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PRESENT STATUS OF ICHTHYOFAUNAL DIVERSITY AND IMPACT OF EXOTICS IN UTTAR PRADESH

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ABSTRACT – Existence of 126 fish species has been recorded in Uttar Pradesh. Some of the fishes have been introduced in this state for aquaculture and ornamental purposes. Impact of the exotics on native fish germplasm, with special reference to aquaculture has been discussed. Measures to enhance aquaculture production in Uttar Pradesh have also been enumerated.

Key words : Exotic fish species, Impact of exotics on native germplam, Uttar Pradesh.

INTRODUCTION

Uttar Pradesh, located in the northern part of India, covers an area of 243,286 km^2 (93,933 sq mi) with a population of 199,581,000 people (around 200 million, 2011 census). As such, it is the most populous state of India as well as the most populous sub-national entity of the world. In fact, a nation in its own right, Uttar Pradesh would be the fifth most populous country of the world, ahead of Brazil (a country thirty-five times larger in territorial area than Uttar Pradesh).

Life on earth is diverse at many levels, beginning with genes and extending to the wealth and complexity of species, life forms and functional roles, organized in spatial patterns from biological communities to ecosystems, regions and beyond (Colwell, 2009). In other words, it means variety and variability among living organisms, their genetic differences and the ecosystems in which they live (Winter and Hughes, 1997; Rahbek and Colwell, 2011). Uttar Pradesh has vast potential of aquatic bio-resources and offers immense scope of inland fisheries development and aquaculture (Janaki Ram and Pandey, 2003). Fishery resources are available in the form of 28,500 km of rivers and canals, 1.38 lakh ha of reservoirs and 1.61 lakh ha of ponds and tanks as well as 1.33 lakh ha of floodplain lakes and derelict water. During the last few decades, the fish biodiversity of the state are declining rapidly due to anthropogenic environmental degradation like urbanization, damming, abstraction of water for irrigation and power generation and pollution, which have subjected natural water bodies in general and rivers, in particular to severe stress with devastating effects on freshwater fish diversity (Pandey and Das, 2006; Lakra and Pandey, 2009; Lakra, 2010; Ayyappan *et al*, 2011). Though occurrence and impact of exotics on Indian fish production and diversity has been discussed (Natarajan, 1989; Jhingran, 1989; Tripathi, 1989; Thakur, 1998, 1999; Mishra *et al*., 1998, 2000: Bijukumar, 2000; Lakra and Singh, 2007; Lakra *et al*, 2008; Singh and Jena, 2012), reports on these aspects with reference to the state are very few (Singh and Mishra, 2001; Singh *et al*, 2010; Mayank *et al*, 2011; Pathak *et al*, 2011). Therefore, an attempt has been made to compile and review the available information regarding the exotics and their impacts on development of aquaculture and fish germplasm resources in Uttar Pradesh.

During the last few years tremendous development has taken place in the fishery sector. In the inland fishery sector, Fish Farmers Development Agency (FFDAs) have been established at the district level which boosted the inland fish production. The total fish production from all resources in the state is 3.93 lakh tonnes (2009-10) (http://fisheries.up.nic.in). The world fisheries and aquaculture sectors have registered immense development during the last 60 years resulting rapid increase in their production. Total world fish production was only 19.3 million tonnes in 1950 which has increased dramatically to 154 million tonnes in 2011 (FAO, 2012) (Fig. 2). Fish production in Uttar Pradesh during the last decade has been summarized in Fig. 3.

Status of exotic fish species

About 324 exotic species - 291 ornamental, 31 aquaculture and 2 larvicidal taxa have been recorded from the Indian waters. To augment the fish production in Uttar Pradesh, the State Fisheries Department introduced certain exotic fishes in the beginning while others have entered by traders in due course of time. Among the cultivatable fishes, the State Fisheries Department has promoted

common carp, grass carp and silver carp while tilapia, bighead carp and Thai magur (African catfish) were brought by the farmers themselves.

