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SPRING 2012

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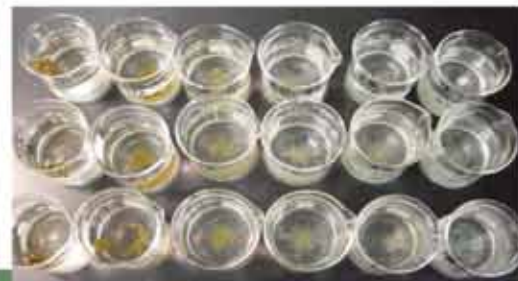
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Photo by Tina Bond. This photo was taken in Kissimmee, FL at the Mt research plots for the hydrilla demonstration project.



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Production of eelgrass sod for use in lake restoration projects

**By Lyn A Gettys,
William T. Haller, Ed Hayes
and Kyle Thayer**

The Aquatic Habitat Restoration and Enhancement Subsection of the Florida Fish and Wildlife Conservation Commission (FWC) is charged with planning and executing lake restoration projects in Florida. Fish and wildlife populations are healthiest when submersed aquatic vegetation (SAV) is present, so SAV is often planted to improve habitat quality for fish and wildlife. Lake restoration projects rely on the use of native SAV to maintain ecological integrity. Eelgrass (*Vallisneria americana*) is a highly desired

candidate for inclusion in these programs for a variety of reasons. Eelgrass (also called tapegrass or American watercelery) is a perennial submersed aquatic herb with ribbon-like leaves arising from a central rosette. The species is widely adapted and is more tolerant of adverse environmental conditions such as high turbidity, low light levels and various water chemistry regimes, than other native SAV. Although eelgrass produces seeds, most colonization is the result of vegetative reproduction of ramets (plantlets).

Revegetation efforts at some sites have been effective and newly planted eelgrass thrives, but in other cases, establishment of self-sustaining populations of SAV has been unsuccessful. This could be due in

part to the techniques used to plant SAV in the field. The roots of field-collected plants used for revegetation are sometimes damaged during collection, which can cause transplant shock and failure to establish. Also, the typical procedure is to hand-plant individual ramets, a technique that is very tedious and labor-intensive. This is especially true when ramets are planted at a fairly high density as recommended for best establishment. In response to this dilemma, the FWC requested that researchers at the University of Florida Center for Aquatic and Invasive Plants partner with their lake restoration biologists to investigate techniques and develop methods to optimize field plantings and hopefully improve restoration success.

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Ramets of eelgrass inserted in the openings of the coir rope net. Photo by Lyn Gettys.

Eelgrass sod in the greenhouse

In these experiments, we assessed the feasibility of producing eelgrass “sod” that can be cultured in the greenhouse and transplanted to the field. This novel approach addresses several of the challenges associated with revegetation programs. First, a relatively small number of plants are needed to start sod in the greenhouse; this can be desirable if supplies of eelgrass are limited. Second, sod can be cultured under greenhouse conditions, which drastically reduces predation and grazing while plants become established. Third, instead of planting individual ramets in the field, high-density populations are transplanted, which improves the likelihood of field establishment. Finally, large swaths of the restoration site can be planted quickly, which can reduce labor costs.

Our first goal was to identify the best matrix in which to culture eelgrass sod. This matrix had to be biodegradable to facilitate its breakdown after planting, but also stable and solid enough to support the sod during greenhouse culture and hold up during transport to the field. We tested two potential matrix materials – 100% cotton burlap and 1” thick coir (coconut fiber) – to determine which material would best serve our purposes. We cut sheets of each

matrix to 1.5’ x 2’ and inserted eight rooted plantlets on 6” centers through the matrix. Planted sheets were placed on a layer of sand amended with a controlled-release fertilizer in 1.5’-deep tanks filled with well water. As newly planted sheets had a tendency to float, each sheet was weighted down with 2 bricks that were placed between the newly planted ramets. After 16 weeks of culture, we found that most sheets hosted well-established populations of eelgrass, with an average of 80 plants per sheet (a 10-fold increase from the original planting density of 8 ramets per sheet). Matrix type did not have a significant effect on total number of plants produced during the culture period, but mats with a burlap matrix were extremely unstable and fell apart upon removal from culture tanks. In contrast, mats with a coir matrix maintained their structural integrity and held together upon removal from tanks. Because the burlap matrix failed to produce mats that would remain intact during transport from a greenhouse production facility to the transplant site in the field, we selected coir as the best matrix to use for production of eelgrass sod. Based on the results of these experiments, we determined that production of eelgrass sod in the greenhouse was indeed possible and that a coir matrix was superior to a burlap matrix.

Can Eelgrass Sod Work in the Field?

