dam	--
5.	Bijapur	Ramanahalli tank	--
		Boothanalkere	--
6.	Dharwad	Rayanal Kere	--
		Devaragudiyala Kere	382 acres
		Neerasagara dam	490.00 ha
7.	Gadag	Bennehala	--
8.	Haveri	Small tanks	--
9.	Kalaburagi	Bennithora dam	20234 ha
		Amajra dam	1.554 TMC
		Bhima river	--
		Kagna river	--
		Mullamdri	--
10.	Koppal	Small tanks and Kere	--
11.	Raichur	Small Kere	--
12.	Vijayanagara	Tungabhadra reservoir	133 TMC

Table 1 - District wise water bodies with their capacities.

Table 2: Dams impounded along various tributaries in Northern Karnataka

Sl. No.	*Name*	*River*	*Nearest City*	*District*	*Basin*	*Length (m)*	*Max Height above Foundation (m)*
1	Balakundi Dam	Balakundi	Hungund	Bagalkot	Krishna	1640	14.15
2	Basavapattana Dam	Basavapattana	Mudhol	Bagalkot	Krishna	90	14.16
3	Bellikindi Dam	Bellikindi	Badami	Bagalkot	Krishna	457	11.91
4	Hiresangagutti Dam	Hiresangagutti	Hungund	Bagalkot	Krishna	260	11.45
5	Kalasakoppa Dam	Kalasakoppa	Bagalkot	Bagalkot	Krishna	585	15.8
6	Mangalore Dam	Mangalore	Badami	Bagalkot	Krishna	124	16.38
7	Muchakhandi Dam	Muchakhandi	Bagalkot	Bagalkot	Krishna	158	18.3
8	Rangasamudra Dam	Rangasamudra	Badami	Bagalkot	Krishna	317	23.8
9	Aigali Dam	Hirehalla River	Athni	Belgaum	Krishna	526.5	15.66
10	Arbenchi Dam	Arbenchi Nala	Ramdurg	Belgaum	Krishna	312	17.65
11	Bellary Dam	Bellary Nalla	Belgaum	Belgaum	Krishna	440.6	36.55
12	Bhairapur Dam	Malaprabha	Hukeri	Belgaum	Krishna	600.5	15.3
13	Bidi Dam	Malaprabha	Khanapur	Belgaum	Krishna	580	11.67
14	Ghastoli Dam	Local Nala	Khanapur	Belgaum	West flowing	486	14.5
15	Hanamapur Dam	Local Nala	Gokak	Belgaum	Krishna	375.75	14.33
16	Harinala Dam	Harinala	Sampgaon	Belgaum	Krishna	3120	19.41
17	Hebbal Dam	Malaprabha	Khanapur	Belgaum	Krishna	530	12.64
18	Hidkal Dam	Ghataprabha	Hukeri	Belgaum	Krishna	10183	62.48
19	Hirekop Dam	Local Nala	Parasgad	Belgaum	Krishna	785.4	12.39
20	Itagi Dam	Malaprabha	Khanapur	Belgaum	Krishna	757	15.25
21	Jawahar Dam	Shiruguppi	Chikodi	Belgaum	Krishna	676.16	21.64
22	Kadasagatti Dam	Local Nala	Sampgaon	Belgaum	Krishna	706	10.68
23	Kadatana Begewadi Dam	Banki Halla	Khanapur	Belgaum	Krishna	594.5	13.55
24	Kadatnal Dam	Kotbagi Halla	Sampgaon	Belgaum	Krishna	470	13.75
25	Kanvikervinkoppa	Malaprabha	Belgaum	Belgaum	Krishna	454	16.76
26	Kohalli Dam	Hire Halla	Athni	Belgaum	Krishna	659	14.63
27	Malaprabha Dam	Malaprabha	Parasgad	Belgaum	Krishna	154.52	43.13
28	Markandeya Dam	Markandeya	Hukeri	Belgaum	Krishna	475	47
29	Murakumbi Dam	Chella Halla	Parasgad	Belgaum	Krishna	726	16.94
30	Nandgad Dam	Local Nala	Khanapur	Belgaum	Krishna	Small	
31	Rakkaskop Dam	Markandeya	Belgaum	Belgaum	Krishna	358.37	26.34
32	Ramapura Dam	Local Nala	Khanapur	Belgaum	West flowing	345	14
33	Siddasamudra Dam	Malaprabha	Sampgaon	Belgaum	Krishna	712	13.72
34	Yallammavadi Dam	Malaprabha	Athni	Belgaum	Krishna	775	10.3
35	Yallur Dam	Markandaya	Belgaum	Belgaum	Krishna	393	15.5
36	Yarazarvi Dam	Local Nala	Parasgad	Belgaum	Krishna	699	12.16
37	Ankamanhal Dam	Krishna	Sandur	Bellary	Krishna	278	21.29
38	Appenahalli Dam	Krishna	Kudligi	Bellary	Krishna	525	13.75
39	Aralihalli Dam	Krishna	Huvinahadagalli	Vijayanagara	Krishna	1920	11.86

