



# Catfish Aquaculture - Case studies

Using Standard BioTools Microfluidic Technology

Standard BioTools™  
March 2023

# TABLE OF CONTENTS

1. Gene Expression and Growth
2. Gene Expression and Stress Response
3. Gene Expression and Fish Welfare

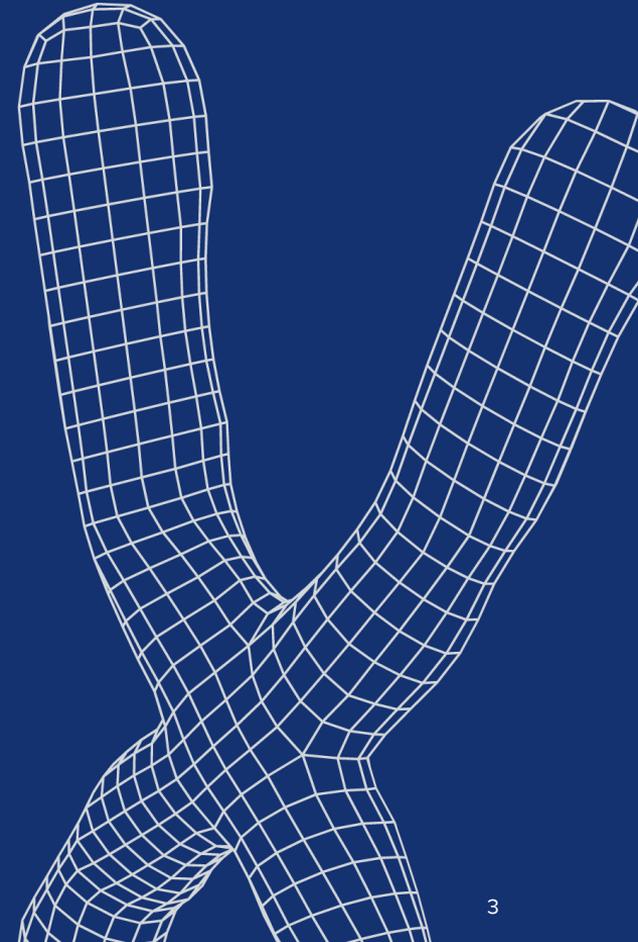




# Gene Expression and Growth

Any questions?

[Talk to us](#)



# Gene Expression and Growth



**Objective:** The objective of this study was to develop and validate a high throughput, microfluidic array for assessing changes in gene expression associated with channel catfish appetite, growth, metabolism, and intestinal health, while also providing a cost effective, dynamic, gene expression platform for use with other cultured fishes.

### Utilization of Standard BioTools products:

- Biomark HD System
- MX Controller
- 48.48 dynamic arrays

### Conclusions:

- Developed and validated Channel Catfish gene expression panel.
- Provide reliable cycle threshold levels, amplification efficiency, and quality threshold scores.
- Demonstrated benefits of Standard BioTools microfluidics high throughput qPCR method over conventional qPCR.
- Array paves the way for rapid evaluation of feeding strategies, dietary formulations, supplementation, and environmental and management effects for improving channel catfish culture.

Schroeter, et al. "Development of a multitissue microfluidic array for assessing changes in gene expression associated with channel catfish appetite, growth, metabolism, and intestinal health". *Aquaculture* (2016)

# Gene Expression and Growth

Any further question?

Talk to us



## Background

- At the time of publication, channel catfish represented the USA's largest finfish aquaculture industry.
- A fast, cost-effective, easy method for affecting production parameters in channel catfish did not exist.
- The authors developed and validated a panel to assess channel catfish appetite, growth, metabolism, and inflammatory response.

[Schroeter, et al. "Development of a multitissue microfluidic array for assessing changes in gene expression associated with channel catfish appetite, growth, metabolism, and intestinal health". Aquaculture \(2016\)](#)

# Gene Expression and Growth



## Background

- Data collected using the 48.48 GE IFC on the Biomark HD.
- Established primer amplification efficiency, quality scores, and cycle threshold using Standard BioTools Real-Time PCR Analysis software.
- Delta Gene assays (Standard BioTools) used to create 48 gene target panel including genes related to the following categories:
  - Appetite
  - Growth
  - Metabolism
  - Inflammatory response

**NOTE:** Paper was published before channel catfish genome published. A high-quality channel catfish genome is now available.

