Aquatics

Summer 2001

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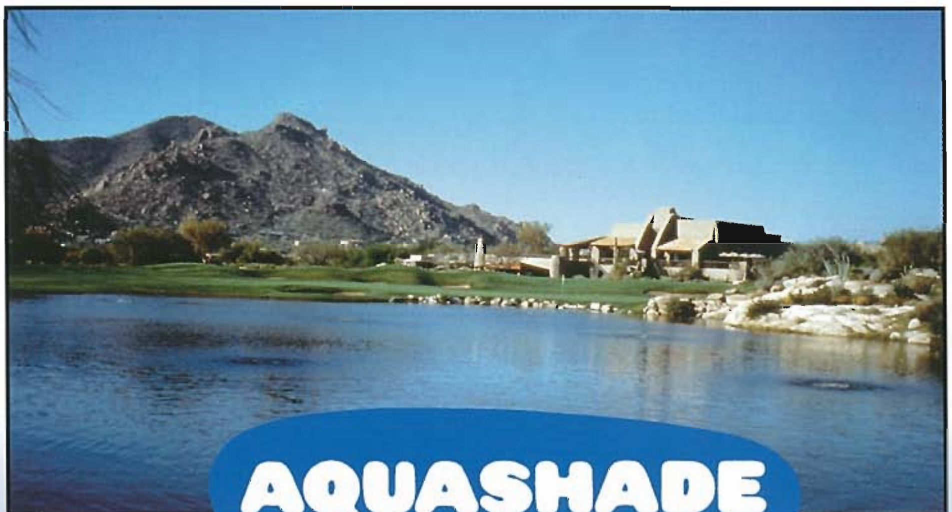

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Are new permit requirements in our future?

by
Steven de Kozlowski, Manager, Aquatic Nuisance Species Programs, South Carolina Department of Natural Resources

Aquatic herbicides, which are designed for use in water, have never been considered a pollutant in the past, but that may change. The United States Ninth Circuit Court of Appeals ruled last month that the application of the aquatic herbicide Magnacide H (acrolein), in irrigation canals in Oregon requires a National Pollutant Discharge Elimination System (NPDES) permit, and that the EPA-approved label under the Federal Insecticide, Fungicide, Rodenticide Act (FIFRA) does not eliminate the obligation to obtain a NPDES permit.

This ruling overturns a lower District Court ruling that recognized the active ingredient in Magnacide H, acrolein, as a "pollutant" because it can be toxic to fish and other wildlife. However, the lower court ruling also stated that a NPDES permit was not needed because the herbicide label, as approved by the EPA under FIFRA, did not require the user to acquire a permit.

On the surface this ruling appears to indicate that NPDES

Continued on page 12

FAPMS Website:
www.homestead.com/fapms/main.html

Florida's extraordinary drought continues. Scenes from the Withlacoochee River, Hernando County, FL before (inset) and during the drought. See inside for more amazing photos. Photo by Jim Kelly (cover) and Alison Fox (inset).

Aquatics

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Contents

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Is a "Quiet" Airboat Possible?

