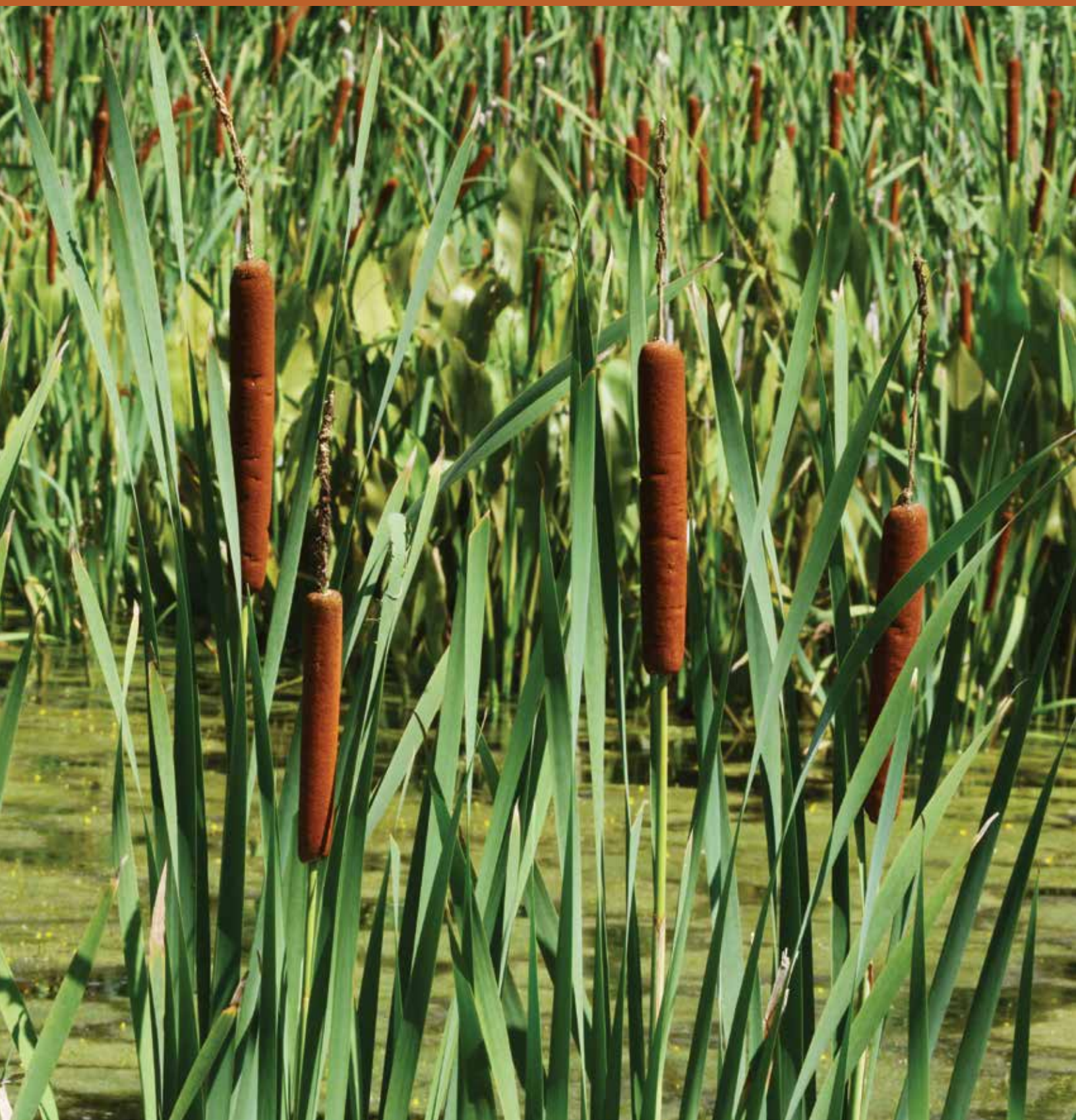
Aquatics

SUMMER 2017

A Publication of the Florida Aquatic Plant Management Society



Aquatics

SUMMER 2017

Volume 39, Number 2

COVER

Typha or cattail – a native that can ultimately become a nuisance. See Breaking Bad – Natives Edition by Dr. Lyn Gettys on page 18. Photo by Thomas Schrider courtesy of the University of Florida/IFAS Center for Aquatic and Invasive Plants.

Contents

To become a member of FAPMS and receive *Aquatics* magazine, please visit the website at: www.fapms.org

The mission of FAPMS is "To Preserve Florida's Aquatic Heritage." FAPMS was formed in 1976 and provides a forum for those interested in aquatic plant management to meet, discuss and exchange ideas and information.

 Aquatics (ISSN 1054-1799) is the official publication of the Florida Aquatic Plant Management Society.

Welcome Dr. Jay Ferrell New Director of the UF/IFAS Center for Aquatic and Invasive Plants

By Karen Brown

The University of Florida/IFAS Center for Aquatic and Invasive Plants would like to introduce our new director, Dr. Jason Ferrell. Dr. Ferrell has worked at UF/IFAS since 2004 and was an agronomy professor and weed scientist prior to accepting the position of CAIP director. During that time, he received numerous honors and awards including Outstanding Extension Specialist, Researcher of the Year by the Florida Cattlemen's Association and Weed Scientist of the Year by the Florida Weed Science Society. Dr. Ferrell earned his bachelor's and master's degrees in plant and soil science from the University of Kentucky. He earned his doctorate in agronomy from the University of Georgia in 2003.

Among his many goals, Ferrell hopes to work with state agencies to further build communication on invasive plant control techniques. "CAIP is not a 'this is what you spray' group," Ferrell said, referring to herbicide treatment of invasive aquatic plants. "It is a management entity that looks at every piece of the puzzle and tries to figure out how we can link them together to develop a management plan."

He would like to increase communication among the multidisciplinary UF/IFAS faculty members so that their research and Extension activities in invasive aquatic plants produce multifaceted results that benefit even more stakeholders. From there, he'd like the Center's voice to grow with regional and national groups that study and conduct outreach on invasive aquatic plants.

The Legislature established the Center for Aquatic and Invasive Plants in 1978 "to develop environmentally sound techniques for the management of aquatic and natural area weed species and to coordinate aquatic plant research activities within the State of Florida." Faculty and staff at the Center work extensively with the state's water management districts and the Florida Fish and Wildlife Conservation Commission's Invasive Plant Management Section to better manage invasive plants. Two UF/IFAS faculty members work at the off-campus Center location in Gainesville: Drs. William Haller and Stephen Enloe. Several other faculty members on the Gainesville campus and at UF/IFAS research and education centers around Florida contribute to the Center's mission: **to inform and educate all stakeholders about the impacts and management of invasive plants.**

Feel free to contact Dr. Ferrell at 352-273-3685 or jferrell@ufl.edu

by Karen Brown, UF/IFAS Center for Aquatic & Invasive Plants, kpbrown@ufl.edu

With the appointment of Dr. Ferrell as new director of the Center for Aquatic and Invasive Plants, the question on everyone's mind is, "What is Dr. Haller going to do?" Well, he is still a full professor at the Center. All I can say is, "Only the man himself can answer that question." –Editor

Evaluation of a New SC Formulation of Flumioxazin for Control of Hydrilla and Water Lettuce

By Christopher R. Mudge and Bradley T. Sartain

Flumioxazin is a protoporphyrinogen oxidase (PPO) inhibiting herbicide with activity on terrestrial (soil and foliar) and aquatic (in-water and foliar) plants. Flumioxazin WDG was registered as an aquatic herbicide in 2010 to control nuisance aquatic plant species. The PPO inhibiting contact herbicide has activity on a variety of submersed, floating, and emergent plant species including hydrilla (*Hydrilla verticillata*), fanwort (*Cabomba caroliniana* Gray), water lettuce (*Pistia stratiotes* L.), landoltia (*Landoltia punctata*), giant salvinia (*Salvinia molesta*), and alligatorweed (*Alternanthera philoxeroides*). Recently, flumioxazin SC was developed and registered for aquatic use. This new formulation was developed for 1) applicator desire for a product that will rapidly dissolve into water (dry formulation solubility issues), 2) increased compatibility with other herbicides, and 3) potential for increased efficacy. Since there is no efficacy data available on this new formulation of flumioxazin, a series of trials were conducted to compare efficacy of the new SC formulation to the WDG formulation against hydrilla and water lettuce.

