

**PREDATORY INTERACTIONS BETWEEN CAPE FUR SEALS
AND SEABIRDS AT ICHABOE ISLAND, NAMIBIA**

by

MICHELLE DU TOIT

Submitted in partial fulfilment of the requirements for the degree

M.Sc. (Zoology)

in the

Faculty of Natural and Agricultural Sciences

University of Pretoria

Pretoria

March 2002

**PREDATORY INTERACTIONS BETWEEN CAPE FUR SEALS
AND SEABIRDS AT ICHABOE ISLAND, NAMIBIA**

by

Michelle du Toit

Supervisors:

Prof. M.N. Bester

Mammal Research Institute

Dept. of Zoology and Entomology

University of Pretoria (UP)

Pretoria 0002

SOUTH AFRICA

Dr. J-P. Roux

Ministry of Fisheries and Marine Resources

Lüderitz Marine Research

P.O. Box 394

Lüderitz

NAMIBIA

ABSTRACT

Cape fur seals (*Arctocephalus pusillus pusillus*) prey on Cape gannets (*Morus capensis*), Cape cormorants (*Phalacrocorax capensis*), bank cormorants (*P. neglectus*), and African penguins (*Spheniscus demersus*) at Ichaboe Island (26°17'22"S, 14°56'36"E), Namibia. Opportunistic observations were conducted from September 1991 to May 2001, and focal event sampling and continuous observations between November 1999 and May 2000. Predatory events total 2 989, involving 932 gannets, 560 Cape cormorants, 142 bank cormorants and 552 penguins; high annual variation is evident. Individual seals specialising in seabird predation did not conform to this pattern of predation, differing in predation rate and bird species targeted. Seabird predation may be learnt from other seals, or forms an extension of play behaviour; subadult males are predominantly responsible. Incidental observations introduce a potential bias in spatial sampling but may reveal diurnal and environmental trends. Seasonally abundant fledgling gannets and cormorants contribute one-third of predations noted. Seals do not eat birds as an alternative food resource. The deteriorating conservation status of these seabirds is cause for concern; the predation impact of seals should be quantified, taking into account individual variability, and compared with other causes of mortality.

ACKNOWLEDGEMENTS

The Namibian Ministry of Fisheries and Marine Resources provided logistic support and granted permission for my study at Ichaboe Island. I am grateful to Hans Benecke from Atlas Organic Fertilisers, Eric Looser from Atlantech (Lüderitz) and the Department of Landscape Architecture (UP) for the loan of various equipment, and to the UP Bursary Programme, Africa Wildlife Films, Atlas Organic Fertilisers, Urban Computer Systems and Wild Dog Productions for financial support and donations. Many thanks to Pete Bartlett, Les Underhill, Chérie du Toit, Greg Hofmeyr, Mike Meyer and Silvia Kirkman, who shared discussions and contributed constructive comments on earlier versions of this manuscript. I am indebted particularly to Les Underhill for discussions and help with the statistical analyses. To Pete Bartlett, for introducing me to planet Ichaboe and to all the other (furred and feathered) “Ichaboens”, and helped me become an “Ichaboen” myself: a tribute to his years of fieldwork, a fraction of which is condensed in this manuscript. For his help, encouragement and (infinite) patience... this would not have been possible without his dedication. Special thanks are owing to my parents and siblings, for their love, encouragement and humour, and for tolerating a newly-fledged islander in their midst. I am honoured to have been guided in my research by Marthán Bester and Jean-Paul Roux, whom I thank for their advice and assistance, and for entrusting this project to me. Finally, I dedicate this thesis to my fellow “Ichaboens”, with whom I shared the peace and perils of an offshore paradise.

