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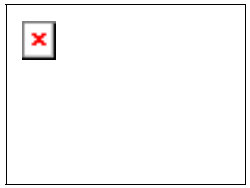
Environmental Impact Assessment of Mechanical Deweeding on Dal Lake

Unbelievable Facts



- Light penetration in the lake water had got reduced to the extend of **47 %** after deweeding.

- There is significant increase in the Chlorophyll a concentration of the lake waters after deweeding and the increase is to the extent of 50 %
- *Bacillariophyceae* population has increased by as much as 40 % after harvesting
- The green algae which depicted increase in their number after deweeding were: Closteriopsis longissima, Selenastrum gracile, Coeleastrum sphaericum and Pediastrum simplex.
- A number of blue green algae registered significant numerical increase after deweeding. The important species are Anabeana constricta, Merismopedia elegans and Oscillatoria sp.
- 7.99 tonnes of fish loss annually from the lake gets entangled in the harvested weed
- It has been observed that after harvesting plant beds in the cut area were restored within three to four weeks back to their earlier coverage after mechanical harvesting

Evaluating the feasibility of weed harvesting as a corrective measure for eutrophication abatement, extensive data on physico-chemical and biological parameters of the Dal Lake were analyzed.

The secchi visibility of the lake water varied significantly both in time and space. It has been observed that the extend of light penetration in the lake water had got reduced to the extend of **47 %** after deweeding. The increase in turbidity of the lake water may have caused by the suspension of sediment due to the impact of harvesting machines. Since the lake is shallow with soft bottom overlaid with marl, a little disturbance in the water column would result in increased turbidity. However this effect appears to be short lived and suspended material apparently settled down on the bottom of the water column on cessation of cutting. But frequent harvesting is bound to disturb the extend of light penetration in the lake and thus interfere with the photosynthesis process.

Electrical conductivity of the lake water depicted significant change in its value after deweeding. The change is appreciable both in time and space .This is due to the depth of the lake.

The concentration of total phosphorus of the lake water before and after deweeding did not show any significant variation at 0.05 probability level but the mean values depicted an increase in the phosphorus content after the commencement of harvesting operations perhaps due to the release from the bottom sediments on disturbance. Since authority had a view that harvesting operation would lower the ambient nutrient load from the lake. Aquatic plant harvesting operations resulted in the removal of only **0.8 %** of the total phosphorus inputs to the lake. Sediment phosphorous have become available through resuspension following turbulent mixing with the overlying water in this shallow lake. Weed harvesting was not an effective method of reducing nutrient supplies in the Dal lake , which is going through cultural enrichment.

Statistical analysis of the results show that there are no significant variations in the nitrate content of the lake water after deweeding. However, the mean value depicted that the **nitrate- nitrogen concentration increased** as a result of deweeding. However sediments do not add any appreciable amounts of nitrate-nitrogen to water except in the well oxidized stirred situations such as might be

occurring in shallow area and during homothermy in the lakes. **Ammonical – nitrogen** concentrations showed an increasing trend after the commencement of the harvesting operations, but there is no significant mean or temporal variation at 95 % probability level.

There is significant increase in the **Chlorophyll a concentration** of the lake waters after deweeding and the increase is to the extent of **50 %** .Temporal increase in Chlorophyll content were also significant . Interpreting such observations, it appears that the increase in Chlorophyll a concentration is not the increase d concentration of viable phytoplankton but as a result of turbidity and pigment concentration from disturbed sediments from macrophyte beds.

