# Lake Apopka And Aquatic Weeds

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The problems associated with Lake Apopka are many and complicated but basically the lake is completely nutrified and in an accelerated rate of eutrophy. It is a lake that has been neglected by man and allowed to age or go down hill rapidly.

There are many reasons why this lake is non-productive at the present time. It has been determined by the Governor's Lake Apopka Technical Committee in their Final Report (September 1968), that there are three major sources of artificial nutrients entering the lake. These are: pumped discharges from a large truck farming interest on the north shore; citrus processing and sewage treatment plant efflents on the south shore. There are minor natural sources, being the springs in the Gourd-Neck area, ground water leaching and overland drainage around the entire lake.

A plan has been developed whereby these artificial sources of nutrients will be either isolated, diverted or treated prior to bing released into Lake Apopka.

This still leaves a second problem, a lake that has loose unconsolidated material on the bottom, and the waters above having a tremendous algal growth with very little rooted aquatic plant life throughout the lake. This loose unconsolidated material has caused a condition where game fish cannot spawn, and small organisms needed in the food chain cannot survive. Consequently, there is a tremendous population (±95) of gizzard and thread fin shad, gar fish and a small game fish population (±5%).

Many research projects have been enacted on the lake to ascertain the effects caused by this lack of aquatic weed growth. The lake must have a firm substrate which will support benthic organisms and provide a suitable habitat so game fish can spawn. In the summer of 1967, fish reefs were constructed of wood, concrete block, limestone, sand and hyacinths. Most of these cribs or pens were 12′ x 70′ long. All proved to be successful in raising a standing crop of fish food organisms.

The hyacinth pen was unsuccessful because wave action caused the plants to grate against the wire sides of the pen causing them to break apart. The limestone and sand reefs were the most practical to build and maintain. The limestone reef supported adequate fish food organisms. The sand reef provided a suitable spawning habitat for fish. The sand reefs could also provide suitable substrate for submerged aquatic plants to root.

Mud drying experiments were conducted by the Orange County Pollution Department to ascertain if there were seeds of both annual (land) and aquatic plants lying dormant in this loose mud and silt of Lake Apopka, and to determine whether or not this material (silt, muck, peat, detritus) would consolidate when exposed to the atmosphere.

In August 1967, bottom samples of Lake Apopka were obtained to initiate this experiment. The top 6 - 12 inches of the unconsolidated material was removed from the lake bottom by means of a two (2) inch clear plastic sampler. Samples were taken at water depths of 1, 3, 4, and 6 ft. depths (the lake was at an elevation of 66.5 ft. above mean sea level). Sample locations were on the north shore at the two story pump house, west at Smith's Island, Gourd-Neck area and on the East at Crown Point. Sealed wooden boxes 2′ x 2′ x 9″ high were obtained to hold the samples. The samples were placed in containers (to a height of seven (7) inches) and covered with window glass. They were allowed to dry for eight weeks.

After this eight week period plants grew in most all of the one (1) and three (3) foot samples. Most of these plants were marsh plants (found in areas that are normally both wet and dry depending on the time of the year). "There were not many upland plants and therefore it is doubtful that they seeded from surrounding areas". (1)

From a cursory reviewal of Table I *Lake Apopka Silt Drying Experiments* it can be observed many marsh plants grew in the one (1) and three (3) foot depths while few if any grew in the four (4) and six (6) foot depths. Numerous plants did grow at the six (6) foot depth in samples taken from Crown Point. This might be explained by the fact that this area is one of the most biologically productive areas remaining in the lake. This biological production is probably due to the sandy bottom material of Crown Point.

It can be concluded from the 1967 mud drying experiments that marsh plants would grow if the lake was drawn down three (3) feet to the sixty three and one-half (63.5 ft.) elevation, above mean sea level.

On October 15, 1967 the boxes were flooded with clear well water to ascertain what type of aquatic plants would grow after the extended (8 weeks) drying period. The boxes were kept flooded continuously until June, 1968 when they were allowed to dry out for two (2) weeks to simulate natural fluctuation of the lake. They were reflooded July 1, 1968 and kept full of clear water until October 1968. Essentially the same plants continued to grow (See Table I).

