Cetacean research in New Zealand 2007/08

Simon Childerhouse (Comp.)

DOC RESEARCH & DEVELOPMENT SERIES 324

Published by
Publishing Team
Department of Conservation
PO Box 10420, The Terrace
Wellington 6143, New Zealand

DOC Research & Development Series is a published record of scientific research carried out, or advice given, by Department of Conservation staff or external contractors funded by DOC. It comprises reports and short communications that are peer-reviewed.
This report is available from the departmental website in pdf form. Titles are listed in our catalogue on the website, refer www.doc.govt.nz under Publications, then Science & technical.

ISSN 1177–9306 (web PDF)
ISBN 978–0–478–14849–7 (web PDF)

This report was prepared for publication by the Publishing Team; editing and layout by Lynette Clelland. Publication was approved by the General Manager, Research and Development Group, Department of Conservation, Wellington, New Zealand.

In the interest of forest conservation, we support paperless electronic publishing.

CONTENTS

Cetacean research in New Zealand 2007/08

Simon Childerhouse (Comp.)

Marine Conservation Team, Department of Conservation, PO Box 10420, Wellington 6143, New Zealand

Present address: Australian Antarctic Division, Kingston, Tasmania 7050, Australia. Email: simon.childerhouse@aad.gov.au

A B S T R A C T

This report summarises cetacean (i.e. whale and dolphin) research undertaken in New Zealand over the period from April 2007 to March 2008, with statistical information for the 2007 calendar year. It covers research undertaken by a wide range of researchers including government, university, and non-governmental agencies and individuals. Information presented includes details of species studied, strandings, summaries of collections and catalogues, research projects undertaken, samples collected, and publications resulting from research. Data are included from 26 species, from 15 different institutions and agencies and over 40 researchers. Although this is a comprehensive collection of research for 2007/08, it does not include all cetacean research carried out in New Zealand over the period, as some researchers did not provide a report of their work to the New Zealand Department of Conservation. This report provides a published record of the New Zealand National Progress Report on Cetacean Research for 2007/08, which was presented to the Scientific Committee of the International Whaling Commission.

Keywords: cetacean, research, marine mammal, International Whaling Commission

Childerhouse, S. (Comp.) 2010: Cetacean research in New Zealand 2007/08. *DOC Research & Development Series 324*. Department of Conservation, Wellington. 33 p.

1. Introduction

This report follows on from previous reports that have summarised cetacean research in New Zealand over the period 1997–2005 (Childerhouse 2002, 2004, 2005, 2006, 2010a, b). It provides updated information about cetacean research in New Zealand from April 2007 to March 2008. For a full description of the format and explanation of the sections in the report, please refer to Childerhouse & Donoghue (2002). This, and previous reports, are published records of the New Zealand National Progress Report on Cetacean Research, which is presented annually to the Scientific Committee of the International Whaling Commission (IWC).

The IWC is the international agency responsible for the 'conservation of whale stocks and the orderly development of the whaling industry' and has 88 member nations including New Zealand. New Zealand has been a member of the IWC since 1948 (Freidheim 2001). One of the obligations of member nations is the provision annually to the IWC of a National Progress Report on Cetacean Research. This report includes details such as the number and location of cetaceans taken commercially or incidentally in fishing operations, numbers of stranded cetaceans, and status of ongoing research projects. One of the original aims of these reports was to provide data on the commercial catch of large whales to facilitate the management of whaling. However, over time, National Progress Reports have been modified to include the reporting of additional information such as levels of bycatch and other data on dolphins. Prior to 1997, National Progress Reports were published in their entirety in IWC volumes but since then only a small summary of the full report has been published.

The National Progress Reports have been compiled annually by the New Zealand Department of Conservation (DOC) based on reports from researchers. Although a considerable amount of effort has been made to contact all researchers who have undertaken cetacean research in New Zealand, and encourage them to provide details of their research, this has not always been completely successful. As such, the report presented in this document covers most of the work undertaken in New Zealand in 2007/08; but some research, which has not been reported to the Government, does not appear. However, overall, only a small proportion of the active cetacean research in New Zealand has not been included in this document.

The aim of compiling and publishing these reports is to make the information accessible and useful as a tool in the management and protection of cetaceans in New Zealand. These reports are a useful resource for summarising New Zealand-based research projects and for identifying researchers who are working on species or projects. Obviously, research is ongoing and these reports will continue to be published in the future.

This report summarises information obtained from a number of organisations. Details of these organisations, and their contact email addresses, are provided in Table 1.

TABLE 1. DETAILS OF ORGANISATIONS INVOLVED IN CETACEAN RESEARCH IN NEW ZEALAND IN 2007/08.

