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# Maternal Investment in Kaimanawa Horses

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***“THINK, WHEN WE TALK OF HORSES, THAT YOU SEE THEM  
PRINTING THEIR PROUD HOOFS I’ THE RECEIVING EARTH”***

*Shakespeare, circa 1599, ‘Henry V’.*

*Photo caption:*

*C-band in August 1994.*

*Band stallion, Charly (085), is in the foreground. Mares Celia (132) and Cashew (112) are also visible.*

*Photo by Wayne Linklater*

## ABSTRACT

Maternal investment (MI) was studied in Kaimanawa horses, a population of feral horses in central North Island, New Zealand. It is predicted that individual mares will vary their maternal behaviour so as to maximise their own and their offspring's reproductive success. Maternal investment is defined and measured by maternal input, proximal maternal costs and reproductive costs to the mother. The primary maternal input is milk. Time spent suckling is frequently used to measure milk intake based on the assumption that more suckling equates with proportionately more milk intake. A review found little support for this assumption and so I tested whether suckling time predicted milk intake by labelling the milk of thoroughbred mares with tritium and measuring its transfer to foals. No significant predictive relationship was found. Therefore suckling time cannot be used as an index of milk intake and conclusions about differential MI based on time spent suckling may be wrong. A mare's social environment is a significant modifier of her MI. Mares were more protective, and suffered reproductive costs, in bands with more than one stallion or in other circumstances where paternity is uncertain or rates of aggression are high. Despite individual differences in maternal style, mare behaviour was modified by experimental manipulations of the number of stallions in a band. In an unusual event when a mare and her adult daughter lived in the same band, both co-operated in the care of a single foal. Mare age and experience modified maternal behaviour. As mares age they become more successful at raising foals through better-targeted input, but no extra investment. I tested the Trivers-Willard hypothesis (TWH) of sex differential MI. The hypothesis predicts that mothers in better condition should produce more sons, and invest more in their sons, whereas mothers in poorer condition should favour their daughters. I argue that horses are an ideal species on which to test the TWH. We found no sex biased MI on a population level in terms of maternal input, proximal costs or ultimate costs. However, the TWH makes specific predictions about individuals, not populations. Individual mares in poor condition gave birth to more daughters and biased their MI towards daughters. Conversely, mothers in good condition gave birth to more sons and biased their investment towards sons, supporting all the predictions of the TWH. Mares alter their maternal investment in ways that conform to predictions based on maximisation of lifetime reproductive success.

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Alison Franklin introduced us to the horses, and named some of them (yep, Quin is still out there everyone!). Wayne Linklater also named some, though I'm afraid I have to take credit for most of the names. I still think Mr Blobby is a wonderful name! Although field trips were usually spent just with Wayne Linklater, the dogs (BJ and Uzuri), the horses, and the various other inhabitants of the range, I was lucky to have had, at various times, assistance and company in the field from Tarmo Põldmaa, Rachel Standish, Nokome Bentley, Jenny Lee, Peter "little-cup" Ritchie, Jay McCartney, Kim Carter, Alastair Robertson and Simon Pearce. Jay and Kim were not even put off by the

erupting volcano (Mount Ruapehu) and an ash fall during field work! My constant field companion was Uzuri, who found dead horses, kept me company, kept me warm, reminded me to eat and told me in no uncertain terms when the day had been too long.

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Finally, no research is possible without the subjects, and Kaimanawa horses are wonderful to work with. Even those sub-zero days in wind, rain or snow were filled with enjoyment when working with Kaimanawa horses. On a fine clear day, with green grass, fat horses and young foals in the valley, and with an erupting mountain as a backdrop it is just magic. And it doesn't get much better than that.



## NOTE ON THE TEXT

Each chapter is set out largely in the style of the journal to which it has been submitted. Consequently, there is some repetition, particularly in methods sections, and there are stylistic differences between chapters. In addition, other authors are included in the paper reference. For each chapter, my input was the greatest. I planned the research, undertook the field work, analysed the data and wrote the manuscripts. I was, however, helped by my co-authors. Kevin Stafford, Edward Minot and Clare Veltman were my supervisors. Wayne Linklater was studying the Kaimanawa horses for his own PhD and thereby contributed to most aspects of my study.

All research described in my thesis was approved by the Massey University Animal Ethics Committee.