INTERNATIONAL JOURNAL OF SCIENCE AND NATURE

www.scienceandnature.org

DIMINISHING FISHERY OF REBA CARP *CIRRHINUS REBA* (HAMILTON, 1822) IN LOWER ANICUT, TAMIL NADU WITH REFERENCE TO NEEDFUL CONSERVATIONAL MEASURES

Mathialagan, R., *Sivakumar, R., Chandrasekar, S., Rajasekaran, N., & Suresh, K.
P.G. and Research Dept. of Zoology, Government Arts College (Autonomous)
Kumbakonam-612 001, (Affiliated to Bharathidasan University, Thiruchirappalli), Tamil Nadu, India.
*Corresponding Author: Tel.: +91 94433 32332; Fax: 0435-2442977; E-mail: sivaera@gmail.com

ABSTRACT
Lower Anicut is one of the major fishing points in the Cauvery river system in Tamil Nadu which is selected for the present study. The total catchment area of this reservoir is 29,693 square miles (sqm^2) and has the capacity to storage 150.13 MCFT of water. It is the major landing centre for fish fauna and varieties of fin and shell fishes, where the Tamil Nadu State Fisheries Department has the sole authority for the landing and sale point throughout the year. Among this, Cyprinidae represented were a dominant fishery resource in Lower Anicut. Besides, the Reba carp *Cirrhinus reba* is a major fin fish resource of this region. *C. reba* fishery is declining because the catching survey is most important one on the basis of the annual catch composition of this species before past twelve years is crossed about nearly 71.7 (t) tonnes. The annual catch was compared with the earlier periods of the study area and recorded the data shows that the diminishing stage of the reba carp resources. Hence, the present attempt has been made to gather the information about the causes of declining the *C. reba* resource in Lower Anicut was need conservational measures.

KEY WORDS: Diminishing fishery, *Cirrhinus reba*, Craft and gears, Annual catch composition, Conservation activity.

INTRODUCTION

Fishes have a great significance in the life of mankind, being an important natural source of protein and providing certain other useful aspects for socio economic status of fisher folk as well as economic sustenance to many nations. In gradual erosion of commercial fish stocks due to overexploitation and alteration of the habitat is a major reason. It has a richest diversity among vertebrates, concerning 25% of recorded species on global platform. Fisheries are one of the most important sources of revenue to economy of a country and as an important food sector in human nutrition (Dwivedi *et al.*, 2009). At present, people to make use of this sector through commercial fishing, aquaculture and recreation (Alp and Balik, 2000). Now-a-days fish assemblage structure and function are also linked with geographic dissimilarity (VanSickle and Hughes, 2000). However, absolute contribution of riverine fisheries may not be huge in economic terms; it is a very crucial component in livelihood and nutritional security of the rural fisherfolk. Fish populations of India represent 11.72% of species, 23.96% of genera, 57% of families and 80% of the global fishes. Like, Cyprinidae is the most diverse and dynamic largest family of freshwater fishes in world (Nelson, 1994), have long been introduced beyond their native ranges, a practice that continues today. Concerning 2,070 species of carps (Family: Cyprinidae) are available in Indian waters. In India is regarded as a 'carp country' due to its rich diversity of carps in freshwater ecosystems as well as backbone of the Indian freshwater aquaculture, comprising around 85% of the total freshwater fish production. Now-a-day's it is cultured especially in Bangladesh, Pakistan, Nepal, Burma and Thailand (Day, 1873; Jayaram, 1981 and Kapoor *et al.*, 2002). Furthermore, Lower Anicut (Coleroon) is one of the rich indigenous fishery of the main tributaries of Cauvery river along with estimated catchment area of fish are 29.693 square miles. Fish diversity of Cauvery River (Lower Anicut) has been reported (Jayaram *et al.*, 1982 and Balasundaram *et al.*, 1999) is a major species of this reservoir such as *Cirrhinus cirrhosus, Labeo kontius, L. fimbriatus, C. reba, C. mrigala, Puntius sophore, P. sarana, P. carnaticus, P. conchonius* (Cyprinidae) *Mystus oar, M.gulio, M.bleekeri, M.vittatus, M,cavasius, M.dibrugarensis,* (Bagridae) *Pseudeutropius atherinoides* (Schilbeidae) *Etroplus suratensis E.maculatus* and *Oreochromis mossambicus* (Cichlidae). Among the fishery, Cyprinids is a major part of fish and *Cirrhinus* is a major genus was represented in this reservoir. Three of them, the mrigala carp *C. cirrhosus, C. mrigala* (Hamilton, 1822) and reba carp *C.reba* (Hamilton, 1822) are there in the Lower Anicut, Tamil Nadu. Moreover, *C.reba* is a most important leading fish resource (year around) of Lower Anicut show the relative catch composition of virtually in tonnes. Currently, the *Cirrhinus* (Cuvier, 1817) is an important genus comprised of eleven species in widely distributed, containing several cultivable and economically value species. Two of them, the mrigala carp *Cirrhinus mrigala* (Hamilton, 1822) and reba carp *Cirrhinus reba* (Hamilton, 1822) are there in the Lower Anicut, Tamil Nadu. One of the most important indigenous minor carp *C. reba* is locally known as 'arainjan podi or kendai' (Lower Anicut region) in Tamil and Reba Carp in English. Moreover, 15-20 varieties of minor and medium carps that has a high potential for freshwater aquaculture, which is yet to be exploited in India. Many of these species is under decline, with some