Trial 1: Water Lettuce Foliar Trial

An outdoor mesocosm trial was conducted at the Louisiana State University (LSU) AgCenter Aquaculture Research Facility in Baton Rouge, to compare the efficacy of flumioxazin SC (Clipper® SC, Nufarm Americas) and flumioxazin WDG (Clipper™ 51 WDG, Valent USA Corporation) formulations against water lettuce. On 27 June 2016, 10 water lettuce plants (10 to 12 cm in diameter) collected from University Lake in Baton Rouge, LA, were placed into 20 gallon plastic containers filled with pond water (pH 8.5) and amended with 2.1 g Miracle-Gro® (24-18-16, The Scotts Company) fertilizer. Water level was maintained weekly at 60 L. In addition, fertilizer was added three days prior to herbicide application to encourage plant growth.

Plants were allowed to grow for an additional 17 days (14 July 2016) and covered 100% of the water surface prior to treatment, at which time there were approximately 25 to 30 water lettuce plants per container (43.9 ± 1.7 g mean dry weight). In addition, the water pH decreased to 6.0-6.5 during the establishment period. On 15 July 2016, plants were treated with foliar applications of flumioxazin SC (2, 4, 6, and 8 oz product/acre), flumioxazin WDG (8 oz product/acre), or carfentrazone (Stingray®, SePRO Corporation, 8 oz product/acre). Carfentrazone is also a PPO inhibiting herbicide and was included for comparison purposes. A modified vegetable oil (Turbulence™, Winfield Solutions) was included as a surfactant with all treatments. Foliar treatments were applied using a forced air CO_2-pressurized sprayer calibrated to deliver a spray volume of 100 gallons/acre diluent through a single TeeJet® (Spraying Systems Co.) 80-0067 nozzle. The treatments were completely randomized and replicated four times. A non-treated control was also used to compare plant growth in the absence of herbicide. At 6 weeks after treatment (WAT) (24 August 2016), all viable biomass was harvested and dried at 65°C to a constant weight. Data were analyzed using an analysis of variance (ANOVA) and means separated using Fisher's Protected LSD ($p \leq 0.05$).

Trial 2: Water Lettuce and Hydrilla Subsurface Trial (Low pH)

A second mesocosm trial was conducted to evaluate efficacy of subsurface applications of flumioxazin SC vs flumioxazin WDG when applied to water lettuce and hydrilla cultured under low pH conditions (6.0 to 6.5). The subsurface trial was established, treated, and harvested at the same time as the foliar trial. Hydrilla was collected from a pond at LSU Aquaculture and planted on 16 June 2016. Four healthy apical meristems (20 cm in length) were planted into topsoil in 3 L pots amended with Osmocote® (The Scotts Company, 19-6-12) fertilizer at a rate of 2g kg^{-1} soil. The sediment surface was top-dressed with a 2 cm layer of masonry sand to reduce sediment and nutrient suspension in the water column. Four pots were placed inside 20 gallon plastic containers filled with pond water (pH 8.5). Water lettuce collected from the same source as the foliar water lettuce trial was established in the hydrilla containers 11 days post hydrilla planting (27 June 2016). The addition of the water lettuce plants aided in maintaining a low pH (6.0 to 6.5) until the day of herbicide application. In addition, water level was maintained weekly at 60 L.

On 14 July 2016, water lettuce covered 100% of the water surface and hydrilla reached the surface beneath the water lettuce canopy. At herbicide application, approximately 25 to 30 water lettuce plants were present per container. Pre-treatment water lettuce and hydrilla mean dry weight were 41.9 ± 2.2 and 4.0 ± 1.1 g, respectively. Subsurface applications of flumioxazin SC (50, 100, and 200 ppb), flumioxazin WDG (100 and 200 ppb), or carfentrazone (200 ppb) were dispensed from a stock solution to the water surface in each plastic container, followed by thorough mixing. The herbicides were applied to healthy, actively growing plants as static exposures. The treatments were completely randomized and replicated four times. A non-treated control was also used to compare plant growth in the absence of herbicide. At 6 WAT (24 August 2016), all viable biomass (water lettuce whole plant and hydrilla

shoots) was harvested and dried at 65°C to a constant weight. Data were analyzed using an ANOVA and means separated using Fisher's Protected LSD ($p \leq 0.05$).

Trial 3: Hydrilla Subsurface Trial (High pH)

A third mesocosm trial was conducted to determine the efficacy of flumioxazin SC vs. flumioxazin WDG when applied to hydrilla cultured under high pH conditions (8.5 to 9.5). Hydrilla collected locally from the LSU Aquaculture pond was planted on 9 August 2016. All hydrilla planting techniques were the same as trial 2. On 6 September 2016, healthy, actively growing hydrilla was near the water surface and treated with subsurface applications of flumioxazin SC (50, 100, 200 ppb), flumioxazin WDG (100 and 200 ppb), or carfentrazone (200 ppb). The treatments were completely randomized and replicated four times. A non-treated control was also included. At 6 WAT (18 October 2016), all viable hydrilla shoots were harvested and dried at 65°C to a constant weight. Data were analyzed using an ANOVA and means separated using Fisher's Protected LSD ($p \leq 0.05$).

RESULTS AND DISCUSSION

Trial 1: Water Lettuce Foliar Trial

All foliar applications of flumioxazin SC, flumioxazin WDG, and carfentrazone resulted in 10 to 25% water lettuce injury (chlorosis) 1 to 2 days after treatment (DAT). Plants treated with the lower rates of flumioxazin SC (2 and 4 oz/acre) were initially slower to develop injury symptoms. At 1 WAT, injury was >85% for those plants treated with either flumioxazin formulation or rate, whereas carfentrazone resulted in 60 to 75% injury. At 2 to 3 WAT, recovery was observed on those plants treated with flumioxazin SC at 2 oz/acre or carfentrazone at 8 oz/acre.

At harvest (6 WAT), flumioxazin SC (4, 6, and 8 oz/acre) and flumioxazin WDG (8 oz/acre) provided 100% water lettuce control (Figure 1). All herbicides performed similarly across formulations and rates of application. The 2 oz/acre rate of flumioxazin SC and carfentrazone at 8 oz/acre reduced biomass 97% and 98% compared to the non-treated control, respectively. These data provide evidence that flumioxazin SC is similar in efficacy to the previously registered formulation of flumioxazin WDG and performed similarly to carfentrazone.

Trial 2: Water Lettuce and Hydrilla Subsurface Trial (Low pH)

All water lettuce plants treated with subsurface applications of flumioxazin SC or flumioxazin WDG under low pH conditions were injured >10% by 8 hours after treatment (HAT). The rapid development of injury symptoms included initial chlorosis and loss of buoyancy <1 WAT. Water lettuce plants treated with carfentrazone produced similar injury symptoms, but required 2 days to develop. At 1 WAT, no viable biomass was present for flumioxazin SC or flumioxazin WDG treated plants. At 6 WAT, all herbicide treatments (flumioxazin and carfentrazone) resulted in 100% water lettuce control (Figure 2).

