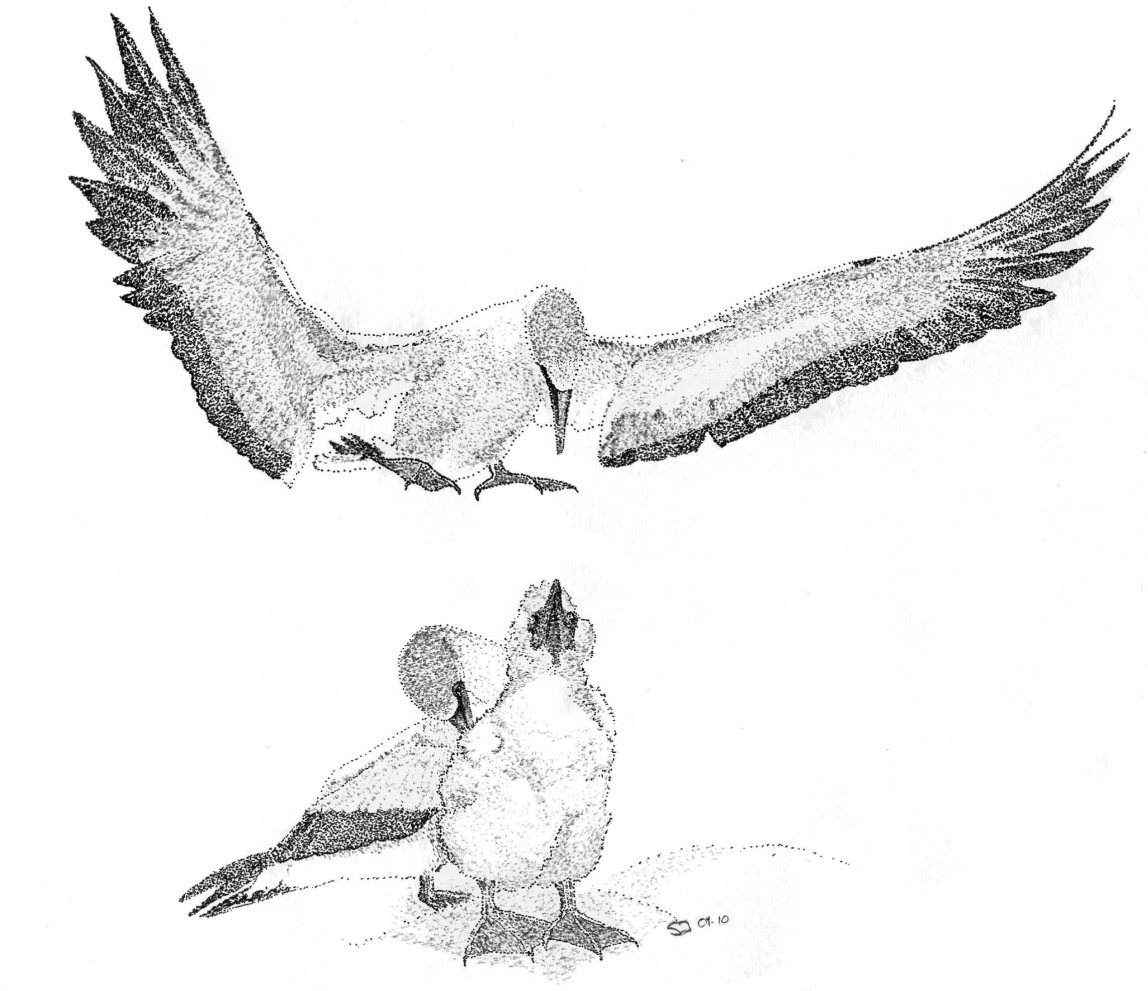
Foraging and breeding ecology of the Australasian gannet Morus serrator, with applications for rare New Zealand seabirds



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To my Mother,

and in memory of my Father

Abstract

The foraging ecology and breeding phenology in seabirds are strongly linked, as their reproductive success is critically dependent on food availability. The prey of these marine top-predators is highly patchily distributed in time and space and accordingly breeding success is extremely variable between years. The sex-specificity of breeding behaviours, parental care roles, and foraging strategies, as well as subtle forms of sexual dimorphism, yet warrant investigation particularly in many size-monomorphic taxa amongst the typically obligately biparental seabird species. I employed molecular sexing, extensive field observation, spectrophotometry, visual modeling, and stable isotope analyses, and deployed geolocation sensors, Argos satellite devices, and depth gauges to assess sex-specificity of phenotype, mate retention, parental care roles, and foraging parameters, and their implications for reproductive success in the Australasian gannet *Morus serrator* at Cape Kidnappers gannetry, Hawkes Bay. I also applied some of these methods to small breeding populations of other seabird taxa on the Kermadec Islands, capturing an example of rare natural re-colonisation of the recently predator-free Raoul by black-winged petrels *Pterodroma nigripennis* and monitoring offspring sex-ratio in these growing populations. I additionally illustratively applied the methods refined in the study of *M. serrator* to the assessment of potential sexual dimorphism in red-tailed tropicbirds *Phaethon rubricauda* and masked boobies *Sula dactylatra*, breeding on the Kermadec Islands. This thesis reports sexual dichromatism together with a high degree of size-monomorphism in the Australasian gannet, with the exception of a subtle, but significant size-dimorphism in bill size. While showing that mate retention in this species entails higher reproductive success, I report an annual divorce rate of ~40%. I show that early-season territorial establishment is male-accrued, and that early arrival to the breeding site is linked with a reproductive advantage for male, but not for female Australasian gannets. Furthermore, nest material provisioning is shown to be a male-accrued task, and to entail a thermal benefit for incubating gannets. My findings uncover that males contribute higher parental investment during incubation, while females display increased foraging effort and distinct diet targeting during these early breeding stages. I further present first tracking results depicting migration of fledgling and adult Australasian gannets to Australian waters, with a realized post-fledging flight path over Stewart Island which minimizes the distance traveled across open water, while adult migration routes appear more plastic. I detect a significant male offspring bias in black-winged petrel populations under low competitive constraint. I also describe the extent of sexual size-dimorphism in Kermadec breeding populations of the red-tailed tropicbird and the masked booby. This dissertation includes a general review of the research field with an introduction to the study species and sites, stating my specific contributions to the following data chapters. A general discussion summarizing the main findings, evaluating these in the light of sexual and natural selection on sexual dimorphism and sex-specific behaviour in sulid seabirds, and suggesting further research and implications for seabird conservation concludes the thesis.

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