AERF

Aquatic Ecosystem Restoration Foundation

2024 Aquatic Weed Tour

Table Of Contents

Aquatic Ecosystem Restoration Foundation, Inc.

Florida Aquatic Plant Management and Mosquito Control Tour

June 3-7, 2024

The first post-COVID AERF tour of aquatic/wetland systems was held in south-central Florida to demonstrate typical weed management and mosquito control activities operated by the various responsible public agencies. The primary purpose of these field trips is to provide an educational opportunity for pesticide regulators to learn about the objectives, coordination, and daily operations of the numerous governmental entities that utilize pesticides in public health and ecosystem management programs.

Day 1 (Monday, June 3, 2024): Participants arrived in West Palm Beach by noon and boarded a charter bus at the Airport Hampton Inn. Following lunch, the group visited the South Florida Water Management District (SFWMD) headquarters in West Palm Beach and spent the afternoon attending presentations designed to give them an overview and orientation of aquatic weed management in Florida and the District. The Florida Fish and Wildlife Conservation Commission (FWC) is responsible for aquatic plant management programs in most of the 1.25 million acres of water, lakes and rivers in the state. The FWC is the constitutional agency responsible for protecting and preserving the fish and wildlife resources of the state, and as such, maintain close coordination with other agencies responsible for water management, flood control, and other relevant water-related operations. The SFWMD was originally formed by the U.S. Congress in 1948 as the Central and South Florida Flood Control District following

the hurricane season of 1947, when over 100 inches of rain flooded the southern half of Florida for several weeks.

Almost all the aquatic weeds requiring control in the state are non-native species of foreign origin. The FWC utilizes an integrated approach to control both floating and submersed species using mechanical harvesting and biological control methods in addition to herbicides. The primary floating weeds requiring control throughout Florida are waterhyacinth [*Eichhornia* (*Pontederia*) *crassipes*] and waterlettuce (*Pistia stratiotes*), whereas target submersed weeds are primarily hydrilla (*Hydrilla verticillata*) with lesser amounts of limnophila (*Limnophila sessiliflora*), hygrophila (*Hygrophila polysperma*) and rotala (*Rotala rotundifolia*). Floating plants are generally less expensive to control because herbicide is applied directly onto the foliage, whereas submersed treatments have to overcome the dilution effect of the water. The goal of all weed management programs in the state is selective control of target weeds with minimal damage to native species to preserve habitat. This is not always possible, but the registration of additional herbicides in the past 20 years has allowed the development of more selective control of some species, and the use of a handgun to treat floating and emergent plants also contributes to less damage to native species. The practice of maintenance control (keeping weedy species at the lowest possible area through limited but frequent herbicide applications) is also practiced. Funding for FWC aquatic plant programs (around $30 million annually) comes from annual legislative appropriations. The FWC manages weeds in very diverse locations, purposes and situations (for example, to facilitate boating in urban lakes, swimming, fishing, hunting, fishing tournaments, wetlands, irrigation, potable water, etc.) and regularly holds public meetings to discuss lake management plans.

The five Water Management Districts in Florida were established in 1972 along hydrologic boundaries. These Districts often have responsibility for “District-owned lands and waters” and also have weed management programs. The SFWMD is the largest of Florida's Districts and includes central and south Florida, with the area of responsibility running from Orlando, some 250 miles down the Kissimmee River, through lake Okeechobee, and the Everglades into Florida Bay. During the early 20th century, six major canals were built to drain the marshes around Lake Okeechobee and to regulate water levels in the lake to conserve fresh water for use during the dry season. The SFWMD is responsible for maintaining these large flood control canals in a weed-free condition since the lake can fill much more quickly than it can be lowered. The Kissimmee River-Okeechobee waterway are federal navigable waterways. Thus, water levels, navigation and aquatic weed control in this sub-system of the SFWMD is the responsibility of the U.S. Army Corps of Engineers (COE). There are two other large water holding systems managed by the SFWMD that require aquatic plant management. The Water Conservation Areas (WCAs; around 100,000 acres) were built in the 1940s-1950s along the East Coast Ridge to conserve and replenish potable water well fields in urban coastal areas. Water quality issues in Lake Okeechobee in recent years have resulted in some large blue-green algal blooms in the lake and drainage canals and have caused encroachment of cattails (*Typha* sp.) into the native sawgrass (*Cladium jamaicense*)-dominated WCAs. To mitigate these undesirable events, the

SFWMD has built about 80,000 acres of Stormwater Treatment Areas (STAs), surrounded by earthen levees and divided into cells containing emergent and submersed aquatic plants. Water from the Everglades Agricultural Area (EAA) and Lake Okeechobee (delivered via the large SFWMD canals from Lake Okeechobee) are passed through these cells to reduce dissolved phosphorus levels in the water prior to pumping into the WCAs.

The SFWMD Plant Management Section holds weekly meetings with the FWC, the COE and the Department of the Interior (due to their operating WCA-1 as a Federal Wildlife Refuge) to discuss recent plant surveys and to plan and coordinate control operations.