Injury symptoms of hydrilla treated with flumioxazin SC (all concentrations) under low pH conditions included bleaching (1 to 2 DAT) in the apical tip and reddening of the stem (3 to 5 DAT) followed by necrosis (7 to 10 DAT). In general, flumioxazin SC provided more intense and faster plant injury symptoms compared to flumioxazin WDG. Conversely, carfentrazone treated plants did not produce noticeable injury symptoms throughout the trial or provide control when applied to hydrilla at 200 ppb. At harvest (6 WAT), flumioxazin SC provided 82% to 89% hydrilla control, which is similar to flumioxazin WDG at 100 and 200 ppb (73% and 86% control, respectively) (Figure 3). Flumioxazin WDG applied to hydrilla at pH 7.0 was efficacious with an EC_{50} (effective concentration required to reduce dry weight biomass by 50%) of 77 ppb (Mudge and Haller 2010). Although hydrilla will rarely thrive under low pH conditions, the water conditions in this research permitted the evaluation and comparison of the SC and WDG formulations of flumioxazin. These results indicate hydrilla control with flumioxazin SC is similar to the original formulation of flumioxazin (WDG) in low pH water and warrants early season field investigation when plants are young and water pH is substantially less.

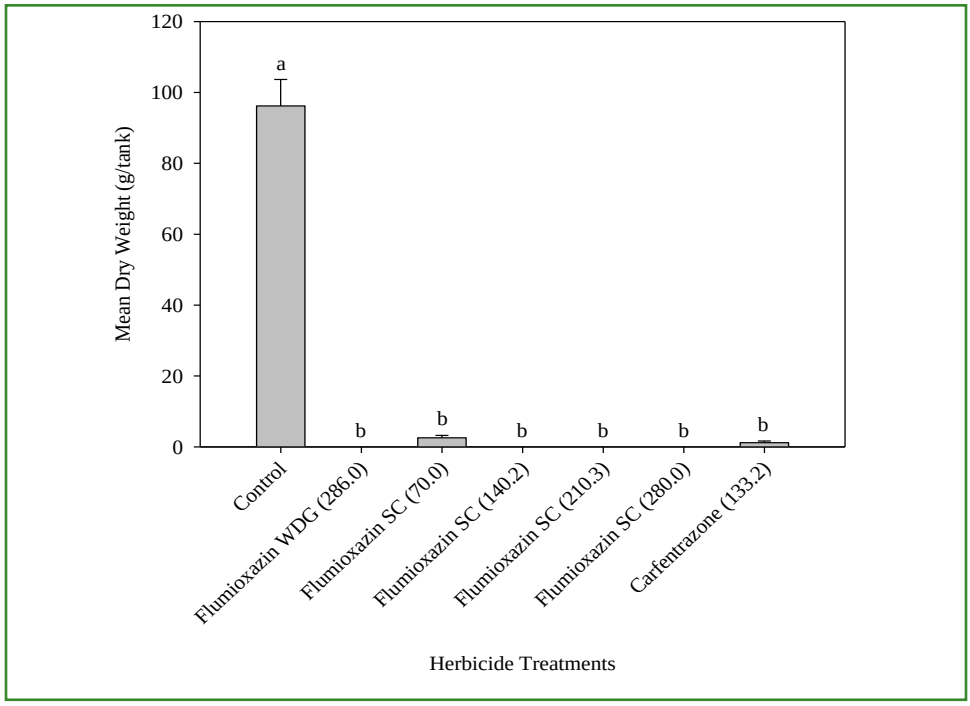


Figure 1. Effect of foliar applications of flumioxazin SC, flumioxazin WDG, and carfentrazone on water lettuce dry weight (mean ± standard error) 6 weeks after treatment. Numbers in parentheses represent herbicide rates (oz product/acre). Means with the same letter are not significant according to Fisher's Protected LSD test at $p \leq 0.05$; n = 4.

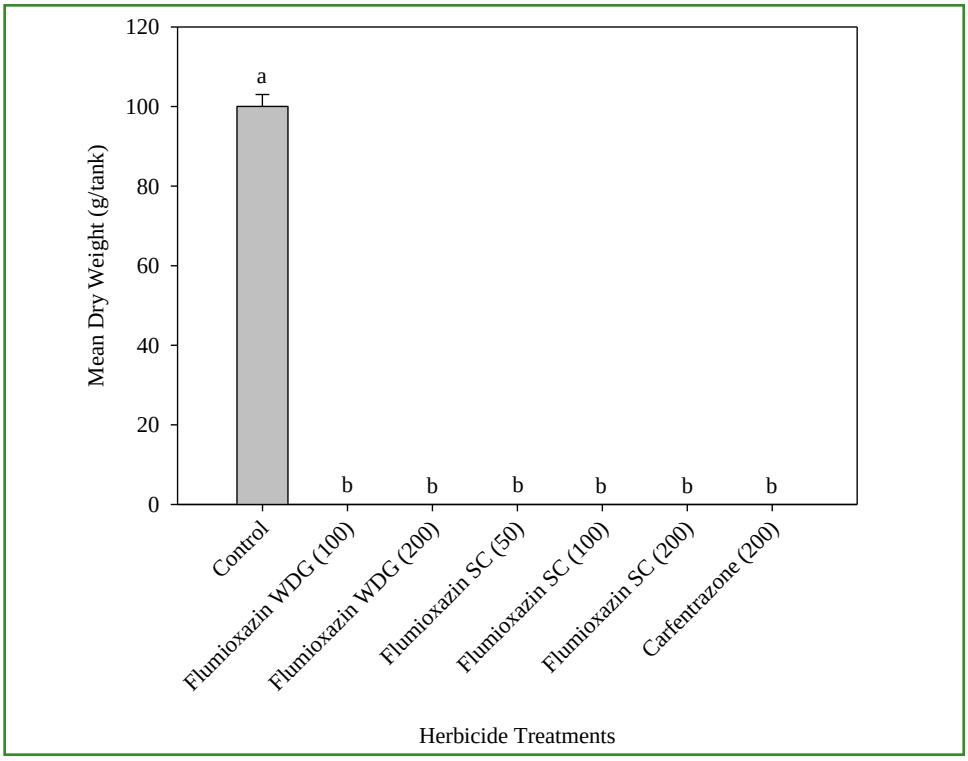


Figure 2. Effect of subsurface applications of flumioxazin SC, flumioxazin WDG, and carfentrazone on water lettuce dry weight (mean ± standard error) cultured under low pH conditions (6.0 to 6.5) 6 weeks after treatment. Numbers in parentheses represent herbicide concentrations (ppb). Means with the same letter are not significant according to Fisher's Protected LSD test at $p \leq 0.05$; n = 4.

Trial 3: Hydrilla Subsurface Trial (High pH)

All flumioxazin treatments applied under high pH conditions injured hydrilla 1 to 2 DAT. Similar to the low pH trial, bleaching of the apical tip occurred within 2 DAT and reddening in the stem was evident by 5 DAT. Carfentrazone also resulted in similar injury as the low pH trial. However, plant recovery was evident 7 to 10 DAT in all tanks regardless of herbicide or concentration. All flumioxazin and carfentrazone treatments, except flumioxazin SC at 50 ppb, reduced hydrilla dry weight 52% to 62% compared to the non-treated control (Figure 3). The higher pH water decreased the half-life of flumioxazin and ultimately influenced efficacy. Although flumioxazin SC was not highly efficacious when applied to hydrilla cultured under high pH conditions, these data provide evidence that it is bioequivalent to the WDG formulation of flumioxazin.

The research conducted to evaluate flumioxazin SC vs. WDG demonstrates the utility of the new formulation to manage water lettuce and hydrilla when applied under low and high pH conditions. The mesocosm trials also provided evidence of herbicide injury symptoms, speed of control, and plant recovery. In these trials, the new SC formulation of flumioxazin provided faster and more intense injury compared to the WDG formulation. Additional testing at the laboratory, mesocosm, and field scale should be conducted to evaluate the SC formulation against other target and non-target/native floating, emergent, and submersed aquatic species. In addition, flumioxazin SC half-life should be investigated under low, medium, and high pH conditions to determine herbicide stability and degradation.