Common carp: Three strains of common carp, *Cyprinus carpio* var. *communis* (common carp), *Cyprinus carpio* var. *specularis* (mirror carp) and *Cypruinus carpio* var. *nudus* (leather carp) were brought for aquaculture from Sri Lanka and Bangkok during 1939 and 1957. The Bangkok strain is widely used in composite culture and has contributed significantly towards development of aquaculture in India (Tripathi, 2009). Recent assessment survey revealed the infestation of Yamuna river by this species resulting in the decline of precious Indian major carp fisheries at Allahabad (Singh *et al*, 2010; Pathak *et al*, 2011).

Grass carp: *Ctenopharyngodon idella,* a voracious feeder on aquatic weeds and grasses, was introduced in India from Japan, Hong Kong in 1959 at Pond Culture Division of Central Inland Fisheries Research Institute, Cuttack (Orissa) and bred successfully through hypophysation (Alikunhi *et al*, 1963; Alikunhi and Sukumaran, 1964). It is an important species under composite fish culture and contributed significantly towards aquaculture production of this country including Uttar Pradesh (Janaki Ram and Pandey, 2003). By controlling weeds, grass carp brings about circulation of the nutrients locked up in the weeds and produces valuable proteins but it impacts the survival of those fishes (murrels) and prawns that hide to escape the predators thus upsetting the ecological balance of the ponds and natural aquatic environment (Tripathi, 2009).

Siver carp: *Hypophthalmichthys molitrix,* a voracious plankton feeder, was introduced in India from Japan, Hong Kong in 1959 at Pond Culture Division of Central Inland Fisheries Research Institute, Cuttack (Orissa) and bred successfully through hypophysation (Alikunhi *et al*, 1963, Alikunhi and Sukumaran, 1964). It is an important species under composite fish culture and contributed significantly towards aquaculture production of this country including Uttar Pradesh (Janaki Ram and Pandey, 2003). Since catches of silver carp is increasing in Rihand reservoir, probably by impacting the precious catla fishery of the water body. This species has been reported to compete with catla because its fine gill rakers filters zooplankton along with phytoplankton too (Tripathi, 2009). Occurrence of this species has also been reported from natural water bodies of Uttar Pradesh (Pandey, 1997).

Tilapia: *Oreochromis mossambicus* (introduced in 1952 and 1962 from Sri Lanka) and *Oreochromis niloticus* (introduced from Thailand/Israel in 1987) admired in this state during 1987s. Populations of both the species exist in natural water bodies (rivers and reservoirs) of this country, particularly in penninsular India (Kurup and Radhakrishnan, 2008; Tripathi, 2009). Although they were never officially promoted by any agency but they are now found in all types of water bodies of the state. Invasion of *Oreochromis niloticus* has recently been reported in Yamuna river at Allahabad (Mayank *et al*, 2011).The only demerit is that being a prolific breeder, it becomes a dominant species thereby reducing the growth rate of the other species cultured along with it. It is not suitable for composite fish culture along with carps as it competes with major carps for space, food and oxygen besides predating on carp fry.

Bighead: *Aristichthys nobilis* introduced in India in 1980, most probably from Bangladesh and Nepal routes for purpose of aquaculture in West Bengal. It is also unwelcomed fish but entered by private seed traders from West Bengal in 1987. This species, a voracious zooplankton feeder, is being cultured by some fish farmers due to fast growth (500 g in 6 months) in some seasonal waters and has been successfully bred on a large scale in hatcheries of Uttar Pradesh. The bighead is also being cultured in polyculture system of the state too. This species is found to competes severely with the priced *Catla catla* in composite culture (Tripathi, 2009).

