



Fish Biodiversity and Invasion Risks of Alien Species in Some Aquatic Bodies under Forest Areas of Uttar Pradesh

A. K. Singh, U. K. Sarkar, Rehana Abidi and S. M. Srivatstava

National Bureau of Fish Genetic Resources
Canal Ring Road, P. O. Dilkusha, Lucknow-226002 (Uttar Pradesh)
Email : aksingh56@rediffmail.com

Introduction

Uttar Pradesh (23° 52' - 30° 24' North and 77° 5' - 84° 38' East) has a diverse and important abode of several important fish species of freshwater ecosystem. These natural aquatic resources harbouring variety of fishes exist in the form of rivers, lakes, reservoirs, wetlands and ponds and tanks. Many of these aquatic bodies are protected and lying in forest areas where fishing is prohibited under Wildlife Act 1972 while others are unprotected. These water bodies are beautiful sites of rich and varied pristine diversity. A list of such water bodies is in Table 1.

These forest water bodies are the most important biodiversity hotspots of the State. These protected areas remain strong and vital reservoirs for fish biodiversity, and cover important social and economic assets. Due to intense human pressure, the persistence of most aquatic species is of immense concern. However, the recent spread of invasive fish species such as *Oreochromis mossambicus*, *O. niloticus*, *Cyprinus carpio*, *Clarias gariepinus*, *Aristichthys nobilis* and many more are causing threat to important fish diversity (Singh and Lakra, 2011). Further, changes in river hydrology, associated with siltation, and excessive ground water exploitation are also causing changes in aquatic bodies lying in forest areas (Lakra *et al.* 2009). The present status and conservation needs of some of the aquatic bodies of forest areas are presented here in this paper:

1. **Bakhira Wildlife Sanctuary:** Despite continuous vigilance by the forest department incidents of illegal fishing are reported. Over 6,000 boats operate.. The fishing method is very traditional and includes hunting of fish with pointed sticks.
2. **Hastinapur Wildlife Sanctuary:** It lies along the banks of the Ganga which still harbours the highly endangered Gangetic Dolphin *Platanista gangetica*. The Sanctuary is subjected to great human disturbance and pressures, mainly due to large-scale commercial exploitation.
3. **Kudaiyya Marshland:** It is connected to a tributary of the rightwing Ganga canal, and frequently gets water through this source throughout the year. Even when completely full during the monsoon, water depth in the wetland does not exceed 1.5 m in the deepest parts. For the most part, it is less than 0.5 m, and the marsh dries up in the peak summer month of June, before it is filled up by the rain water again in July.
4. **Lakh-Bahosi Bird Sanctuary (Farrukhabad):** Management of this protected area is difficult, since a major portion of the area belongs to private landowners. Illegal fishing, hunting and bird trapping are reported occasionally. While the Lakh jheel is nearly free of weeds, Bahosi is heavily infested with *Ipomoea*.



