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Ichthyofaunal diversity of Nandurbar District (Northwest Khandesh Region) of Maharashtra (India).

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Abstract
Ichthyofaunal diversity is carried out during the study period November 2013 to April 2014 in the rivers, streams, reservoirs or ponds of Nandurbar district lays in the northwest region of Maharashtra state. The district is transverse by the river Tapi and its principal tributaries, viz., the Gomai, the Vir, the Rangavali, the Daheli and the Shivan River etc. The survey was made from nine collection centers spread over the entire district. In present study of 83 specimens observed that the ichthyofauna belongs to 6 orders, 11 families, 24 genus and 32 species, were Cypriniformes order is dominant with 19 (59.40%) species followed by Perciformes and Siluriformes with 05 (15.60%) species, Beloniformes, Clupeiformes and Osteoglossiformes contribute 01 (3.10%) species each. As no attempt had been made in the past to explore the ichthyofaunal diversity of this region. All the species reported in present investigation are reporting fist time under mopping survey programme. It is concluded that the fish in this area are under threat due to anthropogenic activities such as overfishing and organic and inorganic pollution of the river. Therefore site based conservation action plants are needed for conservation of rare and threatened fish in this area.

Keywords: Ichthyofauna, Khandesh, Tributaries, Anthropogenic, Rare, Conservation.

1. Introduction
In India, various workers have studied diversity and distribution of freshwater fishes from different parts of country viz., Hamilton-Buchanan (1882), Menon (1962) studied ichthyofauna of Himalayan Rivers, David (1963) recorded fishes of Godavari and Krishna river system, Jayaram *et al* (1982) studied fishes of Cauveri River, Singh and Kamble (1987) recorded 32 genera of fishes from Jalgaon district (M.S.), Singh (1990) recorded 26 species from Dhulia district (M.S.), Yatzani (1994) worked on fishes of Ganga River, Jayaram (1995) worked out fish species of Krishna River, Yadav (2003) presented account on 135 species of fishes from northern part of Western Ghats, Wagh and Ghate (2003) reported 62 species of fish from Mula and Mutha rivers of Pune (M.S.), Yadav (2004) reported 33 species from Pench National Park, Yadav (2005) included 96 species on fauna of Melghat Tiger Reserve, Yadav (2006) complied 84 species of fish fauna of Tadoba Andhari Tiger Reserve and Yadav (2008) reported 58 freshwater fish fauna of Goa state. Recently, Patole and More (2010) reported 31 species of fish fauna of Panzara-Kan river from Sakri tahsil (Disttrict- Dhulia, M. S.), Jadhav *et al* (2011) studied the freshwater fish fauna of Koyana river northern western Ghats, Joshi *et al* (2012) recorded 20 species on ichthyological fauna of Buldhana district (M.S.), Kharat *et al* (2012) reported 51 species of Krishna river at Wai, Western Ghats, Nagma and Khan (2013) reported 36 freshwater fish fauna of district Bijnor in western Uttar Pradesh and Kalbande *et al* (2013) represent 60 fish faunal diversity from Rawanwadi lake of Bhandara district (M.S.). Very recently, Sheikh (2014) reported 37 species of ichthyofaunal diversity of Pranhita River, Sironcha district- Gadchiroli (M.S.). However, no attempt has been made so as far to explore the freshwater fish fauna of the Nandurbar district in spite of district is transversed by Tapi and its tributaries river system. Hence attempt has been made here to present piscine inventory from this well-known district. Tapi River harbors a very rich fish fauna in its various tributaries including ponds and lakes.

2. Materials and Methods
To study the ichthyofauna of Nandurbar district, fish sample was collected from 9 stations during November 2013 to April 2014. The fish specimens collected were instantly fixed in

4% formaldehyde solution and subsequently after 4-8 h fixation and washing with tap water, transferred to 70% ethanol. The large sized specimen was given incision on belly Identification of fishes was done up to species level while identifying its natural color, pattern of scales, fins, mouth pattern, identification marks like black or red spots, blotch on operculum, paired and unpaired fins and body parts with the help of standard literature by Day (1978), Menon (1987), Datta Munshi and Srivastava (1988), Beaven (1990), Talwar and Jhingran (1991), Jayaram (1981, 2002, 2010) etc. Fish species which were not identified was sent to Zoological Survey of India, Western Regional Station (WRS), Pune. The identified fishes and their valid scientific names have incorporated in the present paper.

2.1 Study area

Nandurbar district lays northwest corner (Khandesh region) of Maharashtra. It belongs to Nasik Division of Maharashtra State situated between 73.31^0 and 74.32^0 East longitudes and 21.03^0 and 22.00^0 North latitude. The district is surrounded by Madhya Pradesh State on the North, Dhule district on the East, Gujarat State in the West and Nasik district on the South.

