



Existence of freshwater biodiversity and its fauna

Khole AM

Department of Zoology, B. Raghunath College, Parbhani (M.S.), India

Email: kholeanilm@gmail.com

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ABSTRACT

Freshwater habitats occupy, 1 percent of the Earth's surface, yet are hotspots that support 10 percent of all known species, and, 1/3 of vertebrate species. Freshwaters also are hotspots for human activities that have led to widespread habitat degradation, pollution, flow regulation and water extraction, fisheries over exploitation, and alien species (species introduced by humans) introductions. Not all aquatic environments are similar in nature. While some marine environments are comparatively stable, but very different conditions prevail in rivers, lakes and other inland waters. The Rivers has the highest species diversity of any other freshwater system and richness in species. This diversity provides benefits to humans both directly, such as through livelihoods from fisheries and indirectly through purification of water for drinking purpose. In the world network of rivers and lake basins are identified as potential key biodiversity areas most important for the protection of threatened and restricted range species. Today due to human-assisted spread of non-indigenous fishes and aquatic invertebrates, microbes and plants has strong ecological impacts in rivers and lakes worldwide. The freshwater bodies facing the impact which causes severe declines in the range and abundance of many freshwater species, due to that they are far more imperiled than their marine or terrestrial counterparts. This review paper focused on the conservation of freshwater biodiversity and outline key challenges for the future.

Keywords: Biodiversity, Freshwater, Conservation, Pollution, Fauna

INTRODUCTION

Not all aquatic environments are similar. While some marine environments are comparatively stable, very different conditions prevail in rivers, lakes and other inland waters. These provide an array of dynamic habitats that present a great variety of physiological and ecological challenges. Approximately 70 percent of Earth's surface covered by water, yet only 2.5 percent of Earth's water is freshwater (McAllister *et al.*, 1997). Most of the freshwater is locked in polar ice caps stored in underground aquifers or part of soil moisture and permafrost. Only 0.01 percent of Earth's water is available as freshwater in rivers and lakes. This one hundredth of a percent

of Earth's water that occupies only 0.8 percent of Earth's surface provides us with a vast array of environmental services (McAllister *et al.*, 1997).

Freshwater water animals comprise those species that live in or on freshwater for at least a part of life cycle, or are dependent on freshwater ecosystems for some aspects of their ecology (Balian *et al.*, 2008). The current estimate of the numbers of freshwater animal species is about 126,000, although higher numbers have also been proposed (Abramovitz 1996: Balian *et al.*, 2010). Approximately 45 percent of known fish species inhabit freshwater (Leveque *et al.*, 2008), representing almost 25 percent of the world's known vertebrates. When the amphibians, aquatic reptiles and mammals are added it becomes 38 percent of all vertebrate species are confined to freshwater. The great diversity of freshwater species is confined to a relatively small extent of habitats (Gleick 1996: Dudgeon *et al.*, 2006). Terrestrial and marine ecosystems may have a greater percentage of known species but freshwaters are considered to have a far greater spatial richness of species. The natural ecosystem have been modified for so long that what we now see is a relatively stable, though altered, fauna. Most other faunas are much less well known, and an adequate assessment of their conservation status and needs is generally impossible.

Major threats to freshwater species

Worldwide freshwater biodiversity and habitats are seriously threatened (Revenga & Kura, 2003: Levenque *et al.*, 2005). The Living Planet Index (Hails, 2008) shows that 458 freshwater species declined by an average of 35 percent, compared to an average 33 percent decline in 887 terrestrial species and a loss of 14 percent decline in 341 marine species between 1970 and 2005. The main threats to freshwater biodiversity are habitat degradation caused by infrastructure development and land conversion, water pollution, flow modification, introduction of invasive alien species, overharvesting and overexploitation (MEA, 2005: Dudgeon *et al.*, 2006). Increasing human population growth and economic development are recognized as the indirect drivers behind many of these threats. Several environmental changes, occurring globally, are also being responsible for these threats. Many invertebrate species, which comprise nearly 99 percent of all animal diversity and occupy an important trophic level in the ecological

pyramid of energy, are either already extinct or severely threatened (Ponder *et al.*, 2001). David (2006) during his research work on Challenges for freshwater invertebrates' conservation stated that freshwater invertebrates conservation faces challenges, about 10000 species of freshwater invertebrates around the world may already be extinct or imperiled, and human pressures on freshwater resources are intense and will increase in the coming decades, putting yet more species at risk.