In August of 1968, duplicate samples were obtained at each of the sixteen (16) stations. The containers used to hold the samples were the bottom twelve (12) inch section

TABLE I. Lake Apopka Silt Drying
1967

| Location | Water Depth (feet) | Bottom Material | Amount Consolidated (inches) | Plant Identification |
|---|---|---|---|---|
| Crown Point | 1 | sand and shell | 3 | Not enough sample |
| Crown Point | 2 | sand and shell | 3.5 | 3 grasses<br>1 small arrowhead *Sagittaria* |
| Crown Point | 4 | sand and shell | 3.5 | 4 grasses<br>2 small arrowhead |
| Crown Point | 6 | sand and shell and some muck | 4 | 6 small cattain—*Typha*<br>1 small arrowhead<br>2 small pigweed—*Amaranthus* or *Achnida* |
| Smith Island | 1 | muck | 4.5 | 2 large pigweed<br>2 small pigweed<br>1 water hyacinth—*Ecchornia*<br>1 pickerelweed or arrow arum *Pontedaria* or *Peltandra*<br>1 *Umbelliferae* |
| Smith Island | 3 | muck | 5 | 4 pigweed |
| Smith Island | 4 | muck and shell shell (great shrinkage) | 4 | 1 pigweed |
| Smith Island | 6 | muck | 4.5 | 1 large sedge *Cyperus* |
| Gourd Neck | 1 | muck | 6.5 | 3 large pigweed<br>1 grass<br>1 rush or bulrush-*Juncus* or *Scirpus* |
| Gourd Neck | 3 | muck | 6.5 | 1 rush or bulrush |
| Gourd Neck | 4 | muck | 5.5 | nothing |
| Gourd Neck | 6 | muck | 5 | nothing |
| Two Story Pump House | 1 | muck | 4 | 37 pigwood<br>3 grass<br>2 sedge |
| " " | 3 | peat and shell | 3.5 | 3 pigweed |
| " " | 4 | peat | 2.5 | nothing |
| " " | 6 | peat | 1.5 | nothing |

of fifty-five (55) gallon drums. These drums were cleaned, scraped and coated with asphalt paint both inside and outside for protection. Once again the top six (6) to twelve (12) inches of the silt was obtained from the four (4) different locations. Each sample was approximately nine (9) inches deep and they were taken back to the Orange County Pollution Department laboratory in Orlando where they were then covered and allowed to dry for eight weeks. The plants in each container were then counted and identified. (See Table II).

After this, they were flooded, one set with Lake Apopka water, and the other set with clear water. Table II is only the data on the drums flooded with Lake Apopka water. Essentially the same results were obtained in the samples flooded with clear water. Also, samples from each of the sixteen (16) stations were taken back to the base camp laboratory where they were dried on the shore edge using the middle twelve (12) inch section of the fifty-five (55) gallon drums. A portion of the shore line was prepared with three (3) inches of coarse sand to support the samples. The containers (open on both ends) were submerged approximately six (6) inches into the lake edge on the prepared sand. As the lake level fluctuated it was hoped that this would simulate natural drying conditions. Unfortunately the lake rose a foot (approximately 67.5 mean sea level) during October, 1968 and was held at this level throughout the fall and winter keeping the containers inundated.

The complexity of the problem is indicated in the "State Board of Health Report, 1962 - 64 Physical, Chemical and Biological Report on Lake Apopka".

"Failure of the submersed aquatic vegetation to recover following the hurricane as a result of a reduced transparency of the water caused by the first algal bloom of record (DeQuine, 1950) is not, within itself, a complete explanation. The dependence of these plants upon the substrate was demonstrated experimentally by Bond (1918).

Vallisnerig (*Vallisneria spiralis*) was found to be dependent upon the soil for sufficient supplies of nitrogen jotassium and phosphates. While the uprooted plants were capable of synthesizing starch, they were unable to maintain a starch proteoid balance and died as a result of this inbalance.

The extent to which the litter of uprooted plants may have affected the regrowth of the remaining plants or the germination of seeds is also unknown. Viable seeds have been found to be present in the bottom muds. Since no tendency toward recovery was observed during the fall of 1962 and the spring of 1963 when the water was clear, it is obvious that conditions during the seventeen years subsequent to the hurricane have not been favorable or that other environmental conditions must be satisfied as a prerequisite". (2)

Comparing Tables I and II it would appear that drying would facilitate emergent shortline vegetation growth. Lily pads grew in the samples from Smith Isle and Gourd Neck. The only submerged aquatics noted was Chara and Sagitteria. Chara does not seem to be significant here, and the Sagitteria may turn out to be emergent rather than submerged. Clugston (4) reported that Lake Apopka supported Eel grass, Southern naiad and variable pond weeds all aquatics. Unfortunately, these did not grow during the 1967-68 experiment. This does not mean that they will not grow if the lake is drawn down and this loose unconsolidated silt allowed to dry out and other pollution sources are corrected.

With regards to mud consolidation, while all of the samples showed shrinkage during the drying period, samples with large amounts of plant fiber and one muck sample, seemed to suspend when they were reflooded (at the six (6) foot water depth). For most of the samples, after shrinkage and oxidation, they remained consolidated and did not resuspend.

From Table II, it is interesting to note that none of the mud samples consolidated to a high degree that were taken at the 6.5 foot water depth. (60.5 ft. above mean sea level). This would indicate that the lake level has never receded below a 59.0 to 61.0 ft. mean sea level for any extended period of time.

