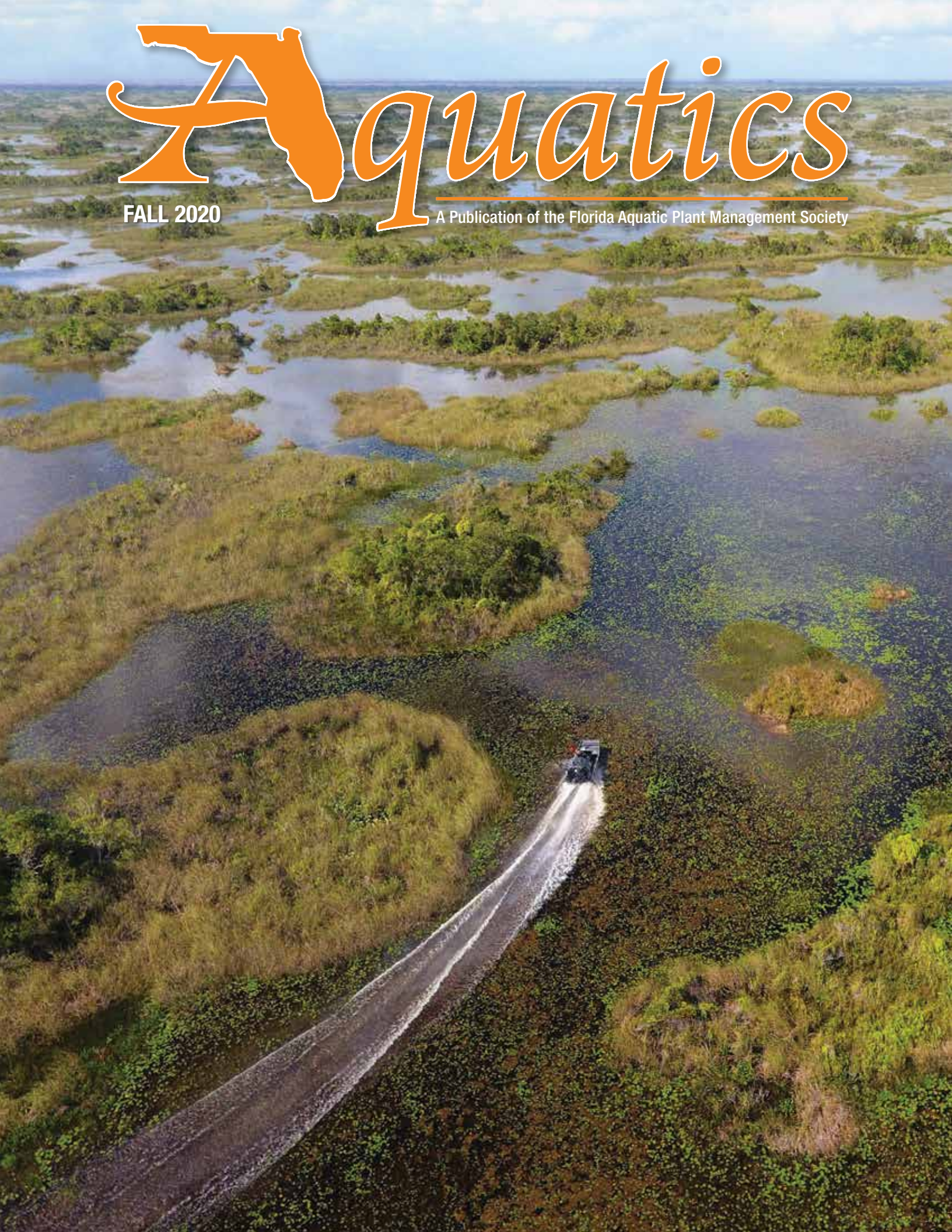


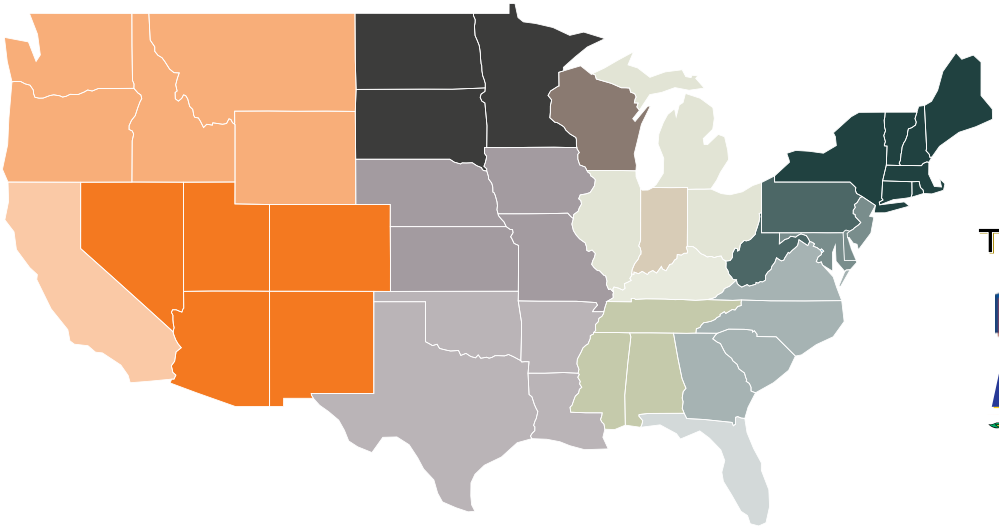
Aquatics

FALL 2020

A Publication of the Florida Aquatic Plant Management Society

FROM COAST TO COAST, HELENA IS YOUR FULL-SERVICE WEED MANAGEMENT PARTNER.

Helena Agri-Enterprises, LLC has the People, Products and Knowledge to assist with your management of nuisance aquatic vegetation. Contact a Helena representative in your area to learn more.



KINETIC
INDUCE
Dyne-Amic
KAMMO PLUS

TRYCERA Selective Broadleaf Herbicide
OPTIMA
HardBall
DLZ DROPLET LANDING ZONE

OR, WA ID, MT, WY
Scott Tweedy | 509.961.2621
TweedyS@HelenaAgri.com

CA
Shaney Emerson | 530.434.3381
EmersonS@HelenaAgri.com

AZ, CO, NM, NV, UT
Dave Cromley | 970.481.1885
CromleyD@HelenaAgri.com

MN, ND, SD
Tom Jameson | 320.241.3258
JamesonT@HelenaAgri.com

WI
Shawn Hilliard | 608.516.4006
HilliardS@HelenaAgri.com

IA, KS, NE, MO
Mark Person | 816.560.5448
PersonM@HelenaAgri.com

AR, LA, OK, TX
Kelly Duffie | 281.415.7301
DuffieK@HelenaAgri.com

IL, KY, MI, OH
Greg Ward | 616.340.9557
WardG@HelenaAgri.com

IN
Jeff Parker | 765.635.6311
ParkerJ@HelenaAgri.com

AL, MS, TN
Greg Wall | 662.312.0510
WallG@HelenaAgri.com

CT, NH, NY, MA, ME, RI, VT
Lou Bettencourt | 978.580.8166
BettencourtL@HelenaAgri.comWIWI

PA, WV
Dan Dillman | 724.290.5511
DillmanD@HelenaAgri.com

DE, NJ, MD
Roy Petters | 856.981.9209
PettersL@HelenaAgri.com

GA, KY, NC, SC, VA
Geer Dubose | 803.480.1425
DuboseG@HelenaAgri.com

FL
James Boggs | 863.557.0076
BoggsJ@HelenaAgri.com

DISTRIBUTOR/AGENT
Applied Biochemists | BASF
Biosafe Systems | Corteva | Monsanto
Nufarm | SePRO | Syngenta | UPI

HELENA®
People...Products...Knowledge...

helenaprofessional.com | Always read and follow label directions. Helena, Dyne-Amic, Kinetic, Induce, Optima, Trycera, HardBall, DLZ and People...Products...Knowledge... are registered trademarks and Kammo is a trademark of Helena Holding Company.

Aquatics

FALL 2020 Volume 42, Number 3

Jonathan Glueckert (jglueckert@ufl.edu) received FIRST PLACE in Aquatic Scene category of the FAPMS Photo Contest. This image was taken at Arthur R. Marshall Loxahatchee NWR, Florida. The refuge is a 145,000 acre remnant of the northern Everglades. Tree islands are a prominent feature on the landscape, and they are heavily impacted by Old World climbing fern (*Lygodium microphyllum*). Jonathan was doing post-treatment monitoring of Old World climbing fern on a tree island using an unmanned aerial system (UAS) to document the change in the tree canopy. A US Fish and Wildlife employee was passing by on his way to prepare a unit in the refuge for a prescribed fire, and Jonathan was lucky enough to have the UAS in the air at the right moment to get this shot. This photo was taken prior to the ban of drones on Department of the Interior property, and all flights were approved through a Special Use Permit.

CONTENTS

Alexandra Onisko
Upland/Wetland Invasive Species Biologist
South Florida Water Management District

Committees

Aquatics Magazine Advertising
Angie Huebner
Invasive Plant Management

Auditing
Keshav Setaram

Awards
Scott Glasscock
Disney Pest Management

By-Laws
James Boggs Jr.
Branch Manager
Florida IVM
Helena Agri-Enterprises, LLC

Education and Outreach
Steve Montgomery
Allstate Resource Management

Governmental Affairs
Matt Phillips
Florida Fish and Wildlife Conservation Comm
Invasive Plant Management

Historical
Andy Fuhrman
Allstate Resource Management, Inc.

Local Arrangements
Bill Torres

Merchandise
Steve Montgomery
Allstate Resource Management

Nominating
Scott Jackson
Syngenta

Program
Brett Bultemeier

Resource Demonstration
Dharmen Setaram
WinField United

Scholarship
Keshav Setaram

Vendor
Scott Jackson
Syngenta

Web Site
Angie Huebner
Invasive Plant Management

LETTER FROM THE PAST PRESIDENT

Thank you for the honor and privilege of serving as your President this past year. This year has been challenging on so many levels; personally and professionally for all of us. Yet, we forged ahead and continued our efforts to educate and outreach, emphasizing the science of aquatic plant management. FAPMS launched its new and more user-friendly website. To end the year, we conducted the FAPMS Virtual Online Training Conference which was a smashing success with 162 attendees who listened to outstanding presentations from our excellent presenters while earning 4 CEU's. Next year is sure to present unique challenges and circumstances as well, but we will prioritize science and outreach to address these issues. If you have ideas or thoughts, please feel free to share and we urge you to become engaged with FAPMS and see how you can make a difference!

Gratefully,
Scott Jackson


Coming together to help you protect, preserve, and restore surface water resources with expanded technologies and technical services.
SePRO
Applied Biochemists
To learn how we can assist you, visit sepro.com
Copyright ©2020 SePRO Corporation.

LETTER FROM THE EDITOR

Dear Aquatics Subscribers,

For the last 9 months, COVID-19 has significantly disrupted our work environments, supply chains, and opportunities for learning. Despite the fact that in-person conferences and meetings have been cancelled or delayed indefinitely, there are still many ways to continue to learn about aquatic plant management, network with colleagues, and even earn CEUs during this time of necessary physical distancing.