40	Dasanahalli Dam	Krishna	Huvinahadagalli	Vijayanagara	Krishna	780	11.83
41	Gandabommanahalli	Krishna	Kudligi	Bellary	Krishna	1104	23.15
42	Hagari B Dam	Hagari	Hagaribommanahalli	Vijayanagara	Krishna	1759	15.24
43	Hulikunta Dam	Tungabhadra	Sandur	Bellary	Krishna	550	28.65
44	Kottur Dam	Krishna	Kudligi	Bellary	Krishna	1777	15
45	Narihalla Dam	Narihalla	Sandur	Bellary	Krishna	295	32.92
46	Talakal Dam	Krishna	Huvinahadagalli	Vijayanagara	Krishna	1200	14.02
47	Bavalgaon Dam	Local	Aurad	Bidar	Godavari	389	22.39
48	Bhopalgod Belkone Dam	Local	Aurad	Bidar	Godavari	602	19.72
49	Changliar Dam	Mullamari	Homnabad	Bidar	Krishna	505	17.89
50	Chikkanagaon Dam	Mullamari	Basavakalyan	Bidar	Krishna	365	15.95
51	Chulkinala Dam	Chulkinala	Basavakalyan	Bidar	Godavari	2340	18
52	Ekamba Dam	Local	Aurad	Bidar	Godavari	648	13
53	Karanja Dam	Karanja	Bhalki	Bidar	Godavari	3480	28.1
54	Medipally Dam	Local	Aurad	Bidar	Godavari	487	22.03
55	Tegampur Dam	Local	Aurad	Bidar	Godavari	780	23.36
56	Upper Mullamari Dam	Mullamri	Basavakalyan	Bidar	Krishna	810	28.4
57	Aheri - Jumbagi Dam	Aheri-jumbagi	Bijapur	Bijapur	Krishna	1018	10.59
58	Almatti Dam	Krishna	Basavana Bagevadi	Bijapur	Krishna	1564.83	52.24
59	Areshankar Dam	Areshankar	Basavana Bagevadi	Bijapur	Krishna	1189	19.2
60	Babaleshwara Dam	Sindi Halla	Sindgi	Bijapur	Krishna	975	12.11
61	Bharatagi Dam	Bharatagi	Bijapur	Bijapur	Krishna	1076	13.02
62	Bhutnal Lake Dam		Bijapur	Bijapur	Krishna	Small	
63	Bommanahalli Dam	Bommanahalli	Bijapur	Bijapur	Krishna	770	12.7
64	Gundwan At Site- I Dam	Gundwan - I	Indi	Bijapur	Krishna	973	13.05
65	Gundwan At Site- II Dam	Gundwan -II	Indi	Bijapur	Krishna	690	11.21
66	Hanajagi Dam	Hanajagi	Indi	Bijapur	Krishna	785	12.81
67	Hanchinal Dam	Hanchinal	Bijapur	Bijapur	Krishna	655	11.05
68	Hokarani Dam	Hokarani	Muddebihal	Bijapur	Krishna	755	11.72
69	Jigajinagi Dam	Jigajinagi	Indi	Bijapur	Krishna	1420	11.93
70	Kadlewadi Dam	Kadlewadi	Sindgi	Bijapur	Krishna	1080	11.52
71	Katral Dam	Katral	Bijapur	Bijapur	Krishna	1240	11.22
72	Krishyal Dam	Krishyal	Basavana Bagevadi	Bijapur	Krishna	730	10.91
73	Kuppakaddi Dam	Kuppakadi	Basavana Bagevadi	Bijapur	Krishna	865	11.27
74	Kuvalgi Aheri Dam	Kuvalgi Aheri	Bijapur	Bijapur	Krishna	518	13.55
75	Makhanpur Dam	Makhanpur	Bijapur	Bijapur	Krishna	951	13.75
76	Mukherthihal Dam	Mukherthihal	Basavana Bagevadi	Bijapur	Krishna	852	10.41
77	Nagathan Dam	Nagathan nala	Bijapur	Bijapur	Krishna	1125	10.63
78	Narayanapura Dam	Krishna	Muddebihal	Bijapur	Krishna	10637.52	29.72
79	Ramanahalli Dam	Navalli Nalla	Sindgi	Bijapur	Krishna	1619	16.5
80	Ronihal Dam	Ronihalla	Basavana Bagevadi	Bijapur	Krishna	689	13.02
81	Sulkod Dam	Sulkod Nala	Basavana Bagevadi	Bijapur	Krishna	762.2	10.9
82	Tadavalga Dam	Tadavalga Nala	Indi	Bijapur	Krishna	1070	11.02