Thai magur: *Clarias gariepinus* entered in this country in 1994 in West Bengal through Bangladesh but presently seed is brought from West Bengal, Andhra Pradesh and Maharashtra and cultured in most parts of Uttar Pradesh and Bihar owing to its high environmental tolerance and wide food spectrum. This species has an immense impact on the indigenous species competing for space and food resulting in decline of indigenous fish stock. Uttar Pradesh State Fisheries Department has banned the introduction of this species under the guidelines given by Government of India. This species also called as African catfish and with the introduction of this species, some water bodies are found to be completely devoid of all the indigenous fish fauna as they devour the aquatic animals of all kinds without sparing any one (Thakur, 1998, 1999). The highly carnivorous African catfish which is illegally introduced to the aquatic system of India caused severe damage to indigenous fish fauna. The exotic catfish is known as a carrier of 18 species of infectious bacteria as against 3 reported in indigenous *Clarias batrachus* (Tripathi, 2009). The Union Agriculture Ministry has ordered killing of these fishes *en masse* and preventing further culture of these fishes but this order did not have any impact as it lacked any specific guidelines to destroy this fish (Bijukumar, 2000).

Role of quarantine in regulation the introduction

Geographical map of Uttar Pradesh

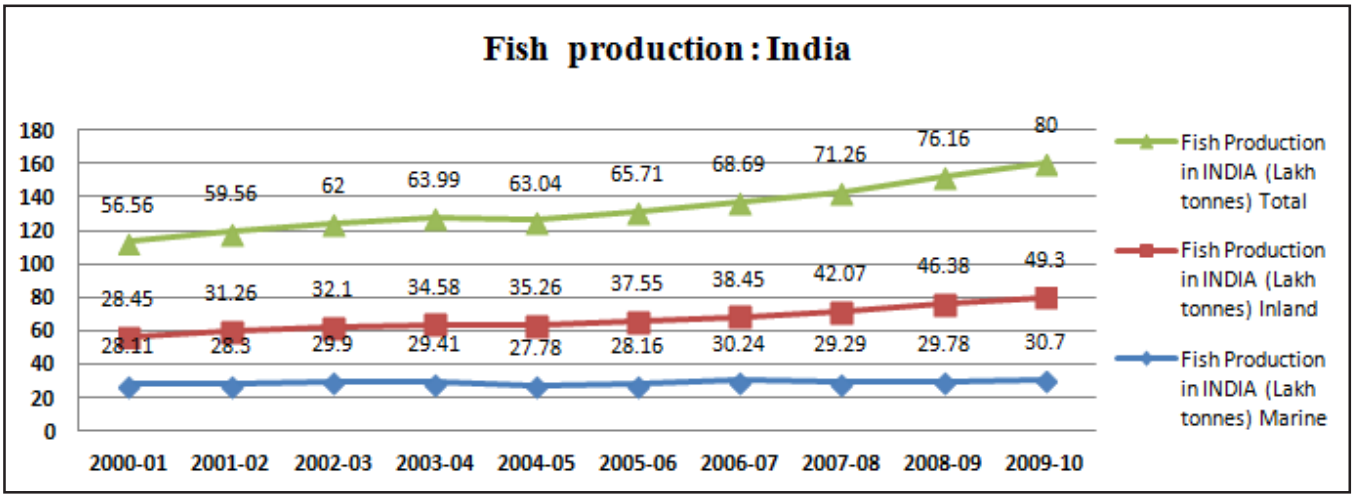

Fig. 2: Fish production in India. (FAO, 2012).