Dr. Christopher R. Mudge is a Research Biologist with the U.S. Army Engineer Research and Development Center (Christopher.R.Mudge@usace.army.mil) and Bradley T. Sartain is a Graduate Research Assistant at Louisiana State University.

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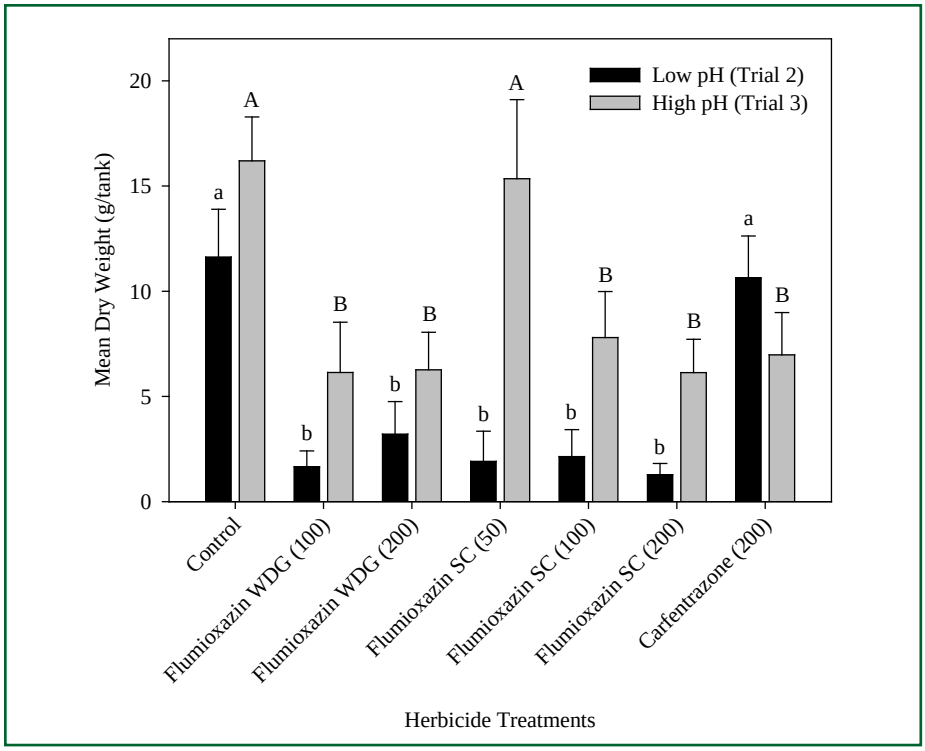
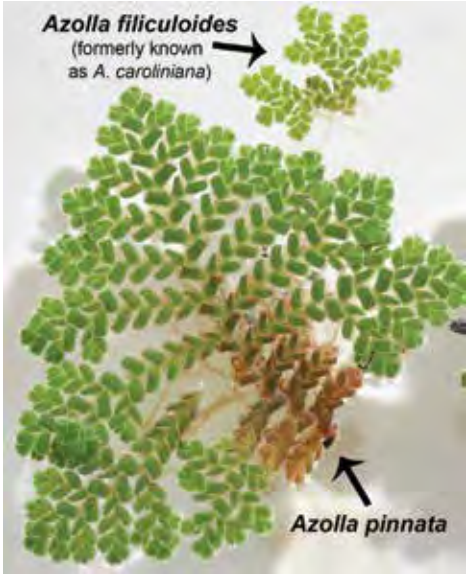


Figure 3. Effect of subsurface applications of flumioxazin SC, flumioxazin WDG, and carfentrazone on hydrilla dry weight (mean ± standard error) cultured under low (6.0 to 6.5) and high pH (8.5 to 9.5) conditions 6 weeks after treatment. Numbers in parentheses represent herbicide concentrations (ppb). Means with the same letter within a particular pH condition are not significant according to Fisher's Protected LSD test at $p \leq 0.05$; n = 4.

Recently Introduced and Established Aquatic Plants in the Southeastern U.S.

By Ian Pfingsten

There are over 150 nonindigenous obligate aquatic plant species found in the U.S. and its territories, of which almost 90 species were documented as of 2017 (USGS 2016) in the Gulf and South Atlantic Region States (Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, Puerto Rico, South Carolina, Texas, and the U.S. Virgin Islands). The US Geological Survey's Nonindigenous Aquatic Species (NAS) program documented five newly introduced and currently established aquatic plant species in the Southeastern U.S. since 2007 (USGS 2016). Four of the five species were found in Florida (*Azolla pinnata, Luziola subintegra, Phyllanthus fluitans,* and *Scleria microcarpa*) and one was recently discovered in North Carolina (*Philydrum lanuginosum*). These species were likely introduced as cultivated plants or contaminants of cultivated plants, while there is the possibility of wind- or animal-dispersed seed in *L. subintegra* and *S. microcarpa*, which are both South and Central American species, respectively. All five new species are under active management to monitor and reduce their populations. The two most recently introduced species, *P. lanuginosum* and *S. microcarpa*, were likely established populations for multiple years prior to their discovery, but the origins of the introduced populations are unknown. They have native ranges in U.S. territories (Guam for *P. lanuginosum* and Puerto Rico for *S. microcarpa*)



Azolla pinnata (larger) with *A. filiculoides* (smaller). Photograph by Colette Jacono, University of Florida.

Azolla pinnata (feathered mosquito-fern)

Federally listed noxious weed (USDA)

Native Range: Australia

Biology: *A. pinnata* is a small, free-floating fern typically found in clusters (Bodle 2008). Florida specimens were determined to be the subspecies *pinnata* (Saunders and Fowler 1992, Madeira et al. 2013). Reproduction mostly occurs vegetatively (Rao 1935). The fern will form dense floating mats that interfere with navigation and limit light and oxygen penetration into the water column (Lumpkin and Plucknett 1980).

Introductions: FL – Found in ponds and canals of Florida Southeast Coast (2007) and Everglades drainages (2013) and in Lake Hall of Lower Ochlockonee drainage (2012). Status is established at all sites.

Means of Introduction: Introduced via the aquatic plant trade as a hitchhiker on other plants (S. Kay, NCSU, pers. comm. 2015).

Risk Assessment: N/A, but on Federal Noxious Weed List

Luziola subintegra. Photograph by John Kunzer, Florida Fish and Wildlife Conservation Commission.

Luziola subintegra (Tropical American watergrass)

Native Range: South/Central America, including Puerto Rico

Biology: *L. subintegra* is a perennial floating or emergent grass that spreads laterally across the water surface, creating thick mats of vegetation (Kunzer and Bodle 2008). It rapidly reproduces by vegetative fragmentation and seed (Cayon and Aristizabal 1990), which can spread by water and contaminated equipment (Tascon and Fischer 1997, Piepenbring and Stein 2000).

Introductions: FL – Found in Fisheating Bay, Lake Okeechobee (2007), a disturbed wetland near Everglades National Park (2009), and in Jane Green Creek of Upper St. John's River drainage (2016). Status is established at all sites.

Means of Introduction: Likely dispersed via waterfowl, in contaminated seed, or on farm equipment (M. Bodle, SFWMD, pers. comm. 2015).

Risk Assessment: High risk of invasion in Florida (Lieurance et al. 2016) and throughout most of the Southeastern U.S. (Koop 2016).

Philydrum lanuginosum. Photograph by Schelle, licensed under the Creative Commons Attribution-Share Alike 3.0 Unported license.

Philydrum lanuginosum (wooly frog's mouth)

Native Range: Asia and Australia, including Guam

Biology: *P. lanuginosum* is a rooted, emergent, perennial forb that is a common weed in rice patties in its native Southeast Asia (Holm et al. 1979). It produces thousands of microscopic seeds that disperse by water, wind, birds, and mammals (Ohwi 1984, Koop 2016).

Introductions: NC – Holly Shelter Game Land of Northeast Cape Fear River drainage (2013). Status is established with little chance of eradication in the near future due to proximity to an at-risk species.

