Climate change and its impact on aquatic ecosystem in the central Himalayas

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INTRODUCTION

The Himalayas is considered as one of the most unstable ecologically fragile regions on earth. Due to their wide exposure to environmental stressors, lakes in the region are more susceptible to global warming. Lakes at different altitudes can be used as a climatic gradient and could serve as models for predicting the possible impacts of climate change.

A high incident of UV-B irradiance and change of climate may transform not only on the physical characteristic of the aquatic ecosystem but also the chemical and biological parameter. The adaptive strategies of aquatic biota may occur by developing specialized protective mechanism that pledge long-term survival and domination in the upland lakes.

The main objectives

- To identify planktonic group in aquatic ecosystem that could be used for monitoring the impact of climate change in the central Himalayas,
- To determine the adaptive strategies of aquatic organism to the changing climate.

MATERIAL & METHODS

Water and sediment samples were collected from seven lakes of the central Himalayas (2 sites; 2 seasons).

Water temperature, pH, DO, Conductivity, ORP, PO4-P & NH4-N, Turbidity, Transparency, Alkalinity & Hardness of water were determined using standard methods (USEPA, 2007 & APHA, 1999).

Total organic matter (TOM) was estimated by ignition loss method.

Humic compounds (HA) and Lignin like compound (LLC) were extracted using UHSS protocols & determine their concentrations & degree of humification.

Carotenoids pigments were extracted from copepods were estimated using aceton: hexane (1:3) & identified under microscope. Abundance was estimated by enumerating under Sedgekow rafter.

Results

Zooplankton species were collected by sieving water in plankton net (25um mesh size) & identified under microscope. Abundance was estimated by enumerating under Sedgekow rafter.

In low altitudinal lakes, TOM are significantly high particularly during high flood(Fig. 1a). Lake sediment generated higher amount of humic substance (Fig. 2a) & Lignin like compounds (Fig 2b) in higher transparent lakes (F = 0.693, p = 0.006 & F = 0.751, p = 0.002).

High LLC deposited in the sediment of the shallow high altitude lakes (Fig 2c). Aromatization & & condensation processes from plants leaves and twigs. In turbid shallow lakes where high depositions of TOM occurs, concentration of humic compounds are greatly reduces & low degree of humification also (Fig 2c).

Copepods were dominated in high altitude shallow lakes (Fig 3a & b) while cladoceran in the deeper lakes. Copepods abundance showed significant positive correlation with amount of humic compounds (F = 0.755; p = 0.002).

In the high latitude lakes of the Himalaya, changes in climate influence greatly on the species composition of aquatic biota.

The copepods of high altitude shallow lakes contain greater amount of carotenoid pigments (Fig 4) & positively correlated with humic substances (F = 0.652, p = 0.012).

CONCLUSION

In the high latitude lakes of the Himalaya, changes in climate influence greatly on the species composition of aquatic biota. Copepods of shallow lakes unable to migrated and appear to develop adaptive strategies by changing food habits. They adapted to persistently low temperatures and high transparency.

The remnants of leaf litter derived from the shoreline generated humic compounds.

The photoprotective compounds accumulated through the food chain helps in survival (against oxidative stress from ultraviolet sunlighet) & adaptation of Copepods from high intensity UV irradiances.

Shoreline plantation in Lake Ecosystem augmented in survival and adaptation of the aquatic organism to climate change.

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