

# **Global Center for Aquatic Health and Food Security**

**Mississippi State University**

**Annual Report: January – December 2023**



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**GLOBAL CENTER FOR AQUATIC  
HEALTH AND FOOD SECURITY**

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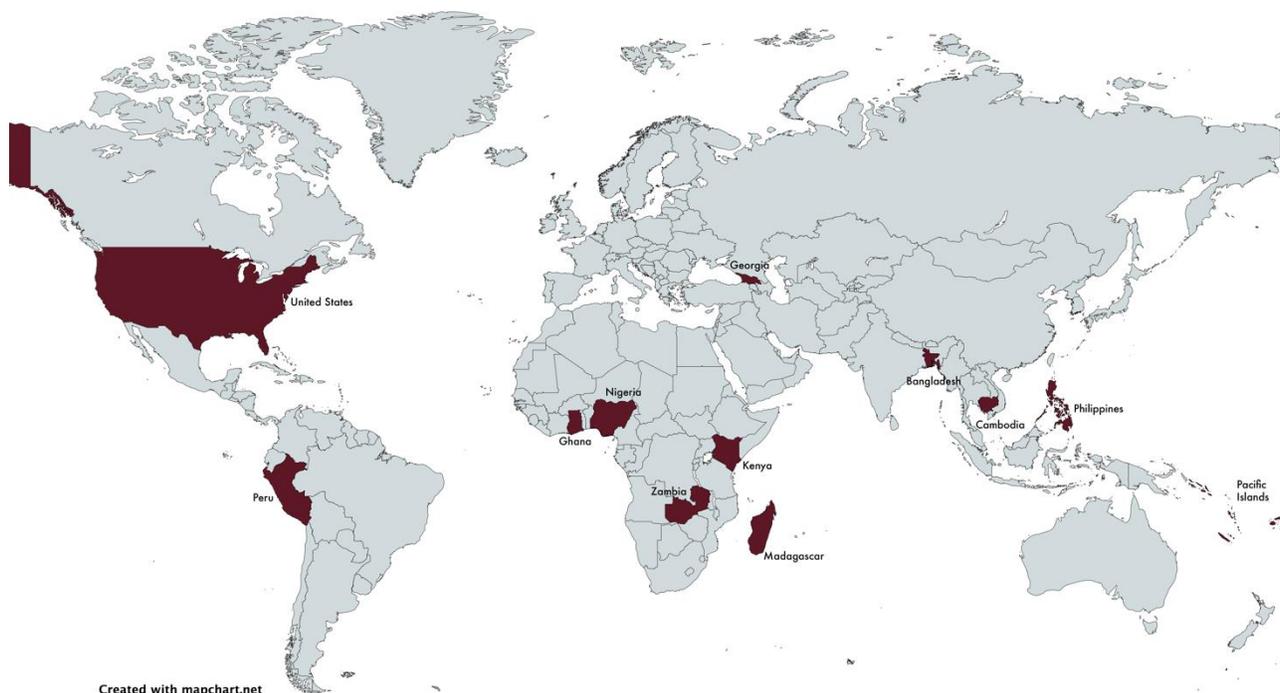
## Mission

The Global Center for Aquatic Health and Food Security (GCAHFS) furthers the mission of Mississippi State University in service by engaging MSU faculty in domestic and international development. Faculty service aims at improving aquatic health, reducing world hunger, and building capacity to support healthy aquatic ecosystems and sustainable aquaculture and fisheries. GCAHFS furthers the university's mission in research by engaging MSU faculty in investigative research to address problems in aquatic health and food security. In addition, GCAHFS furthers the university's mission in teaching by promoting and supporting knowledge transfer and student exchange between the U.S. and other countries as well as increasing learning opportunities for students, staff, and faculty.

## Vision

GCAHFS actively pursues development of aquatic health and food security in the U.S. and abroad. Because of the importance of aquaculture to the state of Mississippi, MSU has longstanding strength and expertise in aquatic health and food security. GCAHFS serves as a facilitator to engage MSU faculty, staff, and students in domestic and international development. Specifically, GCAHFS addresses the health of aquatic environments by improving the impact of these important ecosystems on the quality of life of humans, increasing food production and security, implementing aquatic animal disease mitigation strategies, supporting aquaculture technology development and adoption, and promoting sustainable aquatic resource management.

## Countries with Activities



## Food and Agriculture Organization of the United Nations Reference Center on Antimicrobial Resistance and Aquaculture Biosecurity

Mississippi State University has been designated as a Food and Agriculture Organization of the United Nations (FAO) Reference Center on Antimicrobial Resistance (AMR) and Aquaculture Biosecurity, which is managed by GCAHFS. The reference center provides independent technical and scientific advice and supports FAO’s mandate for agricultural and aquacultural development and food security. MSU and GCAHFS are committed to supporting and serving the needs of the Mississippi aquaculture industry, and the university’s recognition as an FAO reference center will enable its experts to address the global issues of antimicrobial resistance, reducing the burden of disease in aquaculture.

