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Fish Diversity of Jagadispur Reservoir, Kapilbastu District, Nepal-a Ramsar Site

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Abstract

A total of 2273 fishes were captured from Jagadispur reservoir, one of the Ramsar sites of Nepal using gill nets. Forty-two fish species belonging to 6 orders, 18 families and 34 genera were recorded during the investigation period from the reservoir and listed with their nomenclature and systematic position. Cypriniformes and Cyprinidae were the dominant Orders and family in terms of species composition as well as catch composition respectively. *Nandus nandus* was the most dominant fish species accounting 16.50% of the total catch which is an indication of deteriorating water quality. However, water quality parameters (surface water temperature: 20.7°C–31°C; pH: 6.8–7.6; dissolved oxygen: 5.2mg/l–8.7mg/l; free carbondioxide: 11.1mg/l–23.6mg/l; total hardness: 68.2mg/l–137.5mgl; total alkalinity: 69.6mg/l–192mg/l) were observed within a desirable range supporting warm water fish species.

Key words: fish diversity, gill net, Ramsar site, reservoir, water quality

Introduction

Nepal is the second richest country in the world in freshwater resources occupying at least 5.5% of its area with different types of wetlands (Shrestha 1981). Wetlands are areas where water is the primary factor controlling the environment and the associated plant and animal life. The Informal Wetland Group in Nepal at the first meeting on wetland management in Nepal (Shrestha and Bhandari, 1992) attempted to define wetlands as follows; "Wetlands represent landmass saturated with water due to high water table through ground water, atmospheric precipitation or inundation. It may be natural or artificial, permanent or temporary, static or flowing and fresh water or brackish water."

Wetlands in Nepal constitute about 816954 ha of inland water resources comprising of rivers and streams (48.38%), lakes (0.61%), reservoirs (0.18%), village ponds (0.80%), marginal/swamps/Gholes (1.36%) and irrigated paddy fields (48.71%) (DoFD 2007).

The Ramsar Bureau has designated and listed the Beeshazar Tal (Lake) of Chitwan district, Ghodaghodi Tal of Kailali district and the Jagadishpur reservoir of Kapilvastu district of Nepal as Ramsar Sites in August 13, 2003. Moreover four new wetland sites, namely Rara Lake, Phoksundo Lake, Gokyo and Associated Lakes, and Gosainkunda and Associated Lakes have also been added in the Ramsar list (Kafe 2008).

Shrestha (2003) studied the fishes of Nepal from their recent taxonomic point of view and reported 186 species while Rajbansi (2005) prepared a checklist of Nepalese fishes from published literature and reported 187 species.

Ng and Edds (2004-2006) studied the fishes of Nepal and reported some new species. Therefore 184 fish species of Nepal increased to a total number of 199 as earlier identified two species (*Batasio batasio* and *Pseudechenis sulcatus*) have been abolished from the list of Shrestha (2003) (Saund & Shrestha 2007). Shrestha (2008) has reported a total of 217 species from Nepal.

During the past 10 years, 14 new species have surfaced in the eastern Himalayas. As a result of this increase in ichthyological activity during 1998 to 2008, 7 new fish species have been reported from Nepal (WWF 2009).

Very little research work has been done in this wetland site in the field of freshwater ecology. DNPWC/IUCN (2002) made a single survey in July 1997 and reported that the reservoir helds at least 25 fish species. Fishes are one of the major wetland resources harvested by the local populace living adjacent to the reservoir (DNPWC/IUCN 2002). For the sustainable management of the fish resources in the reservoir, the water quality of the reservoir, the types of fishes, their tolerance limits towards different water quality variables, potential threats to the fish resources and the harvesting rate of fishes should be known. The present investigation aims towards addressing these issues.

Description of the study area

The present study area, Jagadispur reservoir (225ha), lies in Niglihawa VDC, Kapilvastu district, Lumbini zone; 10km north of Taulihawa, the district headquarter of Kapilvastu district, at geographical coordinates $27^0$35'00.0"N and $83^0$05'00.0"E. The area is characterized by its low elevation (197m above mean sea level) experiencing tropical monsoon climate of hot, rainy summer and cool, dry winter (DNPWC/IUCN 2002).

