

## Algal diversity in the sacred lake of Tung Kyong, Dzongu, Northern Sikkim.

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### ABSTRACT :

Dzongu falls under the Reserved and Protected Area of Sikkim and part of the area comes within Khangchendzonga National Park (KNP), a World Heritage site. People believe Tung Kyong Doh is a wish fulfilling lake located in the foothills of KNP. Though various studies have been done on the flora and fauna of Dzongu, but the algal diversity is yet to be explored. The present investigation is an attempt to record algal diversity from aquatic habitat in the Tung Kyong Doh, Hee Gyathang following proper methodology of collection of samples and identification procedures. The present study found the following groups of algae occurred in all the four seasons, throughout the year: Conjugatophyceae (10), Chlorophyceae (3), Cyanophyceae (1) and Euglenophyceae (2). This is the first study in Tung Kyong Lake, in the state of Sikkim.

**Keywords:** Algae, diversity, Tung Kyong Lake, Dzongu, Sikkim, India.

### INTRODUCTION :

Sikkim (ca 7096 sq km; 27°05' to 28°07' latitudes and 87°59' to 88°56' longitudes) has lakes though not very large in size. Lakes and rivers are important water resources for livelihood. On account of this perennial water flow, this small state of Sikkim in India shows an important aquatic biological diversity. Dzongu is located in Northern Sikkim at an elevation ranging from 800m and 6,000m above sea level. Dzongu is bounded to the south-east by Teesta river and north-east by Tholungchu (river) and to the west by the mountain leading to Khangchendzonga, meaning 'bright auspicious forehead peak' that borders the Khangchendzonga Biosphere Reserve (KBR) at north. A fairly triangular shaped Dzongu landscape covers approximately 78 square km geographical area extending between 27°28' – 27°38' N lat. and 88°23' – 88°38' E long, along the 700 m to 6000 m amsl altitude. Lakes are sacred to the Lepcha as they believe that some of the clans originated from the lakes. Some important lakes with historical significance in Dzongu are Kishong, Tung Kyong and Dawathang. Dzongu has remained void in its phycological terms. This research is first of its kind in the lake Tung Kyong. Thus, this research paper looks forward to take an insight vision on the algal diversity in Tung Kyong Doh of Sikkim without disturbing the biodiversity of Dzongu.

### MATERIALS AND METHODS:

#### Study sites:

Tung Kyong Doh lake (N27°29'01.6" E088°30'43.5") is situated at an altitude of 823 m from the sea level in the Hee Gyathang village of Lower Dzongu. The area is 0.1330 acres. Aquatic habitats are selected from both lotic and lentic parts of the lake (Figures 2, 3, 4). 10 samples were collected randomly from different parts of the lake. The study was conducted in four seasons of the year from 5/11/15 to 5/11/16.

#### Collection

Samples from the lake were collected in wide-mouth bottle from surface dipping the bottle mouth into the water. One sample is fixed with 3 ml Lugol's iodine (as standard is about 0.3 ml per 100 ml sample) solution at the spot and another is carried to the laboratory as it is for isolation purpose. Some physiochemical parameters of water and soil samples are estimated as discussed by APHA (1989). The parameters includes pH, temperature, total dissolved solids, conductivity, dissolved oxygen / biological oxygen dissolve and the amount of phosphate, nitrate, ammonia, sulphate, calcium and magnesium.

## Isolation

Isolation of algae is done following serial dilution method (Vincent 1970). Different types of culture media are used for isolation of algae such as Bold Basal, BG11, Chu 10, Fogg s, *Volvox* medium, Desmid medium, *Spirulina* medium, Soil-water medium (Andersen 2005) etc. Enrichment cultures are raised from the collected samples by incubation at  $\pm 28\ 0\ C$  for 20-40 days for proper growth of algae for identification in the Phycology Research laboratory of Nowgong College and Sikkim State Council of Science and Technology, Gangtok. For uni-algal isolation different dilutions are prepared from enrichment culture. Inoculum from each dilution (preferably from 10<sup>-3</sup> and 10<sup>-4</sup>) are streaked in solid media contained in sterile Petri-plates. The plates are incubated for 10-15 days until individual colonies appeared on the surface. Each colony represented a unialgal culture. The individual colonies are picked up and transferred to liquid medium in flasks. The flasks are incubated in culture racks for multiplication and further taxonomical study.

## Identification

Micro algae were identified by microscopic observations, photomicrographs and measurement of vegetative and reproductive structures as described by John et al (2011) and Andersen (2005) Taxonomical analysis was done with the help of cited literatures and monographs of Prescott (1951, 1954, 1976); Desikachary (1959, 1987b); Philipose (1967); Iyengar and Desikachary (1981); Gonzalves (1981); Anand (1988); Wehr and Sheath (2003); Jena et al. (2006a, 2006b); Rath et al. (2006) Jena and Adhikary (2007); Coesel and Meesters (2007); Misra et al. (2008); Dwivedi et al. (2009); John et al. (2011); Arulmurugan et al. (2011) and Buragohain et al (2012).