### Personnel

Name	MSU affiliation	FAO reference center role
Dr. Stephen Reichley	Assistant Professor, Pathobiology and Population Medicine, College of Veterinary Medicine	Head
Dr. Matt Griffin	Research Professor, Pathobiology and Population Medicine, College of Veterinary Medicine	Technical Working Group Member
Dr. Larry Hanson	Professor, Comparative Biomedical Sciences, College of Veterinary Medicine	Technical Working Group Member
Dr. Mark Lawrence	William L. Giles Distinguished Professor, Comparative Biomedical Sciences, College of Veterinary Medicine	Technical Working Group Member
Dr. Michael Sandel	Assistant Professor, Wildlife, Fisheries and Aquaculture, College of Forest Resources	Technical Working Group Member
Dr. Fernando Yamamoto	Assistant Research Professor, Wildlife, Fisheries and Aquaculture, College of Forest Resources	Technical Working Group Member

### Successes and Impact

In June 2023, FAO hosted an event to launch the new network of reference centers focused on antimicrobial resistance and aquaculture biosecurity. Dr. Stephen Reichley, head of the reference center, attended the event in Rome, Italy, along with MSU President Dr. Mark Keenum, MSU Provost and Executive Vice President Dr. David Shaw, MSU Associate Vice President of International Programs and Executive Director of the International Institute Dr. Dan Reynolds,



member of the FAO Reference Center on AMR and Aquaculture Biosecurity Technical Working Group Dr. Larry Hanson, and others. Throughout 2023, several MSU faculty members led research projects aimed at improving aquaculture biosecurity and combatting antimicrobial resistance. MSU faculty members were engaged in regional, national, and international meetings sharing information, leading technical discussions, and participating in policy-focused discussions. Additionally, several MSU veterinary and graduate students participated in research and outreach events to improve understanding and awareness of AMR. Learn more about the FAO Reference Center on AMR and Aquaculture Biosecurity at [www.gcahfs.msstate.edu/projects/fao-reference-center-antimicrobial-resistance-and-aquaculture-biosecurity](http://www.gcahfs.msstate.edu/projects/fao-reference-center-antimicrobial-resistance-and-aquaculture-biosecurity).

### Student Engagement

Dr. Seto Ogunleye, MSU doctoral candidate in veterinary medical science with a concentration in infectious disease and immunology under the direction of Dr. Hossam Abdelhamed, participated in the American Society for Microbiology Hill's Day of Antimicrobial Resistance held in fall of 2023 in Washington, D.C. The event provided an opportunity for policymakers to learn from scientists and experts about the significance of innovative research to reduce the risks of antimicrobial resistance emerging and spreading in the U.S. and around the world.

"It is important that we fight together against resistant pathogens," Ogunleye said. "This issue is important here and beyond the shores of America. It is a worldwide issue, which is why it is so important to have the support of policymakers, taking a One Health approach to enhance antimicrobial resistance-related research."

Learn more about Ogunleye's participation in the event here:

[www.msstate.edu/newsroom/article/2024/01/msu-students-faculty-collaborate-reduce-risks-antimicrobial-resistance](http://www.msstate.edu/newsroom/article/2024/01/msu-students-faculty-collaborate-reduce-risks-antimicrobial-resistance).

### Feed the Future Innovation Lab for Fish

Funded by the U.S. Agency for International Development (USAID), the Feed the Future Innovation Lab for Fish (Fish Innovation Lab) works to reduce poverty and improve nutrition, food security, and livelihoods in partner countries by supporting research on sustainable aquatic food systems. The Fish Innovation Lab supports and links research partners around the globe to identify, develop, and scale promising methodologies and technologies for local fish farming and to intensify and diversify major aquatic food production systems where the poor and undernourished are concentrated. Through competitive research subawards, the Fish Innovation Lab funds country-focused research and capacity-building activities. These subawards constitute an integrated, cooperative, multi-institutional research program that aims to produce applicable research results, increase the capacity of local partners, and support the adoption of new innovations.

## Active Grants

1. M. L. Lawrence, S. R. Reichley, G. R. Mendez, P. Allen. 2023-2028. Feed the Future Innovation Lab for Fish. USAID (Feed the Future), \$15,000,000.