Means of Introduction: Likely escaped from cultivation. It is widely available in the international nursery trade (Koop 2016).

Risk Assessment: High risk of invasion throughout most of the Southeastern U.S. (Koop 2016).

Phyllanthus fluitans. Photograph by Kelle Sullivan, Florida Fish and Wildlife Conservation Commission.

Phyllanthus fluitans (red root floater)

Native Range: South America

Biology: *P. fluitans* is a free-floating, perennial forb that propagates vegetatively forming floating mats (Sowinski 2011). Seed viability is unknown, but the initial population has persisted despite chemical treatment.

Introductions: FL – Peace River drainage (2010). Status is established but isolated to the river.

Means of Introduction: Likely escaped from cultivation as it is popular in the aquarium trade. It is sold outside of the Southeast U.S. (Allen et al. 2016).

Risk Assessment: Medium risk of invasion in Florida (Lieurance et al. 2016).

Scleria microcarpa (tropical nutrush)

Native Range: South America

Biology: *S. microcarpa* is a rooted, emergent, perennial sedge that inhabits wetlands. It is distinguished by the unprotected seeds and the decurrent [extending wing-like] leaf blades along the culm [stem] (Affonso et al. 2015).

Scleria microcarpa. Photograph by Fabiola Areces, El Verde Virtual Flora.

Introductions: FL – Lake Hatchineha of the Kissimmee drainage (2016). Status is established.

Means of Introduction: Possibly introduced as a contaminant in cattle forage grass seed (A. Onisko, SFWMD, pers. comm. 2017).

Risk Assessment: N/A

Range expansion in the Gulf and South Atlantic States since 2016

Since January 2016, we reported 12 new NAS occurrences outside of their

established range (Fig. 1, 2). The cape blue waterlily (*Nymphaea capensis*) is new to Texas and tropical nutrush (*Scleria microcarpa*) is new to the U.S. (not including Puerto Rico). More information on these occurrences and other NAS can be found on our database (nas.er.usgs.gov). We also have a sighting report page and mobile app for anyone to submit NAS occurrences (nas.er.usgs.gov/mobilesightingreport.aspx).

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Ian Pfingsten, Cherokee Nation Technologies, Nonindigenous Aquatic Species Program, 352-264-3517, ipfingsten@usgs.gov, https://nas.er.usgs.gov

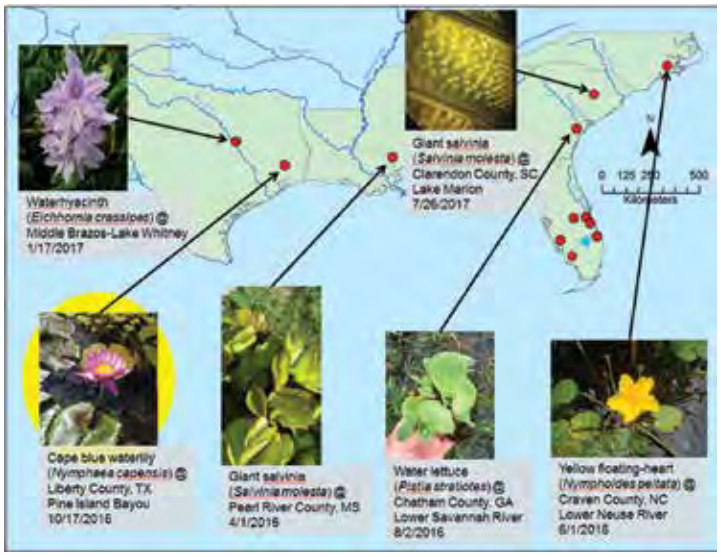

Figure 1. NAS found in new locations (states, counties, and drainages) in the Southeastern U.S. from January 2016 to August 2017. The yellow circle behind cape blue waterlily indicates a new state occurrence.

Figure 2. NAS found in new locations (states, counties, and drainages) in Florida from January 2016 to August 2017. The yellow star behind tropical nutrush indicates the species is new to the U.S.

NEW!

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APMS Honors Aquatic Plant Managers

By Jeffrey D. Schardt

Nearly 250 members and guests attended as the Aquatic Plant Management Society returned to Florida for the 57th Annual Meeting at the Hilton Daytona Beach Resort Ocean Walk Village on July 16-20, 2017. The Annual Meeting provides an opportunity for researchers, managers, and industry representatives to share new information through formal presentations and social events scheduled during the week. There were 55 oral and 13 poster presentations. Eighteen students from six universities presented research updates on aquatic plant control, ecology and physiology, integrated management, and modelling.

Events

The APMS Annual Meeting complements a full agenda of technical information with opportunities for informal and focused discussions. Delegates gather on Sunday evening for the Presidents' Reception to get reacquainted, and again on Monday evening for a Poster Reception in the exhibit hall to interact with researchers and vendors. Continental breakfasts and extended breaks are offered each day in the exhibit hall to provide more time to network with colleagues. Presidents and a guest from each APMS Chapter met during a Monday luncheon to share regional issues and provide Chapter insight while a Student Luncheon offered all registered students time to interact and discuss research and career perspectives in aquatic plant management. Students elect a Student Director to serve a one-year term on the APMS Board of Directors. APMS Past Presidents gathered at a Tuesday luncheon to advise the Board of Directors on current matters, while the newly sanctioned Women of Aquatics met to discuss topics of the day.

Awards

The featured social event during the APMS Annual Meeting is the Tuesday evening Awards Banquet. APMS honors long-term achievements as well as research contributions presented by students during the meeting. Following is a list of the awards presented at the 2017 APMS Annual Meeting.

Student Presentations

Eighteen students competed in oral (10) and poster (9) presentation competitions. Cash awards are presented for first ($300), second ($200), and third ($100) place in each presentation category. Erika Haug, from North Carolina State University, placed first in the Student Oral Presentations with her project: *Monoecious Hydrilla: Growth in the Absence of Photosynthesis*. This is the third time Erika has placed first in the Oral Presentation competition. Ciera Kinley and Tyler Geer, both of Clemson University, placed second and third, respectively.

Mirella Ortiz of Colorado State University took first place in the Poster competition with her presentation: *Efficacy of Endothall (Aquathol® K) and Endothall+2,4-D (Chinook®) for Curlyleaf Pondweed (Potamogeton crispus) Control Under Simulated Fall Conditions*. Andrew Howell and Kara Foley, both of North Carolina State University, placed second and third, respectively.

Chris Mudge, Student Affairs Committee Chair, presents the first place Oral Presentation check to Erika Haug.

Mirella Ortiz receives the first-place check for the Poster Presentation competition

Student presenters at the APMS Annual Meeting with Student Affairs Committee Chair, Chris Mudge – far right)

Outstanding Graduate Student Award

Alyssa Calomeni of Clemson University received the Outstanding Graduate Student Award for her scholarship, publication record, and commitment to algal management research as a Ph.D. student at Clemson.

Alyssa Calomeni receives her award from President Madsen (left) and Major Professor John Rodgers (right))

APMS Student Director

Andrew Howell from the North Carolina State University was voted by his peers to serve a one-year term as Student Director on the APMS Board of Directors. The Student Director represents student issues and is a full voting member on the APMS Board of Directors.

Andrew Howell (right) receiving congratulations from Student Affairs Committee Chair, Chris Mudge

APMS Graduate Student Research Grant

The Graduate Student Research Grant (GSRG) is the premier education initiative offered by the Aquatic Plant Management Society. The objective is to provide a grant for a full-time graduate student to conduct research in an area involving aquatic plant management techniques (used alone or integrated with other management approaches) or in aquatic ecology related to the biology or management of regionally or nationally recognized nuisance aquatic vegetation.

The 2017 GSRG was on a specific topic – starry stonewort (*Nitellopsis obtusa*). This GSRG was supported jointly by APMS, Midwest APMS, Northeast APMS, Lonza, SePRO, and UPI; each at the $5,000 per year level for two years. Thirteen judges evaluated proposals and selected the project submitted by Clemson University to receive the two-year, $60,000 GSRG that will run from January 2018 through December 2019.

