

they are conducive to mosquito breeding and account for certain mosquito species prevailing in such areas. Research studies establish a definite correlation existing between these plants, which are found to directly and indirectly affect the Public Health and comfort. It is found that the hyacinth plant Eichhornia crassipes (Kunth), and the sometimes associated water lettuce plant, Pistia stratiotes (L.) and related floating weeds are responsible for many of our mosquito problems. The importance of these plants and their existing correlation to the past and current mosquito problems are hereby cited.

1. Both plants afford protection for certain mosquito larvae from predacious biological life, thus permitting their development.

2. Both plants are used as host plants by certain pest and disease bearing mosquitoes.

3. These plants interfere with the circulation of water and impede quick water run-off and drainage of certain marsh and low areas thus causing breeding of certain mosquito species as well as being responsible for breeding of the Glade Psorophora and flood water Aedes mosquito in temporarily impounded areas.

4. The cost of applying larvacide is increased when these plants are present in bodies of water to be treated.

In further elaborating on the protection of mosquito larvae from predacious forms of life, it is pointed out that the principal potential vector of malaria in the State of Florida is Anopheles quadrimaculatus, the larvae of which are surface feeders. The larvae of Anopheles quadrimaculatus and Anopheles crucians, a non vector, are found associated with water hyacinth growths. The correlation of the breeding of these mosquitoes to hyacinth growths is now an established and recognized fact, as it has been found that these plants harbor the mosquito larvae and otherwise protect them from fish and other beneficial forms of life which feed on the larvae. In areas where malaria is hazardous, the removal of the plants was one of the accepted control measures for controlling the breeding of the anopheline mosquitoes. Now growth hormones of the 2,4-D type have proven effective and relatively inexpensive.

The water hyacinth and lettuce plants are the host plants of three mosquito species, the larvae of which obtain their oxygen beneath the water surface, through the roots of these plants. Data compiled bears out the fact that the hyacinth plant, besides being a host plant of Mansonia perturbans (Walk.), has also been incriminated as a good host of two other Mansonia species, M. titillans (Walk.) and M. indubitans (D. & S.). The annoyance and density of Mansonia perturbans and Mansonia indubitans in certain sections in Florida are at times comparable to the annoyance and density of the "Salt Marsh Mosquitoes" Aedes taeniorhynchus (Wied.). All three species of the genus Mansonia constitute a mosquito problem that is difficult with which to cope — as regular surface applications of oils or preparations of insecticides in petroleum bases are not satisfactory for control, since the larvae are not surface breathers. If emulsions are used in sufficient strength to kill the larvae, injury to fish and beneficial life may result. Eradication of the host plants, which indirectly destroys the larvae, appears to be the most practical method of controlling these Mansonia species. The destruction of the water hyacinth plant would contribute greatly toward controlling these mosquitoes, and species of the Culex genus.

Hyacinth growths often cause barriers, thus retarding drainage of marsh areas and decreasing the circulation of water through constructed systems of mosquito control and drainage ditches thereby contributing to mosquito breeding. These obstructions cause dams, impoundment of water and high water tables which are conducive to mosquito breeding. The interference by hyacinths to normal water functions, further adds to the necessity and importance of a program for their control.

In treating bodies of water mosquito breeding is associated with hyacinths growths, a larger amount of the larvacide is required and the result of the treatment is not as effective. Thus, the cost factor is increased by hyacinth growths not only because of the material cost of the larvacide, but also because of the labor time element and the frequent periodic treatment necessary for adequate control.

On July 3rd the writer had the occasion to personally make observations by boat through the St. Lucie River, Lake Okeechobee and Caloosahatchee River. While enroute west, it was noted that from the second lock at Moore Haven and beyond the following lock, the Caloosahatchee River contained a mass of floating hyacinths drifting toward Ft. Myers. Evidently,

previous rains had broken up the masses of these plants in the adjacent ditches and tributaries. This poses somewhat of a complex problem to you people living here and interested in hyacinth control as this reservoir serves as a continuous source for reinfestation.

It is of interest to note that the hyacinth control methods tried and recommended up to 1899 and the experiments conducted incident to 1946 and also recommended included the following:

1. Physical transferral of the plants to adjacent dry land.

2. Towing to accumulation areas by means of rafts and nets and then destroying or allowing the masses to float out to salt water.

3. Burning.

4. Spraying with chemicals including salt water, muriatic acid, sulphuric acid, carbolic acid, kerosene, mixture of salt water and quick lime.

