



IMPACT REPORT 2024-2025

Aquaculture Research Institute

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DIRECTOR'S MESSAGE

This report covers two years, 2024 and 2025, and looking back across both, I am struck by how much the Aquaculture Research Institute accomplished during a period of real transition. Across the two years, ARI faculty and affiliates managed 49 sponsored projects totaling more than \$18 million, including more than \$10 million in awards that began in 2024 and 2025. They also published more than 40 peer-reviewed articles and 12 books and book chapters, and trained 15 graduate and 12 undergraduate students, and 9 postdocs, research scientists, and visiting scientists.



We also marked milestones for colleagues who shaped this institute. Ken Cain retired and joined the emeritus faculty. Carol Hoffman, Joe Evavold, and Lori Maxwell retired after years of keeping our laboratories and fish systems running. Jessie Ma accepted a faculty position at the University of Georgia, and Ken Overturf and Sara Schwarz moved to new roles in industry. Their contributions to fish health, genetics, nutrition, and the daily work of our facilities are part of ARI's foundation, and the programs they built continue through the people they trained.

Our partnerships remain the core of who we are. Our collaboration with the Columbia River Inter-Tribal Fish Commission deepened, with renewed support for the Hagerman genetics laboratory and the Genetic Assessment of Columbia River Stocks. CRITFC scientists earned the American Fisheries Society's Best Genetics Paper award for the third consecutive year, deployed a mobile genetics laboratory, and supported the first tribally led Pacific lamprey translocation above five dams in the Willamette Basin. They also completed a production-scale kelt reconditioning facility and transitioned leadership of that program to the Nez Perce Tribe. With USDA-ARS, we closed out one five-year project and launched its successor on feed science, farming practices, and broodstock management for sustainable salmonid aquaculture.

In feeds and nutrition, our scientists advanced new ingredients, from sorghum protein concentrates to gene-edited soybeans with reduced antinutritional factors, and gained new insight into the mechanisms of soybean meal-induced enteritis in trout. For the second consecutive year, an ARI paper was recognized as the most cited in Reviews in Aquaculture. Additionally, our burbot work matured into a published culture guide and transfer of stock to prospective producers.

Extension and outreach kept their momentum. We hosted the Idaho Coldwater Fish Culture Course in Hagerman, organized the Idaho Aquaculture Association annual meetings, and welcomed aquaculture stakeholders from the Republic of Georgia for training through our USDA Foreign Agricultural Service program. Our faculty and trainees carried ARI's science to audiences on four continents, and our students and postdocs earned recognition at national and international meetings.

None of this happens without the people listed in these pages. I am proud to work alongside them, and grateful to the industry, agency, and tribal partners who trust us with their most important questions.

Go Vandals!

A handwritten signature in black ink, appearing to read "B. Small". The signature is fluid and cursive, with a large loop at the end.

Brian C. Small, Ph.D.
ARI Director



ABOUT ARI

Established in 1988, the Aquaculture Research Institute (ARI) at the University of Idaho stands as a premier interdisciplinary hub, dedicated to advancing aquaculture and related fisheries research. Its mission encompasses a broad spectrum of activities including food production, fisheries management, and restoration of fish stocks. ARI serves as a nexus for faculty from diverse disciplines across the university, pooling expertise in fish nutrition, genetics, genomics, physiology, immunology, and water quality.

The institute spearheads and facilitates research, education, and extension efforts across various scientific domains, collaborating closely with multiple departments and colleges within the university. ARI's partnerships also extend beyond academia, forging formal collaborative ties with federal, state, and tribal agencies, as well as commercial enterprises.

ARI's research portfolio spans fundamental and applied investigations in aquaculture, fisheries, and aquatic resources. While rainbow trout serves as a focal species, ARI researchers explore a wide array of native and non-native organisms including Pacific salmon and trout, Atlantic salmon, sturgeon, lamprey, burbot, tilapia, catfish, shrimp, and zebrafish. Research endeavors encompass not only fish rearing studies but also delve into the molecular, cellular, and organismal dynamics governing responses to environmental stimuli, diet, and pathogens by employing cutting-edge techniques such as next-gen sequencing, proteomics, metabolomics, and bioinformatics.

Key research thrusts at ARI encompass fish nutrition, physiology, health, selective breeding, genomics, water quality, and sustainability. ARI is dedicated to mitigating the environmental footprint of aquaculture while unraveling the intricate interplay between genetics and the environment in shaping phenotypic traits. In essence, ARI is committed to fostering environmentally sustainable aquaculture and fisheries management through cutting-edge research and the cultivation of future leaders in these vital fields.

FACILITIES



Hagerman Fish Culture Experiment Station

The Hagerman Fish Culture Experiment Station is in south-central Idaho approximately 90 miles southeast of Boise, Idaho, the state capital. The University of Idaho leased the facility from the US Fish & Wildlife Service in 1996 and took possession of the 4-acre property in 1998. In 2006, a new 14,000 ft² building was dedicated, and included offices, a classroom, and analytical laboratories. A six-bedroom dormitory and additional fish rearing buildings were also constructed, augmenting existing fish rearing facilities and providing housing for trainees and visiting scholars.

Hagerman Station features a 6000 ft² wet lab supplied with 2000 gpm, 14.5°C, gravity-fed, first-use spring water. The wet lab contains 142 38-gallon (145-liter) and 42 152-gallon (450-liter) tanks for conducting comprehensive experimental procedures. Egg incubators and hatchery small troughs are used for incubating eggs and start-feeding trout fry. Quarantine facilities with the capacity to heat or chill water and to sterilize the effluent are in a separate, biosecure building. Physiological and behavioral studies can be conducted in a common garden environment consisting of six recirculating aquaculture systems and utilizing state-of-the-art swimming, respirometry, and cardiac output chambers. Thirty covered outdoor tanks utilize second-use water and are suitable for raising groups of fish to maturity. Outdoor, 1/3 scale raceways (8 total) complete the fish rearing facilities. The Hagerman Station also has extensive analytical laboratories used to support research in feeds, molecular biology, population genetics and genomics, including next-generation sequencing.

Cold Water Laboratory

The 8000 ft² Cold Water Laboratory operates on the Moscow campus as a water-limited recirculating facility. There are currently seven independent recirculating systems on backup power that can accommodate a variety of cold-water species, including salmonid species and sturgeon. The facility also maintains one warmwater system for rearing tilapia. Each system has independent chilling/heating, biofiltration,



and UV treatment. The largest system has four four-meter diameter tanks for rearing of large populations or broodstock. The other systems are high-replicate systems, comprised of as many as 66 tanks. The Cold Water Lab has the capabilities to incubate eggs in Heath tray incubators and McDonald jars. Fry can also be held in fiberglass troughs and fed with either single-pass or recirculating water. Temperatures in the systems can be maintained between 4 °C and 20 °C. The Moscow Cold Water Lab facilities are available to researchers across the University for a nominal fee.

