

the ocean, rivers, streams, lakes, ponds, swamps, and ditches. There is no question that our waters are naturally rich in organic matter and other nutrient materials, which produces an outstanding and vigorous crop of all types of aquatic and terrestrial plants. The addition of waste water increases these nutrients, causing a heavy production of plankton, which in turn produces a heavy population of midges and of the mosquito Culex quinquefasciatus, a known carrier of St. Louis encephalitis.

Here, man is busy unbalancing nature in the hope of producing a better environment for the *Homo sapiens*. Just how far can man go or dare to go in these unnatural episodes is difficult to say. It can probably be said, however, that only time will tell, but time waits for no man and he who will not take heed of nature's warnings may do for himself and his fellow man irreparable damage.

It is my belief that today Florida stands at the crossroads. She has come a long way in the difficult struggle to eliminate the historical mosquito-borne diseases, and to eliminate tremendous environments of floodwater mosquitoes. This has made it possible for Florida's beaches and coastlines to develop.

Unless caution, wisdom and good judgment are used in the creating of impoundments and the pollution of water courses, the day may soon come when the yoke that once hung around the necks of the citizens of Florida of yesteryear may again come on the wings of the Culicidae to wreak havoc once again to its citizenry.

The one thing that may deter such a catastrophe is the diligent and proper control of aquatic vegetation. Four genera of great vectoring mosquitoes can be almost completely controlled at the source by controlling aquatic vegetation. Under these conditions, nature will have a chance to bring about a balance which must be maintained in all man-made endeavors if we are to keep Florida the crown jewel of the North American continent.

(¹) Steenis, J. H., Smith, L. S., and Cafer, H. P. Studies on cattail management in the northeast. N. E. Wildlife Conf., 1:149-155, 1958 (1959).

The Effects Of Aquatic Vegetation On Fish

By C. L. Phillippy

Fassett (1940) stated that the relations of plants to fish are complex and most statements in the literature are very general. He further stated that aquatic plants may serve as food, shade, protection to fish, support algae and small animals which are directly or indirectly food for game fish, form habitats for the deposition of eggs, and may aid animal life by oxygenating the water.

Lager (1956) said vegetation is of the greatest importance not only in providing food for the organism upon which stream fish live, but also in providing shelter for these organisms and for young fish as well.

Eddy (1957) stated that an abundance of organic matter, such as a heavy weed crop or even domestic sewage through the oxidation processes of decomposition causes a great oxygen consumption and often results in depletion of the oxygen. Eddy also said that minnows, bullheads, and other rough fishes consume large quantities of plant food. The game fishes are mostly predaceous, feeding on smaller fishes and on all sorts of other aquatic animal life such as are found in the root systems of certain floating aquatic plants and living on the leaves of some emergent plants. Eddy explains that we are just beginning to learn about the daily movements of many of our common fishes. Pike move into shallow waters during the day to feed and at evening pass into deeper waters outside of the weed bed to spend the night. On the other hand, the pikeperch move inshore at sundown and spend the night in shallow water moving outside the weed beds during the early morning to spend the day. Perch and sunfishes also exhibit similar daily movements.

Borgerson (1957) writing on home aquariums said no aquarium really needs plants. Their often-touted virtues as oxygen producers have been overrated, and people with the most know-how, tropical fish breeders and dealers, often make little use of plants, except for show, or for actual breeding.

He later states that plants do have functions. They do produce oxygen to a limited degree and they consume carbon dioxide, the fishes waste gas. They use organic refuse or fertilizer. Many fish instinctively deposit their eggs on plants and without plants they won't spawn. And plants provide hiding places for shy species, help all fishes feel at home.

Eipper and Brumsted stated some farm pond owners think that their ponds should be kept completely free of all plant growths. There is generally a definite advantage in controlling the amount of some plant life, but complete eradication of all forms is rarely necessary or practical.

In farm ponds, as in all waters, the microscopic, bloom-forming algae are important food for tiny animals which, in turn, may be eaten by fishes. High yields from bass-bluegill ponds and bait ponds require a heavy growth of these algae. Ponds used for growing bait minnows and other warm water fish are usually fertilized to encourage algae growth.

