AQUACULTURAL ENGINEERING SOCIETY

Newsletter, April 2022

President's Letter

Dear AES members,

What an unbelievable world situation we are currently living in - the 21st century and talking about war, a real war, the kind of war that happened long time ago and nobody would have never thought that would be repeated. But yes, it seems that COVID (which believe it or not it is still around us) was the beginning of a terrible chain of events.

In our industry in general, and in our Society in particular, we have just participated in two events: Aquaculture America 2022 held in San Diego (California) and RAStech 2022 held in Hilton Head Island (South Carolina). Indeed, this has been the first time that the AES has sponsored a session in an industry based conference like RAStech. I believe it is a step forward to the new look of the Society and where we are focusing most of our efforts. Cutting-edge companies of the aquaculture industry participated in the events. Very diverse companies (i.e. AST filters, Balmoral tanks, Spring Genetics, Adsorptech, Searen, HTH full spectrum, Isco-pipes) that consist of a great part of the technologies, products and services of the industry and managed to attract a full conference room. Moreover, the roundatble discussion at the end of the second session turned into a very interesting question-reply-discussion between the audience and the speakers. For me, it has been an-honor to be the chairwoman of the sessions and I hope that this will be the first of many conferences like this one. In case you are interested in some of the presentations, most of them from both of the conferences will be available in our website.
Along those lines, our last event was a webinar with Marlon Greensword as presenter. Marlon is an Engineering Researcher at Texas Christian University, where he designs and evaluates biofilters. His specialties are aquaculture water and wastewater management, biofiltration, economic analysis, and the incorporation of lean process improvement into aquacultural engineering. Our BOD member talked about "Aquaponics Decoupled: The Way of the Future" where Huy Tran, David Cline and Ron Malone also participated as panelists.

The world is changing, and so is the aquaculture industry. In the world that we have created, the supply chain is having huge issues. In fact, it seems that the distances have been elongated instead of shortened and this is creating critical situations as well as product and living costs increases. Feed, electricity, shipping, and construction prices have increased, in some of cases up to 50%, and the time of delivery for many products is creating delays in lots of companies and projects. Moreover, we cannot forget that Ukraine, the biggest victim in all of this, was (we need to talk in past term and at this moment and in the near term future we do not know how this is going to evolve) one of the most important cereal exporters and this already has had a devastating impact in many aquaculture producers around the world. On the other hand, energy and fuel prices have reached historic maximums not only generating tremendous economy losses but closing down several companies and leaving lots of production in a tight spot. As I wrote in one of my latest articles in Hatchery International magazine, the cost of living is going to increase and the world is going to be different after this war. Unfortunately some are already paying for all of us, and not with money but with lives.

Presidents Letter

The conclusion is that the world, our lives, our present and future have and are being transformed. The new generations think about being influencers, tik-tokers and youtubers, making social media a must right now. As strange as this might sounds, if you are not in, you are out and that is why our Society is trying to be more active in social media such as LinkedIn. Follow us there and keep tuned for the latest news and events.

I hope you had a great Easter holiday, and that you have been able to rest and regain strength for the year ahead!

Scientific Spotlight

Teaching aquaponics and RAS in 2022: trends and challenges

At a time when food security and environment-friendly solutions are a priority, STEM educators have focused on aquaculture and engineering to invest in the next generation of consumers, farmers, researchers, engineers, and fellow educators. Aquaponics, the dual system where tank water is passed to the plants that absorb nutrients while hosting nitrifying bacteria, has been a viable method for aquaculture and plant production. More specifically, decoupled aquaponics allows for optimal control of pH, and of nutrient and mineral content. This RAS method still uses the nutrients excreted by the fish to grow plants but uses solely the filtered or digested sludge as source of plant nutrient.

