South Carolina Aquatic Plant Management Society

SCAPMSNEWS

www.scamps.org September, 2021

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President's Message...

To sum up the last 18 months I look to the words of Ron Burgundy "Boy that escalated quickly". 2020 was the year that paused life, but remarkably the Aquatics industry surged ahead. Backyard ponds that had been neglected for years were finally of interest again and the Aquatics service industry has seen tremendous growth. There are still challenges we face in our industry from staffing to product availability to price increases across the board, but from the conversations I have had with many of you, everyone has been astounded how well business is going and are excited for the future.

I had the opportunity to attend the national APMS meeting in New Orleans and was pleasantly surprised how normal and pre-Covid it felt. The exchange of ideas was great and the conversations that sparked even more was something I missed. It was great to see so many friends and catch up and I truly hope our industry is one that values human interaction and will continue to primarily hold in person meetings.

Our SCAPMS board have been working hard to ensure our upcoming meeting is both safe and fun for everyone. Our new layout will hopefully allow more room for both our presentations and vendor breaks. In addition, we will have the usual Covid supplies available for everyone. We will continue to watch the state and local mandates and make the necessary adjustments to ensure everyone's safety. I also wanted to give a note of appreciation to our 2021 venue the Ocean Drive and Beach Resort. They have been extremely accommodating allowing us to cancel our 2020 meeting at no cost while keeping our room and meal cost for 2021 very close to what our projected 2020 costs were to be.

I wanted to keep this short because I would much rather have a face-to-face conversation with you all after being couped up in this home office for the last 18 months. I can't wait to see you all in a little over a month.

Justin

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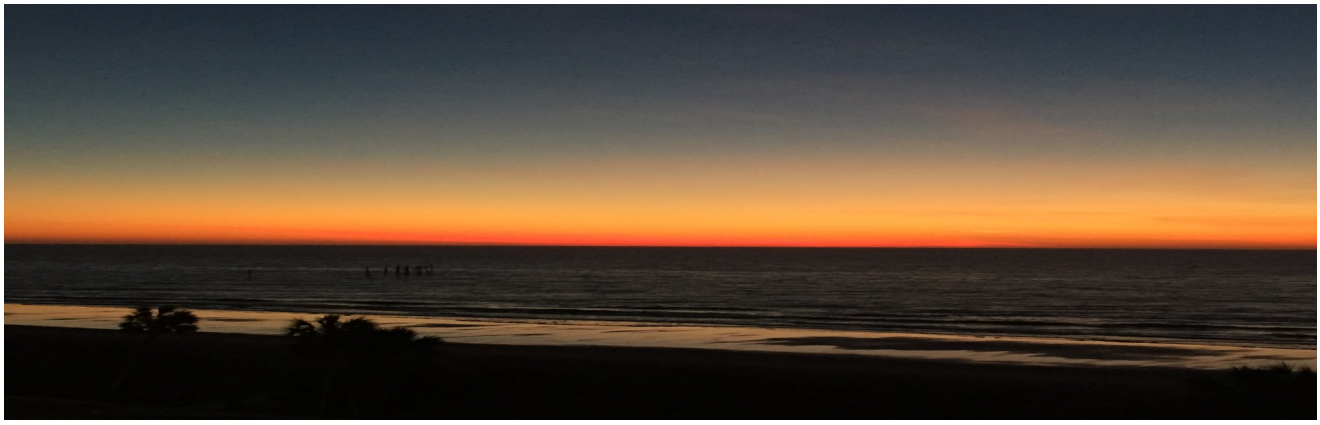
Scholarship Fund Reaches Goal of $100K

One of the four missions of the Society as stated in our By-laws is to "promote university scholarships." Soon after the Society was formed in 1979, we began raising money to build a scholarship fund. And by 1991 we amassed a whopping $10,000 and gave out our first scholarship of $1,000.