83	Attiveri Dam	Bedthi	Kalghatgi	Dharwad	West flowing	773.31	21.43
84	Devargudihal Lake	Isolated lake	Hubli	Dharwad	West flowing	Small	
85	Hulikere Dam	Hulikere Nala	Dharwad	Dharwad	West flowing	637	21.75
86	Neerasagara Dam	Bedtinala	Kalghatgi	Dharwad	West flowing	1158.25	24.6
87	Unkal Lake Dam	In isolation	Hubli	Dharwad	West flowing	Small	
88	Veerapur Tank	In isolation	Hubli	Dharwad	West flowing	Small	
89	Majjur Dam	Dodda Halla	Shirhatti	Gadag	Krishna	413.5	19.51
90	Mundawad Dam	Shirahatti Nala	Mundargi	Gadag	Krishna	994	20.19
91	Amarja Dam	Amarja	Aland	Gulbarga	Krishna	960	31.85
92	Beeranahalli Dam	Kal	Chincholi	Gulbarga	Krishna	485	30.02
93	Bennithora Dam	Bennithora	Chitapur	Gulbarga	Krishna	2340	31.39
94	Chandrampalli Dam	Sarnala	Chincholi	Gulbarga	Krishna	926.54	28.65
95	Chikkalingadalli D	Mullamari	Chincholi	Gulbarga	Krishna	701.04	14.48
96	Dinshi Dam	Dinshi Nala	Gulbarga	Gulbarga	Krishna	360	17.1
97	Gandorinala Dam	Gandorinala	Gulbarga	Gulbarga	Krishna	1813.5	24.27
98	Gobbur Dam	Gobbur Nala	Afzalpur	Gulbarga	Krishna	1525	10.3
99	Kodli-Allapur Dam	Mullamari	Chincholi	Gulbarga	Krishna	510	16.93
100	Lower Mullamari Dam	Mullamari	Chincholi	Gulbarga	Krishna	1546	24.46
101	Asundinala Dam	Chandrapura	Ranibennur	Haveri	Krishna	1595	15.7
102	Bullapura Dam	Kumadavati	Hirekerur	Haveri	Krishna	114.6	18
103	Madagamasur Dam	Kumadavati	Hirekerur	Haveri	Krishna	950	32.87
104	Medleri Dam	Local Nala	Ranibennur	Haveri	Krishna	701.5	10.68
105	Chittawadagi Dam	Chittawadagi	Kushtagi	Koppal	Krishna	481	12
106	Hirehalla Dam	Hirehalla	Koppal	Koppal	Krishna	3606.6	17.62
107	Lower Hirenala Dam	In isolation	Kushtagi	Koppal	Krishna	Small	
108	Tungabhadra Dam	Tungabhadra	Koppal	Koppal	Krishna	2443	49.39
109	Upper Hirenala Dam	Hirenala	Kushtagi	Koppal	Krishna	1935	18.27
110	Kanakanala Dam	Kanakanala	Sindhnur	Raichur	Krishna	975.65	20.12
111	Maskinala Dam	Maskinala	Lingsugur	Raichur	Krishna	814	29.88
112	Hattikuni Dam	Hattikuni stream	Yadgir	Yadgir	Krishna	923	22.88
113	Soudagar Dam	Soudagar Nala	Yadgir	Yadgir	Krishna	600	27.03