Our next goal was to “ground-truth” this new eelgrass sod technology to determine whether this strategy could be transferred to the field to increase the success rate of restoration projects at areas where previous revegetation efforts have failed. We established additional pieces of sod in the greenhouse, using coir as a matrix and following the procedures described above, then transported the sod to planting sites at three lakes. Well-rooted eelgrass sod was transplanted in the field at single locations in Lakes George, Jesup and Josephine. Water depth at the planting sites was 1.5’ at Lakes George and Jesup and 2’ at Lake Josephine. Planting sites were protected by exclosures at all three locations to reduce the likelihood of herbivory by turtles and other aquatic fauna. Replicate plots were established at each site; some plots were amended with controlled-release fertilizer tablets, whereas other plots were left unfertilized. Eelgrass sod was transplanted at all sites with and without fertilizer, with 4 replicates each of fertilized and unfertilized treatments. Sod

was placed on the bottom of the lake and secured with 8” long metal spikes; fertilizer tablets were pushed into the lake sediment under the sod in plots calling for fertilizer. Within 48 hours of planting, sod planted at Lakes George and Jesup had been torn or pulled up by wave action; this problem was addressed by returning to the field and top-dressing sod at these locations with pea gravel to provide more stability. This did not occur at Lake Josephine, where deeper water at the planting site resulted in reduced wave action; it therefore seems likely that planting site instability is a function of water depth.

Field visits 4 months after planting revealed that eelgrass sod had become established with varying degrees of success at the three sites and that there was no difference between fertilized and unfertilized plots. Small plants were visible at the Lake George site, but plants did not extend beyond the original pieces of sod and failed to colonize the unplanted area within the exclosure. It is worth noting that the planting site at Lake George is referred to as the Desert because virtually no SAV is present and

previous plantings have failed to establish. The observation that eelgrass was persistent 4 months after planting suggests that the use of sod may improve the success rate of revegetation efforts at this site. In contrast, plantings of eelgrass sod at Lakes Jesup and Josephine were much more successful. Plants at both sites were well-established and growing vigorously as soon as 2 months after the sod was transplanted. Healthy, self-sustaining populations of eelgrass are still present at both sites more than a year after planting and have expanded to fill the unplanted areas within the exclosures.

Results

These experiments revealed that the use of eelgrass sod for restoration and revegetation projects may be an effective strategy to increase transplant success and improve population establishment. Eelgrass was still present at all three field sites 4 months after planting and populations at these sites have become self-sustaining. Although little growth was evident at the Desert site of Lake George, the fact that eelgrass was still present at the site 4 months after planting is encouraging, as previous revegetation attempts at this site have failed. These results suggest that the use of eelgrass sod may provide a new tool to restoration managers and could result in more successful, cost-effective lake restoration programs. If water at the planting site is shallow (< 1.5’), care should be taken to ensure that sod is securely anchored to the planting site by top-dressing with gravel. Another alternative for shallow-water plantings is to locate the planting site behind existing populations of emergent plants, which will protect the newly planted sod by reducing wave and current action.

Can This Work with Larger Eelgrass Species?

These small-scale studies led us to wonder whether the production of eelgrass sod could be scaled up to produce larger pieces of eelgrass sod. In other words, instead of planting eelgrass sod that covered 3 square feet, why not try to produce sod that would cover 45 square feet? We also wanted to find a way to address the stability issue we found when planting eelgrass sod in shallow water. With these goals in mind, we identified a



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Well-rooted pieces of large (3' x 15') eelgrass sod after 16 weeks of culture. Photo by Lyn Gettys.

product that is composed of a large (3' x 15') "pillow" of coir enclosed in a coir rope net. We built large tanks (9' x 45' x 2' deep) out of plywood and pond liners; each tank accommodates 9 of these jumbo-size mats. As with our smaller sod experiments, we found that the coir pillows floated, so they were weighted down with bricks prior to planting. This was one of the few parallels between small-scale and large-scale eelgrass sod production.

We set up a total of 4 of these tanks to produce 36 pieces of eelgrass sod, for a total of over 1600 square feet of coverage. The first tank to be planted had 20 g of controlled-release fertilizer per square foot broadcast over the bottom of the tank before the mats were placed directly on top of the pond liner in the tank. This is half the low label rate recommended by the fertilizer manufacturer for culture of terrestrial nursery plants and approximately equal to the rate used in our production of small eelgrass sod. The water level in the tank was brought up to around 1' and well-rooted ramets of eelgrass were inserted on 6" centers into the openings in the coir rope

net wrapped around the coir pillow. Once planting was complete, the water level in the tank was increased to 1.5' and maintained at that level throughout the culture period. It quickly became clear that our protocol for production of small eelgrass sod could not be scaled up for production of large eelgrass sod without modifications. The tank became murky within a week and an algae bloom of epic proportions reduced water clarity to virtually zero. Pumps and biofilters were installed in an attempt to control the algae to no avail. We continued to have algae problems so severe that they impeded the eelgrass growth by blocking sunlight and smothering the plants.

