MINISTERIO DE ECONOMÍA Y COMPETITIVIDAD

INIA Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria

FISHBOOST The next level of aquaculture breeding

Random regression analysis of feed efficiency in families of Turbot

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EAAP 2016
67th Annual Meeting of the European Federation of Animal Science
Belfast UK, 29 Aug – 2 Sept 2016

Introduction

Feed efficiency:

Feed > 50% of production costs & environmental loading

Feed Conversion Ratio (FCR) vs Residual Feed Intake (RFI)

☞ Measurement of (individual) feed intake

In livestock species: cattle, pigs, chickens, etc

Introduction

Feed efficiency in fish:

☞ Measurement of (individual) feed intake complicated

- Housing fish individually
- X-radiography

☞ Using the tank as the unit of measurement

Material & Methods

1. Feed efficiency during growth
2. Feed efficiency with restricted feeding
3. Feed efficiency, growth and slaughter

Material & Methods

☞ Feed efficiency during growth

2. Feed efficiency with restricted feeding

3. Feed efficiency, growth and slaughter

Material & Methods

Facilities:

Cluster de Acuicultura
de Galicia (CETGA)

1 room

8 families

84 fullsibs/family

3 tanks/family

400L, open-circuit seawater, ~13.6°C

Material & Methods

Trait recording

Individual body weight (BW) at 0, 47, 83, 119 days exp.

Feed intake per tank

Period 1: 0 – 47

Period 2: 47 – 83

Period 3: 83 – 119

Material & Methods

Trait recording

Individual body weight (BW) adjusted to age →

- Coefficient of variation in BW = [sd/mean] x 100%

Material & Methods

Trait recording

On tank-average values:

Feed conversion ratio (FCR) = FI / BWG

Residual feed intake (RFI) =

$$FI_i = b_0 + (b_1 \times BW_i^{0.80}) + (b_2 \times BWG_i) + e_i$$

Material & Methods

Statistical analysis

Few, repeated observations:

Random regression (R 2.6.2) with Bayesian interference

Lmer {y ~ 1 + Period + [1 + Period | Tank:Family]}

1 = intercept = baseline measure (centered data)

Period = slope = rate of change

→ Overall effect, tank effect, family effect

Results

Body weight gain

Fixed:

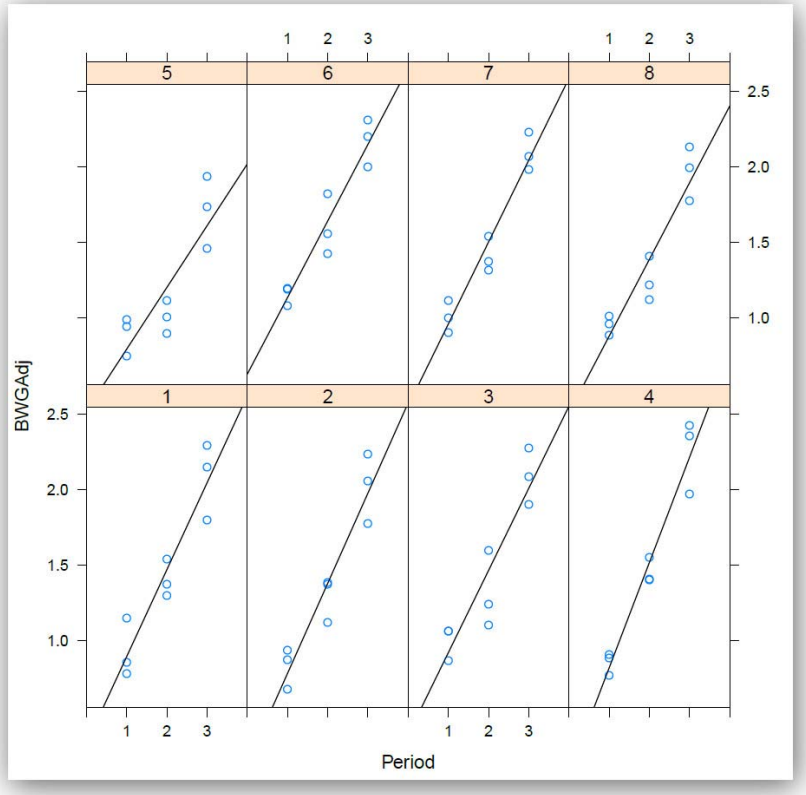
Intercept = significant

Slope = significant

Random Family :