NAME OF AGENCY/INSTITUTE	ABBREVIATION	CONTACT EMAIL ADDRESS
Auckland University of Technology	AUT	emma.beatson@aut.ac.nz
Australian Antarctic Division	AAD	Glenn.Dunshea@aad.gov.au
Bay of Plenty Polytechnic	BOP	caroline.schweder@boppoly.ac.nz
Department of Conservation	DOC	lchilvers@doc.govt.nz
Dolphin Watch Ecotours	DWE	info@naturetours.co.nz
DuFresne Ecology Ltd	DEL	sam@dufresne.co.nz
Encounter Kaikoura	EK	info@dolphin.co.nz
Massey University—Albany	MU-A	K.A.Stockin@massey.ac.nz
Massey University—Palmerston North	MU-P	W.D.Roe@massey.ac.nz
Museum of New Zealand/Te Papa Tongarewa	TP	AntonVH@tepapa.govt.nz
National Institute of Water and Atmospheric Research	NIWA	s.hanchet@niwa.co.nz
South Pacific Whale Research Consortium	SPWRC	nan@whaleresearch.org
Texas A&M University	TAMU	wuersig@sbcglobal.net
University of Auckland	UA	r.constantine@auckland.ac.nz
University of Queensland	UQ	ellen.garland@uq.edn.au
University of Otago	OU	liz.slooten@stonebow.otago.ac.nz

2. Species and stocks studied

The cetacean species and stocks studied in New Zealand in 2007/08 are listed in Table 2.

TABLE 2. CETACEAN SPECIES AND STOCKS STUDIED IN NEW ZEALAND IN 2007/08.

IWC COMMON NAME	IWC RECOMMENDED SCIENTIFIC NAME	AREA/STOCK(S)	RELEVANT SECTIONS IN TEXT
Andrew's beaked whale	*Mesoplodon bowdoini*	NZ	5.3, 5.4, 9
Blue whale	*Balaenoptera musculus*	NZ	3.1.1, 3.1.2, 4.1.1, 7.1
Bottlenose dolphin	*Tursiops truncatus*	NZ	3.1.1, 3.1.2, 4.1.1, 5.3, 5.4, 9, 10
Bryde's whale	*Balaenoptera edeni*	NZ	3.1.1, 3.1.2, 4.1.1, 5.3, 5.4, 7.1, 9, 10
Common dolphin	*Delphinus delphis*	NZ	3.1.1, 3.1.2, 4.1.1, 5.3, 5.4, 6, 8.3.2, 9, 10
Common minke whale	*Balaenoptera acutorostra*	NZ	9
Cuvier's beaked whale	*Ziphius cavirostris*	NZ	5.3, 9
Dusky dolphin	*Lagenorhynchus obscurus*	NZ	3.1.1, 3.1.2, 3.2, 4.1.1, 4.2, 5.3, 6, 9
Dwarf sperm whale	*Kogia sima*	NZ	3.1.1
Gray's beaked whale	*Mesoplodon grayi*	NZ	5.3, 9
Hector's dolphin	*Cephalorynchus hectori hectori*	NZ	3.1.1, 3.1.2, 4.1.1, 5.3, 5.4, 6, 8.3.2, 8, 9
Humpback whale	*Megaptera novaeangliae*	NZ, Tonga	3.1.1, 3.1.2, 4.1.1, 5.1, 5.3, 5.4, 9
Killer whale	*Orcinus orca*	NZ	3.1.2, 5.3, 9
Long-finned pilot whale	*Globicephala melas*	NZ	4.1.1, 5.3, 5.4, 9
Maui's dolphin	*Cephalorynchus hectori maui*	NZ	3.1.1, 5.3, 5.4, 10
Pan-tropical spotted dolphin	*Stenella attenuata*	South Pacific	3.1.1
Pygmy right whale	*Caperea marginata*	NZ	5.3, 9
Pygmy sperm whale	*Kogia breviceps*	NZ	5.3, 9
Rough toothed dolphin	*Steno bredanensis*	South Pacific	3.1.1, 5.4
Sei whale	*Balaenoptera borealis*	NZ	7.1
Short-finned pilot whale	*Globicephala macrorhynchus*	NZ	3.1.1, 4.1.1, 5.4
Southern right whale	*Eubalaena australis*	NZ	5.1, 10
Southern right whale dolphin	*Lissodelphis peronii*	NZ	5.3, 9
Spectacled porpoise	*Australophocaena dioptrica*	NZ	5.3, 9
Sperm whale	*Physeter macrocephalus*	NZ	3.1.1, 4.1.1, 5.3, 9, 10
Spinner dolphin	*Stenella longirostris*	South Pacific	3.1.1, 5.4

3. Sightings data

3.1 FIELD WORK

3.1.1 Systematic

J. Rodda (OU) continued analysing 24 consecutive months of research on Hector's dolphin at Te Waewae Bay, Southland. A photo-ID catalogue is being compiled that will be used to analyse spatial and temporal movements of the dolphin distribution, density, and fine scale habitat usage. A final report is scheduled to be submitted in 2009.

