A Test of the Hutchinson Theory of Interspecific Competition

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Abstract

Kangaroo Island is of high conservational significance with the largest remaining interface between native vegetation and agriculture in South Australia. The two main native herbivores on Kangaroo Island are the western grey kangaroo and the tammar wallaby. Two introduced herbivores, sheep and feral goat, also contributed to the study. All animal species coexist in the north western districts of Kangaroo Island. All species coexisted at the Borda Vale property, Cape Borda and Correll property de Mole River field sites.

Competition between mammals on Kangaroo Island was investigated to determine if the Hutchinson Theory of Interspecific Competition could be either rejected or not-rejected. Hutchinson's theory states that an animal needs to be at least 2.1 times either larger or smaller in body weight than another competitor in the same environment to escape the influences of interspecific competition. The current investigation was two pronged; comprising field studies with subsequent analysis of plant cuticles from faecal matter, and secondly scientific trials on the mainland held at The University of Adelaide, Roseworthy campus, South Australia. The *in situ* field studies involved collecting faecal samples from each species and pasture comparison at three sites. The pasture structure on both sides of the recently erected boundary fence at two sites on Borda Vale was determined. Plant cuticles from faecal samples provide insight to the dietary composition for each species, and any dietary overlap between species. The body condition of all herbivores in the trial was assessed prior to the pen trials. Recognised body condition assessment methods for sheep and goat were available, but not for the macropods. Therefore, a condition score system (CS) was devised utilising biological indices as the basis of the CS system. Pen

trials included species-specific pens and mixed species pens, a total of eleven half hectare pens. Each pen had the same pasture plant structure with a plant survey determining the level of competition among the four species. A palatability/cafeteria trial of the pen plant species was undertaken by placing replicated plant specific pots in a test arena to record food preference for each animal species. Animals from each of the four species had mouth characteristic data recorded to detect any morphological differences which could provide an alternative explanation to the Hutchinson theory.

Pasture at all three sites fluctuated with seasonal condition, with the exception of bryophytes, that were only present in pastures on Borda Vale. The dietary overlap results (average *C* 0.14) indicated a low dietary overlap among the four herbivores throughout the four seasons. However, the greatest average seasonal dietary overlap result was between pairs of herbivores, occurring in spring (*C* 0.76 and *C* 0.85), when regrowth is at its greatest. In summer (*C* 0.70) and autumn (C 0.67) the dietary overlap decreased slightly, due to diversification of plant species eaten, with the increase of native browse vegetation in the diet. The wallaby, the smallest competitor, is in direct competition with the three larger competitors, with the greatest competition for resources being with the kangaroo (*C* 0.90) throughout the seasons.

The condition score (CS) indices were applied to both macropods. However; the focus was mainly on the CS system for the tammar wallaby. The development of the CS system included four body indices. The system has five condition score levels, ranging from level one, representing an animal in very poor body condition, to level five, representing an animal in optimal condition. The boundary between being fit for this trial work and not fit occurred at CS 2 and CS 3. Locomotive performance was impaired below CS 3.

Therefore, animals that failed to achieve CS 3 status were rejected from inclusion in the trials.

The two pen trials, one replicated and one pseudo-replicated, indicated that all herbivore species ate all of the pasture species on offer. Only a proportion of the competitive interactions between the mammalian grazing herbivores of Kangaroo Island were consistent with the predictions of the Hutchinson Theory. The results of the study produced some instances in which the smallest animal was the more effective forager. In several instances, no differences were detected, and in two instances (*Althaea officinalis* and *Heliotropium europaeum*) two of the larger grazers were more effective than the wallaby. Also, there was an instance in which one large herbivore had an advantage over another large herbivore for *Tribulus terrestris*. However, it appeared that the wallaby ate none of the oat grain (*Avena sativa*) even though it was the most abundant potential food source available in the trial pens. Further investigations of the palatability of fodder in the pen trial are indicated.

Further investigation into the association between the wallaby and ingestion of oat grain were undertaken. Wallabies ate oat grain only as a last resort, and were not able to maintain good body condition on a diet of oats. The finding that wallabies find oat grain unpalatable has ramifications for the farmers and conservation management on Kangaroo Island during drought condition, when hand feeding of oat grain is the major form of supplementary feeding of sheep.

Many factors may explain the lack of support for the Hutchinson Theory of size displacement in this study. The absolute morphological characteristics of lip length, incisor length, tongue length and lower dental arcade width of the wallaby were

statistically smaller than all the larger herbivores species in this study. Although the morphological differences (corrected for scale) in mouth structures revealed some statistically different characteristic among the four herbivores with no wallaby characteristic being statistically smaller or larger than all of the larger herbivores species. Other factors that could explain species diet separations, thereby reducing direct competition, are discussed including, height of reach, eye sight, height of vegetation preferences, temporal and diurnal separation.

The Hutchinson Theory is not supported in the current field study either, with the wallaby clearly in direct competition with the three larger herbivores on Kangaroo Island with the greatest competitor of the wallaby being the kangaroo. The pen trials only provided weak support for the Hutchinson Theory which provides only one explanation of competitive separation. Therefore, this theory is simplistic when there are many alternative explanations that allow dietary separation and reduce direct interspecific competition. This research highlights management issues that have important implications for the farmer and conservation managers on Kangaroo Island.

Declaration

This work is the result of my own investigation. The content herein has not been accepted for the award of any other degree or diploma in any university or other tertiary institution to Richard Bosworth and, to the best of my knowledge and belief, contains no material previously written or published by any other persons except where due reference is made in the text.

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Richard Bosworth

January 2012

Acknowledgements

The birth of the Aboriginal Flag occurred at Tarndanyangga / Victoria Square, Adelaide, in July 1971 at a land rights rally. Later that same year, the Aboriginal Flag was flown at the Aboriginal Tent Embassy in Canberra. Today, the Aboriginal Flag has become a powerful symbol for Reconciliation and hope for many Indigenous and non-Indigenous people throughout Australia.

The Aboriginal Flag was designed by Harold Thomas. Harold is a Luritji man who currently resides in the Northern Territory. Harold was born in Alice Springs and was the first Aboriginal person to graduate from an Australian Art School.

The Aboriginal Flag is divided horizontally into two equal halves of black and red, with a yellow circle in the centre. The black symbolises Aboriginal people; the red symbolises the mother earth and the ochre, which is used by Aboriginal people in ceremonies, the yellow, the sun, the constant giver and renewer of life.

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