## Personnel

Name	MSU affiliation	Fish Innovation Lab role
Dr. Mark Lawrence	William L. Giles Distinguished Professor, Comparative Biomedical Sciences, College of Veterinary Medicine	Director
Dr. Stephen Reichley	Assistant Professor, Pathobiology and Population Medicine, College of Veterinary Medicine	Deputy Director
Dr. Peter Allen	Professor, Wildlife, Fisheries and Aquaculture, College of Forest Resources	Productivity Frontier Specialist (through September 2023); Aquaculture Advisor (as of September 2023)
Jared Dees	Contract and Grant Specialist, Comparative Biomedical Sciences, College of Veterinary Medicine	Contract and Grant Specialist (through April 30, 2023)
Alaina Dismukes	Communications Specialist, Comparative Biomedical Sciences, College of Veterinary Medicine	Communications Specialist
Shauncey Hill	Program/Finance Manager, Comparative Biomedical Sciences, College of Veterinary Medicine	Program/Finance Manager (through March 31, 2023)
Dr. Gina Rico Mendez	Assistant Research Professor, Social Science Research Center	Human Outcomes Specialist and Monitoring, Evaluation, and Learning Specialist (January–September 2023); Research and Learning Manager (as of September 2023)
Joy Nabors	Communications Consultant and Intermittent Worker, Comparative Biomedical Sciences, College of Veterinary Medicine	Communications Consultant/Intermittent Worker (as of May 30, 2023)



Dr. Kathleen Ragsdale	Research Professor, Social Science Research Center	Gender and Youth Equity Specialist (through September 2023)
Dr. Mary Read-Wahidi	Associate Research Professor, Social Science Research Center	Gender and Youth Equity Specialist (through September 2023); Gender and Social Inclusion Specialist (as of September 2023)
Masey Smith	Program Manager, Pathobiology and Population Medicine, College of Veterinary Medicine	Program Manager (as of October 2, 2023)
Kelly Stewart	Business Manager, Pathobiology and Population Medicine, College of Veterinary Medicine	Business Manager (as of October 16, 2023)
Laura Zseleczky	Marketing and Communications Manager, Comparative Biomedical Sciences, College of Veterinary Medicine	Marketing and Communications Manager

### Successes and Impact

The Fish Innovation Lab completed its first 5-year phase (Phase 1) in September 2023 and, in the same month, received an extension for an additional 5 years until 2028 (Phase 2). In 2023, the Fish Innovation Lab finalized 19 research-for-development activities from Phase 1 in Bangladesh, Cambodia, Ghana, Kenya, Nigeria, and Zambia, as well as a USAID Buy-In activity covering Madagascar, the Pacific Islands, Peru, and the Philippines. Seven of the activities were led by 14 MSU faculty in seven departments in four colleges across the MSU campus. The program also launched Phase 2 in 2023, including dissemination of application invitations for 1-year Startup and Scaling Activities, preparation for the Phase 2 Request for Applications, planning and preparation for Phase 2 indicators and reporting, and virtual meetings and engagement with USAID Missions.

Fish Innovation Lab accomplishments in advancing productivity (Phase 1 Area of Inquiry 1) included applying Lean management methods to improve efficiency of aquaculture production, feed production, and fish processing in Nigeria; implementing integrated rice-fish farming on private farms in rural communities in Nigeria; determining feasibility of fishmeal replacement in fish feed using black soldier fly larvae meal in Nigeria; and supporting improved genetics of carp species in Bangladesh through family selection and sperm cryopreservation. Fisheries productivity was advanced using community-led fish landing monitoring activities in the Sre Ambel River in Cambodia and in coral reefs in southern Kenya, resulting in adoption of sustainable fisheries management practices in fishing communities.

The Fish Innovation Lab addressed reducing and mitigating risks (Phase 1 Area of Inquiry 2) by determining fish pathogens impacting aquaculture in Nigeria and establishing a network of fish health veterinarians with support from fish diagnostic capacity at the University of Ibadan; identifying major foodborne pathogens on fish and behaviors associated with fish contamination by processors in Dhaka City, Bangladesh; and characterizing pathogenic bacteria responsible for tilapia mortalities in Zambia for autogenous vaccine development.

Human outcomes (Phase 1 Area of Inquiry 3) were addressed by using machine learning to identify aquaculture ponds from satellite imagery and producing extension videos in Bangladesh; developing low-literacy training for women fish processors in Nigeria to increase knowledge on nutritional value of fish and food safety; conducting nutrition training and sensory panels on complementary foods integrating fish powder in Zambia; using social marketing to increase mothers'/caregivers' use of fish in diets and increasing fishers' income from modified fishing gear in Kenya; identifying impacts of invasive crayfish on artisanal freshwater fisheries in Zambia; analyzing economic implications of aquaculture value-chain development in Bangladesh to improve food security and market access for consumers and producers; and analyzing oyster samples harvested by women shellfishers for essential minerals to determine potential of oysters to reduce anemia prevalence in women of reproductive age in Ghana.