T. Webster and W. Rayment (OU) carried out photo-identification surveys of Hector's dolphins in Porpoise Bay, Southland, during January and February 2008. Mark-recapture techniques were used to obtain an abundance estimate for the Hector's dolphins that used the bay during this time. Eighteen photo-ID surveys were undertaken, during which 16 marked dolphins were identified. A total of 1224 digital photographs were taken of dorsal fins, of which 768 were of suitable quality for analyses. A mark rate of 33% was obtained from these photographs. Chapman's version of the Lincoln-Petersen estimator was used to calculate an abundance estimate of 49 (95% CI 44–55) individuals. This estimate was similar to abundance estimates obtained in 1997/98 (Bejder & Dawson 2001) and 2002/03 (Green 2003). There is no evidence to suggest any trend in population size between 1997 and 2008.

T. Webster (OU) and C. Edwards (DOC) completed a series of alongshore aerial surveys on the west coast of the North Island to examine the distribution of Maui's dolphins in relation to the southern boundary of the current protected area. Thirteen surveys were carried out between Manukau Harbour in the north and Cape Egmont in the south. During these surveys, 23 groups of Maui's dolphins were sighted between Manukau Heads and just south of the Mokau River. The southernmost sighting was approximately 10.4 n.m. north of the southern boundary of the protected area.

W. Rayment (OU), S. DuFresne (DEL), T. Webster (OU), D. Clement, (OU) and S. Scali (OU) conducted aerial line-transect surveys of Maui's dolphins on the northern west coast of the North Island in October 2007 to assess their distribution. A total of 13 sightings of Maui's dolphins were made during these surveys. These sightings comprised nine single animals and four pairs (mean group size = 1.31, SD = 0.48). All sightings except one were made inside the 4 n.m. offshore boundary of the current protected area. The one sighting outside the protected area was 4.05 n.m. from the coastline. In addition to the survey sightings, four sightings of Maui's dolphins (three singles and one pair) were made while 'off effort' between transect lines. All of these sightings were made inside the 4 n.m. boundary of the current protected area.

C. Edwards (DOC) undertook 32 days of survey for Maui's dolphins in the Manukau Harbour, Auckland in January and February 2008, using boat- and land-based methods. A land-based survey platform on Cornwallis Peninsula gave a 150° arc of visibility over the upper Manukau Harbour and its main channels. Boat-based surveys took place on the upper harbour channels and the area west

of Cornwallis Peninsula/Kauri Point up to the harbour entrance. A combined total of 229 hours of survey were completed. No Maui's dolphins were observed, although killer whales were seen on 24th February.

S. Scali, S. Dawson and E. Slooten (OU) are using passive acoustic methods (Timing-Porpoise Detectors—T-PODs) to study habitat use by Maui's dolphin along the northwest coast of the North Island. Maui's dolpins are partially protected from gillnet entanglement by a protected area on the open west coast from Northland to Taranaki that includes almost all of the range of the subspecies. However, the harbours along this coast are not included in the protected area (except for the entrance to the Manukau Harbour). Multiple sightings and acoustic detections of Maui's dolphins in the Manukau Harbour over a 3-year period have shown that the dolphins use the harbour on a regular basis, and range into the harbour well beyond the protected area. Sightings of Maui's dolphins have been made in at least three of the five harbours within their range. Research has demonstrated that T-PODs are an effective research tool for studying Maui's dolphin movements. Sound recordings using a hydrophone and T-POD simultaneously have confirmed that T-POD acoustic detections in the harbours along the North Island west coast are from Maui's dolphins. Matching sightings and acoustic detections using T-PODs for Maui's and Hector's dolphins has further validated the effectiveness of T-PODs for detecting these dolphins. In the 2007/08 year, the number of T-PODs in the Manukau Harbour was increased from four to six, to provide more detailed information about Maui's dolphins' habitat use in that harbour. T-POD work has also begun in several other harbours, including Kaipara, Raglan and Kawhia. In addition, further calibration work with the T-PODs is being carried out, including deploying them together with hydrophones when other species of dolphins (e.g. common and bottlenose) are also present.

P. Ensor participated in a research cruise in the eastern Barents Sea for the Institute of Marine Research, Bergen, Norway (the NILS2007 cruise), and acted as cruise leader on the IWC-SOWER 2007–08 Antarctic cruise.

R. Currey, S. Dawson and E. Slooten (OU) continued research on the conservation biology of bottlenose dolphins in Doubtful Sound, Fiordland. Based on recent intensive photo-ID work, there are between 55 and 57 individuals in the population. There has been a decline of 34%–39% among adult and sub-adult members of the population over the last 12 years. Preliminary modelling of survival rates for adults and calves has suggested that a decrease in calf survival is a key factor in this population decline. R. Currey, L. Rowe, S. Dawson and E. Slooten (OU) began research on the abundance and population structure of bottlenose dolphins in Dusky Sound, Fiordland. Recent intensive photo-ID work has determined that there are between 100 and 104 individuals in this population.

