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**Metabolism and Physiology During Ontogeny of
Cultured Yellowtail Kingfish (*Seriola lalandi*
Carangidae)**

by

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A thesis submitted in partial fulfilment of the requirements
for the degree of Doctorate of Philosophy.

The University of Auckland, 2007.

Abstract

Various aspects of metabolism and physiology were investigated during the ontogeny of yellowtail kingfish (*Seriola lalandi*), a fish of growing aquaculture importance in both New Zealand and other countries. Incubation experiments between 18-24°C showed that developing eggs and larvae were heavily influenced by temperature. It appeared that at warmer temperatures larvae hatched smaller but grew on the yolk sac, whereas at cooler temperatures larvae grew inside the chorion. Oxygen consumption data supported this, with a negative correlation found between total embryonic oxygen consumption and temperature. A mechanism was proposed to explain the differential effect of temperature on ontogeny and growth. Like other marine fish with pelagic eggs, yellowtail kingfish were found to be heavily reliant on free amino acids as a source of energy. At 23°C the pattern of substrate utilisation in eggs was considerably different from that at 17-21°C, indicating that 23°C exceeded the tolerance for normal development. Inter-individual aggression by large individuals was associated with the development of size heterogeneity in juveniles. Although this aggression also affected the survival of smaller juveniles, it was not the primary agent of much of the mortality that occurs during this phase, as many of these individuals were on a degenerate developmental trajectory. Yellowtail kingfish fingerlings used for ongrowing were robust to the stressors imposed by live transport. The ontogenetic development of metabolic rate from 0.6 mg-2.2 kg did not follow the same scaling exponent as that observed for mammalian models of allometry, and has implications for interspecific studies of mass-dependent metabolism.

Acknowledgements

I wish to acknowledge and thank Rufus Wells for his role as my supervisor, particularly in the planning and analysis of the transport stress work and respirometry. I am also thankful for the useful discussions and guidance provided by Carolyn Poortenaar and Brendan Gara, both of whom were co-supervisors during the first 18 months of my doctoral studies. A Foundation for Research Science and Technology Top Achiever Doctoral Scholarship provided financial support for the majority of my time as a doctoral student, and a 12 month stipend provided by the University of Auckland Doctoral Scholarship Scheme helped me in my last year. I am thankful to both of these organisations for allowing me to focus on my studies and not get distracted with part-time work.

Thank you to the following people for providing useful feedback and discussion on technical aspects of some of the methodologies I used: Michael Bruce, Mary Sewell, Peter Lee, Brendon Dunphy, Tony Hickey, Zöe Hilton, Gretchen Skea, Guy Carton and Berit Finnkennest. Particular thanks goes to Paul Barrett, who helped me develop the necessary statistical and mathematical skills to analyse the metabolic scaling data in a meaningful way. All of my experimentation was carried out at the NIWA Bream Bay Aquaculture Park, where I enlisted the help of nearly every staff member at one time or another. I wish to thank all of these people, but in particular Cea Smith and Steve Pether.

Brendon Dunphy was a great friend and mentor during my thesis years. Brendon took more than a passing interest in my work and provided me with the reflection and support that helped get me through the rough patches.

My wife Maren Wellenreuther was a fantastic support and helped me settle into the best 4 years of my life. Maren's determination in getting unbelievable amounts of work completed did a lot to encourage me to strive harder- if I figure out how to bottle her work ethic I'll be rich, but will have a heart condition. My parents, Sian and Kevin, and my sister, Bethan, also had a lot to do with making my doctoral studies particularly special. My family, right up to my grandparents Jean & Alan and Jean & Den in Wales, have helped mould my love of the natural world, and this thesis is a testimony to their support of my desire to be a biologist from a very, very young age.

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List of Abbreviations

AIC	Akaike information criterion
ANOVA	analysis of variance
BP	break point
DPH	days post hatch
HPF	hours post fertilisation
LS	least squares
NIWA	National Institute of Water and Atmospheric Research
$\dot{M}O_2$	mass oxygen consumption rate (e.g. mg O ₂ /unit time)
$\dot{N}NH_3$	molar ammonia excretion rate (e.g. mmol NH ₃ /unit time)
$\dot{N}O_2$	molar oxygen consumption rate (e.g. nmol O ₂ /unit time)
NQ	nitrogen quotient
RSS	residual sum of squares
SIC	Schwarz information criterion
$\dot{V}O_2$	volumetric oxygen consumption rate (e.g. ml O ₂ /unit time)

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