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Predation by Lesser Scaup on Baitfish at Commercial Farms During Winter of 2014

Luke A. Roy, Extension Aquaculture Specialist, UAPB; Micheal Kearby, Biological Science Technician, USDA APHIS Wildlife Services; Anita M. Kelly, Extension Fish Health Specialist, UAPB; and Michael Hoy, District Supervisor, USDA APHIS Wildlife Services

In recent years, commercial baitfish and sportfish producers in Arkansas have been reporting larger numbers of lesser scaup (*Aythya affinis*) on their farms. Since most baitfish and sportfish farms in Arkansas are located along the Mississippi Flyway, there are typically large numbers of migratory waterfowl present on baitfish and sportfish farms during the winter months every year. Diving ducks, particularly lesser scaup, have been routinely observed by farmers feeding in large numbers on ponds stocked with fathead minnows, golden shiners, and sportfish such as bluegill, redear sunfish and crappie.

Farmers have stated that January, February, and March are typically the months in which lesser scaup are most problematic. Fish losses sustained by migratory birds represent significant annual losses in production and income for Arkansas fish farmers. At many farms, large numbers of small fish (<3 inch) have been found in lesser scaup after being harvested by duck hunters. In addition to fish directly consumed by lesser scaup, many farmers have reported large numbers of "scarred" fish during spring harvests and suspect that large numbers of fish die as a result of injuries sustained while escaping predation. During hunting season, many fish farmers in Arkansas will lease a portion of their ponds to duck hunters which helps keep the scaup in check during hunting season. After hunting season is over, and prior to the migration back north, controlling lesser scaup predation on commercial fish farms becomes much more difficult.

To further examine this issue, a scientific collection permit was obtained from the Arkansas Game & Fish Commission and the U.S. Fish & Wildlife Service to collect lesser scaup on baitfish farms in February and March of 2014. A total of 120 lesser scaup were collected during the study. Lesser scaup were collected with shotguns at various commercial baitfish fish farms, primarily in Lonoke and Prairie counties. Prior to collection, ducks were allowed to forage 10-15 minutes. A syringe without a needle was used to inject 50 mL of 92% ethanol down the esophagus of the duck to preserve any fish in the crop. Ducks were then transported on ice to the Lonoke Fish Disease Diagnostic Laboratory in Lonoke, Arkansas and frozen until processing.

Scaup were thawed on ice and dissected (Fig. 1). The esophagus and crop of each duck were examined for the presence of whole fish or partially digested fish (Fig. 2). Fish retrieved from the esophagus and crop were identified,

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Figure 1. Lesser scaup dissection. The arrow indicates fish coming out of the crop just below the neck.

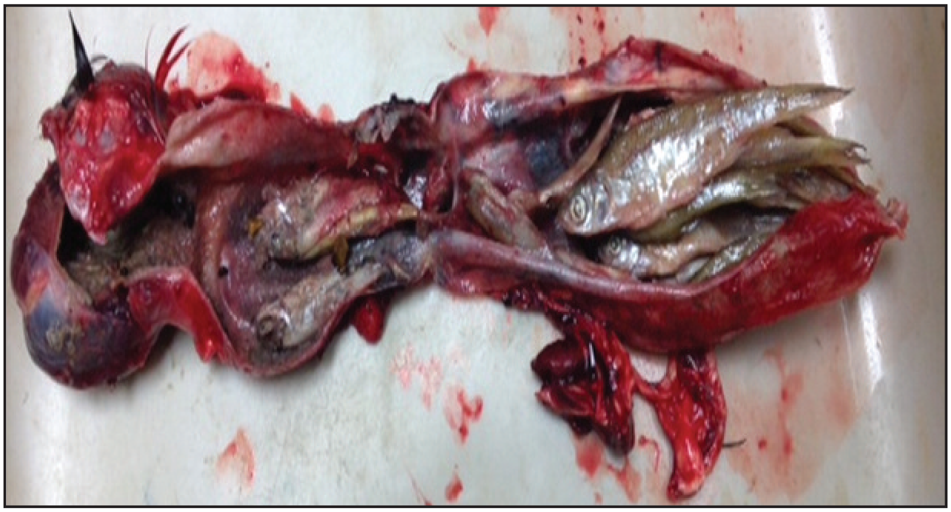

Figure 2. The crop and gizzard of a lesser scaup that had recently consumed golden shiners.

Figure 3. Fathead minnows consumed by lesser scaup.