Faced with this dilemma, we reduced the fertilizer level to 10 g per square foot in the next three tanks we planted. This helped to reduce – but did not eliminate – algae problems. Finally, the algae problems in the first tank were so severe that we abandoned the tank and set up replacement mats in a new tank. In this iteration, we placed and planted the mats as before, but did not add any fertilizer to the tank before planting. Instead, we waited until the eelgrass started to

grow well (around 4 weeks after planting), then inserted a 7.5 g controlled release fertilizer tablet under the planted mats at 1 foot intervals (equivalent to 5 g per square foot). This strategy seemed to work very well; plant density and establishment quickly increased and the algae blooms noted in earlier plantings failed to materialize.

After 4 to 5 months of culture, all mats were well-populated and hosted robust populations of eelgrass. Transport to the field was accomplished by rolling each 3'-wide piece of sod onto a 4' length of aluminum fence post, which acts as a spool and provides handles on either end of the roll. This process was fairly quick (a 15' long piece of sod could be rolled in 5 minutes) and resulted in an easy-to-transport unit that could be taken to the field. Although a rolled 3' x 15' piece of eelgrass sod is fairly heavy when saturated, the coir drains rapidly and weighs around 50 pounds within a few minutes of being removed from the tank. Sod is rolled with the shoots of the eelgrass inside and the drained coir retains enough water to ensure that plants do not desiccate during short transport periods. Rolled eelgrass sod is then loaded onto a boat, transported to the revegetation site, unrolled on the bottom of the site, and secured with 6" long biodegradable stakes.

These large pieces of eelgrass sod were transplanted to field plots in August 2011. While it is too soon to tell whether they will establish robust, self-sustaining populations of eelgrass in the field, it seems likely that they will perform as well or better than the smaller pieces of sod used in our previous trials. We expect that the new material used for the large eelgrass sod will be more stable because the coir pillow is wrapped with a coir rope net, so topdressing the sod with pea gravel at shallow planting sites may not be necessary. We believe these experiments show that the use of eelgrass sod may provide a new tool to restoration managers and could result in more successful, cost-effective lake restoration programs.

Dr. Gettys is an Assistant Professor at the University of Florida's Research and Education Center in Ft. Lauderdale. Sources for materials, supplies and literature used to prepare this paper are available from Dr. Gettys at lgettys@ufl.edu.



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Demonstration Project on Hydrilla and Hygrophila: **Wrapping Up**



Lake Tohopekaliga, 2009. Photo by Stacia Hetrick.

By Stacia Hetrick

Osceola County, Florida is wrapping up a six-year “Demonstration Project on Hydrilla and Hygrophila” that sought to find new and alternative ways to manage invasive plants in the Upper Kissimmee Chain of Lakes. Funded by the United States Environmental Protection Agency (EPA) and managed by the University of Florida/IFAS Osceola County Extension Office, the \$2.881 million project included multiple components that demonstrated various methods of managing these fast growing weeds.

There are five elements that comprise the EPA Demonstration Project. In this issue of *Aquatics* we will discuss the research and results of **Element 3: Biological Control of Hydrilla and Hygrophila**. The objective of this element was to evaluate the effectiveness of biological controls in the treatment of hydrilla and hygrophila. Osceola County collaborated with the University of Florida and SePRO Corporation to conduct this portion of the demonstration project.

Millions of dollars are spent each year managing *Hydrilla verticillata* and *Hygrophila polysperma* in Osceola

County and throughout Florida. If left unmanaged, these serious weeds create damaging infestations that can choke out native plants, clog flood control structures, and impede waterway navigation and recreational use.

Continued on page 10

“MILLIONS OF DOLLARS ARE SPENT EACH YEAR MANAGING *HYDRILLA VERTICILLATA* AND *HYGROPHILA POLYSPERMA* IN OSCEOLA COUNTY AND THROUGHOUT FLORIDA.”

Hydrilla has become more challenging to manage in recent years due to the development of fluridone resistance. This occurred in hydrilla infested waters that received repeated applications of fluridone over many years. Further, hydrilla is now showing tolerance to endothall, another mainstay in Florida hydrilla management, on a few lakes in Central Florida. Hygrophila, on the other hand, is difficult to control with all currently registered herbicides. Since hygrophila grows primarily in flowing water, it is difficult to maintain the contact time between the herbicide and the plant that is necessary for effective control. Because of these issues, new management strategies are needed in order to keep these weeds under control.

Classical biological control can be particularly successful at controlling invasive pests of foreign origin. Let's take hydrilla for example. The underlying principal of classical biological

to introduce it where the exotic plant has become invasive.

There has been no previous research on the potential for biocontrol of hygrophila. This is due to the limited range of hygrophila in the US; i.e., it has not become serious or widespread enough to justify biocontrol research, despite the fact that scientists think there is good potential for discovery of successful biocontrol agents.

The use of plant pathogens (bacteria, fungi and other micro-organisms, or chemicals produced by these microorganisms) as biological control agents has been successful for some terrestrial weeds. This technique involves culturing appropriate natural microorganisms and applying them to aquatic weeds to induce disease.

