fishes

MDPI

*Editorial*

# Current Advances and Challenges in Fisheries and Aquaculture Science

**Eric Hallerman [1], Maria Angeles Esteban [2] and Bernardo Baldisserotto [3,]***

[1] Department of Fish and Wildlife Conservation, Virginia Polytechnic Institute and State University, 100 Cheatham Hall, Blacksburg, VA 24061, USA; ehallerm@vt.edu
[2] Department of Cell Biology and Histology, Faculty of Biology, University of Murcia, 30100 Murcia, Spain; aesteban@um.es
[3] Department of Physiology and Pharmacology, Universidade Federal de Santa Maria, Santa Maria 97105-900, Brazil
* Correspondence: bernardo.baldisserotto@ufsm.br; Tel.: +55-3220-9382

Advances in fisheries and aquaculture science often follow the introduction of new tools or analytic methods. For example, the introduction of geographic information systems led to advances in spatially explicit conservation planning and the siting of aquaculture operations. Advances in genetic marker technologies led to whole-genome sequencing and improved the detection of performance- or fitness-related loci, in turn leading to advances in marker-assisted breeding and conservation planning. Among the keys to successful modern aquaculture are advancements in understanding the biology of cultivated species, leading to improved diet and health management. Hence, we designed this Special Issue to address current advances and challenges in fisheries and aquaculture science.

Achieving a greater understanding of biology and ecology is critical to the management and conservation of fishes. Precise determination of how temperature affects fish populations is important for assessing the impacts of climate change. Cordova de la Cruz et al. [1] subjected tropical gar *Atractosteus tropicus* to elevated temperatures during embryological development. They found that elevated temperatures may induce craniofacial and morphological alterations, suggesting that global warming may affect the expression of morphological traits, thereby impacting the species. Traditional mark-recapture or telemetry methods for tracking the movement of fish are labor-intensive, limited to sufficiently large individuals, and yielding results only for those individuals handled. McBaine et al. [2] compared the efficacy of direct and molecular marker-based observation of movement and reproduction by candy darter, *Etheostoma osburni*, an endangered fish in the southeastern United States. Molecular markers allowed the tracking of more individuals and provided new insights into the spawning ecology and early life history of the species. Black bullhead *Ameiurus melas*, a catfish native to eastern North America, was introduced outside of its range, where it frequently proves invasive and a nuisance. Reasons for its invasiveness are poorly understood because the species is understudied. By demonstrating relatively fast growth rates, early age at maturity, moderate fecundity, and a diverse omnivorous diet, Sikora et al. [3] explained the potential for black bullheads to dominate fish community biomass in both their native and introduced range.

Cost-effective monitoring of marine systems and conservation of highly exploited species remain technical challenges. While soft-bottom habitats constitute a major part of the coral reef seascape, their fish assemblages are difficult to sample, as individuals are scattered over very large areas and often at significant depth. Existing soft-bottom sampling methods—including trawling, long-lining, and hook-and-line—are destructive. Mallet et al. [4] developed a remote, unbaited 360° video sampling method to monitor fish species assemblages on soft bottoms. They demonstrated that the method was effective for sampling bare soft-bottoms, seagrass beds, macroalgae meadows and mixed soft-bottoms



**Citation:** Hallerman, E.; Esteban, M.A.; Baldisserotto, B. Current Advances and Challenges in Fisheries and Aquaculture Science. *Fishes* **2022**, *7*, 87. https://doi.org/10.3390/fishes7020087

Received: 1 April 2022
Accepted: 7 April 2022
Published: 8 April 2022

and provided future users with general recommendations for estimating total species richness. Reliable and current information on the conservation status of key commercial marine fishes is crucial for their conservation. Miqueleiz et al. [5] assembled fisheries statistics from the FAO, IUCN Red List, FishBase, and RAM Legacy databases to determine the extent to which the conservation status of the top commercial species has been assessed. While levels of assessment for top-fished species were higher than those for fished species in general, almost half of the species had outdated assessments. Future evaluations for commercial fish species should integrate new parameters from fisheries sources and improve collaboration among fisheries stakeholders and managers.