K. Stockin (MU-A) submitted doctoral research undertaken on the ecology and conservation of New Zealand common dolphins and, in collaboration with D. Lusseau (DAL), published research on the behavioural ecology of common dolphins and impacts associated with dolphin tourism. K. Stockin (MU-A) and colleagues at the Coastal-Marine Research Group (MU-A), have continued to investigate the ecology of common dolphins in the Hauraki Gulf in relation to anthropogenic impacts.

V. Petrella, in association with K. Stockin and D. Brunton (MU-A), began a doctorate study investigating the vocal repertoire of common dolphins in the Hauraki Gulf. The study aims to investigate the repertoire of New Zealand common dolphins and investigate differences in the repertoire in relation to foraging strategy and the presence of associated species.

E. Martinez, M. Orams and D. Brunton (MU-A) completed the final year of a 3-year field study examining the impacts of vessel activity on the behaviour of Hector's dolphins in Akaroa Harbour, Banks Peninsula. This study aims to determine and quantify the current level of vessel activity; identify whether such impacts are significant for the local Hector's dolphin population; and assess whether these can be mitigated by appropriate changes to the dolphin-watching permit conditions. The research utilises theodolite tracking and 3-minute focal group scan sampling methodology from land- and vessel-based platforms.

M. van der Linde, S. Dawson and E. Slooten (OU) continued work on an ongoing study of the abundance and distribution of sperm whales at Kaikoura. Photo-IDs for nine new individuals were added to an existing catalogue in 2007/08, with the updated photographic catalogue containing records for 236 individuals. A measure of field effort will be incorporated into the existing photographic mark-recapture model of abundance estimation, in order to improve the accuracy of sperm whale abundance estimates. A GIS model will be used to investigate distribution of individual sperm whales, in particular, spatial and temporal variation in habitat utilisation and relative range.

W.J. Markowitz (MU), T.M. Markowitz (UC), S. DuFresne (DUF), S. Deutsch (TAMU), M. Srinivasan (TAMU) and B. Würsig (TAMU) used a research vessel to conduct surveys of dusky dolphins at Kaikoura on 82 days, for a total of 442 hours and 242 encounters. During these surveys, focal follow group behavioural data, information on interactions with tour vessels and photo-identification records were collected. S. DuFresne (DUF), W.J. Markowitz (MU) and T.M. Markowitz (UC) used small vessels to conduct systematic surveys of dusky dolphins in the area south of Kaikoura from the Haumuri Bluffs to the Waiau River. Additional focal follow data and images for photo-identification were collected during encounters with Hector's dolphin groups (15 groups on 8 days). Common dolphins interacting with the dusky dolphins and occurring in independent groups were also documented, as were killer whales (on 2 days), a blue whale, and a southern right whale passing through the area. D. Lundquist (OU), S. Deutsch (TAMU) and M. Srinivasan (TAMU) conducted shore-based monitoring on 69 days, with a total of 348 hours of research effort. During this time, 191 dusky dolphin groups and all vessels interacting with the groups were tracked using a surveyor's theodolite linked to a laptop computer.

N. Gibbs (DOC), supported by many volunteers and ex-whalers, undertook a land- and vessel-based survey of humpback whales in Cook Strait for 2 weeks in June and July 2008. This was the fourth dedicated humpback whale survey in New Zealand since whaling finished in 1964. From 111 hours of land-based observation, 16 pods of 25 humpback whales were observed. Six photo-IDs and ten genetic samples were obtained.

During summer 2007/08, D. Neale (DOC) and colleagues repeated a survey of Hector's dolphins in South Westland first carried out in autumn 2004, to assess the off-shore and along-shore distribution of the species in this locality. Close

to 200 sightings of Hector's dolphins were recorded. An initial analysis of the results indicated that Hector's dolphins were present much closer to shore than observed in the earlier survey, and were concentrated in several specific locations along the 80 miles of coastline covered. Four groups of bottlenose dolphins were also sighted. Photo-ID images of Hector's (and bottlenose) dolphins collected during the surveys will be assessed as part of the final report, which is due to be completed later in 2008.

R. Constantine (UA) continued to investigate the effects of commercial and recreational dolphin-watch vessels and swimmers on the behaviour of bottlenose dolphins in the Bay of Islands. The current focus of the research, initiated in December 2007, is to investigate the effectiveness of changes made by DOC to the commercial dolphin-watch operators' permits to try and minimise disturbance to the dolphins. Focal group follows are being used to determine behavioural changes by the dolphins, duration of vessel presence and the type of vessels interacting with the dolphins. Swimmer placement and dolphin responses are being collected to determine the effect of swim attempts. The methods being used are consistent with those used in past research, so that effective comparisons over time can be made.