Aquatic Animal Research Facility



In 2019, the University completed construction of the Aquatic Animal Research Facility (AARF) on the Moscow campus. Adjacent to the Cold Water Laboratory, this two-story facility boasts office and classroom space coupled with a state-of-the-art 4000 ft² wet lab. The AARF also operates as a water-limited recirculating facility. There are currently four independent recirculating systems with backup power. Three of these systems were specifically designed to facilitate new species development. A live-feed room to produce artemia and rotifers supports this work. The fourth system is a dedicated, high-replicate marine system suited for shrimp and marine fish research.

Bozeman Fish Technology Center

Through a cooperative agreement with the USDA/ARS Trout Feeds Program, ARI researchers have access to state-of-the-art diet manufacturing equipment for making fish feeds at the Bozeman Fish Technology Center, Montana. This includes a variety of equipment including a hammer mill, air swept pulverizer, mixers of various sizes and types, pelleting equipment including a Buhler twin screw extruder, feed drier, and a vacuum coater for oil addition.



PEOPLE

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1. Research Highlights

Feeds and Nutrition

- Top-cited article in Reviews in Aquaculture (Hossain et al. 2024).
- Increasing the dietary tolerable limit of corn distillers' dried grains (DDGS) in tilapia feeds, including improved phosphorus digestibility via phytase.
- Examination of the nutritional value of novel sorghum protein concentrates as alternative aquafeed ingredients.
- New methodology to simultaneously measure soybean antinutritional protease inhibitors.
- Simplified fecal collection method for rainbow trout to support digestibility and nutrition studies ("Fish Poop Tells the Story").
- Creation of sorghum-based extruded fish feed with comparable digestible energy to wheat flour.
- CRISPR-Cas9–edited soybeans with reduced protease inhibitors to improve feed ingredient performance.
- Published research on functional feed ingredients in rainbow trout, including pistachio by-products.
- Characterized proteomic mechanisms underlying soybean meal–induced enteritis resistance in rainbow trout.

Genetics and Genomics

- 2024 Award for Best Genetics Paper in an AFS Journal (Hess et al. 2023).
- Discovery and validation of candidate genes associated with age-at-maturity in Chinook Salmon.
- Improvements to genetic monitoring of salmonids through deployment of a mobile genetics laboratory.
- Published studies in conservation genomics, including genetic monitoring of salmonids, lamprey, and white sturgeon.
- Reconstructed a two-generation pedigree and assessed reproductive success in Upper Yakima River spring Chinook Salmon.
- Genotyping and long-term genetic shift analysis of Hood River steelhead before and after dam removal.
- Developed and optimized protocols for detecting epigenetic patterns in salmonids.
- Initiated a genetic diversity assessment contract for Snake River white sturgeon.
- Created an in-season genetic-informed application to forecast Spring Chinook Salmon abundance.
- Produced parentage-based tagging hatchery program reports for Columbia River RM&E programs.

- Developed genetic applications for genus and life-history identification of lampreys.
- Began collaboration on epigenetics of sex determination and maturation in Pacific lamprey.

Physiology, Health, and Management

- Technical research on gut health and easing nutrition trial bottlenecks supports increases in soy inclusion rates in aquafeeds.
- Conducted work showing that burbot with high whole-body selenium levels exhibit higher clinical significance of deformity compared to larvae with normal selenium levels.
- Completed burbot tetraploid research demonstrating hydrostatic shock induction.
- Conducted research showing recirculating aquaculture system (RAS) culture of burbot eggs and larvae is feasible.
- Conducted hatchery and field pilot studies on endocrine bioindicators of growth and metabolic status in juvenile salmonids.
- Development of a PCR-based assay for biosecurity risk assessment of aquafeed for White Spot Syndrome Virus (WSSV).
- Advanced research on host–microbiome interactions in aquaculture systems, including biofilters and host stress responses.
- Member of NSF-funded research team studying climate change effects on predator–prey physiology and interactions (cutthroat trout and tailed frogs).

Extension and Outreach

- Published a burbot culture guide to assist prospective producers.
- Completed construction of a production-scale kelt reconditioning facility and transitioned program leadership to the Nez Perce Tribe.
- Expanded international aquaculture development via USDA-FAS CADI, hosting Georgian aquaculture stakeholders for training.
- Delivered extension programming focused on aquaculture workforce development, including genomics and youth outreach.
- Contributed to the American Fisheries Society *Hatchery Management Manual* (Water Quality chapter).
- Led and delivered the Coldwater Fish Culture Course for hatchery and aquaculture professionals.
- Continued leadership in aquaculture extension and industry engagement (Idaho Aquaculture Association Annual Meeting, producer consultations).
- First CRITFC- and Member Tribe-led Pacific Lamprey translocation above five dams in the Willamette River Basin.

2. Trainees

Ph.D. Students

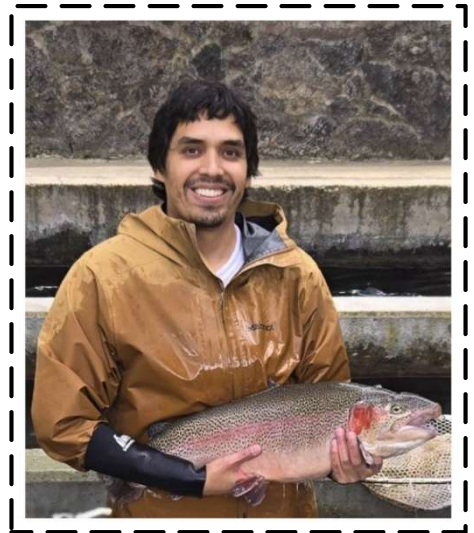
- Alonso Carrillo Longoria – Ph.D. in Animal Physiology
- Clayton Mabey – Ph.D. in Animal Physiology
- Daniel Assan – Ph.D. in Natural Resources
- Jake Bowman – Ph.D. in Biological Sciences
- Jamison Semla – Ph.D. in Natural Resources
- Jonathan Masingale – Ph.D. in Natural Resources
- Megan Cox – Ph.D. in Natural Resources
- Melanie Moffitt – Ph.D. in Natural Resources
- Mosope Abanikannda – Ph.D. in Animal Physiology
- Nick Hoffman – Ph.D. in Biological Sciences
- Zarin Subah – Ph.D. in Environmental Science

Master's Students

- Christine Trahan – M.S. in Natural Resources
- Jose Ortiz – M.S. in Natural Resources
- Manuel Carballo – M.S. in Natural Resources
- Rachael Valeria – M.S. in Biological Sciences
- Veronica Myrsell – M.S. in Natural Resources

