Kentucky State University

Aquatic Farming News

April 2022

KENTUCKY STATE UNIVERSITY

Land Grant Program

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Welcome to the Kentucky Aquactic Farming News!

The Aquatic Farming Newsletter has been a decades-long source of relevant information to aquaculture stakeholders throughout the state of Kentucky. After a brief hiatus, this quarterly newsletter is resuming publication. New editions will be released in February, April, July, and October. The newsletter will provide information on national and local topics, current research in the field, issues important to farmers, market information, networking and educational opportunities, and more!

If there is a topic you would like more information on, or an opportunity you would like to share, please contact Janelle Hager (janelle.hager@kysu.edu) or John Kelso (john.kelso@kysu.edu).

Upcoming Event

May's Third Thursday Thing workshop will be focused on aquaculture. Join us at the Harold R. Benson Research Farm on May 19, 2022, from 10 a.m. to 3 p.m. The full day of aquaculture adventure will include presentations, hands-on activities, demonstrations, and networking. Check the Kentucky State aquaculture Facebook page (@KSUaquaculture) for updates on the program. Lunch will be provided.

Contents

KENTUCKY STATE UNIVERSITY
Land Grant Program

Aquaculture Extension Staff

In each issue, we'll feature some of our aquaculture staff here at Kentucky State University.

Richard Bryant, Extension Associate

Richard Bryant is an aquaculture and agricultural extension professional who has worked in four different countries, helping to ensure food security through education and aquaculture demonstrations. He earned his B.S. in Aquaculture / Fisheries Management from Auburn University and his M.S. in Aquaculture and Aquatic Science from Kentucky State University. He has worked at Kentucky State University for 10 years.

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Janelle Hager, State Specialist Aquaponics

Janelle Hager has been with KSU for 8 years working in research, Extension, and teaching in aquaponics and aquaculture. She works with commercial growers, backyard enthusiasts, and everyone in between. Whether you're an established grower or are tinkering with the idea, you can reach out to her for assistance. She earned her B.S. in Marine Science from James Cook University; her M.S. in Aquaculture and Aquatic Science from Kentucky State University; and is working on her Ph.D in Plant Science at the University of Kentucky.

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Mason Crawford, Area Agriculture Agent/Coordinator

Based in Elizabethtown, Mason services Hardin, LaRue, Breckinridge and Logan Counties. With a long history working in agricultural education, private sector consulting and now Cooperative Extension, he assists small and limited resource farmers and youth with aquaponics production and studies. He currently serves as the principle investigator on a farm-to-cafeteria demonstration model utilizing integrated fish and vegetable production at the Kentucky FFA Leadership Training Center in Hardinsburg. He earned his B.S. in Agriculture from Western Kentucky University and his M.A. in Education from Western Kentucky University. He has worked at Kentucky State University for six years.

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John Kelso, Extension and Research Assistant

John Kelso is based at the Aquaculture Research Center in Frankfort and covers the central and eastern regions of Kentucky. He graduated from the State University of New York with his bachelor's degree and is currently pursuing a M.S. in Aquaculture and Aquatic Sciences from Kentucky State Unviersity. He offers free fish disease diagnostic services at the KSU Aquaculture Research Center, annual fish health inspection with U.S. Fish and Wildlife Services, aquatic weed control and pond management consultation. He has been with Kentucky State University since 2014.

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Joni Nelson, Manager of Center for Sustainability of Farms and Families

As Manager of the Center for Sustainability of Farms and Families under the Extension program, Joni Nelson's duties include securing external funding (competitive and non-competitive) for continued long term operations of the Center. Her Extension objectives include giving presentations and workshops at Extension offices, non-profits, and the Kentucky Association of Conservation Districts; and working on collaborative projects with The Habitat Workshop, the Kentucky Center for Agricultural and Rural Development, Community Farm Alliance, NRCS, and more. She administers grant funding to Kentucky-based small-scale farmers and maintains accountability procedures for awarded funds as outlined by the Kentucky Office of Agricultural Policy and the Agriculture Development Board. She coordinates efforts for demonstration projects related to organic agriculture, development of value-added products from locally grown crops, agroforestry, food insecurity and certain aquaculture initiatives. She earned her B.S. in Horticulture from Auburn University and her M.S. in Environmental Sciences from Kentucky State University. She has worked at Kentucky State University for 11 years.

