

Andrew J. Ray, Ph.D.

Associate Professor of Aquaculture Production
Kentucky State University, School of Aquaculture

103 Athletic Rd., Frankfort KY 40601 USA • Andrew.Ray@kysu.edu • 502-597-8109

EDUCATION:

- **Doctor of Philosophy in Coastal Sciences, December 2012**
The University of Southern Mississippi, Ocean Springs, MS
- **Master of Science in Environmental Studies, August 2008**
The University of Charleston, Charleston, SC
- **Bachelor of Science in Biology, May 2005**
The University of Central Missouri, Warrensburg, MO

PROFESSIONAL EXPERIENCE:

- **Associate Professor, and Lead Scientist for the Center for Sustainable Shrimp Aquaculture Production, Kentucky State University, July 2019 – Present**
I am currently a Tenured Associate Professor and Lead Scientist for the Center for Sustainable Shrimp Aquaculture Production in the KSU School of Aquaculture. I lead a productive research and extension lab, currently employing three full time employees, two M.S. students, and two B.S. students. My work is nationally and internationally recognized, I maintain a substantial level of funding (primarily federal grants), routinely publish in esteemed journals, teach a course every semester, and maintain a variety of local, national, and international collaborations. In addition, I have continued the duties I had as an Assistant Professor listed below.
- **Assistant Professor, Kentucky State University, September 2014 – June 2019**
I conducted sustainable brackish-water aquaculture systems research, and integrated agriculture research. Some specific topics under study were systems development, greenwater biofloc systems, indoor biofloc systems, RAS technology simplification and improvement, aquaculture isotope dynamics, polyculture, and phytoremediation and denitrification of reused marine water. I taught Water Quality Management and the associated lab course, developed an online version of this course, and worked to develop a course on Recirculating Aquaculture Systems. I routinely worked with farmers to help transfer the technology my lab develops at KSU. I facilitated the opening of two indoor Kentucky shrimp farms in 2018 and 2019 that are continuing to make profit and have continued to expand production. I secured a variety of funding sources including Federal, State, International, and Private funds. I mentored high school, undergraduate, and graduate students, and maintained a respectable publication record.
- **Post-Doctoral Fellow, The University of Southern Mississippi, January 2013 – August 2014**
During this full-time faculty appointment I secured grant funding to conduct sustainable aquaculture research projects at the Gulf Coast Research Laboratory's Thad Cochran Marine Aquaculture Center. As part of this appointment I taught at the undergraduate and graduate levels, published research papers, participated in national and international conferences, and worked with private industry to develop and improve aquaculture projects in the United States and globally including a large project I led in South Africa.
- **Research Assistant, The University of Southern Mississippi, August 2009 – December 2012**
As part of a Ph.D. research program, I managed a large-scale, 16,000 square foot shrimp production facility and taught undergraduate and graduate level laboratory courses. I designed

and managed large and meso-scale experiments, analyzed and disseminated data through professional channels, and managed four employees. Under my supervision the facility achieved the highest level of shrimp production in its history.

- **Biologist, SC Dept. of Natural Resources, Waddell Mariculture Center, May 2008 – July 2009**
I assisted with various animal husbandry efforts, managed a three month-long experiment comparing two shrimp diets (a fish-free diet and a conventional fish-containing diet), and published several papers.
- **Research Assistant, The University of Charleston, March 2007 – May 2008**
As part of a M.S. Thesis project, I helped to plan and implement an experiment analyzing the effects of shrimp diets and various management regimes on communities of microorganisms and chemical cycling dynamics within shrimp aquaculture systems.

AWARDS:

- **Top Article in the Aquaculture Advocate Magazine 2017**
 - Number one ranked article for the year in this widely read magazine
 - Rankings based on page views, social media shares, and reader feedback
- **Distinguished Early Career in US Aquaculture** – US Aquaculture Society, Aquaculture America 2011, New Orleans, LA
- **Best Student Poster, 2nd Place** – US Aquaculture Society, Aquaculture America 2011, New Orleans, LA
- **Best Abstract/Travel Award** – World Aquaculture Society, World Aquaculture 2010, San Diego, CA
- **Best Student Presentation, 3rd Place** – 2010 Graduate Student Symposium, Gulf Coast Research Laboratory, Ocean Springs, MS
- **Best Abstract/Travel Award** – US Aquaculture Society, Aquaculture America 2008, Orlando, FL.
- **Jack Bayless Best Presentation Award** – SC Fishery Workers Association/SC Chapter of the American Fisheries Society Joint Meeting, Santee, SC 2008

TEACHING COMPETENCY:

Highlights

- Teaching as a faculty member of an accredited university since Summer of 2013
 - Served as primary advisor for nine M.S. students, and co-advisor for 13 M.S. students
 - Mentored 13 undergraduate students as research assistants, and eight as an academic mentor
 - Mentored seven high school students, and four interns
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- **University Courses**
 - Recirculating Aquaculture (AQU 470; 3 CH) – Kentucky State University
 - Developed a detailed plan for the course, it is fully approved by Faculty Senate
 - Fall 2023, to be offered annually going forward
 - Recirculating Aquaculture (AQU 570; 3 CH) – Kentucky State University
 - Developed a detailed plan for the course, it is fully approved by Faculty Senate
 - Fall 2023, to be offered annually going forward
 - Water Quality Management (AQU 460; 3 CH) - Kentucky State University
 - Fall 2015, Fall 2017, Fall 2019, Spring 2021, Spring 2022
 - Water Quality Management (AQU 560; 3 CH) - Kentucky State University
 - Fall 2015, Fall 2017, Fall 2019, Spring 2021, Spring 2022
 - Water Quality Management Laboratory (AQU 461; 1 CH) - Kentucky State University

- Fall 2015, Fall 2017, Fall 2019, Spring 2022
 - Water Quality Management Laboratory (AQU 561; 1 CH) - Kentucky State University
 - Fall 2015, Fall 2017, Fall 2019, Spring 2022
 - Marine Aquaculture (COA 424/424L; 6 CH) – The University of Southern Mississippi
 - Summer 2013
 - Marine Aquaculture (COA 524/524L; 6 CH) – The University of Southern Mississippi
 - Summer 2013
 - Marine Aquaculture Laboratory – Co-Taught (COA 424L/525L; part of a 6 CH course)
 - The University of Southern Mississippi
 - Summer 2010, 2011, and 2012
- **Master of Science Graduate Students**
 - Primary Advisor
 - Mark Johannemann (M.S. AQU; Fall 2021 – Spring 2023) – Graduated
 - Thesis Title: The effects of carbon source and woodchip media ini denitrification filters on water quality and shrimp production in hybrid RAS (Manuscript is in preparation)
 - Shrijan Bajracharya (M.S. AQU; Spring 2020 – Fall 2021) – Graduated
 - Thesis Title: The effects of systems type, salt formulation, and sugar additions on Pacific white shrimp (*Litopenaeus vannamei*) production and digestive enzyme activity (Manuscript is in review)
 - Leo Fleckenstein (M.S. AQU; Spring 2018 – Fall 2019) - Graduated
 - Thesis Title: The effects of substrate and stocking density on Pacific white shrimp (*Litopenaeus vannamei*) performance and water quality dynamics in high tunnel-based biofloc systems (Published in the journal Aquacultural Engineering)
 - Nathan Kring (M.S. AQU; Fall 2017 – Fall 2019) – Graduated
 - Thesis Title: The effects of stocking density and artificial substrates on production of Pacific white shrimp (*Litopenaeus vannamei*) and water quality dynamics in greenhouse-based biofloc systems (Published in the journal Aquacultural Engineering)
 - Thomas Tierney (M.S. AQU; Fall 2015 – Summer 2017) – Graduated
 - Thesis Title: A comparison of biofloc, clear-water, and hybrid-water culture systems for super-intensive shrimp *Litopenaeus vannamei* nursery production (Published in the journal Aquacultural Engineering)
 - Kylie Gehfer (M.S. AQU; Spring 2023) – Current
 - Sagun Chhetri (M.S. AQU; Fall 2022) – Current
 - Gyanu Rana (M.S. AQU; Spring 2022) – Current
 - Anthony Adams (M.S. AQU; Spring 2018) – Current
 - Co-Advisor
 - Oluwafemi Adebayo (M.S. AQU; Fall 2022) – Current
 - Cole Daleiden (M.S. AQU; Fall 2022) – Current
 - Aakriti Khanal (M.S. AQU; Fall 2021) - Current
 - Uchechukwu Ohajiudu (M.S. AQU; Fall 2021) – Current
 - Ashton Schardt (M.S. AQU; Spring 2021) - Current
 - Chris Ward (M.S. AQU; Spring 2021) – Current
 - Andrew Lohman (M.S. AQU; Fall 2019 – Spring 2022) – Graduated
 - James Brown (M.S. AQU; Spring 2019 – Spring 2022) – Graduated
 - Kala-Mallik Meesala (M.S. AQU; Spring 2019 – Fall 2021) – Graduated
 - Joshua Dusci (M.S. AQU; Fall 2018 – Fall 2020) – Graduated