Mechanical deweeding had profound impact on the **species number, composition and on the community structure** of both, the phytoplankton and zooplankton of Dal Lake. Harvesting had registered increase in the number of taxa and in the numerical population. Removal of aquatic vegetation could result in increased algal densities. It is probable that the same mechanism worked in the Dal Lake where deweeding released enough nutrients for the development of

phytoplankton population and reduced competition in the absence of macrophytes. As analyzed, deweeding had significant impact on the densities of ***Bacillariophyceae.*** The population increased by as much as **40 %** after harvesting .Other algal groups did not have much impact on their numerical populations .Phytoplankton community of Dal Lake is dominated by diatoms, most of the forms are epiphytic and are found in plankton. Possible explanation for substantial increase of diatoms population after deweeding was that due to vigorous shaking of macrophytes by harvesters, the periphytic forms attached to the submerged vegetation got dislodged in the process, remained suspended and added to the overall numerical abundance of group. As a result of deweeding there is significant increase in the numerical population of some dominant species which include : Eunotia praerupta , Amphora ovalis , Rhopalodia gibba , Nitzschia paradoxa and Cymbella ventreicosa

The green algae which depicted increase in their number after deweeding were: Closteriopsis longissima, Selenastrum gracile, Coeleastrum sphaericum and Pediastrum simplex.

A number of blue green algae registered significant numerical increase after deweeding. The important species are Anabeana constricta, Merismopedia elegans and Oscillatoria sp.

Accordingly Zooplankton population registered significant numerical increase which is more pronounced in case of rotifers: Anuraeopsis fissa, Colurella obtuse, Trichocerca semilis, Lecane luna and Karatella serrulata

One of the major impacts of mechanical deweeding on the Dal Lake ecosystem has been substantial **loss of fish** which get entangled in the harvested weed. This fish represented some important species of the lake both endemic and exotic. As per the references, the estimations made on the basis of the field data demonstrated fish loss of about **0.5 kg per 100 kg** of harvested weed. If we take into consideration the efficiency of the harvesters for weed removal and the number of the days for which they remained functional , the total amount of weed removed comes about **1600 tonnes** per year. This would account for **7.99 tonnes of fish loss annually from the lake**. The maximum number of fish trapped in the harvested weed is of **Nemachilus latius which account for**

4.047 tonnes of annual fish loss. This was followed by **Cyprinus carpio communis which lost 2.23 tonnes** per year and the **others account for 1.26 tonnes** annual loss.

It has been observed that after harvesting plant beds in the cut area were restored within three to four weeks back to their earlier coverage after mechanical harvesting .Studies have indicated that the macrophytes have not so far developed fan-shaped appearance but an apical cut in plants resulted in the formation of a number of secondary branches thereby increasing the canopy considerably and giving a fan like appearance after the harvesting operations. As per studies conducted on similar lakes in foreign countries showed that underground harvesters resulted in the death of many of the harvested stems which have the capability to cut below the leafy portion or else and thus showed minimal growth. However in of the stem, fewer stems died and re growth is much faster. New stems generally sprouted from the first node below the cutting plane and many younger stems which remained intact rapidly reached the water surface.

Mechanical harvesting had no visible improvements in the weed nuisance of the Dal Lake although deweeding has been going on. This is mainly because harvesting operations are not being carried out under a definite schedule and time frame. Total eradication of weed is not desirable and deweeding process should be undertaken on a selective basis to avoid harm to the biological life. The harvesters could be useful during the high tourist season. The importance of deweeding process for improving recreational facilities in the Dal Lake should be based on sound ecological plans coupled with definite time schedule and frequency of deweeding. The present programme of deweeding has a limited utility and is not a permanent solution to the problem of excessive weed growth. The use of mechanical harvesting as a management technique in Dal Lake had affected its overall stability. **Besides huge fish losses there is increase in biological population; change in the morphology of aquatic weeds accompanied by rapid re growth (3-4 weeks) and occurrence of algal bloom**. The lake water has become more turbid thereby reducing euphotic zone. Mechanical deweeding is particularly suited to open channels or where control is required in only small area of the water body.

Above Report has been submitted to :

- Cabinet Committee on Economic Affairs GoI
- National Lake Conservation Plan GoI
- Expenditure Finance Committee GoI
- Chairman Lakes & Waterways Development Authority
- MoEF Government of J&K