by

Robert Maglievaz, Environmental Specialist II

Volusia County Health Department

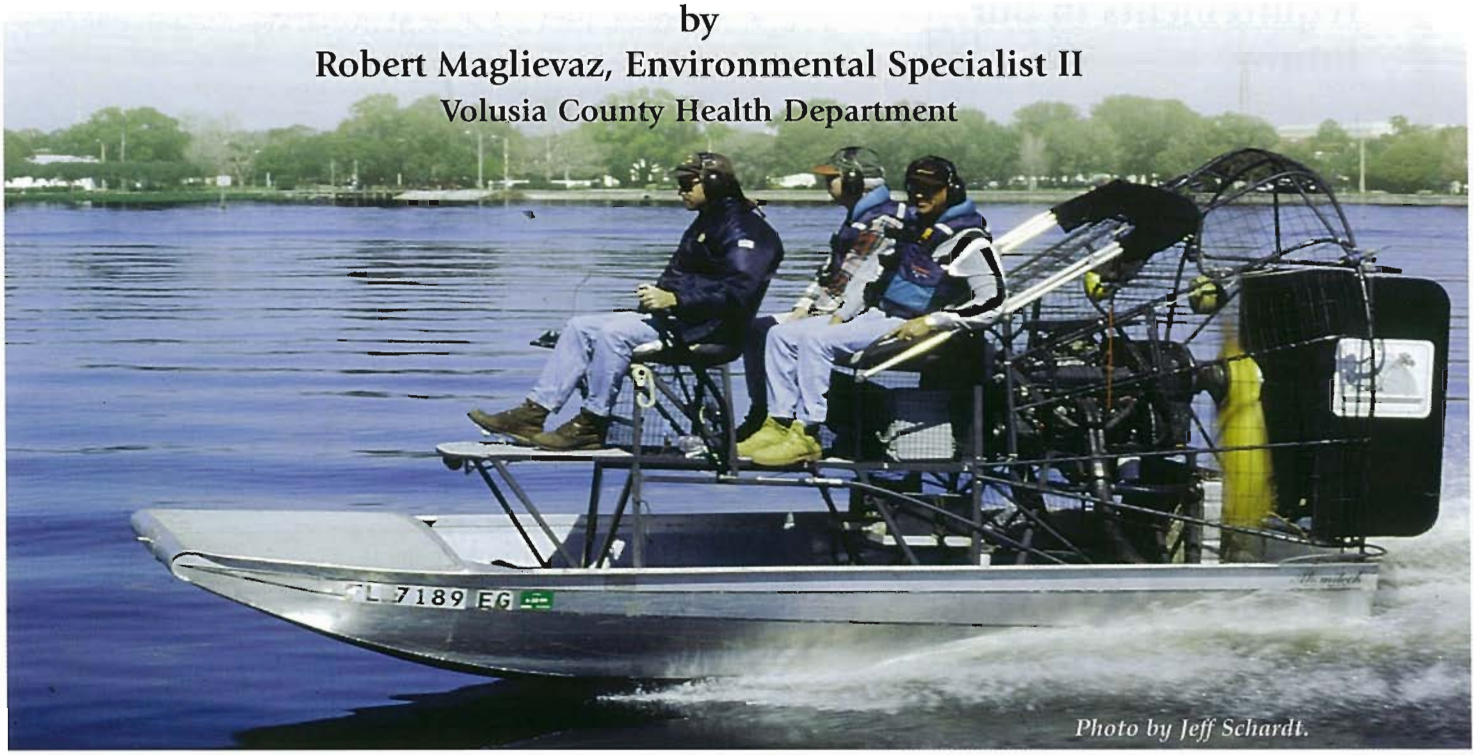

Photo by Jeff Schardt.

Introduction

Can't you people do something about that noise? Is this a question you've heard before? Airboats can produce Sound Pressure Levels (SPLs) exceeding 120 dBA, which is roughly equivalent to the noise generated by a rock concert and approaches the human threshold of pain (Temple University, 2001). Sound pressures generated by airboats can quickly wear thin on the public's patience making it a difficult issue not only for airboat recreationists but also the companies and agencies that use them. Claims abound in magazines, the Internet, and in advertising pamphlets of "quiet" propellers and airboats. There is a prevailing public belief that muffling devices can reduce airboat noise to acceptable levels. But, how much do we really know about airboat noise and its sources? Propellers and exhaust are not the only source of noise on an airboat. Noise can also come from the engine and boat vibration. How significant are these other sources to the total noise of an airboat? Can any or all of these noise sources be controlled or even reduced? Is it possible to make a "quiet" airboat?

Methods

An attempt to answer these fundamental questions was made between July 1999 and March 2000 with the assistance of the Southwest Florida Water Management District and the Citrus County Aquatic Services Division. The levels and sources of airboat noise in a variety of situations were measured and the effectiveness of various control methods was evaluated. Experimental data were also compared to and evaluated against the extensive amount of literature on aircraft propeller noise reduction experiments. The equipment used for these tests, including airboats, engine and propeller configurations are shown in Table I.

The characterization of propeller and engine noise was made using static, motion, and time history tests. "Static" tests were sound measurements taken from an airboat that remains in a stationary position. In this case, the boat remained on a trailer during sound measurements. Static measurements were helpful for isolating, evaluating and comparing different noise sources on the boat. "Motion" tests were sound measurements taken from a boat in normal movement on water. Motion tests were assumed to be more representative of actual operating conditions and were helpful in evaluating the relative usefulness of static noise measurements.

Static tests for the aircraft engine-equipped airboat were conducted at the Hernando County Airport near Brooksville, Florida and automobile engine-equipped airboats were measured at the Citrus County government building complex located in Lecanto, Florida. Care was taken to avoid aircraft, trucks and other noise interferences. Prior to all testing, loose contents of the boat were removed.

Motion tests were conducted in the middle of Silver Lake within the Withlacoochee State Forest in Hernando County Florida. Sprayer and pellet spreader SPL measurements were made during the motion tests.

Like a nasty flu virus can put you out of commission, invasive plants such as hydrilla, Eurasian watermilfoil and egeria can invade a waterbody and upset its natural balance, all but eliminating activities like fishing, swimming and boating.