Fish Diversity Status in North Karnataka

Sl. No	***Order***	***Family***	***Fish species***	***Common name***	***Status***
1	Siluriformes	Ailiidae	*Eutropiichthys goongwaree (Sykes, 1839)*	Goongwaree Vacha	DD 2010
2	Siluriformes	Ailiidae	*Proeutropiichthys taakree (Sykes, 1839)*	Indian Taakree	LC 2011
3	Siluriformes	Ailiidae	*Silonia childreni (Sykes, 1839)*	White Cat Fish	EN 2010
4	Siluriformes	Ailiidae	*Silonia silondia*		LC
5	Siluriformes	Ambassidae	*Chanda nama (Hamilton, 1822)*	Elongate Glass Perchlet	LC 2010
6	Siluriformes	Ambassidae	*Parambassis ranga (Hamilton, 1822)*	Indian Glassy Fish	LC 2011
7	Anguilliformes	Anguillidae	*Anguilla bengalensis (Grey, 1834)*	Indian Mottled Eel	NT 2019
8	Cyprinodontiformes	Aplochelidae	*Aplocheilus lineatus (Valenciennes, 1846)*	Striped Panchax	LC 2009

9	Siluriformes	Bagridae	*Hemibagrus maydelli (Rossel, 1964)*	Giant Cat Fish	LC
10	Siluriformes	Bagridae	*Mystus bleekeri*		LC
11	Siluriformes	Bagridae	*Mystus cavasius (Hamilton, 1822)*	Gangetic Mystus	LC 2009
12	Siluriformes	Bagridae	*Mystus gulio*		LC
13	Siluriformes	Bagridae	*Mystus seenghala*		LC
14	Siluriformes	Bagridae	*Rita buchanani*	Rita	DD
15	Siluriformes	Bagridae	*Rita gogra (Sykes, 1839)*	Gogra rita	LC2010
16	Siluriformes	Bagridae	*Rita pavimentata*		NE
17	Siluriformes	Bagridae	*Sperata oor (Hamilton, 1822)*	Long-whiskered Catfish	LC 2011
18	Siluriformes	Bagridae	*Sperata seenghala (Sykes, 1839)*	Giant River Cat Fish	LC 2010
19	Cypriniformes	Balitoridae	*Balitora mysorensis (Hora, 1941)*	Slender Stone Loach	VU
20	Cypriniformes	Balitoridae	*Nemacheilus semiarmatus (Day, 1867)*	Dotted Loach	LC 2010
21	Beloniformes	Belonidae	*Xenentodon cancilo (Hamilton, 1822)*	Gar Fish	LC 2019
22	Siluriformes	Cariidae	*Clarias batrachus*	Magur	LC
23	Siluriformes	Cariidae	*Clarias gariepinus*	African Catfish	
24	Prciformes	Channidae	*Channa marulius (Hamilton, 1822)*	Great Snake Head	LC 2009
25	Cypriniformes	Channidae	*Channa punctata (Bloch, 1793)*	Spotted Snakehead	LC 2019
26	Parciformes	Channidae	*Channa striata (Bloch, 1793)*	Snake-headed Murrel	LC 2019
27	Cichliformes	Cichlidae	*Oreochromis mossambicus*	Mozambique Tilapia	VU
28	Cichliformes	Cichlidae	*Oreochromis niloticus*	Nile tilapia	LC
29	Cypriniformes	Cobitidae	*Botia striata (Rao, 1920)*	Zebra Loach	EN 2011
30	Cpriniformes	Cobitidae	*Cobitis paludica*	Southern Iberian Spined Loach	VU
31	Cypriniformes	Cobitidae	*Lepidocephalichthys thermalis (Valenciennes, 1846)*	Common Spiny Loach	LC 2019
32	Cypriniformes	Cobitidae	*Misgurnus anguillicaudatus*	Pond loach	LC
33	Cupeiformes	Cupeidae	*Alosa aestivalis*	Blueback Herring	VU
34	Cypriniformes	Cyprinidae	*Amblypharyngodon mola (Hamilton, 1822)*	Mola Carpet	LC 2009
35	Cypriniformes	Cyprinidae	*Balantiocheilos melanopterus*	Bala Shark	VU
36	Cypriniformes	Cyprinidae	*Catla catla*	Labeo catla	LC
37	Cypriniformes	Cyprinidae	*Cirrhinus cirrhosus (Bloch, 1795)*	Mrigal Carp	VU 2011
38	Cypriniformes	Cyprinidae	*Cirrhinus mrigal (Hamilton, 1822)*	Mrigal	LC 2010
39	Cypriniformes	Cyprinidae	*Cirrhinus reba (Hamilton, 1822)*	Reba Carp	LC 2010
40	Cypriniformes	Cyprinidae	*Ctenopharyngodon idella (Valenciennes, 1844)*	Grass Carp	LC 2010
41	Cypriniformes	Cyprinidae	*Cyprinus carpio*	Scale carp	VU
42	Cypriniformes	Cyprinidae	*Cyprinus carpio Linnaeus, 1758*	Common Carp	VU 2008
43	Cypriniformes	Cyprinidae	*Garra gotyla*	Gotyla sucker head	LC
44	Cypriniformes	Cyprinidae	*Garra mullya (Skyes, 1839)*	Mullya Garra	LC 2010
45	Cypriniformes	Cyprinidae	*Gymnostomus fulungee (Sykes, 1839)*	Deccan White Carp	LC 2010
46	Cypriniformes	Cyprinidae	*Hypselobarbus jerdoni (Day, 1870)*	Jakkali	LC 2010
47	Cypriniformes	Cyprinidae	*Hypselobarbus kolus (Sykes, 1839)*	Kolus Barb	VU 2010
48	Cypriniformes	Cyprinidae	*Hypselobarbus mussullah (Sykes, 1839)*	Musulla Barb	EN 2010
49	Cypriniformes	Cyprinidae	*Labeo angra*		LC
50	Cypriniformes	Cyprinidae	*Labeo bata*	Minor Carp	LC
51	Cypriniformes	Cyprinidae	*Labeo bata (Hamilton, 1822)*	Minor Carp	LC 2011