- Eugene Blair (M.S. AQU; Spring 2016 – December 2018) – Graduated
- Kristy Allen (M.S. AQU; Spring 2015 – Fall 2017) – Graduated
- Thomas Drury (M.S. – University of Miami, Florida; conducted an internship in my lab for the Master of Professional Science Degree) – Graduated

- **Undergraduate Research Assistants (supervised and mentored)**

- Rayne Pollack (Spring 2023 – Current)
 - KSU Student in the AFE Program
- Kasha Fisk (Fall 2022 - current)
 - Morehead State Student
- Dominick Williams (Summer 2022)
 - KSU Student
- Mark Johannemann (Fall 2018 – Spring 2021)
 - KSU Student in the AFE Program
 - Supervised Practicum I (AFE 311) Project
- William Drury (Summer 2019)
 - Georgia College and State University student
- Benjamin Lawson (Summer 2017 – Spring 2019)
 - Eastern Kentucky University Student who worked in my lab
- Malik Sims (Fall 2018 – Summer 2019)
 - KSU Student in the MBA Program
- Mayowa Titiloye (Spring 2018 – Summer 2018)
 - KSU Student in the MBA Program
- Adam Cecil (Fall 2014 – Spring 2017)
 - KSU Student in the AFE Program
 - Supervised Practicum I (AFE 311) and Practicum II (AFE 411) Projects
- Jill Fisk (Summer 2017 – Summer 2018)
 - KSU Student in the AFE Program
- Nathan Kring (Spring 2016 – Summer 2017)
 - KSU Student in the AFE Program
 - Supervised Practicum I (AFE 311) and Practicum II (AFE 411) Projects
- Dustin Casey (Spring 2015)
 - KSU Student in the AFE Program
 - Supervised Practicum II (AFE 411) Project
- Phillip Henderson (Fall 2014 – Spring 2015)
 - KSU Student in the AFE Program

- **Undergraduate Mentees**

- Rayne Pollack
 - Supervised Practicum II (AFE 411) Project – Spring 2023
- Savanna Frye
 - Supervised Practicum II (AFE 411) Project – Fall 2021
- James Brace
 - Supervised Practicum II (AFE 411) Project – Fall 2017
- Latrish Williams
 - Supervised Practicum II (AFE 411) Project – Spring 2017
- Kinita Hill
 - Supervised Practicum II (AFE 411) Project – Fall 2016
 - Supervised under the Federal Work Study Program
- Ashley Craigmyle

- Supervised Practicum II (AFE 411) Project – Spring 2016
 - Ashley presented her findings at the 2016 KSU Liberal Arts Symposium
 - Caitlin Mullins
 - Supervised Practicum I (AFE 311) Project – Spring 2016
 - Scott Watts
 - Supervised Practicum II (AFE 411) Project – Spring 2016
- **High School Students**
 - Ariana Billings (Research Assistant, Fall 2022 – current)
 - Started as H.S. Student, transitioning to a KSU Student
 - Kasha Fisk (Research Assistant, Summer 2022 - current)
 - Started as H.S. Student, now a Morehead State University Student
 - Jacob Tracy (Upward Bound Summer Program; Summer 2019)
 - Ottis Jagers (Summer Apprenticeship Student; Summer 2016)
 - Keziah Thomas (Summer Apprenticeship Student; Summer 2016)
 - Anne Holden (Research Assistant; Fall 2014 – Spring 2015)
 - Delyia Oldham (Summer Apprenticeship Student; Summer 2015)
- **Interns**
 - Victor Lobanov – Fall 2021 – From Sweden
 - Alexander Dubsky – Summer 2019 – From Switzerland
 - Jonathan Olsen – Spring 2018 - From Lexington, KY
 - Viktor Vagesjo – Fall 2017 – From Sweden
- **Other Teaching**
 - Collaborating with Russellville High School and Eminence Independent High School
 - Growing shrimp in their classrooms as a STEM learning tool
 - Spring 2022 - present
 - Guest Lecturer at the University of Maine
 - Spring 2021, Spring 2022, and Spring 2023
 - Course Title: Advanced Aquaculture
 - Lecture Title: Marine Shrimp Culture in Recirculating Systems: Past, Present, and Future
 - Guest Lecturer in the New Mexico State University course Food Microbiology
 - Fall 2019
 - Guest Lecturer at the Universidade Federal Do Ceara, Fortaleza, Brazil
 - Fall 2019
 - Lecture Title: Intensive Shrimp Farming in the U.S.A.
 - High Tunnel Greenhouse Experiential STEM Learning Facilities
 - 2016 - current
 - Built and help manage a high tunnel at an elementary school in Versailles and a middle school in Lexington. They contain aquaculture and terrestrial agriculture production systems used to engage and teach students STEM principles.
 - Part of a grant-funded project that has impacted over 100 students
 - Collaboration with Versailles Montessori School and Providence Montessori Middle School
 - Biofloc Technology Shortcourse – Kuwait Institute for Scientific Research
 - 5-day course, taught in Kuwait City, Kuwait, November 2014

SCHOLARLY ACTIVITY:

Highlights

- Brought in **\$3.3 million in external funds in the last eight years**. My funding rate is approximately 50% on nationally competitive grants (not including Evans Allen Projects because these are not externally competitive).
- Published **22 peer-reviewed manuscripts**
- Routinely participate in **national and international professional conferences**, and involve students in those activities.

Funded Grants:

- **The Effects of Density and Salt on Olive Flounder (*Paralichthys olivaceus*) Production in RAS, and Evaluating Full-Scale Production for Inland Farms (Approximately \$400,000)**
 - Research Grant (Lead-PD; 2023 - current)
 - USDA – National Institute of Food and Agriculture, Evans Allen Research Program
- **Providing Experiential Learning Opportunities and Extension training in Aquaculture and Fisheries to Underserved and Underrepresented Student Communities From 1890 Land Grant Institutions. (Subaward - \$145,338 - KSU Portion) - Teaching/Extension Grant (Co-PD; 2023 - current)**
 - USDA-NIFA - 1890 Capacity Building Grant Program
 - A collaboration between KSU, U. of Arkansas Pine Bluff, and Delaware State University
- **How risky are U.S. aquaculture businesses: Economic risk assessment of aquaculture species, production systems, and risk management strategies (\$30,000 – KSU Portion) – Research Grant (Co-PD; 2022 – current)**
 - USDA-NIFA – Special Research Grants Program for Aquaculture Research (ranked #1 proposal in the entire program out of 100 proposals)
 - A collaboration between KSU, MS State University, Texas A&M University, and Virginia Tech
- **Evaluation of the U.S. Shrimp Farming Industry – A Survey-Based Assessment (\$149,663) – Research Grant (Lead PD; 2021 – 2023)**
 - USDA – Animal and Plant Health Inspection Service
 - I was invited by APHIS to lead this project
- **Practical, Integrated Agriculture to Supply Year-Round Farmer Income And Fresh, Nutritious Food to Underserved Communities (\$599,062) - Research, Teaching, and Extension Grant (Lead-PD; 2019 - current)**
 - USDA – National Institute of Food and Agriculture, 1890 Capacity Building Grant Program
 - A collaboration between KSU, the USDA, and FoodChain (a local non-profit combating food insecurity)
- **Integrating biofloc technology with aquaponics to improve sustainable aquaculture production (\$171,698 – KSU Portion) – Research Grant (Co-PD, University of Arkansas Pine Bluff Subaward; 2019 – current)**
 - USDA – National Institute of Food and Agriculture, 1890 Capacity Building Grant Program
 - A collaboration between KSU and the University of Arkansas Pine Bluff
- **Development of shrimp culture technology for sustainable production (\$20,000 per year - \$120,000 so far) – Collaborative Grant, has been renewed annually (Lead-PD; 2018 – current)**
 - NOAA Joint Project Agreement with the Republic of Korea Ministry of Oceans and Fisheries
- **Practical Optimization of an Economical Salt Formulation for Inland, Rural Shrimp Production (\$499,109) - Research and Extension Grant (Lead-PD; 2018 - 2022)**

