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Genetically standardized trout stock to improve research

1 May 2009

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Light-control hatchery will provide greater egg availability

Rainbow trout are an outstanding model for physiological and genetic studies, and genomic tools are already available for the species.

Fish are the third most commonly used experimental research animal after mice and rats in some countries. This is a result of the rapid development of the aquaculture industry, regulatory requirements for testing involving fish as indicators of environmental change and the use of fish as a replacement

for mammals in biomedical, pharmacological and genetic research.

Aquatic species such as zebrafish, fugu, rainbow trout, catfish, Atlantic salmon, tilapia and bivalves are exclusively used in several scientific and agricultural research programs.

Genetic background relevance

Slight variations in study conditions such as water temperature or quality, feeding level or frequency, or methods of analysis among laboratories are often offered as explanations for differences in results. However, discrepancies in experimental results sometimes are not due to experimental procedures or analysis, but instead to differences in the genetic background of the animals used in the studies. Genetic diversity is believed to be the basis for these differences.

Rainbow trout

Among farmed fish, one of the most intensively studied species is rainbow trout, because of its intensive and long-term use as both a sport and food fish. This species has proven to be an outstanding model for physiological and genetic studies. A number of genomic tools are already available for rainbow trout research, such as gene sequences, linkage maps, microarrays, and expressed sequence tags and bacterial artificial chromosome libraries.

Rainbow trout are relatively easy and inexpensive to culture. Studies can be performed on small fish, saving space and maximizing water availability, or on larger fish, which are more suitable for surgical manipulation and the isolation of distinct tissues and organs.

Reproduction in rainbow trout is well understood and can be manipulated to spawn fish at any time of the year. Furthermore, information and methods are available for chromosomal manipulation and sex reversal such that haploid, triploid or tetraploid fish, or monosex populations can be produced. Finally, several distinct domesticated strains are available, along with nonselected cultured strains and fish from the wild.

The development of a defined rainbow trout stock will reduce the variability associated with the use of different stocks in different research labs.

Stock development

Most rainbow trout stocks used in research studies come from eggs purchased from commercial suppliers, local broodstock, academic stocks or wildlife management facilities. Such stocks often differ in their responses to dietary treatments.

To alleviate problems associated with conducting research studies with fish of unknown and likely quite diverse genetic backgrounds, a collaborative project has been established by the University of Idaho, United States Department of Agriculture Agricultural Research Service and U.S. Soybean Board to produce a stock of rainbow trout with a defined genetic background for use in fish nutrition research.

This stock will be derived from an equal crossing of the University of Washington Donaldson strain obtained from the National Center for Cool and Cold Water Aquaculture (NCCCWA) and the Housecreek strain from the College of Southern Idaho. Both strains are highly domesticated and have been used in research studies for years. Since these stocks are also being used in the NCCCWA rainbow trout selection program, the current genomic tool set will be directly applicable to this new research line of fish.

An additional benefit of using well-defined research stock will be that new findings from researchers using these stocks can be incorporated into further improving the selected lines at NCCCWA. In the past, quantitative trait loci markers defined in a given trout strain were not always applicable to other strains, limiting their effectiveness for use and evaluation in other strains of rainbow trout.

The goal of the University of Idaho Hagerman Fish Culture Experiment Station is to supply lots of up to 10,000 eggs or several hundred fry upon request. The construction of a new light-control hatchery will provide almost constant year-round availability of eggs. In the future, if researchers are interested in evaluating genetic variations between strains, distinct genetic stocks or specific stock crosses may be made available to the research community.

(Editor's Note: This article was originally published in the May/June 2009 print edition of the Global Aquaculture Advocate*.)*

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