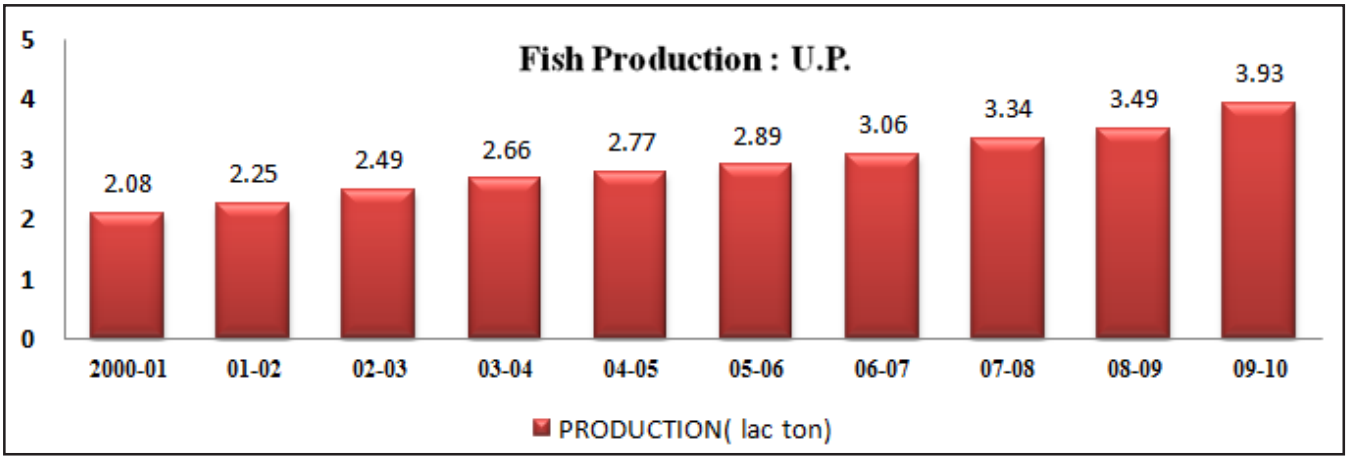

Fig. 3 : Fish production in Uttar Pradesh.

of exotic species

Quarantine is a regulatory measure enforced legally by the government to protect its people and environment from invasion of foreign pests and diseases. Historically, the word 'Quarantine' was derived from Latin "Quadraginata" and the Italian word "Quaranta" which means forty and the Italian word "Quarantina" meaning quarantine. The Ministry of Agriculture, Government of India, New Delhi is the authority to regulate the importation and inter-state movement of invasive animal species derives primarily from the Livestock Importation Act 1898. Fisheries are not included in the Wildlife (Protection) Act 1972. The main available legal instrument covering fishes is the Indian Fisheries Act, 1897 that was enacted to protect aquaresources. The main roles of quarantine are to prevent introduction of species from outside which could threaten native ecosystem or species and control the risk associated environmental effects.

Ichthyofaunal biodiversity

Total fish biodiversity of Uttar Pradesh contributes approximately 14.68% of the national fish biodiversity. According to published reports, out of 111 fish species recorded from Uttar Pradesh, 87 species recorded from eastern part of the state (Talwar and Jhingran, 1991; Pandey, 1999; Srivastava, 2002; Dwivedi *et al*, 2004, 2007; Lakra, 2010; Kumar *et al*, 2013). Recently, 63 fish species belonging to 20 Families and 45 Genera were recorded (Lakra *et al,* 2010) from river Betwa (a tributary of Ganga basin approved under India's first River-Linking Plan) in Uttar Pradesh. Of late, 92 fish species belonging to 58 Genera and 24 Families were recorded by NBFGR from river Ganga in Uttar Pradesh. Another report revealed 56 species belonging to 42 Genera, 20 Families and 7 Orders from river Gomti. Recent assessment surveys conducted by NBFGR recorded the existence of about 123 fish species in Uttar Pradesh. Evaluation of the utilization pattern of fish taxa in Uttar Pradesh., reveals that out of 123 species, about 33% are considered as ornamental fishes, nearly 57% are potential food fishes and 10% are listed under potential sport fishes (Lakra, 2010)**.** According to the recent conservation assessment of NBFGR, a total of 20 freshwater fishes included as threatened status of which 9 under Endangered and 11 Vulnerable.

Recently, NBFGR has declared 16 state fish to develop strategies for conservation and enhancement by the respective state (Ayyappan *et al*, 2011). The state fishes selected by different states are - Uttar Pradesh (*Chitala chitala*), Andhra Pradesh (*Channa striatus*), Arunachal Pradesh (*Tor putitora*), Bihar (*Clarias batrachus*), Haryana (*Labeo calbasu),* Himachal Pradesh (*Tor putitora),* Jammu and Kashmir (*Tor putitora*), Karnataka (*Puntius carnaticus*), Kerala (*Etroplus suratensis*), Manipur (*Osteobrama belangeri*), Mizoram (*Semiplotus modestus*), Nagaland (*Neolissocheilus hexagonolepis*), Odisha (*Tor mahanadicus*), Tripura (*Ompok bimaculatus*), Uttarakhand (*Tor putitora*) and West Bengal *(Tenualosa ilisha*).