Now 30 years later we can look back and take pride in providing financial support totaling $76,000 to 34 students attending 11 different colleges and universities in the southeast. We are the only local chapter that opens its scholarship to the entire United States provided the research is applicable to South Carolina. In fact 61% of all our scholarships have gone to students attending schools outside the state.

One of the goals of the Scholarship Committee and Phil Fields, who the scholarship is named after because of his fundraising prowess, was to build it up to $100,000. Thanks to good investing over the years and a decision by the current Board to transfer excess operational funds to the scholarship fund, we have reached that goal. But most of the credit needs to go to our members who have been so generous over the years in supporting our fundraising efforts through raffle ticket sales, golf and fishing tournaments, and duck races. The Scholarship Fund now totals over $113,000 and the Board has increased the annual scholarship to $5,000! - Steven de Kozlowski



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Assessing A Lake's Water Quality Status

Gathering information about a lake and its watershead is an important step in managing a lake. The goal of a lake monitoring program is to determine the water quality and ecological condition of a waterbody.

There are many reasons for performing a water quality assessment of a lake. One may be concerned because the issues of excessive algae or aquatic plants are causing issues with health, navigation or just esthetics. On the other extreme, one may have a pristine waterbody, but may want to document the existing condition of it. Assessing the water quality status may help to determine and evaluate the long-term condition of the waterbody as well. The type, extent and cost of the lake study will depend on the reason for the study and the amount of information required. A monitoring program for a lake can be as simple as keeping a diary of observations or as sophisticated as a regular detailed scientific study. A detailed study, however, should be performed by someone educated an trained in lake ecology and management.

What to Monitor:

In order to properly monitor the complete lake ecosystem, one should monitor the physical, biological and chemical aspects of it.

Physical:

- Historical water uses and management
- Lake depth, area and volume
- Location of structures such as rocks, tree stumps and other fish habitats
- Depth of bottom sediments in the lake
- Hydrological information such as precipitation amounts, inlet and outlet flows
- Transparency (measured using a Secchi disk)
- Temperature Profiles

Biological:

- Location, type and abundance of aquatic plant species
- Types (species) and amount of phytoplankton
- Fisheries data
- Types and amount of zooplankton
- Fecal coliform bacteria
- Chlorophyll a (a measure of phytoplankton biomass)

Chemical:

Water chemistry plays a critical role in the ecological condition of a lake. While there are numerous tests that can be performed, some of the more important ones are:

- Nutrients that affect plant growth, particularly phosphorus and nitrogen
- Lake acidity status, measured as pH and alkalinity
- Total suspended solids
- Dissolved oxygen profiles

Where to Monitor:

For many waterbodies, one lake monitoring station, located at the deepest part of the lake is sufficient. For large lakes or lakes with complex shapes or many inlet streams, multiple stations should be monitored. In deep lakes that have a thermal stratification, water samples should be collected at different depths because the water quality is different in these stratified layers. Generally, samples should be collected at the surface, mid-depth, and just above the lake's bottom. As a minimum, samples should be collected at the surface, approximately two feet below the water surface. There are specific methods and equipment that should be used to collect water samples for chemical and biological analysis. If samples are collected incorrectly, the results could be misleading or incorrect.

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When To Monitor:

The scheduling of a monitoring program will depend on the objectives of it and the budget. The EPA Clean Lakes Program Guidance Manual recommends that sampling be performed twice per month from May through September and once per month from October through April. This is an excellent but very expensive monitoring program. A good moderate monitoring program would be to monitor the lake once per month from April though September. If a limited budget is all that is available and just want to know the condition of the waterbody during the critical summer months, a program that monitors the water once per month in July and August will work.

Understanding Lake Monitoring:

As discussed above, lake monitoring includes the measurement of physical, biological and chemical data to determine the water quality and ecological condition of the waterbody. Measuring the vertical profiles of temperature is important as this information indicates if the lake is thermally stratified too. The chemistry and biology of a stratified lake is different than that of a completely mixed lake. The temperature and oxygen data also indicate the occurrence and extent of oxygen depletion in the lake's bottom waters and thus the quality of the lake for fish and other aquatic organisms.

