Aquatic Biodiversity and Sustainable Eco-tourism: Opportunities, Impacts and Interventions

Radha Chaube[1]
and
Uttam K Sarkar[2]

[1]Department of Zoology, Institute of Science,
Banaras Hindu University,
Varanasi-221005

[2]ICAR-Central Inland Fisheries Research Institute,
Barrackpore, Kolkata -700120,
West Bengal, India

Introduction

Biodiversity, the variety of life on Earth, provides us with a wealth of natural resources that are extremely important for the tourism sector. Biodiversity underpins places of beauty that are so often popular tourist destinations, such as tropical forests, coast beaches and national parks, thus re-enforcing the notion that a healthy natural environment is one of the world's most important tourism attractions. Visiting nature also serves to heighten awareness of its intrinsic value for us all. Knowing and experiencing nature makes us happier, healthier and raises understanding of the importance of nature and biodiversity.

Ecosystems provide services essential to humanity, which in short can be described as supporting life, supplying materials and energy, and absorbing waste products (*Daily, 1997*). Species richness generally increases with decreasing latitude. Due to this biogeographical phenomenon, the overwhelming majority of species are located in developing countries (DCs) (*WCMC, 1992*). DCs often face problems like rapid population growth, workforce-pressure, lack of capital and foreign debts, which lead to over-exploitation of wild living resources, expansion of agriculture, forestry and aquaculture, and—with mounting pressure on the remaining habitats—to loss of biodiversity (*Burgess, 1993*; *Vorlaufer, 1996*). Today, human activities have contributed to an increase in species extinction, which has made the implementation of safeguarding strategies an imperative issue (*Ehrlich and Ehrlich, 1981*; *Wilson, 1985*; *Lawton and May, 1995*).

The tourism industry represents one of the main sectors in the global economy, often referred to as the world's largest single industry. Harnessing the

opportunities and dealing with the challenges of the largest ongoing migration of people in history is of utmost importance, and is particularly significant for developing countries.Ecotourism one of the fastest growing sectors of tourism worldwide, is fast gaining the attention of developed and developing countries as a potential means to conserve natural resources and support sustainable economic progress. Particularly in areas with stagnant economies, ecotourism is being looked to as a promising means to protect wildlife and ecosystems, to maintain rural aesthetic character, to provide economic alternatives to resource extraction activities, and to gain income for local communities.Ecotourism with an ecological conscience involves visiting fragile, pristine, and relatively untouched natural areas, with the intention to support conservation efforts. One observes the flora and fauna in their natural environment and cause as little impact as possible. It is often done on a small scale and is a great alternative to the mainstream commercial tourism.

Fisheries-related tourism is developing in several countries as a product that, by linkingfisheries to tourism, can be an answer both to the need to develop innovative tourism products andto the priority to find new sources of income for profitable and more sustainable fisheries.Uttar Pradesh is the fourth largest state in India with an approximate area of 2,40,928 sqkm. It is also the most populous state in the country with a population of 199.5 million (2011). Uttar Pradesh is one of the most favoured state for tourists in India with a consistent ranking amongst the top states in terms of tourist arrivals. In 2014 it was ranked 2nd in terms of total tourist arrivals, 2nd in terms of domestic tourist arrivals and 3rd in terms of foreign tourist arrivals amongst Indian states. The Tourism industry in Uttar Pradesh has a significant contribution to the state's economic growth. The contribution of tourism to employment generation both direct and indirect is of immense importance to the state.Tourism includes ecotourism which also includes fisheries; the meeting point could majorly make fishery an element of tourist attraction. Fishery is not concerned with capturing or culturing fish for human consumption only there are other areas of human satisfaction that could be aroused. However, there is scope to utilize the resources by linking ecotourism with aquatic biodiversity through systematic involving different stakeholders in a sustainable manner.

Elements involved in eco-tourismdevelopment

Ecotourism supposes carrying out the tourism activities in an environment with landscapes unaltered by pollution and at the same time reassuring. It represents a model of sustainable exploitation of the tourism resource, due to the minimizing of the negative effects on the environment.