Major threats and conservation status

The environmental threats could be man-made and natural or in combination with cascading and interlinked impacts. Conservation and sustainable utilization of natural resources are the issues receiving global attention after signing the Convention on Biodiversity in 1992 (Agenda 21). The freshwater resources of Uttar Pradesh are currently experiencing an alarming decline in fish biodiversity due to various anthropogenic activities. Destructive fishing methods, entry of exotic species, use of poison, habitat alteration and water diversion, poor vegetation cover in the river banks, siltation, water abstraction and low water velocity have affected the overall fish diversity to large extent. Though not much published literature is available on the threat status of fish species of Uttar Pradesh, yet it is the fact that population of some species is constantly declining and there is an urgent need to safeguard the same. According to recent conservation assessment of NBFGR, a total of 20 freshwater fishes included as threatened status of which 9 under Endangered and 11 Vulnerable (Lakra, 2010). The Government of Uttar Pradesh has declared endangered *Chitala chitala,* as a state fish and planning for conservation actions are in process (NBFGR, www.nbfgr.res.in).

Conclusions

In view of the significance to improve the socio-economic condition of fisherman community and to achieve sustainable utilization of resources for fisheries development, optimum production of fish from water bodies, employment generation, availability of protein - rich food, appropriate planning and strategies are of utmost importance. To respond to new challenges and developments, Government of India has legislated the Biological Diversity Act (2002) and the Biological Diversity Rules (2004) which aims at conservation of our natural heritage and ensures the sharing of benefits of the utilization of biological resources in an equitable manner. The large scale industrialization and the consequent effluent discharge are going to make the river almost lifeless or dead. Netting operations and other anthropogenic activities has become routine so that the aquatic ecosystem never get adequate time to recover its natural community structure.

During the last few decades, the fish biodiversity of the country are declining rapidly due to anthropogenic environmental degradation like urbanization, damming, abstraction of waters for irrigation and power generation and pollution, which have subjected the natural water bodies in general and rivers, in particular to severe stress with devastating effects on freshwater fish diversity (Pandey and Das, 2006; Lakra and Pandey, 2009). However, more awareness and motivation is required on the value of indigenous fish diversity and their conservation which aims at conservation of aquatic resources to ensure the sharing of benefits of the utilization of biological resources in an equitable manner. So that, the aquatic ecosystem gets adequate time to recover its natural community structure.

Constraints in transfer of technology in fisheries

Low level of social, economic and educational status of clients: Fishermen/fish farmers belong to the lowest strata of the society. The socio-economic status plays an important role in adoption and propagation of advanced technology.

Lack of training facilities: At present, there is no regular training programmes organized for benefit of extension workers. Therefore, they are often not in a position to keep abreast of the latest technological advances.

Communication gap: Success stories of new technologies adopted in a particular locality are usually not sufficiently published so as to attract and motivate the others to adopt the same.

Lack of coordination between research organization, development authorities and industry: At present, there is no proper coordination between research organization, development authorities and processing industry. This needs considerable improvement for rapid transfer of technology from research stations to actual beneficiaries. This would certainly increase the production as well as gives better returns to fish farmers/ fishermen.

Lack of good quality and proper size of fish seed for stocking: In order to bring about a change in attitude, skill and knowledge of fishermen, we need dedicated extension work regarding production of quality seed, recommended stocking size and density of fish seed.

Suggestion for enhancement of biodiversity

(i) Productivity enhancement through intensification, (ii) increased area coverage under fish culture (horizontal expansion), (iii) strengthening of physical and financial infrastructure through institutional support, (iv) strengthening of cooperative sector, (v) development of markets and market information system, and (vi) diversification of aquaculture activities in the state.