5. Placing log booms so as to permit flotation downstream, but prevent plants drifting upstream.

6. Mechanical destruction by cutting or chapping.

All of these methods were relatively ineffective, costly or for other reasons not desirable. Now, fortunately, with the advent of 2,4-D, we have a chemical that can be successfully used for hyacinth control, thus directly and indirectly increasing the efficiency of our mosquito control program.

History Of Hyacinth Control In Florida

By Angelo Tabita¹ and John W. Woods²

Synopsis

Removal of the water hyacinth from the waters of the State and the search for efficient means of accomplishing destruction or control started before 1900, not too many years following the plant's introduction and the beginning of rapid spread. The Corps of Engineers — by authority of the Congress of the United States — and the Florida Game and Fresh Water Fish Commission are two of the principal agencies which have played a significant role in the battle against the water hyacinth. The activities of these two agencies are described herein.

Introduction

The history of man and often his survival has been one of endless battle against the forces of nature. At the outset, and surely by design, the pressures of vegetable and animal life for a dominant position on the earth were kept in balance. Often, by accident, displacement will upset a natural balance and other forms of life are endangered unless a check is provided. This has been the case of the water hyacinth in the United States where in the absence of natural enemies to inhibit its spread it has been necessary for man to employ all possible means to destroy it or prevent its further incursion. Losses from hyacinths and other undesirable plant growth have been tremendous. This paper describes, mainly, the roles of the Corps of Engineers and the Florida Game and Fresh Water Fish Commission in hyacinth control in the State of Florida.

The Water Hyacinth

Description. The water hyacinth is a fresh-water, free-floating plant with bulblike leaf bases and a bushy mass of fibrous roots 6 to 24 inches long. The plant varies in form and size; it has dark green leaves and a spike of lavender flowers. The plant produces seeds which either settle to the bottom or become enmeshed in the mat of floating vegetation; they may germinate after being dormant for 7 years or more. Two crops of plants will mature directly from the seeds during warm weather months, and a third crop will be in such condition as to mature early in the following spring. The principal method of reproduction is by stolons which develop rapidly into healthy plants that generally break away from the parent plant and produce their own individual stolons. The plants have a water content of 94 percent. They form a dense mat on the water and are capable of doubling in area every month of the growing season.

History. Accounts vary as to the origin of the hyacinth and the manner of its introduction into this country. It is believed to be a native of tropical South America and it was introduced into this country many years ago. Earliest accounts indicate

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that the plant was observed in Louisiana in the 1860's. It has been said that several plants were brought to Florida in 1884 by a visitor returning from the Cotton States Exposition in New Orleans who placed them in a lawn fountain on the banks of the St. Johns River near Palatka. The plants multiplied rapidly and the excess growth was thrown into the nearby river. By 1896 the hyacinth had spread throughout most of the St. Johns River Basin. By 1900 the plant had so taken over the river at Palatka that steamboats and other craft were unable to reach the docks or pass through the navigation openings of the bridges. Since then the hyacinth has spread to such an extent that it exists or has been observed in almost all interior water areas of the State.

Extent in Florida. The total area of the State of Florida is about 58,600 square miles, of which about 4,000 square miles or about 7 percent is fresh-water surface. This does not include the innumerable swamps and water-retention areas which serve as natural habitat for the many species of water weeds. There are 27 major basins in the State which include numerous named streams and waterways with a total length of more than 8,000 miles. There are upward of 30,000 lakes in the State varying in size from ponds of a few acres to Lake Okeechobee, which has a surface area of 730 square miles. The largest drainage basins are the St. Johns, Kissimmee, Suwannee, and Apalachicola River Basins. About 50 percent of the Suwannee River Basin and 90 percent of the Apalachicola River Basin are within Georgia and Alabama. The combination of the abundance of surface water in the innumerable swamps, lakes, and sluggish streams, the natural fertility of those waters, and the warm, moist, subtropical climate is particularly conducive to the prolific growth of aquatic vegetation in Florida. Of the many species of aquatic plants, the water hyacinth is the most abundant of the obnoxious weeds. A survey of the major waterways and streams of the entire State completed by the Corps in August 1947 showed a total of about 63,000 acres of hyacinths. Since that date there have been phenomenal increases of infestation in some areas as the result of conditions favorable for regrowth, reseeding, and new growths. Areas and locations of hyacinths vary from time to time depending upon the climatic and growth conditions or the time of year and, to a great extent, upon control operations.

