

Copyright is owned by the Author of the thesis. Permission is given for a copy to be downloaded by an individual for the purpose of research and private study only. The thesis may not be reproduced elsewhere without the permission of the Author.

THE BEHAVIOUR AND ECOLOGY
OF SHORT-BEAKED COMMON DOLPHINS
(*Delphinus delphis*) ALONG THE EAST COAST
OF COROMANDEL PENINSULA,
NORTH ISLAND, NEW ZEALAND

- with a note on their interactions with humans

A dissertation presented in partial fulfillment

of the requirements for the degree of

Doctor of Philosophy

in Marine Science

at Massey University

by

Dirk R. Neumann

November 2001

This dissertation is my own composition.
All sources have been acknowledged.
No part of this work has been submitted
for another degree at Massey, or any other University.

Dirk R. Neumann

November 2001

ACKNOWLEDGEMENTS

Firstly, my deepest thanks to my chief supervisor, Senior Lecturer Dr. Mark Orams (Massey University), for his help, expertise, patience, and encouragement throughout my Ph.D. candidacy. The way in which he and his family made me feel at home in New Zealand went far above and beyond what I could have wished for. My heartfelt thanks therefore also extend to Renée, Daniel, and Brianna Orams. Thank you to my second supervisor, Dr. Liz Slooten (University of Otago) for her advice on the research project, and this thesis. Several people at Massey University deserve my thanks, especially Associate Professor John Monin, Mary Miller, Lynne Tunna, and Dr. Denny Meyer.

I am indebted to my volunteer research assistants who were (in chronological order) : Trine Baier Jepsen, Colleen Clancy, Paul Grant, Sandra Winterbacher, Jo Moore, Jodie Holloway, Birgit Klumpp, Christiane Knappmeyer, Tina Jacoby, Nikki Guttridge, Lindsey Turner, Karen Stockin, Chris Smith Vangsgaard, Aline Schaffar, Daphne Bühler, Patrice Irvine, Stefanie Werner, Fabiana Mourao, Deanna Hill, Miriam Brandt, and Johanna Hiscock.

I am grateful to Scott Baker (University of Auckland), Rochelle Constantine (University of Auckland), Kirsty Russell (University of Auckland), Mike Donoghue (Department of Conservation), Michael Uddstrom (National Institute for Water and Atmospheric Research), Ingrid Visser, Alexandra Leitenberger, Susana Caballero, Deborah Kyngdon, Sue Halliwell, Adrienne Joyce, and Vicky Powell for their help and input. A special thanks to Brett Orams for creating the fabulous diagrams illustrating dolphin behaviour. The Massey University Animal Ethics Committee was kind enough to grant permission for the genetic sampling conducted as part of this research.

Vital support for this project came from dolphin-tour operators Rod & Elizabeth Rae (Mercury Bay Seafaris, Whitianga), John Wharehoka & Karen Waite (Dolphins down under, Whakatane), Graeme Butler (Gemini Galaxseas, Tauranga), and the late Stephen Stembridge (Dolphin Explorer, Auckland).

This 3-yr research project was funded by : Massey University (MU) Doctoral Scholarship, MU College of Business research grant, MU Research Equipment Fund, MU research fund, Graduate Research

Fund (MU Department of Management and International Business), WADAP (Whale and Dolphin Adoption Project), and the Department of Conservation Science Investigation Programme. Additional financial support was provided by Konrad Kohlhammer. The support of my friends and family in Germany has also been invaluable and is greatly appreciated. I thank all of you for keeping your fingers crossed, and believing in me. Finally, let us not forget, that none of this would have been possible without the cooperation of the common dolphins, who were kind enough to allow me a glimpse into their daily lives. Thank you !

PUBLICATIONS

The following have been produced during the Ph.D. candidature, as a result of the research presented in this dissertation :

Publications in peer-reviewed journals

Neumann, D.R. (2001). Seasonal movements of short-beaked common dolphins (*Delphinus delphis*) in the northwestern Bay of Plenty, New Zealand: The influence of sea-surface temperature and “El Niño/La Niña”. *New Zealand Journal of Marine and Freshwater Research*, 35:, 371-374.