2.2 Collection Stations

A total nine collection centers were made from where fishes were purchased from local fishermen. The inventory reports from these centers of total 83 specimens of 32 species of fishes have been collected. The collection stations include;

1. Nndurbar – Shivan river, 2. Shahada - Gomai river,
3. Prakasha - Tapi river, 4. Navapur - Rangavali river,
5. Visarwadi - Local stream, 6. Sarangkheda - Tapi river,
7. Taloda - Tapi river, 8. Khapar - Daheli + Tapi river and
9. Dhadgaon - Unai river.

3. Results and Discussion

The ichthyofaunal diversity of collected and identified fish species from all collecting stations are shown in table-1. During the study of 32 species of freshwater fishes belonging to 11 families and 24 genera recorded from the Nandurbar district are carried out during November 2013 to April 2014. The member of order Cypriniformes was dominated by 19 species followed by Perciformes and Siluriformes with 5 species each, Beloniformes, Clupeiformes and Osteoglossiformes contribute 1 species each.

Cypriniformes with 19 species was dominant group in the assemblage composition in which *Garra mullya*, *Labeo boggut*, *Rasbora daniconius* and *Puntius* species were found most dominant. Its dominance may due to more fecundity of fishes and suitable environmental condition relatively higher population density of this order was evident in the water bodies. In these reported fishes, family Cyprinidae was comparatively more dominance (53%) than remaining 10 families. Most of earlier workers viz., Sakhare (2001), Shinde *et al* (2009), Ubarhande *et al* (2011), Nagma and Khan (2013), etc. have reported the strong dominance of Cyprinidae family in their investigation on ichthyofaunal diversity. Our results are corroborating with these findings. The fishing operation was carried out for 6 months. It is suggested that the fishery authorities should investigate and practice the proper exploitation and management of this fishery resources according to ecological principles. Scientific fishing standard and fishing quotas are to be worked out; this will play an important role in protection of the reservoir biodiversity. Thus it is duty of each one to play an important role to conserve fish diversity at this plays and handover the valuable biodiversity in the healthy condition to the future generation. The work will be provide further strategies for development and fish fauna conservation at Nandurbar district.

Table 1: Fish fauna of Nandurbar district (Maharashtra)

Sr. No.	Name of species	Common name	Status	Locality within Nandurbar district	Fish account	Distribution (India)
01	I. ORDER - BELONIFORMES 1.FAMILY - BELONIDAE *Xenentodon cancila* (Hamilton)	Vam	R	Taloda	*Xenentodon* Regan, 1911, *Ann. Mag. Nat. Hist.*, (8)7, P-332 (type- species, *Belone cancila* Hamilton-Buchanan, by subsequent designation).	Throughout India
02	II. ORDER – CLUPEIFORMES 2. FAMILY - CLUPEIDAE *Tenualosa ilisha* (Hamilton)	Bhat - masa	M	Taloda, Khapar, Shindkheda.	*Tenualosa* Fowler, 1934, *Proc. Acad. Nat. Sci. Philad.*, 85, P-246 (type species, *Alosa reevesii* Richardson).	Cauvery, Ganga, Godavari, Tapi, Krishna, Pennar, Narmada,Yamuna.
03	III. ORDER – CYPRINIFORMES 3. FAMILY - BALITORIDAE *Acanthocobitis moreh* (Sykes)	Mooree	R	Khapar	*Acanthocobitis* Peters, 1861, *Monats, Akad. Wiss*, Berlin for 1861, P-712 (type species *Acanthocobitis longipinnis* Peters = *Cobitis pavonaceus* McClelland, by monotypy).	Peninsular India.
04	*Schistura denisoni* (Day)	Mooree	R	Visarwadi	*Schistura* McClelland, 1839, *Asiat. Res.*, 19, P-306, 439 (type species, *Cobitis* (*Schistura*) *rupecula* McClelland by subsequent designation).	Pamba and Kollur drainages of Kerala, Karnataka states respect. on the S. W. coast. Deolali, Maharas. Javadi hills, Eastern