Federal Maintenance Project

General. The hyacinth problem was recognized by the Federal Government as early as June 1897 when Congress made an appropriation to pay the cost of an investigation of the obstruction of the navigable waters of Florida and other South Atlantic and Gulf States by the water hyacinth and of experimental work to determine some suitable and feasible plan for checking and removing such obstruction so far as it is a hindrance to interstate and foreign commerce. The Chief of Engineers recommended that two crusher boats be built (one for Florida); that log booms be used as an adjunct to the operation of the crusher boats; and that an appropriation be made to each district for conducting operations. The recommendation was adopted by Congress in the River and Harbor Act approved March 3, 1899 (H. Doc. No. 91, 55th Cong., 3d sess.).

Existing Corps of Engineers' project. This provides for the destruction or removal of the water hyacinth in the navigable waters of Florida, Alabama, Mississippi, Louisiana, and Texas, so far as they constitute an obstruction to commerce, using any mechanical, chemical, or other means whatsoever (except that in Florida the use of chemicals injurious to cattle is prohibited); for the construction and operation of boats equipped with machinery suitable for such destruction or removal; and for the use of booms to close sloughs and backwaters and prevent the drifting of plants from one stream to another. The existing project, Removing the Water Hyacinth from Navigable Waters in the State of Florida, was authorized by the River and Harbor Acts of March 3, 1899, June 13, 1902, and March 3, 1905.

Under the existing project, the destruction or removal of hyacinths has continued intermittently since 1899. Among the streams where operations have been conducted frequently are: St. Johns River, Okeechobee Waterway, Kissimmee River, Hillsborough River, and Withlacoochee River, and their tributaries. Numerous other navigable streams, creeks, canals, and lakes have been cleared of the hyacinth when required. The cost to June 30, 1961, for maintenance of the navigable channels in the Jacksonville District was \$1,861,788. The average annual expenditure for the past 10 years has been \$66,100.

Control methods under the project. This program confined the operations to navigation channels. Early operations utilized

considerable mechanical plant which was designed to operate at water depths of the navigable channels. These mechanical means will be mentioned very briefly herein since they will be described in greater detail in other papers to be presented at this second annual meeting of the Hyacinth Control Society. These mechanical means were: The derrick and grapple, which bodily removed masses of plants jammed against bridges or other restricted areas; conveyor belts, which picked up the plants and discharged them on the shore (these proved to be impractical for general use); and cutter or destroyer boats, which chopped up the plant masses (these proved to be very effective in opening channels massively clogged with hyacinths). In the last 15 years, destruction of the plant has been accomplished mainly by spraying with chemicals — principally compounds of 2,4-D — using boats, airboats, and aircraft.

Florida Game and Fresh Water Fish Commission

Fish and Wildlife Aspects. The hyacinth has encroached on many of Florida's public fishing waters. It has covered a number of the more easily accessible lakes completely eliminating fishing. In addition to the hyacinths, water lilies, bonnets and other aquatic plants have reduced available fishing waters in many areas. Game and panfish are adversely affected by hyacinths in several ways. Drifting mats of hyacinths in open water frequently cover spawning areas in shallow water occluding sunlight or sweeping away the eggs. By occluding the sunlight and blanking out other submerged plants that serve as hosts to aquatic organisms, the food supply is diminished or destroyed. Gars, one of the principal predators of game and food fish, can breathe air and are therefore the last fish to succumb to the lack of oxygen. As the game and food fish are forced to concentrate in the remaining open areas where there is ample dissolved oxygen, they become progressively more exposed to predators and lures of fishermen.

The U. S. Fish and Wildlife Service found that the water hyacinths and alligatorweed were particularly detrimental to fish and wildlife. In large open waterways drifting mats of hyacinths tear up beds of submerged food plants, defoliate floating leaf aquatics and overwhelm marginal food plants. As destruction of food plants progresses, the waterfowl concentrate on the remaining areas containing the food supplies thus exposing themselves to greater destruction by hunters and natural enemies and to increased parasitism and disease.

The Fish and Wildlife Service estimated the water hyacinths seriously interfered with the utilization of resources that furnish recreation, food and livelihood to an estimated 150,000 waterfowl hunters, 20,000 trappers, 150,000 sportfishermen, 225,000 cane pole fishermen and 7,500 commercial fishermen in the southern states.