Florida Aquatic Plant Management Society (FAPMS) is proud to announce the launch of a newly designed website which is much more user-friendly and looks great, too!! A big thank you goes to the website committee (Angie Huebner, Scott Jackson, Dr. James Leary, Kelli Gladding, and James Boggs) that worked so hard to make this happen! Please visit https://fapms.org and have a look! There are some items that are still being routed from the old website to the new website (e.g. archived issues of *Aquatics* magazine, etc.), so please check back often and see what's new!

For regional chapter updates and information about upcoming meetings/offerings nationwide, please follow Aquatic Plant Management Society on Facebook (@APMS1961), Twitter (@APMSociety), and Instagram (@apmsociety).

You may have found yourself wandering the paragraphs of page 5 of the article on "Do Pesticides Cause Boat Corrosion?" in the Summer 2020 issue of Aquatics trying to make sense of some mixed-up verbiage. Unfortunately, there was a glitch with printing, and the text of this article was printed out of order. The electronic version of the issue has been corrected and can be found on the website. Our sincere apologies to Dr. Brett Bultemeier…it was a fantastic piece!

Just a reminder that submissions to Aquatics magazine are always welcomed! Articles are typically 1,000-2,000 words in length, include a few photos, and are written for the general public. And although the magazine originates in Florida, we welcome content from all over the world. We learn best from each other, and we'd love to hear from you!

Stay safe and be well,

Amy L. Giannotti, Editor
AquaSTEM Consulting
aquaticsmagazine@gmail.com

American Water-willow (*Justicia americana*) By Mason Brock (Masebrock)

Uses of American Water-Willow (*Justicia Americana*) By Reservoir Fishes in Lake Conroe, Texas

Introduction

The native range of the American Water-willow (*Justicia americana*), herein referred to as water-willow, extends from southern Texas into northern Canada and from Kansas to the eastern coast of the United States and inhabits shallow riffles and stream banks (USDA and NRCS, 2015; Penfound, 1940). It often grows in circular stands and has perennial rhizomes (Fritz et al., 2004). These rhizomes help with rapid re-growth in the spring (Twilley et al., 1985).

Water-willow influences stream biodiversity by increasing sediment stability via growth of roots and rhizomes that provide attachment points for various macroinvertebrate taxa (Fritz et al., 2004). In contrast, little to no documentation is available regarding water-willow in lake systems and its effects on macroinvertebrate and fish assemblage structure. Its presence in these systems should be properly assessed because water-willow can occupy a range of water depths, making it an efficient plant for habitat restoration.

Characteristics of water-willow that support its use as an integral part of habitat management projects include: its hardy nature and tolerance to desiccation (Strakosh et al., 2005), ease of establishment and resistance to aquatic animal herbivory. As a case for its hardy nature, water-willow can persist in water bodies inhabited by nonnative Grass Carp (*Ctenopharyngodon idella*) that have been stocked to consume vegetation.

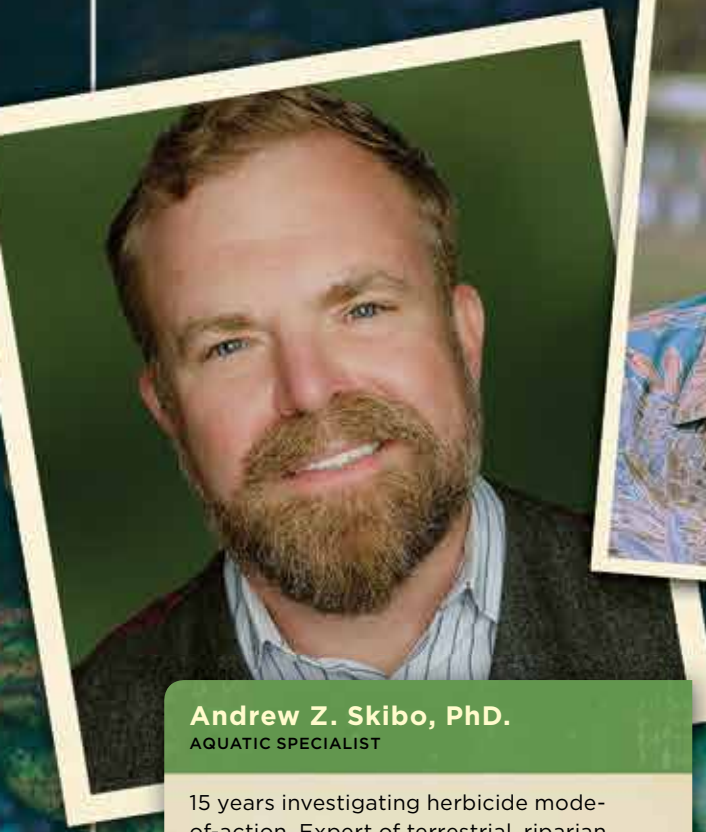
Habitat manipulations show that complex physical structures provide refugia for organisms within the water column, resulting in greater local abundance and diversity (Strakosh et al., 2006). In fact, many fish species show a preference for habitat with more complex structure (Killgore et al., 1993).

Vegetated plots in reservoirs could increase survival of juvenile fishes of both game and non-game species, by reducing the efficiency of predators, thus increasing the probability that juveniles will recruit to adulthood. Increased structure provided by water-willow also reduces mortality of juvenile largemouth bass (Stahr and Shoup, 2015). Macrophytes within the littoral zone increase habitat complexity and increase biodiversity by balancing competition and predation among community taxa (Manatunge et al., 2005; Rennie et al., 2005). More specifically, water-willow is associated with increased abundance and diversity of macroinvertebrates and fishes (Strakosh, 2006).

Personnel from the Texas Parks and Wildlife Department (TPWD) Inland Fisheries office in Snook, Texas planted Water-willow stands in the Caney Creek arm of Lake Conroe, near Conroe Texas in the summer of 2011 to reintroduce vegetation in the presence of nonnative, herbivorous, triploid grass carp. The stands have persisted and currently grow in water depths averaging 1.2 m (range 1 to 1.3 m). These stands also demonstrate a distinct growth form compared to plants in streams. This study will focus on water-willows ecological value, using Lake Conroe as a study system. The objective of this study was to evaluate the ecological value

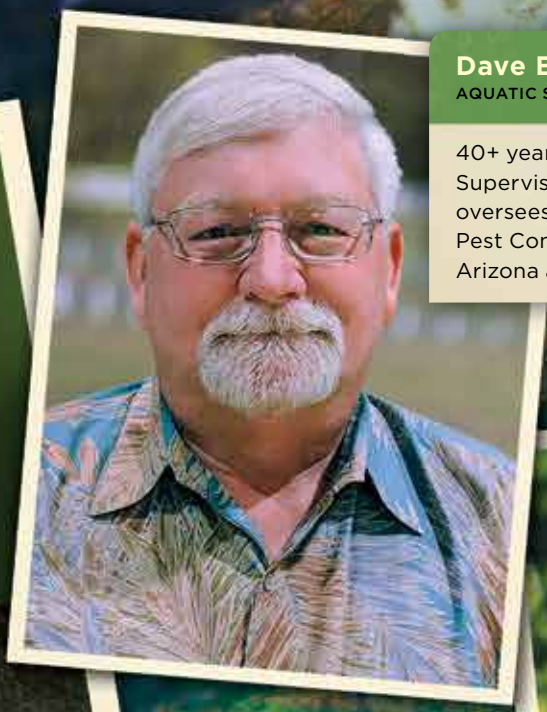
A Comprehensive Product Portfolio

WITH THE KNOWLEDGE AND POST-APPLICATION SUPPORT YOU NEED



Andrew Z. Skibo, PhD.
AQUATIC SPECIALIST

15 years investigating herbicide mode-of-action. Expert of terrestrial, riparian, and aquatic weed species. Currently on Board of Western Aquatic Plant Management Society.



Dave Blodget
AQUATIC SPECIALIST

40+ years aquatic plant management. Supervises Aquatic Specialists and oversees MAGNACIDE™ H herbicide. Pest Control Advisor in California, Arizona and Oregon.

Bo Burns, M.E.M.
AQUATIC SPECIALIST

34 years aquatic plant management. Master of Environmental Management degree in Resource and Wetland Ecology. Past president of South Carolina Aquatic Plant Management Society and NE APMS.


Craig Aguillard
AQUATIC SPECIALIST
38 years plant management. Develops treatments to manage algae, weeds and other conditions in lakes and ponds. Past President of APMS and Midsouth Aquatic Plant Management Society.
Norma Cassinari
AQUATIC SPECIALIST
26 years aquatic plant management. Past President of South Florida Aquatic Plant Management Society. Licensed aquatic pesticide applicator in Florida.
Eli Kersh, M.A.
AQUATIC SPECIALIST
13 years aquatic plant management. Applicator, consultant and technical representative. Currently on Board of California Weed Science Society. Certified Lake Manager by North American Lake Management Society.
Call 888-255-4427 or visit Alligare.com
to find your Alligare Regional Specialist.
A MEMBER OF ADAMA
ADAMA
Consumer and Professional Solutions
ALLIGARE
America's VM Specialists

of water-willow across a range of patch diameters and seasonal variation.

Methods

Water-willow stands were surveyed (Figure 1) and categorized into sizes: bare substrate (no vegetation), small (1.0-2.0 meters), medium (2.1-3.5 meters), and large (3.6-5.5 meters).

Sites were sampled by encircling the area with a seine (1.8 m tall, 0.6 cm mesh size) and using metal poles temporarily driven into the sediment to support the net and nylon clips closed the netting (Figure 2). Fish were collected by electrofishing. Water-willow stems were collected to survey invertebrates present on the stems and to calculate the density of water-willow stand.

Data was separated into groups for analysis:

- Group A: Season
- Group B: Stem Count and Stem Weight
- Group C: Plot Size Category and Diameter.

Relative weight indices (Wr) were calculated to evaluate body condition of Largemouth Bass, Bluegill and Channel Catfish (Anderson and Neumann, 1996; Pope and Kruse, 2007), to compare with other fish of the same species and size.

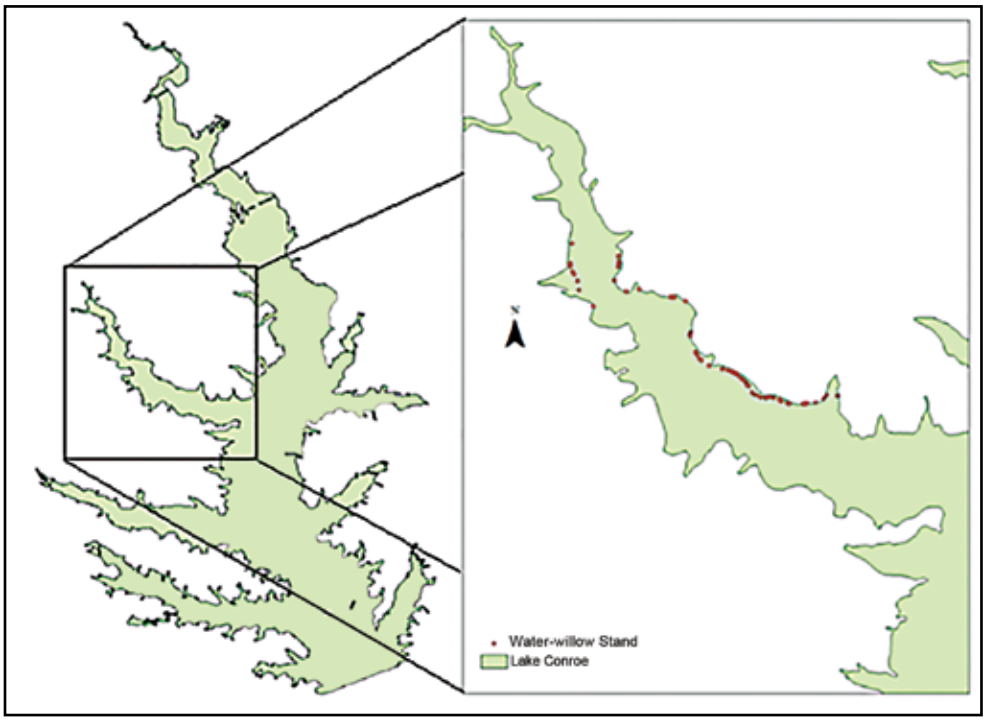


Figure 1: Water-willow stands surveyed in Caney Creek arm of Lake Conroe.