Biological lake parameters indicate the biological condition of the waterbody. For example, chlorophyll a, a green pigment present in all algae, is a measure of the algal biomass. Phytoplankton cell counts and identification is an indication of the algal diversity. The presence of blue-green algae, for instance, indicates that the lake may be eutrophic or becoming eutrophic.

Macrophyte surveys, which are usually performed by visual observations, show the extent and variety of aquatic plants in the lake. Fecal coliform bacteria are indicator organisms; most are harmless, but their presence indicates the possible presence of pathogenic bacteria.

Lastly, chemical parameters for phosphorus and nitrogen are the key nutrients used by algae and aquatic plants to grow. The amounts of chemical forms of phosphorus and nitrogen are important in understanding the condition of the waterbody.

In summary, all of these parameters are evaluated together to determine the ecological condition of the waterbodies we all work on. - Editor, Cary Martin, Nutrien Solutions

References:

- US Environmental Protection Agency (EPA): www.epa.gov
- National Resource Conservation Services (NRCS): www.nrcs.gov
- Clean Lakes Program Guidance Manual, EPA-440/5-81-003 December, 1980 Office of Water

Parameter	Lakes	Streams	Explanation
Alkalinity		20 to 200 mg/L	Usually expressed in terms of calcium carbonate Optimal is 100-200 ppm
Calcium (CA)	<11mg/L = Oligotrophic >24 mg/L Usually etrophic	In Limestone areas, typically 30-100 mg/L	Leached from nearly all rocks but most prevalent in regions with limestone &gypsum deposits
Chlorine, Total residual		4 day average not to exceed 0.011 mg/L and 1 hr max not to exceed 0.019 mg/l	Used for disinfection Does not occur naturally
Chlorophyll a	<2.0 ug/L Oligotrophic 2.0-6.0 ug/L Mesotrophic 6.0-40.0 ug/L eutrophic > 40.0 Hypereutrophic	Recreation/ aesthetics: <0.025 mg/l	0-10 ug/L No problems evident, no water discolor 10-20 ug/L algal scums evident, some discolor 20-30 ug/L Nuisance conditions encountered > 30 ug/L severe conditions encountered
Dissolved Oxygen	Same as streams 4– 5 mg/L minimum	<3-r mg/l is stressful to aquatic life, 6 mg/l is best for cold water fishes	O2 levels controlled by photosynthetic & respiratory activity & diffusion higher late in the day; lowest early AM
Fecal Coliform Bacteria	<200/100 ml (Summer Months)		Not necessarily bad in itself, but may indicate presence of pathogens
Hardness		0-60 mg/l = soft 61-120 mg/l -= mod. Hard 121-180 mg/l = hard >180 = very hard 100-200 mg/l optimal	Due to dissolved salts of calcium, magnesium & sometimes aluminum manganese and iron. May affect fish tolerance to toxic metals, toxicity of mercury, copper, lead, ammonia. Phenols increase with lower alkalinity
Iron (Fe)	Will be higher near lake bottom	Not to exceed 1500 ug/L Acceptable level: 0.3 mg/L	At pH>3, iron precipitates out in water as “yellow boy” (ferric hydroxide) Can clog gills &smother habi-
Manganese (Mn)	Similar to iron		Mostly a color problem
Magnesium (Mg)		In areas with source, 5-50mg/L	Mainly from leaching of igneous & carbonate rocks; essential micronutrient in plants for chlorophyll pro-
Nitrogen (N)			Present in several forms—Organic nitrogen, ammonia (the product of decomposition), nitrate and nitrite.
Ammonia Nitrogen (NH3-N)	May reach 5 to 10 mg/L in anoxic bottom waters in eutrophic lakes	Non polluted: <1 mg/L	EPA’s recommended criteria is 0.02 mg/L for freshwater aquatic life. pH>8.5 (toxicity affected by pH) Acute lethal levels for fish ranges 0/2 to 2.0 mg;L Sources, wastewater, agricultural runoff, decay of organisms