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Chelsea Walling, Aquaculture Extension and Research Associate - K-12 STEM

Chelsea Walling demonstrates aquaculture and STEM concepts to youth and educators through the use of aquaponics. Her team is currently executing aquaponics curriculums in four Kentucky high schools (2 in Lexington, 2 in Louisville). This curriculum has been implemented in 12 Kentucky high schools since the program began in 2016. Aquaponic project-based investigations (APBI) can be used to make complex scientific concepts like the nitrogen cycle and carrying capacity more tangible. She also assists with youth Extension events like AgDiscovery and STEM camps and provides tours of the Kentucky State University Aquaculture Research Center (ARC). If you are interested in information about K-12 aquaculture or would like a tour of the ARC, you can contact her. She earned her B.S. in Agriculture, Food, and the Environment and her M.S. in Aquaculture and Aquatic Sciences, both from Kentucky State University. She has been a staff member at Kentucky State University since 2020.

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Forrest Wynne, State Extension Specialist for Aquaculture

Forrest Wynne's responsibilities are to provide consultation and information on freshwater aquaculture production, marketing, water quality, site evaluations and construction. He works with fee fishing facilities and owners and managers of private lakes and ponds regarding site selection, pond constructions, fish stocking, water quality, pond aeration and aquatic algae/plant control. He earned his M.S. in Fisheries Management from Mississippi State. He has worked at Kentucky State University for 32 years.

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Evaluating a Low-Cost, Simple Denitrification Method for Small-Scale Marine Aquaculture Producers

Leo Fleckenstein
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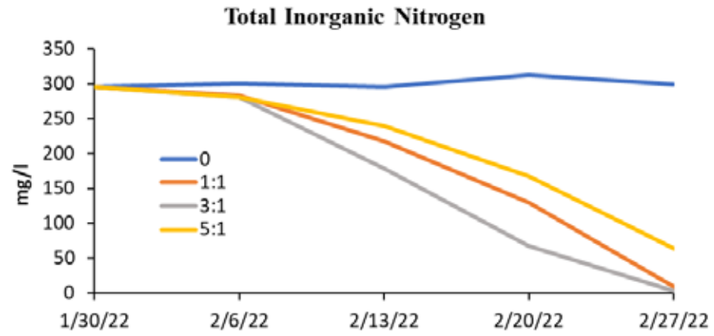
Indoor aquaculture production is increasing in popularity in the United States due to a growing demand for seafood. Use of indoor recirculating aquaculture systems (RAS) can provide fresh, locally produced fish or shrimp in inland areas that would otherwise not have access to such products. RAS commonly produce high amounts of nitrate-rich water due to high stocking densities of cultured animals and therefore rely on periodic water exchange to reduce nitrate levels. Inland producers, particularly marine producers, may be unable to discharge effluent due to local regulations and must consider the costs of replacing both water and salt. To remedy high levels of nitrate, producers can use denitrification to reduce levels in their systems. Many denitrification methods, including fixed film bioreactors, sulfur-based reactors, and sequence batch reactors are often costly to setup, maintain, or difficult to operate.

Nitrate builds up in RAS over time due to the conversion of protein in the feed to ammonia, which is then oxidized to nitrate by nitrifying microbes. In low concentrations, nitrate is not generally considered toxic to most aquaculture animals; however, high stocking densities and feed rates of most RAS means nitrate levels rapidly rise and reach toxic levels in a relatively short amount of time. For example, most indoor marine shrimp production operations raise shrimp at a density of around one shrimp per gallon of water. At this density, farmers will see their nitrate level rise between 100-150 mg/L in 90 days, a typical shrimp grow out. In two or three crops of shrimp, nitrate levels can exceed 300 mg/L. At this level, noticeable decreases in shrimp growth and survival will occur. Most shrimp RAS used by small-scale producers in the United States range between 4,000-6,000 gallons of water. Replacing this volume of water and salt in a marine or brackish water system can cost producers more than $1,000.