Neumann, D.R. (2001). The activity budget of free-ranging common dolphins (*Delphinus delphis*) in the northwestern Bay of Plenty, New Zealand. *Aquatic Mammals*, 27 (2): 121-136.

Neumann, D.R. & M.B. Orams. (2001). Feeding strategies of short-beaked common dolphins (*Delphinus delphis*), in the northwestern Bay of Plenty, New Zealand. *Marine Mammal Science*, under review.

Neumann, D.R., A. Leitenberger & M.B. Orams. (2001). Long-term tracking of common dolphins in New Zealand - a photo-catalogue of easily recognizable individuals. *New Zealand Journal of Marine and Freshwater Research*, under review.

Neumann, D.R., K. Russel, M.B. Orams, C.S. Baker & P. Duignan. (2001). The common dolphin's codpiece : A new tool for sexing *Delphinus delphis* at sea. *Aquatic Mammals*, submitted.

Other publications

January 1999-July 2001. Quarterly updates on common dolphin research in the Whale and Dolphin Adoption Project Newsletter, by D. Neumann.

April 1999. Massey University magazine, pp. 21-22 : "A passion for dolphins", by L. Granville. Article about the common dolphin research project.

March 2000. Spirits of the sea magazine, p. 3 : “Dolphins under human threat”, by D. Neumann.

April 2000. New Zealand Fishing News, p. 30 : “Dolphin article irresponsible”. Letter to the editor by D. Neumann.

March 2001. Marine mammals of the Bay of Plenty, by J. Berghan, edited by R. Constantine, pp. 11-16 : “Common dolphins”, by D. Neumann.

Presentations at professional meetings

Neumann, D.R. 1999. Seasonal movements of short-beaked common dolphins (*Delphinus delphis*) in the northwestern Bay of Plenty, New Zealand: The influence of sea-surface temperature and “El Niño/La Niña”. *13th Biennial conference on the biology of marine mammals, Wailea, Maui, Hawaii, USA, 28 November - 3 December, 1999.*

Neumann, D.R. and M.B. Orams. 2001. The effects of tourism on common dolphins (*Delphinus delphis*) in the northwestern Bay of Plenty, New Zealand. *Southern Hemisphere Marine Mammal Conference, Philip Island, Victoria, Australia, 28 May - 1 June, 2001.*

Neumann, D.R. 2001. Activity budget and feeding strategies of short-beaked common dolphins (*Delphinus delphis*) in New Zealand. *14th Biennial conference on the biology of marine mammals, Vancouver, Canada, 27 November - 3 December, 2001.*

Public presentations and media appearances

10.3.2000. Public seminar, Mercury Bay area school, Whitianga, hosted by Forest and Bird Society. 60-min presentation on the biology of common dolphins.

14.3.2000 - TV3 News (6 p.m.) - "Love hurts", 3-min interview with Darren McDonald on the dangers dolphins face today.

14.3.2001 - Seaweek seminar, Auckland Museum, hosted by the Whale and Dolphin Adoption Project. 30-min presentation on common dolphins and swim-with-dolphin tourism. Hon. Sandra Lee, Minister of Conservation in attendance.

18.3.2001 - Radio New Zealand, Spectrum programme 1144, "Dirk and the dolphins". 20-min interview with David Steemson on dolphin biology and conservation.

18.4.2001 - Radio New Zealand, Kim Hill programme. 15-min live interview on dolphin biology and conservation.

21.4.2001 - Public seminar, Whakatane, hosted by Dept. of Conservation. 60-min presentation on common dolphins and swim-with-dolphin tourism.

4.7.2001 - Auckland Science Fair, Massey University, Albany. Two 45-min presentations on the biology of common dolphins and the logistics of field research.

