Aquatics

FALL 2024

A Publication of the Florida Aquatic Plant Management Society

Aquatics

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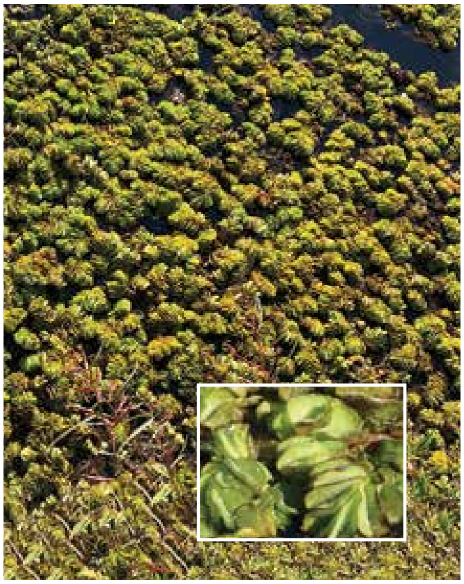

Accordion-like growth form, typical of dense infestations of *Salvinia molesta*

Cover photo credit: Jessica Spencer, US Army Corps of Engineers

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Letter from the Editor

Shelby Thomas

Dear Aquatics Readers,

Welcome to the latest edition of *Aquatics Magazine*, where we delve into the fascinating world of aquatic ecosystems, management, and conservation. This issue is packed with insightful features and updates that highlight the dynamic and complex nature of our water bodies and the ongoing efforts to protect and manage them.

In our cover story, "Giant Salvinia (*Salvinia molesta*) Eradicated from the St. Johns River Basin," we celebrate the successful eradication of this highly invasive plant from one of Florida's major river basins. This achievement underscores the importance of coordinated efforts and persistent action in combating invasive species that threaten our aquatic environments.

"Naturally Native – Wild Rice," explores the ecological significance of wild rice, a native aquatic plant that plays a crucial role in maintaining biodiversity in our waterways. This feature sheds light on the importance of preserving our native species and the challenges they face in a rapidly changing environment.

In "How Do Aquatic Herbicides Work?", we take a closer look at the science behind these essential tools used in aquatic plant management. Understanding the mechanisms and effects of herbicides is vital for ensuring their effective and responsible use in controlling invasive species and maintaining the health of our aquatic systems.

One of the highlights of this issue is the coverage of the "AERF Florida Aquatic Plant Management and Mosquito Control Tour." This tour provided an excellent opportunity for professionals and stakeholders to exchange knowledge and ideas on the latest techniques and strategies for managing aquatic plants and controlling mosquito populations. The insights gained from this tour are invaluable for advancing our collective efforts in these critical areas.

The FAPMS Annual Meeting Agenda provides a detailed overview of the upcoming tentative sessions and events, offering a platform for professionals to share their knowledge and network with peers. Also, "Lake Okeechobee - Update on State and Federal Management Activities" brings you the latest news on the ongoing efforts to manage one of Florida's most iconic and significant water bodies.

We hope you find this issue both informative and inspiring. I look forward to bringing you the latest information and features from our industry. Interested in being featured or writing for Aquatics, email Shelby Thomas at aquaticsmagazine@gmail.com. Together, we can continue to support and enhance the health and sustainability of our aquatic ecosystems.

Warm regards,
Shelby Thomas
Editor, *Aquatics Magazine*

Giant Salvinia (*Salvinia molesta*) Eradicated from the St. Johns River Basin?

In the Winter 2023 Special Edition issue of Aquatics Magazine, there was an article titled "Giant Salvinia (*Salvinia molesta*) Found in St. Johns River Basin". This article is the continuation of that story.

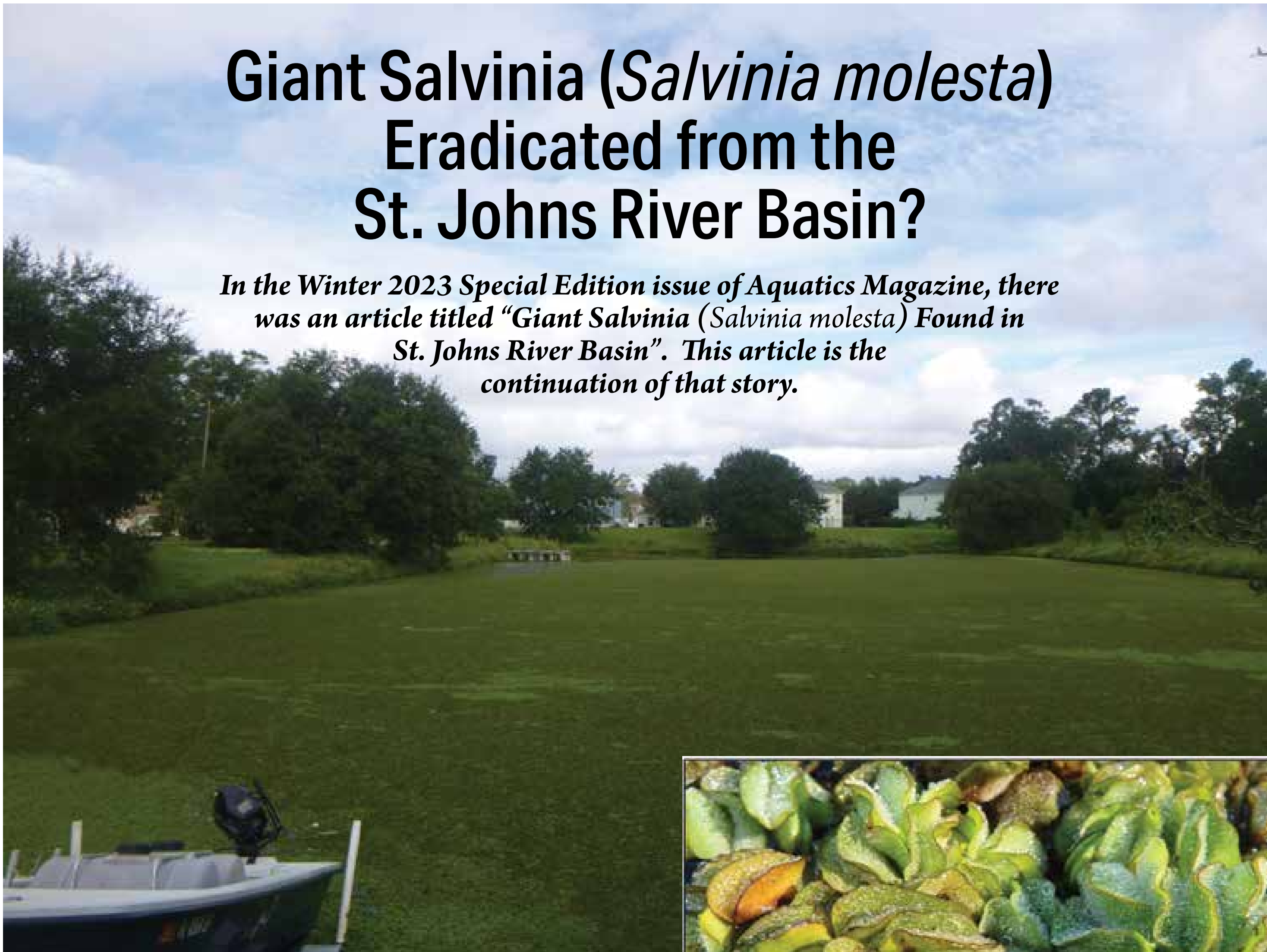


Figure 1, above: COJ stormwater pond on 9/30/23 prior to initial treatment of *Salvinia molesta* Photo credit – City of Jacksonville

Figure 2: Accordion-like growth form, typical of dense infestations of *Salvinia molesta*

By: Jessica Spencer, US Army Corps of Engineers*

We will start with a little recap. On November 1, 2023, *Salvinia molesta* was reported to the Florida Fish and Wildlife Conservation Commission (FWC). It was aggressively growing in a City of Jacksonville stormwater pond less than a mile from the St. Johns River. The FWC and the US Army Corps of Engineers (Corps) worked with the City of Jacksonville to contain the population and work towards eradicating it.