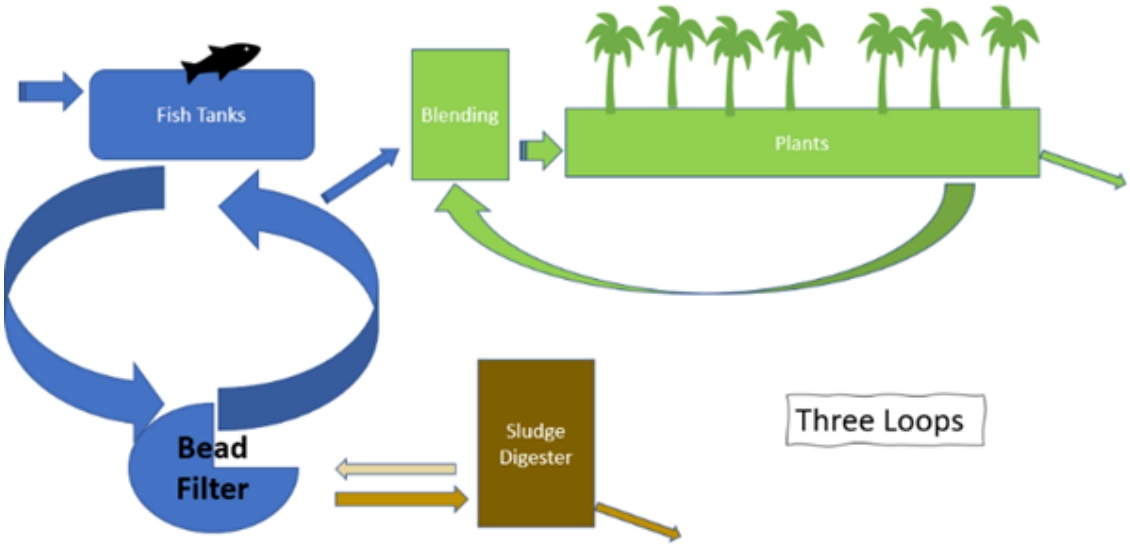


Figure 1: Mineralized decoupled system design as presented by Malone, Tiersch, and Tanner (2021)

The decoupled system is of growing interest in secondary schools, and educators are increasingly advocating for the integration of aquaponics as part of the STEM curriculum. Many researchers and practitioners are favoring decouple designs that provide for enhanced plant and fish growth over coupled designs that inherently define uniform water quality for both growth regimes. The use of mineralization basins enhances nutrient availability, increasing plant production from a given quantity of feed. Modern mineralized decouple systems are designed to extract more nutrients from decaying sludge. The more recent systems are designed to minimize labor demands, which is ideal for secondary school contexts, where teenage students constitute the labor force. Thus, the result is a more user-friendly environment for the production of plants with nutrients cascading from fish production systems. Nevertheless, there are concerns with the complexity of management, cost, and – as is always the case when dealing with high school students – making the science engaging and relevant to our daily lives.

Management of school-scale systems

The major management parameters pertain to nitrogen and solids removal, as well as BOD control. STEM departments should therefore apply the following guidelines.

- Store nutrients in the fish tank: on average, dosage of 20 g of feed per m^2 of fish growing area is recommended. Nevertheless, to sustain plant growth, it is best to dose as needed for plants and not be concerned with excess feed. Indeed, the ammonia that plants need will come from fish excretion as well as uneaten feed.

- Use the RAS filter to prefilter all water going to plants: the sludge should be properly removed regularly in order to avoid solids in the plant tray. This task can be included in teachers' management plan – and as a playful discipline strategy.

- Use an aerobic mineralization bed to enhance nutrient supply: pneumatic backwash should be used to move the sludge from the filter to the sludge basin and to clean the filtering media. This system allows for rapid digestion of solids, increases the nitrogen supply, and avoids denitrification. On the other hand, anaerobic systems take longer to break down solids, and denitrification that occurs in such systems causes nitrate loss. (Another convenient attribute to aerobic mineralization in school environments is that it drastically reduces odor-causing bacteria.)

- Do not return water from plant tray in order to avoid salt build up.

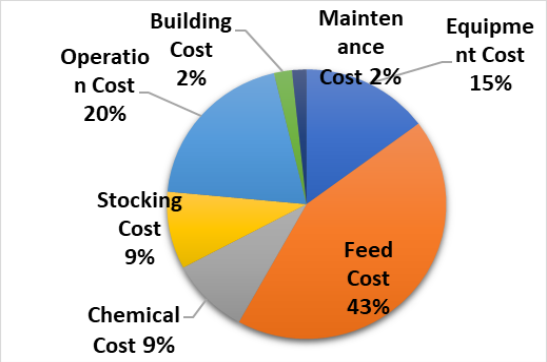
To sum it all up, the challenge of teaching aquaponics in 2022 is that STEM educators are required to be knowledgeable in aquaculture, design, and plant management.

