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PHYSIOLOGICAL AND BEHAVIOURAL STUDIES ON THE
ECOLOGY OF SOME NEW ZEALAND CHITONS

Thesis presented for the Degree of Doctor of Philosophy
in Zoology, at the University of Auckland
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by

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ABSTRACT

Experiments on the responses to osmotic stress and desiccation, are reported for several species of New Zealand littoral chitons. Qualitative and quantitative studies on the ecology of the common Auckland species have been undertaken, with special reference to microhabitat conditions. The micro-anatomy of the dorsal sensory organs has been studied, and related to the comparative responses to light stimuli, and experiments involving interference with these organs.

Sypharochiton pelliserpentis was found to be an osmo-conformer, showing only limited volume regulation but a wide tolerance to salinity fluctuations. Size of the animal had a negligible effect on the osmotic response, and it is likely that other chitons are osmo-conformers but with less tolerance of osmotic stress. Animals of this species were better able to resist the effects of desiccation than several other chitons. This resulted from a kinetic behaviour pattern in response to low humidities causing aggregation in the laboratory, and a well developed tolerance of extreme water loss, Sypharochiton pelliserpentis colonises a wide range of microhabitats on rock surfaces, some exposed to wide salinity changes ($13.28^{\circ}/\text{oo}$ to $45.80^{\circ}/\text{ooS}$) between tides, and others exposed to drying. Population size structures indicate that exposure to desiccation is likely to be more important than osmotic stress in controlling populations, and microhabitat more important than tidal level. The other chitons studied were restricted to pools, beneath boulders or to wave-splashed situations which did not dry.

One very fast-moving chiton, Ischnochiton maorianus exhibited photo-negative orientation and the 'shadow response', the full range of reactions to light stimuli yet reported in chitons. It possesses only the megal aesthete type of dorsal sensory receptor. Experiments showed masking or abrading these organs to affect the rate of response, and it is concluded that at least one of their functions is light reception. Onithochiton neglectus, a species possessing well developed extra-pigmental ocelli, did not show such clear responses to light. Problems of the structure and function of these organs are discussed.

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