The Fish Innovation Lab Management Entity (ME) and subawardees worked to achieve impacts within four cross-cutting themes: capacity development, gender equity and youth engagement, nutrition, and resilience. Capacity development activities engaged U.S.-based and partner country teams, enabling the formation of an aquaculture and fisheries community of practice. Individual capacity development included both long-term, hands-on, graduate training of students in partner countries and engagement of stakeholders, community members, and end users through short-term trainings and direct involvement in research activities. The ME additionally facilitated a Fish Innovation Lab student network. In Bangladesh, collaboration between the research teams and government entities raised the interest of government officials to explore avenues for implementation of innovations developed through the Fish Innovation Lab. To support gender equity and youth access, the Fish Innovation Lab ME led or participated in gender/youth-related activities, and several research activities included specific gender equity goals. Research teams engaged youth in rice-fish farming capacity enhancement activities in Nigeria, which had 82% youth participation. In addition, fisheries monitoring training for community members in Kenya had 56% youth participation and 39% female participation. The ME promoted synergistic dissemination of nutrition approaches and results from Fish Innovation Lab activities and provided technical support related to nutrition for activities as requested. The ME developed and launched online training in resilience for Principal Investigators (PIs) and worked with seven research activities to develop more robust frameworks for resilience in their approaches.

## Student Engagement

Two MSU students assisted Dr. Kathleen Ragsdale on a trip to Zambia as a part of the Fish Innovation Lab's FishFirst! Zambia activity. Makayla Smith, a MSU undergraduate sociology major, and Robert Kolbila, a MSU PhD candidate in the Department of Sociology, accompanied Ragsdale to promote Complementary Food for Africa + dried fish powder (ComFA+Fish), which is primarily made with dried fish powder used to add nutrients to meals. This was Smith's first trip to Zambia and Kolbila's second trip, and while in Zambia, the two students joined the research team as they promoted the Fish Innovation Lab activity to the private sector, Ministry of Health officials, and the USAID Zambia Mission.

Nyia Sawyer, a sophomore biomedical engineering major; Deja Howard, a senior psychology major; and Smith all presented on FishFirst! Zambia work under the direction of Ragsdale during the 2023 Spring Undergraduate Research Symposium, organized by the Shackouls Honors College. The three students created posters and presented at the Research Symposium, gaining professional experiences in academic research. Learn more about their presentations here: [www.fishinnovationlab.msstate.edu/newsroom/2023/06/msu-undergraduate-students-serving-research-feed-zambians](http://www.fishinnovationlab.msstate.edu/newsroom/2023/06/msu-undergraduate-students-serving-research-feed-zambians).

## Gulf Coast Aquatic Health Lab

The Gulf Coast Aquatic Health Lab (GCAHL) is in Gautier, Mississippi, and includes projects that strive to address aquatic animal health needs to improve, protect, and maintain the health of aquatic animals and the aquatic environment. Ongoing projects focus on support for marine mammal cause-of-death investigations and sea turtle conservation, recovery, and monitoring activities. Additional projects being developed in the GCAHL will focus on investigating the interrelationships among viruses, microorganisms, and aquatic animals, which significantly impact global biochemical cycles, aquatic animals, and ocean health.

## Active Grants

1. Lawrence, M.L., S.R. Reichley, B. Peterman, D. Moore, K. McNulty, and A. Lee. 2023-2026. Enhance conservation of sea turtles in Mississippi state waters by strengthening capacity for science-based animal health and management. Mississippi Department of Environmental Quality (Natural Resource Damage Assessment), \$2,175,000.
2. Lawrence, M.L., S.R. Reichley, B. Peterman, D. Moore, and K. McNulty. 2023-2026. Enhance conservation of bottlenose dolphins in Mississippi state waters by strengthening capacity for science-based marine mammal health and management. Mississippi Department of Environmental Quality (Natural Resource Damage Assessment), \$2,044,500.



3. Reichley, S.R., B. Peterman, and M.L. Lawrence. 2023-2026. Establishing the Mississippi State University Gulf Coast Aquatic Health Laboratory. National Oceanographic and Atmospheric Administration, \$1,800,000.
4. Lawrence, M. L., S.R. Reichley, D. Moore, T. Morgan, W. Epperson, A. Karsi, and D. Peterson. 2021-2024. Evaluation and monitoring of marine mammal and sea turtle abundance, population health, habitat delineation, and restoration resulting from the opening of the Bonnet Carré Spillway. Mississippi Department of Marine Resources (Gulf of Mexico Energy Security Act), \$2,474,573.
5. Lawrence, M. L., S.R. Reichley, T. Morgan, and W. Epperson. 2017-2023. Mississippi Marine Mammal and Turtle Conservation, Recovery, and Monitoring Program. Mississippi Department of Environmental Quality (National Fish and Wildlife Foundation), \$7,873,033.29.