Species threatened status

Change in status of threatened species is accepted as one of the best indicators for assessing the condition of ecosystems and their biodiversity. Butchart *et al.*, (2008) expressed that the measurements have shown that the rate of biodiversity loss is not slowing. Vie (2009) suggest that the ICUN Red list of threatened species is recognized as the best source of information, at the global level, on the threatened status of plants and animals. It provides information on the taxonomy, distribution, ecology, utilization, livelihoods, values, threats, conservation measures and risk of extinction. The precise number of extant fish species remains in threats. Leveque *et al.*, (2008) finds that about 28900 species were listed in Fish Base in 2005, but some experts feel that the final total may be considerably higher. Freshwater fishes comprise until now almost 13000 species or about 15000. Noteworthy is the fact that the estimated 13000 strictly freshwater fish species live in lakes and rivers that cover only 1 percent of earth's surface.

Extinction Rate of Freshwater Fauna

Anthony and Joseph (2001), during research on *Extinction rates of North American freshwater fauna* recorded that, since from year 1900, 123 freshwater animal species have been recorded as extinct in North America. Hundreds of additional species of fishes, mollusks, crayfishes, and amphibians are considered imperiled. The extinction rates for North American freshwater fauna that are five times higher than those for terrestrial fauna. It is assuming that imperiled freshwater species will not survive throughout that North America's temperate freshwater ecosystems are being depleted of species will not survive throughout the next century. The future extinction of 4 percent per decade, which suggests that North America's temperate freshwater ecosystems are being depleted

of species as rapidly as tropical forests. The situation for freshwater biodiversity is so grave that freshwater fish alone comprise one fourth of all living vertebrate species, and recent assessments suggest that over 30 percent of them are threatened (World Conservation Union, 2000). David and Dudgeon (2010) noted that, freshwater habitats occupy 1 percent of the Earth surface, yet are hotspots, 10 percent of all known species, and half of vertebrate species. Freshwaters also are hotspots for human activities that have led to widespread habitat degradation, pollution, flow regulation and water extraction, fisheries overexploitation, and alien species introductions. These impacts have caused severe declines in the range and abundance of many freshwater species, so that they are now far more imperiled than their marine or terrestrial counterparts.

Freshwater faunal diversity situation around some areas

The freshwater bodies have complex underwater world and face capricious climate and to the far-reaching consequences of human activities. Freshwater ecosystems provide vital resources for humans and are the sole habitat for an extraordinarily rich, endemic, and sensitive biota. Human demand on freshwater ecosystems has risen steeply over the past century, leading to large and growing threats to biodiversity around the world (Dudgeon *et al.*, 2006). A habitat is more than a place where a species, assemblage or community is located, because fishes and other animals often occur in areas that could not sustain them for long periods.

The core habitat provides the resources and conditions needed for them to complete their life cycles and to sustain viable populations. The freshwater habitat includes abiotic (physical, chemical) and biotic (living) components. On the basis of the size and shape of the water body, its hydraulics, the water chemistry and nature of the substratum are all parts of the abiotic environment, many of them determined by the inherent properties of water (Gordon *et al.*, 2004). Freshwater systems in Brazil provide essential goods and services but these ecosystems are being rapidly degraded and will be lost if not adequately protected (Valter *et al.*, 2019). However, many of these ecosystems have been disrupted by human activities, threatening the maintenance of native biodiversity and ecosystem

services. This scenario points to the scientific, educational and political realms (Pelicice *et al.*, 2017, Penha & Izzo, 2018). The situation for freshwater biodiversity throughout the world is so grave that an additional plea for freshwater research is warranted (necessity). The freshwater fish fauna alone comprise one-fourth of all living vertebrate species, and recent assessments suggest that over 30 percent of them are threatened (World Conservation Union 2000). The situation is even more serious for other freshwater faunal groups.