Stomach contents were extracted for diet analysis.

Results

22 fish species were observed. The most abundant species were weed shiners (N=1121) and bluegill (N=1064). Figure 3 shows the correlation of fish abundances. Stem counts, weights, category, and diameter showed the strongest connection to fish occurrence.

Figure 2: Closure of netting, prior to electrocfishing.

Largemouth bass and weed shiner were correlated with large category stands and increased stand diameter. Bluegill, bullhead minnow and threadfin shad abundances were favored increased stem weights and density. Bloodworms were the most common invertebrate in bluegill and minnow stomachs. Where largemouth bass primarily consumed fishes.

Discussion and Conclusion

Fishes in Lake Conroe utilize water-willow as stand size and stem density increase, similar to findings of other studies in streams and experimental manipulations (Rennie et al., 2005; Savino et al., 1992; Spotte, 2007; Beckett et al., 1992, Killgore et al., 1993).

High density stands held more small fish. Additionally, largemouth bass and weed shiners favored large-size stands. Since weed shiners utilize water-willow, largemouth bass can take advantage and inhabit water-willow stands, or surrounding areas while hunting. Vegetated stands also provide increased prey variety which allows predator species, such as largemouth bass, the option to pick and choose their favorite meal (Spotte, 2007).

Smaller largemouth bass (< 6 in) made up the majority of individuals, suggesting

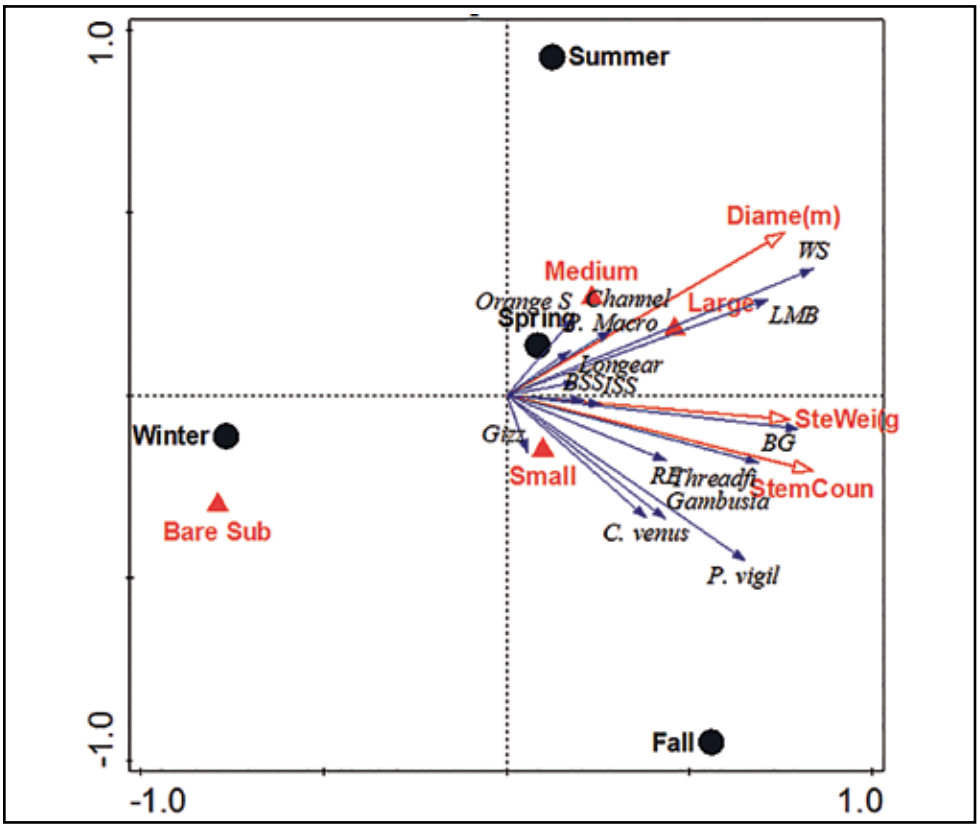


Figure 3: RDA analysis of fish assemblages.

that water-willow may act as nursery habitat and provide protection from predators. Bluegill showed a similar pattern, meaning water-willow could be a nursery habitat for bluegill as well.

Macroinvertebrates were consistently observed in higher numbers in vegetated sites. Bloodworms were the most abundant food source for largemouth bass and bluegill sunfish.

The high number of bloodworms in stomach contents, and in vegetated stands, supports the use of water-willow by multiple fish species as a foraging habitat.

In summary, water-willow is a tough plant that can provide forage and nursery habitat for multiple species of fish and invertebrates in lake systems.

Figure 4: Largemouth Bass surveyed from water-willow stands.

Literature Cited

Beckett, D.C., Aartila, T.P., and Miller, A. 1992. Contrasts in density of benthic invertebrates between macrophyte beds and open littoral patches in Eau Galle Lake, Wisconsin. Am. Midl. Nat. 127: 77–90.

Fritz, K.M., Gangloff, M.M., and Feminella, J.W. 2004. Habitat modification by the stream macrophyte *Justicia americana* and its effects on biota. Oecologia 140, 388– 97.

Killgore, K. J., Dibble, E.D., and Hoover, J.J. 1993. Relationships between fish and aquatic plants: Plan of Study, Miscellaneous Paper A-93-11, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Kristopher J. Stahr and Daniel E. Shoup. 2015 American Water Willow Mediates Survival and Antipredator Behavior of Juvenile Largemouth Bass, Transactions of the American Fisheries Society, 144:5, 903-910,doi:10.1080/00028487.2015.1052559

Manatunge, J., Asaeda, T., & Priyadarshana, T. 2000. The Influence of structural complexity on fish–zooplankton Interactions: A study using artificial submerged macrophytes. Environmental Biology Of Fishes, 58(4), 425-438.

Penfound, W.T. 1940. The biology of *Dianthera americana* L. Am. Midl. Nat. 24:242-247

Pope, K. L. and C. G. Kruse. 2007. Condition. Pages 423-472 in C. S. Guy and M. L. Brown, editors. Analysis and interpretation of freshwater fisheries data. American Fisheries Society, Bethesda, Maryland.

Rennie, M. D., & Jackson, L. J. 2005. The influence of habitat complexity on littoral invertebrate distributions: patterns differ in shallow prairie lakes with and without fish. Canadian Journal of Fisheries & Aquatic Sciences, 62(9), 2088-2099. doi:10.1139/F05- 123

Savino, J., Marschall, E., and Stein, R.,. 1992. Bluegill growth as modified by plant density: an exploration of underlying mechanisms. Oecologia 89(2): 153-160.

Spotte, S. 2007. Bluegills: biology and behavior. American Fisheries Society, Bethesda, Maryland.

Strakosh, T.R., Eitzmann, J.L., Gido, K.B., and Guy, C.S. 2005. The response of water willow *Justicia americana* to different water inundation and desiccation regimes, North American Journal of Fisheries Management, 25:4, 1476-1485,DOI: 10.1577/M05-051.1

Strakosh, T. R. 2006. Effects of water willow establishment on littoral assemblages in Kansas reservoirs: focus on age-0 largemouth bass. Doctoral dissertation. Kansas State University, Manhattan

Twilley, R.R., Blanton, L.R., Brinson, M.M. and Davis, G.J., 1985. Biomass production and Nutrient cycling in aquatic macrophyte communities of the Chowan River, North Carolina. Aquat. Bot., 22:231-252.

USDA, NRCS. (2015). The PLANTS Database. (http://plants.usda.gov, 30 September 2015). National Plant Data Team, Greensboro, NC 27401-4901 USA.

Ryan O'Hanlon (ryan@stoneflyaquaticnursery.com) is the co-owner and lead aquatic horticulturalist at Stonefly Aquatic Nursery and holds a Bachelors and Masters from Texas A&M University majoring in Wildlife and Fisheries Sciences. This article is a portion of the thesis, under supervisor Dr. Frances Gelwick, which studied the fish and invertebrate uses of American water-willow.


Stewards of Water and Procella Water Resource Solutions
Where expertise and innovation come together to protect and restore Earth's most precious natural resource…water.
PROCELLA
Water Resource Solutions
WEEDS
Coming Soon
Sonar Infinity
Aquatic Herbicide
ProcellaCOR
Aquatic Herbicide
ALGAE
Coming Soon
ReHAB
Algaecide
WATER QUALITY
Coming Soon
EutroSORB
NEW TECHNOLOGY
The Stewards of Water
PRO CERTIFIED
SePRO
Procella Water Resource Solutions is a platform of innovative technologies developed from SePRO research and available through Pro Certified Stewards of Water. Visit sepro.com/aquatics/procellacor to learn more.
SePRO
Always read and follow all label directions. Procella Water Resource Solutions, ProcellaCOR, ReHAB, EutroSORB, and Sonar Infinity are trademarks of SePRO Corporation.

APPLICATORS' CORNER

The Summer 2020 issue of *Aquatics* magazine provided excellent information on Florida lake biology and two articles should be read carefully since they answer questions commonly asked by the public. Thayer and co-authors explain the trophic classification of Florida lakes (my note: "Florida lakes used to be crystal clear" is commonly heard at public meetings) and possible limitations of the widely used Carlson Trophic State Index. The reprint of the 2004 LAKEWATCH newsletter discusses the sediment research of Mark Brenner and Jason Curtis (UF) on Lake Davis in Citrus County, and we again commonly hear how our invasive weed management programs are "filling up our lakes with sediment". Their research showed that sediment accumulation in the lake has been relatively constant over the past 5,000 years at a rate of about 3 feet per 1,000 years (about 1/25 inch per year). It's difficult to imagine the geological time scale; but the old saying "You can move a mountain with a teaspoon if you have enough time" is sort of like the evolution of a lake to a bog at a rate of 1/25 of an inch per year.

In the last issue we discussed the potential utilization and low economic value of harvested aquatic plants, particularly waterhyacinths. There has been keen interest by many regarding water quality, algae blooms and the potential for harvesting aquatic plants to remove nutrients, primarily phosphorus (P), from Florida waters.