Undergraduate Trainees

- Cole Pettit – Fish and Wildlife Sciences
- Emma Walker – Environmental Science
- Harrold Garcia – Fish and Wildlife Sciences
- James Forell – Fish and Wildlife Sciences
- Katie Theissen – Mathematics
- Remington Sitts – Fish and Wildlife Sciences
- Shelby Countess – Fish and Wildlife Sciences
- Spencer Lythgoes – Idaho NIH INBRE Fellow
- Spencer Steinmark – Fish and Wildlife Sciences
- Tyler Christensen – Idaho NIH INBRE Fellow
- Violeta Varela – Fish and Wildlife Sciences
- Zoe Doerr – Fish and Wildlife Sciences



3. Visiting Trainees

- Kathryn Rapp – DVM Student, Mississippi State University (1-week training abroad)
- Pankaj Yadav – M.S. Student, University of Idaho (1-week molecular training)
- Vandana Dharan – Ph.D. Student, Mississippi State University (1-week training abroad)

4. Postdocs, Research Scientists & Visiting Scientists

- Ali Hamidoghli – Research Scientist
- Krishna Singha – Postdoctoral Researcher
- Laura Jenkins – Visiting Scientist
- Lea Medeiros – Research Scientist
- Luke Oliver – Postdoctoral Researcher
- Marina Subramaniam – Postdoctoral Researcher / Research Scientist
- Matt Keefer – Visiting Scientist
- Nathan Redman – Research Scientist
- Neil Graham – Visiting Scientist



5. Faculty, Researcher & Trainee Awards

- 2024 Award for the Best Genetics Paper in an AFS Journal (3rd consecutive award): Hess, J.E., R.T. Lampman, A.D. Jackson, T. Sween, L. Jim, N. McClain, G. Silver, L. Porter, S.R. Narum. 2023. The return of the adult Pacific Lamprey offspring from translocations to the Columbia River. North American Journal of Fisheries Management 43:1000–1016. <https://doi.org/10.1002/nafm.10922>.
- 2024 Award for Most Cited Paper in Reviews in Aquaculture (2nd consecutive award): Hossain, M.S., B.C. Small, V. Kumar, R. Hardy. 2024. Functional additives in plant-based aquafeed. Reviews in Aquaculture. <https://doi.org/10.1111/raq.12824>.
- Marina Subramaniam – Top Poster Award, 2025: Wageningen Fish Nutrition Workshop. Presentation: "How are methionine absorption and gut barrier function affected by soybean meal-induced enteritis in salmonids, and what are the roles of specific anti-nutritional factors?"
- 2 Travel Awards (Graduate Student Krishna Pada Singha) – Fish Culture Section (FCS), World Aquaculture Society 2024, San Antonio, TX.
- Vikas Kumar – Natural Science Award, Innovative Solution for Animal Liver and Gallbladder Health, Scientific & Technological Ways to Husbandry Development, Jinan, Shandong, China, April 2024.

6. Formal Research Collaborations (MOUs, SCAs)

- USDA and Kootenai Tribe (see Sponsored Projects and Awards for details).
- 2050-21310-006-006S: Improving the Competitiveness of Rainbow Trout Production by the Integrated Development of Improved Feedstuffs, Feeds, and Trout | Cooperator: University of Idaho.
- 2050-21310-006-016N: Cooperative Research Program on Fish Nutrition and Diet Development | Cooperator: Montana State University.
- 2050-21310-006-023S: Improving the Competitiveness of Rainbow Trout Production by the Integrated Development of Improved Feedstuffs, Feeds, and Trout | Cooperator: University of Idaho.
- 2050-21310-006-017R: Optimization of Rainbow Trout Production Through Integrated Assessment of Trout Strains, Feeds, and Production Conditions | Cooperator: Clear Springs Foods, Inc.

- 2050-21310-006-019R: Mixing up an Optimal Diet for White Sturgeon Grow-out | Cooperator: University of Washington.
- 2050-21310-006-021T: Examination of the Nutritional Value of Novel Sorghum Protein Concentrates | Cooperator: Virginia Polytechnic Institute (VPI).
- (Unnamed): Evaluation of Corn DDGS in Practical Feeds of Tilapia | Cooperator: U.S. Grains Council.
- TERMINATING: Project 2050-21310-006-000D, 'Improving Nutrient Utilization to Increase the Production Efficiency and Sustainability of Rainbow Trout Aquaculture' – Term date December 27, 2024. Final report submitted FY2024.
- CONTINUING (new project initiated): Project 2050-10600-001-000D, 'Innovations in Feed Science, Farming Practices, and Broodstock Management to Improve Sustainability of Salmonid Aquaculture' – Initiated upon OSQR certification, replacing the terminating project.
- Bigelow Labs: Microalgae identification for rainbow trout feed formulations (Sub-objectives 2A/2B).
- Helios: Microalgae source identification and characterization (Sub-objectives 2A/2B).
- Marine Algae Industrialization Consortium (MAGIC): Microalgae identification for aquaculture feed applications (Sub-objectives 2A/2B).
- ARS St. Louis, MO: CRISPR-Cas9 soybean gene editing collaboration (Sub-objective 1F).
- Virginia Tech: Sorghum protein concentrate evaluation (Sub-objective 1A).
- U.S. Sorghum Board: Sorghum grain supply and collaboration (Sub-objective 1A).
- Oregon Zoo: Pacific Lamprey Exhibit and Restoration Research, 2025–2026.
- Formal research partnership (MOU) with the Columbia River Inter-Tribal Fish Commission (CRITFC) on multiple projects (steelhead trout, Chinook salmon, Pacific lamprey).