Based on a 1947 survey on extent of infestation, it was estimated that fish and wildlife crop destroyed by water hyacinths each year in or portions of the six southeastern states of North Carolina, South Carolina, Georgia, Florida, Alabama and Mississippi alone was valued at about \$4,013,000. Eradication of the water hyacinth would eliminate this loss. Control measures would reduce it in proportion of the areas freed of hyacinths. An additional annual loss of \$873,000 was estimated to result from the presence of alligatorweed in the streams of the above southern states.

Programs. For protection of the fish and wildlife resource, early 1952 saw the beginning of an attack on one of Florida's foremost enemies of fresh water fishing; the water hyacinth. With the aid of the Dingell-Johnson Federal aid to fisheries funds which first became available in 1951, a limited program of controlling the obnoxious aquatic plants in fishing waters was started. Under this program public fishing waters where hyacinths or other plants had become a nuisance were treated with a chemical spray which killed the plants. The project program was equipped with a PA-18 125 h.p. airplane for spraying larger areas and a boat with a portable power sprayer to follow the airplane work on waters where the use of the plane was not feasible. All equipment and manpower for performing this necessary work was provided by the Commission with local interests reimbursing the Commission for the necessary chemicals and other materials used at cost. Preliminary surveys to determine the most practical method of control were made on 48 bodies of water. A total of 39 waters comprising some 3,209 acres of hyacinths had been treated up to the end of 1952. This program was described in detail by Luethy in 1955. Conclusions reached by Luethy during this program were: (1) exceptional results were experienced through the use of 2,4-D and specialized equipment such as airboats and spray planes;

(2) the hiring and continued employment of qualified personnel were necessary, (3) the total average cost per acre for hyacinth control during this period was approximately \$8.03, (the program's operational expense made up approximately 5/8 of this amount) and, (4) a preliminary survey is a prime necessity before undertaking any proposed project.

In 1953 the Game and Fresh Water Fish Commission carried on the hyacinth control project as a State operated project rather than on a Federal aid basis as originally initiated. An increase in the amount of funds resulted in a stepped up program but yet one that was still far from ample to meet the demands. The 1955 session of the Florida legislature appropriated a fund amounting to \$276,500 subject to the Florida State Cabinet to be administered by the Game Commission for hyacinth control over a period of two years. The Game and Fresh Water Fish Commission also placed in its budget \$100,000 for the control of noxious vegetation during this same biennium. At this time the local interests were no longer required to pay the cost of chemical, provided the lakes or other water areas were opened to the public. This program has been continued through appropriations from the State legislature and budgeted amount of approximately \$50,000 per year from the State Game Fund. These appropriations were made in the 1957, 1959 and 1961 sessions of the legislature. In 1959 as will be mentioned later, the legislature enacted enabling legislation so that the Game and Fresh Water Fish Commission would be the official agency of the State representing the State and local interests in an expanded aquatic weed project with the U. S. Corps of Engineers.

Expanded Federal Project for Aquatic Plant Control

General. A comprehensive study of the obnoxious aquatic plant problem was undertaken in response to a resolution of the Committee on Rivers and Harbors of the House of Representatives adopted February 6, 1945, which requested a "review of reports on water-hyacinth obstructions submitted in House Document No. 91, 55th Congress, 3d session." The results of that study — undertaken cooperatively by the Fish and Wildlife Service of the Department of Interior, the Department of Agriculture, the United States Public Health Service, and the Corps of Engineers — are contained in the report of the Chief of Engineers dated June 1, 1956, which was the basis of House Document No. 37, 85th Congress, 1st session.

Authorization and Act. This project was authorized by Section 104 of Public Law 85-500, 85th Congress, approved July 3, 1958, which reads as follows:

That there is hereby authorized a comprehensive project to provide for control and progressive eradication of the water hyacinth, alligatorweed, and other obnoxious aquatic plant growths from the navigable waters, tributary streams, connecting channels, and other allied waters in the states of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas, in the combined interest of navigation, flood control, drainage, agriculture, fish and wildlife conservation, public health and related purposes, including continued research for development of the most effective and economic control measures, at an estimated additional cost for the expanded program over that now underway of \$1,350,000 annually for five years, of which 70 per centum, presently estimated at \$945,000, shall be borne by the United States and 30 per centum, presently estimated at \$405,000, by local interests, to be administered by the Chief of Engineers, under the direction of the Secretary of the Army in cooperation with other Federal and State agencies in accordance with the report of the Chief of Engineers published as House Document Numbered 37, Eighty-fifth Congress: Provided, that local interests agree to hold and save the United States free from claims that may occur from such operations and participate to the extent of 30 per centum of the cost of the additional program: Provided further, that Federal funds appropriated for this project shall be allocated by the Chief of Engineers on a priority basis, based upon the urgency and need of each area, and the availability of local funds.