#### Personnel

Name	MSU affiliation	Gulf Coast Aquatic Health Lab role
Dr. Mark L. Lawrence	William L. Giles Distinguished Professor, Comparative Biomedical Sciences, College of Veterinary Medicine	Director
Dr. Stephen Reichley	Assistant Professor, Pathobiology and Population Medicine, College of Veterinary Medicine	Associate Director
Dr. Beth Peterman	Assistant Clinical Professor, Pathobiology and Population Medicine, College of Veterinary Medicine	Project Manager
Mark Arick II (Tony)	Computer Specialist and Biocomputing Lead, Institute for Genomics, Biocomputing, and Biotechnology	Genomics Specialist
Dr. Christa Barrett	Clinical Instructor, Pathobiology and Population Medicine, College of Veterinary Medicine	Clinical Veterinarian (through July 2023)
Dr. Caroline Betbeze	Associate Clinical Professor, Clinical Sciences, College of Veterinary Medicine	Ophthalmologist
Basant Gomaa	Postdoctoral Research Associate, Comparative Biomedical Sciences, College of Veterinary Medicine	Postdoctoral Research Associate
Jill Hudnall	Research Associate I,	Research Associate I



	Pathobiology and Population Medicine, College of Veterinary Medicine	(as of May 2023)
Dr. Barbara Kaplan	Associate Professor, Comparative Biomedical Sciences, College of Veterinary Medicine	Toxicologist
Dr. Attila Karsi	Professor, Comparative Biomedical Sciences, College of Veterinary Medicine	Geneticist
Dr. Nelmarie Landrau Giovannetti	Postdoctoral Research Associate, Pathobiology and Population Medicine, College of Veterinary Medicine	Postdoctoral Research Associate (through August 2023)
Dr. Alison Lee	Assistant Professor, Clinical Sciences, College of Veterinary Medicine	Radiologist
Dr. Anna Linhoss	Associate Professor, Biosystems Engineering, Samuel Ginn College of Engineering, Auburn University	Ecologist
Dr. Kaylin McNulty	Assistant Clinical Professor, Pathobiology and Population Medicine, College of Veterinary Medicine	Pathologist
Dr. Paul Mickle	Co-Director, Associate Research Professor, Northern Gulf Institute	Ecologist
Dr. Todd Mlsna	Professor, Chemistry, College of Arts and Sciences	Chemist
Dr. Debra Moore	Assistant Clinical Professor, Pathobiology and Population Medicine, College of Veterinary Medicine	Clinical Veterinarian
Ryanne Murray	Research Associate I, Pathobiology and Population Medicine, College of Veterinary Medicine	Research Associate I (as of September 2023)
Dr. Daniel Peterson	Professor and Director, Institute for Genomics, Biocomputing, and Biotechnology	Genomics Specialist
Dr. Justin Stilwell	Assistant Clinical Professor Pathobiology and Population Medicine, College of Veterinary Medicine	Pathologist



Dr. Natalie Stilwell	Assistant Clinical Professor, Pathobiology and Population Medicine, College of Veterinary Medicine	Microbiologist
Dr. John Thomason	Associate Professor, Clinical Sciences, College of Veterinary Medicine	Internist
Dr. Robert Wills	Professor, Comparative Biomedical Sciences, College of Veterinary Medicine	Epidemiologist

### Successes and Impact

Funding for GCAHL activities was provided by the National Fish and Wildlife Foundation (NFWF) and Natural Resource Damage Assessment (NRDA) administered by the Mississippi Department of Environmental Quality (MDEQ), the Gulf of Mexico Energy Securities Act (GOMESA) administered by the Mississippi Department of Marine Resources (MDMR), and the National Oceanographic and Atmospheric Administration (NOAA).

Funding provided by NFWF began in 2018 and ended on November 30, 2023. Because of this funding through GCAHFS, the College of Veterinary Medicine (CVM) is one of only two veterinary programs in the nation that provide all veterinary students with hands-on marine animal medicine. From its inception, the program provided training of veterinary students or interns on diagnostic imaging of sea turtles. Initially, nine veterinary students or interns were trained on diagnostic imaging in 2017, but by 2023, all CVM veterinary radiology interns and residents were trained in interpretation of sea turtle diagnostic imaging. This opportunity has not only expanded their education but also has increased their professional marketability.

GCAHL funding also supports hands-on training and experience in necropsy of marine mammals and sea turtles to veterinarians, students, and stranding network members, and it provides training in the care of sea turtles in rehabilitation to strengthen veterinary capacity in aquatic health. GCAHL funding provides research experience for veterinary students participating in CVM’s Veterinary Medical Research Scholars (VMRS) program to investigate morbidity and mortality of marine mammals and sea turtles that would not have been available if not for these grants.

MSU’s collaboration with the Institute for Marine Mammal Studies in the stranding response and diagnostic evaluation of stranded marine mammals and sea turtles has resulted in achieving NFWF, USFWS, and NOAA goals of providing a base level capacity for stranding response across Mississippi to keep response times within appropriate levels.

The capacity and quality of veterinary care for sea turtles during rehabilitation has increased, resulting in greater numbers of rehabilitated sea turtles released in the Mississippi Sound. The



funding provided enables GCAHL to analyze baseline mortality trends and identify common diseases impacting dolphin and sea turtle populations in the Mississippi Sound. This information is important for making policy and management decisions that reflect the changing health and diseases affecting dolphins, sea turtles, and their environment in the northern Gulf of Mexico.

This project has allowed for strengthening of stranding response and cause-of-death investigations of marine animals. CVM diagnostic lab capacity has expanded by adding testing capabilities for Cetacean morbillivirus and *Brucella* sp. This testing has allowed for increased individual- and population-level health analysis. Additionally, the CVM diagnostic lab can conduct testing for marine mammals, extending the regional and national capacity for morbidity and mortality investigations.