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enumerated, and weighed (Fig. 3). Following processing, fish were preserved in a formalin solution. Whole fish were observed in 10.8% of the lesser scaup collected during the study. When whole fish were present, an average combined fish weight of 10.4 g (0.38 – 26.7 g range) was recovered. The number of whole fish retrieved from scaup ranged from 1 to 19 (average of 10 fish). The maximum number of fish found in an individual lesser scaup was 19 golden shiners. On a separate occasion 18 fathead minnows were recovered from another duck. One seperate occasion, 18 fathead minnows were recovered from one duck. The contents of duck gizzards were dried in glass petri dishes in an oven at approximately 200 °F for 48 hours. The dried contents were then transferred to plastic petri dishes for evaluation using a dissecting microscope. Fish parts (bones, scales, otoliths) were identified in 41% of the lesser scaup examined. Crawfish (7.7%), polychaetes (42.7%), snails (60.7%), and various other food items were also found in lesser scaup but their number and weight were not quantified.

More in depth studies are needed to further examine the issue of scaup predation on commercial fish farms in Arkansas. Currently, baitfish and sportfish farmers are able to add twenty-five lesser scaup to their existing depredation permits. For further information on adding lesser scaup to an existing depredation permit, please contact USDA APHIS Wildlife Services. In the winter of 2015, 100 lesser scaup were collected on sportfish farms in Arkansas. Analyses for this second study are currently ongoing and will be shared at a future date.

Upcoming Events

Catfish Farmers of Arkansas
January 14-15, 2016
Embassy Hotel & Suites
Hot Springs, Arkansas

Midcontinent Warm Water Fish Culture Workshop
February 1-3, 2016
Eugene T. Mahoney State Park
Ashland, Nebraska
For further Information contact:
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Arkansas Bait & Ornamental Fish Growers Association
February 11, 2016
Lonoke Agricultural Center
Lonoke, Arkansas

Aquaculture 2016
February 22-26, 2016
Paris Hotel and Convention Center
Las Vegas, Nevada
For further Information:
www.was.org

Smith Joins Aqua/Fish Staff

Matthew Smith joined the staff at the University of Arkansas at Pine Bluff (UAPB) Lonoke Fish Disease Laboratory as an Extension associate in fish health. In this position, Smith provides diagnostic and water quality support to commercial producers, and carries out applied research in the laboratory and field experiments on commercial farms.

Smith recently completed a Master of Science in Aquaculture and Fisheries from UAPB. His thesis work focused on a comparison of winter production of golden shiners in split-pond systems and traditional ponds. While at UAPB, Smith served as the student chapter president of the American Fisheries Society. He has a bachelor's degree in fisheries from Auburn University where he worked as a technician on natural fisheries projects involving largemouth bass, bluegill and shad. Since his arrival, Smith has been instrumental in helping set up the new fish inspection laboratory in Lonoke.

Dr. Rebecca Lochmann Named Interim Director of Aquaculture/Fisheries Center at UAPB

Dr. Rebecca Lochmann has been named interim director and interim chair for the University of Arkansas at Pine Bluff Aquaculture/Fisheries Center of Excellence. In this position, she will administer overall activities related to the Center in the areas of instruction, research and Extension.

Dr. Lochmann will be responsible for planning research, education and Extension programs relevant to the aquaculture and natural resource industries and to the state of Arkansas. As principle liaison for the aquaculture/fisheries center, she will work with local producers and industry councils. Additionally, she will supervise the ponds and equipment at the university research station, as well as the university's four fish diagnostic labs, with locations at UAPB, Lonoke, Lake Village and Newport.

Prior to this position, Dr. Lochmann served as professor of aquaculture/fisheries at UAPB since 1996. Her research focus is fish nutrition with an emphasis on small cyprinids (baitfish), channel catfish and largemouth bass. Her most recent research focuses on alternative protein and lipid sources in fish diets and improving the product quality of foodfish for consumers.

During her tenure at UAPB, Dr. Lochmann has procured dozens of research grants for the university and local industry. She also does international research, and recently obtained a $100,000 grant from the U.S. Agency for International Development to enhance the nutritional value of tilapia for human health.

Dr. Lochmann formerly served as associate editor for the North American Journal of Aquaculture. She has published more than 55 refereed journal articles, 13 book chapters and 14 Extension publications.