Parameter	Lakes	Streams	Explanation
Nitrate Nitrogen NO3-N	Relatively "Healthy" lake = <0.05 mg/l in summer, top layers of eutrophic lake has low levels due to plant uptake: bottom higher due to decay	Rarely exceeds 10 mg/L Frequently <1 mg/L during high primary production	The most abundant inorganic form of nitrogen. Drinking water standard is 10 mg/L Algae can use nitrate as nitrogen source for growth.
Nitrite Nitrogen (NO2-N)		Typically present in extremely low concentrations	Rarely measurable in unpolluted natural waters; generally <1 mg/l. High concentrations may be indicative of
pH (Standard Units)	6.0 to 9.0 ideal range for aquatic organisms	6.5—8.2 optimal	7.0 is neutral, 8.5 and above may result from biological productivity (CO2). 5.5 and below is stressful to organisms, may indicate acid rain/acid mine drainage; low pH can release metals into water
Phosphorus (P)	TP (totalP) below 0.01 mg/l (<10 ug/l) provides a high level of protection; oligotrophic. < 0.02 mg/l avoids nuisance algal growth. >0.03 mg/l Likely to experience problem weed and algae growth; eutrophic	Non Polluted waters—total phosphorus usually ,0.1 mg/l	Present in several forms—organic bound, inorganic polyphosphates and inorganic orthophosphates. Very biologically active and cyclic. Sources– leaching from phosphate bearing rocks; fertilizers; sewage; detergents; septic tanks; soil erosion; agriculture; development. The element most likely to cause stimulation of plant production. (Algae and aquatic plants use only the orthophosphate (PO4) form of phosphorus)
Ortho-phosphorus (DRP)	In unproductive lakes, ortho -P < 0.005-0.007 mg/l	Ortho-phosphorus < 0.01 mg/L	Soluble Ortho-Phosphorus is the form most available to plants
Sulfate (SO4)	Much higher in saline lakes Concentration cyclic in	5-50 mg/l in natural waters not to exceed 250 mg/l	Usually the 2nd most commo anion; from sedimentary rocks. In lakes is cyclic—organically reduced forms &
Specific Conductivity adjusted for temperature		Usually between 50-1500 umhos	In natural waters, unit is micrmho Affected by temperature. Indicator of the amount of total dissolved solids.
Temperature	Above 88 deg F can be stressful to fish	Up to 66 deg F for coldwater Fish Up to 87 deg F for warmwater fish	Maximum allowable temperature varies by season and waterbody.

Parameter	Lakes	Streams	Explanation
Total Dissolved Solids (TDS)	Unpolluted = 17-30 mg/L Polluted = 400 mg/L	Maximum 1,500 mg/L	The total amount of solids that are in solution in water; total dissolved solids consist of the anions and cations that are dissolved in water and include sodium, calcium sulfates, orthophosphate and other dissolved
Total Suspended Solids (TSS)	Clear Water = , 25 mg/L Intermediate = 25-100 mg/L Muddy = >100 mg/L TSS of 25 mg/L produces a "turbid" appearance generally perceived as a water quali-	High levels of protection = <25 mg/L; Moderate protect. = 80 mg/L; low level protect. = 400 mg/L; verly low protect. = >400 mg/L; Harmful to fish eggs—75-100	Not all kinds of TSS are equally harmful. Walleye are sensitive to TSS with death rates at >200 m/L Good to moderate fisheries—25-80 mg/L. Good to moderate fisheries 25 to 80 mg/L. 80-400 mg/L unlikely to support god fishery but could get by at lower end. AFS suggest limit of 100 mg/L to prevent aquatic life mortal-
Turbidity		> 100 NTU is excessive. 50 NTU is considered turbid	Turbidity is caused by the presence of suspended matter in water such as clays, mud, algae, silica and bacteria.
Clarity—Secchi Disk	Excellent = 15-20' feet + Poor = <2 Feet Oligotrophic = >8 meters Mesotrophic = 4-8 meters		20 cm diameter standard Secchi disk, black and white; used to measure the clarity of lake water; Excellent, inexpensive measurement of lake water quality condition.