The reservoir irrigates 6,200ha agriculture land of 18 VDCs and 1 municipality through one main canal, 16 sub-canals and 160 minor canals (Joshi 2006). The current uses of the reservoir include fishing, grazing, fuelwood and fodder collection and supply of water for irrigation (DNPWC/IUCN 2002).

Jagadispur reservoir was constructed over the location of the Jakhira Lake and agricultural land in the early 1970s and construction of a rock-fill dyke took place in the early 1980s. The water was fed from the nearby river known as Banganga. Water depth varies from 2m–3m to 5m–7m at the deepest area. The reservoir is surrounded by cultivated land and there are few smaller lakes known as the Sagarhawa and Niglihawa situated near its periphery (DNPWC/IUCN 2002).

Methodology

Baseline information was collected from the study sites during January to December 2005 by conducting six field visits in January, March, May, July, September and November. Additional information was collected by consulting the related experts, local people, literature and maps of the research area.

For the present investigation, only three sampling sites were selected and designated as site I, site II and site III respectively (Fig. 1). These sites were chosen as they were netting places of local fishermen.

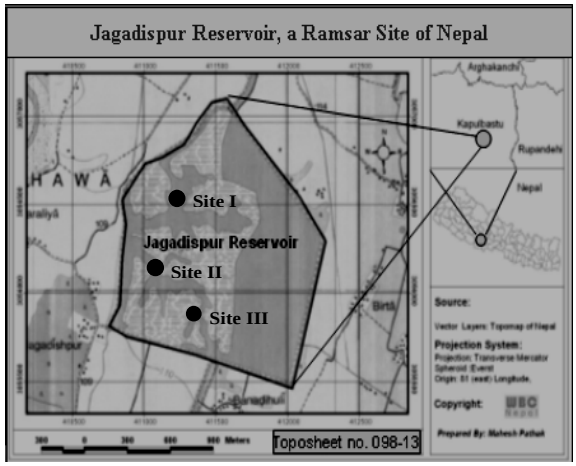

Fig. 1. Sampling sites in the study area

General description of the sampling sites

Site I: Inlet region of the reservoir, which is dominated by flowing water and small patches of islands.

Site II: Main body of the reservoir, which contains deep pool of water with free floating vegetation.

Site III: Outlet region of the reservoir, which contains stagnant water with submerged aquatic vegetation.

Water sampling and analyses

Rubber tubes were used to reach the sampling sites and water samples (surface water) were collected with the help of sterilized sampling bottles. The parameters like depth, temperature, pH and transparency were measured immediately at the time of sampling and other parameters like dissolved oxygen, free carbon dioxide, alkalinity and hardness were measured within few minutes after collection of samples following the standard methods prescribed by APHA, AWWA and WEF (1998).

Fish sampling and analyses

A composite gill net formed from two sets of nets (Type 1- length: 50m, height: 1m and mesh size: 0.5inch and

Type 2- length: 50m, height: 1m and mesh size: 1inch) attached linearly, was used for fish sampling. Three composite gill nets were used for each site. Certain fish species such as *Amblypharyngodon mola* and *Mastacembelus armatus* could be collected only in nets with mesh size of 0.5inch. So, in order to sample majority of the fishes present in the reservoir, two sets of nets were used.

In the late evening, the composite gill net was fixed horizontally in the water body for overnight. Early morning the next day, the net was taken out of the water body and the fishes entangled in the net were collected. Two fishermen were hired for this purpose.

The collected fishes were counted on the spot and the samples of each species were preserved in 5% formalin solution. The samples were then brought to the laboratory and identified to species level using taxonomic literature (Shrestha 1981, 1995, 2001 & Jayaram 1999).