- USDA-NIFA, AFRI Foundational Program, Small Farms Program.
- A collaboration between KSU, Auburn University, and Purdue University
- **The Practical Use of High Tunnels for Fish and Plant Production, Maximizing Energy and Nutrient Utilization Efficiencies (\$598,604) - Research, Teaching, and Extension Grant (Lead-PD; 2015 - 2019)**
 - USDA – National Institute of Food and Agriculture, 1890 Capacity Building Grant Program
- **Simplifying and Optimizing Denitrification to Facilitate Long-Term Water Use in Recirculating Aquaculture Systems (\$391,802)**
 - Research Grant (Lead-PD; 2018 - 2021)
 - USDA – National Institute of Food and Agriculture, Evans Allen Research Program
- **Southern Regional Aquaculture Center Factsheet Preparation (\$1,650) - Publication Grant (Lead PD; 2018 – 2019)**
 - USDA – National Institute of Food and Agriculture, Southern Regional Aquaculture Center Program.
 - Preparing a publication tentatively titled “Indoor Shrimp Farming”
- **The Effects of Density and Artificial Substrate on Shrimp (*Litopenaeus vannamei*) Production in Recirculating Aquaculture Systems (\$186,666) - Research Grant (Lead-PD; 2015 - 2017)**
 - USDA – National Institute of Food and Agriculture, Evans Allen Research Program
- **Integrated Approach for Sustainable Aquaculture and Agriculture Production with the Use of Reclaimed Water from Rural Communities (\$599,751) Research, Teaching, and Extension Grant (Substitute Lead-PD; 2015 - 2016)**
 - USDA – National Institute of Food and Agriculture, 1890 Capacity Building Grant Program
 - I took over as Lead-PD after the initial PD retired from KSU.
- **Optimizing the use of algal meal (*Schizochytrium sp.*) as a fish oil replacer in the practical diets of Pacific white shrimp (*Litopenaeus vannamei*) (\$32,000) Research Grant (Co-PD, 2015 - 2016)**
 - Alltech Corporation
- **Aquaculture Demonstration – Marine Shrimp in Biofloc Demonstration Grant (\$15,000) Demonstration Grant (Lead-PD; 2014 - 2015)**
 - Kentucky Agricultural Development Board “Sustainability of Farms and Families”
- **An Evaluation of Salt Mixtures for the Culture of *Litopenaeus vannamei* (\$61,278) Research Grant (Lead-PD; 2013 - 2014)**
 - Bosasa Operations (Pty) Ltd., Gauteng, South Africa.
- **The Michael Castagna Student Grant for Applied Research; 2010 - 2011 (\$1,250)**
 - The National Shellfisheries Association, Aquaculture Triennial Meeting, San Diego, CA 2010.
- **SEASPACE Academic Scholarship; 2010 (\$2,000)**
 - SEASPACE Adventure Sports and Travel Expo 2010 Scholarship Program
- **US Environmental Protection Agency Fellowship; 2006 - 2007 (\$1,000)**
 - The University of Charleston through an award from the US EPA

Submitted Grants (pending):

- **Practical methods for enhancing productivity, sustainability, and profitability of marine aquaculture systems to grow healthy food (\$499,453)**
 - USDA – National Institute of Food and Agriculture, 1890 Capacity Building Grant Program
 - Submitted August of 2023, a collaboration with the University of Miami, and Bowling Green State University

Submitted Grants (not funded):

- **Efficient Production of Nutritious Seafood near Consumer Markets to Complement Healthy Lifestyle Choices (\$599,919)**
 - Submitted September 2020 to USDA-NIFA 1890 Capacity Building Grant Program
 - Resubmitted October 2021, reviewers liked the research but not the extension component
- **Sustainable Seafood Security: An Exchange Program to Promote Responsible Aquaculture Actions (\$25,000)**
 - Submitted March, 2020 to the U.S.-Mexico Innovation Fund
 - A collaboration between KSU and the Universidad Autonoma de Baja California, Mexico
- **Sustainable Aquaculture System for Shrimp and Algae Increasing Yield (SASSY) (\$50,471 – KSU Portion)**
 - Submitted May 2020 to the USDA-NIFA Aquaculture Research Program
 - A collaboration between KSU and New Mexico State University
- **Practical, Brackish-Water Aquaponics to Supply Year-Round Farmer Income And Fresh, Nutritious Food to Underserved Communities (\$599,062)**
 - Submitted May 31, 2017 to the USDA-NIFA 1890 Capacity Building Grants Program
 - Re-submitted in 2018 and it was selected for funding
 - A collaboration between KSU, Providence Montessori Middle School (Lexington), Versailles Montessori School (Versailles), Spark Community Café (Versailles), and Foodchain (Lexington)
- **Integrating Aquatic and Terrestrial Agricultural Systems to Enhance Sustainable Food Production (\$299,667)**
 - Submitted November 17, 2015 to the USDA-NIFA Sustainable Agriculture Research and Education Grants Program
 - A collaboration between KSU and the University of Southern Mississippi
- **Demonstration and technology transfer of biofloc marine shrimp production to the private sector along the northern Gulf of Mexico (\$300,000; KSU portion = \$76,000)**
 - Submitted November 2, 2015 to the NOAA, National Marine Fisheries Service, Saltonstall-Kennedy Competitive Research Program
 - A collaboration between KSU, the University of Southern Mississippi, and Auburn University
- **An Algae-based Platform for the Production of Food and Fuel from Waste Water and Carbon Dioxide (\$6,000,000; KSU portion = \$1,336,916)**
 - Submitted February 23, 2015 to the National Science Foundation EPSCoR Program
 - A collaboration between KSU, University of Kentucky, Nicholls State University, Santa Fe Community College, and the University of Delaware

Refereed Publications:

- Bajracharya S., Fisk J., Fleckenstein L., and A.J. Ray. In Review. The effects of system type, salt formulation, and sugar additions on water quality, Pacific white shrimp (*Litopenaeus vannamei*) production, and digestive enzyme activity in intensive RAS. Aquaculture, Submitted, In Review.
- Kring N.A., Fleckenstein L.J., Tierney T.W., Fisk J.C., Lawson B.C., and A.J. Ray. 2023. The effects of stocking density and artificial substrates on production of Pacific white shrimp (*Litopenaeus vannamei*) and water quality dynamics in greenhouse-based biofloc systems. Aquacultural Engineering 101. <https://doi.org/10.1016/j.aquaeng.2023.102322>
- Fleckenstein L.J., Tierney T.W., Fisk J.C., and A.J. Ray. 2022. Using alternative low-cost artificial sea salt mixtures for intensive, indoor shrimp (*Litopenaeus vannamei*) production. Aquaculture Reports 24. <https://doi.org/10.1016/j.aqrep.2022.101147>

- Tierney T.W., Fleckenstein L.J., and A.J. Ray. 2021. Evaluating a low-cost salt mixture in brackish water intensive shrimp (*Litopenaeus vannamei*) production systems. *Aquaculture Research* 52(7): 3087-3092. DOI: 10.1111/are.15152
- Fleckenstein, L.J. Tierney, T.W., Fisk, J.C., and A.J. Ray. 2020. The effects of different solids and biological filters in intensive pacific white shrimp (*Litopenaeus vannamei*) production systems. *Aquacultural Engineering* 91. <https://doi.org/10.1016/j.aquaeng.2020.102120>
- Fischera, H., Romanoa, N., Renukdasb, N., Egnewa, N., Sinhaa, A.K., and A.J. Ray. 2020. The potential of rearing juveniles of bluegill, *Lepomis macrochirus*, in a biofloc system. *Aquaculture Reports* 17. <https://doi.org/10.1016/j.aqrep.2020.100398>
- Fleckenstein, L.J., Kring, N.A., Tierney, T.W., Fisk, J.C., Lawson, B.C., and A.J. Ray. 2020. The effects of artificial substrate and stocking density on Pacific white shrimp (*Litopenaeus vannamei*) performance and water quality dynamics in high tunnel-based biofloc systems. *Aquacultural Engineering* 90. <https://doi.org/10.1016/j.aquaeng.2020.102093>
- Tierney, T.W., Fleckenstein, L.J., and A.J. Ray. 2020. The effects of density and artificial substrate on intensive shrimp *Litopenaeus vannamei* nursery production. *Aquacultural Engineering* 89. <https://doi.org/10.1016/j.aquaeng.2020.102063>
- Fleckenstein, L.J., Tierney, T.W., and A.J. Ray. 2019. Effects of supplemental LED lighting on water quality and Pacific white shrimp (*Litopenaeus vannamei*) performance in intensive recirculating Systems. *Aquaculture* 504: 219-226.
- Ray, A.J., Leffler, J.W., and C.L. Browdy. 2019. The effects of a conventional feed versus a fish-free feed and biofloc management on the nutritional and human sensory characteristics of shrimp (*Litopenaeus vannamei*). *Aquaculture International* 27: 261-277.
- Weineck, K., Ray, A., Fleckenstein, L., Medley, M., Dzubuk, N., Piana, E., and R. Cooper. 2018. Physiological changes as a measure of crustacean welfare under different standardized stunning techniques: Cooling and electroshock. *Animals* 8 (158): 1-21.
- Tierney, T.W., and A.J. Ray. 2018. Comparing biofloc, clear-water, and hybrid nursery systems (Part I): Shrimp (*Litopenaeus vannamei*) production, water quality, and stable isotope dynamics. *Aquacultural Engineering* 82: 73-79.
- Fleckenstein, L.J., Tierney, T.W., and A.J. Ray. 2018. Comparing biofloc, clear-water, and hybrid recirculating nursery systems (Part II): Tilapia (*Oreochromis niloticus*) production and water quality dynamics. *Aquacultural Engineering* 82: 80-85.
- Wycoff, S., Weineck, K., Conlin, S., Suryadevara, C., Grau, E., Bradley, A., Cantrell, D., Eversole, S., Grachen, C., Hall, K., Hawthorne, D., Kinmon, C., Guerrero, P.O., Patel, B., Samuels, K. Valdes, F., Ray, A., Fleckenstein, L., Piana, E., and Cooper R. 2018. Effects of clove oil (eugenol) on proprioceptive neurons, heart rate, and behavior in model crustaceans. *Impulse* 2018: 1–21.
- Ray, A.J., and J.M. Lotz. 2017. Comparing salinities of 10, 20, and 30‰ in intensive, commercial-scale biofloc shrimp (*Litopenaeus vannamei*) production systems. *Aquaculture* 476: 29-36.
- Ray, A.J., Drury, T.H., and Cecil, A. 2017. Comparing clear-water RAS and biofloc systems: Shrimp (*Litopenaeus vannamei*) production, water quality, and biofloc nutritional contributions estimated using stable isotopes. *Aquacultural Engineering* 77: 9-14.
- Ray, A.J., and J.M. Lotz. 2017. Shrimp (*Litopenaeus vannamei*) production and stable isotope dynamics in clear-water RAS versus biofloc systems. *Aquaculture Research* 48: 4390-4398.
- Joesting, H.M., Blaylock, R., Biber, P., and A. Ray. 2016. The use of marine aquaculture solid waste for nursery production of the salt marsh plants *Spartina alterniflora* and *Juncus roemerianus*. *Aquaculture Reports* 3: 108-114.
- Ray, A.J., and J.M. Lotz. 2014. Comparing a chemoautotrophic-based biofloc system and three heterotrophic-based systems receiving different carbohydrate sources. *Aquacultural Engineering* 63: 54-61.