52	Cypriniformes	Cyprinidae	*Labeo boga (Hamilton, 1822)*	Boga Labeo	LC 2010
53	Cypriniformes	Cyprinidae	*Labeo boggut (Sykes, 1839)*	Boggut Labeo	LC 2010
54	Cypriniformes	Cyprinidae	*Labeo calbasu (Hamilton, 1822)*	Calbasu	LC 2010
55	Cypriniformes	Cyprinidae	*Labeo catla (Hamilton, 1822)*	Catla	LC 2010
56	Cypriniformes	Cyprinidae	*Labeo fembriatus*	Fringed-lipped carp	LC
57	Cypriniformes	Cyprinidae	*Labeo fimbriatus (Bloch, 1795)*	Finger Lipped Carp	LC 2011
58	Cypriniformes	Cyprinidae	*Labeo gonius*	Kuria labeo	LC
59	Cypriniformes	Cyprinidae	*Labeo kontius (Jordon, 1849)*	Plymouth Carp	LC 2010
60	Cypriniformes	Cyprinidae	*Labeo pangusia (Hamilton, 1822)*	Pangusia Labeo	NT 2010
61	Cypriniformes	Cyprinidae	*Labeo porcellus (Haeckel, 1844)*	Bombay Labeo	LC 2010
62	Cypriniformes	Cyprinidae	*Labeo potail (Sykes, 1839)*	Deccan Labeo	EN 2011
63	Cypriniformes	Cyprinidae	*Labeo rohita (Hamilton, 1822)*	Rohu	LC 2010
64	Cypriniformes	Cyprinidae	*Noemacheilus rupelli*	Giant river catfish.	LC
65	Cypriniformes	Cyprinidae	*Osteobrama cotio cotio*		LC
66	Cypriniformes	Cyprinidae	*Osteobrama peninsularis Silas, 1952*	Ray-finned Fish	DD 2011
67	Cypriniformes	Cyprinidae	*Osteobrama vigorsii (Sykes, 1839)*	Ray-finned Fish	LC 2011
68	Cypriniformes	Cyprinidae	*Osteochilichthys thomassi (Day, 1877)*	Konti Barb	LC 2011
69	Cypriniformes	Cyprinidae	*Pethia narayani (Hora, 1937)*	Narayan Barb	LC 2010
70	Cypriniformes	Cyprinidae	*Pethia ticto (Hamilton, 1822)*	Ticto Barb	LC 2010
71	Cypriniformes	Cyprinidae	*Puntius ambassis (Day, 1869)*	Ray-finned Fish	DD 2010
72	Cypriniformes	Cyprinidae	*Puntius amphibius (Valenciennes, 1842)*	Scarlet Banded Barb	DD 2010
73	Cypriniformes	Cyprinidae	*Puntius bimaculatus (Bleeker, 1863)*	Red Side Barb	LC 2019
74	Cypriniformes	Cyprinidae	*Puntius chilinoide*		VU
75	Cypriniformes	Cyprinidae	*Puntius chola (*Hamilton*, 1822)*	Chola Barb	LC 2010
76	Cypriniformes	Cyprinidae	*Puntius dobsoni,*		
77	Cypriniformes	Cyprinidae	*Puntius dorsalis (*Jordon*, 1849)*	Long-snouted Barb	LC 2019
78	Cypriniformes	Cyprinidae	*Puntius filamentosus*	Featherfin barb	LC
79	Cypriniformes	Cyprinidae	*Puntius sarana*	Olive barb	LC
80	Cypriniformes	Cyprinidae	*Puntius sophore (*Hamilton*, 1822)*	Spot Fin Swamp Barb	LC 2010
81	Cypriniformes	Cyprinidae	*Puntius ticto*	Ticto Barb	LC
82	Cypriniformes	Cyprinidae	*Puntius vittatus*	Greenstripe barb	LC
83	Cypriniformes	Cyprinidae	*Rasbora danioconius*	Slender rasbora,	LC
84	Cypriniformes	Cyprinidae	*Rohtee ogilbii (*Sykes*, 1839)*	Vatani Rohtee	LC 2010
85	Cypriniformes	Cyprinidae	*Salmophasia phulo (*Hamilton*, 1822)*	Salmostoma Phulo	LC 2009
86	Cypriniformes	Cyprinidae	*Salmostoma phulo (*Hamilton*, 1822)*	Finescale Razorbelly	LC 2009
87	Cypriniformes	Cyprinidae	*Schismatorhynchos nukta (*Sykes*, 1839)*	Nukta	EN 2010
88	Cypriniformes	Cyprinidae	*Systomus sarana (*Hamilton*, 1822)*	Olive Barb	LC 2010
89	Cypriniformes	Cyprinidae	*Thynnichthys sandkhol (*Sykes*, 1839)*	Sandkhol Carp	EN 2010
90	Cypriniformes	Cyprinidae	*Tor khudree (*Sykes*, 1839)*	Black Mahseer	LC 2019
91	Cypriniformes	Danionidae	*Chela cachius (*Hamilton*, 1822)*	Silver Harchet Chela	LC 2010
92	Cypriniformes	Danionidae	*Devario aequipinnatus (*McClelland*, 1839)*	Giant Danio	LC 2010
93	Cypriniformes	Danionidae	*Esomus danrica (*Hamilton*, 1822)*	Flying Barb	LC 2007
94	Cypriniformes	Danionidae	*Opsarius bendelisis (*Hamilton*, 1822)*	Baril	LC