There is "value" in the fertilizer content of aquatic plants and also value added by removal of nutrients from the aquatic environment, which, in theory, could reduce harmful algal blooms. A couple of critical questions then have to be asked: how much hyacinth or hydrilla needs to be harvested to remove, for example, a ton of total P? Also, how much P needs to be harvested to have a significant impact on the aquatic ecosystem? This depends on the size and amount of nutrients in the system (sediment, plants, fish and water) and additional inputs from the watershed. The first question is much easier to answer.

As indicated in previous issues of *Aquatics*, we know that the average acre of hyacinths and hydrilla contains about 46 and 2.3 pounds of total P, respectively. The P content of even eutrophic waters is very dilute and contains on average about 50 micrograms P per L (ppb), which is very low compared to P concentrations in terrestrial soils or lake sediments. The root system of hyacinths is extensive and often comprises 10 to 30% of the total hyacinth mass in an acre of plants – and necessarily so, to be able to absorb the low concentration of P in the water to sustain their growth. In contrast, the roots of hydrilla usually constitute a small fraction (< 5%) of hydrilla biomass since hydrilla takes root into the sediment, which typically contains much higher N and P concentrations than the overlying water. Many studies indicate and most scientists believe that submersed plants derive the majority of their required N and P from the sediments; for example, see Gosselin *et al.* (2018) for a recent report on N and P uptake in naiad, hydrilla and pondweed.

Thus, waterhyacinth seems to be the best choice to harvest for P removal from aquatic systems since their biomass per acre is high, they obtain their nutrients from the water column, and an acre of plants contains about 46 pounds of total P.

The South Florida Water Management District (SFWMD) regularly monitors the volume and P content of water flowing into Lake Okeechobee via the Kissimmee River (and all other inflows as well). From these data, the district calculates in metric tons (2,200 pounds) the annual P entering the lake from the northern watershed. The total P flowing into the lake is highly variable from year to year, primarily due to low- or high-water flows entering the lake. Droughts in 1993/94 and 2001/02 resulted in less than 30 metric tons of total P entering Lake Okeechobee from the Kissimmee River. However, during the high-water years of 1997/98 and 2017/18, over 400 metric tons of total P entered the lake via the Kissimmee River. The average P-loading by just the Kissimmee River into Lake Okeechobee over the past 20 years averages about 150 metric tons per year, so we need to harvest large quantities of P to

make a significant dent in the annual P loading via this input alone. How many acres of hyacinths need to be harvested to remove a ton of P? Well, 2,200 pounds divided by 46 pounds of P in an acre of water hyacinth indicate that to remove one metric ton of P, 48 acres of hyacinths will have to be harvested. In addition to the P, harvesting this acre will remove 5.6 tons of total N and the removal operation will have to handle 6,545 metric tons fresh weight of hyacinths (327 tons dry weight). The Okeechobee system is HUGE. An interesting comparison is the harvesting of submersed plants to remove P from a 13-acre lake in Minnesota (Bartodziej *et al.* 2018).

We have covered a lot about nutrients in the past couple issues of *AQUATICS*, so we are going to change gears and start mixing it up a bit. Several years ago, while working on a lake in central Florida, a cold front approached and the ensuing rain and wind required a change in plans. Needing to return to Gainesville, I decided to leave the boat at the County Aquatic Weeds office to pick up later in the week to finish sampling the lake. Upon entering the office building, I noted that the entire aquatics crew was gathered around a large table and having a discussion with everyone taking turns at asking and answering questions while reading an aquatic herbicide label. I learned a lot that afternoon and will provide an example here.

First, we need to read the same label, so go to **www.cdms.net** and get to the label/SDS database. Type "Reward" in the product search box, then click on "Reward Landscape and Aquatic Herbicide", then open the Specimen label; this is the Federal Section 3 label. Use the label to answer the questions below.

Scan or take a picture of your completed quiz and email it to Dr. Gettys (lgettys@ufl.edu). The 1st, 5th and 10th submissions with correct answers will receive a fantastic and classic cap embroidered with the Short Course logo. Please note, this contest is intended for field applicators, not supervisors or company reps, and the answers will be discussed in the next APPLICATORS CORNER.

References

Bartodziej, WM, Blood SL and Pilgrim, K. 2017. Aquatic plant harvesting: an economical phosphorus removal tool in an urban shallow lake. *Journal of Aquatic Plant Management*. 55:26-34. Online and open access at http://www.apms.org/wp/wp-content/uploads/japm-55-01-26.pdf

Gosselin JR, Haller WT, Gettys LA, Griffin T and Crawford ES. 2018. Effects of substrate nutrients on growth of three submersed aquatic plants. *Journal of Aquatic Plant Management*. 56:39-46. Online and open access at http://www.apms.org/wp/wp-content/uploads/japm-56-01-39.pdf

1. What is the signal word for Reward? _____
2. What are the three signal words from least to most restrictive or toxic? (This isn't on the label but you should know this!) _____
3. Would you consider the PPE requirements to be minimal, average or extensive for Reward? (circle your answer)
4. What happens when you inject Reward behind your boat into shallow muddy water? _____ _____
5. Does diquat move or translocate in the plant? _____
6. Is it legal for an unlicensed private pond owner to apply diquat to their contained, (no flow) private pond? _____ _____.
7. Can you re-treat foliar spot applications to duckweed three days after an initial application? Yes or no (circle your answer)
8. The maximum broadcast foliar application rate for diquat on waterlettuce is _____ gallons per acre
9. How many pounds of diquat dibromide are in a gallon of Reward? _____
10. The maximum rate of Reward that can be applied to submersed weeds in water 6 feet deep is _____ gallons per acre.
11. Can you legally pump or place 3 gallons of Reward from a labelled tote into a 5-gallon container to take to the field? Yes or no (circle your answer)
12. You are on a lake and you just tank-mixed Reward with surfactant in 50 gallons of water to treat a 20 to 30 feet wide fringe of waterlettuce on the edge of a lake. A fisherman shows up and starts fishing the lettuce edge about 100 yards from you. How close to the fisherman can you legally spray? _____

44th Annual FAPMS *VIRTUAL* Training Conference

To say 2020 has been an "interesting" year would be a huge understatement. Covid-19 swept across the globe and has affected practically every facet of our day-to-day life, from going to get groceries, to how we interact with each other, to attending large public events such as the FAPMS annual training conference. This year's conference was supposed to meet back in lively, Daytona Beach, which is always FAPMS attendees' favorite meeting location. However, due to Covid-19, the FAPMS BOD had to come up with another method of getting you, the aquatic plant managers and applicators, a 2020 training opportunity. Instead of cancelling the 2020 conference altogether, it was decided to provide a virtual (online) option. Taking into consideration the meeting platform, we still had an impressive 162 registrations! Special thanks go out to Scott Jackson and Syngenta for providing the Zoom platform for the three separate sessions, training webinar with 5 great aquatics-related presentations and 3 industry updates, the annual business meeting, and the always popular duck races. Kudos also go to Dr. Brett Bultemeier for his work developing the Program, lining up the speakers, facilitating the presentations and working with FDACS to provide the all-important continuing education units (i.e., CEUs). Actually, all attendees received 4 Aquatic CEUs. A special thanks to the speakers/presenters; Dr. Jay Ferrell, Dr. Benjamin Sperry, Dr. James Leary, Mr. Matt Phillips, and Dr. Lyn Gettys. Giving presentations to your computer versus a live audience is a difficult thing to do, and you all did very well! Thanks to all of our sponsors as well. Without their support, it would be difficult to pull off these valuable training and networking opportunities.

Grand Sponsors: Applied Aquatic Management, SePRO, Syngenta, UPL NA Inc.

Gold Sponsors: Airmax, Alligare, Allstate Resource Management, Aquatic Vegetation Control, Bayer, Brewer International, Chemical Containers, Helena Agri-Enterprises, Nutrien Solutions, Winfield United

2020 President's Award Winners

President Scott Jackson selected one recipient for the 2020 President's Awards. **The receipt was Mr. John Gardner**.

John graduated from Baldwin Wallace University in Berea, Ohio. He started Aquatic Systems, Inc. (ASI) in 1977 after getting his start in the aquatics industry working for 3M Lakes & Waterway Management Service in Pompano Beach, Florida. He focused on building an organization at ASI that focused on solid ecological principles long before such concepts became popular. He implemented an active R&D initiative at ASI and believed it was important to connect with other likeminded lake management professionals throughout Florida. Most importantly, John built a long career based upon treating all people fairly, honestly, and with respect & appreciation. Because of these vital standards, John developed ASI into a scientific and business leader within the lake management industry in Florida and supported over 150 dedicated team members by 2019. John always enjoyed being a part of the FAPMS and serving in a variety of capacities through the years.

John, thank you for your many years of support of FAPMS and the Aquatic Plant Management Industry and congratulations on this prestigious award!

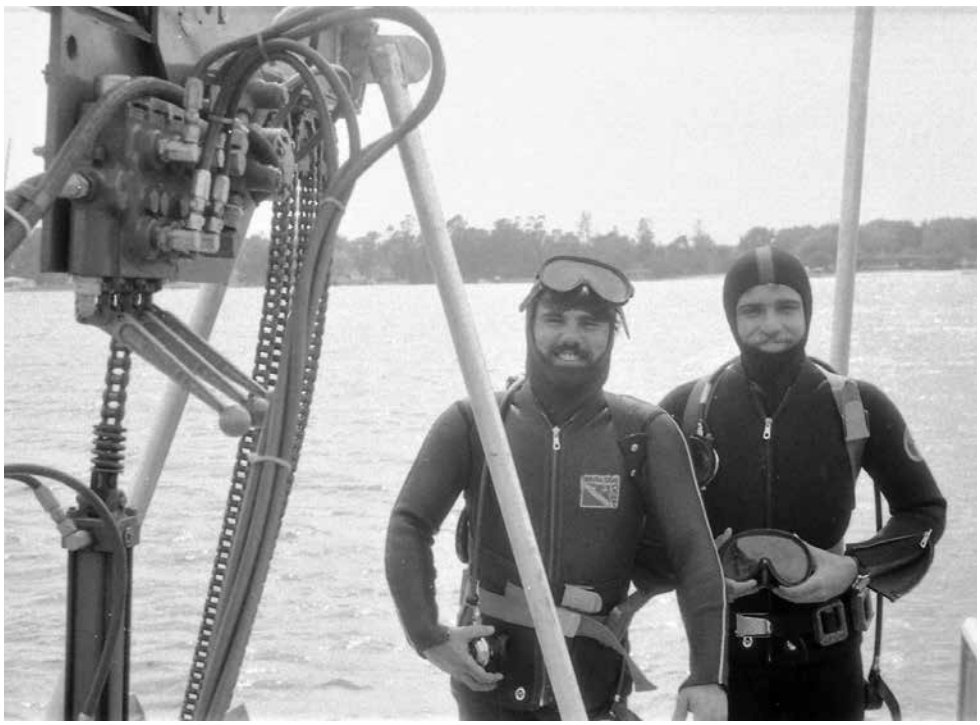
2020 Honorary Lifetime Membership-

None

2020 Dr. Michael D. Netherland Exemplary Colleague Award

Dr. Mike Netherland was a highly respected scientist, friend, mentor and collaborator. Nearly everyone in the aquatic plant management community was influenced by his work and his benevolence through the years. In honor of Mike's memory, FAPMS created the Dr. Michael D. Netherland Exemplary Colleague Award with the following criteria in mind:

- A special recognition given to a current or former APMS affiliate



Jeff Schardt, diving on the aquatic plant biomass survey in Lake Conway in 1978.

member who personifies Michael Netherland's positive attitude, outgoing and inquisitive personality, and genuine selfless giving friendship qualities.