falling under threatened or endangered. Moreover, estimates from the number of freshwater fishes that will become extinct within the next 20-30 years run as high as 300 species (Stiassny, 1998). In this context, decline of the fish faunas in riverine environment is one of the largest documented losses of biodiversity in an ecosystem. Diminishing of this species in river was attributed to overexploitation may include over fishing and over harvesting. Besides, health of riverine fishing grounds are losing and collapsing rapidly. This is indeed worrisome and needs to be ameliorated. At present, *C .reba* is considered as 'vulnerable in natural waters' due to be decline in its abundance of biomass, extent of occurrence, area of occupancy and habitat. Exact population trends and threats of *C. reba* are not known. Furthermore, research is very essential on the population status, stocks, harvest trends and threats to *C. reba.* Since, commercial aquaculture of this species is most possible (Sarkar *et al.*, 2004. Nevertheless, wild population stocks could also decline due to heavily harvested. Hitherto, no quantitative data are available. In this connection, captive breeding programs have become one of the principal tools used in attempts to compensate for declining fish populations and simultaneously to supplement and enhance yields for fisheries in India. However, Long-term conservation will only be successful if the causes of its decline in its wild populations are identified and remedied (Sarkar *et al.*, 2004). Declining the *C. reba* population not merely in India is also to diminish the Bangladesh and Pakistan. During last fourteen years *C. reba* population has declined considerably due to increased fishing pressure and various anthropogenic activities like, leading to siltation, over fishing, water withdrawal, aquatic pollution (toxic pesticides, fertilizers and manures) introduction of exotic or non-native species, indiscriminate killing of supplemental fingerlings and use of different types of destructive fishing methods including fish aggregation device (FAD) and loss of natural habitat for spawning and growth has led to significant declines in its population (Ahmed and Hambrey, 1999; Hussain and Mazid, 2001). With the importance, the present attempt is made to indicate provides an insight aspect of conservation status and management of native fresh water fishes in the rivers in addition to discuss anthropogenic impacts on them.

MATERIALS & METHODS

Study area

Lower Anicut (Kollidam river) is one of the major freshwater fishery resources available, where in the northern region of Tamil Nadu (11° 15' N latitude and 79° 30' E longitude) which is selected for the present study (Figure 1). The river flows from west to east forming the northern boundary of this block. The total catchment area of this reservoir is 29,693 square miles (sqm^2) and capacity to store 150.13 MCFT of water to use agricultural irrigation and fishing activities (Pazhanisamy and Ebanesar, 2008). It is a main commercial landing centre for fish fauna where the Tamil Nadu State Fisheries Department (TNSFD) has the sole authority for landing and marketing of fishes throughout the year. Among the varied fish fauna landed, the Cyprinidae represented is one of the dominant fishery of this region.