Table-1: Aquatic water bodies in Uttar Pradesh under the forest area

Sl. No.	Name of water bodies	Locations	Latitude/Longitude	Area (ha)
1	Bakhira Wildlife Sanctuary	Sant Kabir Nagar	26° 34' 60" N, 83° 00' 00" E	2,894 ha
2	Water Bodies of Dudwa National Park	Lakhimpur-Kheri	28° 29' 27" N, 80° 42' 08" E	49,000 ha
3	Hastinapur Wildlife Sanctuary	Bijnor	29° 32' 28" N, 78° 08' 47"E	2,07,300 ha
4	Katerniaghat Wildlife Sanctuary and Girijapur Barrage	Behraich	28° 14' 40" N, 81° 11' 29" E	40,069 ha
5	Kishanpur Wildlife Sanctuary	Lakhimpur kheri	28° 23' 47" N, 80° 21' 52" E	22700 ha
6	Kudaiyya Marshland	Mainpuri	6° 59' 36" N, 78° 59' 25" E	300 ha
7	Lagga-Bagga Reserve Forest	Pilibhit	28° 37' 00" N, 79° 47' 60" E	1,160 ha
8	Lakh-Bahosi Bird Sanctuary	Farrukhabad	27° 30' 00" N, 79° 30' 00" E	8,024 ha
9	Narora Reservoir	Bulandshahr	28o 14' 15" N, 78o 24' 18" E	12,700 ha
10	Nawabganj Bird Sanctuary	Unnao	26° 34' 60" N, 80° 40' 00" E	225 ha
11	Patna Bird Sanctuary	Etah	27° 34' 60" N, 78° 45' 00" E	109 ha
12	Saman Bird Sanctuary	Mainpuri	27° 04' 60" N, 79° 00' 00"E	525 ha
13	Sandi Wildlife Sanctuary	Hardoi	27° 15' 00" N, 79° 55' 00" E	309 ha
14	Sheikha Jheel	Aligarh	27° 49' 00" N, 78° 10' 00" E	250 ha
15	Sohagibarwa Wildlife Sanctuary	Maharajganj	27° 17' 39" N, 83° 43' 40" E	42,820 ha
16	Soheldev Wildlife Sanctuary	Balrampur	27° 44' 18" N, 82° 09' 25" E	45,247 ha
17	Sur Sarovar Sanctuary (Keetham Lake)	Agra	27° 00' 00" N, 77° 45' 00" E	403 ha
18	Surha Taal Wildlife Sanctuary	Ballia	25° 45' 00" N, 84° 19' 60" E	3432 ha



19	Kurra Jheel	Etawah, Mainpuri	27° 01' 00" N, 79° 05' 60" E	200 ha
20	National Chambal Wildlife Sanctuary	Agra, Etawah	26° 48' 41" N, 78° 40' 55"E	63,500 ha
21	Parvati Aranga Wildlife	Gonda	27° 25' 00" N, 82° 19' 00" E	1,084 ha
22	Pyagpur (Bagheltal) Jheel	Bahraich	27° 31' 00" N, 81° 54' 00"E	2,950 ha
23	Samaspur Bird Sanctuary	Raebaraeily	26° 00' 00" N, 81° 25' 00"E	799 ha
24	Sauj Lake	Mainpuri	26° 01' 00" N, 79° 55' 17" E	400 ha

5. **Narora (Bulandshahar):** Narora is situated on the River Ganga, between Karnabas and Ramghat, includes the total catchment area of Narora Barrage or the Lower Ganga Barrage, and the marshes and wetlands are situated along the river banks. Narora reservoir and a stretch of about 60 km on the River Ganga is extremely important for the protection of the Gangetic Dolphin *Platanista gangetica*, 11 species of freshwater turtles and for Mugger *Crocodylus palustris* and Gharial *Gavialis gangeticus*. The Nature Conservation Society of Aligarh earlier suggested to the government that Narora reservoir from the Barrage to Rajghat, a stretch of about 7 km should be declared as a bird sanctuary (Rahmani, 1992). WWF-India has revived and modified this proposal to declare the stretch between Karnabas and Ramghat as a Dolphin Sanctuary. 16 fish species of different length class have been observed with a total density of 176.42 fish/km stretch and a total average biomass of 5.36 kg/km river stretch. Dolphin density showed a significant positive relationship ($R=0.587$) with density of Reba fish (*Cirrhinus reba*) and Baam fish (*Mastacembelus armatus*) and also with water depth. Presence of dolphins varied across different water depths categories and different parts of the river with more than 50% of dolphin sightings occurring in confluences, indicating their preference for deep water pools (Bashir, 2010).
6. **Patna Wildlife Sanctuary:** It is considered a sacred place due to the presence of a temple, so villagers do not allow hunting, fishing resulting in unusual tameness of birds and shelter to fishes. Since the establishment of the Sanctuary and some restriction on the fishing activities, the villagers have become somewhat indifferent to the Sanctuary. This is only 80 km from Agra, a major tourist centre of India, and attracts thousands of tourists every year. This sanctuary could be developed like Keoladeo National Park at Bharatpur, Rajasthan. Patna WLS is a classic example of how, within a few years of protection, a long-neglected wetland can become one of the finest wetland habitats of the country.
7. **Sheikha Jheel (Aligarh):** Sheikha jheel is a typical monsoonal wetland of the Gangetic plains. It gets most of its water from rainfall, but seepage of water from the adjoining canal has made it perennial. Before the canal was constructed, this jheel probably dried up during summer like other similar wetlands. Sheikha jheel is surrounded on three sides by natural