95	Cypriniformes	Danionidae	*Salmostoma bacaila*	Large Razorbelly minnow	LC
96	Gobiiformes	Gobidae	*Glossogobius giuris (*Hamilton, *1822)*	Tank Gobi	LC 2019
97	Gobiiformes	Gobiidae	*Glossogobius giuris*	Bareye Goby	LC
98	Gobiiformes	Gobiidae	*Gobius biocellatus*	Sleepy Goby	LC
99	Gobiiformes	Gobiidae	*Psammogobius biocellatus*		DD
100	Siluriformes	Horabagridae	*Pachypterus khavalchor (*Kulkarni, *1952)*	Khavalchor Catfish	DD 2010
101	Cypriniformes	Mastacembellidae	*Macrognathus pancalus (*Hamilton, *1822)*	Barrel Spiny Eel	LC 2010
102	Synbranchiformes	Mastacembellidae	*Mastacembelus armatus (*Lacepede, *1800)*	Spiny Eel	LC 2019
103	Cypriniformes	Nemacheilidae	*Indoreonectes evezardi (*Day, *1872)*	Ray-finned Fish	LC 2010
104	Osteoglossiformes	Notopteridae	*Notopterus notopterus (*Pallas, *1769)*	Bronze Featherback	LC 2019
105	Perciformes	Osphronemidae	*Pseudosphromenus cupanus (*Cuvier, 1831)	Spike-tail Paradise Fish	LC 2019
106	Siluriformes	Pangassidae	*Pangassius pangassius* (Hamilton, 1822)	Pangas Cat Fish	LC 2009
107	Siluriformes	Siluridae	*Ompok bimaculatus* (Bloch, 1794)	Butter Cat Fish	NT 2009
108	Siluriformes	Siluridae	*Ompok pabda*		NT
109	Siluriformes	Siluridae	*Wallago attu (Bloch & Schneider, 1801)*	Cat Fish	VU 2019
110	Siluriformes	Sisoridae	*Bagarius bagarius (Hamilton, 1822)*	Devil Cat Fish	NT 2009
111	Siluriformes	Sisoridae	*Gagata itchkeea (Sykes, 1839)*	Sucker Cat Fish	VU 2011
112	Cypriniformes	Xenocyprididae	*Hypophthalmichthys molitrix*	Silver carp	NT