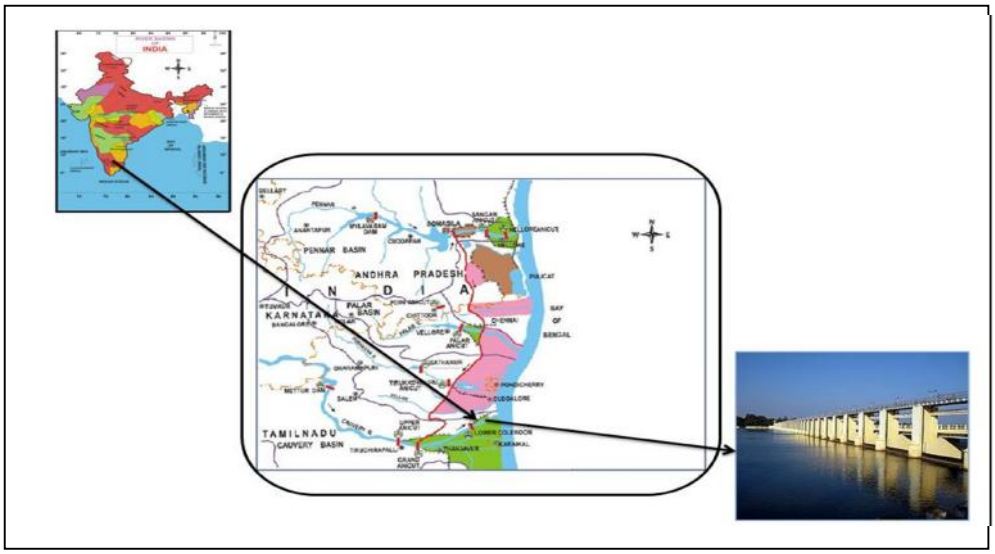

FIGURE 1. Map showing the geographical location of Kollidam (Coleroon) river, Lower Anicut, Tamil Nadu

Crafts and Gears

Fishermen were used coracle as a major craft for fishing. In addition, they are using four wheelers rubber tubes and thermocole raft teppam as craft. Generally, cast net, gill net, scoop net and hooks and lines are used for fishing activities in this region. This net could be operated either from the bank of the river or by employing in the craft.

Catch composition

Cirrhinus reba is a major fin fish resource in Lower Anicut reservoir shows the relative catch composition of nearly tonnes per annum. Catching *C. reba* in year around and weighed in (kg) kilo gram and calculate the catch composition nearly in tonnes. The total annual catch composition of this species was constituted from 2000 to 2012. The catch was calculated from cast net to hooks and line. Finally, the total catches were measured nearly in tonnes. Statistical analysis were performed by MS excel ver. 7.

RESULTS & DISCUSSION

CRAFTS

Coracle

Coracle is a saucer shaped country craft, locally called 'thoni' is one of the major fishing craft used for catching fishes in Lower Anicut. It's prepared by wrapping HDPP sheet over the split bamboo frame with the help of coal tar as an external covering (Fig. 2). Internal diameter varied ranging from 2 to 3 m width and inner depth around nearly 0.5 m. Apart from being simple and inexpensive, coracle is durable and has very good maneuverability in all types of waters. It is also a versatile craft used for laying and lifting of nets, besides navigation and transport of fish and other materials. This modified version of coracle is cheaper and more durable as the conventional one is made for costly leather.

FIGURE 2. Coracle, as a major fishing craft

FIGURE 3. Thermocole raft teppam as a craft

Thermocole raft teppam

In lower and upper stretches, especially near confluence of Kollidam River at Lower Anicut, the fishermen were observed to use an improvised craft made up of thermocole for net operation. Slices of thermocoles were tied with nylon rope to make a bundle of length 0.4-0.5 m with a diameter of 0.2-0.3 m. Two such bundles were tied with rope on which fishermen used to sit and go for fishing activities (Fig. 3).

Four wheeler rubber tube platform

In the river Kollidam, the fishermen were observed to rely on another kind of improvised materials. It showed considerable ingenuity in fabricating makeshift crafts out of discarded old rubber tubes. A wooden platform (~1 sq m in area) is placed over the rubber tube and tied tightly with nylon rope. It is mostly used for hook and line operation and also setting and hauling of gill nets (Fig. 4).