One potential pathogen of hydrilla, *Mycoleptodiscus terrestris* or Mt, is



control is that hydrilla is kept in equilibrium in its native range by natural enemies such as insects, diseases, nematodes or other biological organisms. When hydrilla is introduced into another geographic range away from its natural enemies, it can proliferate and become a serious weed as we have seen firsthand in Florida.

Thus, classical biocontrol of weeds is a process to determine the native range of an exotic plant (where did it come from?) and search that range for natural enemies (what kept it in check in its native range?). Once a promising natural enemy is discovered, the exhaustive process continues to determine if it is a good candidate (will other species be affected if we introduce the organism to the US?), and will it be able to establish where it is introduced. If the organism proves to be a good candidate, researchers will seek approval from the appropriate agencies

a native fungus, discovered on submersed weeds in the 1970s and has been evaluated periodically since that time. The problem with Mt has been the inability to successfully develop virulent formulations of the pathogen for commercial use. Future projects will continue to study Mt as a potential option for hydrilla management.

The Demonstration Project on Hydrilla and Hygrophila is funded through March 2012, but it is hoped that the results of this work will provide additional tools to aquatic plant managers for the integrated pest management toolbox. Please check future issues of *Aquatics* magazine for results of other elements of the Demonstration Project on Hydrilla and Hygrophila. These involve evaluating new and existing herbicides for use on aquatic weeds, new harvesting techniques and the education and outreach component of the project.



Hydrilla: Help Stop the Spread Photo by Tina Bond.

To learn more about the Demonstration Project on Hydrilla and Hygrophila, please visit our website at <http://plants.ifas.ufl.edu/osceola> or contact Eleanor Foerste, efoe@osceola.org.

Fungal Biological Control for Managing Hydrilla



Mt plots in Osceola County, FL. Photo by Mark Heilman.

By Mark Heilman

Mycoleptodiscus terrestris (Mt) is a fungus that was first examined for use as a bioherbicide for submersed weed bio-control in the 1970s. Herbicidal activity in laboratory studies and limited field studies was demonstrated on both water milfoil and hydrilla with different types of the fungus. When evaluated as a potential milfoil bioherbicide, the fungus showed

an ability to cause disease on only 3 of 16 aquatic plant species tested, and two of those sensitive species in the study were the potential non-native, target weeds hydrilla and parrot feather (*Myriophyllum aquaticum*). Previous commercial efforts in the late 1980s and early 1990s to optimize the Mt fungus as an aquatic bioherbicide for Eurasian water milfoil (*Myriophyllum spicatum*) by incorporating the vegetative portion of the fungus into a calcium-based pellet were not successful.

Partnerships to Develop a Bioherbicide

Starting in 2000, a cooperative research effort was initiated between the United States Department of Agriculture–Agricultural Research Service–National Center for Agricultural Utilization Research in Peoria, Illinois, the Aquatic Plant Control Research Program at the Environmental Laboratory of the US Army Engineer Research and Development Center (ERDC) in Vicksburg, Mississippi, and SePRO Corporation headquartered in Carmel, Indiana with a field research facility in Whitakers, North Carolina. This collaborative effort ultimately developed new fermentation methods that produced a stable Mt material that could be incorporated with other materials and stored for several months or more prior to use. The new culturing approach stimulated the fungus to produce dormant vegetative spores termed microsclerotia. Mt microsclerotia are small (<1 mm), vegetative structures that can be produced, dried and processed to produce bioherbicide materials that are stable for many months. Upon rewetting, Mt microsclerotia come out of dormancy through either vegetative or spore germination and are infective on target aquatic weeds.

Various Mt bioherbicide prototype formulations were evaluated for hydrilla control efficacy. Efforts were also made to examine the potential interaction of the Mt bioherbicide

with various chemical herbicides. Past research has also documented strong interaction between Mt and other current aquatic herbicides for control of several potential target weeds. For hydrilla management, the registered chemical herbicides fluridone (Sonar), diquat (Reward), and endosulf (Aquathol) all show strong synergistic interaction with the Mt fungus.

What We Discovered

While the Mt bioherbicides indicated an ability to attack and reduce hydrilla biomass under the right water quality conditions, the fungus did not provide enough consistent, sufficient hydrilla control to merit expanded field development efforts. Results indicated that under optimal water quality conditions (moderate water temperature and well-oxygenated conditions); the Mt bioherbicide alone did reduce hydrilla biomass by up to 50% for 1 to 2 months after application. Evidence was generated that aquatic herbicides such as Sonar (fluridone) could enhance effects of an Mt treatment. Despite positive findings of Mt infection and impact to hydrilla in central Florida ponds—some of the first evidence for successful field use of a fungal pathogen as an aquatic bioherbicide—the levels of performance in controlling hydrilla were less than desired. Use rates well in excess of 500 lbs per acre combined with limited

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duration of hydrilla biomass reduction (1 to 2 months of observed impact before full recovery) did not support expanded field development of the Mt bioherbicide with current technology anticipated for fungal fermentation, stabilization, and delivery.