## Results and Discussion:

The algae recorded are mainly from Chlorophyceae, Conjugatophyceae, Cyanophyceae and Euglenophyceae. The research on phycology is the first ever done in the Tung Kyong Doh, HeeGyathang, Dzongu. The filamentous forms of Chlorophyceae, are recorded from the aquatic habitat where aquatic flora was also seen in submerged state. Cyanophyceae is seen where blooms appear in epimilion zone of the lake during summer season. Conjugatophyceae are collected from both the lentic and lotic part of the lake. Algae are primary producers in food chain and since the lake is restricted to tourism activities and outside interference, there was little or no change in the physiochemical parameters in which the yearly average of the following were as pH (6.0mV), Oxidation Reduction Potential( 209 mV), Dissolved oxygen (0.1%), Electrical conductivity Micro-Siemens per centimeter ( $\mu S/cm$ ) (0.138), Total dissolved solids in ppm (parts per million)(0.090ppm), Turbidity (TURB) [LED transmission/front 30° scattering method] (NTU)= (Nephelometric Turbidity Units) (2.22 NTU). The main nutrient composition in the lake has also been found to be stable except during monsoons the composition varied by lesser value and the yearly average are as 75ppm(sulphite), 5ppm (orthophosphate) and 10ppm(nitrate). The physiochemical parameters also play an important role in maintaining the algal diversity of the lake.

The algae recorded are *Closterium moniliferum* (Ehrenberg ex Ralfs), *Cosmarium depressum* (Nägeli) P.Lundell, *Micrasterias crux-melitensis* (Ralfs), *Netrium digitus* (Brébisson ex Ralfs) Itzigsohn&Rothe in Rabenhorst, *Staurodesmus omearae* (W.Archer) Teiling, *Cosmarium ovale* (Ralfs ex Ralfs), *Cosmarium granatum* (Brébisson ex Ralfs) *Cosmarium botrytis* (Meneghini ex Ralfs), *Spirogyra fluviatilis* ( Hilse), *Zygnema californicum* (Stancheva, J.D.Hall& Sheath)- *Scenedesmus obliquus* (Turpin) Kützing, *Radiococcus nimbatus* (De Wildeman) Schmidle and *Ankistrodesmus fusiformis* (Corda) ( Chlorophyceae) ; *Coelastrum sphaericum* Nägeli, and *Phormidium autumnale* Gomont (Cyanophyceae)

















					
<i>Closterium moniferum</i>	<i>Cosmarium depressum</i>	<i>Netrium digitus</i>	<i>Staurodesmus somearae</i>	<i>Micrasterias crux-melitensis</i>	
					
<i>Cosmarium ovale</i>	<i>Cosmarium granatum</i>	<i>Cosmarium botytis</i>	<i>Spirogyra fluviatilis</i>	<i>Zygnema californicum</i>	
					
<i>Coelastrum sphaericum</i>	<i>Phormidium autumnale</i>	<i>Phacus orbicularis</i>	<i>Scenedesmus sobliquus</i>	<i>Radiococcus nimbatus</i>	<i>Ankistrodesmus fusiformis</i>

Figure 1: Algal Species Recorded In Tung Kyong Lake



Figure 2: Position of Dzongu in the map of Sikkim



Figure 3: Tung Kyong Doh Lake.

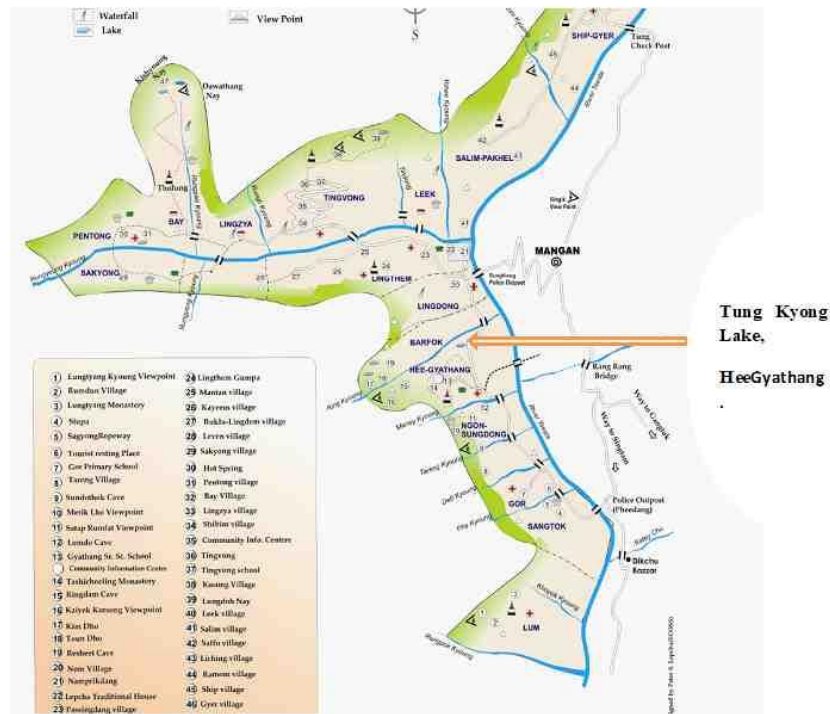


Fig 4: Source: Dzongu ecotourism map, Dzongu,

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