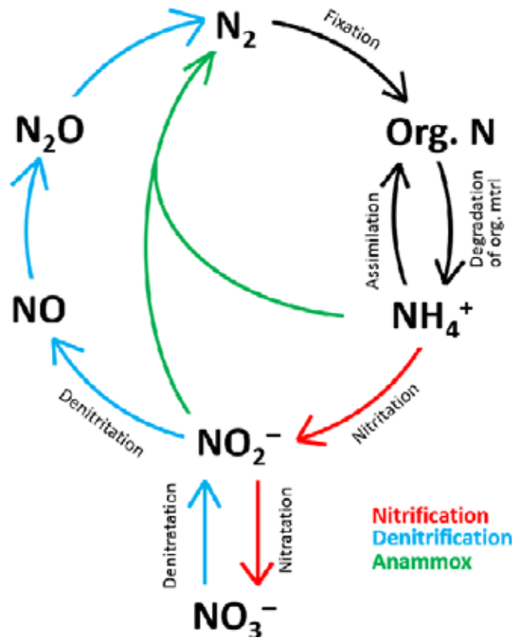
Denitrification is a process where microbes in a low-oxygen environment, provided with organic carbon (sugar, molasses, ethanol, etc.), break nitrate (NO_3) down into nitrogen gas, which then dissipates into the atmosphere. The microbes that perform denitrification need specific ratios of carbon to nitrogen (C:N) in order to function efficiently. This C:N ratio is calculated from the amount of nitrogen in the water and the amount of carbon in the substance being added to the system. Alkalinity also increases during the denitrification process, another parameter that RAS operators often have buffer over time. Most RAS use external filters for denitrification as cultured animals cannot tolerate the low oxygen environment required by the microbes responsible for formation of nitrogen gas. These external filters are an additional cost and can be difficult to manage, as they require precise flow rates and a low amount of solids in the water. Many small-scale producers use methods that require higher solids levels in the aquaculture system, like biofloc or hybrid systems. These solids could be moved into a low oxygen environment favorable for denitrification, similar to water treatment methods found in municipal water treatment facilities. Using existing solids in the system could provide aquaculture producers a simple, low-cost, and effective denitrification method. At Kentucky State University, we aimed to evaluate such a method in a research setting and further test the method at an active aquaculture farm.



Total Inorganic Nitrogen (sum of total nitrite and nitrate) was reduced from 300 mg/L to under 75 mg/L by addition of ethanol in all Carbon:Nitrogen treatments. A ratio of 1:1 C:N was the optimal treatment based on the smallest application of ethanol to treatment tanks.

High nitrate water (298 mg/L) from an active shrimp farm in Kentucky was pumped into twelve 147 L (~40 gallon) tanks, none of which had an external filter. Rather, the study aimed to evaluate the potential of denitrification without an external filter and what Carbon:Nitrogen (C:N) ratio would be most effective. C:N ratios of 1:1, 3:1, and 5:1 were evaluated. The C:N ratios were calculated by measuring the amount of total ammonia nitrogen, nitrite, and nitrate, along with calculating the percentage of carbon by mass present in the carbon donor (in this case, ethanol). Ethanol was added daily to each tank to meet the specific treatment ratio, and the amount of carbon was recalculated twice per week based on the test results for ammonia, nitrite, and nitrate. While the study was ongoing, the water in the system was allowed to stagnate, and no pumps or aerators were used to keep oxygen levels as low as possible.

After 28 days, the study was ended when signs of denitrification stopped. Although all three C:N ratios decreased the nitrate level below 10 mg/L, the 1:1 ratio was considered the optimum due to the lower amount of ethanol needed. The total decrease in nitrate was 288 mg/L in the 1:1 tanks and alkalinity increased over 700 mg/L. To further evaluate this method of denitrification, the 1:1 C:N method was applied to a system at an indoor shrimp production farm in Lexington, Kentucky. The system was a 17,000 L (4,500 gallon) shrimp production tank with an initial nitrate level of 493 mg/L. Ethanol was added daily, and after 7 days the nitrate level had dropped below 10 mg/L. The total amount of ethanol used during this test was 34.7 L (9.2 gallon). The increased rate of denitrification was likely due to the higher water temperature at the shrimp farm. There were increased solids that developed during the denitrification process that would need to be filtered from the water before further use. This method has important implications for aquaculture producers as a simple, low-cost denitrification method. By allowing producers to retain considerable amounts of water and salt, though use of limited amounts of an inexpensive carbon resource, shrimp farmers may lower production costs by saving time and money



Any questions about the method used in this study can be directed to andrew.ray@kysu.edu or leo.fleckenstein@kysu.edu.