A contractor hired by the City of Jacksonville to control aquatic vegetation in the City's 258 stormwater ponds first identified an infestation of "Salvinia" in a stormwater pond off of St. Augustine Road in September of 2023. It was treated with flumioxizan on September 30, 2023, but since there was no indication of which species it was, supervisors assumed it was the widespread *Salvinia minima* (common salvinia). When supervisors returned to the pond a month later (November 1) to monitor whether the treatment was successful, they recognized that it was actually *Salvinia molesta*, not *Salvinia minima* and reported it to FWC. FWC reached out to the Corps to verify the population due to its proximity to the Corps' Jacksonville District office and Corps biologists confirmed the ID on November 6, 2023.

Corps biologists noted that giant salvinia plants were present in the outfall structure of the stormwater pond, so they worked with City of Jacksonville staff to determine where the outfall structure drains. Unfortunately, giant salvinia was also found in a concrete lined ditch and

**Unless otherwise noted, photo credit would be Jessica Spencer, US Army Corps of Engineers*

Figure 3, left: Egg-beater shaped leaf hairs of *Salvinia molesta*

Figure 4: Four-pronged, forked leaf hairs of *Salvinia minima*

in Craig Creek where it empties into the St. Johns River. The plants in Craig Creek seemed to be somewhat stunted, possibly by brackish conditions in the creek. The leaves were not folded into the accordion shape that is typical of dense giant salvinia infestations. Instead, it was growing with the leaves horizontal to the water's surface, very similar to *Salvinia minima*. In order to confirm that these plants were *Salvinia molesta* (giant salvinia), not *Salvinia minima* (common salvinia), a hand lens was used to examine the shape of the hairs on the surface of the leaves. *Salvinia minima* has hairs that fork into a spreading, 4-pronged structure, but in *Salvinia molesta*, the forked hairs curve back together at the tip, forming an egg-beater shape. All of the samples that were collected in Craig Creek had the egg-beater shaped hairs indicative of *Salvinia molesta*.

Figure 5: Stunted growth form of Salvinia molesta in brackish waters of Craig Creek

Figure 6: Concrete-lined ditch where Salvinia molesta was detected downstream of the stormwater pond

The Corps treated the remaining Salvinia molesta plants that were in the stormwater pond with flumioxizan on 11/20/23 (at a rate of 10oz/acre). They also placed a boom around the outfall structure in the pond to prevent any additional plants from getting into the tributary. The treatment was monitored and all of the remaining giant salvinia died within a couple of weeks. Monitoring has continued through spring and summer of 2024, and no regrowth of giant salvinia has been observed in the system since that treatment. A strong low-pressure system moved through the northeast Florida region December 15-17 of 2023, bringing high winds and heavy rain to the area. The rain seemed to have flushed the downstream segments of the drainage (the concrete ditch and the Craig Creek tributary, as well as a segment of the stream that could not be surveyed because it was

Figure 7: FWC boom placed in Craig Creek 12-20-23

on private property). As a result of the storm, Craig Creek flooded out of its banks, so any salvinia that had previously been caught in vegetation likely would have floated up with the flood waters and been carried downstream. After the storm, no Salvinia molesta plants were observed in the concrete-lined ditch or in Craig Creek. It is fair to assume that some of the plants that had been present in Craig Creek were likely washed into the St. Johns River. With the heavy rains, the hope is that any plant material would have been moved downstream with the current of the St. Johns River towards the ocean and less suitable conditions for Salvinia molesta. Three days after the storm, FWC placed a boom in Craig Creek with the assistance of the City of Jacksonville to facilitate our ability to detect and contain any additional *Salvinia molesta* plants that might still be persisting in upstream portions of the creek. The boom was surveyed at least once a month, particularly after rainstorms, but no *Salvinia molesta* plants were observed in the system since the December storm.

It appeared that the treatment of the *Salvinia molesta* population was a success. However, there were still concerns that the population may have spread. We know that plants were likely moving downstream into the St. Johns River. There were also City of Jacksonville contractors and staff that were responsible for maintenance of 258 stormwater ponds throughout the city. It is not unreasonable to think that *Salvinia molesta* could be transported on their equipment from one pond to another. We also couldn't be sure that it hadn't been introduced to the pond in question from one of the other COJ-managed ponds or another nearby waterbody. State, federal and local agency staff worked together to identify all of the COJ-managed ponds and surveyed all 258 of them to verify that there were no other populations of *Salvinia molesta* in those ponds. To assist with that survey effort, the Corps created a project using ESRI's QuickCapture app to allow anyone (no ESRI account necessary) to quickly report the presence or absence of *Salvinia molesta*. The QuickCapture app was designed to collect the data with the press of a button, which would indicate your selection and prompt you to take up to 3 photos of the site to verify the observation. The observation is shared through the cloud and instantly available to the biologist in the office. The data appear as points on a map, red to indicate "Salvinia molesta", green to indicate "No Salvinia" and yellow to indicate "Salvinia spp." for populations where the identity was uncertain. "Salvinia spp." could simply indicate that *Salvinia minima* was present, but since the two species can be confused, it would still warrant a follow up visit. The yellow category could also indicate that the observer was not confident in their plant ID, a hand lens was not available to examine the hairs on the leaf surface or maybe the population was in an area of the pond that could not be accessed to confirm the plant ID. These yellow points were tagged for follow up within a couple of weeks. If *Salvinia molesta* was present, it would quickly become apparent due to its rapid growth, doubling size in 3-5 days, so an increase in the size of the population would be noticeable. Since the app was launched in early December 2023, 581 observations have been recorded, including points for each of the City of Jacksonville stormwater ponds, as well as many other freshwater ponds in the Jacksonville area. Of those observations, *Salvinia molesta* was only documented at the 3 original locations, the stormwater pond, concrete-lined ditch and Craig Creek. There were 30 observations of "Salvinia spp." marked for revisits and the other 548 observations were "No Salvinia". Revisits to the "Salvinia spp." sites did not result in any additional detections of *Salvinia molesta*.

