Eutrophication And Aquatic Weeds

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Eutrophication — a well used word in this the computer age. For all practical purposes it means aged, aging or on the decline. It would be impossible to describe the many causes of eutrophication in Florida's waters, consequently, this paper will present the causes and sources of why a lake or stream becomes eutrophic. The word nutrification is alsost synonymous with eutrophication as for most instances this causes the problems of aging within waters.

In general when a lake receives artificaial nutrients (fertilizers) accelerated eutrophication occurs. Examples of man's devious deeds in this manner are pointed out in the literature by the numerous reports on Lake Erie, Lake Apopka and many others.

The entrance of artificial nutrients into Florida's waters normally causes one of three (3) problems: t

1. Tremendous algae (Plankton) growths.
2. Abnormally large growths of floating plants (Hyacinth)
3. Dense rooted aquatic plant growths.

The real problem with nutrients and the ever growing aquatic weed problem, lies in the fact many of these plants will grow profusely in waters of low nutrient content.

SOURCES OF NUTRIENTS

For simplicity this discussion will review source of nitrogen and phosphorus nutrients, but it must be kept in

mind that a proper carbon-nitrogen-phosphorus (*C-N-P*) ratio plus trace elements are essential for all plant growths.

The many and numerous technical journals in the Engineering, Chemical and Biological fields are constantly reporting how, when, and where these nutrients occur. It is anticipated as technology on this subject increases so will the findings of the many observers.

Nutrient sources can basically be broken down into two categories as follows:

NATURAL: Rainfall, dust particles, ground water leaching, decaying plants, drainage, bottom deposits recycling and many others.

ARTIFICIAL: Treated sewage, agricultural discharges, overland drainage, decaying plants, industrial waste, lawn fertilizer seepage and etc.

Nutrients from rainfall were reported by Chalupa[1] to be upwards of 750 grams of P_2O_5 into a 100 acre lake over a seven (7) month period. Within the Central Florida area, phosphates values of 0.03 - 1.13 mg/L (PO_4) have been obtained with ammonia-N of 0. - 0.88 mg/L, Nitrate-N of .20 - 1.76 mg/L and organic nitrogen-N of 0 - 1.65 being observed during February to May, 1969 The Federal Water Pollution Control Administration[2] sampled rain within the Lake Apopka area in March 1968 and from their preliminary results and a rainfall of 50 inches per year values of 4 - 10 lb/ac/yr nitrogen and 0.5 - 0.7 lb/ac/yr phosphorus (P) were reported.

The literature cites Hutchison[3] with results comparable with the Federal Water Pollution Control Administration figures.

Ground water leaching could in some instances be a rather large natural source of nutrients as indicated by shallow well sampling around selected lakes in the Central Florida area. Total phosphate values ranging from .09 - .30 mg/L as PO_4 have been found. While concentrations of nitrate-N of .05 - .26 mg/L, Ammonia-N of 0 - .18 mg/L and organic Nitrogen-N 1.77 - 3.70 mg/L have been reported.[4]

The amount of nutrients from decaying plants is somewhat difficult to estimate due to type, density and other variable conditions which might occur. Blackburn[5] reported dead and dying hyacinth have a very high B.O.D. loading. It is assumed some of the loosely bound nitrogen and phosphorus compounds would be released from dying and dead vegetation.

It is extremely difficult to determine an exact numerical figure for recycling of nutrients from bottom deposits. In general, shallow lakes (6 - 15′ deep) where wind action will stir bottom sediments will recycle 2 - 10 times those bottom deposits in deeper lakes (30 - 50 ft. deep). Those lakes with natural thermal or other stratification layers, where anerobic conditions occur, will show increased Ammonia-N presumably from the bottom material.

Nutrients from artificial sources are generally discharged at much higher values. The validity of this statement is shown by reviewing data on the total phosphorus (as PO_4) from the conventional secondary sewage treatment plant in Central Florida. On the average these plants discharge total PO_4 ranging from 10 - 70 mg/L while Ammonia-N was found to be from 1.0 - 25.0 mg/L; Nitrate-N from 1 - 10 mg/L and organic nitrogen from 10 - 25 mg/L.