[Schroeter, et al. "Development of a multitissue microfluidic array for assessing changes in gene expression associated with channel catfish appetite, growth, metabolism, and intestinal health". Aquaculture \(2016\)](#)

# Gene Expression and Growth

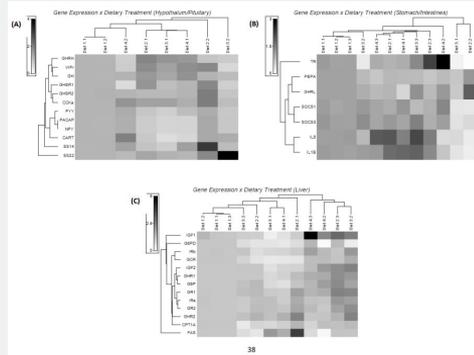
## Results and conclusions

### Results:

- 48 assays designed and validated.
- 8 assays did not meet performance metrics and were removed.
- Alpha Tubulin selected as most appropriate reference gene.
- Tissues from catfish fed four diets were collected and run on a single 48.48 GE IFC to demonstrate the ease of use and cost savings of the microfluidic platform.

### Conclusions:

- Using the Standard BioTools IFC to assess catfish production metrics demonstrates a fast, cost-effective solution over traditional qPCR and sequencing methods.
- Standard BioTools IFC offerings allow the quick change of assay design based on study needs and sample throughput.

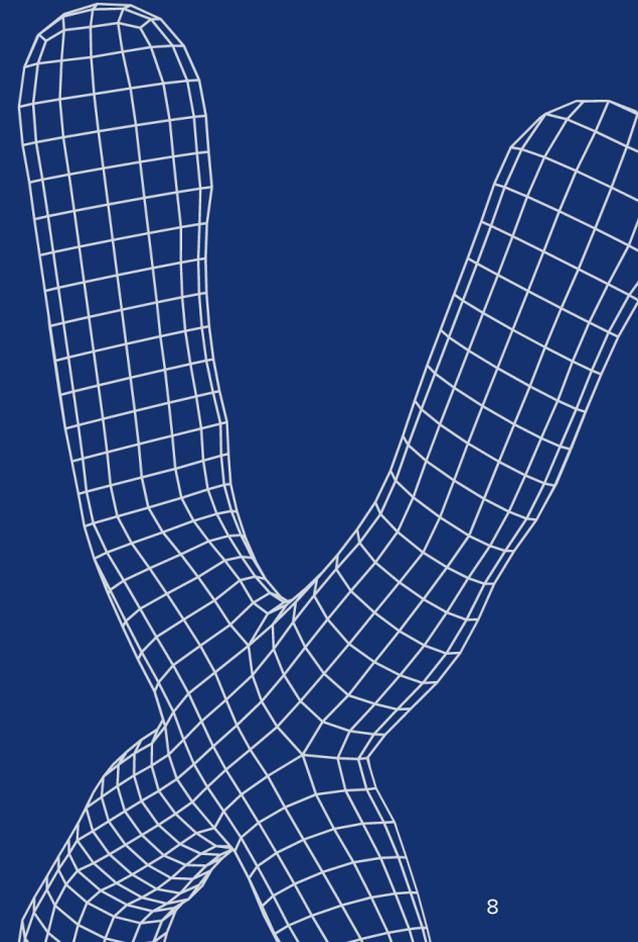




# Gene Expression and Stress Response

Any questions?

[Talk to us](#)





# Gene Expression and Stress Response

Any further question?

Talk to us



## Background:

- In finfish aquaculture, stocking density is a pivotal factor and an issue of frequent debate, as it may be a source of chronic stress, leading to physiological alterations, including stress responses, growth reduction, and impairment of health. Collectively this can be termed fish welfare.
- The authors wanted to test the effects of stocking density on the welfare of African catfish in a commercial setting.
- Authors tested three levels of stocking density and observed fish growth performance, mortality, cortisol levels, skin lesions and gene expression due to different stressors.