- A person that displays a love and pursuit of gaining and sharing knowledge within the APM community.
- A person that exhibits sincerity and friendship towards all FAPMS members, including providing guidance in all forms of aquatic plant management and professional activities.

The winner of this year's Michael D. Netherland Exemplary Colleague Award was Mr. Jeffrey Schardt. For more than 30 years, Jeff worked for the Invasive Plant Management Section (IPMS) now within the Florida Fish and Wildlife Conservation Commission, previously the Florida Department of National Resources (DNR) and Florida Department of Environmental Protection (DEP). He was the invasive aquatic plant management program coordinator for the majority his tenure, where he requested and managed funding for controlling nuisance aquatic vegetation in public systems across the state. He worked to provide answers to aquatic plant research questions with a long-standing history of collaboration with the University of Florida and US Army Corps of Engineers, where his professional affiliation and personal friendship with Dr. Mike Netherland originated. He and Mike wrote several significant pieces (e.g., http://www.apms.org/wp/wp-content/uploads/2012/09/APMS-definition-of-control.pdf). During his career with the IPMS, Jeff also mentored many aquatic plant biologists within and outside the agency.

Mr. Schardt also worked in collaboration with the University of Florida on the educational front through the *Florida Teachers Plant Camp*. This program was developed for Florida science teachers to produce outreach materials and classroom curricula related to invasive aquatic plants and management efforts in Florida. He worked with federal and state agencies to implement common sense regulatory and management approaches related to NPDES permitting and protecting endangered species.

In 2000, Mr. Schardt served as the President of the Florida Aquatic Plant Management Society and received the FAPMS lifetime membership award in 2014. He also served as president of the national APMS in 2006. Jeff just recently "retired" again from serving in the aquatic plant management industry through his participation on the national APMS Board of Directors as the Secretary. Jeff served a total of 19 years with APMS and was active in several important leadership roles.

2020 FAPMS Aquatic Plant Manager of the Year

Every year any active FAPMS member has the opportunity to nominate a peer or team for this award. The purpose of the award is to recognize outstanding performance or achievements in aquatic plant management field activities and enhance professionalism in aquatic plant management in Florida.

Jeff, pictured here in 2013 with hydrilla, was one of the founders of Plant Camp. He was an active speaker and mentor, and he is credited with educating many teachers and students across Florida about the problems with invasive plants.

A name that has become synonymous with winning, Mr. Colin Lewis, is the 2020 FAPMS Aquatic Plant Manager of the Year. Colin's nomination was submitted by his supervisor, Mr. Jason Cull, who also works with the Lee County Hyacinth Control District (LCHCD). Colin is a graduate of Florida Gulf Coast University earning a Bachelor of Science degree in 2017. He has developed an aquatic drone spray program for LCHCD, and he's active in education and outreach activities throughout southwest Florida to showcase and develop his understanding of aquatic plant management tools.

Congratulations on this prestigious award Colin!

2020 Aquatic Plant Applicator Oral and Poster Presentation Winners

Unfortunately, due to the virtual conference format this year FAPMS was not able to provide an opportunity for aquatic applicators to share their work in oral or poster presentations. We're hopeful this very important component of the conference will return next year at our in-person meeting in St. Petersburg, so begin thinking of what you'd like to present to your peers.

2020 Paul C. Myers Applicator Dependent Scholarship Award Winners

The Paul C. Myers Applicator Dependent Scholarship provides funds to deserving undergraduate students whose parent or guardian has been a FAPMS member in good standing for at least three consecutive years. A total of $8,000 was awarded in 2020 to four worthy recipients; Abigail Campbell, Molly Lovestrand, Kaylie Mangus and Abbey Smith. This scholarship is funded primarily through monies raised at the annual conference, including $5 for every registration, as well as additional funds from the sale of raffle tickets and Duck Race entrants. Congratulations Abigail, Molly, Kaylie and Abbey!

Duck Races

Likely the most anticipated and heralded event, the FAPMS Annual Duck Races produced several happy winners with the Cooking/Amazon Duck Race where the first-place prize was a pellet grill, and second & third place prizes were $150 and $50 Amazon gift cards, respectively. In the RTIC Duck Race, the winners received incrementally sized (65 qt, 45 qt, duffle) RTIC coolers:

Cooking/Amazon Duck Race

1st- Alex Onisko

2nd- Andy Fuhrman

3rd- Rocco

RTIC Duck Race

1st- Joe Malone

2nd- Jeremy Slade

3rd- Andy Fuhrman

Vic Ramey Photo Contest

This year's winners of the annual Vic Ramey Photo Contest were awarded cash prizes for their winning photos. Winners took home $150 for 1st place, $100 for 2nd place, and $50 for 3rd place in each category. Thank you to all the photographers with awesome submissions of what you do in your job daily! Congratulations to the winners Mr. Jonathan Glueckert, Mr. Wesley Williams, Mr. Keith Mangus, Mr. Randy Snyder, and Mr. Colin Lewis - who once again took advantage of the "relaxed" FAPMS award policies and is taking home more cold-hard cash to go along with winning the 2020 FAPMS Aquatic Plant Manager of the Year Award!

Aquatic Scene

1st place ($150)- Mr. Jonathan Glueckert

2nd place ($100)- Mr. Jonathan Glueckert

3rd place ($50)- Mr. Wesley Williams

Aquatic Operations

1st place ($150)- Mr. Colin Lewis

2nd place ($100)- Mr. Keith Mangus

3rd place ($50)- Mr. Randy Snyder

To end our business meeting this year, four Directors having served a three-year term rotated off the Board of Directors, and four new Directors joined the Board of Directors. The Directors that rotated off the FAPMS Board are Ms. Kelli Gladding, Dr. Lyn Gettys, Mr. Thomas Calhoun and Mr. Tim Harris. The three incoming Directors joining the FAPMS Board this year are President-elect Stephen "Monty" Montgomery, Ms. Alex Onisko, Mr. Jason Cull and Dr. Jay Ferrell. Thank you for your service to the Society Kelli, Lyn, Thomas, and Tim… and welcome to the Board Monty, Alex, Jason, and Jay!

President Scott Jackson passed the gavel, virtually of course, to incoming President, Jeremy Slade to begin his presidency for 2020-2021.

Next year's annual training conference returns to St. Pete, FL, October 11-13, 2021, so put it on the calendar now and hope to see you there!

Thank to all of the sponsors of FAPMS 2020.

THE HAMMER

Pound tough algae with INFUSION Technology

Get started with Captain® XTR Algaecide that delivers more copper to the algal cells providing a faster knockdown and better control.

THE BROOM

Sweep away the food source, continue to fight algae

Initiate a SeClear Algaecide and Water Quality Enhancer® maintenance program to strip nutrients while continuing to work as an effective algaecide.

SePRO

Learn more. Contact your SePRO Technical Specialist, or call **1-800-419-7779.** Visit **sepro.com**

FWC TAG

The Florida Fish and Wildlife Conservation Commission (FWC) is designated by the Florida legislature as the lead agency to manage nonnative species in the state. The FWC's Aquatic Plant Management Program designs, funds, coordinates, and contracts invasive aquatic plant control efforts in Florida's 1.25 million acres of public waters. When managing invasive aquatic plants, the FWC recognizes it is important to balance the needs of the different stakeholder groups who use Florida's freshwater resources. It can be challenging to manage high-quality fish and wildlife habitat while also balancing the needs of stakeholders using these waterbodies. However, the FWC is committed to doing just that.

In January 2019, the FWC temporarily paused its aquatic herbicide treatment program and conducted a listening tour around the state to better understand the public's concerns and desires. The FWC received a variety of feedback from Florida residents and visitors regarding its Aquatic Plant Management Program. Stakeholders expressed an overall dissatisfaction with the condition of lakes and were concerned about declining water quality and habitat. Stakeholders desired increased oversight and accountability of contractors, the use of mechanical methods over herbicides, and increased coordination with agencies responsible for managing Florida's freshwater resources. Some stakeholders also suggested the agency should manage systems more aggressively, while others preferred less intensive management efforts.

Clearly, there are many challenges to managing our highly-altered freshwater systems and there is no doubt that these resources are vitally important to Floridians and visitors. Because there are so many different user groups, there are diverse opinions on what lakes should look like, and it can be difficult to please all stakeholders,

ultimately making management initiatives more challenging. However, the FWC is committed to working with the public to arrive at solutions together.

So, in an effort to be responsive to stakeholder concerns, the FWC spent the past year incorporating a variety of enhancements into the Aquatic Plant Management Program. One of those enhancements included the formation of a Technical Assistance Group, or TAG, to address the challenges and issues associated with aquatic plant management across the state. The Aquatic Plant Management TAG is comprised of nearly 30 volunteer representatives from recreational and professional anglers, waterfowl hunters, water related businesses, riparian owners, stakeholder organizations, environmental and recreational NGOs, local government representatives and state agencies that are directly involved in or affected by aquatic plant management in Florida. The FWC sought participation from a wide range of interests with a goal to maintain a balance of differing viewpoints from across Florida.

The group was organized to fact-find and to provide information and technical assistance to FWC staff relating to the Commission's responsibilities over aquatic plant management so that the FWC can effectively manage for healthy fish and wildlife habitat. The TAG provides a forum for discussion on all aspects of the aquatic plant management program by establishing common ground, identifying problems, addressing concerns, noting areas of disagreement, and evaluating scientific information. It provides a forum for sharing information and developing solutions to problems. The TAG members worked together to define the following purpose and goals. The TAG:

1. will discuss issues, explore common interests and evaluate scientific information;
2. promote ongoing dialogue and mutual understanding among organizations, agencies, and their respective stakeholders by providing information and opportunities to share viewpoints on issues related to the FWC's Aquatic Plant Management Program and aquatic plant management in general;
3. allow FWC and TAG Members, that represent groups and stakeholder interests, to have a greater understanding of the complexity of aquatic plant management, as well as positions held by others that may be different than their own;
4. will have a mechanism to provide insights for improvements to the Aquatic Plant Management Program that includes increasing accountability, managing fish and wildlife resources for their long-term well-being, and to receive updates from the FWC on program improvements.

To date, the FWC has hosted four Aquatic Plant Management TAG meetings. The kick-off meeting, held September 20, 2019, allowed members to introduce themselves, revise their charter and prioritize issues they would like the TAG to explore. The top four issues identified by TAG members included lack of communication, alternative methods to herbicide, applicator accountability, and money/funding. FWC hosted the 2nd meeting on December 17, 2019 and structured the agenda to allow for more group dialogue on two of the priority issues—communication and funding. FWC staff also provided progress updates on FWC Commissioner-directed improvements to the Aquatic Plant Management Program focusing those updates on harvest-

ing research efforts and the development of habitat management plans for individual lakes. Due to COVID-19 restrictions, subsequent meetings have been held virtually. The FWC hosted a virtual Aquatic Plant Management TAG meeting on May 27, 2020. At this virtual meeting, the agenda again focused on priority issues that had been previously identified by the TAG. FWC provided a live demonstration on a real-time tracking system that monitors contractors and records precise locations of herbicide applications. This fleet tracker technology, similar to systems used by shipping and trucking companies, is being tested on Lake Okeechobee with the goal of having this type of technology incorporated as a requirement for new contracts with aquatic plant control contractors. Once installed, the trackers show precise routes of all equipped vessels including the locations where herbicides are and were applied. Overall, TAG members agreed this type of technology would advance contractor oversight and accountability and provide valuable management data.