The establishment of the Sea Turtle Health Steering Committee has ensured high-quality care and assurance of sea turtle health when they are released in the Mississippi Sound. The sea turtles that were released during this project will help ensure long-term sustainability of the Kemp's ridley sea turtle population, and the established capacity at CVM will provide long-term support for the sea turtle population.

Additional funding was implemented on December 1, 2023, as restoration for the Deepwater Horizon (DWH) NRDA to focus on replenishing and protecting living coastal and marine resources with a focus on marine mammals and sea turtles by increasing survival through better understanding of causes of illness and death as well as early detection and intervention for anthropogenic and natural threats. NRDA projects address gaps and enhance capacity in the Marine Mammal Stranding Network and Sea Turtle Stranding Network throughout the Northern Gulf of Mexico, which improves timeliness of response and diagnosis of illness and cause of death.

Funding provided by GOMESA was ongoing in 2023. Funding for this project provided investigations into the increased dolphin and sea turtle mortalities that have occurred since the opening of the Bonnet Carré Spillway (BCS) in 2019. GCAHFS analyzed samples from marine mammal and sea turtle carcasses collected both before and after the BCS openings. Epidemiological analysis incorporated findings from pathology, toxicology, and microbiology to determine likely causes of death for the affected animals and whether they were associated with the freshwater incursions. Funding for analysis to assess environmental factors affecting the health of dolphins in the Mississippi Sound (MSS) is being pursued for expansion of this project to examine the effects of freshwater from Mississippi River diversion compared to native Mississippi rivers draining into the MSS on mortalities of bottlenose dolphins. Common bottlenose dolphins are an important natural resource and, as apex predators, their health reflects the environmental health of the Mississippi Sound, which is a critical economic and natural resource for Mississippi. Findings will help to inform the Mississippi Department of Marine Resources (MDMR) for management decisions on mitigating threats to the health of fish, wildlife, and natural resources in Mississippi waters.

Funding provided by NOAA began in September 2023 and is allocated for establishing the MSU Gulf Coast Aquatic Health Laboratory. GCAHL is strategically designed to be consistent with and support NOAA Fisheries' mission to provide responsible stewardship of the nation's ocean resources and their habitat. This project is dedicated to establishing a high-quality laboratory, which can be used for research and diagnostic activities. An active search for an assistant research professor to provide support for grant objectives was ongoing beginning in September 2023.

## Student Engagement

- All MSU CVM veterinary radiology interns and residents are trained in interpretation of sea turtle diagnostic imaging. This opportunity has not only expanded their education but has increased their professional marketability.
- Veterinary Medical Research Scholars (VMRS) program provides veterinary students research opportunities to investigate morbidity and mortality of marine mammals and sea turtles. Students who participated in 2023 are
  - Sarah Thurman, DVM Class of 2026
  - Sarah Rubelowsky, DVM Class of 2026
- The activities funded by the GCAHL under the CVM Laboratory Services Rotation have led to the addition of an overnight trip for CVM veterinary students to Gulfport during the rotation. This trip includes hands-on clinical and necropsy activities. Because of this trip, CVM is one of only two veterinary schools in the nation providing all veterinary students the opportunity work with marine mammals.
- Sea turtle release events, commonly attended by students, staff, and faculty occur throughout the year. These events provide a wonderful opportunity to celebrate the work and care provided to be able to return the turtles to their habitat.
  - March 31, 2023 – 9 juvenile Kemp's ridley sea turtles
  - June 26, 2023 – 2 juvenile Kemp's ridley sea turtles
  - August 1, 2023 – 5 juvenile Kemp's ridley sea turtles
  - August 24, 2023 – 3 juvenile Kemp's ridleys and one juvenile green sea turtle
  - September 2023 – 4 Kemp's ridley sea turtles
  - October 10, 2023 – 4 juvenile Kemp's ridley sea turtles
  - November 29, 2023 – 3 juvenile Kemp's ridley sea turtles
  - December 18, 2023 – one juvenile Kemp's ridley sea turtle
- Marine Animal Health Canvas course
  - *Marine Monday!* was created by Dr. Stephen Reichley and is a monthly seminar series that brings in speakers from around the world to discuss contemporary topics relevant to marine health and is facilitated by Dr. Beth

Peterman. Students, staff, and faculty participate in these discussions with world-renowned experts in many disciplines related to the marine environment.