						Ghats.
05	4. FAMILY - CYPRINIDAE *Barilius bendelisis* (Hamilton)	Zora	M	Khapar, Navapur	*Barilius* Hamilton-Buchanan 1822, Fish Ganges, P-266, 384 (type-species *Cyprinus barila* Ham-Buch by subse designa).	Throughout India (except Kerala).
06	*Cirrhinus reba* (Hamilton)	--	R	Taloda	*Cirrhinus* (Oken), Cuvier, 1817, *V. Kl. Fische*, IN: Isis order *Encyclopadische Zeituny*, 8, P-113 (type-species, *Cyprinus cirrosus* Bleeker, by monotypy).	Throughout India.
07	*Crossocheilus latius* (Hamilton)	Regadi	R	Shahada	*Crossocheilus* Kuhl & van Hasselt. 1823, *Algem-Konst. Letter – Bode*, 2, P- 132 (type species, *Crossocheilus oblongus* Kuhl & van Hasselt, by monotypy).	Bramhaputra, Gang a river system. Deolali, Maharashtra.
08	*Cyprinus carpio* Linnaeus	Combda	R	Prakasha	*Cyprinus* Linnaeus, 1758, *Systema Naturae*, Ed. 10,1, P-320 (type- species, *Cyprinus carpio* Linnaeus, by subsequent designation).	Distribution as of the genus. Introduced into India in 1939. Three varieties are known.
09	*Garra mullya* (Sykes)	Mahya	A	Khapar,Shahada, Nandurbar, Visarwadi, Navapur	*Garra* Hamilton-Buchanan, 1822, *Fish Ganges*. P-393 (type species, *Cyprinus* (*Garra*) *lamta*, by subsequent designa).	Throughout India except Assam and the Himalaya.
10	*Labeo boggut* (Sykes)	Ger	A	Taloda, Khapar, Shindkheda, Visarwadi, Navapur, Dhadgaon	*Labeo*, Cuvier, 1816, *Regne Animale*, 2 (ed. 1), P-194 (type- species, *Cyprinus niloticus* Forsskal, by subsequent designation).	Throughout India except Kerala.
11	*Labeo calbasu* (Hamilton)	--	M	Taloda, Khapar.	-do-	-do-
12	*Labeo rohita* (Hamilton)	Rav	M	Kahpar, Nandurbar.	-do-	Throughout India.
13	*Lepidocephalichthys thermalis* (Valen.)	Mooree	R	Dhadgaon	*Lepidocephalichthys* Bleeker, *Versl. K. Akad. Wet. Amsterdam*, 18, P- 38, 42 (type- species, *Cobitis hasselti* Valenciennes).	South India South of Krishna river system, Karnataka, Kerala.
14	*Puntius amphibious* (Val)	--	C	Dhadagaon, Shahada, Prakasha	*Puntius* Hamilton-Buchanan, 1822, *Fish Ganges*, P-310, 388 (type-species, *Cyprinus sophore* Hamilton-Buchanan, by subsequent designation).	Peninsular India up to Orissa and Rajasthan.
15	*Puntius sarana* (Hamilton)	Kunder	C	Taloda, Khapar, Sarangkheda	-do-	India- throughout north of Krishna river system.
16	*Puntius sophore* (Hamilton)	Lal-Dhebri	A	Prakasha, Navapur, Sarangkheda, Nandurbar	-do-	Throughout India.
17	*Puntius ticto* (Ham-Buch)	Dhebri	C	Khapar, Prakasha, Navapur.	-do-	Throughout India.
18	*Rasbora daniconius* (Hamilton)	Zora	A	Taloda, Prakasha, Khapar, Visarwadi, Dhadgaon, Sarangkheda.	*Rasbora* Bleeker, 1859, *Acta Soc, Sci. Indo-Neerl*. 7, P-435 (type- species, *Cyprinus rasbora* Hamilton-Buchanan, by tautonymy).	Throughout India.
19	*Salmostoma bacaila* (Hamilton)	--	M	Dhadgaon, Sarangkheda.	*Salmostoma* Swainson, 1839, *Nat. Hist. Fish*., 2, P-184 (type species, *Cyprinus oblonga* Swainson = *Cyprinus bacaila* Hamilton Buchanan, by subsequent designation).	India- Ganga, Mahanadi and Brahmaputra river systems.
20	*Salmostoma balookee* (Sykes)	--	C	Taloda, Shahada, Sarangkheda	-do-	Cauvery, Krishna, Godavari, Tapi and

