

2024 ICBF: Symposia Description

1. Climate change and urbanization: are we changing the planet to benefit the wrong fish?
2. Sensing the Environment: Fish sensory systems in a changing sensory environment; integrating sensory systems and sensory modality trade-offs under altered sensory scenes
3. Ion and Acid-Base Regulation in Fish
4. Fish Nutritional Physiology: From Evolution to Application and in Between
5. The Science of Fish Welfare
6. The Physiology and Control of Invasive Fish Species
7. Conservation Physiology in Action: From Science to Practice and Policy
8. Environmental Modulation of the Stress Response
9. Sub-lethal impacts of environmental stressors on fishes: when and why are fish vulnerable
10. The Physiology, Biology and Ecology of Polar Fish
11. Extended specimens in museum-based fish research
12. Ancient models in comparative physiology: Agnathan and chondrichthyan fishes
13. 8th International Symposium on Burbot
14. Impacts of a Warming World on Behavior and Physiology
15. Tropical Fishes: Past, present, and Future Challenges
16. Stress Endocrinology: Perception, Mechanisms, and Coping
17. Current Trends in Growth and Metabolism of Fishes
18. General Symposia

Session 1: Climate change and urbanization: are we changing the planet to benefit the wrong fish?

Chair(s): Jay Nelson, Towson University, jnelson@towson.edu; Adalberto (Dal) Va, The National Institute for Research in the Amazon, dalval.inpa@gmail.com

Description: Climate disruption, urbanization and other anthropogenic factors are altering fish habitat across the globe. Water bodies from the tropics to the poles are being impacted by human activities. In addition to increased temperature, decreased [O₂], and decreased pH, other environmental processes such as floods, sea level increases, UV incidence among others are imposing new biological demands on fish. How fish respond physiologically and behaviorally to these changes will determine which fishes survive this human onslaught. Many of these changes have proven detrimental to fishes that humans have come to rely on. Paradoxically, many invasive or undesirable species may be benefiting from the changes wrought by man. Different approaches have been used to analyze these issues and are contributing to a myriad of new revelations concerning the biology of fish now and into the future and why some species are benefiting over others. This symposium will feature analyses of fish physiological responses to perceived future environmental perturbations at all levels of biological organization. By combining studies of whole animals in natural environments responding to recent environmental changes, laboratory experiments under forecasted future environments with cellular and molecular approaches all focusing on the future world, it is hoped that insight concerning the capacity of fish to respond to future environments and the mechanisms whereby they do so will emerge from this symposium. We welcome everyone to share their findings in this emerging field at this symposium that has been part of every ICBF since 2010.

Session 2: Sensing the Environment: Fish sensory systems in a changing sensory environment; integrating sensory systems and sensory modality trade-offs under altered sensory scenes

Chair(s): Suzanne Gray, Ohio State University, gray.1030@osu.edu; Andrew Dittman, NOAA Northwest Fisheries Science Center, Andy.dittman@noaa.gov; Keith Tierney, University of Alberta, ktierney@ualberta.ca; Tyler Buchinger, Michigan State University, buching6@msu.edu

Description: We hope to bring together junior to established researchers in the field of fish sensory biology to link signals (sensory input from various modes) to receivers (molecular level and above) in order to understand the future of fish populations in the context of ecology and a changing environment. This will be the sixth offering of this successful symposium. The initial symposia were primarily focused on the physiology, behavior, and ecology of chemoreception but the symposium has expanded to include all sensory system (vision, olfaction, taste, hearing, lateral line, magnetic and electroreception) and the role they play in the ecology of fishes. We encourage fish sensory biologists from all disciplines (physiology, ecology, behavior) and all senses to participate in the symposium and especially researchers in early career stages and that represent the diversity of people studying how fish investigate the world. For the 2024 Symposium, we especially encourage presentations that focus on the role of sensory systems in the context of the changing sensory environment that fish experience and the use of multiple sensory modalities to adapt to these changes.