7. Sponsored Projects and Awards

- *Mixing up an optimal diet for white sturgeon grow out.* W.M. Sealey, M.S. Powell, and J.A. Gross. USDA-NIFA Western Regional Aquaculture Center. \$423,921 (2021 – 2026)
- B.C. Small and V. Kumar. Pacific Bio Products, LLC. \$13,245 (2022 – 2024)
- B.C. Small and V. Kumar. Ohio Soybean Council. \$105,000 (2022 – 2024)
- *Efficacy and immunomodulatory properties of the probiotic Enterobacter C6-6 for early life stage management of coldwater and columnaris disease and related co-infections.* K. Cain, J.W. Bledsoe. USDA-NIFA. \$295,930 (2022 – 2025)
- *Banbury Springs Limpet Captive Holding & Rearing Project.* B.C. Small. USFWS. \$102,127 (2022 – 2025)
- *Bolstering fish culture education, extension and outreach in Republic of Georgia.* B.C. Small, J.W. Bledsoe, M. Powell, S. Reichley. USDA Foreign Agricultural Service. \$504,168 (2022 – 2026)
- V. Kumar and B.C. Small. United Soybean Board. \$87,497 (2023 – 2024)
- B.C. Small and Ali Hamidoghli. The Andersons. \$64,535 (2023 – 2024)
- B.C. Small. USDA Agricultural Research Service. \$57,961 (2023 – 2024)

- B.C. Small and V. Kumar. Nuseed. \$69,427 (2023 – 2024)
- *Developing Tools and Protocols to Establish Freshwater Cod (Burbot; Lota lota) as a New Commercial Aquaculture Species in the US*. C. Johnson. USDA. \$175,000 (2023 – 2024)
- V. Kumar and B.C. Small. EnviroFlight. \$35,895 (2023 – 2024)
- B.C. Small. Columbia River Inter-Tribal Fish Commission. \$1,682,579 (2023 – 2025)
- *Enhancing trout performance through dietary acidification*. A. Bockus, G. Gaylord, M. Powell, and J.W. Bledsoe. Western Regional Aquaculture Center (USDA-NIFA). \$292,044 (2023 – 2025)
- V. Kumar, J. Ma, and B.C. Small. Soy Aquaculture Alliance. \$99,589 (2023 – 2025)
- V. Kumar and B.C. Small. Ohio Soybean Council. \$70,000 (2023 – 2025)
- *Persistence of small bull trout populations in Idaho sub-alpine lakes*. U.S. Fish & Wildlife Service, Idaho Fish and Wildlife Office. \$57,599 (2023 – 2026)
- *Agriscience Technology Pathways (ATP)*. M. Knutz, M. Fisher, J.W. Bledsoe, et al. USDA-NIFA-AFRI-FANE. \$750,000 (2023 – 2026)
- *Increasing trout consumption in young children and families for cognitive and mental health benefit*. A. Roe, M. Powell, C. Ross, S.L. Johnson, S.G. Lee, and J.W. Bledsoe. USDA-NIFA. \$1,150,000 (2023 – 2027)
- *Improving the Competitiveness of Rainbow Trout Production by the Integrated Development of Improved Feedstuffs, Feeds and Trout*. B. C. Small and J.W. Bledsoe. USDA Agricultural Research Service. \$1,302,114 (2023 – 2027)
- *Consequences of Thermal Programming on the Epigenome and Phenome of Cultured Rainbow Trout*. J.W. Bledsoe. University of Idaho Office of Research and Economic Development Operation Resubmission Success. \$4,691 (2024)
- *Effect of parent age on rate of minijack production among male progeny of spring Chinook Salmon X*. Columbia River Inter-Tribal Fish Commission. \$149,337 (2024)
- *Evaluation of plasma levels of insulin-like growth factor-1 as a tool for assessing growth in juvenile salmonids under field conditions II*. Columbia River Inter-Tribal Fish Commission. \$28,961 (2024)
- *The physiology of kelt reconditioning XVI: developing strategies to increase iteroparity in Snake River steelhead*. Columbia River Inter-Tribal Fish Commission. \$273,843 (2024)
- *Assessment of sex and reproductive maturation in Pacific lamprey*. Columbia River Inter-Tribal Fish Commission. \$55,180 (2024)
- B.C. Small, J. Ma. Kent Corporation. \$112,083 (2024 – 2025)
- *Contaminant related impacts on burbot early life stage development, survival, and immunophysiology*. J. Ma. Kootenai Tribe of Idaho. \$130,685.50 (2024 – 2025)
- B.C. Small. USDA Agricultural Research Service. \$61,644 (2024 – 2025)
- *Ontogeny of lymphoid organs and immunoglobulin producing cells in burbot (Lota lota)*. L. Oliver. USDA, NIFA EWD. \$205,166 (2024 – 2025)
- B.C. Small and A. Hamidoghli. Grain Processing Corporation. \$45,901 (2024 – 2025)
- *Integrated Water Science in the Willamette River Basin, Oregon*. C.C. Caudill, and M. Keefer. USGS/Oregon Water Science Center. \$29,940 (2024 – 2025)
- B.C. Small and Ali Hamidoghli. Soy Aquaculture Alliance. \$47,386 (2024 – 2025)

- *Improved characterization of soybean meal induced enteritis using machine learning automation and standardization to score distal intestinal histology slides.* J.W. Bledsoe. Soy Aquaculture Alliance. \$70,701 (2024 – 2026)
- *Methionine absorption and gut barrier function in soybean meal-induced enteritis in salmonids.* B.C. Small, M. Subramaniam and M. Powell. Soy Aquaculture Alliance. \$157,783 (2024 – 2026)
- *Integrating evolutionary adaptive capacity and trophic dynamics to predict multi-species responses to climate change.* National Science Foundation Organismal Response to Climate Change. \$644,970 (2024 – 2027)
- *Pacific salmon ecology and habitat modeling.* C.C. Caudill and M. Keefer. USGS-Great Basin Cooperative Ecosystem Studies Unit, year 1 funding: \$29,993, anticipated five-year total: \$219,976 (2024 – 2029)
- *Pacific Lamprey translocation along the Willamette River tributaries.* First Nations Development Institute. \$49,193 (2025)
- *Effect of parent age on rate of minijack production among male progeny of spring Chinook Salmon XI.* Columbia River Inter-Tribal Fish Commission. \$151,316 (2025)
- *The physiology of kelt reconditioning XVII.* Columbia River Inter-Tribal Fish Commission. \$269,449 (2025)
- *Assessment of sex and reproductive maturation in Pacific lamprey III.* Columbia River Inter-Tribal Fish Commission. \$53,356 (2025)
- *Epigenetics of Pacific lamprey sex and maturation.* U.S. Department of the Interior. \$99,930 (2025)
- B.C. Small. DPI. \$84,866 (2025 – 2026)
- *Examination of spawning techniques and parent biometrics to enhance burbot conservation aquaculture.* K. Cain. Kootenai Tribe of Idaho. \$134,421.90 (2025 – 2026)
- B.C. Small and W. Sealey. Tyson Foods. \$69,170 (2025 – 2026)
- B.C. Small. USDA Agricultural Research Service. \$61,644 (2025 – 2026)
- *Cryopreservation Suite to Increase Research Capacity and Integrity at the University of Idaho College of Natural Resources.* L.A. Vierling and D.R. Becker, et al. (CCC as Co-Investigator). Murdock Charitable Trust. \$350,000 (2025 – 2027)
- B.C. Small. Columbia River Inter-Tribal Fish Commission. \$2,061,494 (2025 – 2027)
- *Genetic Assessment of Columbia River Stocks.* S. R. Narum. Bonneville Power Administration Accords Grant. \$1.6 million/year for 3 years (2025 – 2028)
- *Short- and long-term vaccination efficacy against piscine lactococcosis.* E. Soto, R. Sallenave, I. Salinas, J. Gross, J.W. Bledsoe. USDA Western Regional Aquaculture Center (WRAC). \$558,166 (2025 – 2028)