In May, Dr. Lochmann was inducted as president of the World Aquaculture Society (WAS) during the organization's annual business meeting, which was held in Jeju, South Korea. The society is a global, professional organization with approximately 2,500 aquaculture professionals from more than 100 countries, which seeks to contribute to the progressive and sustainable development of aquaculture in the world.

As president of the WAS, Dr. Lochmann will lead a 15-member board of directors until her presidency expires in 2016. She previously served two terms as secretary of the society. Additionally, she has served in other

professional organizations including the Central Arkansas chapter of Sigma Xi, and has been a member of the Catfish Farmers of Arkansas, the Arkansas Bait and Ornamental Fish Grower's Association and the Phi Kappa Phi Honor Society.

She earned a doctorate degree in wildlife and fisheries science from Texas A&M University, a master's degree in marine biology from the Florida Institute of Technology and a bachelor's degree in zoology from Louisiana State University.

Herbicides and Control of Filamentous Algae

Bauer Duke, Extension Aquaculture Specialist, UAPB

The UAPB Aquaculture/Fisheries Center held an Aquatic Weed and Irrigation Ditch Management In-service Training at the Aquaculture Research Station on May 21, 2015. A demonstration was arranged to show the effectiveness of flumioxazin, diquat, and sodium carbonate peroxyhydrate by themselves and in combinations with copper sulfate in treating filamentous algae.

Flumioxazin (Clipper) should perform well in this situation, but pH in the pond must be correct for it to work. The Aquaculture Research Station ponds have alkalinity levels near 200 ppm and this supports a 7.8 pH or greater, day and night. Since flumioxazin only performs between pH 5 and 7, it was not tested in this demonstration. But a good lesson is learned – do not buy or use a herbicide that will not work in your situation. For pH sensitive chemicals it is a good idea to check pH at different times of the day and if there is little change, check other aspects of water quality such as alkalinity.

With this information a demonstration was set up to compare diquat (Reward), diquat + copper sulfate, sodium carbonate peroxyhydrate (Green Clean), copper sulfate, and two controls with no herbicide (Table 1).

None of these appeared to control the filamentous algae in their limnocorrals. The dosages used were recommended on the labels of the chemicals for filamentous algae. Once again, however, alkalinity caused problems with this demonstration. Alkalinity and turbidity can interfere with copper performance.

The demonstration was arranged a second time. This time the formula for treating ponds with copper sulfate

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Table 1. Herbicide or herbicide combinations and dosage used in two separate trials for control of aquatic weeds.

Chemical(s)	Concentration Used in First Demonstration	Concentration Used in Second Demonstration
Copper	0.5 ppm	1 ppm
Copper	0.5 ppm	2 ppm
Copper	0.5 ppm	4 ppm
Diquat	2 gal/acre	2 gal/acre
Diquat + Copper	2 gal/acre + 0.5 ppm	2 gal/acre + 2ppm
Green Clean	4lbs/1000ft^2	6 lbs/1000ft^2
Control	0 ppm	0 ppm

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found in Extension MP435, *Aquaculture Producer's Quick Reference Handbook*, was used. This increases the dose of copper sulfate with respect to alkalinity. The recommendation at 200 ppm alkalinity is to use 2 ppm of copper sulfate rather than 0.5 ppm, although the copper sulfate label suggests 0.5 ppm for treating Pithophora. We still applied diquat at 2 gal/acre (approximately 3.7 ppm), and raised the Green Clean level to 6lbs/1000ft2 (highest allowed by the label), see Table 1. Photo results are found in Figure 1.

Before the second round of testing, the pond became infected with duckweed as well as Pithophora. This gave us an opportunity to look at these herbicides on both weeds. Copper performed better than diquat on Pithophora, but diquat performed better on duckweed. In no case were these weeds eliminated, but there was control when diquat and copper were mixed. Sodium carbonate peroxyhydrate gave no control, nor did copper sulfate 0.5 ppm, as in round one. The limnocorrals were checked in June and none was clear of the duckweed or Pithophora. So while there was control, there was no eradication. We included a copper treatment at 4 ppm because that is the highest dose allowed by the label. Copper at 2 ppm was not quite as good as at 4 ppm, but there was no risk to fish at the lower dose. Table 2 shows the approximate cost to buy these chemicals.