Agricultural discharges vary in nutrient contents depending usually on type of crops grown, rainfall and amount of pumping into the water course.

Data obtained by Eck[6] in Wisconsin related that 18 pounds of nitrogen-N and 0.5 lbs. of phosphorus per acre could be carried into watercourse from agricultural run-off. Sampling of the farming discharges, by the Orange County Pollution Department, (north shore Lake Apopka) indicated when pumps are in operation approximately 2,000 lbs. of ortho phosphate (PO_4) and 4,000 lbs. total nitrogen-N (NH_3-N + $N0_3$-N + NO_2 + org. N) per day are discharged into Lake Apopka, from this farming area.

Storm water in urban areas has a tremendous effect on increased nutrients contents within lakes. Sawyer[7] found that the storm water in the Madison, Wisconsin area had 0.22 mg/L soluble phosphorus and 0-3 mg/L organic nitrogen. While in the Seattle area, it was found the nitrate level went as high as 4.2 mg/L from urban street drainage. Sampling in the Orlando, Florida area has related 0.05 - 10.0 mg/L total phosphate (PO_4), 4 - 6 mg/L nitrate-N, 0 - 1 mg/L Ammonia - N and 0 - 1.5 mg/L organic-N. These figures might be more appropriate for the Central Florida area.

Data obtained from shallow leaching wells around Central Florida lakes surrounded by groves and well fertilized lawns have indicated substantial amounts of phosphorus and nitrogen material.

It is estimated that the removal of phosphorus and trace materials is most likely the key to success in controlling nutrients where they do not cause obnoxious algal or aquatic weed growths.

It is important to establish a level of phosphorus, nitrogen and trace material each individual water course can tolerate without being out of balance. It has been calculated that 0.015 mg/L (PO_4) soluble ortho phosphate in a lake at the start of a growing season will result in algal bloom during the summer months.[7] The Federal Water Pollution Control Administration report (Fertilization and Algae of Lake Sebasticook Maine" indicated the soluble ortho phosphate in this lake should be reduced to 0.02 mg/L (PO_4) to eliminate nuisance algae and weed growth. (Mackenthen[7] related in the literature the Upper Limit of Inorganic Nitrogen (NH_3+NO_2+NO_3+Organic-N) should be 0.8 lbs/per acre in any body of water at the start of a growing season, if nuisances are to be stopped. This figure seems to be somewhat high for waters with rooted aquatic weed problems. This latter statement is based on the fact that experiments by the range County Pollution Control Department and others have indicated that Hydrilla (Hydrilla verticillata) has grown successfully in distilled water. This fact occurred after the stem and leaf system died, which in decomposing released the necessary nutrients for new plants to grow and reproduce, causing the weed problem once more. It is assumed that concentration values much lower than those reported in the literature would have to prevail in Florida's waters if Hydrilla (Hydrilla verticillata) is to be controlled by this manner. It is assumed ortho phosphate values lower than 0.01 mg/L (PO_4) would have to prevail at the start of a growing season if Hydrilla is to be controlled.

Much more additional research work is needed on this subject for a definite conclusion to be reached. It is suspected that Hyacinths could possible be held in check (or possibly controlled) if phosphate values of 0.01± mg/L (PO_4) were maintained within the waters in the spring. The problem is however, that most of the time Florida's waters have natural nitrogen and phosphorus values higher than those desired for algae and plant control.

CONCLUSION

In summary it can be stated that there are basically two sources of nutrients — Natural and Artificial that is, supplied by man's activities. Further, the nutrient standards set for the control of most floating and exotic rooted aquatic plants would be difficult to obtain based on the fact many lakes and streams have values naturally higher than those desired.

The expected population growth will assuredly increase artificial nutrients in Florida's waters. This in turn, will cause accelerated and denser growth of all types of aquatic plants (Plankton, floating and rooted).

If we are to keep our waterways productive for all users, an economical solution to elimination of these artificial nutrients must be found. To do this additional man power and research must be forthcoming. *NOW!* If a delay occurs this will only result in more of our most precious natural resources "clean water" being destroyed.

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