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Introduction to genetics in aquaculture XI: The past, present and future of aquaculture genetics

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The Eleventh International Symposium on Genetics in Aquaculture (ISGA) was organized by the Department of Fisheries and Allied Aquacultures (now the School of Fisheries, Aquaculture and Aquatic Sciences), Auburn University, Alabama, USA. The symposium was held from June 22–30, 2012 at the Auburn University Hotel and Conference Center, Auburn University, Auburn, Alabama, USA.

With increased demand for aquacultured foods, has come a need for more efficient production systems. Major improvements have been achieved through enhanced husbandry procedures, improved nutrition, enhanced disease diagnosis and therapies and the application of genetics to production traits. Although several aquaculture species have been greatly improved through the application of genetics, much greater improvements can be accomplished. Genetically, improved fish, shellfish and crustaceans developed through selection, intraspecific crossbreeding, interspecific hybridization, polyploidy, sex reversal (genetically monosex), and marker assisted selection are now being commercially applied for various species throughout the world. However, the potential maximum improvement in overall performance is not close to being achieved. As space for aquaculture becomes more limiting, the necessity for more efficient production or increased production within the same amount of space will further increase the importance of genetic improvement of aquaculture species. Genetic research and its application have had a significant role in the development of aquaculture, and this role and impact will become increasingly important as aquaculture develops further. The combination of a variety of genetic improvement programs — traditional, biotechnological, genomic and genetic engineering — is likely to result in the best genotypes for aquaculture in the future.

Aquaculture genomics has made great strides in the past 20 years, and significant genomic tools are available for application in genetic improvement programs. Large microarrays and EST data bases are available containing the majority of fish genes. Integrated genetic maps have been constructed, and progress has been made in QTL mapping. Whole genome sequences are now available or nearly available for several major, terrestrial livestock species, and with the recent advances in sequencing technologies, it is likely that draft genome sequences will soon be available for several aquaculture species. Recently, large efforts on developing genomic resources for aquacultured species coupled with advances in sequencing technology have resulted in rapid progress.

Although, much remains to be done for developing aquaculture genomics resources, the time is right to take advantage of the vast effort that has been invested in genomics and to begin applying genomics in concert with breeding and genetics. Thus, the theme and thrust of ISGA XI was “The Past, Present, and Future”. ISGA XI provided a valuable forum to exchange information to accelerate genetic improvement through traditional genetics, biotechnology, applied genomics and through the integration of these areas. The conference also provided a valuable forum to accelerate genetic improvement of aquatic organisms by learning from the advances made in applied genomics for terrestrial organisms and exposure to plant genomics bioinformatics software. The conference included a workshop roundtable — Development of Strategies for Integrated Breeding, Genetics and Applied Genomics for Genetic Improvement of Aquatic Organisms, and a workshop on the iPlant Collaborative — The iPlant Collaborative: Cyber infrastructure for Life Sciences.

The objectives of the conference were for the international community of aquaculture geneticists and genomists including both researchers and graduate students 1) to share the latest research on aquaculture genetics and applied genomics for genetic enhancement of farmed fish, shellfish and crustaceans, 2) to link the past, present and future of aquaculture genetics, 3) to present the current state of the integration of breeding, genetics and genomics for genetic enhancement, 4) to provide a forum for aquaculture geneticists to learn from leaders in terrestrial animal research on the latest developments on integrating breeding, genetics and genomics for improving performance, and 5) to develop strategies to utilize the genomics data from the past 20 years for practical application of the genetic enhancement of farmed aquatic animals.

This was only the second time that the USA has hosted this event in the 30 year history of the leading international symposium for the aquaculture genetics. Sessions included 1) quantitative genetics and selective breeding, 2) biotechnology (polyploidy, sex reversal and breeding, genetic stem cell applications, 3) transgenics, 4) ethics, food safety and environmental risk of genetic enhancement programs, and 5) applied genomics (marker assisted selection and whole genome selection).

The international community has had a major impact on aquaculture genetics and its initiation at Auburn University (AU). A collaboration between AU scientists (R. Oneal Smitherman) and Israeli scientists (Rom Moav and Giora Wohlfarth) was the beginning of aquaculture genetics research and teaching at AU. These individuals were remembered and their impact presented at the opening of ISGA XI. Attendance was 145 individuals representing 25 countries with every continent represented except Antarctica. The symposium included six introductory and key note presentations, 32 presentations on quantitative genetics and selective breeding, five on biotechnology (polyploidy,

sex reversal and breeding, gynogenesis/androgenesis), five on transgenics, nine on environmental risk of genetic enhancement programs, and 40 on applied genomics for a total of 97 presentations. A total of 39 posters were presented.

For the symposium proceedings 21 papers were accepted for publication in the proceedings of 28 (including the introduction and conclusion) submitted utilizing the standard review process. I would like to thank Bjarne Gjedre, Gideon Hulata, Zhanjiang (John) Liu, Eric Peatman, Matthew Rise and William Wolters for assisting in evaluating the papers submitted for oral presentation. We also would like to thank the section editor (Gideon Hulata) and all of the anonymous reviewers for their time and effort to ensure the quality of the manuscripts published in these proceedings. Two papers were inadvertently published in advance:

Avner Cnaani, Ewen McLean, Eric M. Hallerman (2013). Effects of growth hormone transgene expression and triploidy on acute stress indicators in Atlantic salmon (*Salmo salar* L.), can be found in *Aquaculture* 412, 107–116.

Pierrick Haffray, Jérôme Bugeon, Quentin Rivard, Benjamin Quittet, Sophie Puyo, Jean Michel Allamelou, Marc Vandeputte, Mathilde Dupont-Nivet (2013). Genetic parameters of in-vivo prediction of carcass, head and fillet yields by internal ultrasound and 2D external imagery in large rainbow trout (*Oncorhynchus mykiss*), can be found in *Aquaculture* 410–411, 236–244.

ISGA XII will be hosted by Grupo Acuigen-Departamento de Genética Facultad de Veterinaria, Universidad de Santiago de Compostela Campus de Lugo, 27002 Lugo, Spain. The meeting will be held in 2015 at Santiago de Compostela, Spain, and we hope to see you there.

We would like to thank our sponsors for ISGA XI: United States Department of Agriculture, National Institute of Food and Agriculture; National Oceanic and Atmospheric Administration, U.S. Department of Commerce; ALFA, Alabama Farmers Federation, Alabama State Catfish Producers Committee; Sigma Life Science; Harvest Select; Auburn University, College of Agriculture; The Center of Aquaculture Technologies, Fishizzles and Morgan Creek Winery.

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