During this meeting, FWC's Fish and Wildlife Research Institute (FWRI) staff also provided an update on recent fish health screenings and monitoring efforts that have been implemented as part of the Long-Term Monitoring Program. Thanks to TAG members and anglers raising concerns about finding fish with lesions in higher numbers, FWRI has initiated a long-term fish health monitoring program as part of FWC's ongoing sampling of fish populations. TAG members provided valuable input to strengthen the research and many expressed a willingness to actively participate.

The FWC hosted another virtual meeting on September 8, 2020. The discussion on potential fish health research projects continued and FWC biologists provided an update on FWC's efforts to develop Lake Management Plans for Lake Okeechobee, the Kissimmee Chain of Lakes, and the Harris Chain of Lakes.

FWC staff continue to provide regular progress updates to the Aquatic Plant Management TAG and actively seek feedback on current issues and activities. The FWC looks forward to future TAG meetings where members will continue to provide topics for discussion and drive agenda priorities.

While the Aquatic Plant Management TAG is a relatively new group, members have demonstrated a strong commitment and shared responsibility to this important issue. Because of their diverse backgrounds, FWC staff are encouraged that the TAG can be effective in assisting the FWC in balancing the competing desires of stakeholders while also striving to maintain and enhance habitat for fish and wildlife species. Cooperation and coordination among agencies and stakeholders are necessary to protect, restore and manage our lakes. The FWC is excited to work with the TAG to develop solutions, advance accountability, and implement enhancements to the FWC's Aquatic Plant Management Program so that current and future residents and visitors are able to enjoy all of the treasures our freshwater systems have to offer.

Danielle Kirkland (Danielle.Kirkland@MyFWC.com) is a Biological Administrator III with the Florida Fish and Wildlife Conservation Commission. Danielle has been lending her expertise with aquatic plant management to the agency since 2004, and she is currently serving as the FWC coordinator for the TAG.

IMOX.™ The Leader In Targeted Weed Control

When Versatility & Selectivity Are Absolutely Necessary.

With no grazing restrictions and minimal irrigation restrictions, IMOX™ *(Imazamox 12.01% A.I.)* from Alligare is the perfect pre- and post-emergent choice for environmentally sensitive areas *(including below the water-line, as well as a plant growth regulator for canal banks)*. Your Alligare technical field representative can help you fully realize IMOX's versatility, including introducing IMOX™ into your glyphosate rotation plan!

Call (888) 255-4427 To Order IMOX™ Today!

Alligare Leads the Way With Our Family of Vegetation Management Solutions.

Argos • IMOX™ • Fluridone • MAGNACIDE™ H

2,4-D Amine • Diquat • Ecomazapyr 2SL • Glyphosate 5.4 • Triclopyr 3SL

Aquatics

Bare Ground / RxR

Roadside / ROW

Alligare.com (888) 255-4427

America's Vegetation Management Specialists℠

ALLIGARE

UF Graduate Updates

Taylor Darnell

Taylor Darnell is a first year agronomy master's student studying applied aquatic weed management. As a graduate assistant, Taylor works with the UF/IFAS Center for Aquatic and Invasive Plants (CAIP) where he is currently planning and establishing Hydrilla verticillata, hydrilla tuber management studies for his thesis and several chemical trials for various suppliers. He is co-advised by Dr. Candice Prince and Dr. Benjamin Sperry.

Taylor is originally from Rural Hall, a small town 15 minutes outside of Winston-Salem, NC. As a child he grew up around his family's daylily gardens which first sparked his interest in plants. He enjoyed understanding how daylily hybridization worked and what he could do to make it better, which led him to earn a degree in Chemistry from Ferrum College in Ferrum, Virginia. Taylor explains, "because I wanted to understand how plant management worked, I felt that chemistry was a great foundation."

After a conversation with Dr. Tim Durham, Assistant Professor of Agronomy and Agriculture Program Coordinator at Ferrum College and UF Doctor Plant Medicine alumni, Taylor was encouraged to explore graduate programs at the University of Florida. When asked about the significance of his research interests, Taylor said that by determining how to manage the reproductive biomass of hydrilla, you can prevent their growth.

Taylor's favorite thing about science is applied fieldwork. One of his favorite fieldwork stories was from two years ago when he was sampling Fraser fir branches and needles/tips (apical meristems) for his research project looking at metabolites with a friend. One day a "freak snowstorm and rain" forced them to rush back to their truck for shelter. As they were running back, his friend fell in a four-foot hole. Aside from the memories he has made in the field, Taylor enjoys applied fieldwork research because it aims to bring scientific solutions to those who need it.

Ultimately, Taylor wants to pursue a Ph.D. and eventually work in research and development in the academic arena. In his spare time, Taylor still enjoys hybridizing daylilies and throwing together whimsical ceramics (piggy banks are his favorite).

Taylor shares that if you are an undergraduate student interested in plants or scientific fieldwork you should reach out to graduate students at UF/IFAS CAIP for opportunities to assist with projects.

Funding graduate student research and supporting students interesting in invasive aquatic plant management are two of the many goals of UF/IFAS CAIP. Any questions should be directed to Shelby Oesterreicher at 352-273-3667 or soesterreicher@ufl.edu. For more information about the UF/IFAS Center for Aquatic and Invasive Plants, please visit https://plants.ifas.ufl.edu. Be sure to follow us on social @UFIFASCAIP.

UF/IFAS CAIP, Turning Science Into Solutions.

Christine Krebs (ckrebs@ufl.edu) is a communications assistant for the University of Florida Institute of Food and Agricultural Sciences Center for Aquatic and Invasive Plants (UF/IFAS CAIP). Christine is also a graduate student currently obtaining her doctoral degree in Agricultural Education and Communication.

Jackson Jablonski

Jackson Jablonski is an agronomy master's student focusing on invasive plants. Cuban bulrush management is his main project with graduate supervisor Dr. Candice Prince. At the UF/IFAS Center for Aquatic and Invasive Plants, Jackson has contributed to projects related to Brazilian Peppertree, Water hyacinth, Hydrilla, and Cogon grass.

In Gainesville, Jackson enjoys exploring the local creeks and sifting for fossils.

Jackson spent approximately one year as a PeaceCorps agriculture volunteer, working with native communities in Madagascar to adopt agriculture techniques that complimented the environment they relied on. In March, Jackson evacuated Madagascar, and he and all other volunteers were sent home in response to the global pandemic.

Upon his return to the United States, Jackson recalled meeting Cynthia Hight, an agronomy academic specialist, after his undergraduate capstone project presentation a few years prior. Cynthia shared she was impressed with his project and encouraged him to continue his education. As his service in the PeaceCorps came to an abrupt halt, Jackson felt it was the perfect time to pursue his master's in agronomy and reached out to Cynthia seeking opportunities available at the University of Florida.

Jackson shares that students interested in science should take advantage of op-

Jackson a PeaceCorps agriculture volunteer, working with native communities in Madagascar.

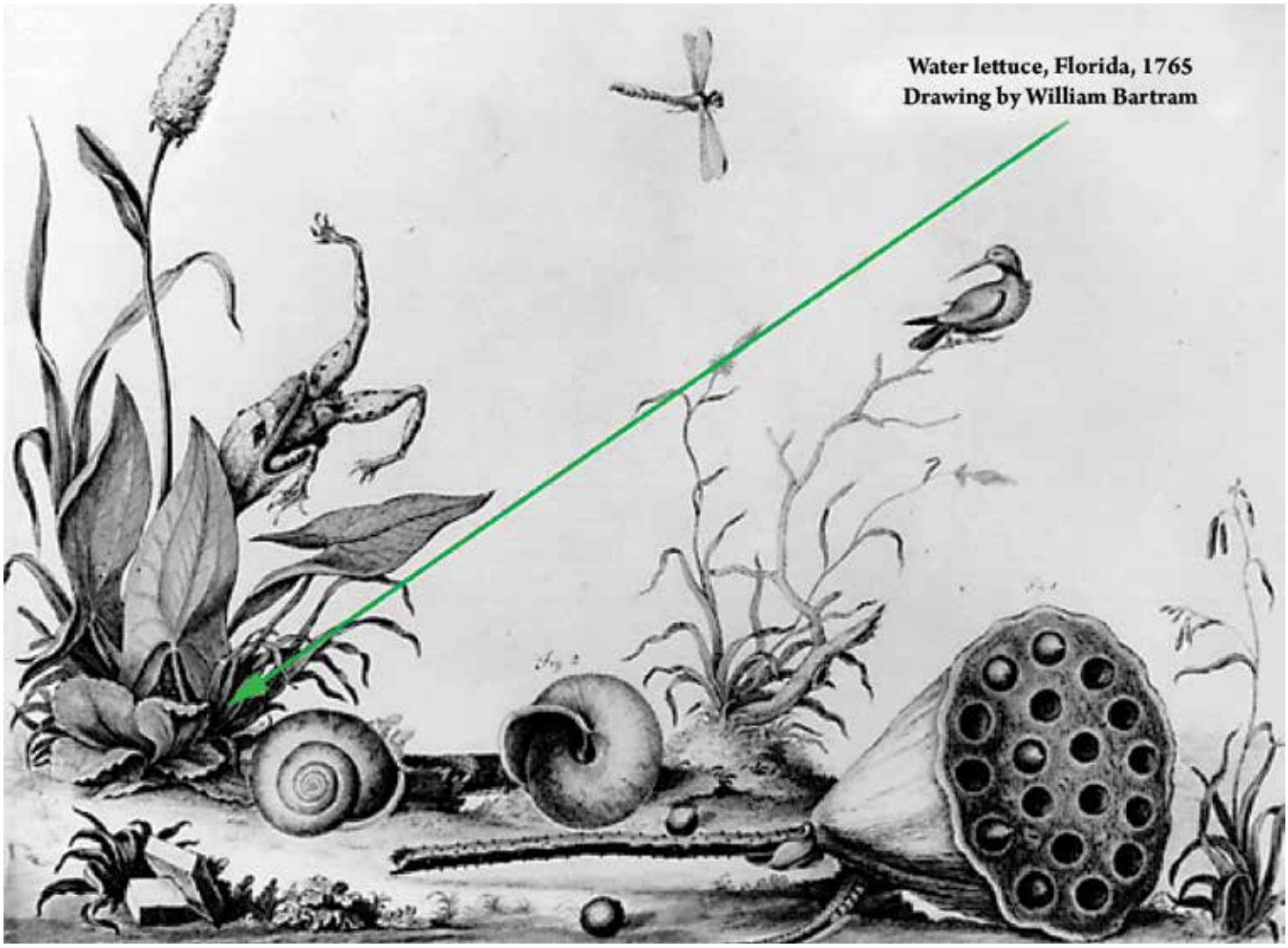
portunities and allow them to introduce you to new ideas. "I allowed myself to lean into the work I happened to be doing on invasive species and now [as a researcher] I have made my own path."