Even filaments algae and higher plants (especially submerged forms) increase fish production, particularly in trout ponds. They sometimes aid trout survival by keeping the water cool by shading. These plants may also improve trout growth by increasing the population of water insects, the chief food of farm pond trout.

In ponds used to raise bait minnows that lay their eggs on vegetation, small amounts of these plants are necessary for good minnow reproduction unless artificial spawning devices are used.

Aquatic plants are interesting forms of vegetation. They help to make a pond look natural and attractive to more varied groups of wildlife.

Stockdale (1960) stated that plants which grow under, on or out of the water may be undesirable in your pond from a variety of reasons. They may interfere directly with fishing and fish production. They may protect little fish, reducing the effectiveness of the bass as predators and hastening the day when the fish population will become unbalanced. Some plants may give the water an unpleasant smell. A mat of thread-like or filamentous algae floating on the pond's surface greatly increases the rate of water loss through evaporation.

Large plants, which have visible stems or leaves, are not needed for fish life. The microscopic plants in your pond will provide the necessary oxygen and plant food.

Klingman (1961) stated that aquatic weeds choke lakes, irrigation and drainage ditches, interfere with swimming and fishing, foul electric and outboard motors, and may cause undesirable odors and flavors in the water.

On the plus side, they may reduce erosion along shore lines, and some plant species provide food and protection for fish, fowl, and game. Algae are the original source of food for nearly all fish and marine animals; and swamp smartweed, wild rice, wild millet, and bull rushes provide food and protection for waterfowl, especially ducks.

Controlling aquatic weeds sometimes causes problems other than those of the chemical itself. For example, rapid killing of dense, weedy growth may kill the fish. This may happen even though the chemical is non-toxic to the fish.

During photosynthesis living plants release oxygen and fish depend on this oxygen for respiration. When plants are killed, they produce no more oxygen. Worse yet, dead plants are decomposed by microorganisms which require oxygen for respiration. These two actions may reduce oxygen content in the water so the fish suffocate. The answer is to treat part of very heavily infested areas at one time; fish will move to the untreated part.

Fassett in his book "Manual of Aquatic Plants", lists many plants compiled by Leopold and Huff which have a relationship to fish. A part of the list is as follows: Water plantain — shade and shelter for fish; Water shield — shade and shelter; Fanwort — cover and valuable food producer; Coontail — good shelter for young fish and supports insects valuable as fish food; Chara — fair shelter and excellent producer of fish food especially for largemouth bass, has a softening effect on water; Needle rush — forms spawning ground for largemouth bass; Mud plantain — food and shelter; Rush — forms spawning grounds for rock bass, bluegills and other sunfish; Duck weed — poor food producer and excessively shady; Water meal — good food and cover; Najas — good food producer and shelter; American lotus — good shade and shelter; Spatterdock — shade and shelter some species leaves harbor insects; Pondweed — food and shelter, leaves eaten by bluegill, softens water removing lime and carbon dioxide; Bulrush — used for nesting by blue-

gill and largemouth bass, good food and cover; Cattails — supports insects; Bladderwort — good food and cover; Eel grass — good shade and shelter, supports insects, and is valuable fish food.

H. S. Swingle and E. V. Smith (1943) reported that they planted Chara in Lake Auburn and allowed cattails to grow around the edge. Lake Auburn is located 5 miles from Auburn, Alabama, and was the subject of a 10 year study to determine the effects of fish management practices. The study was reported in two periods and Swingle states that during the second period, no pond weeds were allowed to grow in the pond and all cattails were removed from the edge because experiments had shown that the growth of plankton, instead of weeds, would result in greater fish production and better fishing at the start of the second period. Swingle decided to flood a luxurious growth of jungle-rice which had grown on the pond bottom while the dam was being repaired. These decaying weeds furnished an abundance of food in the pond from August to December, 1938. Their use for this purpose was found to be a mistake since the lignified stems were resistant to decomposition and wherever present interfered greatly with fishing during the next two years.

As you can see from the literature that I have cited above, there are two sides to the problem of aquatic vegetation in fishing waters.

I would like to point out that in the case of pond management (water areas under 5 acres) most authors agree that the presence of algae as a source of fish food is desirable. The Florida Game and Fresh Water Fish Commission recommends land owner to add fertilizer to ponds to increase algae and plankton growth for two reasons.