On average around the world, freshwater habitats and their species are more imperiled (destroyed) than their terrestrial counterparts (McAllister *et al.*, 1997; Ricciardi & Rasmussen 1999). The research work undertaken by the conservation community shows, freshwater biodiversity crisis affects on species declining problem. Among the freshwater sources humans now capture 50 percent of available freshwater runoff (Jackson *et al.*, 2001), reservoirs trap 25 percent of the global sediment load before it reaches the oceans (Voro & Sahagian 2000), and several of the world's great rivers, including the Ganges-Brahmaputra, Yellow, Nile and Colorado, have stopped flowing to the sea during dry periods (Postel 2000). Pressure on freshwater resources is increasing across the globe (WRI 1995; Brown *et al.*, 1998). During the first eight decades consumption of water increased 75 percent. Increasing freshwater scarcity is becoming a major constraint for growing world population, ecosystem protection and peace among nations (Postel 1996). Freshwater ecosystems support to maintain its biodiversity richness in species as compared to habitat extent then in either marine or terrestrial ecosystems.

Freshwater ecosystems contain approximately 12 percent of all species with almost 25 percent of all vertebrate species concentrated within these habitats (Stiassny 1996). The richness of freshwater species includes a wide variety of plants, fishes, mussels, crustaceans, snails, reptiles, amphibians, insects, microorganisms, birds and mammals that live beneath the water or spend much of their time in or on the water. Many species of flora and fauna from freshwater depend upon the physical, chemical and hydrologic processes and biological interactions found within freshwater ecosystems to trigger their life-cycle stages. Astrid and Aaik (2018) noted that species observed in freshwater are typically good indicators of the health/status of these ecosystems. In the present world as we continue to expand our use of land across

the planet we leave other species little ground to stand on. By 2070, increased human land use is expected to put 1700 species of amphibians, birds, and mammals at greater extinction risk by shrinking their natural habitats, according to a study by Yale ecologists published in *Nature Climate Change*. Walter Jetz, co-author and professor of ecology and evolutionary biology at Yale, says, "Our analyses allow us to track how political and economic decisions through their associated changes to the global land cover are expected to cause habitat range declines in spaces worldwide."

The study shows that with moderate changes in human land use, about 1700 species will likely experience marked increases in their extinction risk over the next 50 years: they will lose roughly 30-50% of their present habitat ranges by 2070. These species of concern include 886 species of amphibians, 436 species of birds, and 376 species of mammals. In the present situation the biotic components include living organisms linked by processes such as competition, predation and parasitism. Some biotic and abiotic components, such as food or spawning sites, may be in short supply at different times or places and may thereby limit the value of the habitat and its capacity to support fishes. Tansley (1935) defined ecosystem as the system resulting from integration of all the living and non-living factors of environment. An ecosystem is an overall integration of whole mosaic of interacting organisms and their environment. It is normally an open system with a continuous, but variable, influx and loss of materials and energy. It is a basic, functional unit with no limits of boundaries, consisting of both biotic and abiotic components interacting with each other, both necessary for maintenance of life upon earth. Therefore, it represents the highest level of energy based ecological interaction.

However, owing to the numerous differences between freshwater fauna studies, they show only fragments of the overall picture of freshwater pollution. This highlights the lack of a holistic vision and evidences several knowledge gaps and data bases. Although many of the most polluted rivers and other freshwater bodies are in Asia. The potential damage caused by pollutants on a wide range of freshwater fauna is as yet undetermined, even though negative impacts have been well documented in similar marine species.

CONCLUSION

The present review study supports the findings of different researchers, which expresses diversity changes with regards to elevation. The nature of the ecosystem which prevails along the freshwater systems of the world creates suitable habitats for flora and fauna. The flora and fauna from freshwater depend upon the physical, chemical and hydrologic processes and biological interactions found within freshwater ecosystems to trigger their life-cycle stages. Many threats have been existence for the freshwater fauna. Hence, urgent attention is necessary to create awareness among communities for the importance of the habitat and its diversity, for the conservation of these important resources for future generations. Freshwater ecosystems and its fauna need not be so threatened. By recognizing the need for naturally varying flows of water and sediments, and reduced pollution loads, we can maintain or restore freshwater ecosystems to a sustainable state that will continue to provide the amenities to the freshwater ecosystem. The greatest threats to the freshwater fishes due to loss of habitat and degradation, in particular due to mining, agriculture and infrastructural development. Water pollution is also having a substantial impact on the fishes, in particular as a result of sedimentation and deforestation. Lastly I believe that we need to think deliberately about the best approaches for conserving freshwater invertebrates and vertebrates biodiversity. We have to try to satisfy legitimate human needs for freshwater while preserving as much biodiversity as possible.

Conflict of Interest

The author declares that there is no conflict of interest.

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