The Ecology of Two Vulnerable Shorebirds (*Haematopus f. fuliginosus* and *H. longirostris*) in Sub-tropical Northern NSW, Australia: Implications for Conservation and Management

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A thesis submitted for the degree of Doctor of Philosophy
of the University of New England

Sumbitted March 2009
Revised December 2009

ACKNOWLEDGEMENTS

I sincerely thank Professor Hugh A. Ford, of the University of New England, for supervising my undertaking of this shorebird project. Hugh first sparked my interest in ornithology during my undergraduate degree, and has since provided much guidance over the years, with his endless enthusiasm, and knowledge of the behavioural ecology of birds. I am very grateful to have had him as a supervisor, for his guidance, patience, understanding and thoughtfulness. I particularly thank him for his assistance with the drafts of each of my chapters and publications. Also, for providing me with opportunities to travel nationally and internationally to give presentations, I am very grateful. I hope that he has also discovered new things through this research. I also thank Dr. Stuart Cairns, my co-supervisor, for his guidance on statistical analysis, and for introducing me to new methods.

I would also like to thank Bo Totterman, who although was not officially my supervisor, provided me with much guidance and assistance, particularly during the field work phase of this research. Bo has a passion for shorebirds, and introduced me to the behavioural aspects of the oystercatchers and their predators. He was full of helpful hints and encouragement, and was always keen to hear about the daily activities on the beach. I am also extremely grateful to both Bo and his wife Eila for their hospitality and friendship, as they also provided a friendly base from which field work was conducted while away from home.

I am also very grateful to Greg Clancy, a life long bird enthusiast who was also keen for a chat, and happy to provide advice when needed. Having undertaken banding on numerous shorebirds throughout the state, Greg was full of information, and was quite happy to have an extra pair of legs for chasing down runners. I thank him for his useful comments also on thesis chapters and for his friendship as a fellow post-grad.

I would also like to thank Kersten Tukey, of the NSW Department of Lands, who welcomed this research and encouraged my participation and advice in the development of the Threatened Species (Australian Pied Oystercatcher) Management Strategy. Kersten also facilitated my involvement in public meetings, school visits and workshops, for which I am very grateful.

Thanks also goes to all those who assisted with field work, some for it may have been weeks on end others for just a day. Special thanks in particular to Jenifer Rowland, with whom I shared many conversations and laughs over the years. There are many things that I will not forget about the times we spent together. Also to Charlotte Deholain, an intern

placed at the National Marine Science Centre, with nothing marine to do who ended up on a birding trip with me. I thank Charlotte for her friendship and the laughs during field trips, also for her hospitality in return during my subsequent trip to France. Claire-Louise Filewood is also especially thanked, for making everyday at the office (and in the field) something to smile about, for her friendship and her inspiration. Her cheeky enthusiasm and love for life is very contagious and refreshing. Thanks also to Beth Hastie for her friendship, advice and field assistance.

I also thank my parents for their continued love and support over the years. And lastly, I sincerely thank my husband, Matthew Harrison and my daughter Emily, for their patience, understanding and continued support. Matt not only assisted with field work, but made life so much easier for me when field demands and other work demands were high and when life became much busier after the arrival of our daughter Emily. Without his support I could not have travelled so far or achieved so much in life. Thank you. I also thank Emily for keeping me grounded and for making me smile.

The creation of a thesis was not a task of ease, and is one that others including family and friends often find hard to comprehend. Although it has been a struggle at times, balancing study, work and family, the experiences and the friendships will never be forgotten.

Permits for this research were gained through the University of New England Animal Ethics Committee, the New South Wales National Parks and Wildlife Service and the Solitary Islands Marine Park Authority. This study was facilitated through the provision of a scholarship and project funding by the University of New England and funding from the Department of Land and Water Conservation (currently the Department of Natural Resources). Small grants and assistance were also provided by the National Marine Science Centre, the International Wader Study Group, the University of La Rochelle (France), the League for the Protection of Birds (LPO), the Coffs Harbour City Council and Birds Australia. Thank you for your assistance. It was greatly appreciated.