1. To provide a source of food for young fish.

2. To help prevent sunlight from reaching the pond bottom in order to stop the growth of the higher aquatic plants.

The question of the higher aquatic plants is more complex. Large concentrations of water hyacinth and water lettuce can interfere with lake and river navigation. On the other hand the root systems of both hyacinth and water lettuce are filled with aquatic insects on which largemouth bass and sunfish feed. In closing I would like to point out the fact that very little work has been done on the relationship of aquatic vegetation to fish life in the State of Florida.

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The Value Of Water Hyacinth In The Propagation Of Fish

By Captain Noah J. Tilghman

A life long resident of Putnam County, reared on the St. Johns River and Palatka, I feel qualified to explain the value of water hyacinth and its importance with nature in the development of our natural resources "FISHING".

For the love of boating and sports fishing, I started making

this my career about 1912, with the purchase of a 43 ft. Cruiser, and several fishing boats. We would entertain out-of-state visitors black bass fishing, for periods of three days to a week. The interest and pleasure of our clients justified the building of Noah's Ark in 1930, which has been a successful operation.

Florida's first water hyacinth was placed in the St. Johns River by a winter visitor, Mrs. W. F. Fuller at San Mateo, five miles south of Palatka. This beautiful flower attracted much attention, and has a rightful place in this land of flowers. We have entertained many parties that would make reservations so as to be here when hyacinth are blooming. To catch a big bass along this green shore line of blooming hyacinth, results in return reservations.

Stationary hyacinth along a shore line where the water is about two to four feet deep is a haven for all kinds of bug life, especially along a wooded area where spiders and frogs inhabit for their food like midges, candleflies. In hyacinth roots are found hardback shrimp, crawfish, and other water bugs, the kind of food required for small fish of all kinds. From the time a fish is hatched from an egg it starts seeking cover, or be devoured by larger fish. There is no better cover than hyacinth roots and between the leaves.

Hyacinth roots extend about 12 to 15 inches in the water, making it possible for fish to feed under and between the roots. It is an old custom for fishermen to make a hole in a hyacinth bank, drop a hook and bait just below the hyacinth roots and you are most certain to catch your fish.

Hyacinth are a floating plant, feed entirely on substance in the water, therefore, this growing plant aids water purification and life, needed for fish propagation. Dead or rotten hyacinth on the water surface or the river bottom are a menace for Nature's act of producing life and beauty for man, fish, or beast.

Growing hyacinth along a shore line prevent bank erosion, by quieting the waves, and water around the tree roots, from washing sand and soil, that does in time fall the trees. Fish definitely require shade and avoid high temperature of water during summer months. Hyacinth provide shade and cools the water from a direct sun-ray, reducing the water temperature.

We now know from experience green growing water hyacinth are an asset to the propagation of fish in the St. Johns River. Fishing records and harvesting of commercial fish produced the greatest catches during the time when water hyacinth were most plentiful.

Hyacinth spread around the roots of orange trees have proven beneficial to the growth of the trees and growth of the fruit. The problem of the farmer is to harvest hyacinth from the water. When hyacinth are made available in a package, so they can be handled profitably, farmers will learn their value used as a mulch in Florida's sandy soil.

Drifting acreage of hyacinth in navigable streams are a menace to boat navigation, which is necessary to control. Hyacinth acreage can easily be removed by the use of a power harvesting machine placed on the bow of a boat. The harvester designed with an elevated conveyor moving hyacinth into the boat hull. A hay-baler conveniently placed in the boat, where hyacinth can easily be dumped, will pack and bundle them in packages the size that can easily be handled. A boat loaded with bales of hyacinth moved to the river bank, where they are unloaded, provides the farmer with a good mulch around tree roots that will hold moisture and fertilizer in sandy soil.

The use of 2,4-D has no good results, and should be used only in extreme necessity for clearing water-ways and boat navigation. It not only kills hyacinth but other plant life, growing flowers, and farm produce. It should be the objective of every Floridian to want to keep Florida green and productive for nature's beauty, and the joy of living in a live and productive outdoors.

Herbicide Operations In Relation To Water Supplies

Florida State Board of Health Bureau of Sanitary Engineering
Division of Water Supply

S. N. Finney, Jr.

The use of weed killers, herbicides and related chemicals on