The first elements involved in the ecotourism development, the respect for *the ecosystem integrity*, aims at emphasizing the importance of the environment in supporting tourism, maintaining the level of development at a small scale under the control and under the local management, using a specific local development, the compatibility of the development plan with the environment, using materials, know-how and local working force, using facilities and equipments which conserve the energy, practicing the recycling, capitalization and national use of resources, preserving vegetation, reducing the deforestations, using alternative, sustainable technologies.

Local participation, the second important element for developing ecotourism, aims at promoting the local participation as much as possible, creating opportunities for the host population, the transfer of property to the local community and its administration, creating opportunities for the group projects and local population as regards the control and administration of natural valuable resources, stipulating some alternative local measures, promoting the socio-cultural "pride" through the organization of programs by the local community, complying with the local ideology and inheritance, stipulating opportunities for the interaction between the local population and visitors. Regarding the third element involved in developing ecotourism, respectively *economic opportunities for the local community, they refer to*

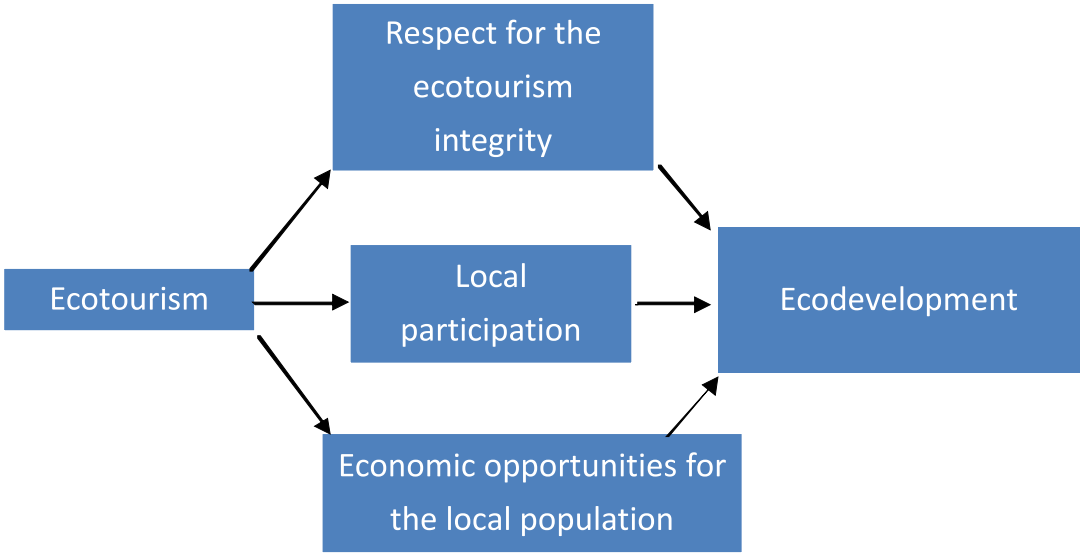

Fig. 1 : Emphasizes the elements involved in developing ecotourism.

coordinating all the elements with the purpose of optimizing the benefits of the local economy, creating jobs for the host population, guaranteeing and protecting the local population, including the communities' ideas in the political decisions, the equitable distribution of the economic benefits, recognizing the local efforts/services, using the local materials and working force to keep the money into the local economy, keeping a decentralized management etc.

Aquatic Resources and biodiversity

Characterizing biodiversity is a vital and basic step in order to assure its sustainable development and conservation. The Uttar Pradesh region harbours a spectacular diversity of freshwater fish species and ecosystems. However, human uses of the region's land and water pose enormous threat to this natural treasure. Uttar Pradesh located between 23°52'-31°28'N latitude and 77°04'-84°38'E longitude is one of the largest states in India.