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Table I
Equipment Used for Airboat Noise Tests

Equipment	Specifications
Automobile Engine	Chevrolet 350 General Motors Corporation Detroit, Michigan
Aircraft Engine	Lycoming 6-cylinder Model O-540-A Williamsport, Pennsylvania
Wood Prop	Sensinetch Model 72LXL Two-Blade "Paddle Prop" Plant City, Florida
Carbon Fiber Prop	Warp Drive Inc. 5-blade Model Ventura, Iowa
Muffler	Custom Made by Combee Airboats
Spray Pump	Hypro Model D-30 Pump S/N 9910/0014 New Brighton, Minnesota
Sprayer Motor	Briggs and Stratton 5hp motor Model 0036 S/N 931529907 Wauwatosa, Wisconsin
Pellet Spreader	Granblo No Model or Serial Number Listed Auburndale, Florida
Spreader Motor	Solo Type 412 Motor S/N 2297 Sindelfingen, Germany
Integrating and Logging Sound Level Meter	Quest Model 1900 S/N HW7050022 Oconomowoc, Wisconsin
Octave Band Filter	Quest Model QB-100 Oconomowoc, Wisconsin
Sound Level Meter Calibrator	Quest Model QC-20 S/N QF7050032 Oconomowoc, Wisconsin
Sound Level Meter Microphone	Quest Model QE4146 No serial number listed Oconomowoc, Wisconsin
Sound Level Meter Cable	Quest Model ICM 10 10-foot microphone cable No serial number listed Oconomowoc, Wisconsin
Dosimeter	Metrosonics Model db-3100 S/N 2072 Rochester, New York
Dosimeter Calibrator	Metrosonics Model cl-304 S/N 4093 Rochester, New York
Dosimeter Microphone	Metrosonics Model db-3100 Microphone No serial number listed Rochester, New York

The sprayer and pellet spreader motors were both warmed up until running at smooth idle. No herbicides were placed into the sprayer or pellet spreader during sound measurements due to environmental concerns. The airboat engine was turned off to isolate the sprayer and pellet spreader noise. The airboat was started and respectively operated at 500 and 1000 RPM to respectively measure combined SPLs.

Sound Pressure Levels were measured using a Quest Model 1900 sound level meter attached to a Model QB-100 octave band filter programmed to measure the "A" weight sound pressure scale using a 3 dB exchange rate and slow response. The meter was attached to a 10-foot microphone cable that was extended from the meter to the pilot and routed up through the personal flotation device until the microphone extended approximately one inch above the left shoulder into the pilot's hearing zone. The microphone was oriented in the vertical position. The SPL of ten octave band center frequencies from 31.5 Hz to 16 kHz were then measured while the boat was operated at various propeller speeds. Time history tests were made using a Metrosonic Model db-3100 logging dosimeter with an omnidirectional microphone. Both microphones were covered with foam windsocks to prevent wind interference. Prior to use, the dosimeter was programmed to record with the "A" weight scale, slow response, a 3dB exchange rate and an 80 dBA cutoff.

Time history tests were useful for evaluating airboat operator noise exposures, characterizing typical noise levels by activity type and comparing "real life" noise levels to experimental measurements. In a typical day, aquatic herbicide applicator crew's activities could be categorized into primary activities. These primary activities included "rest", "application" and "open plane." "Rest" consisted of activities such as administrative time at the office, driving to the site and breaks. "Application" activities occurred when the boat was maintained at constant RPM for herbicide application. When operated at or near maximum RPM, the boat was considered to be in the "open plane." The pilot was interviewed about the day's significant events, including type of treatment, airboat operation, location and approximate times for beginning and ending each significant activity. They were also asked about any specific activities or events that may have been abnormal such as unusual vibration, equipment abnormalities, dosimeter problems and potential interference such as other airboats.

Mufflers were tested only during static tests because temporary mountings were used. To the public, a "muffler" is usually thought to be a cylindrical device that is commonly used on automobiles. However, any device that suppresses exhaust gas noise can be considered as a muffling device. On an airboat, a "muffler" could include flex pipe in addition to the cylindrical chamber device attached to the flex pipe. These devices were tested by comparing SPL measurements from a Lycoming powered airboat with nothing attached to the exhaust manifold; with flex pipe installed and finally flex pipe with a muffler installed.