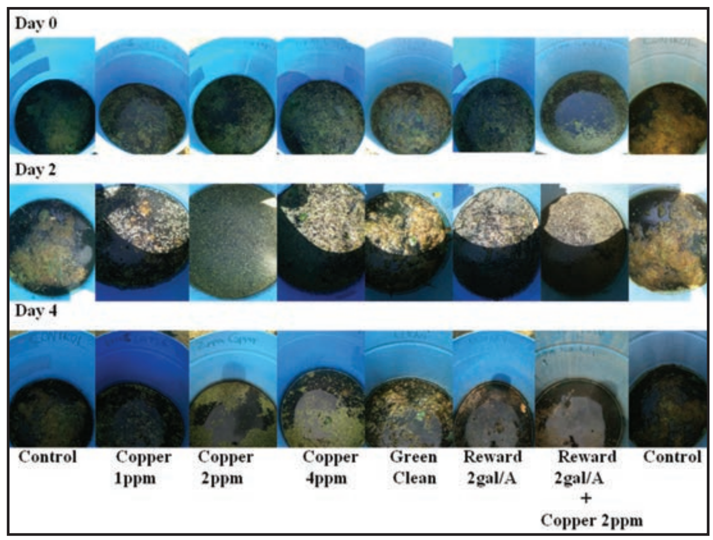

Figure 1. Changes in filamentous algae and duckweed over four days.

Here are things to remember when applying herbicides:

1. Check water quality before choosing a herbicide.
2. Read the herbicide label before buying it.
3. Alkalinity and pH can make or break herbicide application.
4. Use the formula in MP435 to calculate copper usage for maximum effect while avoiding killing fish.
5. Copper is negatively impacted by high levels of organic material, turbidity or alkalinity.
6. Sometimes cheaper is better.

Table 2. Approximate costs for chemicals used in this demonstration.

Copper sulfate	Diquat	Diquat + Copper	Flumioxazin	Green Clean
$23/acre	$174/acre	$197/acre	$93/acre	$941/acre

Adjuvants – What Do They Do?

George Selden, Extension Aquaculture Specialist

The herbicide label should always be read prior to use. Among the typical label instructions, there is often the recommendation to include some type of adjuvant to a tank mix prior to application. But, what exactly are adjuvants and what do they do? For the herbicide active ingredient to be effective it must enter the plant and avoid beading up and rolling off. The chemical must then get past leaf hairs and waxy cuticles, and finally penetrate through cell walls and cell membranes. Adjuvants facilitate this process.

Some adjuvants can improve herbicide coverage and contact by altering the herbicide formulation. Others increase the formulations ability to penetrate through cuticular wax, cell walls and/or stomatal openings. An adjuvant can sometimes enhance the ability to kill selected species without harming non-target plants and may also improve herbicide efficiency, allowing less chemical to be used. In aquatic situations, "sinker" adjuvants help carry the active ingredient down into the water column to target plants at the bottom. Simply defined, an adjuvant is "any compound that can be added to herbicide formulations to facilitate the mixing, application, or effectiveness of that herbicide."

There is currently no standard system to classify adjuvant types used by manufacturers. One way used to classify them is by their function; they are either activator adjuvants or utility adjuvants. Activator adjuvants work to enhance the activity of the herbicide. This often occurs by increasing the rate of absorption into the target plant. Utility adjuvants, sometimes called spray modifiers, work by altering the physical or chemical characteristics of the spray mixture to improve the ease of application, its ability to remain on the plant surface or its persistence in the environment. By themselves, utility activators do not directly enhance herbicidal activity. Table 1 contains a more detailed listing by function.

Activator adjuvants include surfactants, the most widely used adjuvants. These compounds reduce surface tension in the spray droplet, which ensures that the formulation spreads out and covers the plant with a thin film rather than beading up, thus facilitating absorption. Surfactants can also influence absorption by altering the viscosity and crystalline structure of waxes of leaf and stem surfaces, facilitating penetration.

The most commonly used surfactants are nonionic surfactants. These have no ionic charge and are hydrophilic (water-loving). They are also generally biodegradable and compatible with many fertilizer solutions. Fertilizers are sometimes added to increase the efficacy of post-emergent herbicides. The reason is unknown, but may have something to do with increased absorption. Oil adjuvants can increase the penetration of the oil-soluble herbicides into plants and are commonly used when conditions are hot and dry, and/or when leaf cuticles are thick.