Table 3: Fish composition in the major reservoirs of Northern Karnataka region.

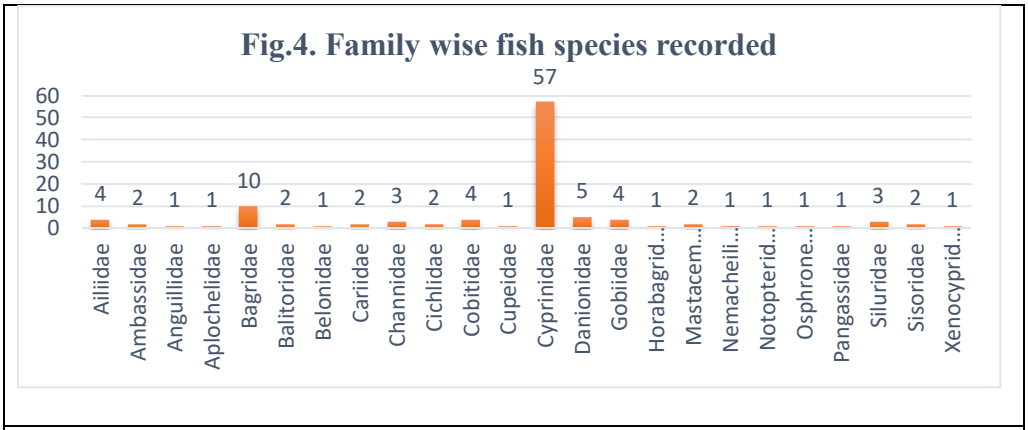

Fig.4. Family wise fish composition recorded from the study area.