Results

Figure 1 shows the results of the propeller comparisons. The data indicate a trend of 2 dB increase for every 100 RPM increase in propeller speed. A direct static comparison between different propellers operated at the same RPM would not be valid because propeller designs differ in their thrust capabilities. Manufacturer thrust data for the carbon fiber propeller was not available for review. It could be assumed that a specific airboat requires a certain amount of thrust to achieve tasks like crossing a logjam or achieving a cruising speed. Using this assumption, time history measurements could be a valid method of comparing the two propeller types. The time history comparisons indicated that the wood and carbon fiber propellers tested had similar sound pressure levels for application and open plane activities.

The ratio of engine to propeller noise could not be quantified without a real time analyzer because the boats could not be run without a propeller installed. However, running an aircraft and automobile powered airboat with the same propeller could differentiate aircraft and automobile engine noise. Because automobile engines operate at high RPM's, reduction systems are used to reduce propeller rotation to acceptable speeds whereas aircraft engines use a direct drive system. Measurements for the automobile engine-equipped airboat were mathematically adjusted to accurately compare SPL at specific propeller RPM rather than engine RPM. The SPL for automobile/aircraft engine-equipped airboats at a specific propeller RPM was shown in Figure 2. After adjustment, the airboat equipped with a Chevy engine and belt reduction had a mean SPL difference that was 12 dB (± 1 dB) greater than the Lycoming (aircraft) engine-equipped airboat. Comparing total noise between gear and belt reduction drive systems, the gear reduction system produced an SPL that was 6 dB (±1 dB) less than a belt driven system.

The results for the no flex pipe, flex pipe and flex pipe-muffling configurations were shown in Figure 3. The highest sound levels occurred

Figure 1
Comparison of Total SPL for Carbon Fiber and Wood Prop
Static and Motion Tests

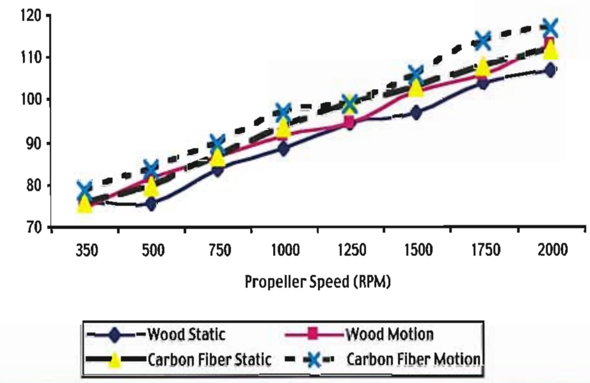


Figure 2
Total SPL for the Chevrolet and Lycoming Powered Airboat
with Wood Prop by Prop Speed