President John Madsen awards the Starry Stonewort GSRG to Tyler Geer and major professor Dr. John Rodgers of Clemson University

Outstanding Research / Technical Contribution Award

Dr. Ryan Thum of Montana State University received the Outstanding Research / Technical Contribution Award. He is honored for his research related to identifying invasive watermilfoil hybrids and his ability to communicate this information to plant managers. He is also recognized for his scientific publication record, commitment to aquatics, and encouraging graduate students to participate in the field of aquatic plant management.

Ryan Thum (center) receives the Outstanding Research / Technical Contribution Award from APMS President John Madsen (left) and Editor Jason Ferrell (right)

Outstanding Journal Article

The Outstanding Journal Article Award is presented to an author (and co-author(s)), recognizing research published in the Journal of Aquatic Plant Management during the previous year that is unique and will further the science of aquatic plant management. The Editor and Associate Editors vote on this award. A paper by Justin Nawrocki, Rob Richardson and Steve Hoyle from North Carolina State University was selected. Nawrocki J, Richardson R, Hoyle S. 2016. Monoecious hydrilla tuber dynamics following various management regimes on four North Carolina reservoirs. J. Aquat. Plant Manage. 54:1-11.

Justin Nawrocki (center) receives the Outstanding Journal Article Award – also pictured from left to right are John Madsen, Rob Richardson (NCSU), Jay Ferrell, and Steve Hoyle (NCSU)

Outstanding International Contribution Award

Dr. John Clayton of the National Institute of Water & Atmospheric Research (NIWA), Hamilton, New Zealand, received the Outstanding International Contribution Award for 40 years of research and advocating for the development and implementation of science-based aquatic plant management. His collaboration through NIWA has led to novel strategies for control and eradication of invasive plants in New Zealand and his mentorship has benefitted international scientists in their contributions to aquatic plant management.

Max McCowen Friendship Award

Mr. David Isaacs of Aquatic Control, Inc. in Seymour, IN received the 2017 Max McCowen Friendship Award. This award is a special recognition given to an APMS member whose demeanor and actions display sincerity and friendship in the spirit of being an ambassador for the APMS. Criteria include warmth and outgoing friendship, sincerity and genuine concern, gracious hospitality, and positive attitude. David has been a respected source of information and advice in aquatic plant management for more than 40 years, and has been an influential leader within APMS as well as the Midwest APMS Chapter.

David Isaacs (center) receives the Max McCowen Friendship Award

T. Wayne Miller Distinguished Service Award

Mr. Tommy Bowen of Duke Energy Carolinas, Huntersville, NC received the 2017 T. Wayne Miller Distinguished Service Award, presented to an individual to recognize "Service to the Society and the Profession." Tommy has been an APMS member since 1987 and the Meeting Planning Committee Chair since 2011. Tommy's optimism, friendly manner, and readiness to take on all challenges are key to successful APMS Annual Meetings.

Tommy Bowen (center) receives the T. Wayne Miller Distinguished Service Award

President's Award

Dr. Jason Ferrell received the 2017 President's Award for his significant contributions as APMS Editor in soliciting quality articles and assembling a team of Associate Editors to expedite reviews and publication of the *Journal of Aquatic Plant Management*. His subject matter expertise and organization and communication abilities culminated in his appointment as Director of the Center for Aquatic and Invasive Plants at the University of Florida in 2017.

Honorary Membership

Honorary Memberships were granted in 2017 to two long-term aquatic plant managers from Florida. Honorary Members must have been an APMS Member for at least 10 years, be retired from their major field, and have contributed significantly to APMS and aquatic plant control. Twenty-three Honorary Memberships have been bestowed in the 57-year history of APMS.

Dr. Joseph Joyce

Dr. Joseph C. Joyce was honored for his foresight and dedication to the development of aquatic plant management programs during his 40-year career while serving the Corps of Engineers in operational management, the University of Florida as Director of the Center for Aquatic and Invasive Plants, and the APMS as a Board Member and President. Joe Joyce is a Charter Member of the Florida Chapter of APMS, served as FAPMS President in 1981, and is an Honorary Lifetime FAPMS Member. Joe has been a member of APMS since 1981; serving on the Board for seven years as Director, and as President in 1991. Dr. Joyce could not attend the Annual Meeting as he was helping his son and family move to Japan for his new Air Force assignment as a deputy Group Commander.

Mr. Jeffrey D. Schardt was recognized for his long-term contributions in supporting invasive plant operations, research and education in Florida. Under his direction, Florida served as a model program for other states in developing science-based

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Non-student Poster Presentation Winner - Adriana Mitchell, University of Florida

Exhibitor Excellence Award - Ray Valley (BioBase C-Map) (center) with students who selected the winner

approaches to aquatic plant management. He was also recognized for his significant, long-term and steadfast support of APMS. Jeff Schardt worked in research, permitting and compliance, and coordinated aquatic plant management activities in Florida waters during his career that began in 1976. He served as President of FAPMS in 2000 and is an Honorary Lifetime Member of FAPMS. Jeff served as President of APMS in 2006, and has been on the APMS Board for 14 years; the last eight years as the APMS Secretary.

Jeff Schardt was presented with Honorary Membership from Editor Jay Ferrell (right) and President Madsen (left)

Other Presentations

Other acknowledgements given during the evening were Outstanding Non-Student Poster, presented to Adriana Mitchell of the University of Florida, and Exhibitor Excellence, presented to Ray Valley of BioBase C-Map, Inc. Outgoing Directors Mr. Dick Pinagel of Aqua Weed Control, Inc. and Dr. Ryan Wersal of Lonza were recognized for their three-year service on the APMS Board. Outgoing Student Director, Samantha Sardes was also congratulated for her service on the Board during 2016-2017. The evening culminated with President Dr. John Madsen of USDA transferring the ceremonial gavel to incoming President, Dr. John Rodgers of Clemson University.

Jeffrey Schardt (jeff.schardt@gmail.com) is Secretary of APMS, Inc., and is retired from the Florida Fish & Wildlife Conservation Commission – Invasive Plant Management Section.

Starry stonewort - Paul Skawinski - Aquatic Plants of the Upper Midwest

Invasive Species Highlight: **Starry Stonewort**

by Shannon Junior

Starry stonewort (*Nitellopsis obtusa*) is a species of macroscopic green algae in the Characeae family. It was first discovered in the United States in 1978 in the St. Lawrence River, but has since spread to Michigan, New York, Indiana, Pennsylvania, Wisconsin, Minnesota and Vermont. When the algae were first discovered in new areas, they were often misidentified as less invasive native species of macroscopic algae. However, the growth habit of starry stonewort is much more aggressive and robust, and can reach nuisance levels. These plants can reduce the growth of desirable aquatic vegetation, reduce suitable fish habitat and cause recreational fishing frustration. Although the algae are non-vascular and have no true plant structures, they have been found to grow as much as eight feet tall. The blooms have severe negative impacts on the habitats where they occur, and have posed unique challenges for lake managers in these areas.

Now that the presence of starry stonewort has become more familiar to lake managers, it is actually quite easy to identify. The blooms appear more "raggedy" than other macroscopic algae species, and have much greater height and biomass. They are also characterized by distinctive "starry" rhizoids, also known as bulbils, which are the reproductive structures of the pond algae (see photo above). The blooms are very transient, and are subject to a "boom and bust" phenomenon where large blooms will crash suddenly and unpredictably. This can cause hazardous low dissolved oxygen conditions in the waterbodies where it occurs.

Starry stonewort is highly sensitive to algaecides and is fairly easy to control, although extensive, established blooms can be extremely difficult to treat and eradicate. Because the "meadows" of starry stonewort are so dense and spongy, it is problematic to achieve good contact with all of the biomass. There is also some evidence that there are convection currents caused by temperature gradients that form within the blooms, which produce an upwelling phenomenon that makes it difficult to get algaecide products down into the mats to achieve the necessary contact for successful treatment. Therefore, proactive management before a bloom becomes established is a more practical approach that yields improved efficacy.