Uttar Pradesh being a land locked state having vast freshwater resources in lentic ecosystems such as lakes, reservoirs, ponds and tanks. The freshwater aqua-culture resources in the country comprises 2.25 million hectares of ponds and tanks out of which Uttar Pradesh has 1,61,372 ha, 1.3 million ha of beels and derelict water, 2.09 million ha of lakhs and has 2,70,652 ha and 1.2 lakh km irrigational canal and channels. The state has 7,20,000 ha where rivers occupy 28500 km and a few lakh hectares of paddy fields, a portion of which is amenable to fish farming. In Uttar Pradesh sixty reservoirs, with an area of 1,18,103 ha, are distributed among 15 districts. The state has rich freshwater fish biodiversity contributes approximately 14.68% of the national fish biodiversity. According to a report as occurrence of 87 species from eastern part of U.P while 111 fish species have been recorded from U.P. and Bihar. In addition, some of the major tributaries of rivers in this state *viz.* Gomti, Ghaghara, Betwa, Ramganga, Ken and Gerua rivers also harbors a rich species spectrum of threatened, migratory and commercially important fishes with a wide distribution of species, families and genera (*Sarkar et al.*, 2010; *Lakra et al.*, 2010, *Sarkar et al.* 2013). In addition, the small indigenous fishes found in the vast inland water resources of this state, provide not only nutrition but also livelihood

Fig. 2 : The Katerniaghat wildlife sanctuary it is home to a number of endangered species including gharial, tiger, rhino, gangetic dolphin, swamp deer, hispid hare, bengalflorican, the white-backed and long-billed vultures.

opportunities and income to a large number of fishers. Many of the fishes under small indigenous groups also highly important for food and nutrition, and important source of various products of pharmaceutical and other commercial value and sustain other trades like ornamental fishes. Recent studies made in the some of the major tributaries of river Ganges basin in Northern India *viz.* Gomti, Ghaghara, Betwa and Gerua rivers revealed the presence of exceedingly rich species spectrum of threatened, migratory and commercially important fishes with a wide distribution of species, families and genera (*Sarkar et al.*, 2013,2012). A study based on protected areas of Uttar Pradesh it was documented that freshwaterprotected areas commonly result in increasedfish abundances for those threatened fisheswhich are extremely important for biodiversity conservation and management. The study also indicated that these areas, withinwildlife sanctuaries, can be used as freshwateraquatic sanctuary (FAS), if additional measuresare taken to protect these aquatic resourcesagainst actual threats (*Sarkar et al.*, 2012).Several studies on the habitat attributes have been carried out (*Sarkar and Bain*, 2007); *Dubey et al.*, 2012).

Inland Fisheries

Inland fisheries provide food for billions and livelihood for millions of people worldwide (FAO 2014b). The relative contribution of inland fisheries to a country's food and economic security is dependent on its level of economic development and social context and, often, this is higher in the developing world and emerging economies. Inland fisheries have a proportionally higher influence on livelihoods than marine fisheries, particularly in Asia and Africa (FAO and World Fish Center 2008; FAO 2014b). Inland fisheries contribute significantly to food security and economic security by providing primary sources of animal protein, essential nutrients, and income (*Welcomme et al.*, 2010). Inland fishes provide protein, omega-3 fatty acids, vitamin D, calcium, B vitamins, vitamin A, iron, zinc, and lysine to those where other nutritional sources are not available or

are cost-prohibitive (*Thilsted et al.*, 1997; *Roos et al.*, 2007; *Youn et al.*, 2014). Particularly in the developing world, small fish provides an important source of nutrients that are difficult to obtain through other dietary sources (*Roos et al.*, 2007).Inland fisheries resources support the livelihood of large number of fishers mainly through capture based fisheries; though culture based fisheries also contribute a good percentage of their income in many areas. Aquaculture is a section in eco-tourism that could be of great advantages if given the necessary attention. This sector has long been neglected probably due to lack of awareness of its large potentials which if wedged together with tourism their prospects are far enriching. There are great potential in developing ornamental fishery business as tourist destination, the public will understand and accept this type of tourist attraction which both excursionists and tourist can visit. It can also be used as a breeder for selling of different ornamental fishes which is very important in the world economy.Apart from this kind of income generation, inland fisheries resources can be used for revenue generation following some of the below mentioned ways:

Recreational fishing

Recreational fishing and tourist activities, in particular, have strong economic multiplying effects for the experiential activities in addition to the market value of the fish. Recreational fisheries are a large sector of inland fish services. In industrialized countries, the economic value of recreational fisheries exceeds subsistence and commercial fisheries in inland waters (FAO, 2010a). Recreational fisheries represent the dominant fisheries sector in terms of participation targeting wild freshwater fishes, particularly in industrialized nations (*Arlinghaus et al.*, 2002). In some developing countries and emerging economies, there is also a growing interest in recreational fisheries (e.g. Argentina, Brazil, China and India) (*FAO, 2010, 2012*). The socio-economic benefits of recreational fisheries are numerous and substantial (*Arlinghaus et al.*, 2002; *Parkkila et al.*, 2010). Recreational fishing in fresh waters has a long tradition and is now enjoyed by millions of people worldwide. It is defined as: "Fisheries conducted by individuals primarily for sport but with a possible secondary objective of capturing fish for domestic consumption but not for onward sale."

Potential fish species

In India, recreational fishing is pretty popular and number of species (popularly known as game fishes) which are having popularity for this purpose. About four dozens of game fishes, some small-sized and others rather large, have been identified from Indian waters. Several fish species have great potential as sport fish for their interesting characteristics of catching bait or fly and give a fight for it for developing recreational ecotourism are like *Chitala-chitala, Riamas bola, Tor chillinoides, Tor tor, Tor putitora, Tor khudree, Schizothoraxprogastus, S. richardsoniiS.esocinus, S.planifrons, Bagarius-bagarius, Catlacatla, Labeocalbasu, Labeorohita, Cirrhinusmrigala, Wallago attu, Clupisomagarua, Siloniasilondia, Pangasiuspangasius, Eutropiich-thysvacha* etc. (Sehgal, 1987). Recreational fishing of wild or stocked species can be used to generate revenue and can be used to support the livelihood of the local people. India earns considerable foreign exchange through tourism including fishing. Mahseer fishing is very popular among the foreign tourists and earlier it has been tried by Government to attract more foreigners for mahseer fishing. Several angling competitions have also been organized in some states to promote recreational fishing (*Sehgal, 1987*).

Linking Ornamental fishes and tourism

The ornamental fish industry is considered as a sleeping giant in India. Ornamental fisheries sector is overwhelmed with aesthetic appeal and the development of recreational and ornamental fishery sector will boost the development of ecotourism project in the potential aquatic areas. Ornamental fish industries are concerned with production and marketing of live attractive or fancy fishes for the sole purpose of beautification of homes and public places. Ornamental fishery in reality of it is fun driven, games

Fig. 3: Gangetic dolphin

taking, andcan be used as key attraction elements of tourism. As many people make fishing an occupation a lot of people engage in fishing as a leisure and recreational activities so, if fishing and tourism develop along that line it would be of great value. Obviously, ornamental fishes are in themselves attractive attraction basically on their unique sizes, colorations and sportish character among others.There is need to strengthen ornamental fishery business as tourist destination.

Present status of fish based recreation

Though sport fishing and aqua tourism is well-articulated industry on the West, it does not have the same progress in India despite ample resources stretching all along the Himalayan belt from Kashmir to Arunachal Pradesh. Except for Himachal Pradesh and Kashmir Valley where the sport fisheries is a bit well-organized, it is not so in other States and needs adequate attention for sustainable development. Therefore, there is a need for proper guidance with regard to the species potential, sizes, fishing sites, approachability, and the seasonality to fish for a particular species, infrastructure facilities of transport and accommodation, etc.While on the one hand, it is necessary to built up the populations of the sport fishes like the mahseers, goonch and trout in different streams/rivers/lakes or even tanks and reservoirs, it is equally imperative to manage the recourse scientifically. Though the law exist but the implementation is largely poor.There is good scope to develop certain lakes, small reservoirs and the like for the purpose would may draw foreign tourist as large-sized rohu, catla and some catfishes are good fighters though some may not reckon them as attractive fighter as the mahseer and goonch. Infrastructure like creation of hatcheries and the rearing of fingerling for ranching and stocking the waters deserve utmost priority