The SFWMD staff also highlighted a very successful program begun in the mid-1990s to control highly invasive melaleuca (*Melaleuca quinquenervia*) trees in Lake Okeechobee and on District- and state-owned lands. Melaleuca trees were introduced to south Florida around 1900 and their seeds were purposely spread throughout south Florida marshes with the goal of draining and drying the soil via increased evapotranspiration. By the 1990s melaleuca trees had developed hundreds of dense monotypic tree islands throughout the lake and wetland areas. Glyphosate did not provide effective control and other herbicides that could kill the trees were not registered for aquatic use, so other than limited mechanical removal, little was done to control this species. The aquatic registration of imazapyr in 2003 provided a means to effectively control melaleuca trees via aerial treatment of monocultures and hack-and-squirt techniques in areas where desirable species were present. These initial treatments were followed up by annual helicopter surveys to seek and hand-pull any young trees encountered. This follow-up was very important, especially following wildfires or even prescribed burns, since these events stimulate germination of melaleuca seeds. In addition to these chemical control efforts, the COE, USDA and SFWMD funded the exploration for, evaluation of and release of two to three melaleuca-specific biocontrol agents which are now established and causing damage to remaining melaleuca trees in the area. Although this approach has not been widely reported, this very successful program has essentially eliminated melaleuca as a problem over two to three decades.

SFWMD staff also discussed their interest in using drones to increase access for treating difficult to reach spaces. For example, many urban canals have highway bridges over District canals; in order to treat these canals with herbicides, any boat being used to apply herbicides must be able to pass under the bridges or must be pulled out and re-launched on the other side of the bridge. This is very inefficient and drones could help with this problem, along with allowing managers to reach small, inaccessible areas during the dry season, locate and treat individual melaleuca trees in the marsh areas and conduct other management operations where access is limited. The District is interested in evaluating the potential use of drones and determining their potential for being integrated into weed management programs.

The Day 1 FWC/District presentations were an excellent introduction to the subject matter that we would see all week, and in particular provided a good introduction to the Day 2 field trip.

Attendees became comfortable asking questions and providing comments. The SFWMD staff emphasized the following:

1. Major drainage canals cannot contain any plant material that could damage or interfere with operation of the 90 pump stations that provide flood control for some 10 million residents of the area
2. Other than in flood control canals, integrated management and selective control of invasive plants is used to optimize water quality, wildlife habitat, etc. in the conservation areas and phosphorus removal in the STA systems
3. The FWC and SFWMD staff made it clear that coordination of weed management programs was critical and they work closely with COE as well as smaller coastal city flood control agencies as necessary
4. The staff noted two problems, both of which are currently under investigation. The first problem is identifying management strategies to control crested floatingheart (*Nymphoides cristata*), an attractive water garden ornamental that escaped cultivation and has invaded many of Florida's waters. The second problem is some farmers in the EAA allow aquatic weeds to accumulate in their drainage canals and then release them into the District flood control canals. This first problem is new, but the second is really old!!!

Day 2 (Tuesday, June 4, 2024): The morning was devoted to a SFWMD field trip to areas in western Palm Beach County where District staff described various locations and projects. A simulated drone application (using water only) was demonstrated in a District canal containing a small area of waterlettuce located several miles from a boat launch site. Using traditional

methods, it would take an hour or two to get a boat into the canal and down to the treatment site to treat these plants, whereas a drone could be launched and the treatment made in much less time. Drones are currently not used by the District, but the District has dedicated staff time to work with a commercial company to evaluate potential drone use. Drones typically apply very low volumes of herbicide mixes and questions arise not only regarding label language, but also about whether low-volume treatments will provide efficacy on target weeds and selectivity to native non-target plants typically realized with traditional higher-volume treatments applied with a handgun.

The use and characteristics of Pump Station S5A was described on the way to our next stop in STA-1. This pump station, located at the intersection of three major canals, is one of the largest shallow lift pump stations in the world. Built by the COE in 1955, it is now operated by the SFWMD. Its six pumps can pump an acre-foot (around 326,000 gallons) of water in 9 seconds into WCA-1 and WCA-2, STA-1, or the L8 reservoir as needed. The District has about 90 pump stations in their system, all of which must be protected from damage caused by the intake of aquatic weeds, trash or other foreign materials that would damage the pumps. The District maintains several floating debris barriers upstream of all pump stations to catch aquatic plants moving towards the pump intakes. Captured plants may be removed via mechanical means or treated with herbicides.

The next discussion with SFWMD staff occurred on a levee in the midst of STA-1 East. We observed many native emergent plants and very few invasive floating plants due to the District's management programs, which operate with the goal of keeping floating plants under strict maintenance control and maintaining phosphorus removal from the water. Depending upon rainfall, the STA may receive water from the EAA and/or Lake Okeechobee, which has phosphorus levels of 150 to 200 ppb. Following filtering through the STAs, the concentration of phosphorus in water entering the WCAs or Everglades National Park is usually less than 20 ppb. The District strives to maintain a constant sheet flow of water through the various vegetated cells in the STAs. We observed planting crews planting bulrush (*Schoenoplectus californicus*), a native emergent plant, into a channelized area to encourage more sheet flow in the cell.

Although melaleuca is essentially under control within the SFWMD, germinating seeds and seedlings remain a problem, particularly following a fire. To demonstrate this problem, we visited a new tract of land recently taken over by the District where extensive infestations of young melaleuca and Brazilian pepper trees (*Schinus terebinthifolius*) are present. We observed a private contracting crew walking along a line through the site, cutting these trees off near ground level with machetes, then immediately spraying the remaining 1 to 2" stump with a mixture of vegetable oil, herbicide and dye to prevent re-growth. GPS tracking was used to map the areas already treated and to re-align the crews to work another swath across the site adjacent to the previously treated area.