Session 3: Ion and Acid-Base Regulation in Fish

Chair(s): Colin Brauner, University of British Columbia, brauner@zoology.ubc.ca; Greg Goss, University of Alberta, Greg.goss@ualberta.ca; Steve McCormick, University of Massachusetts Amherst, mccormick@umext.umass.edu

Description: There have been many recent advances in both our understanding of fish ion transport mechanisms and acid-base physiology and how they are regulated in fish. This symposium will bring together top researchers in the broad field of ion and of acid-base regulation in fishes to discuss current topics and future directions for the field. We plan to have sub-sections within the symposium that will deal with new advances in our understanding of: a) endocrine and mechanistic control of ion regulation, b) smoltification, and c) acid-base regulation, both in relation to basic and applied research including climate change and conservation physiology. The symposia will highlight researchers using whole animal approaches and those following more cellular and molecular mechanisms underlying these regulatory events. This symposium will bring together speakers interested in a holistic approach to understanding the mechanisms involved in alteration and regulation of ion and acid-base status in fishes and the implications of this for whole animal function and responses to altered environments.

Session 4: Fish Nutritional Physiology: From Evolution to Application and in Between

Chair(s): Donovan German, University of California, Irvine, dgerman@uci.edu

Description: The gastrointestinal tract (GIT) is a dynamic physiological system allowing fishes to acquire nutrients from ingested food. Because of its ability to respond to changes in dietary biochemistry, the GIT is a model of physiological flexibility. Studies in fish comparative GIT physiology are providing exciting new insights into gut function from the molecular level to whole animal performance. Indeed, as we move into the post-genomics era, we are discovering new aspects of GI tract function with implications far beyond the organisms under study. Moreover, new discoveries regarding microbial symbioses are changing how we view the role of microbes within the construct of GIT function. In this symposium we will discuss recent advances in the molecular control of dietary adaptation and flexibility, microbial contributions to host nutrient acquisition and secondary metabolite detoxification, and metabolic consequences of digestive specialization. Speakers will cover a wide range of fish taxa from varying habitats, and discuss results in ecological and applied contexts, which should draw broad interest. Overall, the burgeoning field of nutritional physiology is truly integrative in nature and is primed to make significant scientific contributions to medicine, ecology, and evolution alike.

Session 5: The Science of Fish Welfare

Chair(s): Lynne Sneddon, University of Gothenburg, lynne.sneddon@bioenv.gu.se; Marco Vindas, Norwegian University of Life Sciences, marco.vindas@nmbu.no

Description: Fishes are used in a variety of different contexts including aquaculture, large- and small-scale fisheries, recreational fishing, the ornamental (pet) fish industry, and as an important experimental model in science. In all cases, it is vital that the health and welfare of fishes is safeguarded. Scientific approaches can yield valuable information crucial to the improved management of these economically and scientifically important animals. How do we safeguard the wellbeing of fishes through all contexts? Is it possible to have overall general fish welfare guidelines or is it necessary to develop dedicated guidelines according to specific activities and species? This symposium will bring internationally renowned speakers and early career researchers from around the globe to discuss how scientific approaches can address these and other fish welfare issues.

Session 6: The Physiology and Control of Invasive Fish Species

Chair(s): Michael Wilkie, Wilfrid Laurier University, mwilkie@wlu.ca; Pedro Guerreiro, University of Algarve, pmgg@ualg.pt; Cory Suski, University of Illinois, suski@illinois.edu

"Our goal is to assemble a team of internationally recognized experts to discuss our current understanding of the physiology and ecology of invasive fishes and build on our previous 2 successful symposia. Areas of focus may include: (i) a review of invasion theory as it relates to the physiology and behavior of fishes, (ii) types of aquatic ecosystems vulnerable to invasions, (iii) physiological features that are common in successful invaders and that can be used to identify potential invaders, (iv) vectors and routes of invasion, (v) use of physiological and molecular biology to characterize and exploit specific vulnerabilities to mitigate or control invasive species, (vi) the use of eDNA in the surveillance, detection and prevention of invasions, (vii) describing synergies between climate change and invasive species.