- May 2023 – “Successful Dolphin Calf Rescue, Rehabilitation, and Introduction to a New Home” presented by Dr. Debra Moore
  - June 2023 – “Bottle Feeding Dolphin Calves” presented by Dr. Scott Gearhart
  - August 2023 – “Endoscopy: A Required Skillset for Aquatic Animal Medicine” presented by Dr. Sean Perry
  - September 2023 – “Northern Gulf of Mexico Sea Turtle Strandings: A Summary of Findings and Analysis from 2010-2022” presented by Ms. Lyndsey Howell
  - October 2023 – “Attachment Disorder in Orphaned Marine Mammals” presented by Dr. Michael Walsh
  - November 2023 – “Did You Know There Are Coral Reefs Off the Coast of Mississippi?!” presented by Dr. Alexa Delaune
  - December 2023 – “Sea Turtle Fibropapillomatosis” presented by Dr. Annie Page
- Marine Animal Veterinary Externships are available to third and fourth year veterinary students from MSU CVM and other veterinary schools with specific interest in marine animal medicine.
    - Externs in 2023
      - Jeffrey Turn – University of Georgia College of Veterinary Medicine, March 13 - April 2, 2023
      - Alexandra Cheramie – Louisiana State University College of Veterinary Medicine, April 17 - 30, 2023
      - Madi Young – Mississippi State University College of Veterinary Medicine, May 29 - June 25, 2023
  - The Aquatic Animal Health Certificate program is under development with an anticipated start date of July 2024 and will provide introductory training to veterinary students and graduate veterinarians on diagnostic and clinical medicine of aquatic animal species.

## Other Activities

### Active Grants

1. **S. Reichley**. 2022-2023. Bolstering Fish Health in Republic of Georgia. United States Department of Agriculture Foreign Agricultural Service. **\$75,000**.



## Successes and Impact

Bolstering Fish Health in the Republic of Georgia is a collaborative project with faculty at the University of Idaho and Dr. Stephen Reichley at Mississippi State University working with the Caucuses Agricultural Development Initiative (CADI) to increase rural income in the focus region of Adjara by institutionalizing support for small and medium-sized aquaculture trout facilities in the Adjara Region, with a focus on veterinary health. The project focuses on gender equity and inclusion as well as climate adaptation and resiliency to improve the sustainability of the innovations implemented.

The project team made several visits to Georgia throughout 2023. During those trips, the team led outreach activities such as providing training seminars and one-on-one training and interactions with farmers, government employees, and private sector actors in Georgia. During meetings with government agencies, including the national Ministry of Agriculture and the Adjara Ministry of Agriculture, the team participated in discussions regarding policy and resource management to support the sustainable growth of the trout industry.