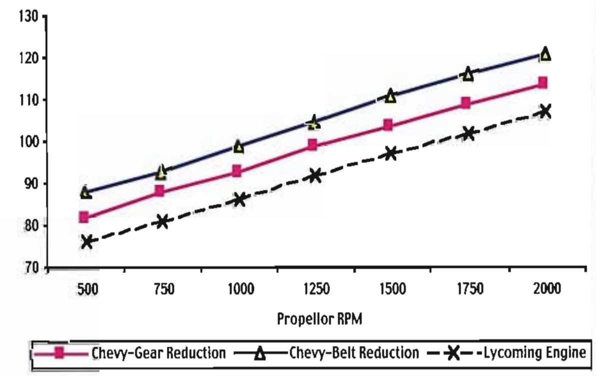
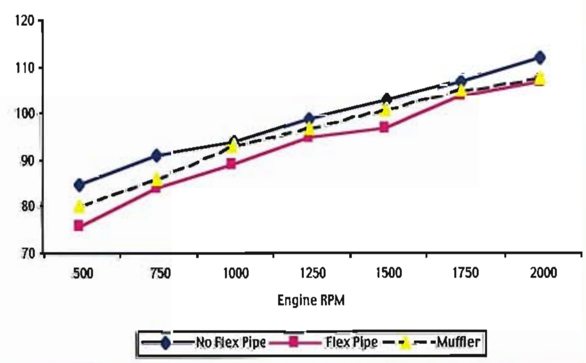
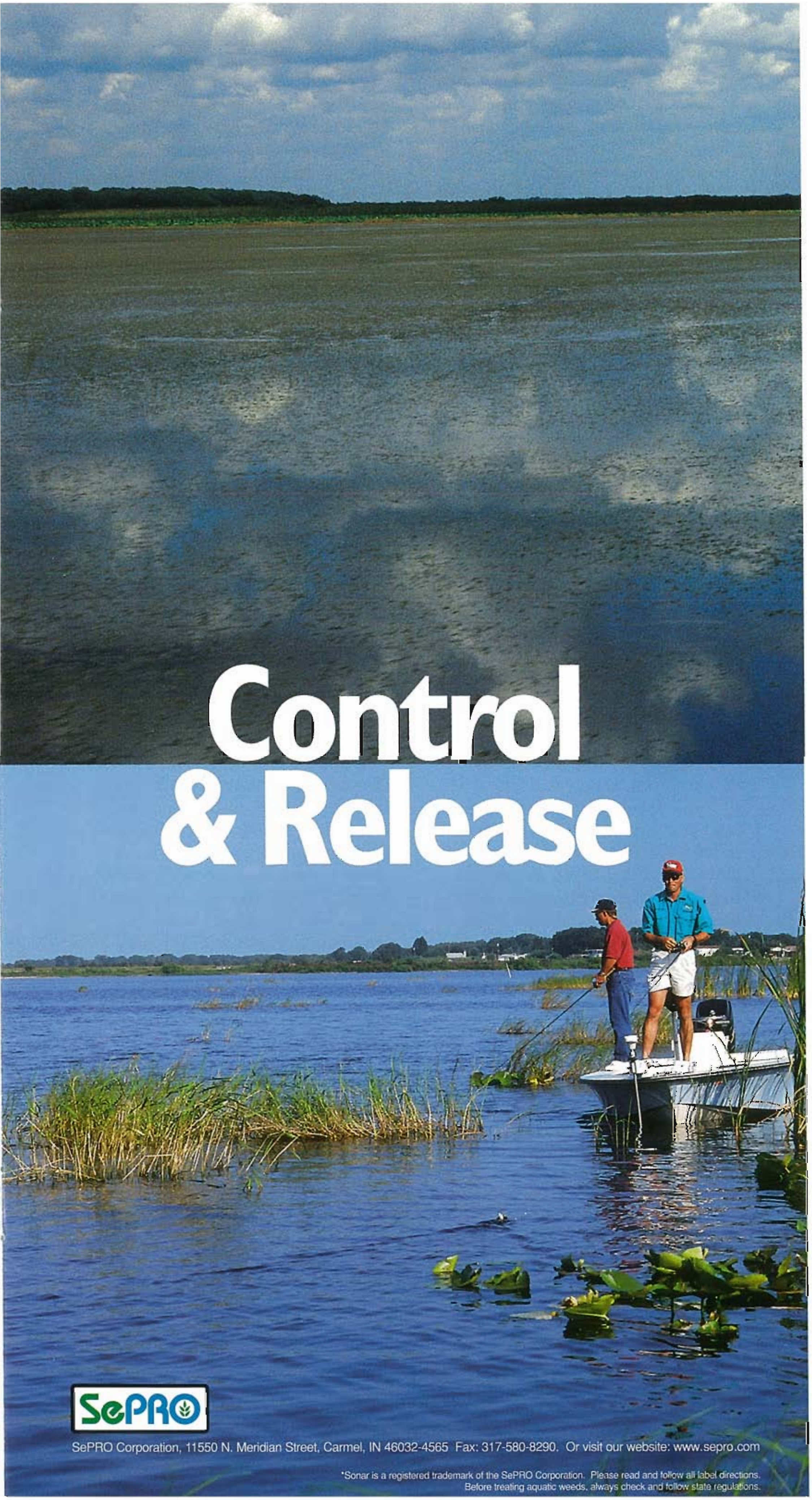


Figure 3
Total SPL for No Flex Pipe, Flex Pipe and Muffler for Lycoming
Powered Airboat with Wood Prop by Engine RPM





Every bass angler worth his salt recognizes and appreciates the value of structure. Aquatic vegetation plays an important role in providing structure for fish and wildlife. But exotic invasive plants like hydrilla and Eurasian watermilfoil crowd out the more beneficial native plants, thus disrupting a diverse habitat. This mixture or balance of plants and structure can improve both the number and quality of fish.

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when the flex pipe was removed. Use of a flex pipe resulted in a median noise level reduction of 6 dB (+-2 dB). The muffler attachment did not result in additional noise reductions.

The total SPL for the isolated pellet spreader and sprayer respectively were 91 dBA and 86 dBA. The sprayer and pellet spreader were not significant total sound contributors when compared to the airboat SPL when it is operated at typical application conditions.

A typical time history for a wood propeller-equipped boat during different kinds of use is shown in Figure 4. The "Lav" is a one minute average of noise exposure. The line represents a plot of these one minute averages over the course of a work day. During rest activities, the Lav ranged between 40 to 80 dBA. During spraying application activities, the SPL generally varied between 85 to 95 dBA. The pellet spreader test indicated application noise ranging between 95-100 dBA. Open plane activities resulted in noise exposures ranging from 110-125 dBA. Time weighted noise measurements over an entire workshift ranged from 94 to 106 dBA. Measurements for wood and carbon-fiber propellers did not reveal a significant difference between propeller types. The general trend indicated that the time weighted noise average increased with longer "open plane" activities.