8. Published Peer-Reviewed Manuscripts

- Amirkolaie, A.K., M.M. Rubio Benito, N. Romano, J. Hong, B.C. Small, V. Kumar. 2024. *Bile acid supplementation in alternative lipid-based diets: Effects on growth, histopathology and digestibility in rainbow trout (Oncorhynchus mykiss)*. Animal Feed Science and Technology. <https://doi.org/10.1016/j.anifeedsci.2024.116179>.
- Bockus, A. B., M. S. Powell, W. M. Sealey, P. Zito, Y. Kurerov, T. Sbisà, J. A. Carrillo-Longoria, and T. G. Gaylord. 2025. *Dietary trimethylamine oxide alters digestibility, intestinal histopathology, and gene expression in soy fed rainbow trout (Oncorhynchus mykiss)*. Aquaculture, 596, p.741810. <https://doi.org/10.1016/j.aquaculture.2024.741810>.
- Cheng, A.-C., DeRuyter, E., de Oliveira Viadanna, P.H., White, Z.S., Lednicky, J.A., Wisely, S.M., Subramaniam, K., & Campos Krauer, J.M. 2025. *Bovine Viral Diarrhea Virus-1 (Pestivirus bovis) Associated with Stillborn and Mummified Fetuses in Farmed White-Tailed Deer (Odocoileus virginianus) in Florida*. Viruses, 17(8): 1104. <https://doi.org/10.3390/v17081104>
- de Oliveira Viadanna, P.H., Brinkman, A., Vimont, B., Gray, M.J., Warwick, A.R., Poudyal, N.C., & Brunner, J.L. 2025. *Prevalence of Batrachochytrium dendrobatidis, B. salamandrivorans, and Ranavirus in the US domestic pet amphibian trade*. Frontiers in Amphibian and Reptile Science, 3: 1698665. <https://doi.org/10.3389/famrs.2025.1698665>
- de Oliveira Viadanna, P.H., & Brunner, J.L. 2025. *Evaluating Responses to Epidemics of Infectious Spleen and Kidney Necrosis Virus in Farmed Tilapia (Oreochromis niloticus)*. Ecological Modelling, 510: 111270. <https://doi.org/10.1016/j.ecolmodel.2025.111270>
- Dunkle, M.R., Bellmore, J.R., Fellman, J.B., & Caudill, C.C. 2024. *Glaciers, snow, and rain: Water source influences invertebrate community structure and secondary production across a hydrologically diverse subarctic landscape*. Limnology and Oceanography, 69: 232-245. <https://doi.org/10.1002/lno.12451>
- Dunkle, M.R., Bellmore, J.R., Fellman, J.B., Hood, E.W., & Caudill, C.C. 2025. *Loss of Meltwater from Glaciers and Snowpack May Increase Synchrony of River Habitats and Resources in Mountain Watersheds*. Ecology, 106(4): e70023. <https://doi.org/10.1002/ecy.70023>
- Egan, J., Ma, J., Myrsell, V.L., Chen, Z., Masingale, J., Caudill, C.C., Boyle, T., Browning, J., Narum, S.R., Cain, K.D., & Hohenlohe, P.A. 2025. *Temperature-related effects on disease susceptibility and immune response in Redband trout (Oncorhynchus mykiss gairdneri) following challenge with Flavobacterium columnare*. Journal of Fish Diseases, 48(2): e14046. <https://doi.org/10.1111/jfd.14046>
- Freeland, J., Sibbett, B., & Narum, S. 2024. *Mini reviews: A new manuscript category for summarizing emerging topics*. Molecular Ecology Resources, e13968. <https://doi.org/10.1111/1755-0998.13968>
- Frías Gómez, S. A., M. S. Powell, L. H. H. Hernandez, M. A. F. Araiza. 2025. *Expression of lipid, carbohydrate, and antioxidant metabolism related genes in juveniles of cinnamon freshwater prawn Macrobrachium acanthurus, fed diets with different levels of protein, lipids, and carbohydrates*. Aquaculture International 33:308. <https://doi.org/10.1007/s10499-025-01981-2>
- Hargrove, J.S., Campbell, M.R., Harris, A.C., Narum, S.R., Horn, R.L., & Hess, J.E. 2025. *Genetic methods for informing conservation and management of salmonids in the Pacific Northwest, USA*. Journal of Fish Biology, 1-11. <https://doi.org/10.1111/jfb.70143>