Explanation of Units:

Typical units of concentration used in water chemistry are milligrams per liter (mg/L) which is equivalent to parts per million (ppm), and micrograms per liter (ug/L) which is equivalent to parts per billion (ppb). The units are related in the following ways:

1 mg?L = 1 ppm; 1 ppm = 1000 ppb 1 ug/L = 1 ppb; 1 ppb= 0.001 mg/L

References:

- Nutrient Criteria Technical Guidance Manual—Lakes and Reservoirs, EPA-822-B00-001, Apr 2000
- EPA Water Reource Center
- US EPA
- National Resource Conservation Service

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Biological Control of Giant Salvinia on the Santee Cooper System (Fear No Weevil: For They Are Monophagous!)

Giant Salvinia Weevil on Giant Salvinia Leaf. Photo: University of Florida

September, 2021

When giant salvinia was introduced in upper Lake Marion in 2017, Santee Cooper's Lake Management Team had one intention: immediate eradication. Unfortunately, the region of Lake Marion where salvinia first appeared is a vast abyss of old-growth Cypress and Tupelo, so hunting down each penny-sized juvenile plant to hit it with a dose of herbicide wasn't in the cards. As a result, the ultimate aquatic invasive species seems to have made a permanent home in the Santee Cooper Lakes.

While giant salvinia is a miserable pest for any lake manager, objectively, one must acknowledge that it's an impressive species. It's equipped with all the most volatile traits: it's adaptable, spreads like wildfire, grows rapidly, and has little appeal to native herbivores. When a tiny, inconspicuous juvenile giant salvinia plantlet settles into a new area, it wastes no time in budding new plants as it matures to create a dense patch, or 'stand' of giant salvinia that easily grows to 6 inches or thicker. While these stands create all the predictable issues with water quality, navigation, water intakes, native species competition (shall I go on?), at least there is one silver lining: they offer a nursery for establishing a promising new ally, giant salvinia weevils.

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Biological Control of Giant Salvinia on the Santee Cooper System Continued…

The giant salvinia weevil, *Cyrtobagous salviniae*, is a small, black weevil native to Brazil. Weevils in the adult and larval stage feed directly on giant salvinia, which can drastically slow plant growth and range expansion. Weevil foraging in combination with herbicides and mechanical control such as accumulation booms can help give lake managers the leg up they need to reclaim their resource.

Giant Salvinia Weevil. Photo: Katherine Parys, USDA-ARS

Introducing an additional non-native species as a control agent always raises a few eyebrows. Take for instance the classic example of the introduction of cane toads to control cane beetles in Australia in the 1940's. With few native predators, cane toads rapidly expanded their population throughout Eastern Australia and decimated native fauna. To make matters worse, the impact on the cane beetle they hoped to control was completely negligible.

Rest assured, our weevil friends are monophagous - in other words, they evolved to rely solely on a single food source at all life stages and lack the ability to substitute any native vegetation, crops, or ornamentals as a snack. Extensive use and research through the USDA Agricultural Research Service (ARS), Fish and Wildlife Service (FWS), Louisiana State University (LSU) have helped solidify this important detail, and weevils have now been introduced in at least 17 countries for biological control with no negative effects on native flora or fauna.

Salvinia-infested waters of Texas and Louisiana that have had the most success with weevil stocking are those where the climate is warm enough for the weevils to easily overwinter. Regions with cooler climates have also seen benefits from weevil stocking, but the results are less pronounced, and weevils need to be restocked annually. The Santee Cooper Lakes are likely somewhere in the middle of this climate range, such that they may overwinter successfully some years but disappear entirely after a cold winter.