Funding graduate student research and supporting students interesting in invasive aquatic plant management are two of the many goals of UF/IFAS CAIP. Any questions should be directed to Shelby Oesterreicher at 352-273-3667 or soesterreicher@ufl.edu. For more information about the UF/IFAS Center for Aquatic and Invasive Plants, please visit https://plants.ifas.ufl.edu. Be sure to follow us on social @UFIFASCAIP.

UF/IFAS CAIP, Turning Science Into Solutions.

Christine Krebs (ckrebs@ufl.edu) is a communications assistant for the University of Florida Institute of Food and Agricultural Sciences Center for Aquatic and Invasive Plants (UF/IFAS CAIP). Christine is also a graduate student currently obtaining her doctoral degree in Agricultural Education and Communication.

Water Lettuce, *Pista Stratiotes:* Native...Invasive... Or Does It Really Matter?

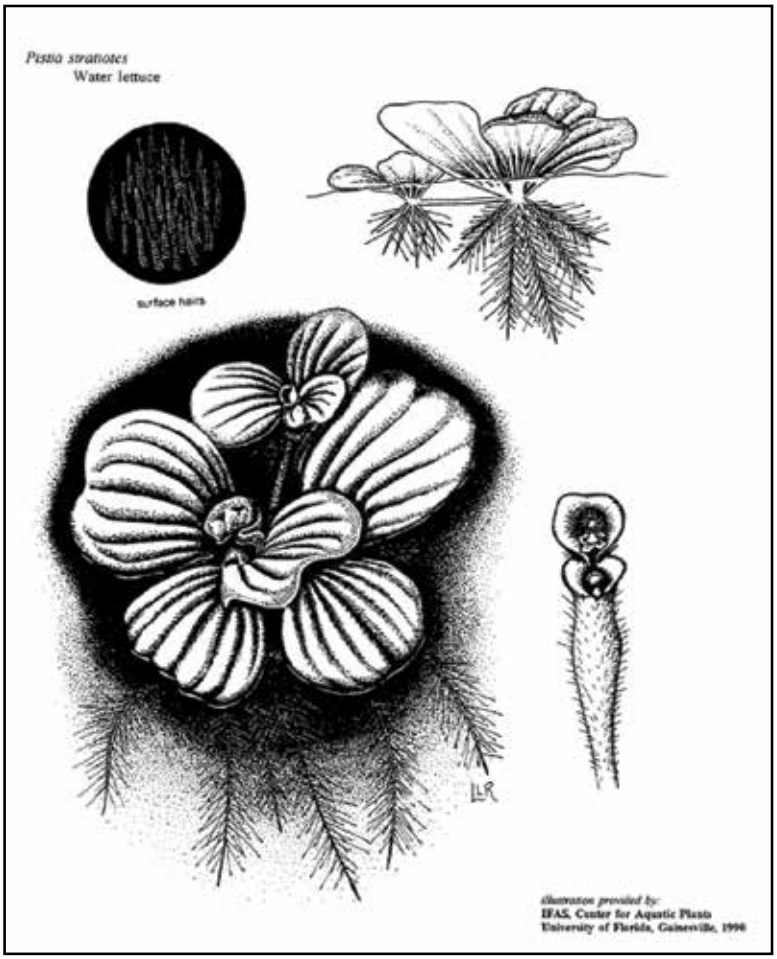


By Dr. Jason Ferrell, UF/IFAS
Center for Aquatic and Invasive Plants Director

Water lettuce is an extremely common floating plant in Florida. This leafy plant can be observed from north to south and has the tendency to grow and reproduce rapidly, form very dense mats and cause numerous problems. Because of these issues, water lettuce is one of the most commonly targeted plants for management in state waters. The guiding principle behind aquatic plant management is to reduce the population of invasive plants to low levels and promote the growth of native plants. The controversy lies in the fact that experts disagree on whether water lettuce is native or invasive. Some excellent genetic data seems to imply it originated from the near east region many millions of years ago and ancient fossil records show the plant occurring in India, Germany, and other European locations[1]. Conversely, both John and William Bartram clearly documented this plant in Florida in the 1700's and fossil records have also been found in Wyoming. So, which is it? Native? Invasive? Or does it really matter? To discuss this, let us start with an understanding of what invasive plants really are.

Invasive plants are not just troublesome, they are the most damaging plants in any ecosystem. By definition, an invasive plant originates from a foreign habitat and is known, or likely to cause, environmental or economic harm or harm to human health. Researchers have suggested said that second to habitat loss, invasive plants are the greatest threat to natural environments and biodiversity. This sentiment is believed because invasives have the tendency to take over and dominate ecosystems (e.g. environmental harm). Conversely, native plants originated in a given ecosystem and are often observed to coexist with a great diversity of other species and provide many ecosystem services.

Based on these definitions and the desire to promote biodiversity, biologists and ecologists have successfully promoted the concept that invasive plants are bad and native plants are good. It is a simple, clear-cut message. Although this message



is generally true, reality is often more nuanced than this. Are all invasive plants 100% bad with no redeeming qualities? Well, not necessarily. Certain invasive plants can be used for bioenergy production while others are able to support native pollinators. Can some native plants be weedy and troublesome? Sure. Crabgrass seems to be present in lawns and sidewalks in every neighborhood and poison ivy is a common problem for most all nature lovers. Rather than just seeing plants in terms of native = good and invasive = bad, an additional concept should be considered: the nuisance species. A nuisance plant is one that causes management issues, possesses a threat to public safety or is an annoyance. Nuisance plants often require management and some native plants fall into this category. These also include Carolina willow and cattail which often require management in aquatic systems.

So back to water lettuce. Is it native or invasive? Honestly, this fact is unknown and may never be known. A better question is this: is water lettuce a nuisance species? To me, this is much clearer and easier to answer. Let us circle back to Bartram, where he describes the plant like this[2]:

> *"It is remarkable that at the entrance of the river into the great lake there floats prodigious quantities of the pistia, which grows in great plenty most of the way from hence to the head of the river, and is continually driving down with the current, and great quantities lodged all along the extensive shores of this river and its islands, where it is entangled with a large species of water-numularia, persicaria, water-grass, and saxifrage...growing all matted together in such a manner as to stop up the mouth of a large creek, so that a boat can hardly be pushed through them, though in 4 foot water; these by storms are broke from their natural beds and float down the river in great patches..."*

Based on Batram's description, an infestation of this size can easily harbor millions of mosquito larvae, impede water flow and increase the potential for flooding, while also shading out acres of desirable submersed plants—thus reducing biodiversity. So, is water lettuce native or invasive? We don't know. Is it a nuisance species? Clearly. Should it be managed to reduce the impact on the environment? For a plant capable of such massive proliferation, management is essential.

This naturally sets up the next question. If water lettuce has been in Florida since Bartram's days when no management was conducted, why does it need to be managed now? Should nature take care of itself?

Honestly, this is a great question that uses both sound logic and reason. To answer the question, we have to ask ourselves another, equally important, question: what is different now vs 300 years ago? Is water lettuce different? Is it more aggressive, more reproductive, more troublesome than in the past? Science suggests water lettuce has not changed and behaves strikingly similar to how it did centuries ago. The next question

Water Lettuce
Pistia stratiotes
Photo by Dr. Bill Haller

is naturally, is Florida different now than it was 300 years ago? I believe that even the casual observer would agree Florida has undergone radical changes in the past 50 years, not to mention the last 300. Simply put, water lettuce may not have changed, but Florida has.

Florida lakes, as a rule, are rather shallow—often with an average depth of 4-6 feet. However, the subtropical climate of Florida brings near 60″ of rainfall annually, with 2/3 of this total occurring between June and September. Historically, these summer rains resulted in dramatic increases in water depth, with some lakes documented to raise 5-8 feet in the summer months. This massive fluctuation would flood large areas and force floating plants and muck sediments to be flushed out of the system and stranded on the shore when the water receded in fall/winter. For centuries, it is said that this was how shallow lakes in Florida cleansed themselves of over-grown plants. This routine and dramatic flooding was anticipated by the 34,000[3] residents that called Florida home in the 1830's (this seems to be the first reliable Census record). There was plenty of land per person and avoiding floodplains was rather easy. However, as the population of Florida steadily grew, avoiding flooding became more difficult.

In 1947, just 19 years after the Okeechobee Hurricane caused massive destruction and loss of life, the Cape Sable Hurricane crossed the state and caused considerable flooding. It is reported that approximately 5,000,000 acres of peninsular Florida was covered with 6 inches to 10 feet of water[4]. This inevitably led to the formation of Flood Control districts in 1949, which ultimately became the Water Management Districts in 1972. As a result, many of our lakes now have water control structures that prevent flooding by reducing these drastic fluctuations in depth. Meanwhile, miles of canals and hundreds of pump stations were installed across the state to move water quickly and efficiently to maintain safe water levels.

So, what does all this have to do with water lettuce? Well, let us return to Bartram[4].

> *"...pistia, which send down very long fibrous roots deep into the water by which they are nourished, growing all matted together in such a manner as to stop up the mouth of a large creek..."*

These tangled roots slow water flow, not to mention the floating plants can lodge

against flood structures. Rafts of plants alter the functionality of the structure, or even cause damage if the populations are high enough.

Water lettuce is a proper threat to flood control. In Bartram's day, with only a few thousand people in Florida, flood prevention was not a pressing issue. But today, with over 21 million residents, flood control is essential for Florida and managing plants like water lettuce is of primary importance.

A second consideration is legislative. Bartram would have never thought plant management laws would become necessary, but today they are a reality. Florida statute, under the Florida Aquatic Weed Control Act[5], now requires the Florida Fish and Wildlife Conservation Commission to:

> *"…direct the control, eradication, and regulation of noxious aquatic weeds and direct the research and planning related to these activities…so as to protect human health, safety, and recreation and, to the greatest degree practicable, prevent injury to plant and animal life and property."*

Why should water lettuce be controlled when for hundreds of years it was not necessary? The simple answer is that the plants have not changed, but Florida has. Our massive state population requires protection from flooding and simply managing floating plants is a key step toward making this happen.

For more information about the UF/IFAS Center for Aquatic and Invasive Plants, please visit http://plants.ifas.ufl.edu. Be sure to follow us on social @UFIFASCAIP.

Dr. Jason Ferrell (jferrell@ufl.edu) has been faculty at the University of Florida Institute of Food and Agricultural Sciences (UF/IFAS) since 2004. In that time, Dr. Ferrell has conducted over 400 extension meetings, written over 200 articles for extension newsletters and trade magazines, published 100 refereed scientific articles and mentored 19 graduate students. He has served as the editor for the Journal of Aquatic Plant Management since 2013. In 2017, he became the Director of the UF/IFAS Center for Aquatic and Invasive Plants (CAIP). As the Director of CAIP he leads a multidisciplinary group of faculty and staff whose mission is to develop and disseminate strategies for addressing the impact of invasive plants. He also serves as the Director of the Pesticide Information Office where he works to ensure that pesticide applicators are trained and licensed in a relevant and timely manner.