- Hargrove, J.S., Delomas, T.A., Powell, J.H., Hess, J.E., Narum, S.R., & Campbell, M.R. 2024. *Efficient population representation with more genetic markers increases performance of a steelhead genetic stock identification baseline*. *Evolutionary Applications*, 17: e13610. <https://doi.org/10.1111/eva.13610>
- Hernandez, L. H. H., M. S. Powell, S. A. Frias Gomez, E. Cortés-Jacinto and F. Vega-Villasante. 2024. *Scientific knowledge of the cinnamon river prawn *Macrobrachium acanthurus* and future perspectives for aquaculture*. *Aquaculture International* 32:10215-10230. <https://doi.org/10.1007/s10499-024-01658-2>
- Hess, J.E., Deacy, B.M., Rub, M.W., Van Doornik, D.M., Whiteaker, J.M., Fryer, J.K., & Narum, S.R. 2024. *Visual and genetic stock identification of a test fishery to forecast Columbia River spring Chinook salmon stocks 2 weeks into the future*. *Evolutionary Applications*, 17: e13667. <https://doi.org/10.1111/eva.13667>
- Hoffman, N.F., Willis, S.C., Nuetzel, H.M., Pierce, A.L., Nagler, J.J., & Narum, S.R. 2025. *Genome-wide association for precocial maturation in juvenile male spring Chinook salmon*. *Conservation Genetics*. <https://doi.org/10.1007/s10592-025-01688-0>
- Hong, J., J.G. Ortiz, W.M. Sealey, B.C. Small. 2024. *Effects of dietary arachidonic acid supplementation in low fishmeal and fish oil-free diets on growth performance, inflammatory response, gut histology, and non-specific immunity in sub-adult rainbow trout, *Oncorhynchus mykiss**. *Aquaculture*, 580, 740272. <https://doi.org/10.1016/j.aquaculture.2023.740272>.
- Hong, J., J.W. Bledsoe, K.E. Overturf, R.W. Hardy, B.C. Small. 2024. *Balancing dietary plant-based lipids and cholesterol to increase fillet omega-3 deposition in rainbow trout (*Oncorhynchus mykiss*) fed a diet without animal ingredients*. *Aquaculture*, 578, p.740029. <https://doi.org/10.1016/j.aquaculture.2023.740029>.
- Hong, J., J.G. Ortiz, B.C. Small. 2025. *Corn fermented protein with solubles as a replacement for fish meal in diets for Atlantic salmon (*Salmo salar*) parr: Growth, feed utilization, antioxidant activity, non-specific immune response, and gut histopathology*. *Journal of the World Aquaculture Society*. <https://doi.org/10.1111/jwas.70020>.
- Horn, R.L., Nuetzel, H.M., Johnson, B., Kamphaus, C., Lovrak, J., Mott, K., Newsome, T., & Narum, S.R. 2024. *Utility of parentage-based tagging for monitoring Coho salmon (*Oncorhynchus kisutch*) in the interior Columbia River basin*. *Evolutionary Applications*, 17: e13607. <https://doi.org/10.1111/eva.13607>
- Horn, R.L., Caisman, J., Kamphaus, C., & Narum, S.R. 2025. *Genomic insights into local adaptation and migration success in reintroduced Coho Salmon of the Wenatchee River basin*. *Transactions of the American Fisheries Society*. <https://doi.org/10.1093/tafafs/vnaf019>
- Hossain, M.S., B.C. Small, V. Kumar, R. Hardy. 2024. *Functional additives in plant-based aquafeed*. *Reviews in Aquaculture*. <https://doi.org/10.1111/raq.12824>.
- Hossain, M.S., A. Hamidoghli, J. Hong, W. Sealey, B.C. Small. 2025. *Effects of high dietary inclusion of defatted mealworm (*Tenebrio molitor*) meal as a fish meal substitute on growth, histological traits and health performances of rainbow trout (*Oncorhynchus mykiss*)*. *Aquaculture Nutrition*. <https://doi.org/10.1155/anu/5568058>.
- Kaylor, M.J., Ciepiela, L.R., Feden, M., Lemanski, J.T., Justice, C., Staton, B.A., Armstrong, J.B., Kelly, S., Narum, S.R., Tattam, I.A., & White, S.M. 2025. *Watershed-scale dispersal patterns of juvenile Chinook Salmon revealed through genetic parentage analysis*. *Movement Ecology*, 13: 6. <https://doi.org/10.1186/s40462-024-00524-3>

- Keefer, M.L., Naughton, G.P., Blubaugh, T.J., Clabough, T.S., & Caudill, C.C. 2025. *River environment effects on adult migration phenology and rate of spring-run Chinook Salmon*. Transactions of the American Fisheries Society, 154(1): 85-102. <https://doi.org/10.1093/tafafs/vnae010>
- Koch, I.J., Staton, B.A., Nuetzel, H.M., Seamons, T.R., Matala, A.P., Warheit, K.I., Johnston, M.V., Strom, C.R., Narum, S.R., & Bosch, W.J. 2025. *Evaluating the long-term per capita productivity benefits and associated costs of supplementation in upper Yakima River Chinook salmon*. Canadian Journal of Fisheries and Aquatic Sciences, 82: 1-17. <https://doi.org/10.1139/cjfas-2024-0289>
- Narum, S.R., Campbell, M., Coykendall, K., Meek, M., O'Malley, K.G., & Wellenreuther, M. 2024. *Advances in salmonid genetics: Insights from coastwide and beyond*. Evolutionary Applications, 17: e13732. <https://doi.org/10.1111/eva.13732>
- Narum, S.R., Horn, R., Willis, S., Koch, I., & Hess, J. 2024. *Genetic variation associated with adult migration timing in lineages of Steelhead and Chinook Salmon in the Columbia River*. Evolutionary Applications, 17: e13626. <https://doi.org/10.1111/eva.13626>
- Narum, S., Kelley, J., & Sibbett, B. 2025. *Editorial 2025*. Molecular Ecology Resources, 25: e14051. <https://doi.org/10.1111/1755-0998.14051>
- Oliver, L.P., Myrick, C.A., Fornshell, G., & Cain, K.D. 2024. *Life History and Aquaculture Methods for Burbot (Lota lota)*. Reviews in Fisheries Science & Aquaculture, 1-18. <https://doi.org/10.1080/23308249.2024.2308917>
- Overturf, K., Abernathy, J., Kultz, D., Bledsoe, J., Narum, S., & Welker, T. 2025. *Potential physiological mechanisms behind variation in rainbow trout (Oncorhynchus mykiss) to biosynthesize EPA and DHA when reared on plant oil replacement feeds*. Aquaculture Reports, 41: 102655. <https://doi.org/10.1016/j.aqrep.2025.102655>
- Rico, J.A.L., Fonseca, A.A., Viadanna, P.H.O., Brunner, J.L., & Campião, K.M. 2026. *Ranavirus infection in anuran species in Atlantic Forest fragments in Brazil*. Diseases of Aquatic Organisms, 165: dao03892. <https://doi.org/10.3354/dao03892>
- Robinson, Z.L., Stephenson, J., Vertacnik, K., Willis, S., Horn, R., McCane, J., Coykendall, D.K., & Narum, S.R. 2024. *Efficient species identification for Pacific salmon genetic monitoring programs*. Evolutionary Applications, 17: e13680. <https://doi.org/10.1111/eva.13680>
- Schiebelhut, L.M., Guillaume, A.S., Kuhn, A., Schweizer, R.M., Armstrong, E.E., Beaumont, M.A., Byrne, M., Cosart, T., Hand, B.K., Howard, L., Mussmann, S.M., Narum, S.R., Rasteiro, R., Rivera-Colón, A.G., Saarman, N., Sethuraman, A., Taylor, H.R., Thomas, G.W.C., Wellenreuther, M., & Luikart, G. 2024. *Genomics and conservation: Guidance from training to analyses and applications*. Molecular Ecology Resources, 24: e13893. <https://doi.org/10.1111/1755-0998.13893>
- Segura-Campos, J. M., L. H. H. Hernandez, M. S. Powell, M. A. Fernandez-Araiza, S. A. Frias Gomez, and M. Castillo-Dominguez. 2025. *Effects of inclusion of probiotic *Pediococcus acidilactici* in diets with high levels of soybean meal in growth and interleukins gene expression of rainbow trout (Oncorhynchus mykiss)*. Estudos em Ciencias agrarias e Ambientais https://doi.org/10.37572/EdArt_3107255981
- Silver, G.S., Lampman, R.T., Percival, N., Timoshevskaya, N., Smith, J.J., Bentley, K.T., Wade, J., Narum, S.R., & Hess, J.E. 2025. *Genetic Identification of Lamprey Genera and Anadromous Ecotypes in Watersheds of the Northeastern Pacific Ocean*. Evolutionary Applications, 18: e70108. <https://doi.org/10.1111/eva.70108>