ABSTRACT

This thesis provides new insights into the behavioural ecology of free-ranging short-beaked common dolphins (*Delphinus delphis*), in New Zealand. A preliminary assessment of common dolphin-human interactions was also carried out as part of this 3-yr field study (1998-2001). 166 surveys were conducted in the greater Mercury Bay area, on the east coast of Coromandel Peninsula, North Island, New Zealand. These led to 105 focal group follows, with a total of 118.2 h spent following common dolphins. Seasonal movements of common dolphins were uncovered, and are apparently tied to fluctuations in sea surface temperature.

Common dolphins appear to live in a fission-fusion society. Groups frequently merged and split again. The merging of groups was often accompanied by either sexual, or feeding activity. 408 individual dolphins were identified from photographs of their dorsal fins. No evidence of long-term associations between individuals was found. Resightings of identifiable dolphins indicate movement of individuals between Mercury Bay and the Hauraki Gulf, as well as between Mercury Bay and Whakatane.

This study provides the first activity budget for common dolphins in the wild. Common dolphins spent 55.6% of their time traveling, 20.4% milling, 16.2% feeding, 7.1% socialising, and 0.7% resting. This proportion did not change significantly by season, or from year to year. Common dolphins were found to feed on at least six different fish species. A number of different feeding strategies were employed to capture these fish. Some of these techniques had previously been observed in bottlenose dolphins and orca, but have never before been described for common dolphins.

The results of this study suggest that common dolphins can potentially be negatively affected by interactions with humans. Boat traffic appears to disturb some dolphin groups, especially those containing few individuals. However, commercial tourism appeared to have little impact on the dolphins, at this study site. Few attempts at swimming with common dolphins resulted in a sustained interaction, but unsuccessful attempts did not elicit an obvious negative response. Fishing poses the greatest threat of physical injury and possible mortality to common dolphins. Several key issues were identified, and their value in managing human-dolphin interactions is discussed.

CONTENTS

Acknowledgements	iii
Publications	vi
Abstract	xi
Contents	xiii
List of Figures	xvi
List of Tables	xviii
List of Plates	xix
Chapter 1: Introduction	1
Chapter 2: Common dolphins - a review of current knowledge	9
Chapter 2.1 Introduction	9
Chapter 2.2 Common dolphin ecology	10
Chapter 2.3 Common dolphin behaviour	16
Chapter 2.4 Common dolphins and their interactions with humans	21
Chapter 2.5 Summary and hypotheses	33
Chapter 3: Methods	41
Chapter 3.1 Introduction	41
Chapter 3.2 Pilot work	42
Chapter 3.3 Observation platform	43

Chapter 3.4 Study area	47
Chapter 3.5 Volunteer research assistants	48
Chapter 3.6 Surveys	50
Chapter 3.7 Definition of group	53
Chapter 3.8 Number of animals in the group	55
Chapter 3.9 Environmental variables	57
Chapter 3.10 Photo-identification	59
Chapter 3.11 DNA-sampling	69
Chapter 3.12 Sampling the behaviour of cetaceans	70
Chapter 3.13 Vessel impact	84
Chapter 3.14 Statistical analysis	86
Chapter 3.15 Summary	87
Chapter 4: Common dolphin ecology	88
Chapter 4.1 Introduction	88
Chapter 4.2 Results	89
Chapter 4.3 Discussion	128
Chapter 4.4 Summary	154
Chapter 5: Common dolphin behaviour	155
Chapter 5.1 Introduction	155
Chapter 5.2 Results	156
Chapter 5.3 Discussion	197

Chapter 5.4 Summary	222
Chapter 6: Common dolphins and their interactions	
with humans	224
Chapter 6.1 Introduction	224
Chapter 6.2 Results	225
Chapter 6.3 Discussion	254
Chapter 6.4 Summary	274
Chapter 7: Conclusions	276
Chapter 7.1 Summary	276
Chapter 7.2 Future research	283
Chapter 7.3 Management recommendations	294
Personal communications	297
References	299
Appendix 1	
Appendix 2	
Appendix 3	