REFERENCES

Alikunhi K H and Sukumaran K K (1964) Preliminary observations on Chinese carps in India. *Proc. Indian Acad. Sci.* **60B**, 171-188.

Alikunhi K H, Sukumaran K K and Parameswaran S (1963) Induced spawning of Chinese carps, *Ctenopharyngodon idellus* (C. & V.) and *Hypophthalichthys malitrix* (C. & V.), in ponds at Cuttack, India. *Curr. Sci.* **32**, 103-126.

Ayyappan S, Moza U, Gopalakrishnan A, Meenakumari B, Jena J K and Pandey A K (2011) *Handbook of Fisheries and Aquaculture.* 2nd edn. Indian Council of Agricultural Research, New Delhi.

Bijukumar A (2000) Exotic fishes and freshwater fish diversity. *Zoo's Print J.* **15**, 363-367.

Colwell R K (2009) Biodiversity: Concepts, Patterns, and Measurement. (copyright document). pp. 257-260.

Dwivedi A C, Tewari N P and Singh K R (2004) Present structure of capture and culture fishery of the Faizabad district (U.P.). *Bioved* **15**, 95-98.

Dwivedi A C, Tewari N P and Mayank P (2007) Biodiversity of fishes of Faizabad district (U.P.). *Flora & Fauna* **13**, 379-383.

FAO (2012) *The State of World Fisheries and Aquaculture*. 26-30. Fisheries and Aquaculture Department, Food and Agriculture Organization of the United Nations, Rome. (http://fisheries.up.nic.in)

Janaki Ram K and Pandey A K (2003) Status and prospects of aquaculture development with special reference to Uttar Pradesh. In: *Brain Storming Session on Production Status and Potential of Fisheries in U.P.: Constraints and Opportunities* (January 22, 2003), 24-38. Uttar Pradesh Council of Agricultural Research, Lucknow.

Jhingran A G (1989) Status of exotic fishes in capture fishery waters of India. In: *Exotic Aquatic Species in India* (ed. Joseph M. M.), 19-25. Asian Fisheries Society: Indian Branch, College of Fisheries, Mangalore.

Kumar J, Pandey A K, Dwivedi A C, Naik A S K, Mahesh V and Benakappa S (2013) Ichthyofaunal diversity of Faizabad district (Uttar Pradesh), India. *J. Exp. Zool. India* **16**, 149-154.

Kurup B M and Radhakrishnan K V (2008) Fish introduction in peninsular India with special refernce to Kerala. In: *Fish Introductions in India: Status, Challenges and Potentials* (eds. Lakra W S, Singh A K and Ayyappan S), 45-61. Narendra Pub. House, Delhi.

Lakra W S (2010) Fish biodiversity of Uttar Pradesh: issues of livelihood security, threats and conservation. In: *National Conference on Biodiversity, Development and Poverty Alleviation* (22th May, 2010), 40-45. Uttar Pradesh State Biodiversity Board, Lucknow.

Lakra W S and Singh A K (2007) Exotic fish introduction in Indian waters: past experience and lesion for future. *Fishing Chimes* **27** (1), 30-34.

Lakra W S and Pandey A K (2009) Fish germplasm resources of India with special emphasis on conservation and rehabilitation of threatened species. In: *Aquaculture Management* (eds: Goswami U C and Kumar D), 85-104. Narendra Pub. House, Delhi.

Lakra W S, Singh A K and Ayyappan S (2008) *Fish Introductions in India: Status, Challenges and Potentials*. Narendra Pub. House,

New Delhi.

Lakra W S, Kumar R S, Dubey V K, Sarkar U K, Pandey A and Gusain O P (2010) Fish diversity, habitat ecology and their conservation and management issues of a tropical river in Ganga basin, India. *Environmentalist* **30**, 306-319.