FIGURE 4. Four wheeler rubber tube platform–as a craft

FIGURE 5. Cast net–a major fishing gear in Lower Anicut

GEARS

Cast net

Cast nets, also called 'throw net' (in tamil veechu valai) are used as a major gear in Lower Anicut. It is a circular net with small weights distributed around its edge. Cast nets are falling gear, conical in shape with lead sunken or weights attached at regular intervals on the lead rope forming the circumference of the cone (Fig. 5). It is made up of either cotton or nylon thread. Cast or thrown by hand in such a manner that it spreads out on the water and sinks. This technique is called net casting or net throwing. Fish are caught as the net is hauled in back. Contemporary the cast nets have a radius which ranges from 4 to 12 feet (1.2 to 3.6 m.). Only strong people can lift the larger nets once they are filled with fish. Weights are usually distributed around the edge at about one pound per foot (1.5 kg/m.). Attached to the net is a landline, one end of which is held in the hand as the net is thrown. The nets are usually cast at random in depths of up to four meters. Fishermen allows the net to sink to the bottom and

entangles the fish, after which the net is retrieved with the aid of a line while the leads/sinkers close together thus capturing the fish.

Gill net

Gill net is a common fishing net used by commercial and artisanal fishermen of all the freshwater and estuary areas. It is a vertical panel of netting normally set in a straight line. Fishes may be caught by gill nets in 3 ways: (1) wedged – held by the mesh around the body (2) gilled – held by mesh slipping behind the opercula, or (3) tangled – held by teeth, spines, maxillaries, or other protrusions without the body penetrating of the mesh (Fig. 6). Gill nets of varying mesh sizes are used to catch different species of fish. Mesh size, twine strength, as well as net length and depth are all closely regulated to reduce by-catch of non-target species. In commercial fisheries, the meshes of gillnet are uniform in size and shape. Fishes are smaller than mesh sizes the net pass through unhindered, while those too large to push their heads through the meshes as far as their gills are not retained.

FIGURE 6. Gill net–main fishing gear at Lower Anicut

FIGURE 7. Scoop net with long handle (operating by a fisherman)

Scoop net

The circular scoop net (with long handle) is used by a single fisherman. It has been observed fishing in freshwater fish-landing centre at Lower Anicut (Fig. 7). Type of nets used a handle with the length of ~1.5 m and diameter ~0.3 m. Fishes are being attracted with light at night and then caught by lifting the net. In shallow waters (0.5-1.0 m), fishes are visible from surface and so easily caught with the help of this net. It is also observed that in some places in upper stretches, *e.g.* above 2.0 km back side of Lower Anciut.

Hooks and lines

Hooks and lines were observed to be used throughout the entire stretch of river Kollidam (Fig. 8). This type of fishing technique is used as a deep pool of 6-8 m, in and around the river and also mainly used for stillwater nature (higher water level and less flow). Using earthworm as live bait and snail-flesh as dead bait, this net is also used to collect small sized fingerlings of all type of fish species from the river.

FIGURE 8. Hooks and lines

Annual catch composition

During the period 2000-01 the total catch of *C.reba* contribute nearly 7.7 tonnes (t) in the landing centre at Lower Anicut, Tamil Nadu. It was decreased gradually upto 2001-02 the total catch was recorded 7.5 t. Whereas, in the year of 2002-03, 2003-04, 2004-05 it came down suddenly reduced upto 6.2 t. The trend was indicated that when the total catch of this species composition as reflected by the various unlawful fishing activities. Similarly the results focused during 2005-06 and 2006-07 the annual catch composition (6.2 and 6.1 t.) did not vary largely. Moreover, in the year of 2007-08 and 2011-12 the composition of annual catch 5.7 to 3.7 tonnes to reduce gradually (Fig. 9). Declining the fishery is a baseline data

on the status of catch composition and distribution of the freshwater fishes has been a significant impediment to their adequate consideration within development and conservation-planning processes (Darwall *et al.*, 2011).