Figures 8 & 9: Screenshots of Salvinia QuickCapture app

The results of the QuickCapture surveys seem to support the idea that this was an isolated population of *Salvinia molesta*. Control efforts appear to have been 100% effective. In the United States, *Salvinia molesta* does not produce fertile spores (U.S. Department of Agriculture, 2000), so once all of the plants have been killed, there is no concern with new plants being generated from a spore-bank in the water or soil. However, there are still some remaining issues. The source of this incipient population is unknown. Without definitively knowing the source, it will be challenging to prevent another introduction. There is also concern with the *Salvinia*

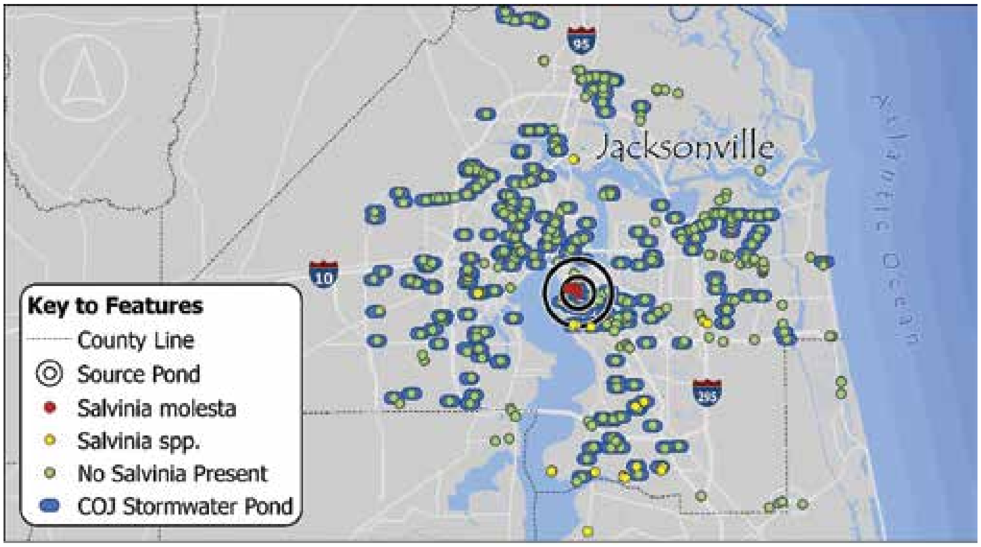


Figure 10: Salvinia QuickCapture results overlaid on a map of the COJ stormwater ponds (Map Credit: Douglas Swanson, GISP)

molesta plants that were washed into the St. Johns River. The Corps has done surveys of the river and has not documented any *Salvinia molesta*. The river is brackish in Jacksonville and the current would move the water north towards the ocean, so there is hope that any *Salvinia molesta* that had been washed into the river would be carried by the current into the ocean. However, since it is a floating aquatic fern, wind could also blow the plant upstream against the current where there might be more favorable conditions. A recent study by the U.S. Army Engineer Research and Development Center and the University of Florida Center for Aquatic Invasive Plants found that *Salvinia molesta* could survive short exposures of up to 24 hours to higher salinity conditions ranging from 0.75 – 16 ppt (Vuillequez, et al, 2024). It is possible that some of the *Salvinia molesta* that made it into the river could have found its way into a tributary where there are more favorable conditions. The Corps will continue to survey the St. Johns River, as well as opportunistically documenting any freshwater ponds with the Salvinia QuickCapture app. Outreach efforts will continue to educate people on how to identify *Salvinia molesta* and the importance of reporting it if you think you have found it. The best way to report it would be through the EDDMapS IveGot1 App or their website (www.eddmaps.org), because the automated alerts will notify associated agencies that regulate Federal Noxious Plants. You can also report it directly to Mariah McInnis (Mariah.McInnis@myFWC.com) or Jessica Spencer (Jessica.E.Spencer@usace.army.mil) if you find it anywhere in Florida. While we are optimistic about the results of our Early Detection and Rapid Response efforts with this population of *Salvinia molesta* in Jacksonville, we will continue to monitor to make sure the eradication was successful!

References:

U.S. Department of Agriculture/Animal and Plant Health Inspection Service. (2000) *Pest Alert: Giant Salvinia;* U.S. Department of Agriculture, May 2000, [cited August 14, 2024] Available from: https://www.aphis.usda.gov/sites/default/files/gsalvinia.pdf.

Vuillequez C., Glueckert J., Sperry B. (2024, July 15-18). *Evaluation of the Salinity Tolerance of Giant Salvinia (Salvinia molesta) Using Concentration-Exposure Time Methods* [Poster Session]. Aquatic Plant Management Society Annual Meeting, St. Petersburg, FL.

Jessica Spencer is an invasive species biologist working for the U.S. Army Corps of Engineers in the Jacksonville District for the Invasive Species Management Branch. She has been in this position for 15 years, developing invasive species management plans, overseeing invasive species control contractors and collaborating with agency partners to address invasive species issues throughout the state of Florida, as well as other district offices throughout the nation. She currently holds a Pesticide Applicator License from the Florida Department of Agriculture and Consumer Services. She is an active member of the Florida Native Plant Society, Florida Invasive Species Council, Everglades Cooperative Invasive Species Management Area and the First Coast Invasive Working Group.

2024 FAPMS Training Conference – Daytona Beach, FL

Monday, October 7th		
8:00-6:00	**Exhibit/Vendor/Poster Setup** – *Coquina E-H*	
2:00-5:00	**FAPMS Board of Directors Meeting** – *Coquina F*	
2:00-5:00	**Registration** – *Coquina prefunction*	
Tuesday, October 8th		
8:00-10:00	**Scholarship and Research Foundation Meeting** – *Room TBD*	
Session 1 *Coquina A-D* (CEUs: 1 AQ, 1 Core) Moderator Matt Phillips		
10:00-10:25	**Matt Phillips**	Presidential Address
10:25-10:30	**Brett Bultemeier**	CEU QR Code Instructions
10:30-10:55	**Lyn Gettys**	Why Manage Invasive Plants?
10:55-11:45	**Brett Bultemeier**	Understanding Pesticide Labels, the Endangered Species Act, and EPA's Changes
11:45-12:10	**Ryan Sullivan**	The Basics of Acoustic Mapping Technology and Their Role in Submersed Aquatic Vegetation Management in Florida
12:10-1:35	LUNCH (On Your Own)	
Session 2 *Coquina A-D* (CEUs: 1.5 AQ) Moderator Brett Bultemeier		
1:35-1:40	**Prize drawing**	
1:40-1:50	**Tom Warmuth**	Sponsor Update (Platinum Sponsor) – *Biosafe Systems*
1:50-2:15	**Jonathan Glueckert**	Concentration-Exposure Time Requirements for Hygrophila (*Hygrophila polysperma*) Control
2:15-2:40	**Ben Willis**	Aquatic Herbicide and Algaecide Formulations
2:40-3:05	**Brett Bultemeier**	Aquatic and Wetland Calibration and Math, How Numbers Just Makes Cents!
3:05-3:20	**BREAK** – *Coquina E-H*	
Session 3 *Coquina A-D* (CEUs: 2 AQ) Moderator Lyn Gettys		
3:20-3:25	**Prize drawing**	
3:20-3:35	**Sam Sardes**	Grand Sponsor Update – *UPL Environmental Solutions*
3:35-4:00	**Kara Foley**	Response of *Vallisneria* Taxa to Combination Herbicide Treatment
4:00-4:25	**Kristin Peterson**	Tangled Tales of *Vallisneria spiralis*: Knot your Average Tapegrass
4:25-4:50	**Craig Mallison**	Distribution and Field Identification of a Non-native, Hybrid Eelgrass (*Vallisneria spiralis* x *V. denseserrulata*) in Florida
4:50-5:15	**Amber Riner**	Automating Water Hyacinth Detection Using Deep Learning on RGB UAS Imagery
5:15-5:30	**John Madsen**	AERF Update
End of Regular Sessions		
5:30-6:00	**Poster Competition** – *Coquina E-H*	
6:00-8:00	**Presidential Reception** – *Mai Tai restaurant*	
6:30-9:00	**Corn Hole Tournament** – *Mai Tai (out front)*	
8:00-10:00	**Fishing Tournament** – *TBD*	
Wednesday, October 9th		
7:00-8:00	**Breakfast** – *Coquina E-H*	
Session 4 *Coquina A-D* (CEUs: 1.5 AQ) Moderator Wykle Greene		
8:00-8:05	**Prize drawing**	
8:05-8:15	**James Boggs**	Platinum Sponsor Update – *Helena*
8:15-8:25	**Josh McGarry**	Platinum Sponsor Update – *SePro*
8:25-8:50	**Jessica Spencer**	Early Detection and Rapid Response to Giant Salvinia (*Salvinia molesta*) in the St. Johns River Basin

