

Sex Allocation and Reproductive Costs in a Gull with a Long  
Breeding Season.

This thesis is presented for the degree of  
Doctor of Philosophy at Murdoch University  
June 2004.

Submitted by

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## **DECLARATION**

I declare that this thesis is my own account of my research and contains as its main content work which has not previously been submitted for a degree at any tertiary educational institution.

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## ABSTRACT

The Silver Gull is a small gull (265 - 450g), which exhibits sexual dimorphism, with males larger than females. It has a protracted laying period of about 8 months over the winter on Penguin Island in Western Australia. The Silver Gull was studied on Penguin Island from 2000 to 2002. Completed clutches were removed from breeding pairs to induce repeat laying in order to determine the effect of increased reproductive effort on maternal body condition, egg production ability, offspring sex ratio and chick rearing capacity.

Increased egg production had no significant effect on maternal body condition as measured by condition index, derived from mass divided by a measure of skeletal size. The seasonal period, divided into thirty-day intervals, had a significant impact on female condition index, with a decline in condition toward the end of the breeding season. While male condition also appeared to decline at the end of the season, this pattern was not significant.

The initiation of laying varied between the three years of the study. The earliest occurred in 2000, which also experienced earlier rainfall than the later two years. Egg size and mass decreased throughout the breeding season although the number of eggs in a clutch did not decline. The size and mass of the eggs was significantly affected by the laying history of the parents, although this effect was dependent on the year in which the eggs were produced.

The minimum interval required by Silver Gulls to replace a lost clutch is about 14 days. This interval increased from the start of the breeding season, but then declined toward the end, as summer was approaching. Laying interval increased significantly as the

number of clutches produced by the parents also increased, up to 4 clutches in total. As more clutches were produced past this point, the laying interval became shorter.

The probability of a replacement clutch being produced after clutch removal, declined as the clutch number increased and as the season progressed. Individuals that laid clutches with a larger mean mass were more likely to lay a replacement clutch.

Increasing reproductive output caused a decline in the proportion of clutches that were replaced after clutch removal. The proportion of clutches that were replaced also varied between the years with the highest rates of replacement seen in 2000 which was also the year that experienced the earliest start in laying. The size of the original clutch in terms of its mean mass and volume was related to the size of the replacement clutch, but this relationship varied according to the timing of laying.

During 2000 and 2001 male offspring predominated in the first two clutches produced by Silver Gulls. Further clutches that were produced demonstrated a sex ratio skewed toward females, the smaller sex in this species. Offspring sex ratio was close to equality in 2002 with very little effect caused by increased egg production. There was no effect of year, season or the laying history of the parents on hatching success. Growth rate in chicks was influenced by the year in which the chick hatched, the period during the season in which the chicks hatched, its sex and the laying history of the parents. The relationship between chick growth and the laying history, however, was complex with no consistent pattern emerging in terms of the performance of chicks from each treatment group. While the chicks from control groups generally grew faster than the chicks from manipulated parents, those individuals that were laid or raised by manipulated parents that had laid at least three clutches in total also performed well.

Using the two main measures of reproductive success in the current study, egg production and chick rearing, those birds that were induced to lay multiple replacement clutches, were able to maintain a high level of condition and reproductive success. It is proposed that in the Silver Gull, only those individuals with a high level of condition continue to lay replacement clutches. If the female is unable to produce well provisioned eggs with a high chance of success, the breeding attempt is abandoned. Despite no loss of condition detected in female Silver Gulls with increasing clutch number, there was a significant shift in the offspring sex ratio toward females, indicating that strategies were in place to cope with the increased reproductive effort incurred as a consequence of repeat laying. Protracted laying in this species allows replacement of lost clutches only after maternal condition has been regained after laying.

## ACKNOWLEDGMENTS

I wish to thank my supervisors Stuart Bradley and Ron Wooller who inspired me to study Silver Gulls in the first place. Stuart managed to turn the torturous task of statistical analysis into something far more manageable and even, at times, enjoyable. I will miss the cups of tea, funny stories and giggles when we both, finally, lost the plot. Ron kept me up to date with all of the latest literature, provided many helpful hints for the fieldwork and hours of interesting evolutionary discussion. Both Stuart and Ron have been brilliant supervisors, supported me through the hard times, understood when I needed a break and have become my great friends.

The Western Australian Department of Conservation and Land Management kindly gave permission to work on Penguin Island. Thanks go to Terry Goodlich and Murray Banks, who ensured that I never had to get my feet wet on the way over to the island. Daily passage to the island was provided free of charge thanks to the owners and staff of Penguin and Seal Island Cruises.

Many thanks to all those friends and family that helped me in the field and endured the wind, rain, seagull poo and aerial attacks. Particular thanks go to Marie Mitchell who spent every available day on Penguin Island helping with the fieldwork and keeping me sane. Thanks also to my Mum who managed to put up with the seagulls, encouraged and supported me completely from the very beginning and always believed that I could do it. Thanks also to Sonia and Dad for all of their support and love, and never telling me to shut up about the seagulls. Last but definitely not least, huge thanks to Jodi Earnshaw for discovering that my thesis also cures insomnia.

This thesis is dedicated in loving memory to Marie Mitchell who gave me so much, and to Linda Cummins who taught me that life is too short and that “a bird is a bird”.

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