Discussion

While airboat noise has not been extensively researched, propeller aircraft have been exhaustively studied. Aircraft research indicates decreasing blade thickness, increasing blade count, and increasing blade diameter would decrease propeller noise (Magliozzi et. al 1991). Data from aircraft research also indicate that engine contributions could negate propeller reduction benefits and therefore the two sources must be considered in unison for significant noise reduction to occur (Jones 1986). For aircraft operating at higher RPMs, muffling devices were proven to be of minimal benefit (Jones 1986). Similar results were found with the airboats.

Using only total, A-weighted SPL measurements, it would appear that there is no advantage to using two blade wood or five bladed carbon-fiber propellers. However, examination of the unweighted SPLs revealed the carbon fiber propeller had most of its sound energy concentrated in the 500-2000 Hz octave bands whereas the wood propeller has most of its energy concentrated at and below the 500 Hz octave band. This difference is significant because noise sources that have energy distributed above 500 Hz have a greater potential for causing hearing loss than sources with distributions below 500 Hz (Berger et. al 1986). By shifting sound energy to frequencies that are less sensitive to the human ear, use of two bladed propellers may offer a hearing conservation and annoyance advantage even though the total noise of the two propeller types is similar.

The relative contribution of aircraft engine noise, such as the Lycoming used in the subject airboat, has largely been discounted in the aircraft research literature (Magliozzi et. al 1991). The primary reasons for this discounting include the noise reduction benefits offered by engine shielding and the use of mufflers. However, airboats differ from aircraft because the engine is not shielded from the environment. Real time analysis conducted on aircraft using similar 6-cylinder Lycoming engines suggested engine noise becomes a significant contributor to total noise when the RPM of the propeller is decreased. Based on this relationship, propeller-engine combinations that allow maximum propeller thrust for minimal engine RPM could be the most effective way to reduce noise levels (Jones 1986). Applying this theory to airboats, the automobile engine had to operate at a much higher RPM to generate the same thrust as the boat equipped with an aircraft engine. Higher RPM operation resulted in greater engine noise. This factor most likely explains why total noise was lower in the aircraft engine-equipped airboat than the automobile engine-equipped one. More importantly, this relationship suggests that the most effective way to reduce airboat noise was to develop maximum thrust at minimal engine-propeller RPM.

Based on the plethora of research on the noise reduction benefits of various muffling devices, the flex pipe and dissipative muffler would be expected to offer noise reduction benefits. The flex pipe offered a minor amount of noise reduction. The dissipative muffler, however, did not offer any additional benefit. This lack of benefit was probably due to propeller and engine noise overwhelming any remaining (after flex pipe reduction) exhaust noise and the fact that engine and propeller noise cannot be affected by exhaust muffling devices. This conclusion was supported by the prevailing research on aircraft, but its application to airboats needs to be proven through real-time analysis.