- vegetation. The submerged vegetation consists of *Hydrilla verticillata*, *Ceratophyllum demersum*, *Vallisneria spiralis*, *Potamogeton crispus* and *Najas*. Free-floating vegetation consists of *Salvinia* and *Azolla*, and in some places, *Eichhornia crassipes*. Rooted floating vegetation includes *Nymphoides cristata* and *Nymphoides indica*. This condition is good for common carp to flourish. Similarly, African catfish *Clarias gariepinus* may have also found its way. Till the mid 1970s, Sheikha jheel was the main shooting ground of local hunters, but due to an intensive campaign by the Nature Conservation Society of Aligarh, hunting was controlled. The Uttar Pradesh Forest Department placed a guard for some years, which greatly helped in preventing poaching. Sheikha jheel could easily become a good place for bird watching and environmental education. A proper management plan needs to be developed and implemented, so that the jheel can attract more visitors and more birds.
8. **Sur Sarovar Sanctuary (Keetham Lake):** Keetham lake was under the control of fisheries department for some time and it was a good source of revenue from the sale of large size fishes such as Indian major carps (*Catla catla*, *Labeo rohita*, *Cirrhinus mrigala*), catfishes, *Wallago attu*, *Rita rita*, *Mystus spp.*, *Clarias batrachus* etc. Presently, 70% to 80% of the water body is covered with weeds, particularly Water Hyacinth, despite constant dredging. The Irrigation Department owns the land, so coordination is required, particularly to maintain adequate water levels for optimum removal of Water Hyacinth. A drain from the Agra canal comes down to Sur Sarovar from Okhla, carrying Water Hyacinth along with it. This means that re-establishment of the weed is certain even after it is removed from this water body. A chain link gate to prevent Water Hyacinth entering the lake has been broken. In December 2000, 20-25% of the lake was cleared of Hyacinth, manually through people's participation. Presently, tilapia, common carp and African catfish are available in this aquatic body.
9. **National Chambal Wildlife Sanctuary (Agra):** This Sanctuary was established to rehabilitate the Gharial. Good protection during the last 30 years has benefited the Smooth Indian Otter *Lutra perspicillata*, the Marsh Crocodile *Crocodylus palustris* and the Gangetic Dolphin *Platanista gangetica*. Chambal is also famous for several species of turtles such as *Lissemys punctata*, *Chitra indica*, *Kachuga kachuga*, *K. dhongoka*, *K. tentoria*, *Trionyx gangeticus* and *Hardella thurjii*. Illegal fishing is very common in this sanctuary. Presently, dominance of tilapia, common carp, bighead and occasional catch of African catfish is a serious concern.
10. **Surha Taal Wildlife Sanctuary:** It is a natural rainfed lake and this wetland has been listed as a high priority wetland of Level V, which is wetland with high ecological and socio-economic potential. Fishing activity is very common in this lake. Local farmers use the lake water for irrigation. Surha Taal is presently under tremendous biotic pressures such as fishing, weed infestation and drainage for cultivation. Suraha Lake is an important natural resource for fisheries in the Ballia district in eastern Uttar Pradesh at altitude of 166 msl. It is a good resource for capture fisheries in this region. It forms the lifeline for rural economy and environment of this area. It has a great recreational value and it also supports local agriculture, irrigation and tourism. It is an open type oval 'U' shaped ox-bow natural (river meandering) lake in the flood plain of river Ganga, located 8 km north to the district head quarters of Ballia. It is a perennial meander of the river Ganga with an area of 2602.18 ha. During monsoon season it covers about 3642.25 ha. The lake circumference is about 25.6 km. The lake has openly connected with river Ganga through Katehar nullaha, its length is about 32.6 km which is drained and filled according to the