Baßmann, et al. "Effects of Stocking Density, Size, and External Stress on Growth and Welfare of African Catfish (*Clarias gariepinus* Burchell, 1822) in a Commercial RAS". *Fishes* (2023)

# Gene Expression and Stress Response

Any further question?

Talk to us

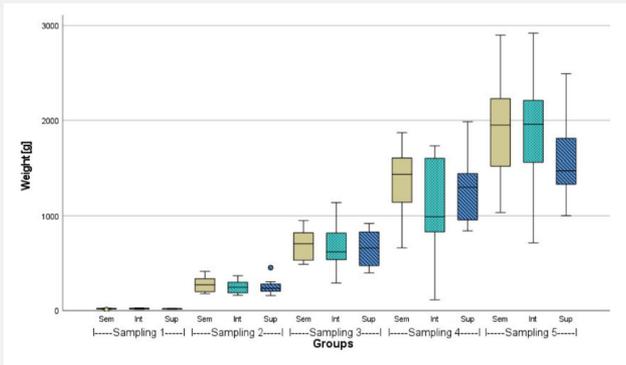
## Results and conclusions

### Results:

- Growth rate of catfish is high at all densities.
- Semi-intensive density results in higher growth with lower aggression.
- Fish welfare decreased at super-intensive densities in general but in all groups due to nearby construction noise.

### Conclusions:

- Adjustments to stocking density during growth phase to semi-intensive.
- Limit external stressors.
- Can monitor stress response molecularly.



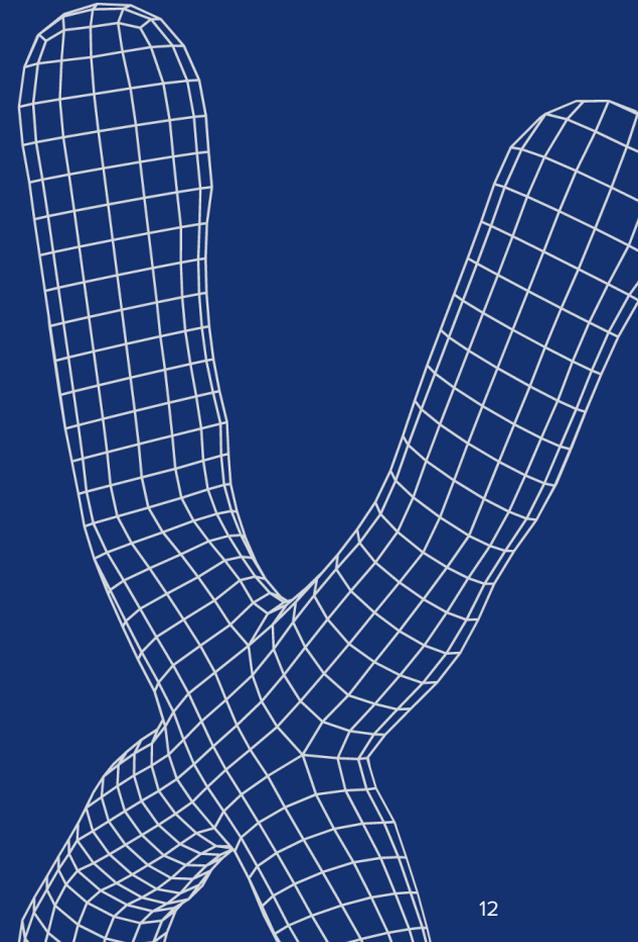
Baßmann, et al. "Effects of Stocking Density, Size, and External Stress on Growth and Welfare of African Catfish (*Clarias gariepinus* Burchell, 1822) in a Commercial RAS". *Fishes* (2023)



# Gene Expression and Diet

Any questions?

[Talk to us](#)



# Gene Expression and Diet

Any further question?

Talk to us



[This Photo](#) by Unknown Author is licensed under [CC BY-SA](#)

**Objective:** Determine the effects of alternatively-sourced dietary ingredients of production indices, gut health, changes in gut microbiota and genes involved in appetite regulation, growth, metabolism, and intestinal inflammation.