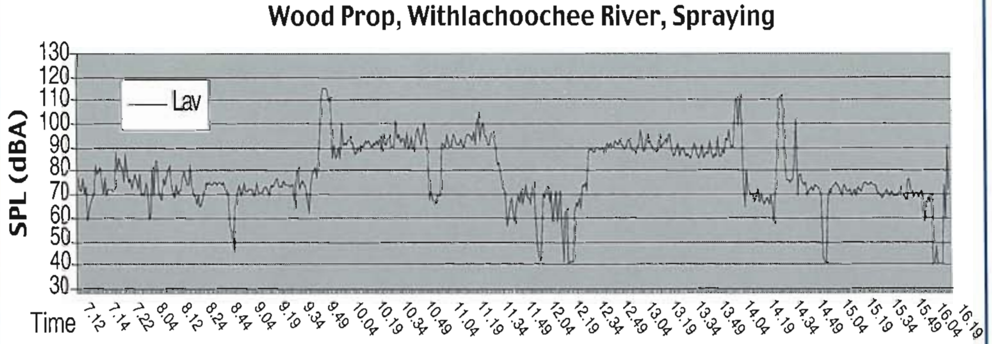

Figure 4 **12-15-99 Time History**
Wood Prop, Withlachoochee River, Spraying

Hearing Protection

Hearing Protection Devices (HPD) can be anything that is worn to reduce the amount of sound energy entering the inner ear. The selection of hearing protection should be based on its comfort, ability to tolerate long term use, and should be chosen based on their spectral attenuation characteristics (NIOSH 1996). The data from this research indicate that when used individually, the most common brands of earmuffs and plugs may not reduce noise dose (dose is the actual amount of noise energy entering the ear) to acceptable levels. However, use of earmuffs and earplugs in combination would in all but the most extreme operating situations reduce noise doses below the relevant governmental standards. The time spectral analysis tell us that the crews experience significant noise exposures during their workday and that most of this exposure occurs during "open-plane" use. Because it is not practical to take HPD's on and off as noise levels change, employees should be encouraged to wear earmuffs and earplugs in combination whenever an airboat is in operation. Employees who routinely use airboats should be actively involved in a hearing conservation program. This program should include annual audiometric examinations, education about hearing loss and prevention and instructing them in the proper use of HPDs. Management should examine the results of annual audiometric testing to both document the presence, if any, of noise induced hearing loss and evaluate the effectiveness of their hearing conservation program.

Silent Airboats?

While the possibility of a silent airboat is unlikely, the quest for a "quiet" airboat is not a lost cause. There are very real engineering steps that could be taken to significantly lessen the noise impacts of airboats. Use of a certain propeller or muffling device is not enough to effectively control noise. Airboat noise is a problem that can only be tackled by dealing with all the noise generating components (e.g., engine, propeller, exhaust and vibration). At the time this research was conducted, the airboat manufacturers were actively developing technological advances that employ many of the methods discussed in this research to reduce noise impacts. The aircraft industry is currently experimenting with the use of noise cancellation devices to reduce noise levels and this technology may hold promise for the airboating community. These technological advances combined with a better understanding of airboat noise offer hope that "you people can do something about that noise" and we may one day have a more "socially" and "environmentally" acceptable airboat.

References available upon request

Permit requirements

Continued from page 3

permits may be in the cards for all aquatic herbicides. Maybe, but hopefully not. A closer look at the Oregon case bears out some extenuating circumstances.

For one, Magnacide H is a "restricted use" product. That is, it is much more toxic to fish and other aquatic life, which places it in a different category of herbicides than all the other aquatic products that we use. Hopefully, any federal permit requirements would be limited to restricted use products. Second, Magnacide H is only labeled for use in canals and ditches. It is not labeled for use in lakes, streams, and ponds, and should not be applied to drainage areas where runoff or flooding will contaminate other bodies of water. In fact, the label clearly states "Do not release treated water (from the canal) for 6 days after application into any fish bearing waters or where it will drain into them." In the case in Oregon, the treated canals discharged water into fish bearing streams during the 6-day holding period and on two occasions the discharged treated water caused fish kills. It seems that the applicant in this case was in clear violation of the label and enforcement of the current label would have been sufficient to protect water quality conditions. Third, the herbicide was applied to the canals by a single hose from a truck, which can be clearly defined as a point source discharge. Diffuse areal application of an herbicide to a water body may not be so clearly defined as a point source discharge.

On the other hand, there are state-

NPDES Permit Program

Facilities which discharge pollutants from point sources (such as discharge pipes) into waters of the United States are required to obtain National Pollutant Discharge Elimination System (NPDES) permits. The NPDES program falls under Section 402 of the Clean Water Act. Typically, wastewater discharges regulated under the NPDES program include industrial wastewater, storm water, and treated effluent from municipal sewage treatment plants, but the recent ruling may expand the definition of "point source" and "pollutant".

ments by the EPA and several interpretations by both the Federal District and Circuit Courts that lean toward the possibility of requiring NPDES permitting for aquatic herbicide applications in public waters. For one, although the EPA administers both FIFRA and the Clean Water Act, it stated in an amicus brief that "EPA approves pesticides under FIFRA with the knowledge that pesticides containing pollutants may be discharged from point sources into the navigable waters only pursuant to a properly issued CWA (NPDES) permit." Also, in 1995, the EPA issued a public notice that a label's failure to include the possible need for a NPDES permit does not relieve a producer or user of such products from the requirements of the Clean Water Act. These statements seem to indicate that if a product violates conditions of the Clean Water Act it should require a permit.

To establish a violation of the Clean Water Act one must show that there is a **discharge** of a **pollutant** to **navigable waters** from a **point source.** The courts definitions of the underlined words in the previous sentence are critical. The courts have found that the direct application of an herbicide into water qualifies as a "discharge" and although the definition of a "point source" is not clear from the ruling issued by the Circuit Court, it seems reasonable that a discharge from application equipment could easily be interpreted as a "point source" as opposed to diffuse runoff which is "nonpoint source." Both the District and Circuit Courts define a pollutant as any "toxic chemical" and even though all other aquatic herbicides are not "restricted use" products like acrolein, they will likely be defined as toxic since they are designed to kill plants. It seems to be the opinion of the Circuit Court that the definition of "navigable waters" includes all surface waters that receive water from or are tributary to navigable waters of the United States. This includes the canals in Oregon and most other public waterways.