Figure 2: Engineering teacher Dr. Marlon Greensword inspects the inaugural aquaponics greenhouse with Senior student Preston Palmer in a local high school

Figure 3: Dr. Ron Malone as President of ASTfilters has developed a line of decoupled aquaponic designs and has conducted countless classroom interventions, class visits, and training sessions for high school students.

Cost

The following cost breakdown summarizes what STEM programs can expect with aquaponics production budgeting. Some of these costs may be considerably reduced if maintenance is enforced as a strong component of the engineering course.



Schools, like all other sectors, are faced with increasing prices. As of March 2022, the least expensive aquaponics systems start in the mid-$4,000. This does not include stock, seeds, feed, energy, water, building (greenhouse), and faculty compensation. Industrial sponsorship is key to the growth of aquaponics education. For example, Aquaculture Systems Technologies sponsors secondary schools and higher education labs throughout the country.

Making the science engaging and relevant

Figure 4: ASTfilters provided Keene High School (TX) with a tank, a PolyGeyser RAS, and floating beads.

Secondary and higher education students typically appreciate the ability to grow edible food as a result of aquaponics education. Because the nitrogen in a feed is assimilated in the fish, students are often initially fascinated by the fact that plant nutrients are excreted through the gills or excreted via digestion (71% of the nitrogen is contained in the feces alone!). But as the new car smell wears off, it is important to consider the opportunities resulting from aquaponics education. While aquaponics has not penetrated the larger commercial-scale markets, it is quite profitable among smaller scale farmers who service fresh markets and local restaurants, which are gaining popularity among millennials and the generations thereafter. STEM educators may find it beneficial to connect with such businesses and seek sponsorship from them for field trip or class visit activities. Another strategy to foster engagement and support is to collaborate with other educators in the visual arts or culinary arts/home economics for interdisciplinary appreciation of the aquaponics-produced foods.




Figure 5: Dr. David Cline, a member of the National Aquaculture Extension Steering Committee, received national recognition for his efforts to expand aquaculture education into secondary schools.

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Events 2022/2023

Last Webinar:

Aquaponics Decoupled: The way of the future

DATE: 21st April: TIME: 13.30 pm CT/20.30 CEST

In the webinar, Dr. Malone, Dr. Cline and Mr. Tran and our BOD member Dr. Greensword presented the latest methods and management strategies with regards to fish, water, and plants in aquaponics systems.

Events:

Aquaculture America 2023—February—New Orleans (United States)

RAStech 2023—April—Miami (United States)

European Aquaculture 2023—TBD

NordicRAS 2023—TBD

Industrial Spotlight

AKVA Group assists with biological challenges in land-based production systems

Several players in the salmon industry are looking at the possibility of success within land-based fish farming. For many of them, the technology is still new and not as incorporated as, for example, sea-based farming. Land-based aquaculture production systems are no longer limited to flow through systems but are replaced by large scale recirculating aquaculture systems (RAS), and the production of post smolt and even grow out to market size fish is realized in RAS today. To assist fish farm managers and workers with handling these high-tech facilities, AKVA group previously provided user manuals and on-site trainings to support the operator with the technical assistance. Alongside the new challenges related with the technologies, fish production in RAS entails biological challenges, which relate to the animal at all life stages, as well as the principles of biological water treatment. This development resulted in an urgent need for more competence and support in the land-based industry. To assist farmers with these biological challenges, AKVA group launched a new service department headed by Wolfgang Koppe. He uses existing expertise in AKVA group but has also hired two specialists. Sebastian Marcus Strauch and Tomas Mosquera work with handover and follow-up of RAS facilities around the world. Sebastian Marcus Strauch comes from Germany and is a specialist in land-based aquaculture. He holds a MSc. in Aquaculture from Wageningen UR and a doctorate from the University of Rostock. Tomas Mosquera is from Chile and holds a PhD from the University of California, Davis. He specializes in water quality and microbiology. One key activity of the new department focuses on trainings in fish and RAS biology. This training program includes about 30 modules, which built up in 3 levels.

The first level is an introduction to biological principles in fish and RAS biology. Here, the attendees get familiar with the fish anatomy, the principles of how land-based production facilities meet the life history demands of the fish, but also the principles of biological water treatment and basic water chemistry.