8:50-9:15	**Conrad Oberweger**	Herbicide Trials for Controlling Alligatorweed (*Alternanthera philoxeroides*) in Florida Waterways
9:15-9:40	**Justin Lamb**	Inadequate Access: How to Reach the Tough Places
9:40-9:45	**Kelley Wittenberg**	Gold Industry Update – *Leading Edge Aerial*
9:45-10:05	**BREAK** – *Coquina E-H*	
Session 5 *Coquina A-D* (CEUs: 2 AQ) Moderator Sam Sardes		
10:05-10:10	**Prize drawing**	
10:10-10:20	**Troy Knowlton**	Platinum Sponsor Update – *Nutrien*
10:20-10:45	**Logan Benedict**	Wildlife and Habitat Management on a Large Landscape Scale
10:45-11:10	**Kelli Gladding**	Hydrilla (*Hydrilla verticillata*) Control after Whole-Lake Treatments of Bispyribac-sodium in Central Florida
11:10-11:35	**Megan Reid**	Competitive Effects of Waterhyacinth Against Submersed and Emergent Species Under Varying Nutrient Levels and Herbivory
11:35-12:00	**Justin Nawrocki**	Herbicide Combinations – An Informative Guide
12:00-1:15	**Lunch** (On Your Own)	
Session 6 *Coquina A-D* (CEUs: 1.5 AQ) Moderator Kelli Gladding		
1:15-1:20	**Prize drawing**	
1:20-1:25	**Clark Boyd**	Gold Sponsor Update – *NuFarm*
1:25-1:30	**Wykle Greene**	Diamond Sponsor Update – *Syngenta*
1:30-1:55	**Tadese Adeagbo**	The Effects of Prescribed Burning in Vegetation Based Stormwater Treatment Areas
1:55-2:20	**Kara Foley**	Evaluation of Hydrilla and Non-target Species Response to Combination Treatments Including Florpyrauxifen-benzyl
2:20-2:45	**Maxwell Gebhart**	Short Term Efficacy of Contact Herbicides on the invasive Vallisneria, *V. spiralis*× *V. denseserrulata* and *V. spiralis*
2:45-3:05	**BREAK** – *Coquina E-H*	
Session 7 *Coquina A-D* (CEUs: 1.5 AQ) Moderator Jonathan Glueckert		
3:05-3:10	**Prize drawing**	
3:10-3:25	**FAPMS Business meeting**	
3:25-3:30	**John Cortell**	Gold Sponsor Update – *Earth Science Labs*
3:30-3:35	**Marti Veatch**	Gold Sponsor Update – *Kasco Marine*
3:35-4:00	**Mike Durham**	Quantifying Select Native Plant Species' Response to Herbicide Exposure
4:00-4:25	**Corrina Vuillequez**	Desiccation Tolerance of Giant Salvinia in Boat Trailer Bunks
4:25-5:15	**Ben King / Jonathan Glueckert**	Airdrives and Application Equipment Overview and Demonstration
End of Regular Sessions		
5:30-6:30	**Duck Races** – *5th Floor Pool - Sunset Pool*	
7:00-9:30	**Awards Banquet** – *South Tower Grand Ballroom*	
Thursday, October 10th		
7:00-8:00	**Breakfast** – *Coquina E-H*	
Session 8 *Coquina A-D* (CEUs: 1.5 AQ, 0.5 NA) Moderator TBA		
8:00-8:05	**Prize drawing**	
8:05-8:30	**Alyssa Jordan**	Utilizing New Technologies in Torpedograss on Lake Okeechobee
8:30-8:40	**Lyn Gettys**	APMS Update
8:40-9:05	**Stephen Enloe**	Lessons Learned from a Decade in the Trenches at CAIP
9:05-9:30	**Thomas Howard**	Mapping Aquatic Vegetation in Every Lake in Rhode Island and New Hampshire Using Shoebox-Sized Satellites
9:30-9:40	**Michael Owen**	Platinum Sponsor Update – Bayer
9:40-9:55	**BREAK** – *Coquina E-H*	

Session 9 *Coquina A-D* (CEUs: 2 AQ, 1.5 NA) Moderator Lyn Gettys		
9:55-10:20	**Minjin Choi**	The Influence of Triclopyr on Old World Climbing Fern (*Lygodium microphyllum*) and Native Fern Spore Germination
10:20-10:45	**Benjamin Sperry**	USACE Aquatic Plant Management Team Research Update
10:45-11:10	**Ian Talty**	Revisiting Cogongrass and Hydrologic Stress: Just How Much Water Can It Handle?
11:10-11:35	**Patrick Belk**	Assessing the State of Cuban Bulrush Management across Florida and the Southeastern United States
11:35-11:45	**Grand Prize Drawing**	
End of Conference		
12:00-2:00	**Board of Directors Meeting** – *Location TBD*	

Haven't registered yet? Do it today at https://fapms.org/conference/2024-conference/

PS: Don't forget to reserve your room and nominate friends and colleagues for FAPMS awards!

Aquatic Ecosystem Restoration Foundation, Inc.

Florida Aquatic Plant Management and Mosquito Control Tour

Part 1
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:

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

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

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

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:

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

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

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.

Presenters for days one and two included: LeRoy Rodgers, Ellen Allen, Matt Garske, Tadese Adeagbo, Brendon Hession, Jake Thayer, Alex Onisko, Brian Parker, Linda Defee, Darrin Jones, Mariah McInnis, Samira H. Daroub, Ph.D, Maryory Orton, Pamela Aracena

Attendees included: Cristina Giuseppina Inglis, Gillian Elizabeth Manning, Leanne Yee Yan Bikai, Scott Johnstone Couture, Nicole Kimmel, Ken Bao, Sergio Santiago, Kelly Kulhanek, Hannah Dean, Michael Piombino, Lindy Caffo, Meghann Niesen, Jerrett Fowler, Daniel Aboagye, Cassi Walls, Victoria Oliver, Jeremy Leonard, Samantha Thomas, DeMariah Koger, Lindsay Roe, Sayed Islam, Lydia Crawford, Carlton Layne, William Haller, Lyn Gettys

HOW DO AQUATIC HERBICIDES WORK?

