Interest in sustainable aquaculture production in the U.S. continues to rise; unfortunately, so do the costs associated with quality fish feed. Research at West Virginia State University has led to increased profitability and the development of sustainable diets for farmed fish while reducing environmental pollution from aquaculture discharge.

Sustainable Aquaculture

Who cares and why?

Interest in sustainable-aquaculture production is growing due to increased demand for quality seafood and depletion of wild harvest supplies. The value of U.S. aquaculture production has risen to nearly $1 billion within the past two decades, making it among the fastest-growing sectors of the United States agriculture industry. Feed accounts for as much as 80 percent of production costs. This factor is primarily due to the reliance on fish meal and fish oil, both primary components in feed formulation. In addition, uneaten and waste from feed are also sources of pollution as a result of effluent discharges.

With the increased demand for quality fish feed, and the rising cost of fish meal and fish oil, researchers have explored the use of alternative sources of protein to partially or completely replace fish meal and fish oil in aquafeeds. Though plant-based products have been extensively studied as possible substitutes, they have disadvantages, such as reduced protein content, palatability and anti-nutritional factors. Additionally, feed is a source of waste outputs in fish culture systems. These factors could have serious consequences on the physiological and biochemical functions that affect fish health and welfare, as well as negatively affecting the environment.

What has the project done so far?

The efficiency of nutrient utilization and growth are the most important traits in commercial fish-breeding programs. Genomic-enabled nutritional research can be used to improve the efficiency of nutrient retention and growth in cultured fish. West Virginia State University's research uses such novel techniques as genomics, proteomics and metabolomics to establish and understand the effects of diets, genetics and other environmental factors on farmed fish.

Current activities focus on manipulating the diet composition of finfish to increase nutrient utilization efficiency and profitability

to the level achieved in other animal production, such as poultry and swine. WVSU research is also assessing the association between mitochondrial function, metabolic efficiency, gene expression and nutrient utilization in different life history stages of finfish fed plant-based diets; and characterizing the interactive effects of temperature and dietary composition on liver- intestine- and muscle-activity in association with nutrient-retention efficiency, growth and development in different life history stages of finfish.

Impact Statement

This research has led to increased profitability and the development of sustainable diets for farmed fish, as well as reduced environmental pollution from aquaculture effluent discharge processes.

This project evaluates the effects of water temperature and dietary composition on growth and nutrient efficiency to optimize growth and reduce production costs. By understanding the molecular mechanisms of the interactive effects of temperature and nutrients on protein/gene expression, we can establish a basis for determining the nutritional requirements of cultured fish. Development of cost-effective diets will enhance finfish production, profitability and sustainability.

What research is needed?

The combination of the laboratory studies with field experimentation is the next step in this research. Planning and developing an on-campus aquaponic demonstration facility for small-scale resource farmers is underway. Aquaponic systems, with leafy vegetables and tilapia or channel catfish production, will be investigated to determine the economic impacts of using different combinations of feed rations and different types of leafy vegetables.

Want to know more?

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Additional links: http://www.umes.edu/ard/Default.aspx?id=46285

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