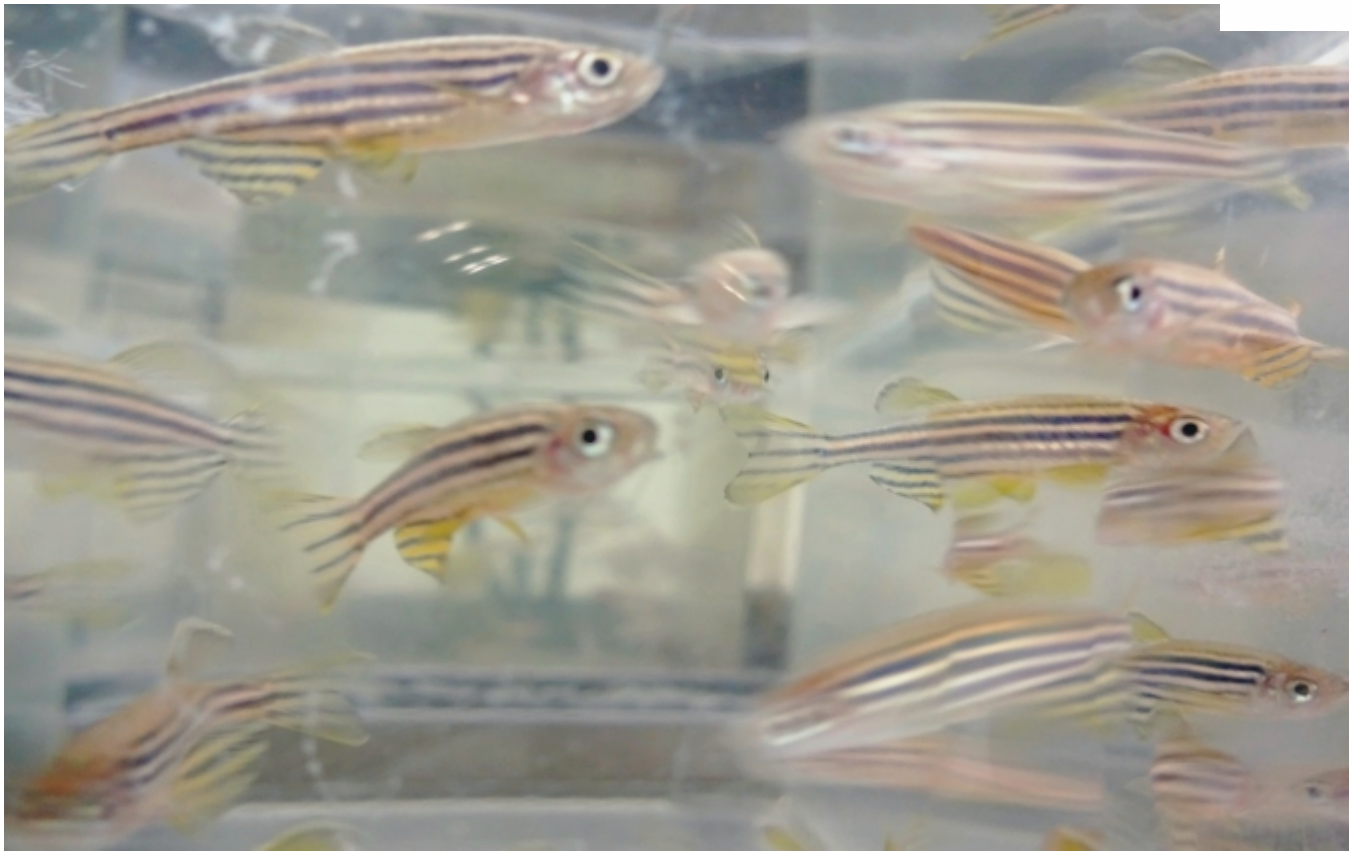

Fig. 4: Zebrafish in aquarium

Aquarium hub

At present ornamental fishes are the most popular pet throughout the world and is the centre of attraction for all age groups. The ornamental fish industry is also largely driven by inland fish species. Over 90% of home aquarium fish trade is represented by freshwater species. Beyond economic value, the fish seen inside an aquarium's glass provides an opportunity for people to engage with the natural world. For example, aquarium visits have been shown to have a lasting impact on conservation knowledge and interest of visitors (Adelman et al., 2000). A small levy as the entry fee can be a way out for income generation for the local people there if the aquarium hub will be set up near the tourist spots.Feeding fish is a noble hobby and if inland water bodies near the tourist spots will be stocked with ornamental fish varieties like koi carp people will be attracted and this will ensure further revenue generation.