While efforts to develop an aquatic bioherbicide based on naturally-occurring pathogens of invasive non-native aquatic plants such as hydrilla have yet to be successful,

the desire for such control technology remains very high. Optimizing a potential bioherbicide to a level feasible for commercialization and use in aquatic plant management provides unique advantages including potential selective control of the target weed, little or no water use restriction, and rotation with other control methods, typically chemical herbicides, as part of IPM approaches for sustainable invasive weed management.

Biological Control Prospects for Hygrophila

By Abhishek Mukherjee and James Cuda

The specific objectives of this study were, to (i) characterize the genetic variation in exotic and native populations of hygrophila and develop a plant growth model, (ii) study how defoliation affects the growth of hygrophila, (iii) conduct exploratory surveys in exotic and native habitats to identify potential natural enemies for biological control, and (iv) develop prediction models to prioritize areas in the native range of hygrophila to conduct future surveys.

Genetics Matter

Studies of genetic diversity of an invasive weed can generate valuable information regarding the invasion history such as finding; the source population and where it was first introduced. 253 plant samples were collected for genetic analysis from the native (India and Bangladesh) and exotic ranges (Australia, Mexico, and US) of hygrophila. Results showed exotic populations of hygrophila are genetically

identical, suggesting that the exotic population may have originated from a single source. Considering the invasion history of hygrophila, this result provided initial evidence that US hygrophila was likely the source for introduction to Australia and Mexico.

What Are the Natural Enemies of Hygrophila

Very little insect feeding damage was observed on hygrophila in Florida. As no information on natural enemies of hygrophila was available, several locations in the exotic (Florida) and native (India and Bangladesh) ranges of hygrophila were surveyed to collect them. Several natural insect enemies, including two caterpillars (*Precis almanac* and *Nodaria* sp.) that defoliate emerged plants, an aquatic caterpillar (*Parapoynx bilinealis*) that attacks submerged hygrophila leaves, and a leaf mining beetle (*Trachys* sp.) were collected during the surveys. Further studies are needed to determine their biology, host range and impact on hygrophila.



Precis almanac



Nodaria sp.



Trachys beetle

"Overall, the results generated in this study confirmed that *hygrophila* is a suitable target for biological control. We also confirmed that defoliation by insect feeding can significantly reduce the growth of *hygrophila*."



Noctuid Moth

A defoliation study, done by mechanically removing leaf tissue from plants to simulate insect feeding, can provide valuable insight about how plants compensate and tolerate defoliation. We looked at the effects of defoliation on growth and biomass to determine the level of feeding necessary to achieve a significant reduction in growth of *hygrophila*. We found that defoliation significantly influenced growth and biomass accumulation of *hygrophila* and predict that an insect that can completely defoliate *hygrophila* at least at monthly intervals could successfully reduce its biomass.

It was shown in earlier studies that the environment (climate, rainfall, temperature, etc.) is crucial for natural enemy survival in the exotic range and important for successful biological control. Due to the lack of information on *hygrophila* in its native range, we used a model to prioritize areas in India and Bangladesh to explore for natural enemies. Based on this model we predicted that the areas most ecologically favorable for *hygrophila* growth were northeastern regions of India and northern Bangladesh.

The Good News

From the modeling and studies we conducted, we concluded that future surveys for *hygrophila* biological controls should be focused on areas in India and Bangladesh. This study helped us confirm that the model we used can be an effective tool for identifying environmentally suitable native habits for foreign exploration.

Overall, the results generated in this study confirmed that *hygrophila* is a suitable target for biological control. We also confirmed that defoliation by insect feeding can significantly reduce the growth of *hygrophila*. A few previously unknown natural enemies that feed on both emerged and submerged forms of *hygrophila* were collected during this study. Some of the insects, particularly the aquatic and terrestrial caterpillar (*P. bilinealis* and *Nodaria* sp.) and the leaf mining beetle (*Trachys* sp.), hold promise as potential biocontrol agents of *hygrophila*. Further studies are necessary to determine their host ranges and specificity to *hygrophila* before they could be released in the US.



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Exploring Africa for Hydrilla Biological Control Agents

By Bill Overholt

We began our work by conducting surveys to locate populations of hydrilla in East African water bodies. First, we surveyed 144 locations in six lakes in Burundi, nine in Uganda and one in Kenya. Hydrilla was found at five locations along the Burundi shore of Lake Tanganyika and in four Ugandan lakes. At locations where it was found, hydrilla rarely reached the water surface, and occurred in localized patches. An in-depth study on the macrophyte community in one of the lakes revealed that hydrilla grew in association with several other plants, had a very patchy distribution and was only moderately abundant compared to the other aquatic plants.

