**EUTROPHICATION OF SURFACE WATERS**

"Eutrophication" is the enrichment of surface waters with plant nutrients. While eutrophication occurs naturally, it is normally associated with anthropogenic sources of nutrients. The "trophic status" of lakes is the central concept in lake management. It describes the relationship between nutrient status of a lake and the growth of organic matter in the lake. Eutrophication is the process of change from one trophic state to a higher trophic state by the addition of nutrient. Agriculture is a major factor in eutrophication of surface waters.

The most complete global study of eutrophication was the Organization for Economic Cooperation and Development (OECD) Cooperative Programme on Eutrophication carried out in the 1970s in eighteen countries (Vollenweider *et al.,* 1980). The sequence of trophic state, from oligotrophic (nutrient poor) to hypertrophic (= hypereutrophic [nutrient rich]) is shown in Table 12.

Although both nitrogen and phosphorus contribute to eutrophication, classification of trophic status usually focuses on that nutrient which is limiting. In the majority of cases, phosphorus is the limiting nutrient. While the effects of eutrophication such as algal blooms are readily visible, the process of eutrophication is complex and its measurement difficult. This is not the place for a major discussion on the science of eutrophication, however the factors noted in Table 13 indicate the types of variables that must be taken into account.

Because of the complex interaction amongst the many variables that play a part in eutrophication, Janus and Vollenweider (1981) concluded that it is impossible to develop strict boundaries between trophic classes. They calculated, for example, the probability (as %) of classifying a lake with total phosphorus and chlorophyll-a concentrations of 10 and 2.5 mg/m3 respectively, as:

|  |  |  |
| --- | --- | --- |
|  | **Phosphorus** | **Chlorophyll** |
| Ultra-oligotrophic | 10% | 6% |
| Oligotrophic | 63% | 49% |
| Mesotrophic | 26% | 42% |
| Eutrophic | 1% | 3% |
| Hypertrophic | 0% | 0% |

The symptoms and impacts of eutrophication are:

 Increase in production and biomass of phytoplankton, attached algae, and macrophytes.

 Shift in habitat characteristics due to change in assemblage of aquatic plants.

 Replacement of desirable fish (e.g. salmonids in western countries) by less desirable species.

 Production of toxins by certain algae.

 Increasing operating expenses of public water supplies, including taste and odour problems, especially during periods of algal blooms.

 Deoxygenation of water, especially after collapse of algal blooms, usually resulting in fish kills.

 Infilling and clogging of irrigation canals with aquatic weeds (water hyacinth is a problem of introduction, not necessarily of eutrophication).

 Loss of recreational use of water due to slime, weed infestation, and noxious odour from decaying algae.

 Impediments to navigation due to dense weed growth.

 Economic loss due to change in fish species, fish kills, etc.