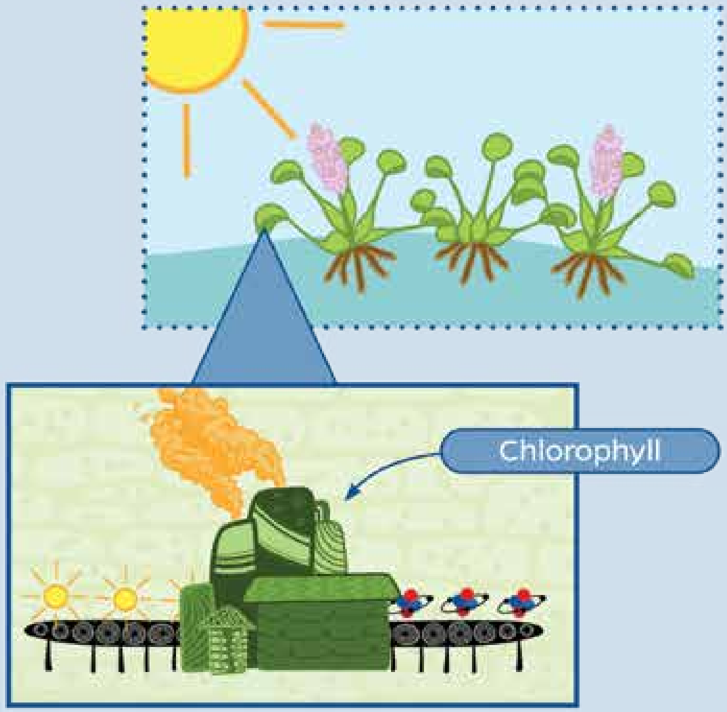
PHOTOSYSTEM 1 INHIBITORS

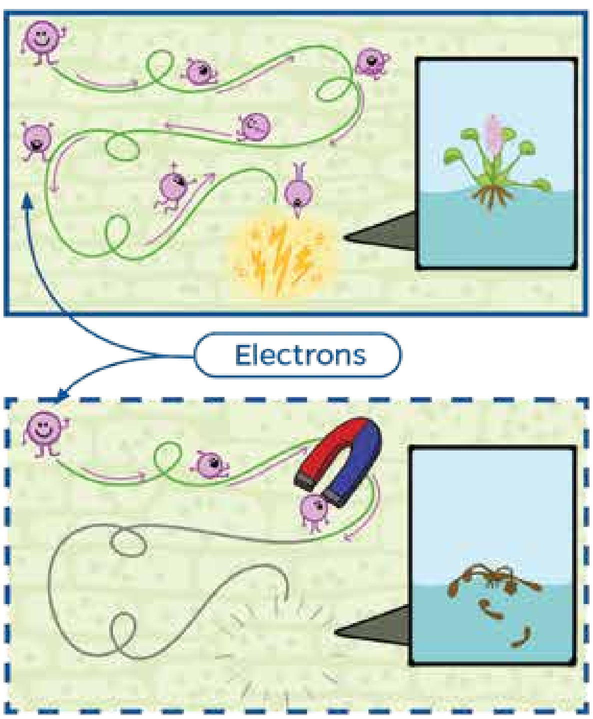
HERBICIDES

Aquatic herbicides are a helpful tool when it comes to controlling problematic plants in our waterways. They are designed to target a specific plant part and prevent it from growing.

PHOTOSYNTHESIS

The chlorophyll acts as a little factory within the plant cells, taking the sunlight energy and turning into the chemical energy, which will be used to power for the plant.





USUALLY...

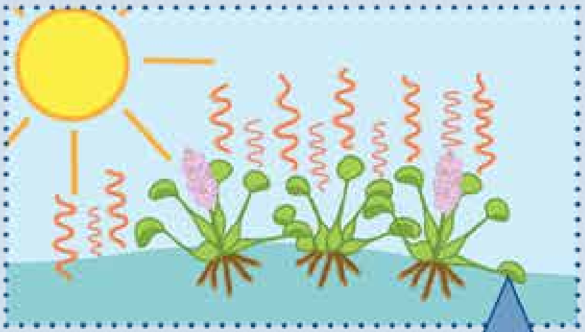
When sunlight energy enters the plant, the electrons start to move through the plant in a very precise way changing into chemical energy that will power the plant to grow.

PHOTOSYSTEM 1 INHIBITORS

These PS1 herbicides work like a magnet to pull tiny electron particles off their regular path. These electrons get confused and can't do their job. This leads to a toxic build up of energy that results in the cells bursting and the plant dying.

HOW DO AQUATIC HERBICIDES WORK?

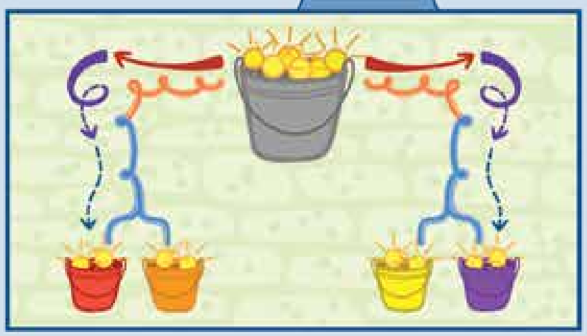
CAROTENOID INHIBITORS



HERBICIDES

Aquatic herbicides are a helpful tool when it comes to controlling problematic plants in our waterways. They are designed to target a specific plant part and prevent it from growing.

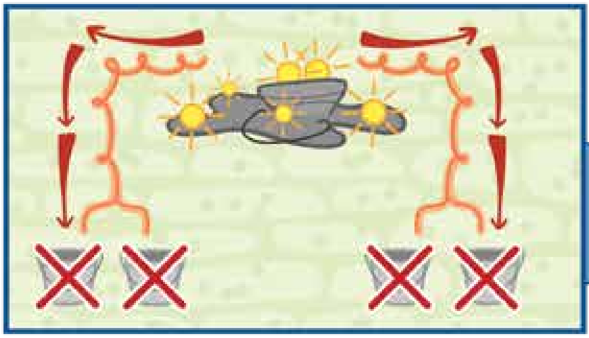
CAROTENOIDS

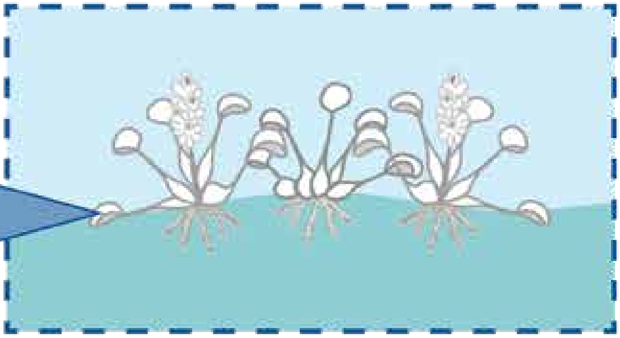


When it comes to photosynthesis, plants also rely on carotenoids (the yellow, orange, and red pigments in leaves). On bright sunny days, chlorophyll can get overwhelmed and collect too much sunlight. That's when carotenoids step in to help. Just like your car engine needs a radiator to help it from overheating, carotenoids help chlorophyll manage the extra energy from the sunlight. They take the extra energy and release it back into the atmosphere as heat to give chlorophyll relief.