Midges and other insects found with hydrilla

The majority of insects reared from hydrilla and other submersed plants were midges. We were very interested in obtaining additional information on two midges, *Polypedilum*

wittei and *Polypedilum dewulfi*, which earlier had been reported to bore into the growing tips of hydrilla. Inspections of hundreds of hydrilla stems found no evidence of midge larvae boring in stems, even though both midge species were present. On many occasions larvae were found crawling on the outside of plants, from which they presumably fed on a mixture of algae, cyanobacteria and detritus from plant surfaces. Even if the midges had been found to feed on hydrilla, neither species appeared to be host specific since they were reared from several different aquatic plants.

In addition to midges, caddisflies were the only other taxa collected with any frequency. Other insects were rare or localized and included a few phorid flies, a single specimen of the caterpillar, *Paraponyx*, two specimens of weevils and a mayfly.

The African mayfly

Earlier, the African burrowing mayfly (*Povilla adusta*) had been reported to bore in basal portions of hydrilla stems.

While these mayflies are known burrow into a variety of substrates including wood (submersed trees and boats), shell fragments, gravel, sandstone, and stems and roots of living aquatic plants, they do not feed on the substances in which they bore; rather they feed on algae and detritus.

In February 2010, a large number of growing tips of hydrilla collected at two locations in Lake Tanganyika had growing tips that had been bored, but no organisms were found in the tunnels. However, many mayfly nymphs were found in containers in which the hydrilla from these sites had been placed. We hypothesized that mayflies were responsible for the damage, and confirmed this suspicion in a laboratory experiment. Thus, earlier reports of midge larvae boring in hydrilla may be due to occasional colonization of abandoned mayfly burrows by midges. Even though the mayfly was found to sporadically cause high levels of damage to hydrilla in Lake Tanganyika, it cannot be considered for use as a biological control agent due to the wide range of plant and inorganic materials in which nymphs create burrows.

Fish herbivory

Hydrilla stems collected in African lakes were often missing their growing tips and the leaves appeared to be chewed. We suspected that fish may cause these types of damage so we trapped fish in gill nets and dissected them to inspect their gut contents. Hydrilla leaf tissue was found in

the stomachs of five species, providing direct evidence that fish consume hydrilla in Africa. Regardless, fish could not be considered as potential biological control agents due to their lack of host specificity.

Molecular studies

DNA analyses were conducted to examine the relationship of different populations of hydrilla. The results confirmed earlier studies which showed that Florida hydrilla was closely related to hydrilla from India and that monoecious hydrilla from the northeastern U.S. matched hydrilla from Korea. Genetic diversity of hydrilla was highest in China, strongly suggesting an Asian center of origin. The most surprising result was that African samples were all the same type as hydrilla from India and Florida, suggesting that both African and Florida populations resulted from introductions from India.

Conclusions

Because no promising natural enemies were discovered, coupled with genetic evidence suggesting that hydrilla is not native to the region, we would not recommend further exploration for natural enemies in Africa. However, exploration in China which, based on our genetic evidence is the likely center of origin of hydrilla, may be productive.



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References are available upon request.

Invasive Species and Social Media: The Use of Short Videos for Outreach and Education

By Kate Wilson

Video can be an excellent way to increase awareness, and the UF/IFAS Center for Aquatic & Invasive Plants has recently done just that with the completion of two Frequently Asked Question videos concerning aquatic plant management. With vast changes in mass media in the past decade, from traditional single sources such as newspapers, magazines, newsletters, radio, and television to “converging media,” or the multimedia delivery of information (YouTube, Facebook), it is now necessary to use online sources to disseminate information. Even television is losing its popularity—viewers can now watch programs online, ad-free, and at their own convenience.

The rise in the use of “social media” is a massive change that has experienced widespread adoption by people internationally of all ages. Social media is the use of web-based and mobile technologies to turn communication into an interactive dialogue. Social media allows users to participate instead of just being passive observers and consumers of information. Social media includes genres such as collaborative projects (e.g. Wikipedia), blogs (e.g. Twitter), content communities (e.g. YouTube), social networking sites (e.g. Facebook), virtual game worlds (e.g. World of Warcraft), and virtual social worlds such as Second Life where you can create your own Avatar (a graphical representation of you or your alter ego or character).

Video is the fastest-growing use of the Internet. According to a *USA Today* study in 2009, 69 percent of adult users watch video online; comedy is the most



See Florida waters: ours to protect at plants.ifas.ufl.edu/manage Click on 1 - Why Manage Plants?

popular genre, followed by the news. Good news for us, educational video viewing has risen as well, from 22 to 38 percent. In 2007 users between the ages of 18-29 were almost exclusively the ones to upload videos to the web; now users 30-49 years old are uploading videos at the same rate. YouTube is currently the most popular video-viewing site online.

In March 2011, the sixth birthday of YouTube, the website was up to 3 billion views per day, a 50 percent increase from 2010 (*Huffington Post*, 2010). Over 48 hours of video are uploaded to the site each minute, a 37 percent increase in the past six months, and a 100 percent increase from last year. In 2008, Cisco, a large American communication technology company, released a study predicting that by 2012, total Internet traffic would be six times greater than in 2007. The study also predicted that this increase would be driven by high definition online video.