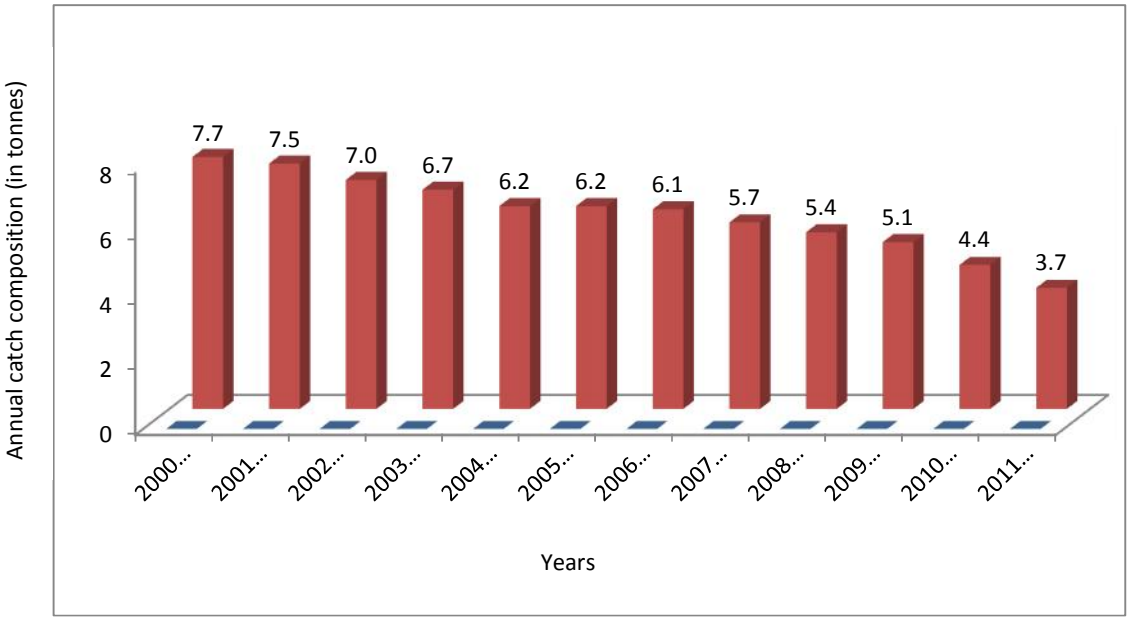

FIGURE 9. Annual catch composition of *Cirrhinus reba* during 2000-2012 in Lower Anicut, Tamil Nadu

However, the detailed accounts of the changes annual catching fish populations were recorded by Sreenivasan (1966, 1979), Ranganathan and Natarajan (1978) in the Cauvery waters, Lower Anicut. No more recent works have been carried out in the study area with compared to the present findings. In this context, among the indigenous species, *Barbus dubilus* and *Cirrhinus cirrhosa* were the major species while *Labeo fimbriatus* and *L. kontius* were the minor ones in the earlier years. Now-a-days the species *Cirrhinus reba* (Fig. 10) to be considered as a minor one. Like, the *B.dubius* accounted for 28% of the annual catch during 1943-44 but almost disappeared subsequently. *C.cirrhosa* constituted 55% in 1953-54 and considerably less at 16.42% in 1969-70. Subsequently it was less than 5% except in the year of 1984-85 and 1985-86, when it was 14.4% and gradually reduced to 7.3%, respectively. Among the major catfishes, *Mystus aor* and *Wallago attu* increased after the construction of dam and together constituted not less than 35% of the total annual catch in most of the years; thereafter in the year of 1964-65 onwards to 1992-93 it was decreased to less than 10% of total catch. In India, the National Bureau of Fish Genetic Resources from Lucknow and Zoo Outreach Organization has recently evaluated of the 329 fresh water fish species for the purpose of catch composition, taxonomical distribution and identification. Despite the rich biodiversity some of freshwater fish species are even endangered due to various anthropogenic factors (Cairns *et al.*, 1993).

