LIFE HISTORY STRATEGIES OF AUSTRALIAN SPECIES OF THE HALOPHYTE AND ARID ZONE GENUS *FRANKENIA* L. (FRANKENIACEAE).

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DECLARATION

I certify that this thesis does not incorporate without acknowledgments any material previously submitted for a degree or diploma at any university. To the best of my knowledge and belief it does not contain any material published or written by another person except for where due reference is made within the text.

I give consent for this thesis being made available for loan and photocopying.

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October 2008

ABSTRACT

This thesis is a comparative study of the life history strategies, and in particular seed germination requirements, in Australian species of the halophyte plant genus *Frankenia* L. (Frankeniaceae). *Frankenia* is a cosmopolitan genus that occurs in Mediterranean, semi-arid, and arid regions on distinctive soil types – commonly on saline, sodic or gypseous soils – in habitats such as coastal cliffs, and on the margins of salt lakes, salt-pans and saltmarshes (Summerhayes 1930; Barnsley 1982). The plants are small shrubs or cushion-bushes with pink, white or pale purple flowers, and salt-encrusted recurved leaves.

This project investigates germination requirements for *Frankenia* in relation to seed age, light requirements, temperature preferences, salinity tolerance, and soil characteristics. It also explores two divergent reproductive strategies – notably seed packaging strategies – in relation to environmental variables. Within the 46 currently recognized endemic Australia species, some species have a few ovules per flower and produce only a few larger seeds per fruit, while other species have many ovules per flower and produce many small seeds per fruit. Large-seededness is thought to increase the probability of successful seedling establishment in drought and salt-stressed environments. As both larger- and smaller-seeded species of *Frankenia* co-occur in close geographical proximity, hypotheses regarding the advantages of large-seededness in stress environments can be tested. By restricting the analysis of seed mass variation to similar habitats and within a single plant genus, it is possible to test ecological correlates that would otherwise be masked by the strong effects of habitat differences and phylogenetic constraints.

Overall, larger-seeded *Frankenia* species were demonstrated to be advantageous for rapid germination after transitory water availability, and for providing resources to seedlings if resources became limiting before their successful establishment. Smaller-seeded species delayed germination until both soil-water availability and cooler temperatures persisted over a longer time period, improving chances of successful establishment for the more slowly growing seedlings that are more reliant on their surroundings for resources.

This study produces information on the seed and seedling biology of many Australian species of *Frankenia* including several that are of conservation significance, e.g. *F. crispa* with its isolated populations, and the rare and endangered *F. plicata.* This information is important for the development of conservation management plans for these and other arid

zone, halophyte species. In addition, the results of this study are of practical significance in determining the suitability of *Frankenia* for inclusion in salinity remediation and mine-site rehabilitation projects, and for promoting *Frankenia* as a drought and salt tolerant garden plant.

PREFACE

The data chapters of this thesis have been compiled in journal manuscript format, and therefore some information of each chapter, notably in the introductions, may be repetitive. Tables, figures and references are also found at the end of each chapter. Chapter status in relation to its progress towards publication at the time of submission of this thesis is noted at the beginning of each chapter.

All chapters were written by myself; however, Chapters 2 through 7 are co-authored to recognise the contributions made by my supervisor Dr Sonia Kleindorfer.

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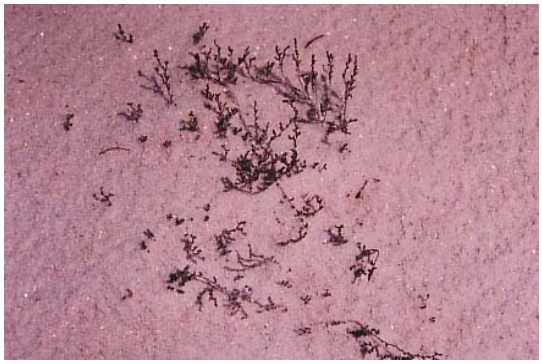

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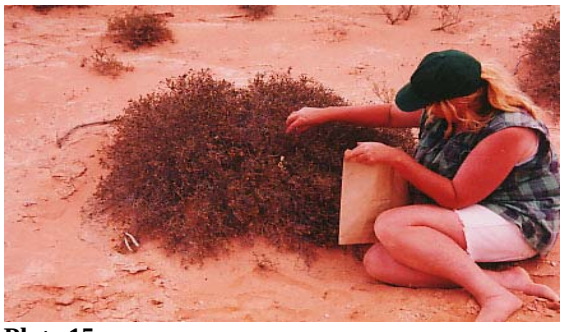

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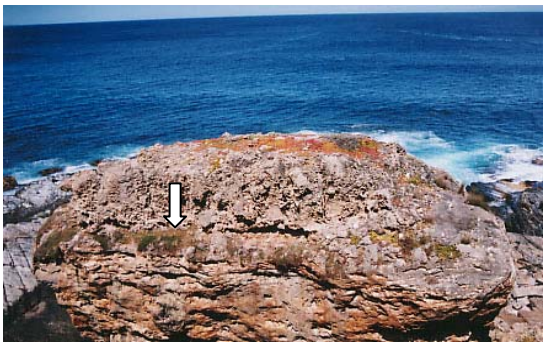

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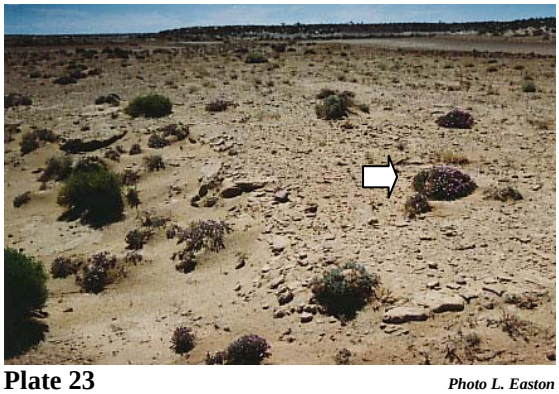

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