The continuing growth of aquaculture will depend upon developing feeds that improve the growth, oxidative status, and immune response of fed cultured organisms. Rodriguez-Viera et al. [6] studied the effect of adding the GHRP-6 peptide, a ghrelin analog, at two levels to a commercial diet for gilthead sea bream *Sparus aurata*. Both experimental diets led to increased growth and feed conversion efficiency over the course of 97 days. The lower level of inclusion of GHRP-6 resulted in better aerobic metabolism, while the higher level increased plasma growth hormone levels, indicating that a better understanding of its dose-specific effects is still required. While fish meal has traditionally been used as the main protein source for carnivorous fish diets, its scarcity has led to an increased evaluation of plant-derived feedstuffs. Basto-Silva et al. [7] evaluated the effects of dietary protein sources and the protein/carbohydrate ratio on gilthead seabream gut function and health, assessing gut histomorphology, gut microbiota composition, digestive enzyme activity, and gut immunological and oxidative stress gene expression. Plant-based diets compromised gut absorptive and digestive metabolism, but decreasing the dietary protein/carbohydrate ratio had little effect on the measured parameters. Martínez-Antequera et al. [8] assessed the possibility of improving the nutritional quality of plant byproducts, such as brewers' spent grain and rice bran, through solid-state hydrolysis using carbohydrases and phytase for use in a feed for grey mullet *Mugil cephalus*. Growth and feed conversion efficiency over the course of a 148-day trial were similar among groups fed the experimental and commercial diets, demonstrating that enzyme pretreatment of plant ingredients may improve the nutritive value of high-fiber plant byproducts in practical diets. The culture of Nile tilapia *Oreochromis niloticus* at subtropical temperatures decreases growth, and several studies reported that the fish efficiently stores dietary n-3 long-chain polyunsaturated fatty acids at cold temperatures, increasing fatty acid unsaturation in cell membranes to maintain their fluidity and permeability. Batista et al. [9] investigated the effect of incorporating meal from the microbe *Aurantiochytrium* sp. into diets at different rates on the tilapia body and hepatopancreas fatty-acid profile, body fatty-acid retention, somatic indices, and morphophysiological changes in the intestine and hepatopancreas through 87 days at 22 °C. The use of *Aurantiochytrium* meal improved the body fatty-acid profile and morphophysiology in Nile tilapia reared at low temperatures. The administration of immunostimulants was found to promote growth and reduce microbial infections in aquatic animals. Safari et al. [10] investigated the effects of the single or combined administration of dietary symbiotics and sodium propionate on humoral immunity and oxidative defense, digestive enzymes, and growth performance of the African cichlid *Labidochromis lividus* challenged with *Aeromonas hydrophila*. The single administration of the synbiotic *Pediococcus acidilactici* and galacto-oligosaccharides combined with sodium propionate enhanced survival, growth, humoral immune response, antioxidant and digestive enzymes.

We trust that you will come to agree that the application of new tools in each of these case studies led to compelling new advances. Each advance raises new questions, which go on to become the subject of innovative future work!

**Conflicts of Interest:** The authors declare no conflict of interest.

## References


1. Cordova-de la Cruz, S.; Riesco, M.; Martínez-Bautista, G.; Calzada-Ruiz, D.; Martínez-Burguete, T.; Peña-Marín, E.; Álvarez-Gonzalez, C.; Fernández, I. Larval Development in Tropical Gar (*Atractosteus tropicus*) Is Dependent on the Embryonic Thermal Regime: Ecological Implications under a Climate Change Context. *Fishes* **2022**, *7*, 16. [CrossRef]
2. McBaine, K.; Hallerman, E.; Angermeier, P. Direct and Molecular Observation of Movement and Reproduction by Candy Darter, *Etheostoma osburni*, an Endangered Benthic Stream Fish in Virginia, USA. *Fishes* **2022**, *7*, 30. [CrossRef]
3. Sikora, L.; Mrnak, J.; Henningsen, R.; Van De Hey, J.; Sass, G. Demographic and Life History Characteristics of Black Bullheads *Ameiurus melas* in a North Temperate USA Lake. *Fishes* **2022**, *7*, 21. [CrossRef]
4. Mallet, D.; Olivry, M.; Ighiouer, S.; Kulbicki, M.; Wantiez, L. Nondestructive Monitoring of Soft Bottom Fish and Habitats Using a Standardized, Remote and Unbaited 360° Video Sampling Method. *Fishes* **2021**, *6*, 50. [CrossRef]
5. Miqueleiz, I.; Miranda, R.; Ariño, A.; Ojea, E. Conservation-Status Gaps for Marine Top-Fished Commercial Species. *Fishes* **2022**, *7*, 2. [CrossRef]
6. Rodríguez-Viera, L.; Martí, I.; Martínez, R.; Perera, E.; Estrada, M.; Mancera, J.; Martos-Sitcha, J. Feed Supplementation with the GHRP-6 Peptide, a Ghrelin Analog, Improves Feed Intake, Growth Performance and Aerobic Metabolism in the Gilthead Sea Bream *Sparus aurata*. *Fishes* **2022**, *7*, 31. [CrossRef]
7. Basto-Silva, C.; García-Meilán, I.; Couto, A.; Serra, C.; Enes, P.; Oliva-Teles, A.; Capilla, E.; Guerreiro, I. Effect of Dietary Plant Feedstuffs and Protein/Carbohydrate Ratio on Gilthead Seabream (*Sparus aurata*) Gut Health and Functionality. *Fishes* **2022**, *7*, 59. [CrossRef]
8. Martínez-Antequera, F.; Barranco-Ávila, I.; Martos-Sitcha, J.; Moyano, F. Solid-State Hydrolysis (SSH) Improves the Nutritional Value of Plant Ingredients in the Diet of *Mugil cephalus*. *Fishes* **2022**, *7*, 4. [CrossRef]
9. Batista, R.; Nobrega, R.; Schleder, D.; Pettigrew, J.; Fracalossi, D. *Aurantiochytrium* sp. Meal Improved Body Fatty Acid Profile and Morphophysiology in Nile Tilapia Reared at Low Temperature. *Fishes* **2021**, *6*, 45. [CrossRef]
10. Safari, O.; Sarkheil, M.; Shahsavani, D.; Paolucci, M. Effects of Single or Combined Administration of Dietary Synbiotic and Sodium Propionate on Humoral Immunity and Oxidative Defense, Digestive Enzymes and Growth Performances of African Cichlid (*Labidochromis lividus*) Challenged with *Aeromonas hydrophila*. *Fishes* **2021**, *6*, 63. [CrossRef]