Mayank P, Arvind Kumar and Dwivedi A C (2011) Alien fish species *Oreochromis niloticus* (Linnaeus, 1757) as a powerful invader in the lower stretch of the Yamuna river. *Bioved* **22**, 65-71

Mishra A, Pandey A K, Singh A K and Das P (1998) Impact of introduction of exotic and genetically-manipulated fishes on freshwater Indian conventional stock. In: *Fish Genetics and Biodiversity Conservation* (eds. Ponniah A G, Das P and Verma, S R), 275-292. Nature Conservators, Muzaffarnagar.

Mishra A, Pandey A K, Singh A K and Raman R P (2000). Genetic threats to ichthyo-biodiversity including capture and culture stocks due to exotics and genetically-modified fishes. *J. Natcon*. **12**, 1-7.

Natarajan A V (1989) Ecological and aquaculture roles of exotic fishes in aquatic productivity in India: a risk-benefit analysis. In: *Exotic Aquatic Species in India* (ed. Mohan Joseph, M), 11-17. Asian Fisheries Society: Indian Branch, College of Fisheries, Mangalore.

Pandey A C (1997) Incidence and impact of capture of exotic carps in river Gomati near Gauhania village (District Sultanpur, Uttar Pradesh). *Indian J. Anim. Sci*. **67**, 637-638.

Pandey A C (1999) An annotated list of fish genetic resources of Faizabad District, U. P. *Indian J. Fish.* **46**, 95-100.

Pandey A K and Das P (2006) Current status of fish germplasm resources of India and strategies for conservation of endangered species. In: *Proceedings of Recent Advances in Applied Zoology* (eds. Singh H S, Chaubey A K and Bhardwaj S K), 1-39. Ch. Charan Singh University, Meerut.

Pathak R K, Gopesh A and Dwivedi A C (2011) Alien fish species, *Cyprinus carpio* var. *communis* (common carp) as a powerful invader in the Yamuna river at Allahabad, India. *Natl. Acad. Sci. Letter* **34**, 367-373.

Rahbek C and Colwell R.K (2011) Biodiversity: species loss revisited. *Nature* **573**, 288-289.

Singh A K and Mishra A (2001) Environmental issues of exotic fish culture in Uttar Pradesh. *J. Environ. Biol.* **22**, 205-208.

Singh A K and Jena J K (2012) *National Consultation on Alien Fish Species in Aquaculture and Aquarium Trade: Issues and Perspectives* (September 06-07, 2012), 1-24. National Bureau of Fish Genetic Resources, Lucknow.

Singh A K, Pathak A K and Lakra W S (2010) Invasion of an exotic fish, common carp, *Cyprinus carpio* L. (Actinopterygi: Cypriniformes: Cyprinidae) in the Ganga river, India and its impacts. *Acta Ichthyol. Piscat*. **40**, 11-19.

Srivastava G J (2002) *Fishes of U.P. & Bihar.* 9th edn. Vishwavidyalaya Prakashan, Varanasi (India).

Talwar P K and Jhingran A G (1991) *Inland Fishes of India and Adjacent Countries.* Vol. 1 & 2. Oxford & IBH Co. Pvt. Ltd, New Delhi.

Thakur N K (1998) A biological profile of African catfish (*Clarias gariepinus*) and impact of its introduction in Asia. In : *Fish Genetics and Biodiversity* Conservation (eds. Ponniah A G, Das P and Verma S R), 315-322. Nature Conservators, Muzaffarnagar.

Thakur N K (1999) "Thai-Magur "- the controversial catfish. *Fishing Chimes* **18** (11), 15-16.

Tripathi S D (1989) *Hypophthalmichthys molitrix* (Val.) and *Ctenopharynogodon idella* (Val.) - exotic elements in freshwater polyculture in India. In: *Exotic Aquatic Species in India* (ed. Joseph M M), 27-33. Asian Fisheries Society : Indian Branch, College of Fisheries, Mangalore.

Tripathi S D (2009) Should Indian aquaculture continue to depend on exotic species? - No. In: *Aquaculture Management* (eds. Goswami U C and Kumar D), 59-70. Narendra Publishing House, Delhi.

Winter B D and Hughes R M (1997) Biodiversity. *Fisheries* (Bethesda) **22** (1), 22-29.