R. Constantine and A. Alexander (UA) continued research on the demographics and habitat use of bottlenose dolphins in the Auckland and Northland regions. Photo-ID, Global Positioning System (GPS) location and data on group demographics are being collected to investigate micro-scale habitat use by different age and sex classes of dolphins using the Bay of Islands and Hauraki Gulf. A geographical information system (GIS) incorporating environmental parameters, group structure and behaviour will be used to understand dolphin use of these areas.

In November 2007, S. Behrens and R. Constantine (UA) began aerial surveys to plot the distribution of Bryde's whales in the northern Hauraki Gulf, focussed particularly on the major shipping routes. Photo-ID, location and behavioural data continued to be collected from a whale-watch vessel in the Hauraki Gulf. These data will be used to create a GIS of Bryde's whale distribution, environmental parameters that influence their distribution and how this coincides with vessel use of the region. Aspects of this research will add to the 12 years of study based out of UA on the population structure and habitat use of Bryde's whales.

In April 2007, M. Oremus (UA), A. Wheeler (DOC) and V. Iese conducted preliminary cetacean surveys (n = 12) around two islands (Funafuti and Nukufetau) in the Tuvalu Archipelago. These were the first surveys of a 2–3-year NZAID-DOC programme which aims to provide capacity-building for Tuvalu as well as reliable scientific information on the occurrence and distribution of cetaceans in its coastal waters. The surveys resulted in 11 encounters with cetaceans, representing at least three species: spinner dolphins, pan-tropical spotted dolphins and dwarf sperm whales (plus one unidentified species). Photo-ID and biopsy surveys resulted in the identification of 44 distinctively marked spinner dolphins and the collection of 21 skin samples (20 from spinner dolphins and one from a pan-tropical spotted dolphin).

M. Oremus (UA) conducted 1 week of fieldwork in May–June 2007 at Savai'i, Samoa, with local government personnel of the Division of Environment and Conservation of Samoa. Five boat-based surveys were conducted to provide training in biopsy sampling and to assess the feasibility of whale and dolphin

watching tourism in the waters of Samoa. Biopsy samples were collected on spinner dolphins (n = 11), rough-toothed dolphins (n = 3) and short-finned pilot whales (n = 1).

K. Russell, C.S. Baker, R. Constantine, K. Stevens (UA), M. Donoghue (DOC) and E. Garland (UQ) conducted humpback whale research in the Vava'u island group in Tonga from 2 to 21 September 2007. Methods included the collection of photo-ID images, biopsy samples for DNA analysis, and acoustic data. During the survey, 20 days were spent on the water (177 hours of effort), resulting in a total of 56 encounters with whales (average 2.8 encounters per day): 11 mother/calf pairs, 10 mother/calf and escort groups, 23 multi-whale groups and 12 singletons. A total of 47 individuals were identified by fluke photos, of which 12 were matched to whales recorded in previous years. Four of the 12 whales have been re-sighted over a number of years, including one that was first photo-identified in 1991. Sixty-three tissue samples were collected, sexed (29% female, 71% male) and sequenced for the mitochondrial DNA (mtDNA) region. Four whales biopsied in 2007 had been biopsied in previous years; 18 whales had photo-ID and tissue samples collected. A total of 10.5 hours of song recordings were made and these are being analysed at UQ. Data analysis, including reconciling the photo-IDs with other catalogues and extracting DNA from the skin samples, is being carried out in collaboration with other members of the SPWRC.

3.1.2 Opportunistic, platforms of opportunity

A. & D. Englehaupt (DWE) collected opportunistic data on all dolphin groups (bottlenose, common, dusky, Hector's) encountered during Dolphin Watch Ecotours trips in the Marlborough Sounds throughout the year. Details of locations, estimated group sizes and presence of calves were collected for all groups, along with, when possible, images for photo-ID and descriptions of behavioural states.

E. Martinez (MU-A) continued to undertake opportunistic surveys on board dolphin-watching/swimming vessels in Akaroa Harbour for her PhD research. The aim of these surveys is to collect data on the behavioural ecology of Hector's dolphins in the presence of vessels and/or swimmers in Akaroa Harbour. Hector's dolphins encountered around dolphin-watching and dolphin-swimming operations were also photographed for photo-ID.

W.J. Markowitz (MU-A), T.M. Markowitz (UC), S. Deutsch (TAMU), M. Srinivasan (TAMU) and D. Lundquist (OU) collected data from dusky dolphin tour vessels on 39 days for a total of 112 hours and 43 dolphin group follows. Photo-ID, GPS tracks, dolphin-tour interactions and focal group behavioural data were collected. Encounter Kaikoura (EK) skippers and naturalists have been recording dusky dolphin sightings (e.g. location, group size, and sometimes behaviour) since 1994. They also note the presence of 'visiting' cetaceans, such as killer whales, in the general area. Data collection occurs during most tours and will continue into the foreseeable future.