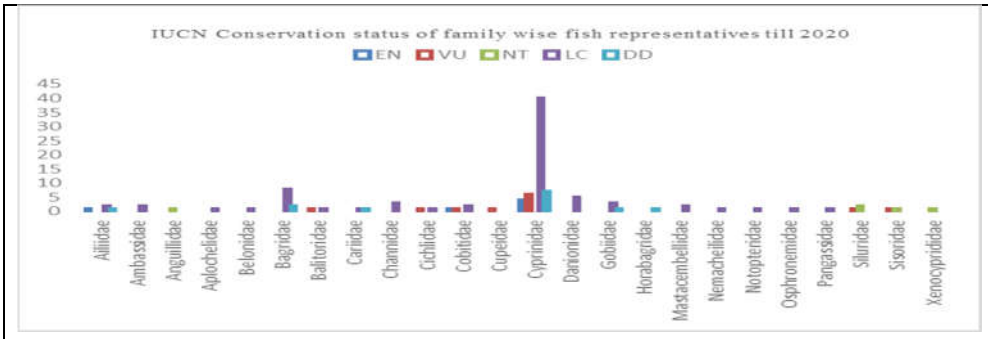

Fig.5. IUCN Conservation status of family wise fish representatives**.**

4. Discussion

Impoundments accounts to 113 dams having been set up across many tributaries in Karnataka. Out of which, 31 dams / reservoirs have been set up in the 12 geographical districts of Northern Karnataka (Table-1), where, Narayanapura dam is the longest one measuring 10,637.52 m at full length next to Tungabhadra. The detailed dams with their geographical coordinates, location and passage are shown in Table 1-2, and Fig-2 and 3.

With immense possibilities for open-water fisheries and aquaculture, India ranks second in the world fish production next to Japan with an annual fish production of about 6.9 mill metric tonnes [13]. India was held sixth in position during 2000 in total fish production and first among the commonwealth countries [33], yet it is 136th among 162 countries in terms of per capita consumption of fish. The Indian average is around 8.11kg/capita against the world average of 12.1kg per capita. India being basically a carp country, the indigenous and exotic carps (Catla, Rohu, Mrigal, Calbasu, Silver-carp, Grass carp & Common carp) account for bulk of the production, being as much as 82% of the total fish. Several other medium and minor carps such as *Labeo fimbratus, Labeo gonius, Labeo bata, Oxygaster* species, *Rasbora* species, *Cirrhinus cirrhosa, Puntius kolus, Puntius carnaticus, Puntius sarana, Amblypharyngodon mola* have regional demand. While large non-air-breathing catfishes such as *Wallago attu, Mystus seenghala, M. aor, Pangasius pangasius* are in great demand in the north and north-western states, smaller varieties of both air breathing (*Clarias barouches, Hetropneustis fossilis*) and

non-air breathing fishes (*Ompak bimaculatus, Ompak pabda*) are considered as delicacy in the eastern and non-eastern states. Murrels (*Channa marulius, Channa punctatus*) are also potential species for culture. Due to wide scope for the fish as a food source something new strategies have to be introduced in the country [1] [2]. India is home for more than 10% of global fish biodiversity with 2200 species [2] of fin fishes and shell fish in both marine and freshwater. He also opined that reservoirs and floodplain lakes offer an opportunity for enhancing fish production. Food and Agricultural Organisation [13] detailed that the total world fish catch from wild fishing was 93.2 million tons, whereas from fish farms it was 62.9 million tons thus totaling about 156 million tons.

Karnataka has 7.4 lakh ha of total water bodies. The reservoir water spread area accounts to about 4.4 lakh ha. Out of which Tungabhadra, Karanja, Lower and higher Mullamari, Alamatti, Narayanapur, Hidkal and Malaprabha Reservoirs covers the major portion.

The survey of fish fauna was carried out by a number of workers. [4] [8] [17] [18] [26] were recent contributors to the study of ichthyofauna in various regions of India. However, qualitative analysis showed nearly 60 species of fishes harbour larger reservoirs of India [33], 40 contribute to commercial fisheries [22].

5. Conclusion

Reservoirs are considered to be the growing resources in India with enormous fish yield potential and are meant to support fishing activity. Only a countable fish species is being utilized for the purpose of culture practices whereas there are other commercial fishes which inhabit the vacant niches that could be tapped for better yield in captivity on a commercial scale without harming the ecological diversity within the aquatic ecosystems. 112 species of fish enlisted in IUCN conservation status showed 6 Endangered, 12 Vulnerable, 5 Near Threatened, 76 Least Concerned and 13 Data Deficient (Table-3 and Fig-5). Continuous monitoring and

adopting new strategies in increasing the fish yield is the need of the time. Collaboration with the remote sensing agency, groundwater tribunal and aquaculture departments would enhance the productivity of the aquatic ecosystems in the scientific manner.

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