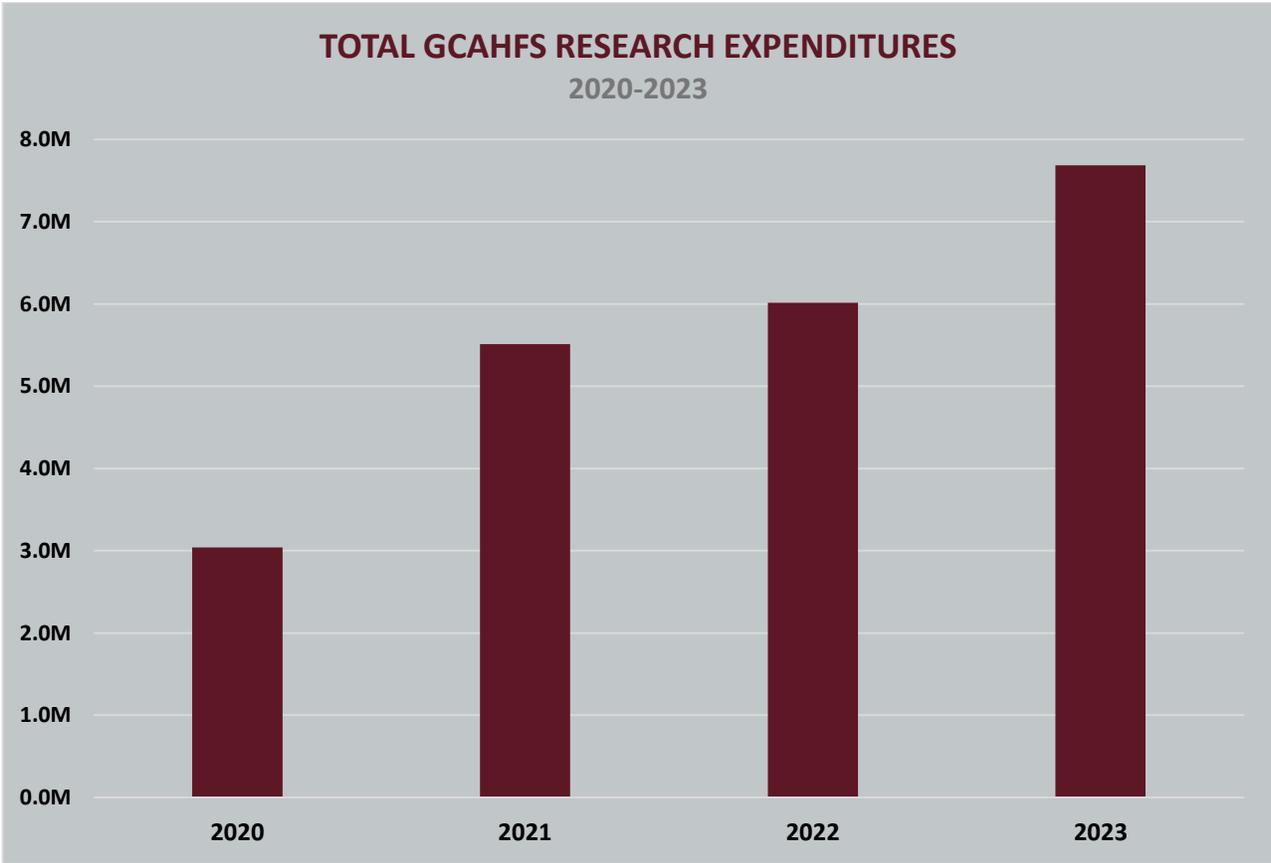
## Student Engagement

Veterinary student Kathryn Rapp, along with graduate students Vandana Dharan (College of Forest Resources), and Divya Rose (College of Veterinary Medicine), traveled to the Republic of Georgia in the fall of 2023 to participate in the Bolstering Fish Health in the Republic of Georgia research project, led by Dr. Stephen Reichley. While in the Republic of Georgia, the three students visited trout farms, took water samples to analyze, and provided farmers with supplies and tools to perform some diagnostic work on the farms. Dr. Reichley and Dr. Jake Bledsoe from the University of Idaho conducted training sessions for farmers on identifying ectoparasites on the skin and gills of the fish. Each farmer was interviewed, covering topics such as farm water sources, management practices, hatchery practices, and other concerns. To learn more, go to [www.msstate.edu/newsroom/article/2024/03/msu-students-support-fish-health-farmers-republic-georgia](http://www.msstate.edu/newsroom/article/2024/03/msu-students-support-fish-health-farmers-republic-georgia).

Financial Highlights

**GCAHFS Research Expenditures  
2020-2023**

<b>2020</b>	<b>\$3,039,174</b>
<b>2021</b>	<b>\$5,510,235</b>
<b>2022</b>	<b>\$6,013,712</b>
<b>2023</b>	<b>\$7,684,800</b>



## Appendix 1: Publications, Presentations, and Outreach Activities

### FAO Reference Center on AMR and Aquaculture Biosecurity

Abdelhamad, H. "Effect of Trans-cinnamaldehyde on susceptibility of catfish to <i>Edwardsiella ictaluri</i> ." Conference of Research Workers in Animal Diseases, Chicago, IL, January 20-24, 2023.
Abdelhamad, H., I. Shamima, M.R. Munshi, M. Shahnewaj, and M.L. Lawrence. "Characterization of genetic mechanisms of antimicrobial resistance identified in <i>Edwardsiella ictaluri</i> ." Conference of Research Workers in Animal Diseases, Chicago, IL, January 20-24, 2023.
Abdelhamad, H., R. Munshi, and M.L. Lawrence. "Characterization of genetic mechanisms of antimicrobial resistance in catfish pathogens." 87 <sup>th</sup> Annual Mississippi Academy of Sciences Meeting, 2023, Biloxi, MS, February 23-24.
Gomaa, B.M., H.A. Abdelhamed, M. Banes, S. Zinnurine, and M.L. Lawrence. "Quantification of virulent <i>Aeromonas hydrophila</i> ML09-119 in channel catfish organs following IP injection." Mississippi Academy of Science, Biloxi, MS, 2023.
Hanson, L. and O.K. Adeyemo. "Implementation of Best Management Practices in Nigerian aquaculture: Capacity building and Approaches." Online presentation, Fish Innovation Lab Aquaculture Project Biosecurity Workshop, May 2023.
Hanson, L. and O.K. Adeyemo. "Implementation of Best Management Practices in Aquaculture and e-Technology Platform Adoption for Sustainable Aquaculture Development in Nigeria: Stakeholder Engagement," Ibadan, Nigeria, May 9-10, 2023.
Hanson, L. "Drivers of disease emergence in aquaculture and AMR." Challenges in aquatic AMR mitigation and possible solutions, Rome, Italy, June 27, 2023.
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## Feed the Future Innovation Lab for Fish

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## Gulf Coast Aquatic Health Lab

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Mississippi State University Global Center for Aquatic Health and Food Security Gulf Coast Aquatic Health Lab Marine Mammal Involvement - Presentation
National Fish and Wildlife Foundation (NFWF) Marine Mammal (MM) Partner Coordination Meeting, Necropsy Dolphin Presentation, Mississippi State University Global Center for Aquatic Health and Food Security, June 2023.
National Fish and Wildlife Foundation (NFWF) Sea Turtle (ST) Partner Coordination Meeting, Sea Turtle Necropsy; Sea Turtle Rehabilitation and Release Presentations, Mississippi State University Global Center for Aquatic Health and Food Security, June 2023.
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