water level of the river. It also receives huge amount of runoff water from adjoining area through Madha and Garari nullahas. The lake water drains out by Nakta and Suraha tal canal system. A study conducted at Surahatal revealed presence of forty one species of fishes belonging to six orders, sixteen families and twenty five genera (Singh *et al.* 2009). 23 species of Cypriniformes (including 4 exotic species *ie.* *Cyprinus carpio*, *Aristichthys nobilis*, *Hypophthalmichthys molitrix* and *Ctenopharyngodon idella*) from the lake, 12 species from Siluriformes, 3 species from Symbrachiformes, 13 species from Perciformes, 1 species from Tetradontiformes, 3 species from Clupeiformes and 1 species from Beloniformes. Cypriniformes contributes about 36% of total fish species. The catch composition of lake consists of Indian major carps 15-20%, minor carps 2-5%, catfishes and featherback 35- 40%, and live fishes 5-10%, forage fishes 15- 20%. Previously, Swarup and Singh (1975) listed 51 fish species in the same lake. The fish composition of this lake is similar to that of the Ganga river system.

11. **Parvati Aranga Wildlife (Gonda):** Till 1996, the Fisheries Department, Uttar Pradesh used to auction the fish which has now been stopped. Fishing, however, continues illegally. The Sanctuary has no weeds, but on the banks some wild Cannabis has made an appearance. This needs to be removed to maintain the wetland. The pesticide used in the surrounding fields runs off into the lakes, but its impact on birds needs to be assessed.
12. **Pyagpur (Baghetal):** Jheel Pyagpur Jheel (2,800 ha) is a shallow, freshwater lake located in Baheraich. It is a marsh on the plains between the Rapti and Ghagra rivers. It is an excellent permanent jheel of 1-3 m depth, and supports very important fishery. It has a tropical monsoon climate typical of the Gangetic Plains. It is state owned, and the surrounding area is privately owned agricultural land. Sitadwar (150 ha) is a

similar shallow freshwater lake with associated marshes, situated some 20 km away on the plains between the Rapti and Ghagra rivers. It is a site of religious pilgrimage and festivals. Sitadwar Jheel is somewhat shallow, prone to drying out in summer. It is state owned, while the surrounding area is privately owned agricultural land (Islam 2001). Sitadwar has the usual complement of aquatic vegetation, some floating and emergent plants such as *Ipomea carnea*. Pyagpur jheel bears similar submerged, floating and emergent plants of a typical jheel of the Gangetic plains. It also suffers from infestation of Water Hyacinth *Eichhornia crassipes* and *Ipomea carnea*. Commercially important fishes are available even today and are caught illegally.

13. **Samaspur Bird Sanctuary:** Despite Samaspur jheels being such an important bird refuge of northern India, detailed work has been conducted with regard to the fish biodiversity of this site (Sarkar *et al.* 2007). Illegal fishing by the people of surrounding villages has also been reported. Livestock grazing in the surrounding land causes soil erosion, which enhances siltation of the lake.

Conclusion

Freshwater protected areas have the potential to become effective in situ conservation and management sites for freshwater organisms and habitats safeguarding the natural freshwater ecosystem services. Interest in this direction has been growing among the scientific community, as well as, among the conservationists in India. But there is need to identify the conservation value of these protected areas in relation to biogeographical diversity of fishes and factors influencing the fish communities. Several factors like environmental degradation due the urbanization, damming, abstraction to water for irrigation, introduction of exotic species, insecticide poisoning, dynamiting and industrial pollution have, in the last few



decades, subjected our natural waters in general and rivers in particulars, to degradation leading to severe stress on fish biodiversity. Such fresh waters protected area (FWPAs) must be guarded against the primary threats so as to protect freshwater species and habitats. The scientific information on the fish diversity, assemblage, occurrence, richness and distribution along with the status of fish habitat is essential for undertaking conservation programme in any water bodies.