Lake management staff at Santee Cooper intended to stock weevils in the spring of 2020, but that date was pushed back due to shutdowns from the pandemic. On September 2020, 1000 weevils were finally stocked in a dense patch of salvinia in upper Lake Marion. The timing of the stocking was less than ideal, but hopefully enough weevils overwintered to establish a population in the area for the 2021 growing season. Weevil stocking will continue in the Santee Cooper System in the spring and summer of 2021.

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Undoubtedly, giant salvinia will continue to spread throughout the Southeastern United States. Public education, signage, and equipment checks are integral to preventing the spread, and potential infestations should be addressed immediately and aggressively. For those currently battling giant salvinia, the herbicide mixes that have been the successful on the Santee Cooper lakes are listed below. Rates may vary depending on plant density.

The efforts to eradicate Salvinia persisted, but it was clearly a losing battle. Tiny, individual plants haunted the nooks and crannies of upper Lake Marion, and untreated sloughs quickly clogged with mature Salvinia. Although record cold temperatures in the winter of 2017-2018 caused more freezing on the lakes than had been seen in any living generation of fishermen, the cold only temporarily slowed the plant's progress.

After the initial discovery of the plant in 2017, 401 acres of Salvinia were treated, although it was often small, primary stages of the Salvinia hiding in water hyacinth and crested floating heart. In 2018, no Salvinia was identified until July, and only 145 acres were treated. A mild winter allowed Salvinia to persist, and in 2019, 499 acres were treated. Herbicides have been successful in treatment areas, but in a labyrinth of cypress and tupelo trees with consistent flow, treating every hidden piece of Salvinia seems impossible.

Through assistance from the Army Corps of Engineers, SePRO staff, the NC Department of Environmental Quality Aquatic Weed Control Program, NC State University, SC Department of Natural Resources and good old-fashioned trial and error, the list of herbicides and tank mixes with the strongest results has been narrowed down to the following:

Diquat, 1.0-2.0 gal/acre with a nonionic surfactant

Penoxsulam, 4 oz/acre Carfentrazone, 8 oz/acre with a nonionic surfactant or MSO

Fluridone, 30 ppb target concentration with follow up treatments to maintain concentration as needed

So, what is the plan for future treatments? The steady fluoridone treatment proved very effective in slowing plant growth and eventually killing the plants altogether. If environmental conditions allow, early season fluoridone treatments will be used in several low-flow areas throughout the lakes. In areas where flow is a concern surface applications of contact herbicides will likely be used. A new weapon will also be introduced to the Santee Cooper System in 2020, the Salvinia weevil, *Cyrtobagous Salvinia*. Weevils have proven effective in significantly slowing plant growth at sites throughout Louisiana and Texas in a climate similar to that of the South Carolina coastal plain. They're also extremely selective in their diet (monophagous, if you will), so there is no risk of affecting valuable native vegetation.

The potential for giant Salvinia to wreak havoc throughout the lake system is always looming. Without a doubt, keeping Salvinia at bay in the Santee Cooper system will require a variety of herbicides, some hungry weevils, educational outreach, some occasional icy weather, and a whole lot of elbow grease.

Diquat at 0.75-1.5 gal/acre with a nonionic surfactant.

Endothall (dipotassium) at 16 oz/acre, flumioxazin at 4 oz/acre with 1% MSO.

Diquat at 0.75-1.5 at gal/acre, flumioxazin at 4 oz/acre with a nonionic surfactant.

Penoxsulam at 4 oz/acre, carfentrazone at 4 oz/acre, flumioxazion at 4 oz/acre with a nonionic surfactant or 1% MSO.

Penoxsulam at 4 oz/acre, Carfentrazone at 8 oz/acre with a nonionic surfactant or MSO.

Fluridone, 30 ppb target concentration with up to 4 follow up treatments to maintain concentration as needed.

Metsulfuron, rate varies based on formulation. Special-Use Permit required for aquatic application.

