

**DEPARTMENT OF COMMERCE  
AND LABOR BUREAU OF  
FISHERIES: AQUATIC PLANTS  
IN POND CULTURE, NO. 643**

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by John W. Titcomb

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# AQUATIC PLANTS IN POND CULTURE

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By JOHN W. TITCOMB

*Chief of Division of Fish Culture, Bureau of Fisheries*

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## AQUATIC PLANTS IN POND CULTURE.

By JOHN W. TIGGERS,

*Chief of Division of Fish Culture, Bureau of Fisheries.*

### POND CULTURE AND ITS APPLICATION.

Among the freshwater fishes most desirable for food purposes and for sport-fishing there are certain species, such as the basses, crappies, sunfishes, and catfishes, which are not susceptible to manipulation for the taking and impregnation of their eggs, but must be allowed to mate and select nests, on which the spawn is deposited, fertilized, and hatched in the natural way. For the cultivation of these species, therefore, it is necessary to provide surroundings fulfilling their requirements, and at the same time permitting control of the fish, which purpose is accomplished by the maintenance of natural or artificial ponds. These ponds are stocked with the maximum number of adult fish, and the young hatch in numbers abnormal for the volume of water in which they are contained, there to be reared for a few weeks or months and then distributed to other waters as desired. The pond itself affords sustenance to the young, and therefore the pond is the direct object of attention in order to produce the maximum number of fish. Fish culture under these conditions is consequently intensive pond culture, and in the United States the term "pond culture" distinguishes this branch of fish culture from the propagation of all fishes whose eggs can be expelled and fertilized artificially or which are incubated in hatching houses by the use of special apparatus and equipment. The species to which it is applied are chiefly the black basses, crappies, sunfishes, and catfishes.

The propagation of the Salmonidae, notably the trouts, approaches pond culture in the fact that several species are often reared in ponds, whereas the other fishes hatched in special equipment are usually distributed as fry as soon as the yolk sac is absorbed. But although the cultivation of the trouts in this country may require ponds in which to rear the young, the different service the ponds perform and the different management required places American trout-rearing

methods outside the proper definition of pond culture.\* In Europe the case is not wholly similar; although in a few instances American methods have been adopted, the term "pond culture" usually embraces the rearing of trout by much the same methods as are in the United States pursued only with fishes that can not be artificially spawned—that is, the young trout may not be fed artificially, but often subsist in large part upon the natural food supply induced by culture of the ponds.

#### IMPORTANCE OF AQUATIC PLANTS IN POND CULTURE.

Since the young of the species of fishes to which pond culture is applied in the United States can not be successfully confined in the troughs or small ponds of the American trout breeder, and do not accept artificial food, they must depend for sustenance upon minute forms of animal life found in the waters and upon one another. At a very tender age they develop cannibalistic tendencies, and even where there is apparently an abundance of natural food they may reduce their own numbers 60 to 80 per cent within a month or six weeks from the time of hatching. It is therefore necessary in pond culture to provide not only sufficient natural food to satisfy the physiological requirements of the young fish, but, so far as possible, an abundance which will divert them from the tendency to devour one another.

Through the necessity for natural food, then, comes the primary importance of aquatic plants in pond culture. All animal life is dependent, directly or indirectly, upon plant life, the minute forms as well as many of the larger feeding directly upon plants, and the herbivorous species in turn serving as food for the carnivorous. The young fishes feed upon small crustaceans and other forms which are abundant only in an environment with abundant vegetation. Aquatic plants are therefore the food-producing agency in pond culture, and

\*It may not be amiss here to point out the distinction between trout culture by American methods and pond culture proper by reference to the procedure and the conditions at an American trout hatchery.

Trout are not dependent upon natural food, and do not require a natural environment. It is customary to rear them in wooden troughs or in small rectangular ponds of earth, wood, or concrete, through which there is a constant flow of water containing no visible plant or animal life. The water supply may have come directly from a spring or from an artesian well; at many of the most successful commercial trout establishments in the United States the troughs and rearing ponds are supplied with water from artesian wells from 25 feet to 100 feet in depth. As the daily feeding of a large number of fish in a confined area necessitates frequent cleaning, any seeds or spores of vegetation introduced by the water supply have little or no opportunity to obtain a foothold. The trout fry will eat artificial food from the time the yolk sac has been absorbed, and by a judicious arrangement of troughs, tanks, or small ponds the trout raiser can maintain a very large number of fish within a comparatively small compass until they are of satisfactory size for distribution or for market. His dependence is artificial food or the artificial introduction of natural food, and without these means he would be powerless to conduct operations on an extensive scale. In American trout culture aquatic vegetation, so essential in pond culture, is but a negative factor.

are accordingly indispensable. It is also obvious that by a judicious selection of plants the quantity of food can be maintained at the maximum, with corresponding results in the production of young fish.

It is the consensus of opinion among pond culturists that plants are also essential for the proper aeration of the water. At a trout hatchery the fish are supplied with the necessary air by means of a constant flow of water; in pond culture the volume of water supply is often little if any more than enough to compensate for evaporation and leakage, and the oxygenation from this source is limited. The balanced aquarium is a well-recognized illustration of the value of plants as oxygenators. Although there are many factors entering into the aeration of the waters at a pond-culture station that do not apply to the balanced aquarium, and it may be assumed that the larger the body of water the more must other factors than those of the balanced aquarium be considered, there can be no doubt as to the rôle of vegetation in the aeration of shallow ponds of limited area.

It is perhaps superfluous to add that submerged plants bind the bottom soil together, thus acting as a deterrent to turbidity from that source; and that plants doubtless facilitate clarification when the water of a pond has become turbid with surface drainage after a rain or from other external causes of a temporary character. The superintendent of the Tupelo, Mississippi, station, Mr. C. W. Burnham, cites as an evidence of this the numerous reservoirs or "tanks" in the West which are devoid of vegetation and in which the water is constantly roiled. It is possible that in some instances the absence of vegetation is due to the constantly roily water, a condition elsewhere referred to; but control tests in aquaria demonstrate that in an aquarium containing *Cabomba* the water is clarified much more quickly than in one devoid of vegetation. It is believed that if many of the so-called "tanks" of the Western States now devoid of vegetation could be stocked with water plants, these would not only prevent turbid water by binding the bottom soil together, but would under certain conditions prove an aid to clarification.

#### OBJECTIONABLE ASPECTS OF POND VEGETATION.

Notwithstanding their essential importance in fish ponds, however, and the careful effort requisite to the securing of suitable vegetation, in one aspect all aquatic plants are to the pond culturist wholly a nuisance and a necessary evil. The seining of the ponds, to obtain the young fish for distribution to waters they are intended to stock, or for other purposes, can not be accomplished while thick plant growth is present to entangle the fish and interfere with the operation of the seine, and there is thus a periodical necessity of clear-