Table 3 provides details of opportunistic surveys or observations of cetaceans made during 2007/08.

TABLE 3. DETAILS OF OPPORTUNISTIC SURVEYS OR OBSERVATIONS MADE DURING 2007/08.

SPECIES	AREA	DATA TYPE/ METHOD	COLLECTED BY	PLATFORM	LOCATION OF ARCHIVE (IF APPLICABLE)	CONTACT PERSON/S (INSTITUTION)
Blue whale	Northern Ross Sea	Photo-ID, sightings	Crew/ scientists	*R.V. Tangaroa*	NIWA	S. Baird, S. Hanchet (NIWA)
Bryde's whale	Hauraki Gulf	Location, group sizes, dorsal fin photos	KS (MU-A)	Eco-tour vessel	MU-A	K. Stockin (MU-A)
Bryde's whale	Hauraki Gulf	Photo-ID, sightings	Crew	Whale-watching vessel	UA	R. Constantine, S. Behrens (UA)
Common dolphin	Hauraki Gulf	Location, group sizes, dorsal fin photos	KS (MU-A)	Eco-tour vessel	MU-A	K. Stockin (MU-A)
Dusky dolphin	Kaikoura	Photo-ID, sightings, behaviour, vessel interactions	Dedicated observers	Dolphin tour vessel	MU-A	W.J. Markowitz (MU); T.M. Markowitz (UC)
Dusky dolphin	Kaikoura	Sightings	EK crew	Dolphin-watching vessel	EK	D. Buurman (EK); A. Dahood (TAMU)
Hector's dolphin	Banks Peninsula	Location, group sizes, dorsal fin photos	EM (MU-A)	Eco-tour vessel	MU-A	E. Martinez (MU-A)
Humpback whale	Northern Ross Sea	Photo-ID, sightings	Crew/ scientists	*R.V. Tangaroa*	NIWA	S. Baird, S. Hanchet (NIWA)
Humpback whale	Kaikoura	Photo-ID	Dennis Buurman	Dolphin-watching vessel	DOC	N. Gibbs (DOC)

3.2 ANALYSES/DEVELOPMENT OF TECHNIQUES

D. Lundquist (OU), W.J. Markowitz (MU), T.M. Markowitz (UC), and B. Würsig (TAMU) continued to apply a multi-platform approach to examining dolphin-tour interactions. S. DuFresne (DUF) examined dusky dolphin distribution and numbers further south from Kaikoura than has previously been systematically surveyed (e.g. from the Haumuri Bluffs to the Waiau River). A. Dahood (TAMU) analysed long-term dusky dolphin occurrence patterns using the first 12 years of sightings information collected by EK skippers and crew. Results of this analysis were presented to the whalewatching subcommittee of the IWC. (e.g. Dahood et al. 2008).

4. Marking data

4.1 FIELD WORK

4.1.1 Natural marking data

Details of photo-ID catalogues held and maintained by researchers in New Zealand are provided in this section. Only the catalogues that have been actively maintained, added to, and reported on in 2007/08 have been reported here. There are other photo-ID catalogues held and maintained by researchers in New Zealand. For a more detailed list of existing catalogues, please consult previous National Progress Reports and individual researchers. Table 4 provides details of photo-ID catalogues for cetaceans held and maintained by researchers in New Zealand in 2007/08.

TABLE 4. DETAILS OF PHOTO-ID CATALOGUES FOR CETACEANS HELD AND MAINTAINED BY RESEARCHERS IN NEW ZEALAND IN 2007/08

SPECIES	FEATURE	AREA/ STOCK	NO. INDIVIDUALS PHOTOGRAPHED IN 2007/08*	CATALOGUE Y/N	NO. INDIVIDUALS IN CATALOGUE	CONTACT PERSON (INSTITUTE)
Blue whale	Dorsal fin	Scott seamount, northern Ross Sea	2	N	2	S. Baird, S. Hanchet (NIWA)
Bottlenose dolphin	Dorsal fin	Hauraki Gulf	~170	Y	>200	G. de Tezanos Pinto, & J. Berghan (UA)
Bottlenose dolphin	Dorsal fin	South Westland	tba	Y	tba	D. Neale (DOC)
Bottlenose dolphin	Dorsal fin	Bay of Islands	tba	Y	439	R. Constantine (UA)
Bryde's whale	Dorsal fin	Hauraki Gulf	tba	Y	72	R. Constantine & S. Behrens (UA)
Common dolphin	Dorsal fin	Hauraki Gulf	40	Y	>600	K. Stockin (MU-A)
Dusky dolphin	Dorsal fin	Kaikoura	tba	Y	2494	T. Markowitz (UC)
Dusky dolphin	Dorsal fin	Marlborough Sounds	tba	Y	>600	T. Markowitz (UC)
Hector's dolphin	Dorsal fin, body markings	Banks Peninsula	tba	Y	877	T. Webster (OU)
Hector's dolphin	Dorsal fin, body	Porpoise Bay	16	Y	16	T. Webster (OU)
Hector's dolphin	Dorsal fin	Te Waewae Bay, Southland	70	Y	250	R. Cole/ (DOC)
Hector's dolphin	Dorsal fin, body marking	Banks Peninsula	tba	Y	tba	E. Martinez (MU-A)
Hector's dolphin	Dorsal fin	South Westland	tba	Y	tba	D. Neale (DOC)
Humpback whale	Dorsal fin	Scott seamount, northern Ross Sea	2	N	2	S. Baird, S. Hanchet (NIWA)
Humpback whale	Fluke	New Zealand	7	Y	50	N. Gibbs (DOC)
Pilot whale	Dorsal fin	South Westland	tba	N	0	D. Neale (DOC)
Sperm whale	Fluke	Kaikoura	9	Y	236	M. van der Linde (OU)