The tour then left the urban east coast and traveled northwest through the northern Everglades towards Lake Okeechobee. Enroute the group saw the sawgrass marshes in WCA-1, numerous

different size irrigation/drainage canals and sugar cane fields in the 400,00-acre EAA. The next stop was the University of Florida Everglades Research and Education Center in Belle Glade, where researchers study the various crops grown in the EAA and develop Best Management Practices (BMPs) to reduce soil loss and manage phosphorus content of drainage waters. The soils of the EAA are highly fertile organic (muck) soils derived from centuries of growth and decay of sawgrass and other marsh plants south of Lake Okeechobee. This area was all wetland prior to drainage projects initiated in the early 1900s. These rich, high organic matter soils need little fertilizer to grow crops but also oxidize when drained and exposed to air, resulting in subsidence (soil loss). A concrete pole was drilled into the organic soil to bedrock and cut off at ground level in 1924 when the research center was first established. Over the first 50 years the organic soils subsided at a rate of about 1” per year, but recently that rate has been slowed to about 1/4" per year. Agricultural BMPs in the EAA (rotating sugar cane with flooded rice, maintaining a higher water table in the EAA, reducing fertilization) have reduced both soil subsidence and the phosphorus concentration in agricultural drainage water.

Day 2 was very diverse and covered many topics but the highlights were:

1. Selective control is profoundly important in the 70,000 acres of STAs. These shallow reservoirs were constructed on former agricultural land over the past 20 years to remove phosphorus from water flowing south from Lake Okeechobee and the EAA. Selective weed control in the STAs is critical since emergent plants are usually planted in the first cells, followed by a combination of submersed and emergent plants in a second cell, with submersed plants in the final “polishing” cell. Floating waterhyacinth and waterlettuce are not tolerated in these areas since these mat-forming plants create anaerobic conditions in the water column under them, causing sequestered phosphorus to be re-released from the sediments
2. Aquatic vegetation, primarily floating plants moving with wind or water flow, can congregate at debris barriers stretched across canals, pump stations and other structures meant to regulate water levels. Some herbicide labels only allow one or two applications at maximum label rate per year, probably with the goal of preventing herbicide accumulation in agricultural soils. However, these rules should not be automatically applied to aquatic situations because we know that water flows or dilutes the herbicide to minimal concentrations over time
3. Label language on herbicides used in spot treatments for brush control such as glyphosate and others may indicate, for example, that the applicator may spot-treat with a 2% solution, but the total application rate should not exceed 4 pounds of active ingredient (a.i.) per acre. The use of GPS mapping tools to determine acres treated, along with the applicator recording the amount of herbicide a.i. used, makes it much easier in real time to remain within maximum label rates with spot treatments.

Day 3 (Wednesday, June 5, 2024): The group met at the COE South Florida Operations Office, Jacksonville District, conference room in Clewiston, Florida, located on the southwest side of Lake Okeechobee. The mission of the COE was established by the River and Harbors Act, first passed by the U.S. Congress in 1899 and since amended. This act authorized the COE to manage aquatic plants and other hinderances to navigation. The Jacksonville District provides services to other COE Districts under the Invasive Species Branch and is the designated Operations Support Center for COE efforts in protection of natural resources in the United States.

The COE aquatic weed management program is conducted in part under the Removal of Aquatic Growth (RAG) program, which is federally funded and responsible for weed control in navigable waterways. In Florida, that includes the St. Johns, Chattahoochee, and Kissimmee Rivers and the Okeechobee Waterway. The Aquatic Plant Control (APC) program matches state funding in other selected tributaries and state waters connected to Federal waters. The COE also cooperates extensively with Florida's Water Management Districts, particularly the SFWMD, under the Comprehensive Everglades Restoration Project (CERP).

The COE has in-house crews to manage aquatic weeds, principally floating plants, on the St. Johns River; however, management of plants in the Lake Okeechobee waterway is conducted by private contractors. The COE weed control projects involve extensive interagency coordination and keeping the public informed about future operations. The federal waterways in Florida, particularly the 450,000-acre Lake Okeechobee, are multi-use systems popular for fishing, hunting and boating while also serving as a source of potable water, irrigation water and water storage. Lake Okeechobee is critically important to some 10 million residents on Florida's east

and west coasts and not only provides potable water, but also protects the coastal aquifers from saltwater intrusion.

The COE has provided funds for research to identify biological control agents for aquatic plants and was one of the lead agencies involved in the release and establishment of the alligatorweed flea beetle (*Agasicles hygrophila*) for control of alligatorweed (*Alternathera philoxeroides*) in the mid-1960s. The COE also worked with the USDA-ARS Invasive Plants Research Laboratory in Ft. Lauderdale to seek successful biocontrol agents for melaleuca trees. The major weeds controlled in Lake Okeechobee are the floating plants waterhyacinth and waterlettuce. Mechanical harvesting of these floating weeds is mostly impractical on Lake Okeechobee since off-loading sites are far apart and plants may be in one location today and 30 miles away tomorrow. Control of these species is funded by the COE who work closely with FWC and SFWMD to avoid interference with major fishing tournaments or other potentially impacted water users. The COE/FWC-monitored private contractors are expected to cease operations when winds exceed 10 mph. All applicators have restricted use pesticide licenses issued by the Florida Department of Agriculture and Consumer Services (FDACS) and regularly attend training programs. Experience on the lake has clearly shown that maintenance control (maintaining floating plants at the lowest feasible level) results in long-term reductions in both total cost and herbicide use. An airboat tour along the Rim Canal and onto the lake allowed tour participants to interview an applicator who described a typical tank mix and demonstrated use of a hand-held spray gun. There were very few floating invasive plants seen, which is to be expected this time of year. The objective of maintenance control is to reduce plant populations to the lowest feasible level before the rainy season, wind season and high growth season, when exponential growth of waterhyacinth and waterlettuce can result in doubled population size in 6 to 8 days. A

discussion of endangered species revealed that the COE and FWC have extensive experience with the Everglades snail kite (*Rostrhamus sociabilis*) and the Okeechobee gourd (*Cucurbita okeechobeensis*). The COE has worked with FWC and U.S. Fish and Wildlife Service (USFWS) and together they have developed the following general guidelines:

a. Applicators must be cautious around nesting Everglades snail kites and must remain 500 m away from the nests during nesting season
b. The foraging zone around Everglades snail kite nests is 1500 m and only selective herbicides may be used in these areas
c. Growth of the Okeechobee gourd, also rare and endangered, seems to benefit from the management of invasive aquatic plants

The endangered species protection plans are being developed; in the meantime, applicators abide by the current USFWS guidelines.