The report of the Chief of Engineers referred to in the authorizing act provides:

***these local benefits warrant participation by local interests either by cash contribution or services in kind.

***with such modifications as in the discretion of the Chief of Engineers may be advisable.

Project in Florida. The current estimated cost of the 5-year expanded project in Florida is \$2,169,900, of which \$1,600,400 are Federal costs and \$569,500 are non-Federal costs. Of the

total estimated cost, about \$1,687,000 or almost 80 percent is for operation or field costs and the remainder is for engineering and research. Field operations under the expanded project were initiated in the spring of 1960; total costs as of the end of Fiscal Year 1962, including engineering and research, have been approximately \$1,070,000. The budget includes an allowance of some \$370,000 for the project in Florida for Fiscal Year 1963, which with the local share is a total of about \$510,000 for the program.

Local cooperation. The Florida Game and Fresh Water Fish Commission is the agency designated to represent the State in the Federal project. The 1959 State Legislature passed an act for the purpose of enabling the Commission to meet the requirements of local cooperation. A contract covering all work performed by the State under the project was negotiated with the Commission under date of March 22, 1960. As agreed, the local share is contributed as work-in-kind in view of the State's active role in weed eradication and its capability relative to personnel, equipment, and experience. In actual practice, the operational portion of the expanded project has been divided about equally between the Corps and the Commission. State work in excess of the local share and in accordance with the prescribed program is done on a reimbursable basis. Selection of specific work areas, based on extent of infestation and availability of funds, is made jointly by the State and the Corps of Engineers.

Operations. To date, work under the expanded project has covered about 60 percent of the State. Major watersheds in which operations are being conducted include those of the Upper St. Johns, Suwannee, Oklawaha, Withlacoochee, and Myakka Rivers, and Lake Istokpoga, as well as some of the smaller tributaries to Lake Okeechobee. Figure 1 shows the work areas in which operations are being conducted under the expanded project. Table 1 lists acreages by watersheds of hyacinths treated between January 1960 and June 1962. It should be noted that these figures include repeated or followup applications on the existing acreages to achieve eradication insofar as practicable.

TABLE 1

Hyacinth Acreages treated January 1960 through June 1962

State of Florida		
Watersheds or Areas	Estimated Acreages	Agency Performing Work
Oklawaha	4,300	Corps of Engineers
Lake Okeechobee minor tributaries	2,400	Corps of Engineers
Withlacoochee River	23,500	G. & F. W. F. C.
Upper St. Johns		
Headwaters to Lake Poinsett	5,950	G. & F. W. F. C.
Lake Poinsett to Lake Monroe	2,200	Corps of Engineers
Myakka	5,400	G. & F. W. F. C.
Hillsborough	1,750	G. & F. W. F. C.
Lake Istokpoga and Trib.	1,400	Corps of Engineers
Sante Fe	100	Corps of Engineers
Alafia, Manatee and Little Manatee	1,100	Corps of Engineers
Peace	3,500	G. & F. W. F. C.
Suwannee	2,900	G. & F. W. F. C.
West Florida areas		
Lakes Grassy-Munson Chain		
Bayou Chico, Martin Bayou, Lynn Haven Lake, Lake Wimico	810	G. & F. W. F. C.
Total	55,300	

Research. The expanded Federal project provides for continued research for development of the most effective and economic control measures. While research efforts in the Federal program have, to date, been concentrated on the alligatorweed, considerable progress has been made in the research for better ways of eradicating the water hyacinth and other obnoxious aquatic plants. One of the more promising herbicides against water hyacinth is Amitrol-T. Indications are that this compound may destroy the hyacinth in one treatment. The bulk of the research program in Florida is being conducted by the Agricultural Research Service at its Fort Lauderdale laboratory. The work of that agency will be described in considerable

detail during this annual meeting. In addition to the Agricultural Research Service, research under the expanded project is also being conducted by the U. S. Fish and Wildlife Service, the U. S. Public Health Service, Auburn University, and the University of Southwestern Louisiana. Research into mechanical means is being done by the New Orleans District of the Corps of Engineers. It was estimated that the cost of the research in the 5-year program of the expanded project would amount to about \$575,000.

