Presented at meetings of the North Central Weed Control Conference, December 10-12, and submitted for publication.

Original: To B. H. Grigsby for publ. in Proc. of the N. Central Weed Control Conf.

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December 31, 1956

Report No. 1500

Aquatic Vegetation Control in Fisheries Management

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The abundance of plants in a lake, pond or stream has far more than a casual relationship to the quantity and kind of fish one finds. Although most fresh-water fish eat little if any plant food, they are nevertheless dependent upon plants for survival. This dependency of fish life upon plants is indirect and is through a food chain. This food chain is summed up rather well in a Chinese proverb.

> "Large fish eat small fish,
> small fish eat water insects,
> water insects eat plants and mud."

A guiding principle that many fresh-water biologists defend quite zealously says that every lake, pond and stream has a more or less fixed capacity for the production of plant life. This capacity is thought to be dependent upon the water body's size, shape, bottom soils and upon the amount of mineral nutrient contained in its water. If our food chain proverb is correct then one might expect the poundage of fish produced in our waters to be limited by the poundage of plants. For many years this idea has been defended quite vigorously by some fisheries workers. Today I think most workers agree this theory holds true within wide limits. It is possible, in fact, to increase the poundage of fish by adding fertilizers which stimulate plant growth. However, considerable evidence has accumulated during the last 30 years which indicates that the various kinds of plants found in our lakes and ponds are not equally beneficial to fish life.

Embody (1928) noted that the more desirable fish food organisms such as water fleas and midges were most abundant in ponds that had few or no weeds. He advocated ridding ponds of all pond weeds, water weeds, cattails and other emergent types so that unicellular algae or waterbloom would flourish. He suggested that there was active competition, between higher plants and the unicellular algae, for the mineral nutrient resources of the pond. Much later (1949) Hasler and Jones demonstrated experimentally this antagonistic action between higher plants and algae. From a study of West Virginia fish ponds, Surber (1945) also concluded that the algae which give waterbloom, chiefly the Chlorophyceae, are much more desirable than filamentous algae, stonewort (Chara), water weed (Anacharis) and various pond weeds (Potamogeton).

Since these conclusions were drawn from small pond studies, it is logical to ask whether or not the same conclusions have been reached from studies of our larger natural lakes and impoundments. Here we find little in the literature to guide us, and it would be dangerous to give a definite answer. Some studies we recently made lead me to believe that the antagonistic relationship between weeds and algae noted in the case of ponds also holds for some of the larger natural Michigan lakes. When the average quantity of phytoplankton (waterbloom) present in eight lakes which we studied intensively in 1953 was plotted against the percentage of the lake basin covered by weeds, we found a reciprocal relationship. Lakes with many acres of weeds tended to have little waterbloom while those which on the average had much waterbloom possessed few weeds. The question whether the weedless or weedy lakes produce the greater quantity of desirable fish still has not been answered.

Excessive weed growth may be detrimental to the production of a desirable fish crop in a second way. Two Alabama workers (Swingle and Smith 1941) recommended elimination of heavy weed growth in ponds as a means of preventing overpopulation and stunting of pan fish. These authors found that weeds tended to

hide young pan fish from predacious species such as largemouth bass. Thus the pan fish were not held in check and so many young fish survived that there was starvation and poor growth. Ridding the pond of weeds allowed the predators to bring the pan fish population back into balance with the food supply.

Apart from all considerations regarding fish we must also consider the fisherman and his ability to harvest the fish crop. A body of water may contain many fish but, if it is blanketed with weeds that foul-up the angler's motor, snarl-up his lures and hang-up his baited hook, it does not contribute much to our sport fishing resources. As shallow lakes and ponds age, they become weed-choked and their use by fishermen tends to decline, even though they have many desirable fish. From an accurate census of "fishing effort" on some Michigan ponds we are now attempting to find out just how much more fishing will be done on ponds after they have been cleared of weeds compared with the fishing they received while weed-choked.

Total removal of weeds is probably not necessary nor is it desirable from the fisherman's viewpoint. Alternating "bands" or "islands" of weeds surrounded by open water give open areas for casting and trolling and also create numerous "boundaries" between weed beds and open water where fish tend to congregate. We have learned that patches of weeds and other types of cover concentrate fish and thus make it easier for the fishermen to locate and harvest the crop.

I would certainly not wish to estimate what percentage of a lake should be allowed to produce weeds and what percentage should be converted to open water in order to obtain both a high production and a maximum harvest of game fish. This would probably vary considerably from lake to lake depending upon local conditions.

We need to know much more about how the fish population of a lake or pond responds to vegetation control before we recommend procedures that can be widely used in fisheries management. At the present time fisheries workers are

awaiting new chemical tools to use in their job of regulating this complex system of weeds, algae, insects and fish so that it produces the right kind of crop. The chemicals now available for control of weeds and algae are far from satisfactory. Aquaculture lags far behind agriculture in this regard, but I suspect that chemicals will ultimately be as important to the fish crop of ponds under intensive management as they are at the present time to field crops under intensive cultivation.

From data recently assembled from 240 lakes I have estimated that some 15 to 20 percent of the lakes of southern Michigan have serious weed problems. We should consider the part herbicides are destined to play in management of fish in these larger natural lakes. Many of these weed-choked waters have populations of slow-growing pan fish. Fishing is excellent if you like to catch 3- to 5-inch bluegills, but it is poor if you are interested in fish of 'keeper' size. Weed control on such lakes with chemicals now available is costly. The cost must be balanced against how much fishing is improved and how much we have increased the aesthetic enjoyment of fishing. From the facts available today it does not seem that weed control on large lakes can often be justified by its benefits to fishing. Discovery of better chemicals and a better understanding of fundamental lake biology may in the future create an important need for herbicides in managing the fishery resources of our large lakes.

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