The final interpretation and implementation of this ruling either by higher courts or EPA will likely be a defining moment in the profession of aquatic plant management. When this will be worked out, is unclear. But what is clear is that we are on the brink of what could be a significant change in the way we do business in the Carolinas and across the U.S.

FIFRA Licensing

The Federal Insecticide, Fungicide, Rodenticide, Act (FIFRA) provides the overall framework for the federal pesticide program. Under FIFRA, EPA is responsible for registering, or licensing pesticide products for use in the United States. Pesticide registration decisions are based on a detailed assessment of the potential effects of a product on human health and the environment, when used according to label directions. These approved labels have the force of law, and any use which is not in accordance with the label directions and precautions may be subject to civil and/or criminal penalties. FIFRA also requires that EPA reevaluate older pesticides to ensure that they meet more recent safety standards. FIFRA requires EPA and states to establish programs to protect workers, and provide training and certification for applicators as well.

More scenes from drought stricken Florida

Alligator Lake, photo by Joe Hinkle.

Newnans Lake, photo by Joe Hinkle.

Orange Lake, photo by Joe Hinkle.

Lake Magnolia, photo by Terry Sullivan.

Aquatics Magazine Subject Index 1989-2000

by
W.T. Haller and R. Goodwin
University of Florida

Aquatics has been published four times a year in March, June, September and December since the first issue in March 1979. The subject index for Volumes 1-10 (1979-1988) was published in the March 1989 issue. The code following the subject refers to the month and year of publication, i.e. S-90 means the article appeared in the September 1990 issue. The dateline on Aquatics changed with Volume 15, No. 4 to Winter 1993. Since that issue, datelines have been Spring (Sp), Summer (Su), Fall (F) and Winter (W) rather than specific months of March (M), June (J), September (S) and December (D). The abbreviations noted in ( ) above indicate the issue (month) or (season).

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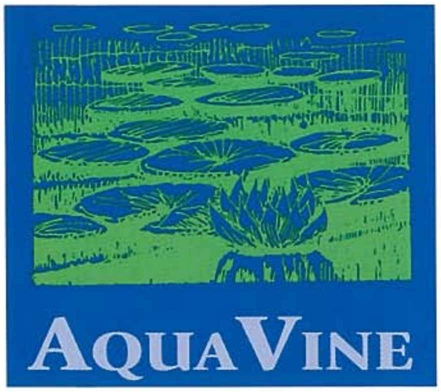
DEP Biologist Joe Hinkle contemplates one of the many newly discovered ancient dugout canoes along the dry shoreline of Newnans Lake, Florida. Photo by Jim Kelley.



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Sep 18th 8-10am, 2 Aquatic CEU's, 10-12noon, 2 Core CEU's, 1-3pm 2 ROW CEU's
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For more information visit USGS Nonindigenous Aquatic Species home page http://nas.er.usgs.gov, Aquatic Plant Management Society at www.apms.org. or http://www.aquatic-invasive- species-conference.org/abstracts.htm

FAPMS 25th Annual Meeting,
October 16-18, 2001, Daytona Beach, David Farr 904-424-2920

North American Lake Management Society 21st International Symposium "2001-A Lake Odyssey"
November 7-9, 2001, Madison Wisconsin. Call for papers deadline May 18, 2001. Contact Richard Lathrop, 608-261-7593 or visit www.nalms.org.

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Lake Louisa, Lake County, Florida. Maybe it's time to trade in that airboat for an ATV. Photo by Robbie Lovestrand.

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Reward® for Fast, Highly-Active Weed Control.

With Reward non-selective herbicide, you never have to wait for aquatic weed control.

- Fast acting
- Excellent Hydrilla control with less than 8 hours exposure to Reward
- Reward is not persistent in water—readily deactivated by adsorption to sediment—level of Reward drops by 73% in 24 hours and more than 97% after 4 days
- Highly active, non-selective
- Broadest-spectrum aquatic herbicide available
- Easy on the environment
- Ideal for integrated plant management
- Low use rates
- Convenient packaging

To learn more about Reward call 1-800-395-8873 for your local Syngenta Sales Representative.

www.syngenta-us.com

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Important: Always read and follow label instructions before purchasing or using this product.