* Tba = To be announced.

S. Hanchet, S. Baird and colleagues (NIWA) collected opportunistic photographic observations of humpback and blue whales during the 2008 New Zealand IPY-CAML survey of the Ross Sea, Antarctica. The photographs will be submitted to the regional sightings database during 2008/09.

G. de Tezanos Pinto (UA) curated the Hauraki Gulf Bottlenose Dolphin photo-ID Catalogue during 2007/08 in collaboration with J. Berghan, K. Algie, N. Wiseman and K. Stockin (MU-A). This catalogue includes individual photo-IDs collected opportunistically in the Hauraki Gulf since 2000. Photographs from 2003–2007 have been analysed and unique individuals will be added into the Hauraki Gulf catalogue and sighting database. This research aims to improve abundance estimates for the Northland population, provide a better understanding of demographic parameters, habitat usage and social organisation of bottlenose dolphins in the Hauraki Gulf.

During 2007/08, W.J. Markowitz (MU), T.M. Markowitz (UC), S. Deutsch (TAMU), M. Srinivasan (TAMU) and D. Lundquist (OU) collected a total of 47 849 photographs of dusky dolphin dorsal fins for individual identification. Cataloguing work is ongoing, but at present the catalogue for dusky dolphins at Kaikoura numbers 2494 with over 600 dusky dolphins catalogued in the Marlborough Sounds. Comparison of photo records shows seasonal movements of individuals between the two areas.

4.1.2 Artificial marking data

None.

4.1.3 Telemetry data

None.

4.2 ANALYSES/DEVELOPMENT OF TECHNIQUES

During 2007/08, T.M. Markowitz (UC), W.J. Markowitz (MU), H. Pearson (TAMU), J. Weir (TAMU) and S. Deutsch (TAMU) updated dusky dolphin photo-ID analyses. This included work on abundance estimates and seasonal residency and migration patterns, and examination of social structure. W.J. Markowitz (MU) worked on further development of high-speed, high-resolution digital photography combined with real-time focal behavioural observations to allow association and grouping patterns to be examined in greater detail.

5. Tissue/biological samples collected

5.1 BIOPSY SAMPLES (SUMMARY ONLY)

Details of biopsy samples of cetaceans collected in 2007/08 are provided in Table 5.

TABLE 5. DETAILS OF BIOPSY SAMPLES OF CETACEANS COLLECTED IN 2007/08.

SPECIES (SAMPLE TYPE)	AREA/ STOCK	NO. SAMPLES COLLECTED IN 2007/08	ARCHIVED Y/N	NO. ANALYSED	TOTAL HOLDINGS	CONTACT PERSON/S (INSTITUTE)
Humpback whale (skin/blubber)	NZ	?	Y	10	42	N. Gibbs (DOC)
Humpback whale	Tonga	63	Y	63	>400	R. Constantine, S. Baker (UA)
Southern right whale	NZ (mainland)	5	Y	5	32	R. Constantine, S. Baker (UA)
Southern right whale	NZ (Auckland Islands)	234	Y	0	768	R. Constantine, S. Baker (UA)

5.2 SAMPLES FROM DIRECTED CATCHES (COMMERCIAL, ABORIGINAL AND SCIENTIFIC PERMITS) OR BYCATCHES

None.

5.3 SAMPLES FROM STRANDED ANIMALS

Details of samples collected from stranded cetaceans in 2007/08 are provided in Table 6.

5.4 ANALYSES/DEVELOPMENT OF TECHNIQUES

K. Stockin (MU-A), in collaboration with W. Roe (MU-P), currently undertakes necropsies on all beachcast and bycaught common dolphins. Cause of mortality and general health status are assessed at gross post mortem, and tissue samples are collected and stored for subsequent histological, toxicological, bacteriological or molecular biological testing.

K. Stockin (MU-A), in collaboration with M. Orams, D. Brunton and D. Raubenheimer (MU-A), continued to investigate abundance of common dolphins in the Hauraki Gulf. Population models were applied to generate abundance estimates and assess trends using a 7-year photo-ID dataset.