Our symposium will cut across disciplines and include researchers whose focus is on physiology and ecology who will highlight the causes, detection, and impacts of previous invasions. We believe this cross-disciplinary session will identify research questions and gaps that will promote further dialogue and collaborative research on means to identify, prevent and deal with the impacts of invasive species on aquatic ecosystems. Given the location of [this] year's ICBF, in the very heart of the Great Lakes, we are particularly interested in legacy invaders such as sea lamprey and common carp, and the successes and failures of efforts to control their populations, leading to discussion of more recent invaders including ruffe and round goby, and present threats to the Great Lakes basin including snakehead and the invasive carps (e.g. grass carp, bighead, silver carp). Our symposium will not be restricted to Great Lakes invaders; we will welcome presentations on European invaders including European catfish, the round goby, and the white-eye bream which have successfully dispersed and invaded regions of Europe taking advantage of the anthropogenic connections between major rivers. Areas such as the Iberian Peninsula, with a large number of endemic species, are particularly at risk due to accidental or deliberate introductions, some with recreational intent, such as largemouth bass, pikeperch, bleak, pumpkinseed, or the chameleon cichlid, among others. We also hope to include more discussion of marine-estuarine invaders, such as the lionfish and the seabass, as well as European invasive species including racer goby, killifish, weakfish, and rabbit fish."

Session 7: Conservation Physiology in Action: From Science to Practice and Policy

Chair(s): Britney Firth, University of Waterloo, bfirth@uwaterloo.ca; Andy Turko, Wilfrid Laurier University, ajturko@gmail.com

Description: The emerging field of conservation physiology has burst on the scene in the last decade propelled by new journals and textbooks. Numerous studies are published each year to help identify conservation issues and help preserve fish species around the globe. However, much work in the field remains academic, and researchers are often unsure how their results can directly influence policy. This session features case studies where conservation physiology research has spurred on-the-ground change. Discussions of these successes (and failures along the way) should help researchers increase the impact of their work.

Session 8: Environmental Modulation of the Stress Response

Chair(s): Kathleen Gilmour, University of Ottawa, kathleen.gilmour@uottawa.ca; Nick Bernier, University of Guelph, nbernier@uoguelph.ca

Description: The stress response consists of a suite of coordinated physiological and behavioral responses that serve to help fish cope with challenges that threaten their capacity to function. However, how fish perceive and respond to such stressors can depend on the environmental conditions, both physical and social, that they experience. For example, the presence of a conspecific can serve as a stressor in some situations (e.g. dominance hierarchies), dampening the capacity of the fish to respond to other stressors. However, the presence of a conspecific may also attenuate stress responses if social buffering occurs. Similarly, prolonged exposure to environmental challenges such as hypoxia, high environmental ammonia, salinization of fresh water, or high temperatures can alter the perception and physiological response to a stressor, as can exposure to environmental challenges during sensitive periods of development. This symposium will bring together researchers who consider how environmental conditions, both physical and social, influence the regulation of stress responses, from perception of the stressor to stress axis activity.

Session 9: Sub-lethal impacts of environmental stressors on fishes: when and why are fish vulnerable

Chair(s): Gail Schwieterman, University of Maine, gail.schwieterman@maine.edu; Erika Eliason, University of California Santa Barbara, erika.eliason@lifesci.ucsb.edu; Kim Birnie-Gauvin, University of Denmark, kbir@aqu.dtu.dk

Description: It has been well documented that environmental stressors such as temperature, oxygen availability, salinity, and pH can have significant impacts on fish physiology. Further, the magnitude of these effects can change when they are applied to different species, life stages, or in concert with other stressors. While these changes have been well documented via metrics such as metabolic rate or critical thermal maximum, linking these established physiological metrics to actual effects in the wild can be difficult. By considering traditional physiology through the lens of sub-lethal impacts, we can begin to link physiological parameters with real-world outcomes. Examples could be linking physiological parameters such as blood biomarkers, metabolism, or heart rate with sub-lethal effects such as changes in the timing of specific behaviors, declines in reproductive output, reductions in growth or body condition, and/or impaired foraging or predator avoidance behaviors. This symposium seeks to bring together researchers working in the space of sub-lethal effects to challenge each other to link our experiments to specific traits that are frequently of interest to managers.