The catch compositions of individual fishes were determined using the following formula:

$$\text{Catch composition by number (\%)} = \frac{\text{Total catch of an individual species} \times 100}{\text{Total catch of all species}}$$

Results and discussion

Water quality was analyzed in order to identify how good was the water of the reservoir for fish production. The fluctuations in water quality parameters (transparency: 0.7 $\pm$ 0.10m and 20.10m; surface water temperature: 20.70.76°C and 311.32°C; pH: 6.80.17 and 7.60.17; dissolved oxygen: 5.20.10mg/l and 8.70.21mg/l; free carbondioxide: 11.10.31mg/l and 23.61.80mg/l; total hardness: 68.26.85mg/l and 137.59.24mg/l; total alkalinity: 69.66.04mg/l and 1924.39mg/l) were found to be within the desirable range to support good fish production. As such, Jagadispur reservoir possessed a great potential for fish production in cage culture. Thus, locals could benefit from its fish production potentiality (cage culture) without hampering its biodiversity.

Forty-two fish species belonging to 6 orders, 18 families and 34 genera were recorded during the investigation period, comprising of 38 indigenous and 4 exotic species. The details are given below:

Systematic classification of fishes

The identified fish species are classified after Jayaram (1999).

Order: Beloniformes
Family: Belonidae
Genus: *Xenentodon* Regan 1911
1. *Xenentodon cancila* (Hamilton-Buchanan) 1822
Order: Cypreniformes
Family: Balitoridae
Genus: *Acanthocobatis* Peters 1861
2. *Acanthocobatis botia* (Hamilton-Buchanan) 1822
Family: Cobitidae
Genus: *Lepidocephalus* Bleeker 1859
3. *Lepidocephalus guntea* (Hamilton-Buchanan) 1822
Family: Cyprenidae
Genus: *Salmostoma* Swainson 1839
4. *Salmostoma bacaila* (Hamilton-Buchanan) 1822
Genus: *Catla* Valenciennes 1844
5. *Catla catla* (Hamilton-Buchanan) 1822
Genus: *Cirrhinus* Cuvier 1817
6. *Cirrhinus mrigala* (Hamilton-Buchanan) 1822
7. *Cirrhinus reba* (Hamilton-Buchanan) 1822
Genus: *Ctenopharyngodon* Steindachner 1866
8. *Ctenopharyngodon idella* (Valenciennes) 1844
Genus: *Cyprinus* Linnaeus 1758
9. *Cyprinus carpio* Linnaeus 1758
Genus: *Labeo* Cuvier *18*17
10. *Labeo pangusia* (Hamilton-Buchanan) 1822
11. *Labeo rohita* (Hamilton-Buchanan) 1822
Genus: *Osteobrama* (Heckel) 1842
12. *Osteobrama cotio* (Hamilton-Buchanan) 1822
Genus: *Puntius* (Hamilton-Buchanan) 1822
13. *Puntius chola* (Hamilton-Buchanan) 1822
14. *Puntius sophore* (Hamilton-Buchanan) 1822
Genus: *Hypothalamichthys* Bleeker 1859
15. *Hypothalamichthys molitrix* (Valenciennes) 1844
Genus: *Aristichthys* Oshima 1919
16. *Aristichthys nobilis* Richardson 1845
Genus: *Amblypharyngodon* Bleeker 1860
17. *Amblypharyngodon mola* (Hamilton-Buchanan) 1822
Genus: *Aspidoparia* Heckel 1843
18. *Aspidoparia morar* (Hamilton-Buchanan) 1822
Genus: *Barilius* (Hamilton-Buchanan) 1822
19. *Barilius bendelisis* (Hamilton-Buchanan) 1822
Genus: *Rasbora* Bleeker 1860
20. *Rasbora daniconius* (Hamilton-Buchanan) 1822
Order: Osteoglossiformes
Family: Notopteroidae