The second level deals with control strategies for key biological aspects in land-based production, such as effective feeding, smoltification strategies, relevance of solid waste removal, nitrification, and denitrification biofilter management.
The third level addresses the assessment and handling of biology-based risks in land-based fish production. Examples of such risks are e.g., avoiding early maturation, formation of hydrogen sulphate, but also the avoidance and treatment of off-flavours in grow-out production.

Figure 1: Figure 2: AKVA Group follow-up assistance, Tomas Mosquera (left) and Sebastian Strauch (right).

A general learning outcome of the trainings is to give the attendees confidence in their abilities when working in RAS. “We want to give the people a good understanding of the implications that a too much or too little of things can have. For example, excess levels of nitrite can certainly kill an entire stock but understanding that a good functioning biofilter and a little sodium chloride can avoid this hazard, sets a basis for successful start for working in RAS” says Sebastian Strauch

Another key activity is to support fish farmers with follow-up assistance. This implies the start-up and operational improvement of nitrifying or denitrifying biofilters, or the assessment of fish mortally. “We believe that success lies in having a culture of open and trustful dialogue with our customers. A scientific approach to problem solving and practical experience allow us to tackle the root of problems quickly, and our customers to focus on their core activities: to be successful in fish farming,” says Sebastian Marcus Strauch.
“It is still early days, but you have to get started, we hope to make it easier for customers to succeed,” says Siri Tømmerås, Commercial Director Land Based.
“Predictability, security and good fish health are important for success. We were still available to help with updates and how things could change, but with the new investment we get much closer to the customer and can help them from day to day. They get access to our entire expertise,” says Wolfgang Koppe, Director RAS Production Advisory Services (PAS).

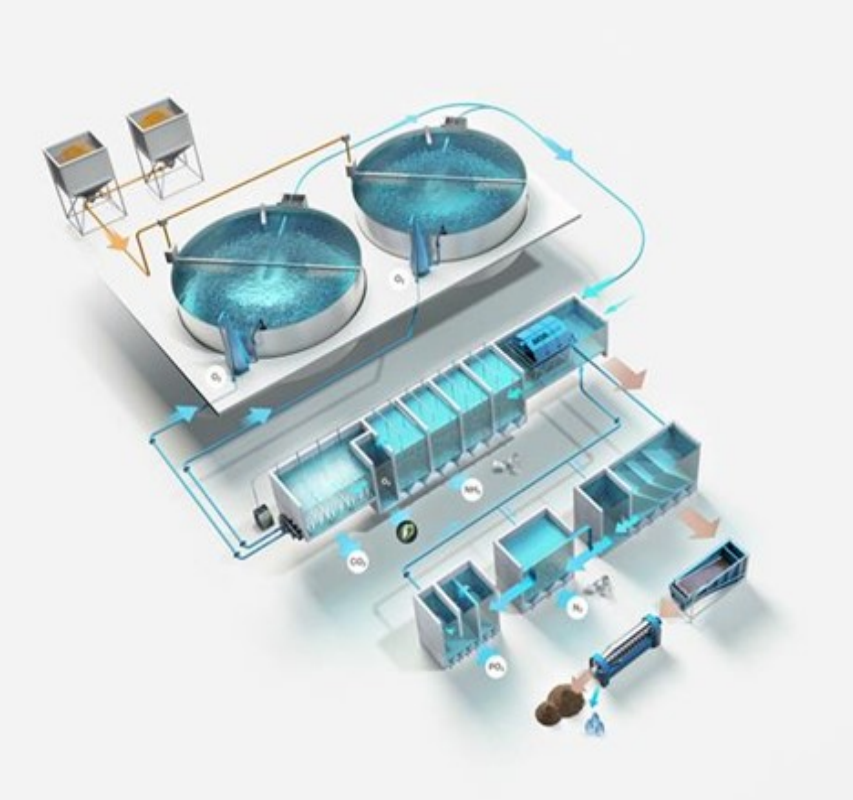

Figure 2: Scheme RAS

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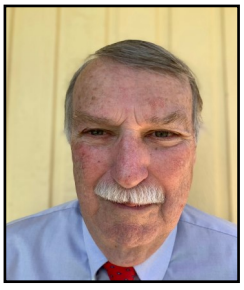

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