FIGURE 10. *Cirrhinus reba* (Hamilton, 1822)

But, now days the reba carp fishery is a major part of the fish population in Lower Anicut reservoir. The above fishery was compared to the earlier annual catch concentration to derive the results by way of the fishery resource to be gradually diminished. Consequently, the reasons for diminished fish population of this fishery can be attributed to indiscriminate with illegal bulk catching during monsoon for breeding. In summer months most of the fishes are kept to confirm below the dam in the major river pools. Killing with passive gears followed by dynamiting neither done nor stable for lucrative markets are available, during last year's. Despite the removal of these constraints, the annual fish catches declined in last decade otherwise the human factors, populist policies and large scale poaching for the probable causes for diminished in the fishery. Fishing gears were combines to

captive breeding management of the threatened freshwater fishes in the field work to help improve the conservation status of those species in the wild, where most possible (Penning *et al.,* 2009). Not only for the above mentioned reasons and also much attention has been given to the potential effects of climate change. By the way of the species distributions are expected to shift towards the poles or higher in altitude in order to track suitable temperatures (Parmesan, 2006) especially those lacks of the inherent behavioural characteristics to disperse the fish population (Strayer and Dudgeon, 2010). Now-a-days growing global human population, there is an ever-increasing need to extract water for agriculture, industrial and domestic uses. 'Over the past century, freshwater abstraction for human use has increased at more than double the rate of population growth' and currently about 3.8 trillion m^3 per annum (IMechE, 2013). Moreover, the problems caused by the associated construction of dams and increased channelization include less-predictable flows and increasing towards spread of invasive species. It is a huge challenge to increase the sustainability of human water-use practices to ensure that enough water is left to support natural ecosystems to prevent decline the fish populations. During the course of this survey measure of the conservation point of view to diminishing the carp species are going to endangered and some are vulnerable to extinction. To conserve these valued carp, it is important to ensure the regulation of mesh size to prevent the catching of brooders and young ones during breeding and larval rearing stages. Besides, the artificial recruitment has been made to revive the carp in the areas where these fishes are less available and catch is declining. Finally the conservation of gametes through gene banking is important for adopting the future strategies of replenishment and stock to enhancement of these valued carp species (Mohanta *et al.,* 2008).

RECOMMENDATIONS

On the basis of some recommendations to necessary actions to be initiated and maintain the minimum water flow otherwise known as environmental flow, to sustain the ecological functions at a healthy status. Lacks of this flow are adversely affects to loading the nutrients and also distribution to recruitment of fish species. Furthermore, continuous stream of water unfavorably affects the migration and breeding of the fishes. Urgent action is needed for the treatment of domestic sewage and industrial effluents, especially from the districts of Thiruppur, Erode and Salem. This would help to the restoration of these two stretches (North and South), which are prevent the polluted sections of the river. Another area is requiring attention for water recharge. In this context, it would be necessary to find ways to recharge the river with rain water and seepage from the surrounding area by channelizing the excess of water into the river. Despite the major interest of the health of the river and fishery resources, to maintaining continuous flow almost throughout the year becomes main mandatory.

ACKNOWLEDGEMENT

I am very much grateful to Dr.V.Ramaiyan, Former Director of CAS in Marine Biology, Annamalai University, for helping me some scientific thoughts in this field of fisheries with extensive suggestions during my research tenure. One of the author Dr.R.Mathialagan express his thanks to UGC – RGNF New Delhi – 110 058, for providing the financial assistance to the present research. I thank to the Tamil Nadu Fisheries Department, Lower Anicut, Thanjavur District, Tamil Nadu to providing the source of annual catch data.

REFERENCES

Ahmed, K.K. (1999) Options for the Management of Major Carp Fishery in the Kaptai Res- ervoir, Bangladesh. Ph.D. dissertation, School of Environment, Resources and Development, Asian Institute of Technology, Bangkok, Thailand.

Alp, A. and S. Balik (2000) Growth conditions and stock analysis of the carp (*Cyprinus carpio*, Linnaeus, 1758) population in Golhisar Lake. *Turk. J. J. Zool.*, **24**. 291-304.

Balasundaram, C., A. Deepa and P. Mariappan (1999) Fish diversity in Grand Anicut, River Cauvery (Tiruchirappalli, Tamil Nadu). *Zoos' Print Journal* **14**, 87-88.

Cairns, J., P.V. McCormic and B.R. Niedertener (1993) A proposed framework for developing indicators of ecosystem health. *Hydrobiogia.* **163**. 1-44.

Darwall, W.R. T., Smith, K. G., Allen, D. J., Holland, R. A., Harrison, I. J. and Brooks, E. G. E. (2011) (Eds.), The diversity of life in African freshwaters: under water, under threat. *An analysis of the status and distribution of freshwater species throughout mainland Africa*. Cambridge, UK, and Gland, Switzerland, IUCN.