- Ray A.J., Seaborn G., Vinatea L., Browdy C.L., and J.W. Leffler. 2012. Effects of biofloc reduction on microbial dynamics in minimal-exchange, superintensive shrimp (*Litopenaeus vannamei*) culture systems. *Journal of the World Aquaculture Society* 43(6): 790-801.
- Ray A.J., Dillon K.S., and J.M. Lotz. 2011. Water quality dynamics and shrimp (*Litopenaeus vannamei*) production in intensive, mesohaline culture systems with two levels of biofloc management. *Aquacultural Engineering* 45: 127-136.
- Ray A.J., Seaborn G., Wilde S.B., Leffler J.W., Lawson A., and C.L. Browdy. 2010. Characterization of microbial communities in minimal-exchange, intensive aquaculture systems and the effects of suspended solids management. *Aquaculture* 310: 130-138.
- Ray A.J., B.L. Lewis, C. L. Browdy, and J.W. Leffler. 2010. Suspended solids removal to improve shrimp (*Litopenaeus vannamei*) production and an evaluation of a plant-based feed in minimal-exchange, superintensive culture systems. *Aquaculture* 299: 89-98.

Book Chapters:

- Ray, A.J. 2014. Biofloc technology for super-intensive shrimp culture. Pages 177-198 In Y. Avnimelech, ed. *Biofloc Technology: A Practical Guidebook*, 3rd Ed., The World Aquaculture Society, Baton Rouge, Louisiana, USA.
- Browdy C.L., Ray A.J., Leffler J.W., and Y. Avnimelech. 2012. Biofloc based aquaculture systems. Pages 278-307 In J.H. Tidwell, ed. *Aquaculture Production Systems*, Wiley-Blackwell, Oxford, UK.
- Ray, A.J. 2012. Biofloc technology for super-intensive shrimp culture. Pages 167-187 In Y. Avnimelech, ed. *Biofloc Technology: A Practical Guide Book*, 2nd Ed., The World Aquaculture Society, Baton Rouge, Louisiana, USA.
- Ray A.J., A.J. Shuler, J.W. Leffler, and C.L. Browdy. 2009. Microbial ecology and management of biofloc systems. Pages 255-266 In C.L. Browdy and D.E. Jory, eds. *The Rising Tide, Proceedings of the Special Session on Sustainable Shrimp Farming, World Aquaculture 2009*. World Aquaculture Society, Baton Rouge, Louisiana.

Magazine Articles:

- Johannemann, M.E., Fleckenstein, L.J., and A.J. Ray. 2022. The Effects of Carbon:Nitrogen Ratio on Suspended-Growth Denitrification in Small-Scale, Closed-System Shrimp Farming. *World Aquaculture Magazine*. March 2022.
- Ray, A.J., Tierney T.W., Fleckenstein L.J., and J.C. Fisk. 2022. Alternative, low-cost artificial sea salt mixtures for intensive, indoor shrimp production. *Responsible Seafood Advocate*. July 25, 2022.
- Ray, A.J., and R. Rode. 2019. Small-scale, year-round shrimp farming in temperate climates. *Aquaculture Magazine*. February/March 2019 Issue: 34-35.
- Fleckenstein, L.J., Tierney, T.W., and A.J. Ray. 2018. Comparing biofloc, clear-water and hybrid RAS systems as tilapia nurseries. *The Global Aquaculture Advocate*. October 1, 2018.
- Ray, A.J., and J.M. Lotz. 2018. Comparing salinities in intensive, commercial-scale biofloc for Pacific white shrimp. *The Global Aquaculture Advocate*. April 16, 2018.
- Ray, A.J., Drury, T.H., and Cecil, A. 2017. Biofloc and clear-water RAS systems: a comparison. *The Global Aquaculture Advocate*. June 19, 2017. Number One Top Article of 2017.
- Ray, A.J., and J.M. Lotz. 2016. Testing shrimp growth in different biofloc systems. *The Global Aquaculture Advocate*. July 22, 2016.
- Ray, A.J. 2015. Indoor-raised shrimp find potential market in Kentucky State University test. *The Global Aquaculture Advocate* 18(6): 76-77.
- Ray, A.J., and J.M. Lotz. 2014. A method of intensive shrimp production: Faster growth, lower FCR. *The Practical, Asian Aquaculture Network* 5(17): 8-11.

- Ray A.J., and J.M. Lotz. 2014. Biofloc trial results in fast shrimp growth, low FCR, high survival. *The Global Aquaculture Advocate* 17(1): 22-23.
- Ray A.J., and J.M. Lotz. 2012. Study shows lower biofloc concentration may improve shrimp production. *The Global Aquaculture Advocate* 15(2): 28-31.
- Ray A.J., Lotz J.M., Brunson J.F., and J.W. Leffler. 2011. Shrimp sampling method improves stocking process. *The Global Aquaculture Advocate* 14(4): 14-15.
- Ray A.J., Lewis B.L., Browdy C.L., and J.W. Leffler. 2011. Suspended solids removal to improve *Litopenaeus vannamei* production in minimal-exchange, superintensive culture systems. *Panorama Acuicola* 16(3): 8-21.
- Ray A.J., J.A. Venero, C.L. Browdy, and J.W. Leffler. 2010. Simple settling chambers aid solids management in biofloc systems. *The Global Aquaculture Advocate* 13(4): 28-30.

Thesis and Dissertation:

- Ray A.J. 2008. The effects of simple management techniques on microbial community dynamics within biofloc-based culture systems and the relationship to shrimp (*Litopenaeus vannamei*) production. Master's Thesis, The University of Charleston, Charleston, South Carolina, USA
- Ray A.J. 2012. Management of biological and chemical constituents for the advancement of intensive, minimal-exchange, biofloc-based shrimp (*Litopenaeus vannamei*) aquaculture. Ph.D. Dissertation, The University of Southern Mississippi, Mississippi, USA.

Extension Publications:

- Ray, A.J. 2021. Small-scale, year-round shrimp farming in temperate climates. North Central Regional Aquaculture Center, Fact Sheet # 124.
- Ray, A.J. 2019. Indoor marine shrimp farming. Southern Regional Aquaculture Center, Publication No. 2602, 7 pp.
- Ray, A.J. 2018. Banking on shrimp. Agknowledge, KSU's Community Research Service Publication. 2017 Ed., Vol. 3.
- Ray, A.J. 2017. Innovative aquaculture production. Agknowledge, KSU's Community Research Service Publication. 2018 Ed., Vol. 4.
- Ray, A.J. 2016. Nitrate accumulation in aquaculture – The problem and potential solutions. The Indiana Aquaculture Association December Newsletter.
- Ray, A.J. 2016. The basics of biofloc aquaculture systems. Buckeye Aquafarming, The Ohio State University Extension Services. 1(2): 6-7.