Weevil keep you updated on how the project goes. Speaking of excellent weevil puns, be sure to follow the *Weevil Rock You* Instagram page, to whom I give full credit for my weevil pun inspiration. Visit the LSU AgCenter page at www.lsuagcenter.com, the UF Institute of Food and Agricultural Sciences page at https://ifas.ufl.edu/, or the USDA Agricultural Resource Service page at www.ars.uda.gov for more information on giant salvinia weevil research. Please feel free to contact me at carl.bussells@santeecooper.com with questions or for more resources.

Carl Bussells

Environmental Specialist, Santee Cooper

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Metsulfuron-methyl: A New 24(c) Label for Giant Salvinia Management in South Carolina

By Dr. Christopher R. Mudge

The invasive floating fern giant salvinia (*Salvinia molesta*) has spread across the southeastern U.S. from waterbodies in Texas and Louisiana all the way to South and North Carolina. Since the rediscovery of giant salvinia in South Carolina in the Santee Cooper system (Lake Marion 2017), management efforts have been ongoing to control and prevent the spread of this troublesome weed with aquatic herbicides and salvinia weevils. Scientists at the U.S. Army Engineer Research & Development Center (ERDC) and former Louisiana State University (LSU) graduate students have identified a new herbicide to aid in the management of this species. Mr. William Prevost and Dr. Bradley Sartain (ERDC researcher) generated three years' worth of replicated data in graduate school that demonstrated how highly efficacious the slow-acting, systemic acetolactate synthase (ALS) inhibiting herbicide metsulfuron-methyl was against giant salvinia in a mesocosm setting. With support from various government agencies, metsulfuron was granted a Section 24(c) registration [Special Local Need (SLN) label] in Texas (2019), Louisiana (2020), and South Carolina (2020) to control giant salvinia in public waterbodies. Natural resource agencies (i.e., local, state, and federal government only) can apply PRO MSM 60 in Louisiana and Texas and Cimarron Max Part A in Texas, Louisiana, and South Carolina to public managed and/or regulated waterways. The dry flowable can be applied alone at 0.5 to 1.0 oz. product/A or in combination with other aquatic herbicides at the same rates, and can only be applied to the foliage of giant salvinia (i.e., no in-water injection) growing in freshwater systems. In addition, the following restrictions are described on the label: do not apply more than 1.0 oz per acre per year, do not apply within 1/4th mile of functioning potable water intake and treated water cannot be used for irrigation. Other specific use patterns and restrictions can be found on the SLN labels. The new SLN will offer a rotational herbicide for managers to institute stewardship that will hopefully reduce selection pressure (herbicide resistance).

Logo Contest—

Do you have an artistic touch? Everything deserves a fresh coat of paint from time to time. The SCAPMS Board of Directors is hosting a contest to spruce up our logo. The membership will vote on entries at the 2020 annual conference this coming fall. The winner of the contest will receive $300! Please submit your entries to board@scapms.org or bring an electronic copy to the registration desk at the annual conference.

Please note: This new logo will IN NO WAY REPLACE our founding logo, this will be for advertisement i.e. hats, T-shirts, stickers etc.

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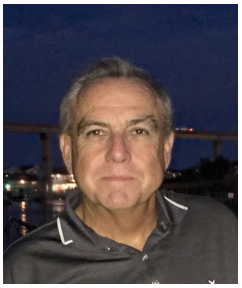


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ANNUAL MEETING OCTOBER 6-8, 2021

41st Annual Conference at

Ocean Drive Beach and Golf Resort

The Ocean Drive Beach and Golf Resort has all the ideal amenities for a SCAPMS conference; plenty of space for meetings and vendors, delicious food, walking access to restaurants and bars, ocean views, beach access, pools, and of course, a lazy river for the duck race! The hotel also has a 'retro' feel that will be very fitting for the 41st annual meeting! As always, the annual meeting is a great place to accumulate the CEU's you need for your Cat 5 license. This meeting will also be packed with informative presentations and educational workshops which will be sure to bring you up to date on current topics. Socials and various gatherings will help you network and get reacquainted with colleagues. *Register at: www.scapms.org*

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