

# Aquatic Insects as Biomonitors of Freshwater Ecosystem: A Review

Arundhati Gogoi<sup>1</sup>, Bijeta Ghose Guha<sup>2</sup>

<sup>1</sup>Research Scholar, Assam University, Silchar, Assam, India

<sup>2</sup>Research Scholar, Dibrugarh University, Dibrugarh, Assam, India

**Abstract:** *Aquatic insects are among the most prolific animals on earth. They are found associated with water for most part of their life cycle, any change in their number and composition in the population at a given time and space may indicate a change in the water quality. This class has many potential representatives that can be used as environmental bioindicators, among which are from the Coleoptera, Diptera, Lepidoptera, Hymenoptera. Water insects or aquatic beetles are biological indicator. The use of bioindicators is essential for environmental monitoring. In this paper an attempt has been made to focus on the importance of aquatic insects as biomonitors of aquatic ecosystems.*

**Keywords:** Aquatic insects, bioindicators, biomonitors, environmental, water quality

## 1. Introduction

Aquatic insects are the major groups of arthropods that spend some parts of their life cycle in the water. All over the world about 45000 species of insects are known to inhabit diverse freshwater ecosystem [1]. Less than 3% of all species of insects have aquatic stages in some freshwater biotopes, the biomass produced by immature insects may comprise over 95% of the total individual or species of macro-invertebrates. They play important ecological roles in keeping freshwater ecosystems functioning properly [2, 3]. They form an important component of the food chain and energy flow pathways and comprise of a high proportion of biomass in fresh water. Studies have shown that between 1% and 57% of the biomass produced by immature aquatic insects (i.e secondary production of aquatic insects) emerges from the aquatic system in the form of adult insect [4].

Insects with their abundance and diversity dominate fresh water ecosystem. Although most invertebrate species are still not described, a high diversity is displayed by certain taxa. In India, limited number of studies have been carried out on the ecological aspects of aquatic entomofauna [5,6,7,8,9,10,11,12,13,14,15, 16].

## 2. Freshwater Ecosystem and Biomonitoring

There are many different kinds of aquatic insects as almost every type of freshwater environment habitats from puddles to river to lakes, including both lentic and lotic habitats, can belong to various species of aquatic insects. Around the world, freshwater habitats are being subjected to increased levels of human disturbance [17]. A recent assessment of the status of inland water ecosystems shows that globally most threatened river catchments are to be found in the Indian subcontinent (WCMC 2000). The organisms that are used for biomonitoring are Fish, Invertebrates (Insects, Crustaceans), Algae, Mussels, Bacteria, etc. Aquatic insects and other benthic invertebrates are the most widely used organisms in freshwater biomonitoring of human impact. Because of the high monetary investment in freshwater management, decisions are often based on biomonitoring

results, and a critical and comparative review of different approaches is required.

## 3. Aquatic insects as Biomonitors

A bioindicator can be defined as “a species or group of species that readily reflects the abiotic or biotic state of an environment, represents the impact of environmental change on a habitat, community or ecosystem, or is indicative of the diversity of a subset of taxa, or the whole diversity, within an area. Such organisms are monitored for changes (biochemical, physiological or behavioral) that may indicate a problem within their ecosystem. Bio indicators can tell us about the cumulative effects of different pollutants in the ecosystem.

Aquatic insects are used as indicators of water contamination. Water quality is evaluated by comparing the number of tolerant species (some midge larva) to the number of intolerant species (Ephemeroptera, Plecoptera, and Trichoptera orders [18]. Furthermore some of these insects are used in toxicological researches in primary stages [19]. Aquatic insect are found in a wide variety of aquatic habitats from pond, spring, stream to rivers which are different in salinity, pH and other characteristics.

Apart from medically importance of aquatic insects, they play an important role in the ecosystem. Aquatic beetles are biological indicator. The use of bioindicators is essential for environmental monitoring. The characteristics of a bioindicator are richness and diversity species, easy handling, ecological faithfulness, fragility to small environmental changes and good organism responses. Class Insect has many potential representatives that can be used as environmental bioindicators, among which are from the Coleoptera, Diptera, Lepidoptera, Hymenoptera. Aquatic beetles are a diverse group and are excellent indicator of habitat quality, age and naturalness. They are indicator of ecological diversity and habitat characteristics as they meet most of the criteria generally accepted in the selection of indicator taxa. Today these fragile ecosystem are under threat due to intensive anthropogenic influence century in

response to a variety of factors particularly agricultural intensification and associated drainage of wetlands and increases in diffuse pollution leading to eutrophication.

They are indicator of ecological diversity and habitat characteristics [20,21] as they meet most of the criteria generally accepted in the selection of indicator taxa. The beetles are especially useful in certain habitats as peat bogs, coastal and saline lagoons, wood and wetland ponds, etc. There is a great deal of papers discussing how to use several methods for estimating the species richness for a wide range of taxonomic groups. The mayfly naiads are an important source of food for fish and other aquatic wildlife. Anglers often use mayflies as bait, or tie "flies" that are made to resemble images and subimagos. The larvae are important as food for other aquatic organisms. Plecoptera have been used as biogeographical indicators and in evolutionary research. Plecoptera (stoneflies) are a source of food for many game fishes. They have been used for centuries in the sport of fly fishing, and fishermen have good knowledge of them. Trichoptera feed on debris, cleaning the freshwater ecosystem in which they live besides being an important source of food for fish. Trichoptera larvae, pupae and adults also form an important link in the food chain and they have also been used extensively by trout fishing enthusiasts as models for "flies"

#### 4. Conclusion

Aquatic insects are important for biological control. Therefore ecological study on aquatic insects can provide information about ecology of insects in an area for any decision making. Conservation of natural resources and biodiversity has become urgent issues in recent years for attaining an environmentally sustainable future. While a lack of data has historically excluded the use of many taxa as possible indicators. Growing number of studies on the habitats and distributional pattern of certain insects is making their use increasingly suitable. The improvement and development of existing and new biomonitoring tools using aquatic insects are a major effort among aquatic entomologists.

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### Author Profile



**Arundhati Gogoi** presently working in Gyan Vigyan Academy has done her M.Phil from Assam University, Silchar. She is a post graduate in Zoology from Guahati University.



**Mrs. Bijeta Ghose Guha** presently working in Gyan Vigyan Academy is a research scholar in Dibrugarh University. She is a post graduate in Life Sciences.