Intercept = significant ($P < 0.001$)

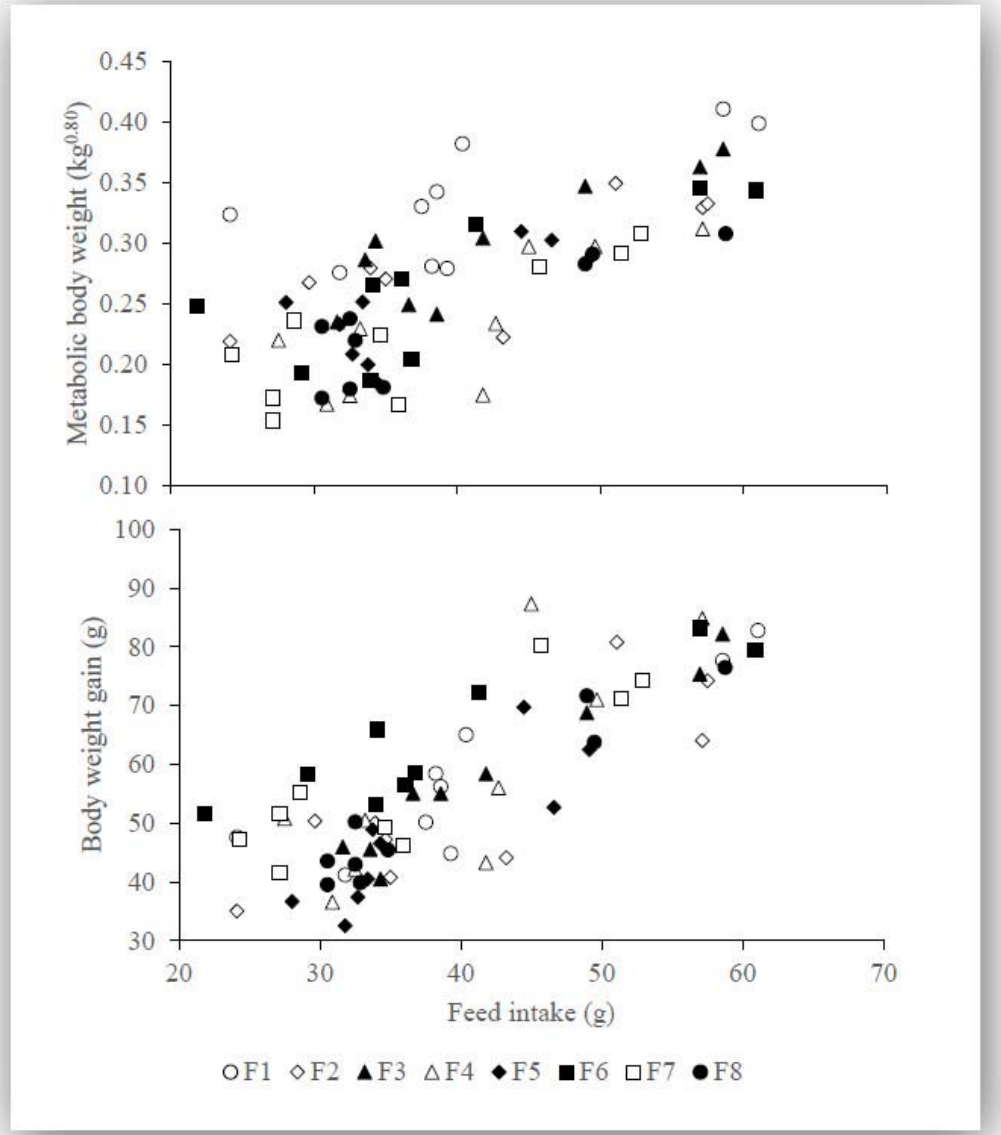
Slope = not significant



Results

Residual feed intake

71% of FI explained by BWG and $BW^{0.80}$



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Results

Residual feed intake

Fixed:

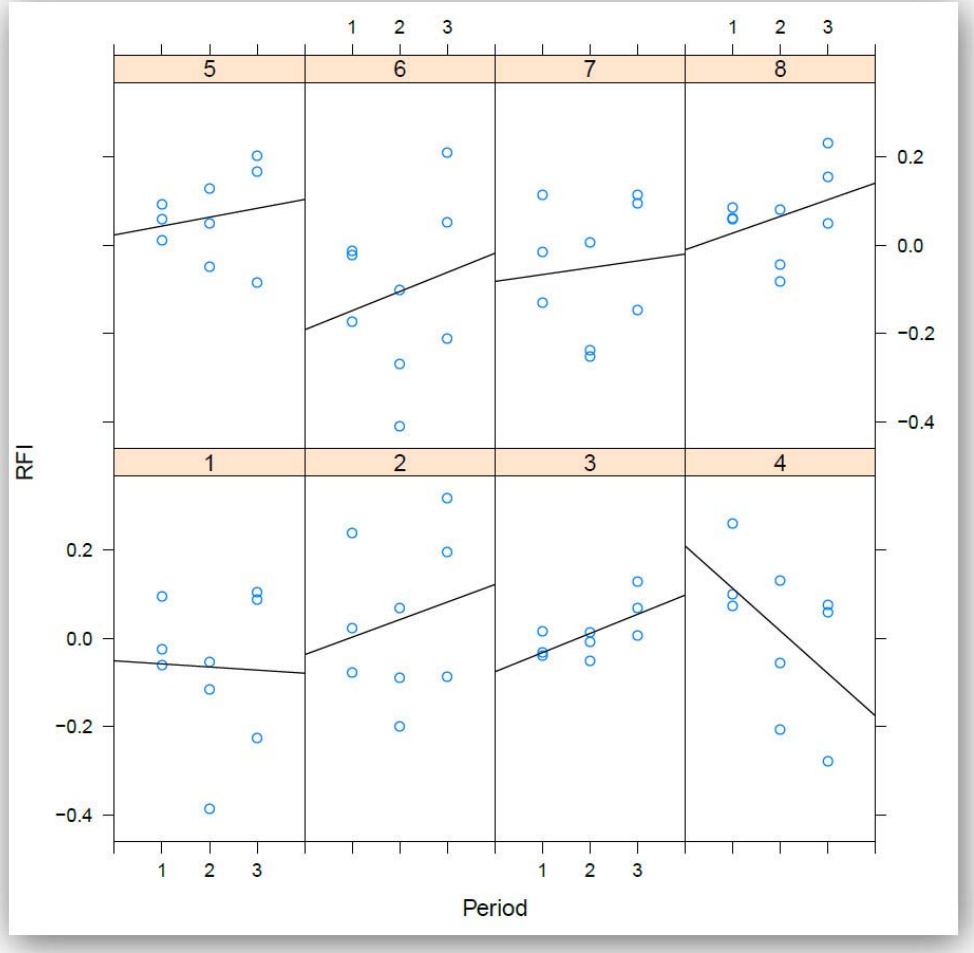
Intercept = not significant

Slope = not significant

Random Family:

Intercept = not significant but …

Slope = not significant



Results

Feed conversion ratio

Fixed:

Intercept = significant

Slope = not significant

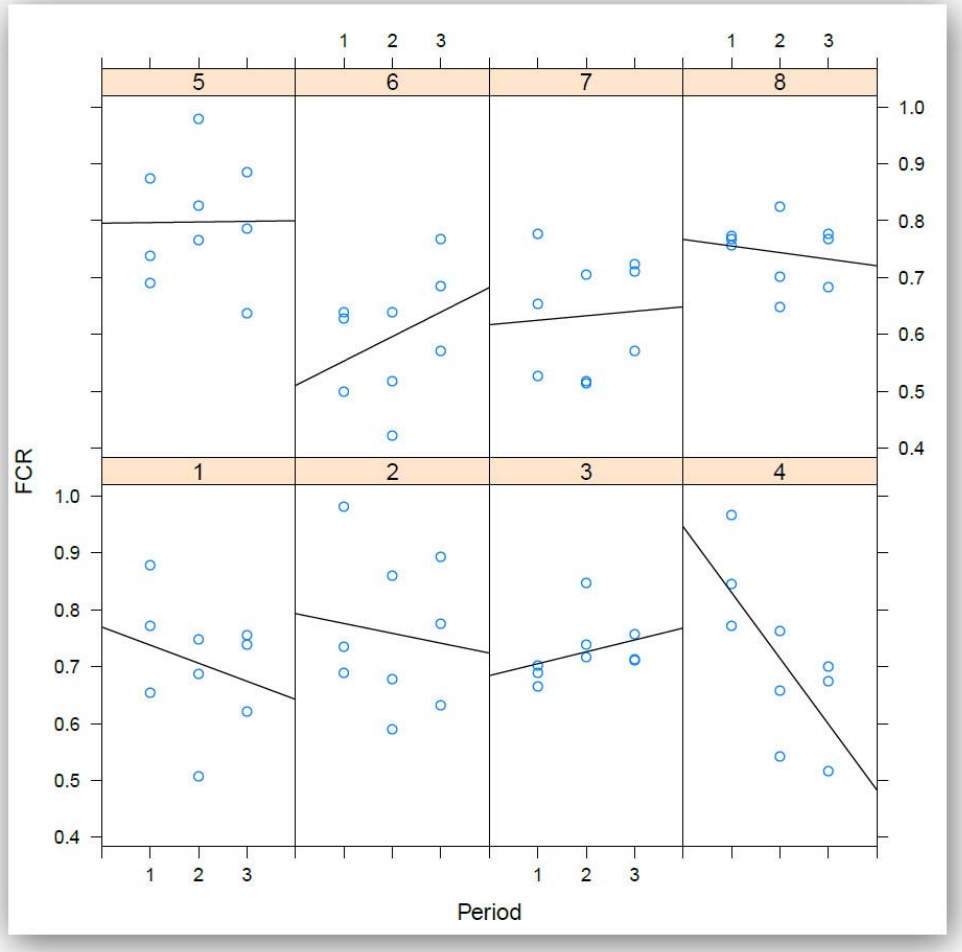
Random Family:

Intercept = significant ($P < 0.009$)

Slope = not significant

FCR with RFI: r = 0.91

~ 15% of variation due to family



Results

Coefficient of variation

Fixed:

Intercept = significant

Slope = not significant

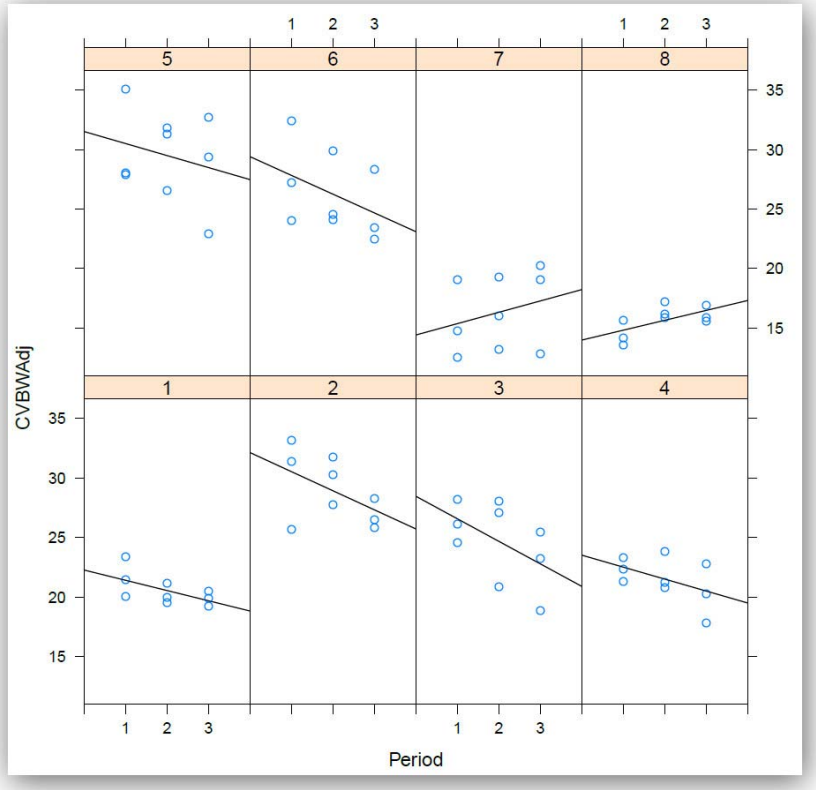
(but tends to decrease)

Random Family:

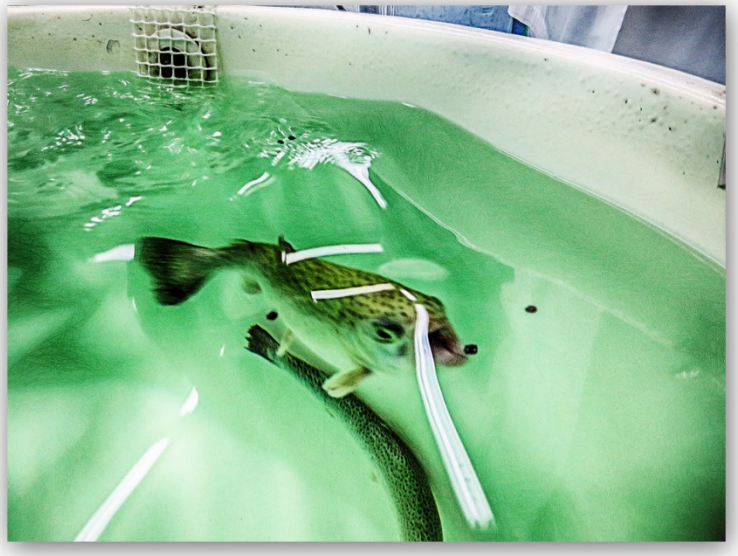
Intercept and slope correlated

Significant family effect (P < 0.004)

Not related to BWG or Feed efficiency



Conclusions



Feed intake and feed efficiency can be measured by tank (in trout: Rauw et al., 2016, Gomez Raya et al., in prep)

Feed efficiency of Rainbow trout (Onchorynchus mykiss) kept at high and low stocking density

International Journal of Recirculating Aquaculture: In Press

2016

Feed Efficiency in Individual versus in Group Housed Juvenile Rainbow Trout

Conclusions

Tank measurements can be useful for selecting families that have superior feed efficiency even though

within-group information is lost

→ In combination with individually recorded traits

RFI not correlated with BWG and size (FCR is)

Scarce literature: feed efficiency is heritable

→ More information needed on genetic parameters

Conclusions

Tank dynamics: traits depend on ‘self’ and tank-mates

→ Dominance hierarchy

Higher ranked = higher FI, higher BWG, increased CVbw

This study: > 60% of variation (intercept) CVbw due to family effect, may potentially have a genetic component

→ Not related to BWG or FE

→ Social behaviour? Separate tests needed

→ Relatedness?

Acknowledgements

Cluster de la Acuicultura de Galicia
Centro Tecnológico Gallego de Acuicultura

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Thanks!