ABSTRACT

Shorebirds around the globe have become increasingly threatened as a result of burgeoning human populations, increased coastal development and habitat loss, recreational activities, predation, and climate change. Australian Pied and Sooty Oystercatchers (*Haematopus longirostris* and *H. fuliginosus* respectively) are two such species, both coastal residents listed as threatened in New South Wales, Australia. Both rely upon the narrow coastal fringe for foraging, roosting and breeding. Both have undergone declines over recent decades, occur in low numbers, have patchy distributions, are specialist foragers, and are thought to exhibit low breeding success. Despite this, there is a paucity of detailed information on their distribution, population size, key habitat attributes, reproductive biology and ecology, or the impact that various threatening processes have upon these species. Previous work in Australia has focused on counts and movements, with banding programs in Victoria, Tasmania and Western Australia where the species is more common. This thesis examines the distribution, habitat use, breeding biology, ecology and impact of threatening processes for both species in northern NSW to provide a basis for effective management of these species.

Population estimates for both species were generated during 2003 to 2005 and compared to past counts and estimates. Australian Pied Oystercatchers had declined dramatically following the late 1990s, and continued to do so, with a net loss of 13% between 2003 and 2005. Adult mortality was estimated at minimum of 10% annually. Declines were evident in all cohorts, and indicated that although breeding adults were being replaced, immature birds were not, and that the rate of adult loss may have been higher than estimated. Sooty Oystercatchers on the other hand, had remained fairly stable over the past decade. However, numbers fluctuate widely between seasons and years. Although almost 70% of the Australian Pied Oystercatcher population were breeding individuals (from a total of 112 individuals), only six Sooty breeding pairs were found (from a total of 45-49 individuals).

Various factors were identified as good predictors of presence for each species, based on generalised linear modelling, and broadly included food supply, habitat structure and human disturbance. The Clarence River represented a divide between the majority of northern Australian Pied Oystercatchers that primarily forage and nest on beaches and the southern birds that use estuaries (39% of birds within the study region). Conversely, Sooty Oystercatchers rarely occurred north of the Clarence. Two primary areas were used by the latter species, one for foraging and one for breeding. Unoccupied suitable nesting habitat was

identified for the Sooty, suggesting that the population may be below carrying capacity. However, productivity of the six island nesting Sooty Oystercatcher pairs was high for the years surveyed, ranging from 1.00 to 0.83 fledglings per pair.

Reproductive success of the 41 breeding pairs of Australian Pied Oystercatcher varied between seasons and between habitat types, with an average of 0.90 and 0.31 fledglings per pair annually (over three years) for estuarine and beach nesting pairs respectively. Therefore, although the majority of pairs occurred on beaches, estuarine pairs produced approximately 70% of all fledged birds. Variation in breeding success and the overall population decline were attributed to several limiting factors, primarily risk of predation, food availability and disturbance.

Predation by the Red Fox (*Vulpes vulpes*), was the largest identified source of egg loss (accounting for 34% of lost eggs), and significantly more beach nests were lost to predators than estuarine nests. Beach and estuarine nesting habitat also varied. Estuarine nests were more complex, possibly offering more protection from predators, whereas beach nests were open, surrounded by little vegetation. Conversely, the risk of tidal flooding was higher for estuarine nesters. Continuing fox control is critical to reduce failure of clutches and should commence in July prior to egg-laying.

Abundance of primary prey species also varied between habitats. The density of *Donax deltoides*, the primary prey species on beaches, has undergone a severe long-term decline that continued through to 2005, with a net loss in stock of 75% between 2003 and 2005. Declines in commercial catches also reflect this trend. Estuarine prey on the other hand, are not harvested and remained abundant during the period of survey. The sustainability of removing bivalves (*Donax deltoides*), from NSW beaches should be investigated as stocks appear to be falling rapidly, and this practice has major ramifications for the reproductive potential and survival of Australian Pied Oystercatchers; in the interim this practice should cease.

Human activity and that of their pets occurred in both habitats, accounting for egg, chick and adult loss. Recreational disturbance also caused birds to depart from nests for 21.5% of incubation time (survey n = 176 hrs, pairs n = 23). Non-incubating partners foraging on shoreline close to nests were also disturbed and lost 18.4% of foraging time. With limited food availability, the impact of disturbance would be exacerbated, likely resulting in fitness costs. Human recreation, particularly involving dogs, was most threatening to incubating Australian Pied Oystercatchers, resulting in significantly higher frequencies and durations of absences than disturbance by researcher approach, slow moving

vehicles and natural stimuli. Human disturbance should be minimised at beach and estuarine breeding sites. Sign-posted buffers with a radius of 195 m should be enforced surrounding nests, in which recreation and pets are excluded.