Demonstration of culture methodologies

Small scale tourism infrastructure can be made in the inland water bodies near the tourist spots to demonstrate the culture methodologies to them. This will attract the students as well as the tourists to visit and will support further revenue generation through entry fee.

Snorkeling

Snorkeling is the practice of swimming on or through a body of water while equipped with a diving mask, a shaped breathing tube called a snorkel and usually with swim-fins. This hobby is quite popular all through the world. In India, places like Andaman and Nicobar Islands, Lakshadweep Island, several islands of Goa are popular destinations for tourists for snorkeling and this is also a way of income generation for many of the local people.

Featherback(Chital)*: Chitalachitala*

Mahseer: ***Tor tor***

Golden mahseer: *Tor putitora*

Goonch:*Bagariusbagarius*

Padhani (Parhin): ***Wallago attu***

Angling of Sport fishes

Sport fishing has conventions, rules, licensing restrictions and laws that prohibit the use of nets. The practice of catching the fish with a hook, known as angling, requires that the fish should be returned to the water – catch and release. Angling is one of the most thrilling sports for the angler and provides employment opportunities to a large number of people. It is a method for fishing by means of an angle(hook). The rod, the line and hook are used for angling. The hook is usually attached by a line to a fishing rod. A bite indicator such as a float is sometimes used. The hook can be dressed with lures or bait. The most enjoyable season for fishing is spring. It is considered to be one of the components of ecotourism as it minimizes the conflict between resources of tourism and livelihood of the local inhabitants.

Conclusion

Aquatic biodiversity serves potential for sustainable tourism. It can have positive impact on ecotourism. The economic potential of ecotourism has remained largely unrealized in different parts of UP so far. Thus, successful strategies to limit tourist numbers, information and education to both visitors and local, management and control of the area efficiently requires strict intervention for development and care of sustainable biodiversity tourism.

References

Burgess, J.C., 1993. Timber production, timber trade and tropical deforestation. Ambio 22 (2–3), 136–143.

Daily, G.C. (Ed.), 1997. Nature's Services. Societal Dependence on Natural Ecosystems. Island Press, Washington, DC

Ehrlich, P., Ehrlich, A., 1981. Extinction. Ballantine Books, New York.

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

Lawton, J.H., May, R.M. (Eds.), 1995. Extinction Rates. Oxford University Press, New York

Sarkar, U.K. & M.B. Bain. 2007. Priority habitats for theconservation of large river fish in the Ganges riverbasin. Aquatic Conserv: Mar. Freshw. Ecosyst. 17:349- 359.

Sarkar, U.K., A.K. Pathak & W.S. Lakra. 2008. Conservationof freshwater fish resources of India: Newapproaches, assessment and challenges. Biodivers.Conserv. 17: 2495-2511.

Sarkar, U.K., B.K. Gupta & W.S. Lakra. 2010. Biodiversity, ecohydrology, threat status and conservation priorityof freshwater fishes of River Gomti, a tributaryof River Ganga (India). Environmentalist 30: 3-17.

Sarkar, U.K., D. Kapoor, S.K. Paul, A.K. Pathak, V.S.Basheer, P.K. Deepak, S.K. Srivastava & L.K. Tyagi.2007. Fish biodiversity in the water bodies of Samaspurbird sanctuary, Uttar Pradesh: Towards developinga freshwater aquatic sanctuary. J. Bombay Nat.Hist. Soc. 104: 51-54.

Vorlaufer, K., 1996. Tourismus in Entwicklungsla¨nder. WissenschaftlicheBuchgesellschaft, Darmstadt, Germany

Wilson, E.O., 1985. The biological diversity crisis. BioScience 35, 700–706.


SUSTAINABLE DEVELOPMENT GOALS
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS
SUSTAINABLE DEVELOPMENT GOALS