CAROTENOID INHIBITORS

Carotenoid inhibitors stop these pigments from collecting the extra sunlight. The plant doesn't realize the carotenoids are stopped by the herbicides, so the chlorophyll continues to process the sunlight energy and becomes overwhelmed. When this happens, the chlorophyll breaks down (like a car's engine would). Sometimes, you'll see these plants turn white and die from sun scolding.





Lake Okeechobee

Update on State and Federal Management Activities

USACE, FWC, SFWMD, FL DEP

Lake Okeechobee, Florida's largest freshwater lakes, faces numerous ecological challenges that require concerted efforts from state and federal agencies. Fluctuating water levels, invasive species and high nutrients are only some of the issues our managers must battle. Over the past few months, these agencies continue to embark on collaborative projects aimed at preserving the lake's biodiversity and addressing invasive species threats. The following will outline some of the major projects and management activities that have been completed throughout Lake O over the last quarter.

Invasive Vegetation Management

The US Army Corps of Engineers (USACE) and the Florida Fish and Wildlife Conservation Commission (FWC) have been actively managing invasive floating vegetation, such as water hyacinth and water lettuce, throughout Lake Okeechobee. Currently, USACE contractors are treating an average of 170 acres per month, with a primary focus on high-density areas like South Bay and Boy Scout Cut. Meanwhile, FWC IPM applicators are managing approximately 190 acres monthly across the rest of the lake. Since January 2022, managers on Lake Okeechobee have achieved maintenance control of floating vegetation. Before January of 2022, applicators were treating an average of 770 acres a month. That is a 53.25% decrease in the amount of herbicide and funding being used for

floating vegetation throughout the lake. With water hyacinth and water lettuce under control, applicators are able to address other invasive species, such as non-native *Ludwigia* spp., *Scleria lacustris* and Cuban bulrush, through targeted spot treatments in critical zones to help preserve native habitats. Lake biologists will continue to maintain Lake Okeechobee at the lowest possible levels of invasive plants into the future, for the persistence and longevity of native plant communities and to further promote ecosystem health.

FWC Aquatic Habitat and Restoration/Enhancement section (AHRE) has been managing invasive torpedo grass throughout the northwest marsh including 2,400-acre treatment in late May. An additional 308.5 acres of spot management was also done in areas that had been previously managed but were re-growing. This management has been shown to positively support the nesting habits of the endangered snail kites and foraging wading bird species. In addition, AHRES is also maintaining their wildlife islands by controlling invasive vines species, Phragmites and para grass along with managing Brazilian pepper and cogongrass within cypress tree plantings on the lake bottom.

The South Florida Water Management District (SFWMD) continues to monitor and manage melaleuca on Lake Okeechobee. Once a dominate force in the lake's marsh, melaleuca infestations have been significantly curtailed through intensive management efforts over the past 30 years. These interventions paved the way for revival of native flora, restoring the health of the lake's wetlands. SFWMD continues to deploy crews to treat melaleuca trees in Lake Okeechobee as needed, prior to the trees' seeding period. Strategic management in Lake Okeechobee will continue indefinitely to maintain melaleuca populations at the lowest feasible level, i.e., maintenance control.

Submersed Aquatic Vegetation (SAV) and Habitat Restoration

During the month of May, AHRE completed a native tree planting on the northwest marsh lake bottom where over 46 acres of wetland tree plantings have occurred since 2015. The group, along with the help from other agencies, completed their submersed aquatic vegetation (SAV) surveys in July, to assess submergent and emergent plant distributions throughout the northwest and southern littoral zone of Lake Okeechobee.

This past spring South Florida Water Management (SFWMD) finalized their submersed aquatic vegetation sampling and found that the SAV coverage on the lake remains near record lows. This is unfortunately expected due to high water levels over the past year. In response to this, SFWMD and FWC are implementing small-scale experiments which will assess whether installing temporary turbidity controls can improve water clarity for SAV establishment. These pilot projects will be taking place at two locations along Indian prairie shoreline and will run through to the end of the calendar year.

Monitoring Bass Populations and Recreational Fishing

The FWC's Division of Freshwater Fisheries Management continues to monitor Largemouth Bass populations through comprehensive sampling and tag return studies. Since January of 2023, FWC has received information on 138 fish out of 450 tagged bass, giving them a 30% return rate for the Largemouth Bass tag study on Lake O. Annual Largemouth bass sampling was also completed, showing that bass populations continue to struggle with reproduction and survival since Hurricane Irma in 2017, that destroyed the submersed aquatic vegetation communities. There are still Trophy Catch Pink Tag bass swimming in Lake Okeechobee, and they must be caught and submitted by September 30, 2024, to claim the prize! https://www.trophycatchflorida.com/pink-tag.aspx

Endangered Species Conservation

The South Florida Water Management District (SFWMD) and collaborating agencies have finished their annual survey for the Federally Endangered Okeechobee Gourd. Reports of vine presence as well as the number of flowers and fruits observed will be submitted to the U.S. Fish and Wildlife Service for archiving and analysis.

As of July, the endangered snail kite nesting season was completed, with currently no new active snail kite nests on the lake. This season there were 109 total nests, with 70 failed nests, 31 successful nests and 8 unknown statuses.

Water Quality and Environmental Reporting

The Florida Department of Environmental Protection (DEP) has completed their *Statewide Annual Report on Total Maximum Daily Loads, Basin Management Action Plans, Minimum Flows or Minimum Water Levels, and Recovery or Prevention Strategies* (STAR, dated July 1, 2024). This comprehensive annual report provides updates on 6,000+ water quality restoration projects being implemented in over 30 active BMAPs across the state. It is presented via an interactive Story Map and includes a database on all BMAP projects during the 2023 reporting period that can be downloaded into an Excel spreadsheet via the DEP website.

The collaborative efforts of state and federal agencies at Lake Okeechobee reflect a unified approach to environmental stewardship and conservation. By addressing invasive species, enhancing aquatic habitats, monitoring fish populations, and protecting endangered species, these initiatives aim to ensure the sustainability of Lake Okeechobee's ecosystem for future generations. Continued monitoring, adaptive management, and public engagement will be essential in overcoming ongoing challenges and preserving this iconic natural resource in South Florida.