Session 10: The Physiology, Biology and Ecology of Polar Fish

Chair(s): Pedro Guerreiro, University of Algarve, pmgg@ualg.pt; Luis Vargas-Chacoff, Universidad Austral de Chile, luis.vargas@uach.cl

Description: Recent technological developments allowed to research deeper into the molecular and functional aspects of the biology and the phylogeny of these fish, and all this research is taking place at a time in which the future of these species is uncertain due to climate change. In the arctic there is novel information on the distribution of species due to temperature shifts, and in the Antarctic current studies focus very much on how the physiology adjusted to extreme environments and whether there is scope to acclimate to new conditions. Meanwhile emerging pollutants are starting to be found in these pristine regions, with likely impacts on fish. Icefish nesting grounds have recently been observed for the first time, new information about larval and early development are finally being looked at, and many questions about the antifreeze proteins are finding their answers.

Session 11: Extended specimens in museum-based fish research

Chair(s): Karen Alofs, University of Michigan, kmalofs@umich.edu; Hernan Lopez-Fernandez, University of Michigan, hlopezf@umich.edu

Description: Natural history collections which were traditionally focused on studying taxonomy, systematics, and biogeography, have expanded their relevance and are key in general biodiversity science. Among numerous emerging uses, collections are now invaluable for studying the impacts of environmental change at scales from decades to centuries. Museum specimens are used to examine changes in genetics, phenotype, and trophic ecology in fishes. Simultaneously, new technologies, such as micro CT scanning and stable isotope analyses, allow using "old" specimens to generate new types of data that expand their value as sources of insight through the Extended Specimen paradigm. We encourage presentations which highlight novel uses and address challenges associated with museum-based research.

Session 12: Ancient models in comparative physiology: Agnathan and chondrichthyan fishes

Chair(s): Alyssa Weinrauch, University of Manitoba, Alyssa.Weinrauch@umanitoba.ca; Gary Anderson, University of Manitoba, gary.anderson@umanitoba.ca; Susan Edwards, Wright State University, susan.edwards@wright.edu; Ian Bouyoucos, University of Manitoba, ian.bouyoucos@umanitoba.ca

Description: Agnathans (i.e., hagfish and lampreys) and chondrichthyans (i.e., sharks and rays) are some of the primitive fishes that are useful for investigations of the evolution of physiological systems. Agnathans diverged from the vertebrate lineage after the first whole genome duplication, while chondrichthyans diverged after the second, yet prior to the within lineage duplications occurring in the more derived actinopterygians. Thus, these enigmatic groups of fishes are often described as 'living fossils' and have been the subject of studies of comparative physiology for decades, both from a fundamental evolutionary perspective and in the context of environmental change. This symposium examines advances in the field in both contexts from across an international stage.

Session 13: 8th International Symposium on Burbot

Chair(s): Jill Leonard, Northern Michigan University, jileonar@nmu.edu; Chris Myrick, Colorado State University, chris.myrick@colostate.edu

Description: The Burbot *Lota lota* is the only member of the cod group (Gadiformes) that lives exclusively in freshwater and it is one of only two freshwater fishes that have a circumpolar distribution. This symposium will contain studies on the biology, ecology, management, and culture of burbot. Of special interest will be (1) studies on the physiology and ecology of burbot; (2) studies on re-establishing extirpated burbot populations and rehabilitating populations that are imperiled; (3) life-history studies of burbot, particularly of juvenile and larval stages; (4) bioenergetics and population dynamics studies; and (5) commercial (including aquaculture) and management applications. The ICBF has hosted numerous International Burbot Symposia (including the last 5) and the 15th ICBF will provide an opportunity to bring burbot researchers together to exchange research findings and ideas.

Session 14: Impacts of a Warming World on Behavior and Physiology

Chair(s): Patricia Wright, University of Guelph, patwrigh@uoguelph.ca; Suzie Currie, Acadia University, suzie.currie@acadiau.ca

Description: Climate warming is characterized by more frequent and intense heat extremes that directly affect the performance of fishes. Fishes have a preferred temperature range within which they function optimally. The vulnerability of fishes to this ongoing warming largely depends on the frequency and magnitude of environmental heat extremes exceeding thermal tolerance. Certainly, rising global temperatures are challenging physiological acclimatory and adaptive capacities, disrupting the intricate ecological relationships between fish and their prey, predators, and competitors, altering behavior, and changing distribution/migration patterns. Furthermore, the nature in which fishes respond to warming is highly species-specific, with different fish species exhibiting varying degrees of behavioral and physiological thermal tolerance. Increasingly, we are also observing distinct differences in how lab and field populations respond to warming temperatures. This symposium will interrogate the impacts and limits of ecologically relevant warming on fishes in marine and freshwater environments with a focus on behavior and physiology.