TABLE OF CONTENTS

ABSTRACT	i
ACKNOWLEDGEMENTS	ii
TABLE OF CONTENTS	iii
LIST OF TABLES	viii
LIST OF FIGURES	vi
CHAPTER 1. INTRODUCTION	1
STUDY AREA	1
<i>Namibian islands</i>	1
<i>Ichaboe Island</i>	1
<i>Seabird breeding populations</i>	4
- <i>Cape cormorants</i>	6
- <i>Cape gannets</i>	7
- <i>African penguins</i>	8
- <i>Bank cormorants</i>	9
- <i>Kelp gulls</i>	10
<i>Cape fur seals</i>	10
SEABIRD POPULATION DECLINES: HISTORICAL FACTORS	12
<i>Guano collection</i>	12
<i>Exploitation of birds</i>	14
<i>Marine pollution and overfishing</i>	14
SEAL-SEABIRD PREDATION	15

RATIONALE FOR STUDY.....	16
<i>Key questions</i>	16
<i>Null hypotheses</i>	17
CHAPTER 2. SEAL-SEABIRD PREDATORY BEHAVIOUR	18
INTRODUCTION.....	18
<i>Seal-seabird predation</i>	18
<i>Predation at Ichaboe Island</i>	19
METHODS.....	19
<i>Observations</i>	19
<i>Data analysis</i>	23
RESULTS	23
<i>Bird species preyed upon</i>	23
<i>Predation cues</i>	24
<i>Predation behaviour</i>	27
<i>Seal specialisation</i>	29
<i>Predation rate and duration</i>	33
<i>Injured and preyed upon birds</i>	34
DISCUSSION.....	37
<i>Seabird predation by seals</i>	37
<i>Predation cues</i>	37
<i>Behaviour</i>	39
<i>Time between predations</i>	44
<i>Age and sex of seal</i>	45
<i>Seal specialisation</i>	46
<i>Gannet clouds</i>	48

<i>Injured birds</i>	49
CHAPTER 3: EVALUATION OF METHODS	52
INTRODUCTION.....	52
<i>Incidental sampling</i>	52
<i>Scan sampling</i>	53
<i>Continuous observations</i>	54
METHODS.....	54
<i>Historical incidentals</i>	54
<i>Scan sampling</i>	55
<i>Continuous observations and project incidentals</i>	56
<i>Proportion of predations represented in incidental records</i>	57
<i>Statistical analysis</i>	58
RESULTS	59
<i>Predations noted per method</i>	59
<i>Predation cues</i>	59
<i>Diurnal differences</i>	60
<i>Environmental conditions</i>	61
<i>Spatial differences</i>	61
<i>Proportion of predations represented in incidental records</i>	67
DISCUSSION.....	68
<i>Bird species preyed upon</i>	68
<i>Continuous observations versus focal event sampling</i>	68
<i>Predation cues</i>	69
<i>Diurnal differences</i>	70
<i>Environmental differences</i>	71

<i>Spatial differences</i>	72
<i>Evaluation of incidental observations</i>	74
CHAPTER 4: ENVIRONMENTAL, SPATIAL AND TEMPORAL VARIATION	76
INTRODUCTION.....	76
METHODS.....	77
<i>Database</i>	77
<i>Selection of records</i>	78
<i>Statistical analyses</i>	78
<i>Assumptions</i>	79
RESULTS	79
<i>Temporal factors</i>	80
- <i>Annual</i>	80
- <i>Seasonal</i>	81
- <i>Diurnal</i>	83
<i>Environmental factors</i>	85
- <i>Beaufort Scale</i>	85
- <i>Sea Surface Temperature</i>	87
<i>Spatial factors</i>	89
DISCUSSION.....	91
<i>Bird species preyed upon</i>	91
<i>Annual trends in predation</i>	91
<i>Seasonal trends</i>	93
<i>Diurnal trends</i>	93
<i>Beaufort Scale</i>	94
<i>Sea surface temperature</i>	95