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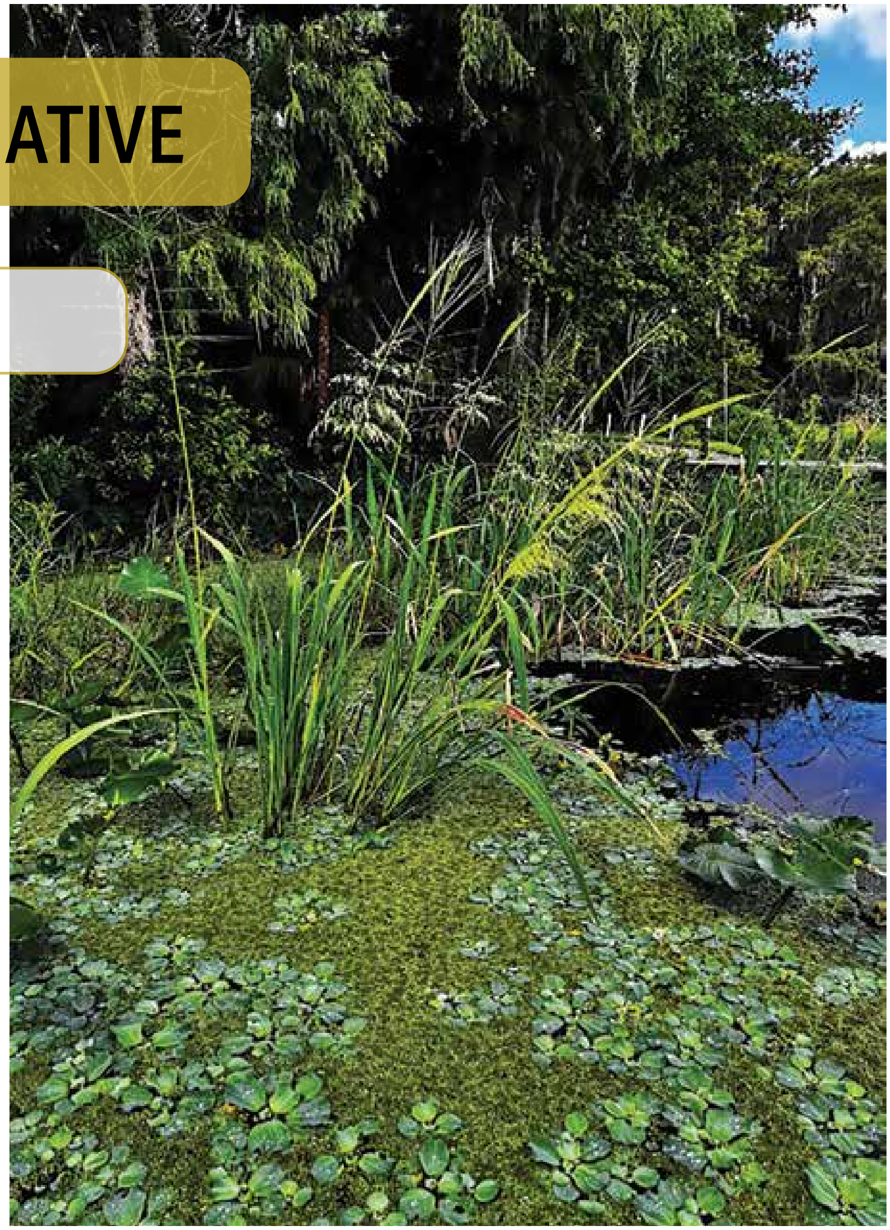
NATURALLY NATIVE

Spotlight



Wild Rice, Indian Rice
Zizania aquatica

By Kelli Gladding

Zizania aquatica is a native plant to Florida north through Canada along the Eastern states and into the mid-west. Its common names are "Wild rice" and "Indian rice". This species is an annual monocot and is a very large grass with stems growing up to ten feet tall and are thick and spongy. Leaf blades are strap like, being two inches across and three-to-four feet long and smooth to the touch but the leaf margins are sharply toothed. The inflorescence is very large, erect and can be two feet long and one foot across, spreading branches and branchlets. Wild rice is listed as an obligate wetland species, which means it almost always grows under naturally wet conditions. It blooms in late summer and early fall. Its fruit is a long ovoid grain and can be harvested as a food source, although there are no commercial crops for wild rice (that I'm aware of).

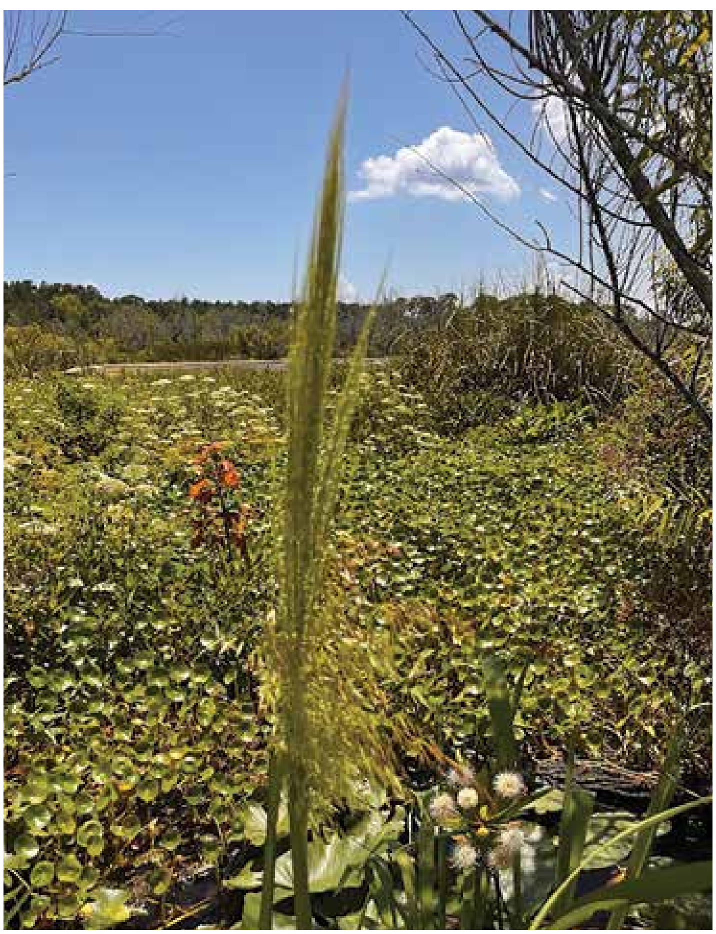
Historically:

As the common names indicate, Native American tribes have long utilized wild rice as an essential part of their diet and culture. It was a staple food source for many tribes, particularly those in the Great Lakes region of North America. It blooms during the summer and was harvested in lake summer and early fall. It could be stored for long periods of time, providing a reliable food source throughout the year. It would be prepped the way we cook rice today, often boiled or steamed. Rice was also an important trade commodity for the tribes and it's value helped establish economic relationships between different tribes and later with European settlers. All parts of the plant were utilized, even the plants roots and stalks were harvested for herbal remedies.

Struggle for habitat:

As wild rice likes to grow along the edges of lakes, streams and spring runs, there are many competitors for this niche, such as Cattails (*Typha spp*-native) and

Giant cut grass (*Zizaniopsis miliacea*- native) which wild rice is commonly mistaken for these species when a seedhead is not present. A common non-native and invasive species which competes with wild rice, is Wild Taro (*Colocasia esculenta*). Wild Taro is listed on the Florida Invasive Species Counsel as a Category I invasive species, which means this plant is altering native plant communities by displacing native species, changing community structures or ecological functions. Wild taro was actually introduced into Florida in 1910 by the U.S. Department of Agriculture as a substitute crop for potatoes. This plant also contains oxalic acid which can cause skin irritation. Since there are no biological control agents for this plant, herbicides are typically used



For additional information; please visit the Center for Aquatic and Invasive Plants website:
| Center for Aquatic and Invasive Plants | University of Florida, IFAS (ufl.edu)

We want to hear from you! Please, submit your favorite native plant column to Kelli and to spotlight your regional chapter. K.gladding@ufl.edu

for management efforts and selectively applied over this invasive plant.