Population analysis for the Australian Pied Oystercatcher, using the finite rate of increase equation, supported the observed population decline. To reverse the decline managers must focus not only on productivity, but on survivorship of immature and adults. If the currently managed level of productivity can be maintained, and adult survival maintained at 10%, the goal should be to achieve at least ≥ 35% of female fledglings surviving to breeding age. However, further monitoring and colour-flagging is required to determine the survival of fledglings to breeding age, the dynamics of floater populations and the long-term population trends of the population as a whole.

Management of the Australian Pied Oystercatcher in northern NSW has been guided by many of the recommendations made within this thesis in the development of a Threatened Species (Australian Pied Oystercatcher) Management Strategy, and more recently in the preliminary determination by the NSW Scientific Committee to upgrade the species from Vulnerable to Endangered. Measures for mitigating human disturbance also apply to the Sooty Oystercatcher where near-shore islands are used for nesting. However, most off-shore breeding territories are in marine parks and are less accessible to people.

Key words: shorebirds, disturbance, breeding biology, nest predation, population trends, sustainability, management.

CERTIFICATION of ORIGINALITY

I certify that the substance of this thesis has not already been submitted for any degree and is not currently being submitted for any other degree or qualification.

I certify that any help received in preparing this thesis, and all sources used, have been acknowledged in this thesis.

I certify that all text, maps, figures, tables and images included in this thesis are my original work. Guidance regarding text revision for each of the chapters of this thesis has also been provided by Professor Hugh A. Ford.

[redacted]

8th March 2009

Candidate

Date

STATEMENT of AUTHORS' CONTRIBUTION

Chapter 4 is the only chapter submitted for publication prior to submission of this thesis. The two authors include myself (the candidate), and my Principal supervisor (Professor Hugh A. Ford).

We, the PhD candidate and the candidate's Principal Supervisor, certify that all co-authors have consented to their work being included in the thesis (Chapter 4) and they have accepted the candidate's contribution as indicated in the *Statement of Originality*.

	Author's Name (please print clearly)	**% of contribution**
Candidate	Annette E. Harrison	90%
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8th March 2009

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DEFINITION of TERMS

Anthropogenic	Anthropogenic effects, processes, materials or objects derived from human activities, as opposed to those occurring in biophysical environments without human influence.
APOC	Australian Pied Oystercatcher
Austral spring/summer	Austral spring includes the period between September 1 and November 30, while summer includes the period between December 1 and February 31.
Dissipative Beach State	One of three beach state categories, dissipative beaches include those with a flat beach face compriosed of fine sand particles, fronted by nearshore sand bars and a wide surf zone. Spilling waves are dissipated as they travel through the shallow water over the bars; this surf zone may be 100 m wide.
Floaters	Generally immature and/or non-breeding, non-territorial birds that move around locally, tending to occur in small groups in a range of regular locations.
Fledgling	Oystercatcher chicks that are able to take flight (generally 5-8 weeks of age), but that generally remain with parents, rather than fledging or leaving the nest as for other species.
Immature	Non-breeding birds, generally less than four years of age.
Intermediate Beach State	One of three beach state catchegories, intermediate beaches include those with a gently sloping gradient and fine sand particles, wide beach face and large surf zone.
Pipi	Bivalve (*Donax deltoides*), also known as the Goolwa Cockle or Surf Clam, one of the best known molluscs occurin on ocean beaches of Australia.

Reflective Beach State	One of three beach state categories, reflective beaches include those with a steep and often narrow beach face comprised of coarse sediment, where small (but plunging) waves break. The zone where these high energy waves break is often < 10 m wide; waves are reflected seaward.
Vulnerable	A taxon is Vulnerable when it is neither Critically Endangered nor Endangered, but is facing a high risk of extinction in the wild in the medium-term future. Includes those are those that are likely to become endangered unless the circumstances and factors threatening their survival or evolutionary development cease to operate.

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