Online Publications:

- Fisk, J.C. and Ray, A.J. 2023. TSS:VSS Days 1, 2, and 3 & 4. A series of YouTube Videos on measuring solids in water samples. (<https://www.youtube.com/watch?v=Cgq8UIgMbPA>) (<https://www.youtube.com/watch?v=puUqQkmEzRk>) (<https://www.youtube.com/watch?v=DLMzbG3CBsE>)
- Ray, A.J. 2021. Water Quality Basics for the High School Classroom. YouTube Video. (<https://www.youtube.com/watch?v=yxWZny0Dtro&t=98s>)
- Ray, A.J. 2021. Spark Community Café. YouTube Video. (https://www.youtube.com/watch?v=Po0xDgWx_9I)
- Ray, A.J. 2018. Kentucky State University Solar Panels at High Tunnels. YouTube Video. (<https://www.youtube.com/watch?v=Jr6bwg-xv-o&t=257s>)

- Ray, A.J. 2018. Indoor Shrimp Farming at KSU. YouTube Video. 18,000 views as of October 31, 2023 (<https://www.youtube.com/watch?v=TyklSdtbmn8&t=745s>).
- Ray, A.J. 2017. Indoor Shrimp Aquaculture. Online Webinar. (<https://www.ncrac.org/video/indoor-shrimp-aquaculture>)
- Ray, A.J. 2016. Growing Marine Shrimp in a Bio Floc System. YouTube Video. Over 214,000 Views as of October 31, 2023 (https://www.youtube.com/watch?v=IwbDqB0C_-Y&t=9s)
- Ray, A.J. 2016. Constructing Fish Tanks in High Tunnel Greenhouses. YouTube Video. 203,000 Views as of October 31, 2023 (<https://www.youtube.com/watch?v=HuJyqM719wE&t=69s>)

Oral Scientific Presentations:

- Ray A.J., Fleckenstein L.J., Kring N.A., Fisk J.C. 2023. Short term effects of elevated nitrite and nitrate on Pacific white shrimp (*Litopenaeus vannamei*) survival. Aquaculture Europe, Vienna, Austria.
- Johannemann M.E., Fleckenstein L.J., Ray A.J. 2023. The effects of woodchip biomedica and different carbon sources in denitrification systems coupled with shrimp RAS. Aquaculture Europe, Vienna, Austria.
- Fisk J.C., Kershaw J.C., Nieschwitz N.C., Hites T.L., Fleckenstein L.J., Kring N.A., Ray A.J. 2023. Human sensory characteristics of kale winterbor F1 hybrid *Brassica oleracea* grown in decoupled brackish-water aquaponics systems at various salinities. Aquaculture Europe, Vienna, Austria.
- Ray A.J., Fisk J.C., Fleckenstein L.J. 2023. Edible and marketable plant species in brackish-water aquaponics. Aquaculture America, New Orleans, Louisiana, USA.
- Fleckenstein L.J., Fisk J.C., Ray A.J. 2023. Salinity tolerance of bell pepper *Capsicum annuum* in brackish water. Aquaculture America, New Orleans, Louisiana, USA.
- Rana G., Ray A.J. 2023. The effects of system type and horizontal substrate addition on Pacific white shrimp *Litopenaeus vannamei* production and water quality in RAS. Aquaculture America, New Orleans, Louisiana, USA.
- Johannemann M.E., Fleckenstein L.J., Ray A.J. 2023. The effects of endogenous vs. exogenous carbon sources and woodchip media in denitrification filters coupled with shrimp production systems. Aquaculture America, New Orleans, Louisiana, USA.
- Kershaw J.C., Fisk J.C., Nieschwitz N.C., Hites T.L., Fleckenstein L.J., Kring N.A., Ray A.J. 2023. The effect of salinity on human sensory characteristics of kale winterbor F1 hybrid *Brassica oleracea* grown in decoupled brackish-water aquaponics systems. Aquaculture America, New Orleans, Louisiana, USA.
- Ray A.J., Fisk J.C., Fleckenstein L.J. 2022. Non-halophyte plant species in brackish-water aquaponics. Aquaculture Europe, Rimini, Italy.
- Ray A.J., Johannemann M.E., Fleckenstein L.J. 2022. Low-cost denitrification in brackish water aquaculture production. Aquaculture Europe, Rimini, Italy.
- Ray A.J., Fisk J.C., Fleckenstein L.J. 2022. Non-halophyte plant species in brackish-water aquaponics. Aquaculture Canada and WAS North America, St. John's, Newfoundland, Canada.
- Fleckenstein L.J., Johannemann M.E., Ray A.J. 2022. Low-cost denitrification in brackish water aquaculture production. Aquaculture Canada and WAS North America, St. John's, Newfoundland, Canada.
- Fisk J.C., Fleckenstein L.J., Kring N.A., Ray A.J. 2022. Comparing performance of coupled and decoupled brackish water aquaponics systems using kale winterbor F1 hybrid *Brassica oleracea* and Pacific white shrimp *Litopenaeus vannamei*. Aquaculture 2022, San Diego, California, USA.
- Fleckenstein L.J., Fisk J.C., Kring N.A., Lobanov V., Ray A.J. 2022. Effects of different iron compounds and aqueous iron concentrations on kale winterbor performance in brackish water