The next stop on the way to Ft. Myers was the Clewiston Airport, where tour attendees visited Agricultural Air Services. This company is an aerial contractor for the SFWMD and has conducted much of the aerial melaleuca treatment work over the past 20 years. Company staff

demonstrated several control droplet nozzles, described the micro-foil/through-flow controlled droplet booms and outlined the areas that are treated, ranging from natural areas to agricultural operations. Safety and drift control is paramount in aerial applications. The “nurse truck” that supplies tank-mixed products to the helicopter has a large water-carrying capacity and, in a few hours, can utilize many 2.5-gallon pesticide containers. Triple-rinsing and re-using the rinsate from these containers would normally be time-consuming and tedious, but these managers have developed a system that rapidly punctures and cuts the empty container, then injects a strong water stream into the container to rinse it. The rinsate is collected in the same process and used to dilute the next mix batch that is loaded into the helicopter. Highlights of Day 3 include:

1. The COE and their contractors have done an excellent job of reducing floating plants on Lake Okeechobee to very low maintenance levels going into the summer growing season. We saw very few floating plants in the Rim Canal or in the marsh on the south side of the lake; however, we only saw a small portion of the lake! The cooperating agencies agree that maintenance control of floating weeds occurs when the total area of these plants in the lake is less than 500 acres. Submersed weeds have historically not been a major problem on the lake
2. Despite concerted efforts to increase public education and information sharing, Lake Okeechobee’s stakeholders still have major concerns over governmental regulation of water levels, weed control programs, water quality, endangered species, fish and duck populations, etc. Spray moratoriums in 1986 and 2019 caused the agencies to stop treating invasive weeds for several weeks. Following the most recent moratorium, it took 2 years and an estimated additional $2 million to return floating plants back to maintenance control levels
3. In Florida (and likely elsewhere), the vast majority of aquatic weed control herbicide use is undertaken by governmental agencies with in-house weed control staff or through contracts with private applicator companies. Although there are no restricted use herbicides labelled for aquatic use, essentially all of these applicators are trained and licensed. Licensure is typically required as a condition of government contracts and is also required by the management companies’ insurance carriers to limit liability and ensure that potential environmental damage in avoided
4. The registration of new herbicide modes of action (MOAs) for aquatic use in the past two to three decades has not only addressed the resistance issues of some aquatic weeds, but has also greatly improved selective control of many of the most serious weeds throughout the country. However, due to low market value and perceived high risk, the major agrichemical companies are reluctant to develop products solely to meet the needs of the aquatic plant management industry

Day 4 (Thursday, June 6, 2024): We visited Florida's east coast on Tuesday and the central southern region of the state on Wednesday, so Thursday's focus was Florida's west coast, where attendees visited the Lee County (Ft. Myers) Mosquito and Hyacinth Control District. The Mosquito Control District (LCMCD) was formed in 1958 and the Hyacinth Control section (LCHCD) was added in 1961. This program has been a pioneer and is well-known for providing leadership to the entire industry since its formation. Historically, aquatic weed control was the responsibility of county mosquito control agencies since the two disciplines are closely related, but state funding for, and oversight of, weed control in Florida's waters is now the responsibility of the FWC. Primary plants controlled by LCHCD include waterhyacinth, waterlettuce and some emergent plants, all of which are preferred habitats for *Mansonia* sp. mosquitoes. Similar to other agencies, LCHCD uses all of the tools available to accomplish their goals. Sterile triploid grass carp (*Ctenopharyngodon idella*) are raised at the District and stocked at appropriate sites for submersed weed control, and mechanical removal is occasionally used following heavy rains or other events that cause accumulation of vegetation in locations needing immediate control. Lee County recognized that floating aquatic plants grow very quickly in waters with high levels of nutrients and these conditions also promote algae blooms; consequently, the county started a "Pondwatch" program where riparian owners send water samples to the District for nutrient analyses. Lee County also enacted a law banning the application of lawn fertilizers during the rainy season, generally June through October. Data from the Pondwatch program has shown significant decreases in primary nutrients in county waters. LCHCD staff are experimenting with drones for use in their treatment programs and also are investigating and increasing the use of invert herbicide application techniques. Inverts are an oil emulsion made by combining vegetable oil and herbicide mix in a "blender" as the mix is sprayed by a handgun onto the

foliage of vegetation. This technique allows spraying under higher pressure and treating over a longer distance without the production of excessive “fines” (very small particles), thus reducing potential drift.