It turns out they were right.

Video is a great way to instantly grab audience attention, it is relatively inexpensive, and can drastically increase web presence and visibility for a person, business, or organization. If a picture is worth a thousand words, imagine what a video can do. Video can target a specific audience, have more influence, and allow greater interaction with viewers. The use of online video for advertising and marketing is an increasing trend for these reasons as well. It has even become possible to mine information online, tracking sites that individuals frequent so they can later be targeted for the advertising of specific products that they have search for or purchased.

If you or your organization are making a video for online viewing, there is a process that will help to ensure its success. The process includes four phases: 1) audience/program analysis; 2) pre-production; 3) production; and 4) post-production.



Audience/Program Analysis

One of the most important aspects of any informational or promotional campaign is knowing your audience. What do they think about the issue/product/service? Where do they get their information? Any demographic information will be useful as well (age, education, income, etc.). During this first phase, it is also essential to develop your purpose and objectives. What do you hope to gain from the online video (increased knowledge/awareness, increased sales, etc.)? Be as specific as possible and create a clear message that will “stick” with your audience.

Pre-production

Planning is crucial in the pre-production phase. Pre-production will likely be the most time-consuming part of the process. Take the time to figure out your budget, timeline, shooting locations, narrator or interviewees, technical crew and other participants, as well as the desired length of the finished video. A Public Service Announcement (PSA) will be 30-60 seconds whereas a more detailed

video (for an adult audience) should not exceed five minutes. This is a good time to create a storyboard, which is a planning tool that delineates all of the shots you will need and merges the visual with the audio. Audio can include narration, interviews, music, and text. It is also wise to write your script during this phase. Having a script helps focus your efforts. Even if it changes, it is important to know what you need to shoot. Using focus groups or other qualitative methods can be extremely helpful in the development of a good message and is recommended if time and budget allows.

Production

The production phase is actually the easiest part of the video process. Since you’ve already figured out what and who you need to shoot, it’s mostly about assigning duties and making sure the weather is going to cooperate (for filming outdoors).

Post-production

The post-production phase requires

knowledge of video editing programs and can also be very labor intensive and time consuming as you select scenes and assemble your finished program. During this phase you add narration or voice-over, captions or text, introductions, music, credits and any desired special effects. The final product can be distributed online through your organization’s website, a shared site such as YouTube, or as a DVD that can be handed out at events or meetings.

Aquatic Plant Management Videos

The UF/IFAS Center for Aquatic and Invasive Plants Frequently Asked Questions (FAQ) videos are a collaborative project with the Florida Fish and Wildlife Conservation Commission (FWC). The purpose was to choose from a long list of FAQs about aquatic plant management and make PSA-style videos that answered these questions. Videos could be showcased on the CAIP and FWC websites, as well as YouTube. FAQs identified included: Why do you keep managing aquatic invasive species? Who manages them in Florida? What are aquatic herbicide restrictions? Can I drink/swim/boat/fish after herbicide treatments? Do herbicides affect the wildlife? Will herbicides hurt my lake? Does aquatic weed management create more muck in the lake?

The target audience includes the general public in Florida; in particular, those stakeholders directly affected by aquatic plant management such as anglers, boaters, shoreline homeowners, waterfowl hunters, and other concerned citizens. We chose to tackle two videos with an introductory theme, so the project would lend itself to additional FAQ videos in the future.



See Why we manage aquatic invasive plants at plants.ifas.ufl.edu/manage/videos

The pre-production phase was extensive and included research on popular online videos, creating a storyboard and script, and searching through existing video footage and still photographs. Filming took place on-site at the Center for Aquatic & Invasive Plants facilities in Gainesville, Florida.

FAQ one, “**Florida Waters-Ours to Protect**,” runs less than two minutes and provides an overview of aquatic invasive species issues in general. We used still shots that feature water users and the potential consequences of not managing Florida’s lakes, rivers, and springs. FAQ two, “**Why We Manage Aquatic Invasive Plants**,” runs just over three minutes and is a more in-depth look at aquatic plant management in Florida. This video explores the history of aquatic plant management, provides a glimpse at Florida’s “worst water weeds,” and explains the concept of maintenance control. The program features Center Director Dr. Bill Haller as the expert. The two videos

complement each other but also can stand alone.

The videos can be viewed at **plants.ifas.ufl.edu/management**. They are accompanied by color brochures that can be downloaded and printed. Intended for a variety of audiences, the videos can be used to increase awareness and knowledge, pique interest, and ultimately lead to a better understanding of aquatic invasive species issues in Florida waters.

Special thanks to FWC for providing funding and oversight for the project, Marco Downs for his excellent artistic eye and knowledge of production software, videographer Phil Chiochio,



and the Center’s Information Office for all their support and suggestions.

Kate Wilson is a graduate student at the University of Florida. She works on aquatic invasive species outreach and education at the UF/IFAS Center for Aquatic & Invasive Plants. She can be reached at kathrynlwilson@uf.edu or (352) 392-6841.