- hydroponics. Aquaculture 2022, San Diego, California, USA.
- Fleckenstein L.J., Johannemann M.E., Ray A.J. 2021 Effect of woodchips, bio-beads, and expanded clay pellets on denitrification efficiency in reused shrimp aquaculture water. Aquaculture America 2021, San Antonio, Texas, USA.
 - Johannemann M.E., Fleckenstein L.J., Ray A.J. 2021. The effects of carbon/nitrogen ratio on suspended growth denitrification in reused brackish aquaculture water. Aquaculture America 2021, San Antonio, Texas, USA.
 - Bajracharya S., Fleckenstein L.J., Fisk J.C., Kring N.A., Ray A.J. 2021 The effects of system type, salt formulation, and sugar additions on Pacific white shrimp (*Litopenaeus vannamei*) production, digestive enzyme activity, and dissolved mineral composition. Aquaculture America 2021, San Antonio, Texas, USA.
 - Ray A.J. 2020. Marine shrimp culture in Recirculating Systems: Past, Present and Future. 50th Anniversary of the Fisheries Engineering Undergraduate Program of the Federal Rural University of Pernambuco. Virtual Conference Presentation.
 - Fleckenstein L.J., Fisk J.C., Ray A.J. 2020. Recent developments in brackish water aquaponics at Kentucky State University. Aquaponics Association Conference 2020, Virtual. October 16-18, 2020.
 - Fisk, J. C., Fleckenstein, L. J., Ray, A. J. 2020. Non-halophyte Brassicaceae species in Brackish water aquaponics. Invited presentation given at the Aquaponics Association Annual Conference, virtual. October 16-18, 2020.
 - Ray A.J., Tierney T.W., Fleckenstein L.J. 2020. Evaluating intensive brackish-water shrimp (*L. vannamei*) production using inexpensive salt mixtures. Aquaculture America Conference 2020, Honolulu, Hawaii, USA.
 - Adams A.A., Ray A.J. 2020. Evaluating *Spartina alterniflora* in decoupled aquaponics to remediate reused shrimp (*Litopenaeus vannamei*) water. Aquaculture America Conference 2020, Honolulu, Hawaii, USA.
 - Fisk J.C., Fleckenstein L.J., Tierney T.W., Ray A.J. 2020. Suitability of Kale Winterbor F1 hybrid (*Brassica oleracea*) in Brackish Water Aquaponics Applications. Aquaculture America Conference 2020, Honolulu, Hawaii, USA.
 - Fleckenstein L.J., Fisk J.C., Tierney T.W., Ray A.J. 2020. Suitability of Sea Purslane (*Sesuvium portulacastrum*) in Brackish Water Aquaponics. Aquaculture America Conference 2020, Honolulu, Hawaii, USA.
 - Ray A.J., Kring N. 2019. The effects of stocking density and artificial substrate on production of Pacific white shrimp (*Litopenaeus vannamei*) and water quality dynamics in greenhouse-based biofloc systems. Latin American and Caribbean Aquaculture Conference 2019, San Jose, Costa Rica.
 - Tierney T.W., Fleckenstein L.J., Ray A.J. 2019. Evaluating a low-cost salt mixture in brackish water intensive shrimp (*Litopenaeus vannamei*) production systems. Latin American and Caribbean Aquaculture Conference 2019, San Jose, Costa Rica.
 - Ray A.J., Fisk J.C., Fleckenstein L.J., Tierney T.W. 2019. The use of inexpensive salt mixtures for inland, intensive shrimp (*Litopenaeus vannamei*) farming. Aquaculture Europe 2019, Berlin Germany.
 - Ray A.J., Kring N. 2019. The effects of stocking density and artificial substrate on production of Pacific white shrimp (*Litopenaeus vannamei*) and water quality dynamics in greenhouse-based biofloc systems. RASTech 2019 Conference, Washington DC, USA.
 - Fleckenstein L.J., Ray A.J. 2019. Effects of LED lighting on Pacific white shrimp performance and water quality in intensive RAS. RASTech 2019 Conference, Washington DC, USA.
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- Kring N.A., Ray A.J. 2019. The effects of stocking density and artificial substrate on Pacific white shrimp *Litopenaeus vannamei* production and water quality dynamics in greenhouse-based biofloc systems. Aquaculture 2019 Meeting Abstract Book, New Orleans, Louisiana, USA.
- Fleckenstein L.J., Ray A.J. 2019. The effects of different solids and biological filters in Pacific white shrimp production systems. Aquaculture 2019 Meeting Abstract Book, New Orleans, Louisiana, USA.
- Ragaza J.A., Rossi, W., Habte-Tsion H.M., Kolimadu G.D., Yadav A.K., Ray A.J. 2019. Use of recovered biofloc material from production tanks as feed ingredient in diets of Pacific white shrimp *Litopenaeus vannamei*. Aquaculture 2019 Meeting Abstract Book, New Orleans, Louisiana, USA.
- Fleckenstein, L.J. Kring, N., and Ray, A.J. 2018. The effects of vertical substrate and shrimp *Litopenaeus vannamei* density on water quality and production dynamics in intensive greenhouse-based biofloc systems. Aquaculture America 2018 Meeting Abstract Book, Las Vegas, Nevada, USA.
- Fleckenstein L.J., Ray A.J. 2018. Effects of supplemental LED lighting on water quality and Pacific white shrimp (*Litopenaeus vannamei*) performance in a chemoautotrophic-based hybrid system. Aquaculture America 2018 Meeting Abstract Book, Las Vegas, Nevada, USA.
- Kring N.A., Ray A.J. 2018. Polyculture of Pacific white shrimp *Litopenaeus vannamei* and juvenile tilapia *Oreochromis niloticus* in indoor biofloc aquaculture systems. Aquaculture America 2018 Meeting Abstract Book, Las Vegas, Nevada, USA.
- Tierney, T.W., and Ray, A.J. 2018. The effects of density and artificial substrate on intensive shrimp (*Litopenaeus vannamei*) nursery production. Aquaculture America 2018 Meeting Abstract Book, Las Vegas, Nevada, USA.
- Grau, E., Kinmon, C., Bradley, A., Cantrell, D., Eversole, S., Grachen, C., Hall, K., Hawthorne, D., Ortiz-Guerrero, P., Patel, B., Samuels, K., Suryadevara, C., Valdes, G., Wycoff, S., Weineck, K., Conlin, S., Ray, A., Fleckenstein, L., Piana, E., and Cooper, R.L. 2018. Investigating potential mechanisms of clove oil (eugenol) in model crustaceans. Aquaculture America 2018 Meeting Abstract Book, Las Vegas, Nevada, USA.
- Ray, A.J., and Kring, N.A. 2017. Polyculture of Pacific white shrimp *Litopenaeus vannamei* and juvenile tilapia *Oreochromis niloticus* in indoor biofloc systems. Latin American and Caribbean Aquaculture 2017 Conference, Mazatlán, Mexico.
- Ray, A.J., Fleckenstein, L., Barksdale, J.O.B., Cecil, A., and Kring, N. 2017. Integrating biofloc systems with organic plant production and renewable energy at KSU's high tunnel complex. Aquaculture America 2017 Meeting Abstract Book, San Antonio, Texas, USA.
- Tierney, T.W., and Ray, A.J. 2017. A comparison of biofloc, clear-water, and hybrid culture systems for intensive shrimp (*Litopenaeus vannamei*) nursery production. Aquaculture America 2017 Meeting Abstract Book, San Antonio, Texas, USA.
- Barksdale, J.O.B., Fleckenstein, L., and Ray, A.J. 2017. The effects of supplementary LED lights on the function of biofloc systems and growth of tilapia. Aquaculture America 2017 Meeting Abstract Book, San Antonio, Texas, USA.
- Barksdale, J.B.O., Fleckenstein, L., and Ray, A.J. 2017. The Effects of Supplementary LED Lights on the Function of Biofloc Systems and Growth of Tilapia. Association of 1890 Research Directors Research Symposium, April 1-4, 2017, Atlanta, GA, USA.
- Gamez, E.R., and Ray, A.J. 2017. Static aquaponics systems for the removal of nitrate and metals from reused marine biofloc water. Association of 1890 Research Directors Research Symposium, April 1-4, 2017, Atlanta, GA, USA.

- Tierney, T.W., and Ray, A.J. 2017. A Comparison of Biofloc, Clear-Water, and Hybrid Culture Systems for Intensive Shrimp (*Litopenaeus vannamei*) Nursery Production. Association of 1890 Research Directors Research Symposium, April 1-4, 2017, Atlanta, GA, USA.
- Kring, N.A., and Ray, A.J. 2017. Polyculture of Pacific white shrimp *Litopenaeus vannamei* and juvenile tilapia *Oreochromis niloticus* in indoor biofloc aquaculture systems. Association of 1890 Research Directors Research Symposium, April 1-4, 2017, Atlanta, GA, USA.
- Ray, A.J., Cecil, A., and Auberry, W.P. 2016. Indoor marine shrimp production at Kentucky State University. Aquaculture 2016 Meeting Abstract Book, Las Vegas, Nevada, USA.
- Drury, T.H., and Ray, A.J. 2016. Shrimp production in clear water and biofloc systems. Aquaculture 2016 Meeting Abstract Book, Las Vegas, Nevada, USA.
- Thompson, K.R., Allen, K.M., Bowman, B.A., Cummins, V.C., Filer, K., Tidwell, J.H., Ray, A.J., and V. Kumar. 2016. Use of algal meal, soybean meal, and decreasing levels of fish oil in practical diets without fish meal for Pacific white shrimp *Litopenaeus vannamei* Aquaculture 2016 Meeting Abstract Book, Las Vegas, Nevada, USA.
- Allen, K.M., Bowman, B.A., Thompson, K.R., Cummins, V.C., Filer, K., Tidwell, J.H., Ray, A.J., and V. Kumar. 2016. Optimizing the use of algal meal *Schizochytrium sp.* as a fish oil replacer in the practical diets of Pacific white shrimp *Litopenaeus vannamei*. Aquaculture 2016 Meeting Abstract Book, Las Vegas, Nevada, USA.
- Ray, A.J. 2015. Applications and advancements in biofloc technology. Aquaculture America Annual Meeting Abstract Book, New Orleans, Louisiana, USA.
- Ray, A.J. 2014. Perspectives and innovations in biofloc-based aquaculture. Proceedings of the 10th International Conference on Recirculating Aquaculture, Roanoke, Virginia, USA. (Invited)
- Ray, A.J., and J.M. Lotz. 2014. Clear water RAS versus biofloc technology and an evaluation of the nutritional contribution of biofloc to shrimp (*Litopenaeus vannamei*). Proceedings of the 10th International Conference on Recirculating Aquaculture, Roanoke, Virginia, USA. (Invited)
- Ray, A.J. 2013. Perspectives and innovations in biofloc-based aquaculture. Proceedings of the 15th Annual Ecuadorian Aquaculture and AquaExpo Conference, Guayaquil, Ecuador. (Invited Expert Lecturer)
- Ray, A.J. 2013. Sustainable aquaculture – biofloc systems for farming of shrimp and prawn. Proceedings of the 50th Annual Meeting of the Brazilian Society of Animal Science, Campinas, Sao Paulo, Brazil. (Invited Expert Lecturer)
- Ray A.J., and J.M. Lotz. 2013. A preliminary comparison of Clearwater RAS and biofloc-based shrimp *Litopenaeus vannamei* culture systems. Aquaculture 2013 Abstract Book, Nashville, Tennessee, USA.
- Ray A.J., and J.M. Lotz. 2013. Recent indoor shrimp *Litopenaeus vannamei* production research at the Gulf Coast Research Laboratory. Aquaculture 2013 Abstract Book, Nashville, Tennessee, USA.
- Ray A.J., and J.W. Leffler. 2013. Biofloc-based shrimp culture systems: Advantages, challenges, and the state of current research. Aquaculture 2013 Abstract Book, Nashville, Tennessee, USA.
- Ray A.J., Wood M.E., and J.M. Lotz. 2012. Comparing salinities of 10, 20, and 30‰ in minimal-exchange, intensive shrimp *Litopenaeus vannamei* culture systems. Aquaculture America Annual Meeting Abstract Book, Las Vegas, Nevada, USA.
- Ray A.J., Breland V.M., Farno C.C., Dillon K.S., and J.M. Lotz. 2012. Comparing chemoautotrophic-based systems and the use of three carbohydrates to promote heterotrophic-based biofloc shrimp *Litopenaeus vannamei* culture systems. Aquaculture America Annual Meeting Abstract Book, Las Vegas, Nevada, USA.
- Ray A.J., Farno C.C., Breland V.M., Duncan J.A., Nicholson C., and J.M. Lotz. 2011. The effects of biofloc management on shrimp (*Litopenaeus vannamei*) production and water quality in mesohaline, intensive culture systems. Marine and Estuarine Graduate Student Association/American Fisheries Society Lunchtime Lecture Series, Ocean Springs, Mississippi, USA. (Invited)

