Reviving Ecological Functioning Through Dingo Restoration

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Contents

Abstract iii

Declaration v

Acknowledgements vi

Chapter 1 **Introduction**

Invasive species: heart of the problem or merely the symptom of a weak heart? 1

Arian D. Wallach

Unpublished

Chapter 2 **Can threatened species survive where the top predator is absent?** 23

Arian D. Wallach, Brad R. Murray and Adam J. O'Neill

Biological Conservation (2009) 142: 43-52

Chapter 3 **More than mere numbers: the impact of lethal control on the abundance and social stability of a top-order predator** 57

Arian D. Wallach, Euan G. Ritchie, John Read and Adam J. O'Neill

PLoS ONE (2009) 4(9): e6861

Chapter 4 **Predator control promotes invasive dominated ecological states** 85

Arian D. Wallach, Christopher N. Johnson, Euan G. Ritchie and Adam J. O'Neill

Ecology Letters (2010) 13: 1008-1018

Chapter 5 **Discussion**

Dingo control is the ultimate cause behind biodiversity loss in Australia – a thesis overview 117

Arian D. Wallach

Unpublished

Chapter 6 **Conclusion**

Collaborating with predators 129

Arian D. Wallach

Unpublished

Appendix 1 **Threatened species indicate hotspots of top-down regulation** 141

Arian D. Wallach and Adam J. O'Neill

Animal Biodiversity and Conservation (2009) 32.2: 127-133

Appendix 2 **Artificial water points: hotspots of extinction or biodiversity?** 161

Arian D. Wallach and Adam J. O'Neill

Biological Conservation (2009) 142: 1253-1254

Abstract

Invasive species are regarded as one of the top five leading causes of the global extinction crisis. The majority of threatened species recovery plans therefore call for lethal control of invasive species, particularly predators. Vast resources are expended to combat the threats posed by invasives, and considerable research efforts have been devoted to developing best practice pest control practices; with little success overall. The reason for this may be that although invasive species cause extinctions, they are not the ultimate cause. Instead, the shift to invasive-dominated states is driven by an underlying loss or lack of ecological resilience. One of the leading processes that might result in widespread resilience loss, and release of invasive species, is the control or absence of apex predators.

Across the globe, and in every habitat investigated, apex predators play a keystone role in enhancing ecological resilience to the damaging influence of environmental perturbations. I tested the hypothesis that state shifts to invasive dominance are symptomatic of the disruption of top-down regulation, and that ecological resilience is largely determined by the social stability of apex predators. Australia presents a unique opportunity to examine these ideas because it is here that mammalian invasions and extinctions have been most severe; pest control is intensive and widespread; and only a single large mammalian predator, the dingo (*Canis lupus dingo*), is extant. I studied the interactions between dingoes, invasive mesopredators, herbivores, small mammals and vegetation in a series of sites across the arid zone, representing different levels of predator control (poison-baiting). Four of the sites were monitored over 2-3 years to study the effects of predator control cessation and intensification. This study was therefore conducted on both a spatial and temporal scale, providing not only correlative, but also (quasi) experimental evidence from large-scale predator manipulations.

The results of this study indicate that ecosystem state shifts to invasive-dominated and degraded landscapes are a consequence of predator control. Where threatened species survive, dingoes were consistently found besides them. Where dingo populations were allowed to recover, invasive and opportunistic species declined considerably, and native biodiversity and productivity increased. The ecological benefits of dingoes were more pronounced and consistent when their social stability was considered. The positive influence of dingoes, and the negative effect of predator control, even outweighed the influence of rainfall in the desert. Whether conducted in the name of the pastoral industry or biodiversity conservation, predator control benefitted neither and undermined both. The results of this study suggest that relaxing human intervention, and allowing large predators to re-assume their natural roles, can rapidly restore ecological resilience and reduce the threat of invasive species. I offer an alternative model for ecological restoration, in which the promotion of predators forms the foundation for recovery programs of threatened species.

Declaration

I hereby declare that this submission is my own work. Any contribution made to the research by others, with whom I have worked, is explicitly acknowledged in the thesis. I also declare that the intellectual content of this thesis is the product of my own work, except to the extent that assistance from others in the project's design and conception, fieldwork, analysis and presentation is acknowledged.

This work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. I give consent to this copy of my thesis when deposited in the University Library, being made available for loan and photocopying, subject to the provisions of the Copyright Act 1968. I acknowledge that copyright of published works contained within this thesis (as listed below) resides with the copyright holders of those works.

All thesis chapters and appendices (excluding the Introduction, Discussion and Conclusion) have been published or accepted for publication, and are presented with minor modifications to allow for a uniform thesis format style.

Chapter 2: Wallach A.D. Murray B.R. and O'Neill A.J. (2009). Can threatened species survive where the top predator is absent? Biological Conservation. 142: 43-52.

Chapter 3: Wallach A.D., Ritchie E.G., Read J. and O'Neill A.J. (2009). More than mere numbers: the impact of lethal control on the social stability of a top-order predator. PLoS ONE. 4(9): e6861.

Chapter 4: Wallach A.D., Johnson C.N., Ritchie E.G. and O'Neill A.J. (2010). Predator control promotes invasive dominated ecological states. Ecology Letters. 13: 1008-1018.

Appendix 1: Wallach A.D. and O'Neill A.J. (2009). Threatened species indicate hotspots of top-down regulation. Animal Biodiversity and Conservation. 32.2: 127–133.

Appendix 2: Wallach A.D. and O'Neill A.J. (2009). Artificial water points: hot-spots of extinction or biodiversity? Biological Conservation. 142: 1253-1254.

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Author contribution

This work greatly benefitted from the thoughts, ideas and expertise of several individuals. Adam J. O'Neill (Chapters 2-4 & Appendices 1,2) fully participated in conceiving, designing and carrying out fieldwork, contributed time and equipment, and analyzed results. This study could not have been carried out without him. Brad R. Murray (Chapter 2) supervised the first stage of this study and contributed funding, analysis and editing. John Read (Chapter 3) co-supervised the work in Stuart Creek and Andamooka stations, and assisted with conceiving fieldwork methods, provided funding and contributed analysis and editing. Chris N. Johnson and Euan G. Ritchie (Chapters 3,4) provided statistical and result analysis, contributed funding (CNJ), participated in publication design (Chapter 4) and editing.

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Photography

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