Benefits. In the preparation of House Document No. 37, cited previously, an estimate of benefits from the expanded project was made. For the area of the six southeastern states, it was estimated that the annual benefits for the 5-year program would amount to \$1,792,000. It was also estimated that at the end of the 5-year period, annual benefits would total to \$3,584,000. Benefits would be from navigation of principal waterways (\$100,000); from improved flood control, drainage, and irrigation (\$400,000); from increased crops of fish and wildlife (\$3,000,000); from decreased cost of malaria prevention (\$44,000); and from decreased cost of water supply treatment (\$40,000). The benefits would continue to be realized so long as the waterways were kept clear. For a 50-year useful life, beginning at the start of the 5-year program, the benefit to cost ratio was estimated at 15.3.

Work of Other Agencies

Other agencies have played an important role in the history of hyacinth control in Florida. Since this will be described by others, only brief mention will be included here. Other Federal agencies involved to some extent in the control of obnoxious water plants in Florida are the U. S. Fish and Wildlife Service and the Department of Agriculture's Soil Conservation Service and Crops Research Division. In connection with wildlife management for the Loxahatchee National Wildlife Refuge, the Fish and Wildlife Service makes periodic checks of undesirable aquatic plants in the area and engages in experimental and control operations. (The Loxahatchee Refuge—located in Conservation Area No. 1 of the Central and Southern Florida Project—consists of some 216 square miles of water-retention area). The U. S. Soil Conservation Service engages in cooperative management of about 2,000 ponds and small lakes in Florida in connection with fish farming, recreational activities, and wildlife conservation. Its work includes chemical treatment of floating and emergent species of water weeds.

Until about 1948 the Everglades Drainage District did considerable work in removing hyacinth from the Everglades canals. The District's work in that area was followed by the Central and Southern Florida Flood Control District which will maintain and operate, after completion, most of the flood control and drainage works of the Central and Southern Florida Project. The project encompasses an area of about 15,000 square miles in all or portions of 18 counties in south and central Florida. The District is concerned with maintenance of levees, pumps, canals, and control structures. Control of obnoxious water plants that may interfere with efficient operation

of those works is essential. In addition to a weed-control program conducted with its own forces, the Flood Control District maintains an annual cooperative weed research and control program with the Florida Game and Fresh Water Fish Commission and with the Agricultural Research Service.

Other State or local agencies conducting active weed-control programs are the Everglades Experiment Station of the University of Florida, the Dade County Water Conservation District, Lee County, Broward County Drainage District, and other drainage districts. Also, there are water companies, sportsmen's clubs, and county mosquito-control units which are engaged to some extent in obnoxious weed control.

Current Status and Progress

As stated previously, a survey of the State water areas in 1947 revealed a hyacinth infestation of about 63,000 acres. While current estimates for the entire State are incomplete, available information indicates that existing acreages are in the order of about 80,000 acres. This, however, does not present a true picture of the actual improvements that have been obtained in many areas as the result of hyacinth operations by the Corps in its regular maintenance program and under the expanded project, and by the operations of the Florida Game and Fresh Water Fish Commission, the Central and Southern Florida Flood Control District, and many other Federal, State, and local agencies. It was not too many years ago that many waterways were so clogged with hyacinths that navigation was virtually impossible. Today, many of these same areas are free of hyacinths with the possible exception of a few isolated areas. To cite an example—the current Withlacoochee River Basin acreage is about 1,500 as compared to about 7,500 acres in 1947, and in the Oklawaha River Basin there are about 800 acres compared to about 4,000 in 1947. Hyacinths multiply at a prodigious rate and with the favorable growing climate in Florida there is practically no halt to the growing process. Consequently, the operations to date for many areas have not only eliminated the increases but have reduced the stands. The situation in the Kissimmee River watershed—where operations are still limited—illustrates how severe the problem can become. The 1947 survey showed about 21,000 acres of hyacinths; a recent count shows about 40,000 acres, or almost double the acreage of 15 years ago. Without a measure of control, and based on the past trend, it is conceivable that in less than 50 years the approximately 130,000 acres of water area in the watershed would be filled with hyacinth growth.

If the progress obtained to date is to continue and if the hyacinth is to be eliminated, insofar as practicable, concerted and increased efforts on the part of those concerned will be necessary.

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