LIST OF FIGURES

Figure 1. Map of northeastern New Zealand	48
Figure 2. Map of the Mercury Bay study area	52
Figure 3. Average group size over months	90
Figure 4. Average number of calves over months	92
Figure 5. Average number of newborns over months	93
Figure 6. Sighting success over months	94
Figure 7. Sighting success over the time of day	96
Figure 8. Sighting success and the timing of low tide	97
Figure 9. Locations of dolphin sightings	99
Figure 10. Mean distance from shore for dolphin sightings	100
Figure 11. Satellite image illustrating sea surface temperature	102
Figure 12. Distance from shore in La Niña years	104
Figure 13. Distance from shore and variations in SST	105
Figure 14. The rate of identifying new dolphin individuals	107
Figure 15. Cumulative number of identifications over time	108
Figure 16. Fission and fusion of groups	110
Figure 17. Intervals between resightings of individuals	113
Figure 18. Activity budget of common dolphins	157
Figure 19. Seasonal variations in the activity budget	158

Figure 20. Activity budget and group size	163
Figure 21. Behavioural event sequences for 'leap'	169
Figure 22. Behavioural event sequences for 'breach'	170
Figure 23. Behavioural event sequences for 'sex'	171
Figure 24. Behavioural event sequences for 'chuff'	172
Figure 25. Behavioural event sequences for 'tailslap'	173
Figure 26. High-speed pursuit of prey	181
Figure 27. Fish-whacking	183
Figure 28. Kerplunking	187
Figure 29. Line-abreast formation	190
Figure 30. Wall formation	193
Figure 31. Carouseling	194
Figure 32. Group size and boat avoidance	229
Figure 33. Activity budgets in the presence of tour boats	231
Figure 34. Recommended style of approaching dolphins	245
Figure 35. In-path placement of swimmers	261
Figure 36. Around-boat placement of swimmers	262

LIST OF TABLES

Table 1. Reference listings for various delphinids	3
Table 2. Correlations between offshore movements and season	101
Table 3. Resightings of identifiable individuals	114
Table 4. Genetic sexing of individuals	122
Table 5. Time spent in five activity states	160
Table 6. ANOVA testing variations in activity budget	162
Table 7. Frequencies of behavioural events	165
Table 8. Behavioural event sequence matrix	168
Table 9. Species associated with common dolphins	178
Table 10. Frequencies of various feeding strategies	180
Table 11. Changes in activity in response to boat approaches	227
Table 12. Success rate of swim attempts (Whitianga)	234
Table 13. Group size vs. swim success (Whitianga)	235
Table 14. Swim attempts leading to interactions (Whitianga)	236
Table 15. Behaviour of swimmers vs. swim success (Whitianga)	237
Table 16. Success rate of swim attempts (Whakatane)	240
Table 17. Group size vs. swim success (Whakatane)	241
Table 18. Swim attempts leading to interactions (Whakatane)	242
Table 19. Behaviour of swimmers vs. swim success (Whakatane)	243
Table 20. Visitor numbers in Whitianga	285

LIST OF PLATES

Plate 1. Common dolphins	2
Plate 2. 'Seafari II' - dolphin-tour boat	31
Plate 3. 'Aihe' - dolphin-research vessel	45
Plate 4. Common dolphin calf featuring fetal folds	58
Plate 5. Common dolphin dorsal fins - variety in fin colouration	61
Plate 6. Dorsal fin colour pattern slightly differs from side to side	62
Plate 7. An anomalously pigmented common dolphin	63
Plate 8. V-shaped cut on a dolphin's peduncle	66
Plate 9. Digital still images captured from video	67
Plate 10. Degrees of distinctiveness among dorsal fins	68
Plate 11. Sex	79
Plate 12. Chest-slap	82
Plate 13. Playing with seaweed	83
Plate 14. Common dolphins with and without postanal humps	120
Plate 15. DNA-banding patterns of common dolphins	121
Plate 16. Postanal hump of a mature male common dolphin	125
Plate 17. Jack mackerel	175
Plate 18. Australasian gannet	176
Plate 19. Common dolphin entangled in fishing line	252