There are 54 species of mosquitoes in Lee County, but only around 15 species are targeted for control due to their aggressive nature and/or concern about their ability to transmit diseases of public health concern. LCMCD has several methods to sample mosquito populations and assess disease potential. For example, mosquitoes are captured in traps of various kinds, collected in large truck mounted net traps, landing rates are counted, and sentinel chickens are monitored for various diseases. Public phone calls (complaints), some 4,400 a year, are logged by GPS, and hot spots for sampling and determining whether control activities are needed can be assessed. Larvicide applications are the preferred method of mosquito control and can be done at any time of the day. Around 10% (56,000 acres) of Lee County consists of salt marshes, which are a primary breeding site for black saltmarsh mosquitoes (*Aedes taeniorhynchus*), which produce huge populations and are aggressive biters. Other species of particular concern are *Aedes aegypti*, *A. solicitans*, and *A. albopictus*, which transmit dengue, West Nile virus, encephalitis, Zika, and other diseases. A decade ago, there were fewer than 10 cases of dengue in humans annually, but recently, for unknown reasons, between 30 to 50 cases have been reported per year.

Applications of adulticides are done in the evening in areas where potential populations reach designated threshold levels. These adulticides include dibrom and various permethrins applied by truck or aerially. Both methods of application utilize sophisticated means of turning the spray system on or off when entering or leaving treatment polygons. In addition to chemical mosquito control, LCMCD has pioneered methods for sterilization and release of sterile male mosquitoes to reduce overall populations.

The District also has an active, aggressive educational program for school children called “Ponds, Puddles and People” which has already reached over 100,000 K-12 students. Children in early classes learn about mosquitoes and their life cycles, whereas later classes focus on mosquito identification, transmission of various diseases, monitoring, pesticides, resistance and even the availability of summer internships.

Afternoon travel to Olando included a 2-hour break at the 13,000-acre Audubon Corkscrew Sanctuary, which was one of the first Audubon properties in Florida. Highlights of Day 4 include:

1. The adoption of technology by LCMCD has certainly been praiseworthy. The automation of spray systems turning on and off as the aircraft or truck enters and exits a target polygon should minimize application errors, as well as improve safety to the equipment operators
2. Disease detection in mosquitoes is also a major advancement
3. The use of drones, once the details are worked out, are also likely to be very useful in certain situations for managing mosquitoes and invasive aquatic plants

Day 5 (Friday, June 7, 2024): The final day of the tour began with attendees boarding airboats to visit West Lake Tohopekaliga (Toho), the 23,000-acre headwaters of the Kissimmee River which drains 80 miles south to Lake Okeechobee. This lake is a COE-designated Federal Flood Control and Navigation Project and a world class sport fishery, ecotourism destination and home to populations of the endangered Everglades snail kite. The lake is managed by the FWC, which has kept floating plants under control but has lacked funds for the past two years to conduct significant amounts of submersed weed (hydrilla) control. The maximum depth of the lake is 12 to 13 feet, but the average depth is around 6 to 8 feet in the winter and 5 to 6 feet in summer, when it is lowered by the COE for water storage in case of a hurricane. Hydrilla can likely grow in water as deep as 9 to 10 feet, which allows growth in about 80% of the lake. These values are typical for most Florida lakes, particularly those in peninsular Florida.

Water levels on West Lake Toho are managed by the COE and SFWMD as part of the Okeechobee Waterway. There is a lock and spillway on the south end of the lake, which is the beginning of the Kissimmee River. Since lake levels have been held lower in summer than "normal" for many years, the littoral fringe of the native species Kissimmeegrass (*Paspalidium geminatum*), spatterdock (*Nuphar advena*), cattails and bulrush, along with the invasive plant torpedograss (*Panicum repens*), have grown into deeper waters during peak growth in the summer and tolerate the higher water in winter when they produce less growth. Consequently, the lake has a very large and noticeable littoral fringe of emergent vegetation and provides excellent conditions for fish and wildlife. As mentioned above, Lake Toho does have an Everglades snail kite population and the rules for treating aquatic weeds in nesting and forage areas for the kite are the same as those noted for lake Okeechobee.

The FWC contractor demonstrated a typical submersed weed application method by applying a water/herbicide mixture from a tank into weighted trailing hoses that are dragged below the airboat at near idle speeds. The group also saw a snail kite sitting on a post feeding on an apple snail (*Pomacea* sp.). The primary submersed weeds in the south portion of the lake were a mixture of native Illinois pondweed (*Potamogeton illinoensis*) and hydrilla; both were growing to the water surface and very dense.

After the tour of West Lake Toho concluded, tour attendees were taken to the Orlando Airport for travel home.

Tour highlights include:

1. The maintenance control concept for floating aquatic weeds appears to be working well in Florida. We saw very few waterhyacinth or waterlettuce plants in STA-1, Lake Okeechobee or in West Lake Toho, although we only saw a small portion of each system
2. The dense submersed plant biomass in the Southport area of Lake Toho, if it is similar in coverage and density in other parts of the lake, certainly indicates potential oxygen problems. Summer's hot temperatures and a cloudy, tropical depression with heavy rainfall could produce a major fish kill
3. This was a fun trip with a great group of people. It looks like we have work to do; we need clarification on drone usage, resolution of endangered species issues, and ways to manage crested floatingheart!!!

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Daniel Aboagye

Daniel Aboagye is a Biologist with the United States Environmental Protection Agency's Office of Chemical Safety and Pollution Prevention (OCSPP). He received an MS in Aquatic Sciences from Auburn University and a PhD from Mississippi State University. He has been with the Environmental Fate and Effects Division (EFED) of the EPA for 5 years and is responsible for evaluating and validating environmental data submitted on pesticide properties and effects for registration.

Ken Bao

Economist/I joined EPA in August 2023 immediately after graduating with my PhD in Economics with an emphasis on the costs of managing agricultural pollution. My dissertation focused on managing nutrient runoffs, especially using the Everglades Forever Act of 1992 as my case study. I am interested in environmental issues and the natural world in general and have always wanted to visit the Everglades!

