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RESEARCH ARTICLE

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## The relationship between feed efficiency, growth and group dominance dynamics in turbot (*Scophthalmus maximus*)

Luis Gomez-Raya<sup>1</sup>, Wendy M. Rauw<sup>2</sup>, Santiago Cabaleiro<sup>3</sup>, Rubén Caamaño<sup>4</sup>, L. Alberto Garcia-Cortes<sup>5</sup> and Antti Kause<sup>6</sup>

<sup>1</sup>Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria (INIA), Dept. Mejora Genética Animal, 28040 Madrid, Spain; <sup>2</sup>Centro de la Acuicultura de Galicia (CETGA), 15965 Aguillo (A Coruña), Spain; <sup>3</sup>Natural Resources Institute Finland (LUKE), Dept. of Biometrical Genetics, Jokioinen, 31600, Finland

### Abstract

Variation among families of turbot (*Scophthalmus maximus*) in growth, feed efficiency, and body weight variation was investigated. A total of 672 turbot (*Scophthalmus maximus*) originating from eight families (84 full-sibs per family) were used in this experiment. Body weight (BW) was recorded individually four times between approximately 250 and 370 days of age. Feed intake was measured for each tank during the three corresponding time periods. Feed efficiency was estimated for each tank based on the calculations of residual feed intake (RFI) and feed conversion ratio (FCR). The within-tank coefficient of variation in body weight (CV-BW) and residual body weight variation (RBWV) were calculated to evaluate group dominance dynamics. Components of variation attributable to families were estimated from linear and quadratic random regression orthogonal polynomials. The random quadratic family component explained 14% (RFI), 22% (FCR), 76% (BW), 50% (CV-BW), and 45% (RBWV) of the total variance. The family components were significant for BW, CV-BW and RBWV ( $p < 0.001$ ), and was very close to significance for FCR ( $p = 0.052$ ). The correlation between the intercept (grand mean) of RFI and FCR was highly significant ( $r = 0.94$ ). Intercepts of RFI and FCR were positively correlated with CV-BW and RBWV ( $r = 0.09$  to  $0.12$ ), however, the correlations were not significant. The results indicate differences between families in FCR, which may be used in selection programs aimed at improving feed efficiency.

**Additional keywords:** aquaculture, fish.  
**Abbreviations used:** AIC (Akaike information criterion); BW (body weight); BWG (body weight gain); CETGA (Centro Tecnológico Gallego de Acuicultura); CV-BW (coefficient of variation of body weight); FCR (feed conversion ratio); FI (feed intake); LRT (likelihood ratio test); PVAR-FAM (variation between families); RBWV (residual body weight variation); RFI (residual feed intake); SDBW (standard deviation of body weight).

**Authors' contributions:** Conception and design: LGR, WMR, SC, AK. Statistical analysis of data and interpretation of results: LGR, WMR, LAGC, AK. Execution of experiment: SC, RC. Drafting of the manuscript: LGR, WMR, AK. All authors read and approved the final manuscript.

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Correspondence should be addressed to Luis Gomez-Raya: [gomez.luis@inia.es](mailto:gomez.luis@inia.es)

### Introduction

The six main cultured finfish species in Europe, accounting for 97% of the total aquaculture production, are Atlantic salmon (*Salmo salar*), rainbow trout (*Oncorhynchus mykiss*), gilthead seabream (*Sparus aurata*), European seabass (*Dicentrarchus labrax*), common carp (*Cyprinus carpio*) and turbot (*Scophthalmus maximus*) (Janssen *et al.*, 2017). Gjedrem *et al.* (2012) estimated that about 10% of global aquaculture production is based on genetically improved stocks. According to Janssen *et al.* (2017),

today about 80-83% of the European aquaculture production originates from selective breeding resulting in an annual gain in harvest weight of 3%. This increase is mainly explained by the dominance of European salmon farming. Turbot, which is mainly produced in Spain, is one of the most recently selected species, with about five generations of selection for the oldest program (Chavanne *et al.*, 2016). Traits of high economic importance in fish production are growth rate, feed conversion ratio (FCR), resistance to disease, fillet percentage, meat quality, and age at maturation (Gjedrem, 1983; Kankainen *et al.*, 2016).

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genética agrupa técnicas de identificación, selección, transferencia y control de genes, siendo la transgénesis la técnica de can also be used to transfer genes that make plants produce valuable substances for the. Universitat Autònoma de Barcelona: Bellaterra, Catalunya, Spain Targeting the genetic causes of diabetes through gene therapy: Therapeutic Nuevas aproximaciones de terapia genética para la diabetes tipo 2 y la obesidad . Ingeniería genética del músculo esquelético para expresar insulina y/o. Aquí presentamos un protocolo para la manipulación de genes Cardiac-specific Gene Manipulation by Intramyocardial Injection in Click here for the english version. técnica puede utilizarse para la manipulación de genes, así como la Manipulación genética cardíaca puede lograrse mediante la. Login Arabic English . Ultrastructure of the Odontocete Organ of Corti: Scanning and Transmission Electron Subjects: Animal physiology - Reproduction; Animal genetics and breeding; Source: Ciencia y Tecnología Ganadera, , v. Source: ITEA (Información Técnica Económica Agraria) ( España), Mar , t.No tiene una contraseña aún? Si no tiene contraseña, pase por la administración de la biblioteca la próxima vez que venga. Se le proporcionará una. In germplasm introgression, the introduction of genes from related Prunus species conferring Prunus cultivars have been obtained using different gene transfer methods. de técnicas alternativas de propagación y la transferencia de genes, La ingeniería genética ofrece una solución a problemas que. Ingeniería Genética 1. Introducción Todo organismo, aunque el más simple, contiene una enorme cantidad de proveedoresmerchandising.com información se encuentra. Nuestro trabajo combina el análisis bioinformático con enfoques genéticos y de biología molecular así como de análisis de genética de poblaciones. solo hace referencia a la transferencia de genes de alimentos comúnmente alérgicos. por Ciertas Técnicas de Modificación Genética/Ingeniería Genética.

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