- Ray A.J., Farno C.C., Breland V.M., Dillon K.S., and J.M. Lotz. 2011. Differences in chemical dynamics between chemoautotrophic and three different heterotrophic biofloc-based shrimp (*Litopenaeus vannamei*) culture systems. The National Shellfisheries Association Annual Meeting Abstract Book, Baltimore, Maryland, USA.
- Ray A.J., Farno C.C., Breland V.M., Duncan J.A., Nicholson C., and J.M. Lotz. 2011. Refining biofloc management in mesohaline, intensive shrimp (*Litopenaeus vannamei*) culture systems. Aquaculture America Annual Meeting Abstract Book, New Orleans, Louisiana, USA.
- Ray A.J., and J.M. Lotz. 2011. Solids management in biofloc-based aquaculture systems. Aquaculture America Annual Meeting Abstract Book, New Orleans, Louisiana, USA.
- Ray A.J., and J.M. Lotz. 2011. Minimal-exchange, superintensive systems for sustainable shrimp aquaculture. Alabama Inland Shrimp Producers Meeting, Greensboro, Alabama, USA. (Invited)
- Ray A.J., Seaborn G., Drake M.A., Browdy C.L., and J.W. Leffler. 2010. The effects of fish-based versus plant-based feeds and solids management on shrimp (*Litopenaeus vannamei*) flesh characteristics. Aquaculture 2010 Abstract Book, San Diego, California, USA.
- Ray A.J., Seaborn G., Drake M.A., Browdy C.L., and J.W. Leffler. 2010. The effects of protein source and suspended solids on nutritional and sensory characteristics of shrimp (*Litopenaeus vannamei*). The 13th Annual Gulf Coast Graduate Student Symposium Abstract Book, Gulf Coast Research Laboratory, Ocean Springs, Mississippi, USA.
- Ray A.J., Shuler A.J., Browdy C.L., and J.W. Leffler. 2009. Microbial ecology and biofloc management of minimal exchange superintensive shrimp *Litopenaeus vannamei* culture systems. World Aquaculture Annual Meeting Abstract Book, Veracruz, Mexico.
- Ray A.J., Shuler A.J., Browdy C.L., and J.W. Leffler. 2009. Microbial ecology and biofloc management of minimal exchange superintensive shrimp *Litopenaeus vannamei* culture systems. Asian-Pacific Aquaculture Annual Meeting Abstract Book, Kuala Lumpur, Malaysia.
- Ray A.J., Leffler J.W., Seaborn G., Venero J.A., and C.L. Browdy. 2009. Effects of fishmeal versus soybean-based feeds and solids removal by settling tanks and tilapia on high-density shrimp (*Litopenaeus vannamei*) production in biofloc culture systems. Aquaculture America Annual Meeting Abstract Book, Seattle, Washington, USA.
- Ray A.J., Browdy C.L., Lewis B.L., Venero J.A., Vinatea L., Shuler A., and J.W. Leffler. 2009. Differences in shrimp (*Litopenaeus vannamei*) production and microbial dynamics as they relate to dietary protein source and solids management in minimal exchange superintensive culture systems. National Shellfisheries Association Annual Meeting Abstract Book, Savannah, Georgia, USA.
- Leffler J.W., Ray A.J., Lewis B.L., Venero J.A., Vinatea L., Shuler A.J., and C.L. Browdy. 2009. Effects of an organic certifiable plant-based diet in conjunction with solids removal on the production of shrimp (*Litopenaeus vannamei*) in minimal exchange superintensive biofloc systems. World Aquaculture Annual Meeting Abstract Book, Veracruz, Mexico USA.
- Leffler J.W., Venero J.A., Ray A.J., Lewis B.L., Lawson A., Haveman J., and C.L. Browdy. 2009. Development of sustainable, commercially viable "organic" shrimp production by integrating plant-based feeds with microbial biofloc community structure. National Shellfisheries Association Annual Meeting Abstract Book, Savannah, Georgia, USA.
- Ray A., Shuler A., McAbee B., Seaborn G., Wilde S., Browdy C.L., and J.W. Leffler. 2008. Influence of microbial community dynamics on the production of shrimp *Litopenaeus vannamei* in zero exchange biofloc systems. Aquaculture America Annual Meeting Abstract Book. Orlando, Florida, USA.
- Ray A., Shuler A., McAbee B., Seaborn G., Wilde S., Browdy C.L., and J.W. Leffler. 2008. Relationships between shrimp (*Litopenaeus vannamei*) growth parameters and microbial abundance in zero exchange culture systems. South Carolina Chapter of the American Fisheries Society and South Carolina Fishery Workers Association Joint Meeting. Santee, SC, USA.

Oral Extension Presentations:

- Ray, A.J., and Durborow, R.M. 2023. The Kentucky State University Aquaculture Program. Aquaculture America, New Orleans, Louisiana, USA.
- Ray, A.J. 2019. Cultivo de Camarao em Sistema Intensivo com Ambientes Fechados (Greenhouse and Indoor). Aquain' 19, Tecnologia em Cultivo Intensivo de Camarao, Workshop in Natal, Brazil.
- Ray, A.J. 2018. Indoor Shrimp Farming and KSU. KSU Indoor Shrimp Farming Workshop, Frankfort, Kentucky, USA.
- Ray, A.J. 2018. Indoor Shrimp Production at KSU. KSU Third Thursday Thing Extension Event. Frankfort, Kentucky, USA.
- Ray, A.J. 2017. Overview of indoor marine shrimp production systems, nutrition, and water quality. KSU Indoor Tilapia, Shrimp, and Aquaponics Workshop, Frankfort, Kentucky, USA.
- Fleckenstein, L.J., and Ray, A.J. 2017. Effects of LED lighting on Pacific white shrimp performance and water quality in intensive RAS. KSU Third Thursday Thing Extension Event. Frankfort, Kentucky, USA.
- Ray, A.J. 2016. Introduction and Fundamental Concepts to Recirculating Aquaculture, Biological and Chemical Processes in Recirculating Aquaculture, and Engineering and Design Concepts in Recirculating Aquaculture. The Shrimp Academy, Sherlock Shrimp Company, Ridgeway, Iowa, USA.
- Ray, A.J. 2016. Biofloc management, water quality, RAS alternative rearing. Marine Shrimp Workshop, The Indiana Aquaculture Association, Indianapolis, Indiana, USA.
- Ray, A.J. 2016. Shrimp aquaculture. The 2016 Iowa Aquaculture Conference, Des Moines, Iowa, USA.
- Ray, A.J. 2016. Indoor marine shrimp production at Kentucky State University. KSU Third Thursday Thing Extension Event. Frankfort, Kentucky, USA.
- Ray, A.J. 2015. Applications of Intensive and Semi-intensive Aquaculture Systems in Kentucky. KSU Third Thursday Thing Extension Event. Frankfort, Kentucky, USA.

Poster Presentations:

- Kim Su-Kyoung, Ray A.J. 2021. Effect of water depth on *Litopenaeus vannamei* production and water quality in biofloc systems. Aquaculture America, San Antonio, Texas, USA.
- Ray A.J., Fisk J.C., Fleckenstein L.J., Tierney T.W. 2019. The use of inexpensive salt mixtures for inland, intensive shrimp (*Litopenaeus vannamei*) farming. Aquaculture Europe 2019, Berlin Germany.
- Kring N.A., and Ray A.J. 2017. Polyculture of Pacific white shrimp, *Litopenaeus vannamei*, and juvenile tilapia, *Oreochromis niloticus*, in indoor biofloc aquaculture systems. Posters at the Capital, Frankfort, Kentucky, March 2, 2017.
- Gamez E.R., Cuevas-Uribe R., Mims S.D., and Ray A.J. 2016. Tissue concentrations of heavy metals in hybrid striped bass grown in a municipal reclaimed water aquaculture facility. Aquaculture 2016 Meeting Abstract Book, Las Vegas, Nevada, USA.
- Ray A.J., Farno C.C., and J.M. Lotz. 2011. Use of settled solids from intensive shrimp culture as a fertilizer alternative for Bitter Panicum (*Panicum amarum var. amarum*). Aquaculture America Annual Meeting Abstract Book, New Orleans, Louisiana, USA.
- Ray A.J., and J.M. Lotz. 2010. Sustainable marine shrimp aquaculture at The Gulf Coast Research Laboratory. Bays and Bayous Symposium Abstract Book, Mobile, Alabama, USA.
- Ray A.J., Venero J.A., and J.W. Leffler. 2009. An evaluation of shrimp (*Litopenaeus vannamei*) stocking practices in minimal exchange superintensive biofloc culture systems. World Aquaculture Annual Meeting Abstract Book, Veracruz, Mexico.