Lindy Caffo

Biologist, OSCPP-OPP-BPPD-RAB Lindy Caffo joined EPA's Biopesticides Pollution Prevention Division in February 2024 as a biologist focusing on human health risk assessment and product characterization of microbial pesticides. She was raised in north central Pennsylvania and received a Bachelor of Science in Biology from Clarion University. Her professional journey started in academia as an ecotoxicology research technician at Ball State University where she later received her Master of Science in Biology and Biotechnology. Since 2016, she has served in various roles as a Department of Defense contractor at Fort Detrick in Maryland. In these roles, Lindy studied the effects of heavy metal and nanoparticle exposure on the human microbiome and researched gene expression in response to viral infections. Lindy also oversaw biosurveillance efforts of vector-borne diseases in Eastern Europe. Lindy has a commitment to continuous learning, and she eagerly anticipates the challenges and collaborations that lie ahead at the EPA.

Scott Couture

21 years - Senior Herbicide Evaluator, PMRA
Conducts value assessments – efficacy and crop tolerances
Lead for invasive species
Works on new registrations and emergency registrations for aquatic herbicides

Lydia Crawford

Biologist
Lydia has over four years of experience as a Biologist at the Environmental Protection Agency (EPA) in the Registration Division. Currently, she is the Acting Product Manager 24 for the Fungicide Herbicide Branch and previously worked in the Herbicide Branch. Prior to joining the Agency, Lydia received her PhD in Ecology and Evolutionary Biology from Tulane University; her thesis focused on the evolution of different forms of shark reproduction. She received Bachelor of Science in Biology from the University of Central Florida, touching a variety of research topics from Lygodium growth and aerial monitoring of sea turtle nesting. Lydia is an avid reader and leads the EPA RD book club.

Hannah Dean

Risk Manager (Microbial Pesticides Branch)
I began working for the EPA as a risk manager in the Biopesticide and Pollution Prevention Division in 2021. As a risk manager, I specialize in the registration and registration review of microbial pesticides to ensure they meet the statutory and safety standards to protect human health and the environment. Prior to working for the EPA, I worked as a Peace Corps health extension volunteer in Zambia for three years, with a particular focus on malaria prevention in rural communities.

Jerrett Fowler

My title is Senior Fate Scientist, and here is my bio: Jerrett's background is in water resource management focusing on stream and wetland restoration. He has a B.S. in Environmental Science from the University of Oklahoma and Master's in Environmental Management from Duke University. In his free time, Jerrett enjoys playing guitar, hiking, cooking, and hanging out with his wife Talya and dog's Zoe and Lou.

Cristina Ingliss

Section Head/Manager, Pest Management Regulatory Agency. I manage a team that works mainly on registering new active ingredients, including herbicides. My background is in biology/environmental toxicology.

Sayed Islam

I obtained my Ph.D. degree on environmental Biology from a university in Japan and pursued my post-doctoral research at the University of Illinois. As a Risk Manager (Biologist) I have been working in Fungicide & Herbicide Branch, Registration Division, OPP, EPA for more than 3-years. My work in the Agency include product registration process that encompasses communication with registrants, product label reviewing, working with CITAB for product chemistry & toxicity review reports, and other science divisions for human health and ecological risk assessments.

Before joining the agency, I worked for Syngenta LLC, as R&D Lead plant pathologist/Trait Project Lead.

Outside my work in EPA, I enjoy a quiet family life with my spouse and children. I enjoy living in the metro area because of the diversity of entertainment available to me. I enjoy going fitness center, fishing, and playing tennis. Currently living in Naples, FL.

DeMariah Koger

3 years
Biologist Pesticide Re-evaluation Division
BS Environmental Sciences & MS Biomedical and Health Sciences
Chemical Review Manager for several herbicides

Nicole Kimmel

B.Sc. of Environmental Conservation Sciences from the University of Alberta in 2000 with specialization in Wildlife and Rangeland Sciences. She began working with Alberta Government upon graduation, as a Research Technician. After 10 years in agriculture-based research, her role evolved to Weed Specialist, for an additional 7 years of employment. In 2018, she moved departments to the Aquatic Invasive Species (AIS) Specialist to support the Aquatic Invasive Species program, under Environment & Protected Areas. Nicole has 24 years of service on invasive species with the Government of Alberta.

Kelly Kulhanek

Biologist (Biological and Economic Analysis Division) Bio: Kelly's work at EPA focuses on analyzing the benefits of chemicals to their end users in support of EPA registration decisions. Originally from California, she earned a PhD in Entomology from University of Maryland and her background is in honey bee health and apiculture best practices.

Jeremy Leonard

Jeremy received his Masters degree in marine science at the University of North Carolina Chapel Hill, while investigating the impact of harmful algal blooms on ecosystem food web dynamics in the St. Johns River, FL. During this time, he also was involved in water quality analyses and fisheries ecology to evaluate the impact of anthropogenic stressors on marine and freshwater vertebrate and invertebrate species. He received his PhD degree in environmental toxicology at North Carolina State University, where he applied biochemical and metabolomics methods to investigate the impacts of contaminants of emerging concern on freshwater mussels. His work as a post-doctoral fellow involved development of pharmacokinetic models and computational methods to support risk assessment for a number of pesticides and other chemicals. He also received a certificate in geographic information systems from the University of Washington, where he was involved in the use of spatial analyses of environmental factors influencing salmon distribution and reproduction. Currently, he is a toxicologist in the Health Effects Division in the Office of Pesticide Programs, where he evaluates pesticide hazard to support risk assessment. In his spare time, Jeremy enjoys scuba diving with his wife and hanging out with his two chameleons.