Annual Meeting of the Kentucky Aquaculture Association

A meeting was held for the Kentucky Aquaculture Association (KAA) on December 4, 2021, at the Hardin County Extension Office in Elizabethtown, Kentucky. Kentucky State University faculty and staff, Kentucky Department of Agriculture (KDA), and the Kentucky Center for Agriculture and Rural Development (KCARD) were present. In all, the membership was represented well by attendees from many producers of aquaculture products in the Commonwealth.

The morning session included an opening by Dr. Tidwell (KSU) with the history of KAA and aquaculture research in Kentucky since the early nineties. After the floor was opened for personal introductions, three businesses were presented: Crystal Bridge Fish Farm, Faul Family Riverside Farm, and Western Kentucky Aquaponics. Then Catherine Nash from the Small Business Development Center presented via Zoom. KSU aquaculture faculty Drs. Semmens and Novelo gave research updates followed by graduate student Jasmine Iniguez for her study of Ultrasound technology for aquaculture. Thanks to all our presenters.

A business meeting was held in the afternoon session. KSU's aquaculture extension working group has committed to the revitalization of this stakeholder group throughout the last year. KAA had not previously met since 2018, and there was much to cover. Organizational overview and board position review, followed by KCARD-facilitated discussion on the future of KAA, comprised the bulk our business meeting. Members leaving the meeting were asked to consider some of the following questions regarding the direction of this group: What does the membership wish to accomplish? What are the members' priorities? In the last order of business, a board election was held by ballot. Congratulations to those elected for leadership positions.

One of the goals for KAA, as stated in the by-laws, is for the group to be represented by the elected board from a diverse group of regions and product groups. The elected board now represents producers of catfish, shrimp, largemouth bass, trout, tilapia, aquaponics, processing, and live haul or pond stocking businesses.

For more information about KAA or to become a member, contact Angela Caporelli or any board member. More announcements about KAA will follow in the next edition of Aquatic Farming News.

KSU Aquaculture Showcased Diversity in Research and Extension at Aquaculture America 2022

Twenty faculty, staff, and students from Kentucky State University attended the Aquaculture America Annual Conference in San Diego, California, the week of March 1, 2022. This year was a triennial, combining the annual meetings for Fish Culture Section of the American Fisheries Society, World Aquaculture Society, National Shellfisheries Association, and the National Aquaculture Association. At the largest aquaculture conference in the world, with nearly 4,000 attendees from 90 countries, the outstanding work conducted at KSU was on full display! In total, participants from KSU gave fourteen oral presentations, gave three poster presentations, and served as Chair of five conference sessions. Research and Extension activities in saltwater shrimp, aquaponics, fish health, fish nutrition, aquaculture engineering, Extension outreach, and K-12 education were presented. The KSU Aquaculture Research Program has long been recognized, both nationally and internationally, as a leader in the field. This conference provided an opportunity to showcase just that and continue the legacy of leadership that defines KSU Aquaculture. The financial support of our Land Grant Program (for which we are greatly appreciative) was essential in creating this opportunity for faculty, staff, and students.

Winter Kills: Fungal pathogens, temperature change and water quality in late winter

John Kelso
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The beginning of March is a common time to notice the effects that winter has had in ponds. With the end of February, recognition of meteorological spring activity signals an emotional response. We see American Robins and Canada Geese return for the nesting habitats, skunks and raccoons litter the roadsides, and perennial plants emerge from their dormant bulbs. In preparation of planting and spring tillage, farmers are consumed with the hope of another warm growing season. For fish farms and pond owners, often this time of year another common condition may be recognized, as the effects of "winter kills" are noticed.