- Lewis B.L., Leffler J.W., Ray A.J., Atwood H., Haveman J., Lawson A., McAbee B., Shuler A., Venero J., and C.L. Browdy. 2009. Use of settling tank clarifiers to manage the microbial biofloc community in superintensive, zero-exchange shrimp production systems. Aquaculture America Annual Meeting Abstract Book, Seattle, Washington, USA.
- Ray A.J., Shuler A., McAbee B., Wilde S., Browdy C.L., and J.W. Leffler. 2008. Relationships between microbial community structure and shrimp (*Litopenaeus vannamei*) performance in zero exchange culture systems. College of Charleston Graduate School Poster Session. Charleston, South Carolina, USA.
- Ray A.J., Shuler A., McAbee B., Wilde S., Seaborn G., Browdy C.L., and J.W. Leffler. 2008. Manipulations of microbial communities and the effects on shrimp (*Litopenaeus vannamei*) in zero exchange culture systems. Marine Biology Research Colloquium, College of Charleston. Charleston, South Carolina, USA.

SERVICE:

University Service:

- **Faculty Search Committee Chair**
 - Chair of a Search Committee for Assistant Professor of Aquaculture Technology and Management
 - Fall 2023
- **Post-Doctoral Fellow Search Committee Chair**
 - Chair of a Search Committee for Post-Doctoral Research Associate in Aquaculture Production
 - Fall 2023
- **Research and Extension Associate Search Committee Chair**
 - Fall 2023
- **Research Associate Search Committee Chair**
 - Fall 2023
- **Research Associate Search Committee Member**
 - Fall 2023
- **Faculty Review Committee for the School of Aquaculture and Aquatic Sciences**
 - Fall 2022
- **Search Committee for the Chair of the School of Aquaculture and Aquatic Sciences**
 - Spring 2022
 - Served as Chair of the Committee
- **Tenure and Promotion Unit-Level Review Committees**
 - Spring 2021
 - Served on two independent committees simultaneously, one for the School of Agriculture, Food, and the Environment, the other for the School of Aquaculture and Aquatic Sciences
- **The KSU Small Scale Farm Grant Review Committee**
 - Member; Spring 2018 – Current
 - Meet quarterly to review grant proposals
- **Member of the KSU Faculty Senate**
 - Fall 2014 – Spring 2016
 - Served on the Budget and Academic Support Committee
- **Hiring Committee Chair** – Research Assistant in Aquaculture Production
 - Spring 2016
- **Hiring Committee Member** – Research Associate in Aquaculture Nutrition
 - Spring 2016

- **Thorobred Express Recruiting Event – Keynote Speaker**
 - Hopkinsville, Kentucky; January 31, 2015

Service to the Community:

- **Work with Spark Community Café (Non-Profit) in Woodford County**
 - Periodically donate shrimp to their food program which provides meals for underserved community members, as part of a grant-funded partnership.
 - 2019 to present
- **Work with FoodChain, Inc. (Non-Profit) in Fayette County**
 - Set up a shrimp aquaculture system and made improvements to aquaponics systems as part of a grant-funded partnership. These systems are used to help educate the community about urban agriculture methods.
 - 2019 to present
- **Serve as Den Leader of the Lion Den in Cub Scout Pack 32, Woodford County, KY**
 - 2023 – present
- **Serve as Assistant Scout Master in BSA Troop 14, Woodford County, KY**
 - 2023 – present
- **Gave a Presentation to the Butler County Adult Farmers Organization**
 - Presentation was an overview of aquaculture and the work being done at KSU
 - February 5, 2019
- **Organized and Hosted the First Ever KSU Indoor Shrimp Farming Workshop**
 - September 14 and 15, 2018
 - 216 attendees from 5 countries and 28 US states. 27 of the attendees were from Kentucky
 - Focused a global aquaculture spotlight on Kentucky
 - Led over 120 people on tours of the KSU Aquaculture facilities
 - Interactive and engaging discussions with World leaders in aquaculture
 - Largest indoor shrimp farming workshop, perhaps the largest shrimp workshop of it's kind
- **Extend Research to Farmers**
 - Answered over 300 inquiries into shrimp farming from farmers globally
 - Currently working with new shrimp farmers in Henry and Fayette Counties
 - Helped design and get these farms started. They are currently producing shrimp.
- **Guest Instructor for the Jefferson County Master Gardeners Class**
 - October 17, 2017; two hour long course on aquaculture
- **Presentation at a Former Mentor's Retirement Celebration**
 - Ray, A.J. An Early Career in Ecology. Pre-Retirement Research Symposium, Dr. Stephen Wilson. April 28, 2017, University of Central Missouri, Warrensburg, MO, USA.
- **Presentation to the Frankfort, KY Kiwanis Club**
 - June 30, 2016; hour-long lunchtime presentation on KSU and KSU Aquaculture
- **Presentation at the Rosenwald Center for Families and Children**
 - August 25, 2016; hour-long presentation on KSU Aquaculture
- **Departmental Seminar at the University of Kentucky**
 - March 26, 2016; hour-long seminar in the Plant & Soil Sciences Department
- **Judge at the Kentucky Junior Academy of Science Symposium**
 - At KSU, Spring 2016
- **Guest Lecture at the University of Kentucky**
 - October 1, 2014; hour-long lecture in Agricultural Biotechnology (ABT 101)

Service to Profession:

- **Aquacultural Engineering Society** – Member 2010 – present
 - Webpage Editor, AES Biofloc Webpages
 - US-Based Director 2015 - 2018
- **Master of Environmental Studies Student Association** – The University of Charleston
 - Treasurer 2006 – 2007
- **USDA-NIFA Southern Regional Aquaculture Center**
 - Publications, Videos, and Computer Software Project Technical Committee Member
 - 2020 - present
- **The Global Aquaculture Alliance** – Member 2010 – 2016
 - Magazine Contributor 2010 – present
- **The United States Aquaculture Society** – Member 2007 – present
 - Member of the USAS Elections Committee 2023 - present
 - Member of the USAS Financial Committee 2021 - present
 - Co-chair of the Shrimp Production and Nutrition Session, Aquaculture America 2021
 - Chair of the Shrimp Production Session, Aquaculture America 2020
 - Co-Chair of the Conference Program, Aquaculture America 2018
 - Chair of the Biofloc/Intensive Systems session, Aquaculture America 2017
 - Chair of the Biofloc Session, Aquaculture America 2015
 - Chair of the Biofloc Session, Aquaculture America 2014
 - Awards Committee Member, Aquaculture 2013
 - Co-chair of the Biofloc Technology Session, Aquaculture America 2011
 - Career Seminar Coordinator, Aquaculture America 2009
 - Student Field Trip Coordinator, Aquaculture America 2009
- **The World Aquaculture Society** – Member 2007 – present
 - Chair of the Shrimp Nutrition Session and the Shrimp and Other Crustaceans Session, Aquaculture 2022
 - Chair of the Shrimp Production Session, Aquaculture 2019
 - Co-Chair of the Shrimp Nutrition Session, Latin American & Caribbean Aquaculture 2017
 - Chair of the Shrimp Program, Aquaculture 2016
 - Co-chair of the Shrimp Program, Aquaculture 2013
 - Co-chair of the Shrimp Production Session, Aquaculture 2013
- **Tri-Beta National Biological Honor Society** – Lifetime Member
 - Secretary and Treasurer of the Gamma Phi Chapter 2004 – 2005
- **Manuscript Referee:**
 - Animals
 - Aquacultural Engineering
 - Aquaculture
 - Aquaculture Reports
 - Aquaculture Research
 - Aquatic Living Resources
 - Brasileira de Zootecnia
 - Egyptian Journal of Aquatic Research
 - International Aquatic Research
 - International Journal for Biotechnology and Molecular Biology Research
 - International Journal of Recirculating Aquaculture
 - Journal of Applied Aquaculture
 - Journal of International Aquatic Research
 - Journal of the International Society for Microbial Ecology

- Journal of Marine Science & Research Development
- Journal of the World Aquaculture Society
- Limnologica
- Marine & Freshwater Behaviour & Physiology
- North American Journal of Aquaculture
- Revista Brasileira de Zootecnia
- Water
- **Grant Proposal Referee (Outside of KSU):**
 - USDA-NIFA
 - Full Panel Member; Spring 2018, Spring 2019, Fall/Spring 2022/2023, Current Panel Member
 - National Science Foundation
 - Review Panel Member; Fall 2020
 - University of Maryland MIPS Program
 - Ad Hoc Reviewer; Summer 2019
 - Maryland Industrial Partnerships Program
 - Ad Hoc Reviewer; Spring 2017
 - South Carolina SeaGrant Consortium
 - Ad Hoc reviewer; Fall 2017
 - Natural Sciences and Engineering Research Council of Canada Strategic Project Grants Program
 - Ad Hoc reviewer; Fall 2017
 - USDA-NIFA
 - Ad Hoc reviewer; Fall 2017
 - USDA-NIFA
 - Ad Hoc reviewer; Fall 2016
 - USDA-NIFA AFRI
 - Full Panel Member; Fall 2015