Gillian Manning

I am a Senior Scientific Evaluator with the Environmental Assessment Directorate (EAD) at Pest Management Regulatory (PMRA). I've been with EAD for almost six years where I've worked on environmental risk assessments of herbicides and algaecides that are applied directly to water. Before coming to PMRA, I worked in consulting for five years with Intrinsik Corp., where I also worked on environmental risk assessments of pesticides.

Meghann Niesen

Ecological Scientist with EFED. Meghann Niesen started in EFED in 2017 and has spent the past several years working on ESA initiatives in the division. She started her career at EPA with an internship in OW's Human Health and Ecological Criteria Division. Meghann earned her Bachelor's degrees in Ecology and Marine Science from the University of Georgia and a Master's degree in Ecology from the University of Maryland in the Marine, Estuarine, and Environmental Science Program. After graduate school, Meghann worked for the State of Florida in their aquatic ecology and criteria department.

Victoria Oliver

Biologist (Epidemiologist), Division: Health Effects Division, Brief Bio: Victoria began her federal career as a pathways intern at the United States Department of Agriculture's Food Safety Inspection Service in 2017. Since 2020, she has been at the EPA in the Health Effects Division in the Office of Pesticide Programs working as an epidemiologist (biologist) on epidemiological literature based risk assessments. She has a passion for the environment and public health and is currently attending George Mason University working on her PhD in Environmental Science and Public Policy with her dissertation research being focused on Suburbanization and Climate Change's Effects on Lyme Disease Prevalence in the mid-Atlantic region. She currently holds a Master of Public Health in Epidemiology from Eastern Virginia Medical School and a Bachelor of Science in Biological Sciences from Old Dominion University.

Mick Piombino

Entomologist, GS 13, BPPD ETB
Study Insects, efficacy, and ecological risk assessments.
Also works on insect resistance management
Background in animal behavior ecology and conservation, sterile insect Technique and biological control

Lindsay Roe

Herbicide Branch Chief
Lindsay Roe has been with EPA for 10 years, all within the OPP Registration Division. She spent about 8 years in the Fungicide Branch, where she was a reviewer then product manager, before moving into her current position as supervisor for the Herbicide Branch. Prior to joining the Agency, Lindsay worked for USDA-ARS and the University of Tennessee as part of a team conducting plant pathology research and extension work mostly focused on soybean diseases and was in the US Peace Corps in The Gambia.

Sergio Santiago

Biologist
Been working with EPA since 2019, first in the Pesticide Re-evaluation Division and now with the Biological and Economic Analysis Division. Before EPA, I was the superintendent at an agricultural research and extension center, working mostly with California coastal and specialty crops. I also worked with the US Army implementing their environmental mitigation program on Oahu, Hawaii by managing the endangered species horticultural program and working within their overall ecosystem restoration mandates, and as an agricultural research specialist also in Hawaii. I began my professional agricultural career began as a 4-year trainee with the USDA-ARS back in 2007 working with tropical fruit systems and urban forestry. Some other roles throughout the years include laboratory supervisor, consultant and farmer (still active), among others. I earned a PhD in Natural Resources and Environmental Management from the University of Hawaii-Manoa and a MS and BSA in Horticulture from the University of Puerto Rico-Mayagüez.

Samantha Thomas

Samantha Thomas is a chemical review manager within the Pesticides Re Evaluation Division at EPA's headquaters in Washington, DC. Samantha has been with EPA since 2018, and has contributed to the registration review of several herbicides, including: 2, 4-DB, amicarbazone, atrazine, and the class of HPPD inhibitors. Before joining EPA Samantha served in Peru via the Peace Corps for two years. Samantha has a BA in Public Health with a concentration in Chemistry, and works remotely from Atlanta, GA, where she lives with her husband and rescue pet dog.

Cassi Walls

Senior Biologist
Dr. Cassi Walls joined OPP in 2004 as chemist and risk assessor in the Antimicrobial's Division and is currently a senior scientist in RAB2 of the Health Effects Division where her focus is occupational and residential exposure and risk assessment. During her time in HED, she has been a co□chair of ExpoSAC and HASPOC, and is currently the co-chair of RARC. She has worked on a variety of OPP workgroups utilizing her multidisciplinary pesticide knowledge. Prior to working at EPA, she was employed by Exponent Inc. (formerly Novigen Sciences, Inc.) and the Weinberg Group where she was responsible for managing and conducting human exposure and risk assessments in compliance with various state and federal agency methodologies and regulations (e.g., FDA's Food Contact Notification Program, EPA's Comprehensive Environmental Response, Compensation and Liability Act, as well as, Resource Conservation and Recovery Act, and California's Proposition 65). Additionally, she led teams in developing exposure methodologies and models (i.e., DEEM and Calendex), prepared exposure monitoring protocols (i.e., AEATF data), and presented data to scientific review panels (i.e., SAP and HSRB). Cassi received her Bachelor and Master of Science in Chemistry, as well as her Ph.D. in Environmental Chemistry and Public Policy from George Mason University.

Leanne (Yeung) Bikai

Acting section head
Cumulative Health Assessment Section
Health Evaluation Directorate
Pest Management Regulatory Agency
Leanne (Yeung) Bikai is currently the acting section head of the Cumulative Health Assessment Section of the Pest Management Regulatory Agency (PMRA). Prior to assuming her current role, she was a senior scientific evaluator involved with occupational/residential and dietary exposure reviews, including the evaluation of several aquatic pesticides. She is a member of the PMRA Invasive Aquatic Species Working Group. Leanne is trained as an occupational hygienist in the University of British Columbia.