The term "winter kill" is associated with two main causes of different nature. The first, "winter kill" has been coined for mortality caused by water quality conditions under the ice, namely dissolved oxygen depletion under snow and ice covered ponds. This type of fish kill can result in pond mortality up to 100%. Fortunately, for us in the southeast region, this type is not as common, since hard icing and snow cover are not as frequent in our winters; low d.o. conditions caused by snow and ice are much more common in smaller, shallow ponds in the north.

The second and more common "winter kill" of ponds in our region is attributed to fungal pathogens. Fungi cause many infections in freshwater fish, with the most prevalent occurring in the egg and fry life stages. However, water molds of the family Saprolegniaceae family cause significant mortality in production and recreational ponds of adult catfish. These infections are referred to as winter saprolegniasis, winter fungus, and winter mortality. Winter fungus typically occurs between October and March when the water temperature is below 60F. Early spring is the time of year when it has been most frequently documented in the fish disease lab, and I get a lot of requests for assistance regarding this condition.

Saprolegniasis is characterized by late winter-spring mortality; brownish, cottony fungal growth on the skin or gills; dry, depigmented skin; and endopthalmia. Lesions on the skin first appear as small, circular spots with hemorrhagic margins. As the condition progresses, they can become ulcerative, penetrating the skin into muscle tissue and proliferating as a large cottony mass when the fungus colonizes. The fish can be completely covered with fungal growth. Most fungi in this family cause disease as secondary or co-morbid pathogens when a pre-existing illness, injury, or environmental stressors are present. Death from this condition is thought to be related to the inability of fish to regulate salt balance in the blood.

The expense of and efficacy of treatments for winter fungus aren't well documented, so prevention is emphasized for dealing with this pathogen in production ponds. Optimize water quality conditions and reduce stress in ponds during the fall. These conditions are achieved by good production practices throughout the year.

Maintaining dissolved oxygen levels (4-5 ppm) by aeration, reducing stocking density of harvestable size catfish in ponds in the winter, and avoiding skin damage with good fish handling protocol are recognized methods to reduce production loss. In my experience, the occurrence of winter fungus in ponds with algae problems the previous summer is correlated. Maintain healthy ponds by cleaning up the pond edges and control the growth of aquatic weeds when they are troublesome.

Research conducted on the use of fungicides like hydrogen peroxide and formalin have investigated these to be potential treatments but are more practical for indoor applications in tanks. Copper sulfate has been shown to lower the abundance of pathogenic zoospores in lab trials as well. There are no pathogen -pecific approved chemical treatments for pond use in food production ponds. Copper sulfate and salt are two chemical compounds that I have recommended for applications to treat winter fungus. Copper sulfate, having been documented to reduce fungal zoospores, and salt, for its effects on the skin (stimulates mucus production, reduces stress, and has antimicrobial properties), are the most practical chemicals to use in ponds in Kentucky.

Recommended reading:
SRAC Publication No. 4700 Saprolegniasis (Winter Fungus) and Branchiomycosis of Commercially Cultured Channel Catfish. R.M. Durborow, Wise D.J., and Terhune J.S. August 2003.
SRAC Publication No. 410 (table 8) Calculating Treatments for Ponds and Tanks. M.P. Masser and Jensen J.W. August 1991

Kentucky farmer provided shrimp for annual Legislative Fish Fry

The Faul Family of Riverside Farm in Sulphur, Kentucky, provided one hundred pounds of shrimp for Kentucky State University's annual Legislative Fish Fry. Held in February 2022, the event invites Kentucky legislators to learn about the great work being done by Kentucky State University's Land Grant Program, Cooperative Extension Program, and College of Agriculture, Community, and the Sciences.

Each year, the menu features local food items. Kentucky State aquaculture staff has worked with the Faul family on shrimp production and prepared the donated shrimp for the meal.

Andre Faul performs morning maintenance on his marine shrimp before packing the shrimp up to donate to Kentucky State University on Feb. 17, 2022, at Faul Family Riverside Farm in Sulphur, Kentucky.

On the cover: Andre Faul holds a few marine shrimp harvested from Faul Family Riverside Farm in Sulphur, Kentucky.

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