<i>Distance</i>	96
CHAPTER 5: IMPACT OF SEAL-SEABIRD PREDATION	98
INTRODUCTION.....	98
METHODS.....	99
<i>Calculation of predation impact per species</i>	99
<i>Other causes of mortality – soaked gannets</i>	100
RESULTS	102
<i>Aerial census counts</i>	102
<i>Impact of predation</i>	102
<i>Soaked birds</i>	103
DISCUSSION.....	104
<i>Bias in results</i>	104
<i>Impact of seal-seabird predation</i>	105
<i>Kelp gull predation</i>	106
<i>Soaked gannets</i>	107
<i>Human-induced mortality</i>	108
SUMMARY.....	109
<i>Seal-seabird predatory behaviour</i>	109
<i>Evaluation of methods</i>	110
<i>Environmental, spatial and temporal variation</i>	111
<i>Impact of seal-seabird predation</i>	112
REFERENCES.....	113

LIST OF TABLES

Table 1.1.	Peak active nest counts of seabirds at Ichaboe Island during the 1999-2000 breeding season (MFMR unpublished data).....	4
Table 1.2.	Demographic and biological details of the seabird species breeding on Ichaboe Island, Namibia.....	5
Table 2.1.	Numbers of different bird species killed by seals of different size categories (age categories are in brackets).....	28
Table 2.2.	Seals shot and recovered while preying on birds at Ichaboe Island.	32
Table 2.3.	Differences between predation rate and duration per prey species. P-values are the results of Kruskal-Wallis ANOVAs. SD = one standard deviation; <i>n</i> = sample size.....	33
Table 3.1.	Numbers (with percentage of total in parentheses) of different bird species preyed upon by seals at Ichaboe Island, as recorded using different methods of observation (see text for details).....	59
Table 3.2.	The number of seal-seabird predations noted (N) and missed (M) during incidental observations between November 1999 and May	

2000 at Ichaboe Island, and the calculated values for PI. Pr – total number of predations noted during this period.....67

Table 3.3. Calculation of the adjusted values of predation for the ten-year period under discussion. TI – sum of all incidental observations excluding project records; PI – proportion of predations represented in incidental records; Pr – project records of predation..... 67

Table 4.1. Number of adult and juvenile birds of each species preyed upon by seals between 21 September 1991 and 17 May 2001 at Ichaboe Island ($n = 2\ 876$). % - percentage of n80

Table 4.2. Relationships between the annual average SST anomaly and the number of predations per year. Contingency tables: **A** – using high-low categories, **B** – using change. Probabilities are based on Fisher’s exact test (two-tailed).....89

LIST OF FIGURES

- Figure 1.1.** Map of Ichaboe Island (6.5 ha), showing position of settlement and observation hut (in red). The shaded area indicates the “summit shadow”, which is the area (17°) of sea not visible from the observation hut.....3
- Figure 1.2.** Aerial photograph of Ichaboe Island, showing the proximity of the island to the mainland (*c.* 1.4 km) and the position of the seal colony at Little Ichaboe (red circle), which lies 200 m south-west of the island. The picture is orientated with north to the left..... 11
- Figure 2.1.** Number of predations per bird species associated with different predation cues.....24
- Figure 2.2.** An example of a gannet cloud. These birds are not involved in fishing activity but are investigating seal-seabird predatory activity.....25
- Figure 2.3.** Percentage of predations associated with a gannet cloud at different wind speeds (as measured by the Beaufort Scale).....25
- Figure 2.4.** Bird carcasses “degloved” by seals: **a** - adult Cape gannets; **b** - adult African penguin; **c** - adult Cape cormorants. The skin has been torn loose and is flung over the head or legs during the seals’

	thrashing actions, exposing the breast muscles and viscera. This is typical of seal predation.....	27
Figure 2.5.	Ragged Flipper, a subadult male seal, specialised in taking African penguins and could be identified by the ragged tipped left flipper (a). Its right flipper (b) was normal.....	30
Figure 2.6.	Photograph of the carcass of a bank cormorant fledgling, showing the extent to which the breast muscles and viscera were removed by the seal.....	34
Figure 2.7.	Bank cormorant fledgling killed by a seal – note the canine imprint in the breast muscle; this bird was not fed upon.....	35
Figure 2.8.	Cormorant breast muscle sliced by seal during predation.....	35
Figure 2.9.	Carcass of gannet fledgling showing breast muscles and viscera removed by seal.....	35
Figure 2.10.	Two penguins killed by the same seal in close succession.....	35
Figure 2.11.	Adult penguin with suspected seal-inflicted injuries. The skin and muscles on the neck are ripped through with additional puncture holes in the neck and feet.....	36