Session 15: Tropical Fishes: Past, present, and Future Challenges

Chair(s): Adalberto (Dal) Va, The National Institute for Research in the Amazon, dalval.inpa@gmail.com;
Vera Maria Fonseca de Almeida e Val, The National Institute for Research in the Amazon,
veraval@inpa.gov.br

Description: Tropical fishes, both marine and freshwater, are a particularly diverse group of fishes, including representatives of the most basal to the most specialized groups. They have faced several challenges in the past, continue to do so in the present, and are likely to face additional difficulties in the future. This symposium aims to provide an overview of the challenges faced in the past, including extreme changes in water characteristics and watersheds and drainage basins over millions of years, which have shaped the diversity of fishes found in the tropics today. Tropical fishes are currently facing unprecedented environmental conditions, including habitat destruction, pollution, overexploitation, and others, all of which are exacerbated by climate change. At present, many of the adaptations of tropical fish may be working against them, such as surface breathing under situations where crude oil remains at the top of the water column after a spill. Future challenges have already begun and affect many tropical fish species. Some examples include acidification of marine and freshwater environments, loss of biodiversity that affects the food chain, and increasing disease outbreaks that cause mass mortality and compromise the health of wild and captive fish. Note that while we have not yet named many species and learned their biology, many species may be at serious risk. Many technologies and elegant methodologies are being used to address many of these questions and produce robust information. Therefore, a collective effort is needed to share what is known and not known about tropical fish biology, best sustainable practices, and strategies for conserving their habitats. As organizers of the Tropical Fish Symposium, we welcome anyone interested in sharing their findings, questions, and suggestions. We look forward to seeing you in Ann Arbor, Michigan, USA.

Session 16: Stress Endocrinology: Perception, Mechanisms, and Coping

Chair(s): Matt Vijayan, University of Calgary, mmvijaya@ucalgary.ca; Lluís Tort, Universitat Autònoma de Barcelona, lluis.tort@uab.cat; Erin Faught, Leiden University, l.e.faught@biology.leidenuniv.nl

Description: This symposium on stress in fish will focus on the endocrine aspects of the stress response. Specifically, the symposium will underscore the versatile and dynamic nature of stress hormones and their interaction with the whole regulatory network in fish. Contributions will include mechanisms involved in the stressor perception, shaping of the stress response, and the associated coping strategies. The presentations will highlight novel mechanism(s) from molecular and physiological responses to behavioral responses, enabling fish to cope with stressors. The use of the knock-in and knock-out, and “omics”, approaches to elucidate the molecular pathways will be of particular interest in this session. We envision that the fundamental work presented will contain highlights from the perspective of aquaculture, environmental monitoring, and biomedicine.

Session 17: Current Trends in Growth and Metabolism of Fishes

Chair(s): Brian Small, University of Idaho, bcsmall@uidaho.edu, Brian Peterson, USDA-ARS, brian.peterson@usda.gov, Suraj Unniappan, University of Saskatchewan, suraj.unniappan@usask.ca

Description: An interplay of numerous external and internal factors orchestrates fish growth and metabolism. This symposium serves as a platform to highlight recent breakthroughs in our comprehension of somatic growth and metabolism of fishes. Special attention will be directed towards unraveling the metabolic and hormonal processes that regulate growth, while illuminating the ways in which the environment, fish tissues, and associated pathways interact. We extend an invitation to researchers engaged in fundamental and applied investigations into the regulatory aspects of growth and metabolism of fish, with a special emphasis on encouraging active participation from students.

Session 18: General Submissions

Chair(s): Charles Madenjian, cmadenjian@usgs.gov, US Geological Survey – Great Lakes Science Center; Kevin Keeler, kkeeler@usgs.gov, US Geological Survey – Great Lakes Science Center

Description: Please include any abstracts here that may not fit into specific research of other symposia.