Endnotes

1 Susanne S Renner, Li-Bing Zhang, Biogeography of the *Pistia* Clade (Araceae): Based on Chloroplast and Mitochondrial DNA Sequences and Bayesian Divergence Time Inference, *Systematic Biology*, Volume 53, Issue 3, June 2004, Pages 422–432, https://doi.org/10.1080/10635150490445904

2 Diary of a Journey through the Carolinas, Georgia, and Florida from July 1, 1765, to April 10, 1766. – John Bartram and Francis Harper. P 39. Transactions of the American Philosophical Society, Vol. 33, No. 1 (Dec., 1942).

3 https://web.archive.org/web/20141121134738/http://www.census.gov/population/www/documentation/twps0056/tabs15-65.pdf

4 https://www.weather.gov/safety/flood-states-fl

5 http://www.flsenate.gov/Laws/Statutes/2011/369.20

Cooperative Management Practices Help Florida Panthers

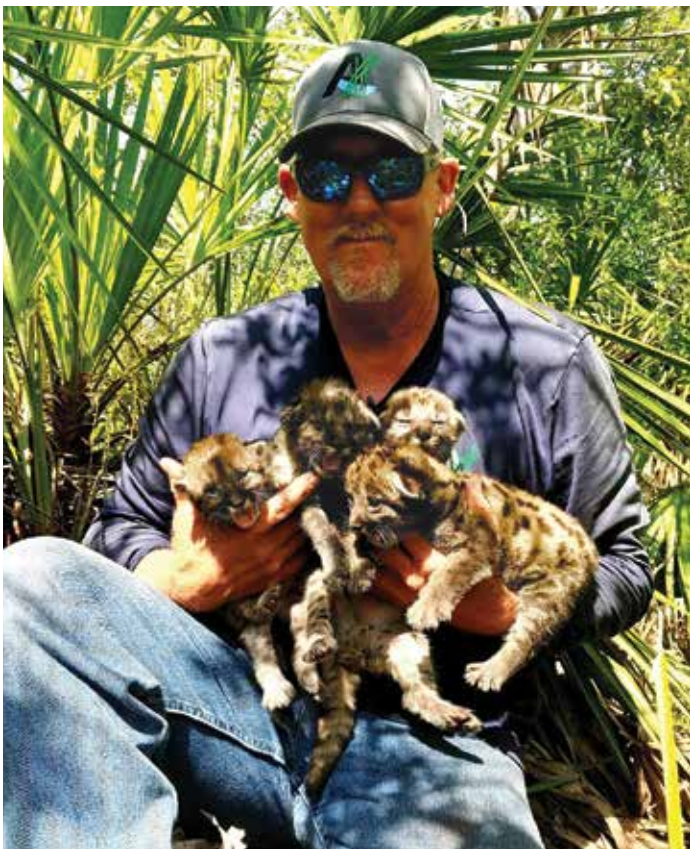
The US Department of Agriculture, Natural Resource Conservation Service (NRCS) initiated a partnership with the US Army Corps of Engineers (USACE) and the two agencies have been working together since 2014 to restore wetlands in Florida. The USACE Jacksonville District Invasive Species Management Branch assists NRCS in restoring wetlands by completing invasive species management as well as minor construction on the properties that are part of the NRCS Wetlands Restoration Program (WRP).

The benefits of invasive species management can pay off in ways large….and small. A PURRRRfect discovery was made early one morning this past spring.

On Tuesday, May 12, 2020, around 7:30 in the morning, two applicators working for Applied Aquatic Management, Inc (AAM), the USACE contractor, found two Florida panther (*Puma concolor coryi*) cubs while performing herbicide applications on Brazilian pepper on a NRCS WRP easement in south Florida. The two applicators immediately informed their crew leader, (Donald aka "Butch" Skidmore) who then informed the Project Manager, Chad Edmund. USACE biologist, Jon Morton, was en-route to the site when he was notified about the suspected den and cubs.

USACE and AAM quickly moved the crews out of the area to avoid disturbance of the den. The USACE Biologist arrived on site around 9:30 that morning, and upon closer inspection of the den, actually found FOUR cubs instead of two! The cubs appeared to be healthy and active, but mother was nowhere to be seen. USACE contacted the FWC panther biologist, to let him know the status and location of the den and young cubs.

FWC quickly assembled a team to travel to the field site that afternoon and collected some data on the young cubs. Because Florida panthers are listed as an endangered species under the Endangered Species Act, protecting them and their habitat is critical to their survival. FWC was interested in knowing the sex of the cubs and taking some samples to analyze DNA for genetic assessments, etc. FWC panther experts reported, "The kittens were estimated to be 10-12 days old. Their eyes were not fully open yet. 3 boys and a girl. They had scabby heads, a condition we've documented frequently (called dermatophytosis) but doesn't seem to cause any ill or long-lasting effects. Otherwise, all seemed healthy."



Donald "Butch" Skidmore. Photo by Mark Lotz, Florida Fish and Wildlife Conservation Commission

Florida panthers have long been part of Native American life in south Florida and were first officially documented in the Everglades in 1513 by Spanish explorers, but their populations have been on a steady decline in recent decades due to habitat loss and overhunting. In the 1980s and 1990s, it was estimated that only 20-30 Florida panthers remained in the wild. A detailed genetic study in 1992 revealed that the species would likely go extinct in 25-60 years due to combined pressures of geographic isolation, habitat loss, and genetic problems associated with inbreeding as existing populations were already too small for healthy reproduction and survival. Today, thanks to careful natural resource management providing food, cover, water, and conserving native habitat needed for the Florida panther, it is estimated there are between 120-230 adults in the population.

While the Florida panther's range extends up to the Georgia border, all of the breeding females are confined to the southern part of the peninsula, south of Lake Okeechobee. Safeguarding their habitat is critical to survival of this beautiful species.

USACE performed invasive plant treatments on this easement in 2014. The area where the cubs were found was infested with Brazilian pepper (*Schinus terebinthifolia*). Native sabal palms quickly inhabited the area following the invasive plant treatments. Long-term management studies have illustrated the aesthetic, economic, and biologic benefits associated with invasive plant treatments on rights of way and easements. Integrated pest/plant management encourages native wildlife to colonize and settle in these areas where invasive species are being controlled. This is certainly an example of how proper vegetation management meets the needs of native—even endangered—wildlife. Only three litters of cubs were documented in 2020, so the significance of this field crew's attention to detail and proper communication for reporting cannot be understated. A big thank you to Gelacio, Jose, Butch & Chad as they certainly had a positive impact on helping this young family to thrive!!

This article was written by Amy L. Giannotti with field reports submitted by Angie Huebner, Biologist with the US Army Corps of Engineers.

2021 Calendar of Events

***With the disruption of meetings due to COVID-19, please see links to upcoming meetings and conferences. Some of these may have virtual learning options available and some may change entirely since this issue of Aquatics went to print, so please check the websites for updated information. Updates and announcements are also made on the various social media channels, so monitor those for information, too.*

February 22-25, 2021
Midwest Aquatic Plant Management Society
https://www.mapms.org/conferences/2021-conference/

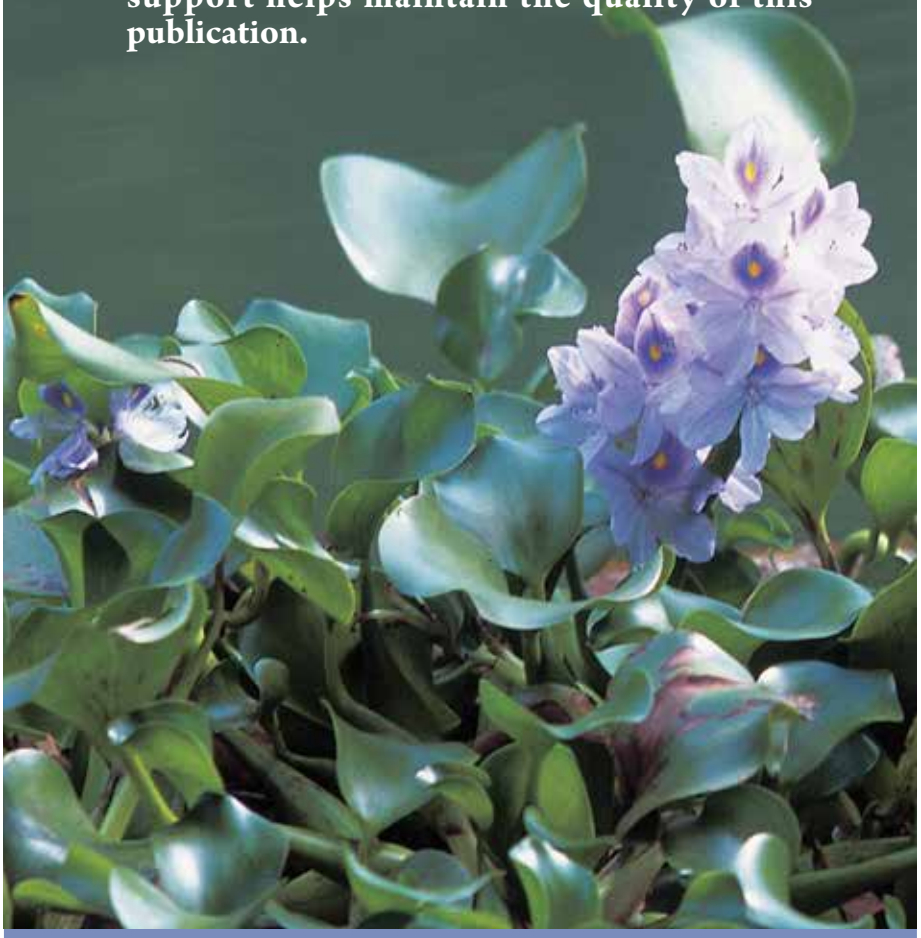
March 1-4, 2021
Western Aquatic Plant Management Society Annual Meeting (Virtual)
https://wapms.org

July 12-15, 2021
Midsouth Aquatic Plant Management Society (in conjunction with Aquatic Plant Management Society Annual Meeting)
New Orleans, LA
http://www.msapms.org/conferences/2020/

Need CEUs but don't see anything that fits your schedule? Visit the FDACS website and search for available CEU classes here: http://aessearch.freshfromflorida.com/AvailableClassSearch.asp. For more information about licensing, certification and finding Florida CEUs, check out "CEUs just for you" in the Summer 2014 issue of Aquatics magazine (http://fapms.org/aquatics/issues/2014summer.pdf)

It Pays to Advertise

- Aquatics is circulated to approximately 2000 environmental managers, landscape managers, governmental resource managers, and commercial applicators.
- Aquatics is a resource for the people who buy and use aquatic products and services.
- Advertising in Aquatics magazine is a profitable investment compared to other magazines.
- Your advertisement not only provides the reader with pertinent information, but your support helps maintain the quality of this publication.



***Aquatics* Magazine**
Advertising Point of Contact

Angie Huebner
Invasive Plant Management
701 San Marco Blvd, Jacksonville, FL, 32207-8175
904-894-3648
Angie.L.Huebner@usace.army.mil

PRESORT STANDARD
US POSTAGE
PAID
PERMIT #592
PONTIAC, IL