Figure 2.12.	Adult penguins with suspected seal-inflicted injuries: a – old, well-healed scar; b – fresh injury.....	36
Figure 3.1.	The number of predations (as a percentage of the total) associated with specific cues as noted during different methods of observation. Observation methods: H – historical incidentals; I – project incidentals; S – focal event sampling; C – continuous observations.....	60
Figure 3.2.	Percentage distributions of the number of birds preyed upon by seals throughout the day, as noted during different methods of observation. Bird species: a – cormorants; b – gannets; c – penguins. Observation methods: H – historical incidentals; I – project incidentals; S – focal event sampling; C – continuous observations.....	63
Figure 3.3.	Percentage distributions of the number of birds preyed upon by seals during different environmental conditions, as noted during each method of observation. Bird species: a – cormorants; b – gannets; c – penguins. Observation methods: H – historical incidentals; I – project incidentals; S – focal event sampling; C – continuous observations.	64
Figure 3.4.	Percentage distributions of the number of birds preyed upon by seals at different distances from the island, as noted during each method of observation. Bird species: a – cormorants; b – gannets;	

c – penguins. Observation methods: **H** – historical incidentals; **I** – project incidentals; **S** – focal event sampling; **C** – continuous observations.....65

Figure 3.5. Plots of the spatial distribution of the number of predations noted, as a percentage of the total, by each observational method. The dark centre circle in each graph represents the island; the concentric rings represent distances at 200m intervals from the island. Observation methods: **H** – historical incidentals; **I** – project incidentals; **S** – focal event sampling; **C** – continuous observations.....66

Figure 4.1. Frequency distribution of the number of birds preyed upon by seals at Ichaboe Island per year, where year ‘1’ runs from 1 July 1991 to 30 June 1992, year ‘2’ from 1 July 1992 to 30 June 1993, and so forth..... 81

Figure 4.2. Number of adult and juvenile birds preyed upon by seals in each season over ten years (see text for details). Bird species predated: **a** – gannets; **b** – penguins; **c** – Cape cormorants; **d** – Bank cormorants.82

Figure 4.3. Percentage distributions of the number of adult and juvenile birds preyed upon by seals throughout the day. Bird species: **a** – gannets; **b** – penguins; **c** – Cape cormorants; **d** – bank cormorants..... 84

- Figure 4.4.** Comparison between overall Beaufort Scale and Beaufort Scale associated with predations by seals involving penguins, gannets and cormorants.....85
- Figure 4.5.** Percentage distributions of the number of adult and juvenile birds preyed upon by seals at different wind speeds, as measured by the Beaufort Scale. Bird species: **a** – gannets; **b** – penguins; **c** – Cape cormorants; **d** – bank cormorants.86
- Figure 4.6.** The relationship between the annual average sea surface temperature (SST) anomalies and the number of seal-seabird predations noted per year. **a** – linear relationship; **b** – plot per annum. 88
- Figure 4.7.** Percentage distributions of the number of adult and juvenile birds preyed upon by seals at different distances from the island. Bird species: **a** – gannets; **b** – penguins; **c** – Cape cormorants; **d** – bank cormorants.90
- Figure 5.1.** Soaked, or waterlogged gannets. **a** – note the scruffy appearance and yellow discolouring of the feathers; **b** – the left-hand-side of this bird was contaminated and it died of poor condition; **c** – the neck of a gannet fledgling showing a severe case of soaking, where the feathers are sticky and do not interlock and the down has a deep

yellow discolouring; **d** – this bird is soaked through but not
discoloured.....101