Day, F. (1873) Report on fresh water fish and fisheries of India and Burma. Calcutta.

Dwivedi, Amitabh Chandra, P., S. Mayank Masud and S. Khan. (2009) An investigation of the population status and age pyramid of *Cyprinus carpio var*. communis from the Yamuna river at Allahabad. *The Asian J. Ani. Sci.,* **4**. 98-101.

Hamilton, F. (1822) An account of the fishes found in the river Ganges and its branches, Edinburgh & London.

Hussain, M. G. and M. A., Mazid (2001) Genetic improvement and conservation of carp species in Bangladesh. Mymensingh, Bangladesh: BFRI and Penang, Malaysia: *ICLARM*, pp. 74.

Imeche, (2013) Global food: waste not, want not. London: Institution of Mechanical Engineers. Available at http://www.imeche.org/knowledge/themes/environment/global-food. (on disk).

Jayaram, K. C. (1981) The freshwater fishes of India, Pakistan, Bangladesh, Burma and Sri Lanka. Zool. Surv. India, Calcutta.

Jayaram, K. C., Venkateshwaralu, T. and Ragunathan, M.B. (1982) A survey of the Cauvery River system with a major account of its fauna. *Records of the Zoological Survey of India*, Occassional Paper No. 36, pp. 115.

Kapoor, D., Dayal, R. and Ponniah, A. G. (2002) Fish biodiversity of India. National Bureau of Fish Genetic Resources Lucknow, India.

Mohanta, K. N. Subramanian, S. Komarpant, N. and Saurabh. S. 2008. Alternate carp species for diversification in freshwater aquaculture in India. *Aquaculture Asia Magazine*. p.11-15.

Nelson, J. S. (1994) Fishes of the world (3rd edition). John Wiley & Sons, New York.

Parmesan, C. (2006) Ecological and evolutionary responses to recent climate change. Annual Review of Ecology, *Evolution and Systematics*. **37**. 637–669.

Pazhanisamy, S. and J. Ebanasar (2008) Studies on mathematic prediction models on the physical characteristics of Lower Anicut reservoir Thanjavur district, Tamil Nadu. *Journal of Basic and Applied Biology*. **2**. 14-18.

Penning, M., Reid, G., McG., Koldewey, H., Dick, G., Andrews, B., Arai, K., Garratt, P., Gendron, S., Lange, J., Tanner, K., Tonge, S., Van den sande, P., Warmolts, D. and Gibson, C. (2009) (Eds.), Turning the tide: *a global aquarium strategy for conservation and sustainability*. Bern, Switzerland: World Association of Zoos and Aquariums.

Ranganathan V and V Natarajan 1978. Fisheries of Mettur Reservoir. In *Proc. Seminar on ecology and fisheries of freshwater reservoirs*. ICAR/CFTRI, Barrackpore. pp. 305-388.

Sarkar UK, Negi RS, Deepak PK, Singh SP, Srivastava SM, Dipak Roy. 2004. Captive breeding of vulnerable Indian carp *Cirrhinus reba* with Ovaprim for conservation of wild populations. October – December.

Sreenivasan, A. (1966) The limnology of tropical impoundments, Hydrobiological feature and fish production in Stanley Reservoir, Mettur dam. *Indian, Rev. Gen. Hydrobial*. **51**. 295-306.

Sreenivasan, A. (1979). The Hydrobiological features of primary production and fisheries of Stanley Reservoir, Mettur dam. *Madras J. of Fisheries*. **5**. 1-6.

Stiassny, M. (1998) The medium is the message: freshwater biodiversity in peril. In: Cracraft, J. and F. Griffo (Eds.), The living Planet in crisis: *Biodiversity Science and Policy, Columbia University Press*, New York pp. 53-71.

Strayer, D. L. and Dudgeon, D (2010) Freshwater bio-diversity conservation: recent progress and future challenges. *Journal of the North American Benthological Society.* **29**. 344–358.

VanSickle, J. and R. M. Hugjes (2000) Classification strength of ecoregion, catchments and geographic clusters for aquatic vertebrates in Oregon. *Journal of the North American Benthological Society.* **19**. 370-384.