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**Latitudinal variation in the demography and life history of a
temperate marine herbivorous fish *Odax pullus* (Labridae)**

By

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Abstract

This thesis examined latitudinal variation in the demography and life history of a temperate marine herbivorous fish, *Odax pullus* (Labridae). Over 1000 individuals were collected at six locations across $\sim 13^\circ$ of latitude, and an age-based approach was used to establish the patterns of variation in growth rate, size-at-age, development rate (size- and age-at-maturity and -at-sex change), life span, and rate of physiological ageing. Firstly, an otolith-based ageing procedure was developed following successful validation of the daily and annual periodicity of opaque zone formation, and histological analysis of the reproductive biology of *O. pullus* was combined with sex-specific demographic information to establish a diagnosis of monandric protogynous sex change. Secondly, a “biota-environment linkage” approach was used to explore the patterns of geographic variation in life history and the effects of potential underlying environmental factors (sea surface temperature, species density, habitat and food availability, exposure, and extrinsic mortality). Significant latitudinal trends in growth, body size, development, and longevity were identified along a broad North – South gradient, with individuals growing slower, maturing and changing sex later, achieving larger body sizes and living longer at higher latitudes. The main effects of latitude on the phenotypic response of life histories were related to the latitudinal gradient in environmental temperature. Species density and habitat (food) availability also affected the responses in body size and development, and these effects were detected on a local spatial scale. Comparison with a temperate carnivorous labrid, *Notolabrus fucicola*, revealed no differences in the response of growth, body size, development and life span to temperature in the two species with contrasting diets, thus providing no support for the hypothesis of a temperature constraint on herbivory at high latitudes in *O. pullus*. Lastly, the processes underlying latitudinal changes in life span were investigated in the context of the oxidative stress hypothesis of ageing and of the predictions of the Metabolic Theory of Ecology, and the age-pigment neurolipofuscin was quantified in older *O. pullus* individuals to assess the rate of oxidative damage accumulation across latitudes. Neurolipofuscin accumulation rate increased with temperature, indicating that a slower rate of ageing contributed to greater life expectancies at colder temperatures.

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