Some commercial herbicide formulations come with an adjuvant included (such as Round-Up). Most companies leave the addition of an adjuvant to the end user in order to allow for the tailoring of the herbicide application for its intended use. The addition of adjuvants allows customization of the herbicide tank mix for each particular situation. However, adjuvants can have antagonistic effects, decreasing the killing power of the herbicide. There are circumstances where adding an adjuvant will not help. For example, if a broadleaf weed has thin cuticles and is growing in high humidity and shade, adding an activator adjuvant is unnecessary. There is no universal adjuvant that can improve the performance for all herbicides, against all weeds and under every environmental condition.

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Table 1

Activator Adjuvants	**Utility Adjuvants**
Surfactants	-Wetting agents
-Nonionic (including organosilicones)	-Dyes
-Ionic	-Drift control & foaming agents
-Amphoteric	-Thickening agents
Oil Adjuvants (including crop oil concentrates)	-Deposition agents (stickers)
-Petroleum oil concentrates	-Water Conditioners
-Vegetable oils	-Compatibility agents
Ammonium (nitrogen) fertilizers	-pH buffers
	-Humectants
	-Defoaming & antifoam agents
	-UV absorbents

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So, do they make a difference? In some instances, the answer is quite a bit. A demonstration was conducted this summer on a production pond in Poinsett County. Plots of Frog's Bit were treated with a 1% solution of Renovate (triclopyr). This active ingredient was chosen because of an excellent control rating for Frog's Bit. There were three treatments; Renovate alone, Renovate with 0.25% of a generic, non-ionic surfactant, and Renovate with TopFilm surfactant. Shoreline plants were also sprayed when they were in the test plots. The two most common shoreline species were indigo and barn-yard grass. As expected in all treatments, the Frog's Bit was killed by the herbicide treatment, including where no surfactant was added. The only difference between the treatments was that the indigo was killed when Renovate plus TopFilm was used (right side of picture), but not killed by the other two treatments (Figure 1).

Finally, adjuvants are chemically active compounds and can sometimes adversely affect non-target plants and animals, and have the potential to be water pollutants. Although adjuvant Material Safety Data Sheets (MSDS) are usually not as complete as those for registered herbicides, they should still be consulted prior to use. Labels and adjuvant product information can be found at http://www.herbicide-adjuvants.com.

Figure 1. Pond treated with Renovate plus TopFilm to kill indigo.

Fall is the Time to Lime

Scott Jones, Small Impoundments Extension Specialist, UAPB

Much of the soil in Arkansas, especially in southern Arkansas, is acidic. This can lead to poor crop production in agricultural fields and poor fish production in fish ponds. A relatively inexpensive solution to soil acidity is crushed agricultural limestone. Although it is far more convenient and effective to apply limestone to an empty pond, it can still be done in a full one. Limestone treatments are not necessary in every pond and if the owner is not interested in growing more or larger fish then there is little point in applying limestone even in acidic ponds. The first step is to determine whether the pond would benefit from limestone in the first place.

There are a couple of ways to evaluate soil acidity in ponds. The first and simplest way is to measure the alkalinity of the water in the pond. Alkalinity test kits can be purchased online and from aquaculture and pool supply stores. Pet shops that stock saltwater aquarium supplies would be another place to look. County Extension agents can also handle alkalinity testing. Alkalinity testing can identify the presence of acidic soils or acidic watersheds without actually testing the soil. Alkalinity is basically the concentration of bases (mostly in the form of carbonate and bicarbonate) that will react with and neutralize acids in the water. These bases are leeched into the water from the dissolution of limestone formations both above and below the ground. Ponds with water alkalinity below 20 mg/L (1 mg/L = 1 ppm) usually contain acidic soil or the watershed feeding the pond is acidic. The actual rate of limestone required to neutralize soil acidity cannot be calculated from this method alone. However, since limestone is relatively cheap (anywhere from $20 to $50 per ton delivered) it is common to recommend applying at least 2000 lbs of agricultural limestone per acre in ponds with water alkalinity below 20 mg/L. If the water alkalinity does not increase to over 20 mg/L after about a month, apply 2000 more lbs of agricultural limestone per acre until alkalinity increases over 20 mg/L.