- Sriwanayos, P., Ossiboff, R.J., Kanchanakhan, S., Polchana, J., Imnoi, K., Viadanna, P.H.O., Rodrigues, T.C.S., Colee, J., & Waltzek, T.B. 2026. *Experimental challenge of East Asian bullfrog *Hoplobatrachus rugulosus* tadpoles with tiger frog virus: dosage impact on disease severity*. Diseases of Aquatic Organisms, 165: dao03896. <https://doi.org/10.3354/dao03896>
- Strait, J.T., Grummer, J.A., Hoffman, N.F., Muhlfeld, C.C., Narum, S.R., & Luikart, G. 2024. *Local environments, not invasive hybridization, influence cardiac performance of native trout under acute thermal stress*. Evolutionary Applications, 17: e13663. <https://doi.org/10.1111/eva.13663>
- Subramaniam, M., K.E. Overturf, S. Schwarz, B.C. Small. 2025. *Effects of a plantmeal vs. fishmeal diet on intestinal integrity between two strains of rainbow trout (*Oncorhynchus mykiss*) reveal regional, strain, and diet differences*. Aquaculture. <https://doi.org/10.1016/j.aquaculture.2025.743433>.
- Van Doornik, D.M., Moran, P., Rondeau, E.B., Nichols, K.M., Narum, S.R., Campbell, M.R., Clemento, A.J., Hargrove, J.S., Hess, J.E., Horn, R.L., Seeb, L.W., Stephenson, J.J., & McKinney, G.J. 2024. *A new, standardized international Pacific Rim baseline for genetic stock identification (GSI) of Chinook Salmon*. North American Journal of Fisheries Management, 44(4): 857-869. <https://doi.org/10.1002/nafm.11019>
- Wang, H., Chen, M., Wang, Z., Huang, L., Caudill, C.C., Qu, S., & Que, X. 2024. *How does extreme point sampling affect non-extreme simulation in geographical random forest?* Earth Science Informatics. <https://doi.org/10.1007/s12145-024-01268-9>
- Willis, S., Stephenson, J., Pierce, A., Medeiros, L., Jenkins, L., Hatch, D.R., & Narum, S. 2024. *A genomic region associated with iteroparous spawning phenology is linked with age-at-maturity in female steelhead trout*. Evolutionary Applications, 17: e13622. <https://doi.org/10.1111/eva.13622>
- Willis, S., Coykendall, D.K., Campbell, M.R., & Narum, S. 2024. *Contrasting patterns of sequence variation in steelhead populations reflect distinct evolutionary processes*. Evolutionary Applications, 17: e13623. <https://doi.org/10.1111/eva.13623>
- Willis, S.C., Horn, R.L., Hess, J.E., Fryer, J.K., Whiteaker, J.M., & Narum, S.R. 2025. *Heritability and genomic basis of age-at-maturity in Chinook Salmon*. Journal of Heredity, 116(5): 632-652. <https://doi.org/10.1093/jhered/esaf021>
- Zambie, A., Loxterman, J., Breech, T., Narum, S.R., & Keeley, E. 2025. *Extent of stream habitat and hybridization influence levels of genetic diversity in Redband Trout (*Oncorhynchus mykiss gairdneri*) populations*. Conservation Genetics. <https://doi.org/10.1007/s10592-025-01734-x>



9. Book Chapters & Books

- Boyd, C., Davis, R., & Kumar, V. (2024). Water quality and its impacts on feeding practices. In V. Kumar (Ed.), *Feed and Feeding for Fish and Shellfish: Nutritional Management*. Elsevier.

- Kumar, V. (Ed.). (2024). *Feed and Feeding for Fish and Shellfish: Nutritional Management* (1st ed.). Academic Press (Elsevier). ISBN 9780443215568 (Hardback); ISBN 9780443215575 (eBook). Published October 31, 2024.
- Kumar, V. (Ed.). (2025). *Nutrition and Physiology of Fish and Shellfish: Feed Regulation, Metabolism, and Digestion* (1st ed., Part I). Academic Press (Elsevier). 865 pp. ISBN 9780323908733 (Hardback); ISBN 9780323908740 (eBook).
- Kumar, V., Ragaza, J., & Glencross, B. (2025). Chemistry and sources of protein. In V. Kumar (Ed.), *Nutrition and Physiology of Fish and Shellfish*. Elsevier.
- Kumar, V., Ragaza, J., & Sahu, N. P. (2025). Chemistry and sources of carbohydrates. In V. Kumar (Ed.), *Nutrition and Physiology of Fish and Shellfish*. Elsevier.
- Esmaeili, N., Singha, K. P., & Kumar, V. (2025). Protein homeostasis. In V. Kumar (Ed.), *Nutrition and Physiology of Fish and Shellfish*. Elsevier.
- Kumar, V., Enes, P., Singha, K., Soengas, J., & Panserat, S. (2025). Metabolism of carbohydrates. In V. Kumar (Ed.), *Nutrition and Physiology of Fish and Shellfish*. Elsevier.
- Kumar, V., Esmaeili, N., Singha, K., Ragaza, J. A., & Trichet, V. (2024). Nutrition and metabolism of vitamins. In V. Kumar (Ed.), *Nutrition and Physiology of Fish and Shellfish*. Elsevier.
- Kumar, V., Mitra, A., & Ragaza, J. (2024). Digestive physiology of marine larvae: An overview of adaptations and mechanisms. In S.-K. Kim (Ed.), *Marine Larvae: Developments and Applications*. CRC Press. ISBN 9781032266787.
- Kumar, V., Ragaza, J., Mitra, A., & Gisbert, E. (2024). Larval and broodstock nutrition of fin fish. In V. Kumar (Ed.), *Feed and Feeding for Fish and Shellfish: Nutritional Management*. Elsevier.
- Oliva-Teles, A., & Kumar, V. (2024). Nutrients and energy requirements for fin fish. In V. Kumar (Ed.), *Feed and Feeding for Fish and Shellfish: Nutritional Management*. Elsevier.
- Waagbo, R., Remo, S., Kelly, A., Bruce, T., & Kumar, V. (2024). Nutritional disorders. In V. Kumar (Ed.), *Feed and Feeding for Fish and Shellfish: Nutritional Management*. Elsevier.