Environmental benefits:

Wild rice plays an important role in maintaining healthy ecosystems, particularly in wetland areas. As this is a native plant, wild rice supports a diverse range of wildlife as a food source for birds, fish and other aquatic organisms. It is an important food source for migratory birds, particularly waterfowl. The growth habit of the plant also provides shelter and breeding grounds for wildlife. In addition, it improves water quality by stabilizing sediments and reducing erosion. Personally, I enjoy observing the inflorescence of wild rice and will be harvesting some of the seeds to try and cook this fall (standby for recipes to follow-).

Kelli is a biological scientist with UF/IFAS CAIP and has been involved with aquatic plant management efforts in Florida for twenty years. She is a past president of FAPMS and is currently the Secretary/ Treasurer for FAPMS Scholarship and Research Foundation.

Calendar of Events

September 30 – October 2, 2024
South Carolina Aquatic Plant Management Society Annual Conference
Ocean Drive Beach and Golf Resort
North Myrtle Beach, SC
https://www.scapms.org/meetings.html

October 7-10, 2024
48th Annual Florida Aquatic Plant Management Society Annual Training Conference
Hilton Daytona Beach Oceanfront Resort
Daytona Beach, FL
https://fapms.org/conference/2023-conference/

October 29-31, 2024
MidSouth Aquatic Plant Management Society Annual meeting
Tennessee Aquarium
Chattanooga, TN
https://msapms.org

November 12-14, 2024
Texas Aquatic Plant Management Society Annual Meeting
New Braunfels Civic Center
New Braunfels, TX
https://www.tapms.org/annual-meeting

December 1 – 4
9th International Weed Science Congress
Jerusalem, Israel
https://www.iwsc2024.com/

January 7-8, 2025
26th Annual Northeast Aquatic Plant Management Society
Holiday Inn Saratoga Springs
Saratoga Springs, NY
https://www.neapms.org

February 24-27, 2025
45th Annual Midwest Aquatic Plant Management Society Conference
Palmer House Hotel
Chicago, Ill
https://www.mapms.org/conferences/2025-conference/

March 17-19, 2025
Western Aquatic Plant Management Society Annual Conference
Sacramento, CA
https://wapms.org

Call for Submissions – The Florida Aquatic Plant Management Society is preparing the Winter 2024 Issue of Aquatics magazine and is seeking articles from industry professionals, researchers, and other interested authors. Submissions can be directed to aquaticsmagazine@gmail.com.

Articles should be no longer than **2,500 words** in length and include photos, captions, author bio and email.

Thanks, Shelby

Shelby Thomas
Editor, Aquatics Magazine
FL Aquatic Plant Management Society
aquaticsmagazine@gmail.com

AERF
Aquatic Ecosystem Restoration Foundation

DID YOU KNOW?

Invasive Aquatic Plants & Harmful Algal Blooms:

- Threaten native aquatic ecosystems
- Degrade water quality, causing health problems for people and animals, loss of habitat for fish and wildlife, and a decrease in property values
- Impacts recreational activities

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SPONSORSHIP OPPORTUNITIES

The Aquatic Ecosystem Restoration Foundation is committed to sustainable water resources through the science of aquatic ecosystem management in collaboration with industry, academia, government and other stakeholders.

Accomplishments & On-Going Efforts

- Best Management Practices Handbook on Biology & Control of Aquatic Plants
- Research partnerships: Private – Government – Academia
- Regulatory Education Tours
- Educational Symposia, Summits, & Seminars
- EPA Liaison
- Science Advisory Panel For Managers & Consultants
- Contributor To Plant Camps For Educators
- White Paper Development
- Graduate Student Assistantships
- Regulatory Engagement & Support
- Connection To World-Leading Scientists In The Discipline
- Webinars For Management & Policy Decision Makers
- Funding For Student Internships
- Travel Assistance For Government & Student Education Opportunities
- B.A.S.S. Alliance & Support

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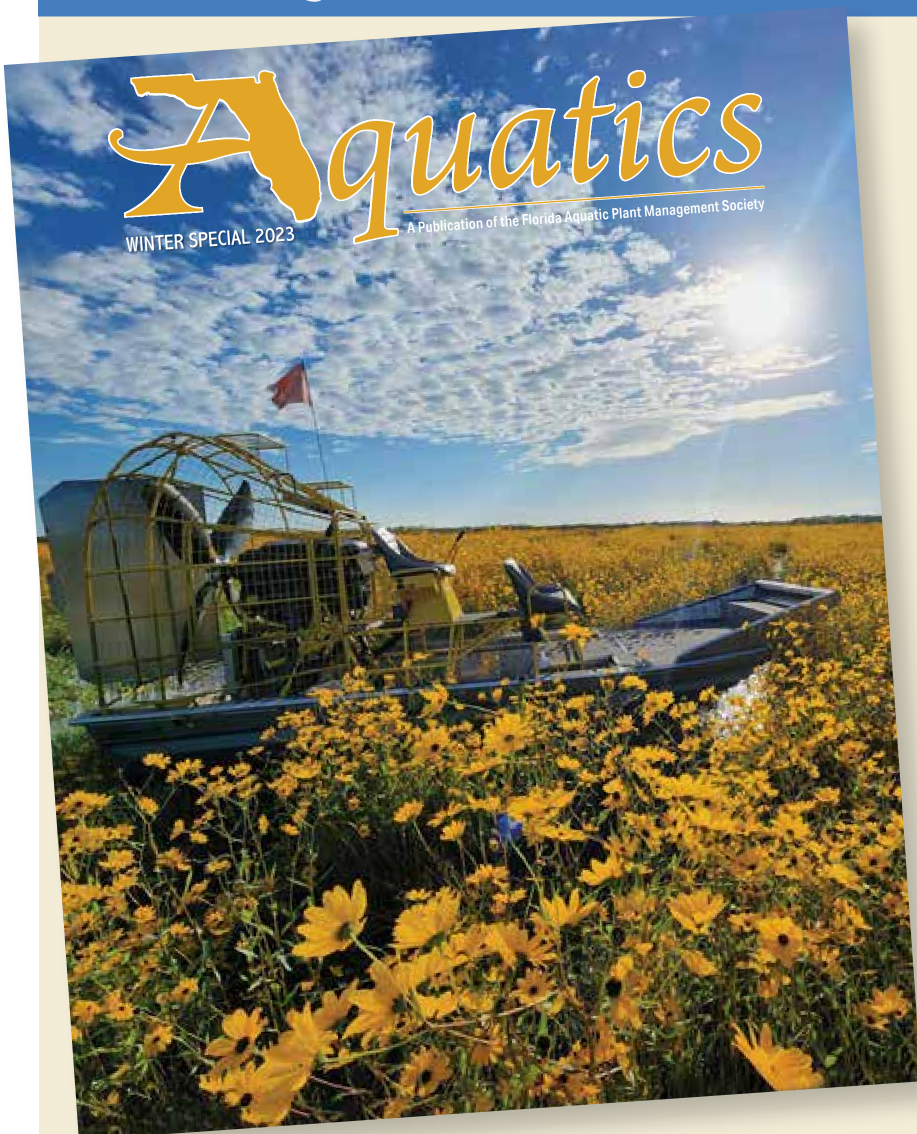

- Aquatics is circulated to approximately 2000 environmental managers, landscape managers, governmental resource managers, and commercial applicators.
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