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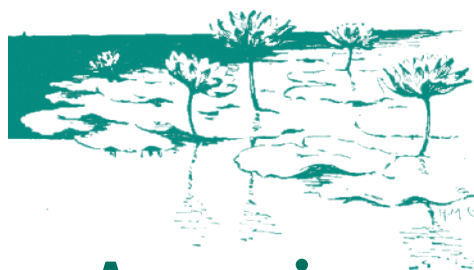
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New Pesticide Chemical Search

EPA has released Pesticide Chemical Search, a new Web-based application that will allow users to easy access to chemical-specific information from the Office of Pesticide Programs' website and several other important sources. Pesticide Chemical Search is designed to consolidate information related to pesticide chemicals (active ingredients), making it easier to find related regulatory and scientific information: www.epa.gov/pesticides/chemicalsearch

The new application allows users access to this information through a single portal. Users will also be able to quickly find the current status of a chemical and where it is in the review process. Another key feature is the ability to determine if there are any dockets open for public comment for a given chemical.

Pesticide Chemical Search will be expanded to include pesticide product labels and other relevant information in the near future.

New Website for Florida Aquatic Plant Managers, Researchers and Agency Personnel

Plant Management in Florida Waters – An Integrated Approach is a newly revised website produced by the UF-IFAS Center for Aquatic and Invasive Plants in conjunction with the state's lead agency for aquatic plant management, the Florida Fish & Wildlife Conservation Commission.

Presented in five main sections, **Plant Management in Florida Waters** will guide you through the many factors considered by FWC biologists when developing aquatic plant management plans for Florida waters. In addition, content from the heavily-used original Plant Management website is being updated and included in the new UF/IFAS

site. Updates are ongoing so please check back often (feedback is welcome).

The launch of the Plant Management in Florida Waters site deliberately coincided with new requirements of the EPA NPDES Permit Program, which includes the application of pesticides to waters of the United States as of October 31, 2011. In response to the new requirements, the Pesticide Generic Permit (PGP) is being implemented by the Florida Department of Environmental Protection.

Anyone applying pesticides to Florida waters should read Section 4 of this website and become familiar with the State of Florida's Generic Permit for Pollutant Discharges to Surface Waters of the State

from the Application of Pesticides.

Questions about the Florida Generic Permit should be directed to the DEP Wastewater Program.

APMS Blog

If you would like to read news articles about aquatic plant management from around the country, check out the APMS Blog at apms-blog.blogspot.com/ or via the APMS website (www.apms.org) under the Social Networks tab. The blog was created under the direction of the APMS Board of Directors, specifically Vice President Mike Netherland, as a new service for members. It will be updated on a weekly basis.



The Aquatic Plant Management Society Announces the **Annual Student Paper Contest**

The Aquatic Plant Management Society (APMS) is inviting student papers for the upcoming 52nd Annual Meeting. The meeting will be held July 22-25, 2012 at the Little America Hotel in downtown Salt Lake City. Oral and poster presentations of original research on the biology or ecology of aquatic and wetland plants, control methods for invasive exotic or nuisance native plant species, and restoration projects involving wetland or aquatic plants are solicited. Eleven students from 9 universities attended the 2011 annual meeting and we want to surpass those numbers at this year's meeting!

The APMS has a strong ethic of student support. The society will provide all qualified attendees room accommodations (based on double occupancy) and complimentary registration. In addition, 1st, 2nd, and 3rd place prize money will be awarded in separate contests for both oral and poster presentations. This meeting presents an opportunity for students to develop their presentation skills, learn about the field of aquatic plant management, and network with key government, university, industry representatives and peers with similar educational and professional interests.

The submission deadline for title and abstract is April 20, 2012. Please log on to www.apms.org to learn more or contact Dr. Rebecca Haynie at hayniers@uga.edu or (843) 991-8069.

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Calendar of Events 2012

April 2-4

Western APMS

31st Annual Meeting
San Diego, CA
<http://www.wapms.org>

April 16-19

Florida Exotic Pest Plant Council

Spring Conference
Ocala, FL
<http://www.fleppc.org/>

April 18-20

Florida Vegetation Management Association

Annual Conference and Trade Show
Daytona Beach, FL
<http://www.myfvma.org/>

May 7-10

University of Florida/IFAS

Aquatic Weed Control Short Course
Coral Springs, FL
<http://conference.ifas.ufl.edu/aw/>

June 18-21

Florida Lake Management Society

23rd Annual Conference
Gainesville, Florida
<http://flms.net/>

July 22-25

Aquatic Plant Management Society

52nd Annual Meeting
Salt Lake City, UT
<http://www.apms.org/>

July 26 and October 25

South Florida APMS

Quarterly Meeting
<http://www.sfapms.org/>

October

Florida APMS

35th Annual Conference

St. Augustine, FL
<http://www.fapms.org/index.html>

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