Genus: *Notopterus* (Lacepede) 1800
21. *Notopterus notopterus* (Pallas) 1767
Order: Perciformes
Family: Anabantidae
Genus: *Anabas* Cuvier and Cloquet 1816
22. *Anabas testudineus* (Bloch) 1785
Family: Belontidae
Genus: *Colisa* Cuvier 1831
23. *Colisa fasciatus* (Schneider) 1801
Family: Channidae
Genus: *Channa* Scopoli 1777
24. *Channa orientalis* (Bloch and Schneider) 1801
25. *Channa punctatus* (Bloch) 1785
26. *Channa striatus* (Bloch) 1785
Family: Gobiidae
Genus: *Glossogobius* Gill 1839
27. *Glossogobius giuris* (Hamilton-Buchanan) 1822
Family: Chandidae
Genus: *Chanda* (Hamilton-Buchanan) 1822
28. *Chanda nama* (Hamilton-Buchanan) 1822
Genus: *Paraambassis* Bleeker 1874
29. *Paraambassis ranga* (Hamilton-Buchanan) 1822
Family: Nandidae
Genus: *Nandus* Valenciennes 1831
30. *Nandus nandus* (Hamilton-Buchanan) 1822
Order: Siluriformes
Family: Bagridae
Genus: *Mystus* Scopoli 1777
31. *Mystus cavasius* (Hamilton-Buchanan) 1822
32. *Mystus tengara* (Hamilton-Buchanan) 1822
33. *Mystus vittatus* (Bloch) 1797
Family: Claridae
Genus: *Clarias* Scopoli 1777
34. *Clarias batrachus* (Linnaeus) 1758
Family: Heteropneustidae
Genus: *Heteropneustes* Muller 1840
35. *Heteropneustes fossilis* Bloch 1785
Family: Schilbeidae
Genus: *Clupisoma* Swainson 1839
36. *Clupisoma garua* (Hamilton-Buchanan) 1822
Family: Siluridae
Genus: *Ompok* Lacepede 1803
37. *Ompak bimaculatus* (Bloch) 1797
Genus: *Wallago* Bleeker 1851
38. *Wallago attu* (Schneider) 1801
Order: Synbranchiformes
Family: Mastacembelidae
Genus: *Macrognathus* Lacepede 1800
39. *Macrognathus aral* (Bloch and Schneider) 1801
40. *Macrognathus pancalus* (Hamilton-Buchanan) 1822
Genus: *Mastacembelus* Scopoli 1777
41. *Mastacembelus armatus* (Lacepede) 1800
Family: Synbranchidae
Genus: *Monopterus* Lacepede 1800
42. *Monopterus cuchia* (Hamilton-Buchanan) 1822

Order Cypriniformes represented the highest species composition (46%) while Perciformes and Siluriformes consisted 21% and 19% respectively. Similarly, family cyprinidae represented the highest species composition (40%) followed by Bagridae, Channidae, Mastacembelidae consisting 31.5%, 7% and 7% respectively.

The catch composition of individual fish species revealed that *Nandus nandus, Puntius chola, P. sophore, Notopterus notopterus, Xenentodon cancila, Channa punctatus, Colisa fasciatus, Clarias batrachus* and *Heteropneustes fossilis* were the dominant fish species of the reservoir (Table 1). High catch composition of these fishes suggested that the water quality of the reservoir was deteriorating gradually.

Of the 42 fish species, *Aristichthys nobilis* (Bighead carp), *Ctenopharyngodon idella* (Grass carp), *Cyprinus carpio* (Common carp) and *Hypothalamichthys molitrix* (Silver carp) were recorded only during the monsoon season, so presence of these exotic species in the reservoir may be due to carriage from nearby culture ponds by flood water. Their presence is not a good news for the indigenous fish diversity. Conservation program promoting diversity of local fish species should be taken into consideration and users group of this wetland should be aware regarding the capture fishery.

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Table 1. Catch composition of fish species

Name of species	Total catch in number	Catch Composition (%)
Nandus nandus	375	16.50
Puntius chola	283	12.45
Puntius sophore	228	10.03
Notopterus notopterus	197	8.67
Xenentodon cancila	136	5.98
Channa punctatus	135	5.94
Colisa fasciatus	86	3.78
Clarias batrachus	83	3.65
Heteropneustes fossilis	80	3.52
Channa orientalis	38	1.67
Mystus vittatus	38	1.67
Mastacembelus armatus	37	1.63
Mystus cavasius	35	1.54
Salmostoma bacaila	35	1.54
Glossogobius giuris	34	1.50
Channa striatus	29	1.28
Macrognathus pancalus	28	1.23
Rasbora daniconius	28	1.23
Mystus tengara	27	1.19
Cirrhinus reba	26	1.14
Other	315	13.88

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