Summary of AERF/UF Aquatic Weed Tour with Presenters

June 2

Facilitators (Haller, Gettys, and Layne) left UF Center for Aquatic and Invasive Plants, 7922 NW 71 St., Gainesville, FL 32653 and travel to West Palm Beach, FL.

June 3 & 4

After lunch the Tour began at the South Florida Water Management District (SFWMD), 3301 Gun Club Road, West Palm Beach, FL. The classroom presentations at SFWMD on 6/3 and the field tour on 6/4 were all coordinated and facilitated by:

LeRoy Rodgers, Section Administrator
Vegetation Management Section
lrodgers@sfwmd.gov

SFWMD Presenters and Tour Assistants:
Ellen Allen
Matt Garske
Tadese Adeagbo
Brendon Hession
Jake Thayer
Alex Onisko

Drone demonstration and expertise provided by:
Brian Parker
Agricultural Air Services
3161SE Chandelle Road
Jupiter, FL 33478
hunterjparker@hotmail.com

continued on next page

June 3 & 4

Storm Water Treatment Area Contractor:
Linda Defee
Aquatic Vegetation Control, Inc.
1860 W 10th Street
Riviera Beach, FL 33404
www.avcaquatic.com

Fran Riech Preserve Contractor:
Darrin Jones
Walker Exotic Tree Eradication & Mitigation, LLC
17681 Caloosa Road
Alva, FL 33920
www.walkerexotics.com

On 6/3, representing the Florida Fish and Wildlife Conservation Commission, we were most fortunate to also have as a classroom presenter:

Mariah McInnis
Invasive Plant Management
Florida Fish and Wildlife Conservation Commission
3800 Commonwealth Boulevard, MS 705
Tallahassee, FL 32399
mariah.mcinnis@myfwc.com

On 6/4, late in the day we arrived at the University of Florida, Everglades Research and Education Center, 3200 East Palm Beach Road, Belle Glade, FL 33430.

Presentations were made by:
Samira H. Daroub, Ph.D
Director and Professor
sdaroub@ufl.edu

Maryory Orton
morton1@ufl.edu

Pamela Aracena
pamela.aracena@ufl.edu

continued on next page

June 5

We met at the offices of the U.S. Army Corps of Engineers, 525 Ridgelawn Road, Clewiston, FL 33440, for a classroom presentation. Then the tour was divided into two groups. One group stayed in the classroom to hear a presentation and discussion on endangered and threatened species protection and the other went on an airboat field trip to observe a simulated herbicide application to floating plants. Then the groups switched places.

Presentations were made by:

Ian Markovich, Invasive Species Biologist
Jessica “Skippy” Fair, Invasive Species Biologist (and airboat driver)

Other CoE participants included:
Tyler Green
Jesse Hall

FWC provided one of the airboats and a driver:
Alyssa Jordan, Biologist 4

We observed a simulated floating plant herbicide application by:
Al Brady
Applied Aquatic Management, Inc.
4305 Bomber Road
Bartow, FL 33830
www.appliedaquaticmgmt.com

The afternoon of June 5th we visited Agricultural Air Services, Airglades Airport, Clewiston, FL 33440. Agricultural Air Services is a commercial aerial application company and is the current aerial contractor for SFWMD.

Presentations were made by:
Hunter Parker, President
And others

continued on next page

June 6

The tour traveled to the Lee County Mosquito Control District and Hyacinth Control District, 15191 Homestead Road, Lehigh Acres, FL 33971 for classroom presentations and a tour of the facility.

Presentations were made by:

Jenifer McBride, Communications Director
mcbride@lcmcd.org

Jason Cull, Operations Manager
cull@lcmcd.org

Ernesto Lasso, De La Vega, Ph.D., Lab Manager
lassodelavega@lcmcd.org

Keith Andreu (Current President of South Florida Aquatic Plant Management Society
andreu@lcmcd.org
Ed Foley, Manager Mosquito Control
foley@lcmcd.org

Jamie Fowler, Logistics
fowler@lcmcd.org

The tour next visited the Audubon Society Corkscrew Swamp Sanctuary,
375 Sanctuary Road West, Naples, FL 34120. This was free time for the participants to take a walking tour of a typical section of the Big Cypress Swamp and see a variety of plant, avian, and reptilian species native to the swamp.

continued on next page

June 7

The final day of the tour began with travel to Boggy Creek Airboat Adventures, 2001 E Southport Road, Kissimmee, FL 34746, for a tour of a portion of Lake Tohopekaliga (Toho).

The FWC facilitator was:

Brittany Lay, Biological Administrator

A simulated submerged aquatic vegetation (SAV)herbicide application demonstration was made by:

Alex Holmes
Applied Aquatic Management, Inc.
4305 Bomber Road
Bartow, FL 33830
www.appliedaquaticmgmt.com

This was the official end of the tour. Participants were delivered to the Orlando International Airport and the facilitators returned to Gainesville, FL.

Special thanks to Keith Mangus, Applied Aquatic Management, Inc. Keith coordinated with the CoE and FWC to be sure the tour participants were able to observe herbicide application demonstrations to both floating plants (Okeechobee) and SAV (Toho).

Transportation was provided by:

A Candies Coachworks, Inc.
6916 West University Avenue
Gainesville, FL 32607
dispatcher@candiescoachworks.com
Driver Alan Rentas

The AERF event planner was:

Bill Torres, President
Florida Event Planning & Meeting Service
945 NW 251 Drive
Newberry, FL 32669
billt@FLEPMS.org