The conclusion of this experiment indicates that artificial substrate material of sand and limestone can be placed in Lake Apopka on top of the loose unconsolidated mud and will support suitable benthic organisms and probable game fish spawning. Further, from the drying experiments it was surmized from the 1967-68 experiments that when the bottom muds are dried out (to a water level of 59 to 61.0 ft above mean sea level) a balance of aquatic weeds and shore line (emergent) vegetation will grow. Further, the silt will oxidize and will not resuspend upon flooding. If a sufficient annual and aquatic plant growth prevails this would help to consolidate the bottom materials. From these experiments it can be concluded that if Lake Apopka is drawn down to a maximum of 59 to 61.0 feet above mean sea level for six to eight (6-8) weeks, during the dry season, a suitable aquatic weed growth should result. From all indications it might take more than one draw down to accomplish the desired results.

## REFERENCES


1. Carroll, Joseph D. Private communication with Mr. Joe Carroll, Jr., Fisheries Biologist, Bureau of Sports Fisheries and Wildlife, November 1967.
2. Florida State Board of Health, Physical, Chemical and Biological Report on Lake Apopka 1965.
3. Mr. G. Kenneth Schudder, Jr., U.S.D.A. Identified the annual plants.
4. Mr. James P. Clugston—Lake Apopka—"A Changing Lake and Its Vegetation." Florida Game and Fresh Water Fish Commission.


TABLE 2. LAKE APOPKA SILT DRYING—1968

| Location | Water Depth (feet) | Bottom Material | Consolidated (inches) | Condition After Flooding Lake Apopka $H_2O$ | Plant Identification Common Name | Scientific Name |
|---|---|---|---|---|---|---|
| Crown Point | 1.5 | Sand & Shell | 1.25 | Consolidated | | Polygonia Sp. |
| | | | | | Dog Fenel | Capillfoliam |
| | | | | | Fox Tail grases | Seteria Sp. |
| Crown Point | 3.5 | Sand & Shell | 1.0 | Consolidated | Careless Weed | Acnida Cuspidata |
| Crown Point | 4.5 | Sand & Shell | 1.5 | Consolidated | No uplands | Chara |
| Crown Point | 6.5 | Sand & Shell & Some Muck | 2.5 | Consolidated | No uplands | Sagittaria |
| | | | | | Arrowhead (?) | |
| Smith Island | 1.5 | Muck | 3.5 | Consolidated | Pickerel Weed | Pontederia sp. |
| | | | | | Careless Weed | Acnida Cuspidata |
| | | | | | Water lily | Nymphaea Sp. |
| | | | | | Soft Stem Bulrush | |
| | | | | | Pigweed | Amaranthus Sp. |
| | | | | | Upland | Unknown |
| Smith Island | 3.5 | Muck | 3.0 | Consolidated | Yerba deToga | Eclipta alba |
| | | | | | Careless weed | Acnida Cuspidata |
| | | | | | Soft Stem Bullrush | |
| | | | | | Water Lily | Nymphaea Sp. |
| Smith Island | 4.5 | Muck & Shell | 3.0 | Consolidated | Water Lily | Nymphaea Sp. |
| | | | | | Aquatic | Sagittaria Sp. |
| Smith Island | 6.5 | Muck | 2.25 | Unconsolidated | no | no |
| | | | | | | Heterotheca sp. |
| Gourd Neck | 1.5 | Muck & plant fibers | 4 | Unconsolidated | Yerba deToga | Eclipta alba |
| | | | | | Careless weed | Acnida Cuspidata |
| | | | | | Cattail | Typha sp. |
| Gourd Neck | 3.5 | Muck & plant fibers | 3 | Unconsolidated | Water Primrose | Jussiaea Sp. |
| | | | | | Soft Stem Bullrush | -------- |
| | | | | | Pickerel Weed | Pontederia |
| | | | | | Water lily | Nymphaea Sp. |
| Gourd Neck | 4.5 | Muck & plant fibers | 3.5 | Unconsolidated | Unidentified | Herothera Sp. |
| | | | | | Marsh plant | |
| Gourd Neck | 6.5 | Muck & plant fibers | 0 | Unconsolidated | Sedge | Cyperus odorata |
| | | | | | Water lily | Nymphaea Sp. |
| | | | | | Pickerel Weed | Pontederia |
| 2 Story Pump House | 1.5 | Muck & Peat | 0 | Consolidated | Careless weed | Acnida Cuspidata |
| | | | | | Grass | -------- |
| | | | | | Sedge | -------- |
| | | | | | Pickerel weed | Pontederia Sp. |
| 2 Story Pump House | 3.5 | Peat & Shell | 0 | Consolidated | Sedge | -------- |
| | | | | | Green algae | Chara |
| 2 Story Pump House | 4.5 | Peat | 0 | Consolidated | Sedge | -------- |
| 2 Story Pump House | 6.5 | Peat | 2 | Consolidated | Cattail | Typha |