The other evaluation method involves utilizing the University of Arkansas Cooperative Extension Service soil testing laboratory. The analysis is free, but you will have to collect the sample and deliver it to a county Extension office yourself. The goal is to get a representative sample of the entire pond bottom, not just what you can reach from the shore. The chemical characteristics of the deep areas of the pond can be substantially different from that of the shallow areas. A sampling tool can be built from a long sturdy pole with a vegetable can firmly attached open-

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end down to the end of the pole. Take the sampling tool and cross the pond in an "S" pattern collecting 10 can-full's of soil from all depths of the pond. Next, dump all the samples into one container and allow the soil to completely dry before delivering it to your county Extension office. Let the agent know that the sample is for a fish pond so that the lab will know what to test for. Two important characteristics that the lab will test are the soil pH and the estimated soil texture. These two pieces of information can be used to estimate the amount of limestone that will be required to neutralize soil acidity. Table 1 contains approximate liming rates based on soil texture and pH; the finer the soil, the higher the limestone requirement.

Different types of limestone products have different acid-neutralizing capabilities and characteristics. Suppliers will sometimes rate their products based on "effective neutralizing value", "calcium carbonate equivalent" or "total neutralizing power." These phrases mean basically the same thing, how much acidity this product will neutralize compared to the same weight of pure calcium carbonate (which is used as the standard and given a 100% neutralizing value). For the sake of safety and simplicity, it is best to stick with finely-crushed agricultural limestone with a neutralizing value as close to 100% as you can find. Hydrated and quick-acting lime products with neutralizing values way above 100% should be avoided in fish ponds because they can quickly increase pH levels during application and kill fish. Also, some pelletized lime products contain binding materials that have been known to turn water brown. Agricultural limestone is safe to apply directly to ponds with fish in them. In fact, it is so safe that applying more than necessary is not a problem. Ponds that require limestone treatments can usually go 3 to 4 years between applications unless the pond is within a highly acidic watershed or water turnover rates are abnormally high.

Limestone will bind with dissolved phosphorus (a vital plant nutrient) and temporarily trap it in the pond mud. This can knock back planktonic algae blooms and potentially lead to rooted aquatic weed problems if the water remains clear for too long in the growing season. Applying limestone in the fall when plant growth is mostly shutting down will reduce disruptions to the pond plant community and give the limestone time to react with soil acidity before the next growing season. Neutralizing soil acidity will usually increase the availability of nutrients in pond water resulting in increased planktonic algae growth and eventually increased fish production. Check with your county Extension office for agricultural limestone availability, pricing and delivery options and get a jump start on your pond management goals for next year!

Table 1. Lime requirements of pond soils based on pH and texture.

	Lime requirement (kg/ha as $CaCO_3$)		
Mud pH	Heavy loams or clays	Sandy loam	Sand
<4.0	14,320	7,160	4,475
4.0-4.5	10,740	5,370	4,475
4.6-5.0	8,950	4,475	3,580
5.1-5.5	5,370	3,580	1,790
5.6-6.0	3,580	1,790	895
6.1-6.5	1,790	1,790	0
>6.5	0	0	0

Boyd, C. E. and C. S. Tucker. "Pond Liming." *Handbook for Aquaculture Water Quality*. Auburn: Craftmaster Printers, Inc, 2014. 120. Print.

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Some Regulations on the Use of Small Unmanned Aircraft in Aquaculture

In the United States small unmanned aircraft or drones are being used for a variety of purposes in Aquaculture. Net pen producers use drones to inspect their facilities and observe fish behavior when nets are drawn in for harvesting. The use of drones in freshwater aquaculture operations should also provide similar insights. Cameras mounted on the drones can take pictures of ponds and the color of the blooms Figure 1. But before you buy a drone there are a few regulations that are important to know and understand. The FAA has policies for use of drones in the U.S. and you should obtain the document before you fly. You can download the document at https://www.faa.gov/uas/media/Sec_331_336_UAS.pdf

Briefly, the basic rules are:

- Keep the aircraft within visual sight at all times
- Fly below 500 feet
- Do not fly within 5 miles of an airport unless you contact and are given permission by the airport and control tower prior to flying

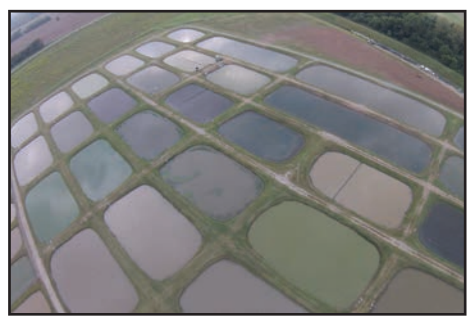

Figure 1. Drone picture of aquaculture ponds showing various bloom colors.

- Don't fly near people or stadiums

With these regulations in mind you can safely fly a drone over your land-based aquaculture facilities.

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