Starry stonewort is an aggressive invasive species, and it is continuing to spread to a greater geographic footprint. Even if you live in an area where starry stonewort has not yet been identified, it is important to be familiar with the morphology and characteristics of the species so that you can be aware if it encroaches into your neck of the woods. How serious is the threat of starry stonewort? The Aquatic Plant Management Society along with the Northeast Aquatic Plant Management Society, the Midwest Aquatic Plant Management Society and private partners in 2017 are funding a two-year $40,000 research grant on the biology, ecology and management of starry stonewort.

Shannon Junior is an Aquatic Ecologist with SOLitude Lake Management, an environmental firm providing lake, pond, wetland and fisheries management services. She can be reached through the website www.solitudelakemanagement.com.

Starry stonewort - Paul Skawinski University of WI Extension Lakes Program

Breaking Bad: Natives Edition

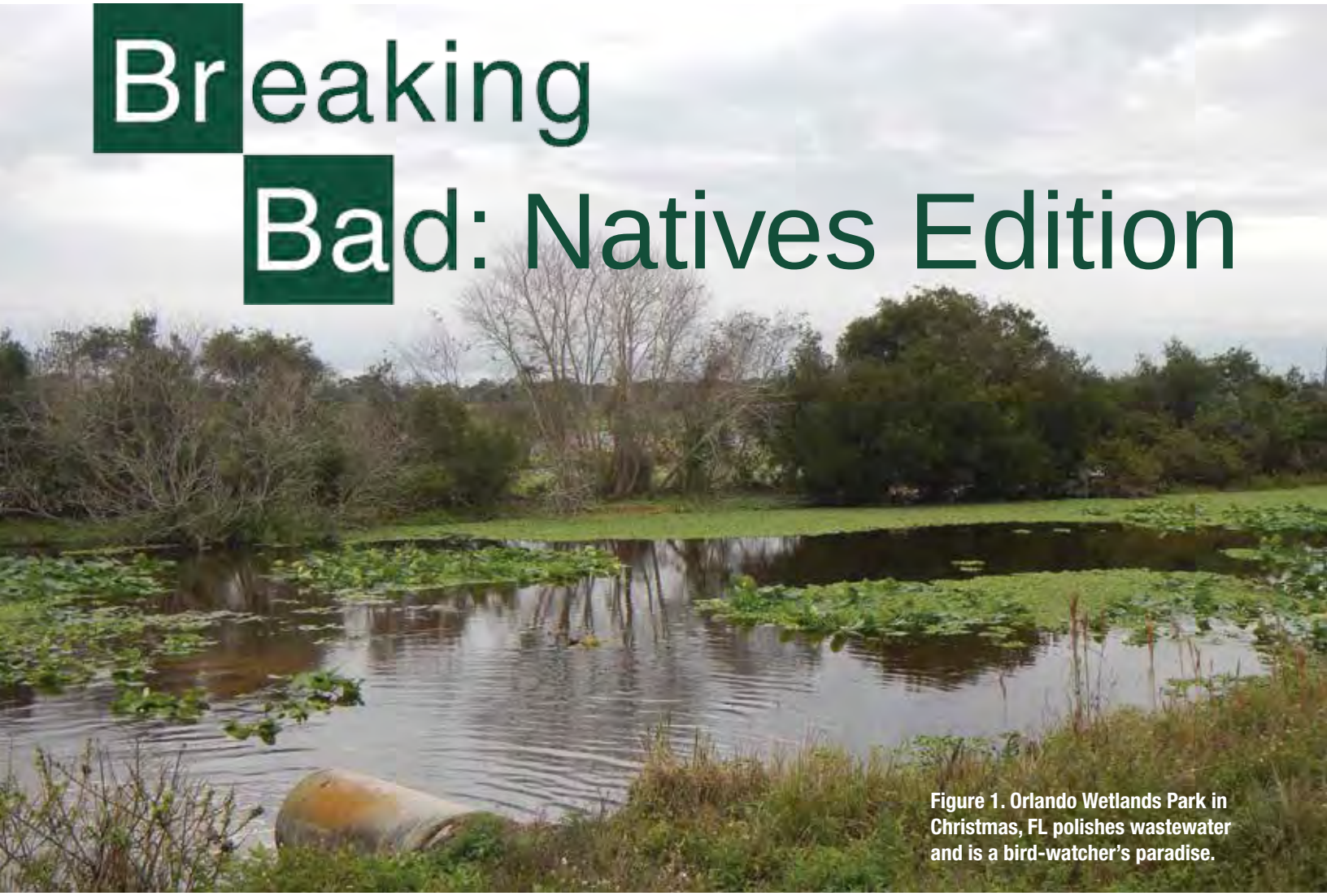

Figure 1. Orlando Wetlands Park in Christmas, FL polishes wastewater and is a bird-watcher's paradise.

by Lyn A. Gettys

All photos by the author unless otherwise noted.

Every well-informed applicator knows that the vast majority of Florida's water bodies are multi-purpose. For example, we use canals for recreational activities like fishing and boating, property owners rely on them for irrigation, and our governmental agencies need them to quickly move water away from developed or residential areas during "severe weather events" like tropical storms and hurricanes. A number of areas designed to hold and treat stormwater and wastewater do double duty by also serving as habitat for birds, game, and other wildlife. Even the lowly retention ponds in planned communities are expected to serve multiple roles – they catch stormwater during the rainy season but are expected to provide beautiful views to the community at large and to the waterfront residents who have often paid a premium to be situated on the water. As such, there are usually conflicting viewpoints among stakeholders regarding the presence, absence, or density of plants in these waters.

We often hear the mantra: "Exotics bad, natives good!" applied to aquatic plants, but that statement isn't always true – it all depends on the use of the water. Although we focus most of our efforts on managing invasive exotic species, there are times when some of our native plants go rogue and interfere with the intended purpose of the water. This article highlights some of the native plants that can "break bad" and trigger management actions due to aggressive growth.

Figure 2. Spatterdock (*Nuphar advena*).

Spatterdock (*Nuphar advena*, also known as *Nuphar lutea*) is a perennial species that produces submersed, floating, and emergent leaves. This plant is also commonly known as cow lily and yellow pondlily. The leaves are bright green with smooth margins and range in shape from sagittate (arrowhead-like) to

cordate (heart-shaped). The flowers are bright yellow, nearly round, and appear to be partly open. As a desirable native, spatterdock provides a number of benefits to an ecosystem; for example, the leaves provide a shady refuge for fish and the seeds are a food source for ducks and other waterfowl. Spatterdock is often planted in restoration projects because of these ecosystem services. However, its aggressive growth can completely overtake an aquatic system and create a monoculture with no plant diversity.

Pickerelweed (*Pontederia cordata*) is an emergent or shoreline perennial species that can grow in water depths ranging from "wet feet" to around 3 feet deep. Leaf shape ranges from lanceolate (sword-shaped) to cordate, and leaves are supported by petioles (leaf stalks) that are up to 4 feet in length. Pickerelweed produces a spike inflorescence with up to 400 blue to purple flowers. Individual flowers are only open for a single day, but the inflorescence can remain showy for up to 10 days as new flowers open daily. Pickerelweed is frequently included in water garden plantings and aquascapes due to its ornamental nature. The species is also used in habitat enhancement projects because the underwater portions of the plant give fish a place to hide and the seeds are a nutrient-rich food source for waterfowl. However, pickerelweed can form dense populations that can exclude other plants and can block access to the water.