						Narmada river system. Deolali, Nasik (M.S.).
21	*Tor khudree* (Sykes)	Khavalya	R	Navapur	*Tor* Gray, 1834, Illustrations of Indian Zoology, 2, P-96 (type-species, *Cyprinus tor* Hamilt-Buch, by monotypy).	Peninsular India, especially Karnataka, Kerala, Maharashtra hill streams.
22	IV. ORDER-OSTEOGLOSSIFORMES 5. FAMILY-NOTOPTERIDAE *Notopterus notopterus* (Pallas)	Patoda	C	Taloda, Khapar, Dhadgaon	*Notopterus* Lacepede, 1800, *His. Nat. Poiss*., 2, P-190 (type species, *Gymnotus notopterus* Pallas, by absolute tautonomy)	Bramhaputra, Cauvery, Ganga, Godavari,Krishna, Mahanadi and other river system in south India.
23	V. ORDER- : PERCIFORMES 6. FAMILY-AMBASSIDAE *Chanda nama* (Ham-Buch)	Kach-masa	M	Taloda, Prakasha	*Chanda* Hamilton-Buchanan. 1822, *Fish Ganges*, P-103, 370 (type-species, *Chanda nama* Hamil- Buch by designation of ICZN, Opinion II2I (1979).	Ganga, Krishna, Mahanadi basins.
24	*Parambasis lala* (Hamilton)	Dhebaree	R	Taloda	*Parambasis* Bleeker, 1874. *Nat. Verh. Holland. Maattsch, Wetensch*., 2(2), P-86, 102 (type- species *Ambassis apogonoides* Bleeker by original designation).	Brahmaputra, Ganga and Mahanadi basins.
25	*Parambasis ranga* (Hamilton)	Dhebaree	C	Taloda, Dhadgaon, Saragkheda.	-do-	Throughout India.
26	7. FAMILY-CHANNIDAE *Channa gachua* (Hamilton)	Dok	A	Khapar, Shahada, Navapur, Dhadgaon.	*Channa* Scopoli, *Introd. Hist. Nat.*, 1777, P-459 (type- species, *Channa orientalis* Bloch and Schneider, by subsequent designation).	Throughout India.
27	*Channa punctata* (Bloch)	Dok	M	Taloda, Nandurbar.	-do-	Throughout India.
28	VI. ORDER-SILURIFORMES 8. FAMILY- BAGRIDAE *Aorichthys aor* (Hamilton)	Ek- kati	R	Khapar	*Aorichthys* Wu, *1939, Sinensis 10, P-131* (proposed originally as substitute name for *Aoria* Jordan, 199, type –species *Pimelodus aor* Hamil-Bucha by subsequent designation).	Bhramhaputra, Ganga, Cauvery, Mahanadi, Tapi, Narmada, Yamuna river systems.
29	*Mystus bleekeri* (Day)	Chichva	A	Taloda, Khapar, Shahada, Sarangkheda, Dhadgaon.	*Mystus* Scopoli, 1777, *Intro. Hist. Nat.* P-151, (type-species, *Bagrus halepensis* Valen IN: Cuvier and Valen = *Mystus pelusius* (Solander), by subsequent selection).	Confined to North India, the southernmost limit being the Mahanadi headwaters.
30	9. FAMILY- CLARIIDAE *Heteropneutes fossilis* (Bloch)	Tochya	R	Nandurbar	*Heteropneustes* Muller, 1840, *Arch. Anat. Physiol*., P-115 (type- species, *Silurus fossilis* Bloch, by monotypy).	Throughout India.
31	10. FAMILY-SCHILBIDAE *Clupisoma garua* (Hamilton)	Vavadi	C	Khapar, Shahada, Sarangkheda.	*Clupisoma* Swainson, 1838, *Nat. Hist. Animal Fish*., 2, P-347, 351, 354 (type-species, *Pimelodus argnetea* Swainson = *Silurus garua* Hamilton-Buchanan by monotypy).	Throughout North Inaida- Assam, Bihar, West Bengal, Poonch Valley, J and K.
32	11. FAMILY-SILIRUDAE *Ompok bimaculatus*	Papada	C	Taloda, Khapar, Shahada.	*Ompok* Lacepede, 1803, *Hist. Nat. Poiss*., 5. P-49 (type- species, *Ompok Siluroides* Lacepede, by	Throughout India

	(Bloch)				monotypy).	
Total: Orders- 06, Families- 11, Genus- 24 and species - 32.						

Fish status: R = Rare, C = Common, A = Abundance, M = Moderate.

4. Conclusion

It may be concluded that the rivers, reservoir and ponds of the Nandurbar district hosts a number of freshwater fish species. However, the fish fauna, especially rare and moderate species is at risk due to several anthropogenic activities like over fishing and recreational activities besides water pollution. The use of illegal method to catch fish should be banned in this area to prevent for the depletion of fresh water fish resources. Since the fish fauna in Nandurbar district also supports the livelihood of several economic classes. Therefore, there is an urgent need to understand the conservation priorities. Our valuable ichthyofauna can be protected by regulating killing of fishes, giving protection to eggs, fry, fingerlings or juvenile by observing close period. Formation of fish ladder, fish sanctuary and putting ban on killing, sale and poaching of threatened species; initiating and encouraging the conservation movement among fisherman are some of the urgent steps to be taken by N. G. O's and fisheries department of government.

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