10. Invited Presentations

- Bledsoe, J. *Idaho aquaculture overview and ongoing research at University of Idaho Hagerman Fish Culture Experiment Station*. Invited Presentation, Middle Snake Regional Water Resources Commission, August 2024.
- Brian Small. *15th International Congress on the Biology of Fishes*, Ann Arbor, MI, 2024.
- Brian Small. *3rd Aquaculture Africa Conference (AFRAQ 2024)*, Hammamet, Tunisia, 2024.
- Brian Small. *Biology Department Seminar Series*, University of Alabama at Birmingham, 2024.
- Brian Small. *AIT Special Session on "Better Fish, Smarter Farms, Skilled People: Resilient Aquaculture in Sub-Saharan Africa for Brighter Future."* World Aquaculture Safari 2025, Entebbe, Uganda.

- Caudill, C.C. *Migrations through worlds: Pacific Lamprey in the Columbia River Basin*. Invited plenary speaker and panel member, 2025 Annual Meeting of the Great Lakes Fishery Commission, Traverse City, MI, 2025.
- Caudill, C.C. *Salmon ecology in the Pacific Northwest*. Invited lecture, LNDARCH 485 Landscape Architecture Senior Comprehensive Project, Washington State University, 2025.
- Jon Hess, Rebekah Horn, Shawn Narum. *Regional Marking and Tagging, Genetic Monitoring with PBT*. Invited Seminar (virtual), February 2024.
- Koch, I. & Narum, S. *Costs and benefits of Chinook salmon supplementation in the Columbia River Basin*. Alaska Department of Fish and Game, Anchorage, AK (remote), June 2025.
- Marina Subramaniam. “*The Ussing Chamber – Providing insight into fish nutritional physiology*.” Invited Talk: Nutrition/Physiology Community of Practice, U.S. Fish and Wildlife Service, 2025.
- Melanie Moffitt. *International Symposium on Fish Nutrition and Feeding*, Puerto Vallarta, Mexico, 2024.
- Shawn Narum & Ilana Koch. *Risk/benefit of conservation hatcheries*. Invited Seminar, ADFG (virtual), May 2025.
- Shawn Narum. *Artificial Selection Workshop* (invited seminar), Switzerland, August 2025.
- Shawn Narum. Invited Speaker, *ESEB Symposium*, Barcelona, August 2025.
- Vikas Kumar. Invited lead speaker, *14th Asian Fisheries and Aquaculture Forum (14AFAF)*, New Delhi, India, February 2025.
- Vikas Kumar. Invited Speaker, *Innovative Solution for Animal Liver and Gallbladder Health*, Jinan, Shandong, China, April 2024.
- Vikas Kumar. Invited speaker, *Mediterranean Aquaculture Industry workshop leveraging sustainability in the blue economy*, Rhodes, Greece, April 2024.
- Vikas Kumar. Lead panelist, *SUSTAINASUMMIT: Advancing Sustainability in South Asia*, Colombo, Sri Lanka, May 2025.
- Vikas Kumar. *Plenary speaker and lead panelist, Aqua Tech Talks: Empowering Aquaculture*, U.S. Soy, Colombo, Sri Lanka, May 2025.
- Vikas Kumar. Plenary speaker, *2024 Annual Conference of Aquatic Animal Nutrition and Feed Committee (CAANFC)*, Chengdu, China, November 2024.

11. Workshops Conducted

- Co-organized AFS Genetics Section Symposium at the AFS Annual Meeting, August 2025, San Antonio, TX.
- Hosted Idaho Coldwater Fish Culture Course, August 2025, Hagerman, ID.

12. Press & Media Coverage

- Idaho Ag Today – Omega-3. May 29, 2025. <https://www.aginfo.net/report/62623/Idaho-Ag-Today/Omega-3>
- Capital Press – UI's Bledsoe, teammates, are breeding a better trout. May 14, 2025. <https://capitalpress.com/2025/05/14/uis-bledsoe-teammates-are-breeding-a-better-trout/>
- University of Nebraska–Lincoln (UNL Water) – From Sandhills to Sustainability. May 9, 2025. <https://water.unl.edu/sandhills-sustainability-exploring-aquaculture-innovation-idahos-hagerman-fish-culture-experiment/>
- KTVB Inside Ag – These rainbow trout thrive on a plant-based diet. April 29, 2025. <https://www.ktvb.com/video/news/local/inside-ag-these-rainbow-trout-thrive-on-a-plant-based-diet/277-39177ca1-1127-44c3-8510-d7e29f373836>
- KTVB Inside Ag – Farming fish for fine dining. April 15, 2025. <https://www.ktvb.com/video/news/agriculture/inside-ag/inside-ag-farming-fish-for-fine-dining/277-1a977ce6-97f4-478a-887f-9099c0155640>
- Aquaculture: From Dinner Plates to Aquariums. Dirt Road Discussions (Podcast), Idaho Farm Bureau. May 28, 2024. <https://open.spotify.com/show/0Lx5ZrfLeiaemAYOhbc2cV>
- World-class Fish Story: UI Researchers in Hagerman bolster fish culture production in former Soviet republic. Magic Valley Times-News (by Eric Goodell). March 7, 2024. https://magicvalley.com/news/local/hagerman-university-idaho-fish-trout/article_b37f6b58-db2e-11ee-969c-17c0559645e7.html
- Gone Fishing: Hagerman Fish Station hosts fish farming course. Magic Valley Times-News. April 4, 2024. https://magicvalley.com/news/local/fish-farm-farming-class-experiment-technology-agriculture-environment-course/article_c96df3ec-f11f-11ee-96c9-1b653f02a278.html
- MSU students support fish health, farmers in Republic of Georgia. Mississippi State University Communications. March 15, 2024. <https://www.msstate.edu/newsroom/article/2024/03/msu-students-support-fish-health-farmers-republic-georgia>



13. Outreach & Community Service

- Organizer, 2024 Idaho Aquaculture Association Annual Meeting, Twin Falls, ID.
- Organizer, 2025 Idaho Aquaculture Association Annual Meeting, Twin Falls, ID.
- Monterey Bay Aquarium Seafood Watch: 2025 Assessment of US Farmed Sturgeon. Expert interview and review. <https://www.seafoodwatch.org/globalassets/sfw-data-blocks/reports/s/seafood-watch-sturgeon-us-28395.pdf>
- Gooding County Science Fair Judge (2020–present).

- Volunteer Aquaculture and Aquaponics Consultant (2010–present).
- Participant, Meridian Ag Expo, September 2025.
- High school outreach: Clinton Central, Carbondale, Galatia, Murtaugh, Mackay, Hagerman, Wendell, and Parma High Schools.





Aerial view of the University of Idaho's Hagerman Fish Culture Experiment Station



University of Idaho

Aquaculture Research Institute

Advancing sustainable aquaculture and the conservation of aquatic resources