Like pickerelweed, **cattails** (*Typha* sp.) are emergent shallow-water to shoreline species. Cattails have long, strap-like leaves that can reach to 8 feet in length and bear fuzzy, medium-brown cylindrical inflorescences that look like a corndog or cat's tail (hence the common name). Although there are some ornamental varieties of cattail that are used in water gardens, most intentional plantings are implemented for ecosystem improvement such as nutrient mitigation and soil stabilization. In addition to these benefits, cattails provide underwater structure for fish and a "resting and nesting" spot for birds. However, cattails can quickly crowd out other plant species and form dense, nearly impenetrable stands that restrict water flow and make navigation difficult or impossible.

Figure 3. Pickerelweed (*Pontederia cordata*).

Figure 4. Cattails. Inset photo David Sutton, UF/IFAS (retired).

Illinois pondweed (*Potamogeton illinoensis*) is a perennial submersed species that grows in water that is up to 6 feet deep. Illinois pondweed bears green to burgundy submersed and floating leaves that are up to 6 inches long; leaves are longer than they are wide, and submersed leaves are usually narrower than floating leaves. The species grows completely underwater but produces fleshy, green flowers on an emergent spike that is held just above the surface of the water. The fruits are a valuable food source for waterfowl because they are rich in carbohydrates, the underwater growth provides a refuge and hiding place for fish, and the root systems can stabilize

Figure 5. Illinois pondweed (*Potamogeton illinoensis*).

underwater soils. Illinois pondweed is often planted in restoration projects for these reasons. However, in some instances the species can grow aggressively and can fill the water column, which can increase near-surface water temperatures, restrict flow, and hinder navigation and recreation.

Like Illinois pondweed, **eelgrass** (*Vallisneria americana*), also called tapegrass or American wild-celery, is a perennial submersed species that can grow in water as deep as 6 feet. The leaves of eelgrass range in color from green to maroon; they are long, thin, and strap-like and are attached in a rosette at the base of the plant. Eelgrass is a relative of hydrilla, Florida's most intensively managed invasive aquatic species, and like hydrilla, eelgrass is dioecious, meaning plants produce either male (staminate) or female (pistillate) flowers. Pistillate flowers of eelgrass float on the surface of the water and are secured to the base of the plant via a long, spiraling stalk. Staminate flowers are borne in a capsule at the base of the plant; when ripe, the capsule splits and the tiny, pollen-bearing flowers are released. They float to the surface of the water, where they drift until they encounter a pistillate eelgrass flower. Once they make contact with the pistillate flower, they tumble in, release their pollen, and fertilize the pistillate flower, which will eventually produce seeds in a long, thin, green pod. Like Illinois pondweed, the fruits of eelgrass are a nutrient-rich food for waterfowl, the underwater growth provides a refuge for fish, and the root systems can stabilize underwater soils. Therefore, eelgrass is often planted in restoration projects. However, eelgrass can grow aggressively and can fill the water column, which can increase near-surface water temperatures, restrict flow, and hinder navigation and recreation. Also, although eelgrass is perennial and remains green all year, the species sheds leaves on a regular basis. These leaves accumulate along the margins and banks of aquatic systems and can become unsightly. This can become problematic in areas where aesthetics are important.

Figure 6. Eelgrass (*Vallisneria americana*). Inset photo courtesy Carl Della Torre III, UF/IFAS.

Dr. Lyn Gettys (lgettys@ufl.edu) is an Assistant Professor of Agronomy at the University of Florida IFAS Fort Lauderdale Research and Education Center.

Figure 7. Pistillate (field) and staminate (inset) eelgrass flowers.

Register TODAY for the 41st Annual FAPMS Training Conference!

We are looking forward to this year's conference at the **Hilton Orlando Buena Vista Palace Hotel** in Lake Buena Vista and hope that you will be able to join us. Make your hotel reservation by September 22 to get the early rate of $124. If you register for the conference by October 6, you'll pay only $135 — a savings of $50 off the regular registration cost of $185. In addition to providing you with access to all sessions, the Awards Banquet and the world-famous duck races, your registration includes a one-year FAPMS membership and *Aquatics* magazine. And, of course, CEUs will be available for meeting sessions attended. Register online by following the links on the FAPMS website at fapms.org. You will also find links to the draft agenda, hotel information and reservation link, sponsorship and vendor information, the equipment demonstration, and the Vic Ramey photo contest.

Don't miss out on this fun and informative meeting!

CALL FOR NOMINEES: FAPMS Aquatic Plant Manager of the Year Award

Now is the time to start thinking of someone you believe is worthy of winning the **FAPMS Aquatic Plant Manager of the Year Award**. Please think about the aquatic plant manager you respect the most and why. The cash award for this honor is $500. Winners also receive an engraved plaque. Eligibility requirements and the official nomination form are on the FAPMS website under the Awards tab, where you can also view the list of previous winners. You may complete the form online and save it using your name in the filename (for example: YOURNAME-manager_form.pdf). You may also print the form or cut it out of the last FAPMS newsletter and complete it by hand but you must stay within the space provided to allow for uniform evaluation. Extra pages will not be considered. The deadline for submission is September 30th. The winner will be announced at the FAPMS Annual Training Conference Banquet on October 18, 2017.

Alex Holmes, 2016 Aquatic Plant Manager of the Year, with President Angie Huebner

Please send completed nomination forms to:
Scott Glasscock
Awards Committee Chair
2200 South Service Lane
Lake Buena Vista, FL 32830
Fax: 407-824-7054
Scott.Glasscock@Disney.com
Good luck, Nominees!

The **FAPMS Annual Photo Contest** will take place at the 2017 Annual Conference in Lake Buena Vista, October 16th – 19th.

Keep your phones/cameras ready for that perfect field shot. Categories are **Aquatic Scenes** and **Aquatic Operations**. New this year: contest winners will receive a **CASH PRIZE**. Winning photos also will be printed in *Aquatics* magazine so download them in their original size. (Note: emailing photos tends to automatically downsize them for faster sending. Ask for help if you need it!) You might even get lucky and get your photo on the cover of *Aquatics* magazine! See the Fall/Winter 2016 and Winter 2012 issues for cover shots from previous photo contest winners. View all previous issues at fapms.org/aquatics/issues.html *Good luck!!!*

Calendar of Events 2017 & 2018

October 4 - 6
South Carolina Aquatic Plant Management Society
(www.scapms.org)
Myrtle Beach, SC

October 16 - 19
Florida Aquatic Plant Management Society
(www.fapms.org)
Lake Buena Vista, FL

October 22 - 26
20th International Conference on Aquatic Invasive Species
(www.icais.org)
Fort Lauderdale, FL

November 6 - 9
North American Lake Management Society
(www.nalms.org)
Westminster, CO

November 27 - 29
Texas Aquatic Plant Management Society
(www.tapms.org)
San Antonio, TX

January 9 - 11
Northeast Aquatic Plant Management Society
(www.neapms.org)
Portsmouth, NH

February 26 - March 1
Midwest Aquatic Plant Management Society
(www.mapms.org)
Cleveland, OH

March 26 - 28
Western Aquatic Plant Management Society
(www.wapms.org)
Reno, NV

PESTICIDE NOTE

From Summer 2017 Chemically Speaking newsletter by Dr. Fred Fishel, UF/IFAS Pesticide Information Office Visit the website at http://pested.ifas.ufl.edu/

Pesticide Registrations and Actions

On August 8, the Florida Department of Agriculture and Consumer Services (FDACS) accepted the Section 24(c) Registration request for the use of Escort XP (metsulfuron methyl), EPA Reg. No. 432-1549, in lake restoration projects in dewatered zones of lakes in Florida. The assigned Special Local Needs registration number is SLN FL-170004 and must appear on the label. (FDACS Letter, 8/8/17)

On August 8, the FDACS accepted the Section 24(c) Registration request for the use of Escort XP (metsulfuron methyl), EPA Reg. No. 432-1549, only for control of Old World climbing fern (*Lygodium microphyllum*) in Florida. The assigned Special Local Needs registration number is SLN FL-170005 and must appear on the label. (FDACS Letter, 8/8/17)

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