## Utilization of Standard BioTools products:

- Biomark HD System
- 48.48 GE dynamic arrays
- Access Array
- 48.48 LP dynamic arrays

## Conclusions:

- Feed conversion rate was affected by diet.
- The gene expression panel used can help determine mechanisms behind FCR change and predict longer term effects of different diets than this study allowed.
- Gut microbiome data can be used to influence future dietary studies.

[Schroeter, et al. "Targeted gene expression panels and microbiota analysis provide insight into the effects of alternative production diet formulations on channel catfish nutritional physiology". Aquaculture \(2018\)](#)

# Gene Expression and Diet

Any further question?

Talk to us



## Background:

- Culturing channel catfish requires nutritionally complete diets for maximal growth and feed efficiency.
- Due to cost and availability, alternative feeds have been produced.
- Many components of alternative feeds introduce high fiber content and anti-nutritional factors which can reduce nutrient uptake and negatively affect production indexes.
- Monitoring gene expression and gut microbiota can show how anti-nutritional factors affect fish health and growth.

[Schroeter, et al. "Targeted gene expression panels and microbiota analysis provide insight into the effects of alternative production diet formulations on channel catfish nutritional physiology". Aquaculture \(2018\)](#)

# Gene Expression and Diet

Any further question?

Talk to us



## Methods:

Catfish were fed four different diets similar to diets in common feeds.

## Gene Expression:

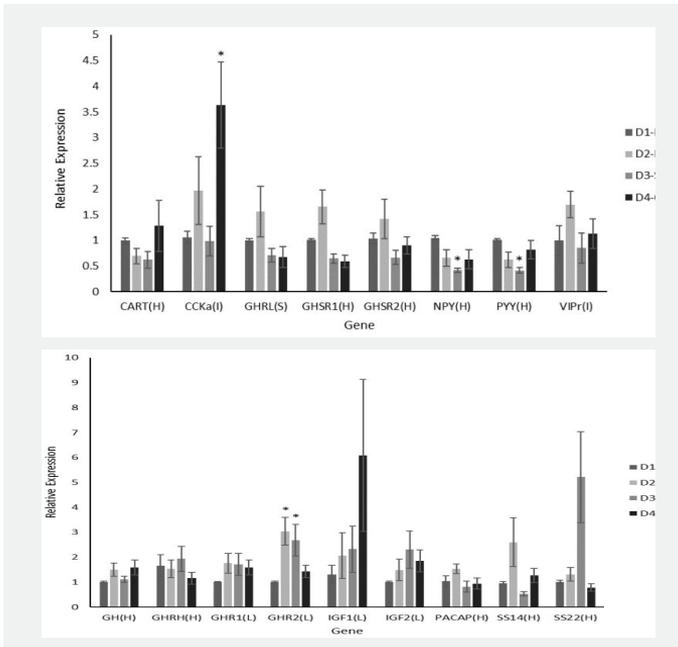
- RNA extracted from multiple tissues.
- 40 gene target panel used to observe appetite, growth, metabolism, and inflammatory response.
- Data collected on Biomark HD using 48.48 GE IFC.

## Library Prep:

- RNA extracted from whole intestines.
- Standard BioTools Access Array system used to create 16s rRNA library for sequencing.

[Schroeter, et al. "Targeted gene expression panels and microbiota analysis provide insight into the effects of alternative production diet formulations on channel catfish nutritional physiology". Aquaculture \(2018\)](#)

# Gene Expression and Diet



## Results and conclusions

### Results:

- Growth rate of catfish is high at all densities.
- Semi-intensive density results in higher growth with lower aggression.
- Fish welfare decreased at super-intensive densities in general but in all groups due to nearby construction noise.

### Conclusions:

- Adjustments to stocking density during growth phase to semi-intensive.
- Limit external stressors.
- Can monitor stress response molecularly.

Schroeter, et al. "Targeted gene expression panels and microbiota analysis provide insight into the effects of alternative production diet formulations on channel catfish nutritional physiology". *Aquaculture* (2018)

# Modern aquaculture is powered by X9

Any questions?

[Talk to us](#)

[education.team@standardbio.com](mailto:education.team@standardbio.com)

[www.standardbiotools.com/x9](http://www.standardbiotools.com/x9)