The introduced fishes would be aggressive, prolific breeders which would move out of the lakes, reservoirs and expand their range along the river courses, both upstream as well as downstream. They would easily push out of their niches the indigenous species and prey upon the local species of fishes, their fingerlings or spawn. They would voraciously feed on the aquatic biomass and successfully compete with all the indigenous species of freshwater fauna. The recent study shows that the protected area act as the refuge for highly endemic local fish fauna and one

of the greatest threats is the presence of exotic species (Singh and Lakra, 2011). African catfish (*Clarias gariepinus*) and tilapia have gained entry into the reservoirs ecosystems of India though accidental or deliberate introduction. Among them tilapia has already entered into all the upstream rivers of Kerala and north India, including forest streams and established viable populations (Singh and Lakra 2011). A critically declining bird, the Moorhen *Gallinula chloropus*, was recently found in the gut of a 67-cm-long African catfish (*Clarias gariepinus*) caught from the Bharatpur bird sanctuary in Rajasthan (Anoop *et al.* 2009). Convention on Biological Diversity States: "Inland water ecosystems are particularly vulnerable to invasive alien species. Therefore, there is an urgent need to monitoring the cases on invasion of alien fish species. It is important to mention here that there is limited success in the prevention, eradication and control of invasive alien species in land water ecosystems.

References

- Anoop K, Gopi Sundar KS, Khan BA, Lal (2009) Common moorhen *Gallinula chloropus* in the diet of the African catfish *Clarias gariepinus* in Keoladeo Ghana National Park, India. *Indian Birds* 5 (1): 22-23.
- Bashir, T. (2010). Ganges River dolphin (*Platanista gangetica*) seeks help. *Current Science*, 98(3), 287-288.
- Behera, S. K., & Rao, R. J. (1999). Observation on the behaviour of Gangetic dolphins in the upper Ganga River. *Journal of Bombay Natural History Society*, 96, 43-47.
- Behera, S. K. (2002). Ganges River dolphin-Wanted alive! (Status report submitted to WWF-Sweden). New Delhi: Ganges River Dolphin Conservation Project, World Wide Fund for Nature-India.
- Kumar, H., Mathur, P. K., Lehmkuhl, J. F., Khati, D. S., De, R. and Longwah, W. (2002) Management of Forests in India for Biological Diversity and Forest Productivity: A New Perspective: Terai Conservation Area (TCA). Vol. VI. WII-USA Forest Service Collaborative Project Report. Wildlife Institute of India, Dehra Dun. Pp. 158.
- Lakra W.S., A.K.Singh and P.C.Mahanta (Eds) (2009). Fish Genetic Resources. Narendra Publishing House, New Delhi (2009). 284pp.
- Rahmani, A. R. (1992) Threatened Fauna of the Indian Grasslands. In: *Tropical Ecosystems - Ecology and Management* (eds. K. P. Singh and J. S. Singh). Pp 143-150. Wiley Eastern Limited, New Delhi.
- Rahmani, A. R. (2001) Status of the Bengal Florican *Houbaropsis bengalensis* in Uttar Pradesh, India. Pp 11. Bombay Natural History Society, Mumbai.
- Sarkar, U. K., Kapoor, D., Paul, S. K., Pathak, A. K., Basheer, V. S., Deepak, P. K., *et al.* (2007). Fish biodiversity in the water bodies of Samaspur Bird Sanctuary, Uttar Pradesh. *Journal of Bombay Natural History Society*, 104, 51-54
- Singh A.K. and Lakra W.S. (2011). Risk and benefit assessment of alien fish species of the aquaculture and aquarium trade into India. *Reviews in Aquaculture* 3, 3-18(Wiley-Blackwell).
- Singh, K.; Agrawal, N. C.; Ahirwal, R. P.; Soni, S. (2009). Biodiversity of fish fauna of Surha Tal, Ballia District (U.P.) India. *Flora and Fauna (Jhansi)* Vol. 15 No. 1 pp. 87-90 ISSN 0971-6920.