TABLE 6. DETAILS OF SAMPLES COLLECTED FROM STRANDED CETACEANS IN 2007/08.

SPECIES	AREA/ STOCK	TISSUE TYPE/S*	NO. SAMPLES COLLECTED	ARCHIVED Y/N	NO. ANALYSED	CONTACT PERSON/S (INSTITUTION)
Andrew's beaked whale	NZ	Skin and blubber	4	Y	4	R. Constantine (UA)
Bottlenose dolphin	NZ	Skin and blubber	6	Y	6	R. Constantine (UA)
Bryde's whale	NZ	Stomach contents	1	Y	0	E. Beatson (AUT)
Bryde's whale	NZ	Skin and blubber	1	Y	1	R. Constantine (UA)
Common dolphin	NZ	Stomach contents, skin, blubber	1	Y	0	E. Beatson (AUT)
Common dolphin	NZ	Skin and blubber	10	Y	0	K. Stockin (MU-A)
Common dolphin	NZ	Skulls	5	Y	0	K. Stockin (MU-A)
Common dolphin	NZ	Teeth	8	Y	0	K. Stockin (MU-A)
Common dolphin	NZ	Stomachs	4	Y	2	K. Stockin (MU-A)
Common dolphin	NZ	Reproductive tracts	4	Y	4	K. Stockin (MU-A)
Common dolphin	NZ	Skin and blubber	12	Y	12	R. Constantine (UA)
Cuvier's beaked whale	NZ	Skin and blubber	1	Y	1	R. Constantine (UA)
Dusky dolphin	NZ	Skin and blubber	5	Y	5	R. Constantine (UA)
Gray's beaked whale	NZ	Stomach contents, skin, blubber, muscle, liver	5	Y	0	E. Beatson (AUT)
Gray's beaked whale	NZ	Skin and blubber	8	Y	8	R. Constantine (UA)
Hector's dolphin	NZ	Skin and blubber	8	Y	8	R. Constantine (UA)
Humpback whale	NZ	Skin and blubber	1	Y	1	R. Constantine (UA)
Killer whale	NZ	Stomach contents, skin, blubber, teeth	2	Y	2	R. Constantine (UA)
Killer whale	NZ	Skin and blubber	4	Y	4	R. Constantine (UA)
Long-finned pilot whale	NZ	Stomach contents	11	Y	11	E. Beatson (AUT)
Long-finned pilot whale	NZ	Skin, blubber, muscle, liver, teeth, parasites	11	Y	0	E. Beatson (AUT)
Long-finned pilot whale	NZ	Skin and blubber	1	Y	1	R. Constantine (UA)
Maui's dolphin	NZ	Skin and blubber	1	Y	1	R. Constantine (UA)
Pygmy right whale	NZ	Skin and blubber	1	Y	1	R. Constantine (UA)
Pygmy sperm whale	NZ	Stomach contents	3	Y	1	E. Beatson (AUT)
Pygmy sperm whale	NZ	Skin and blubber	9	Y	9	R. Constantine (UA)
Southern minke whale	NZ	Skin and blubber	4	Y	4	R. Constantine (UA)
Southern right whale dolphin	NZ	Skin and blubber	2	Y	2	R. Constantine (UA)
Spectacled porpoise	NZ	Skin and blubber	1	Y	1	R. Constantine (UA)
Sperm whale	NZ	Skin and blubber	6	Y	6	R. Constantine (UA)
unknown	NZ	Skin and blubber	7	Y	7	R. Constantine (UA)

G. de Tezanos Pinto and C.S. Baker, in collaboration with R. Constantine, J. Berghan, F. Mourao and S. Wells (AU), continued investigation of the dynamics and abundance of bottlenose dolphins using the Bay of Islands. Group size and composition, frequent users, and re-sighting rates were analysed over two comparative time-periods to understand the dynamics of this population. Trends of abundance were investigated using both closed and open population models over the two time-periods to predict trends in abundance.

C.S. Baker and R. Constantine (UA) continued to analyse samples from unknown species. Samples were primarily identified to species level by genetic analysis with comparison to reference sequences held at www.dna-surveillance.auckland.ac.nz. For the remaining samples, genetic analysis confirmed

morphological identification made by DOC field staff or A. van Helden (TP). In 2007/08, the tissue and DNA archive held at UA contained approximately 1400 samples from 35 species, including 1 porpoise, 9 mysticete, 15 odontocete and 11 beaked whale species. This archive continues to be curated by C.S. Baker and R. Constantine (UA).

M. Oremus and C.S. Baker (UA) completed research on the population structure, genetic diversity and social systems of spinner dolphins, rough-toothed dolphins, long-finned and short-finned pilot whales from French Polynesia and New Zealand. Analyses were conducted on tissue samples using mtDNA and microsatellite loci, and photo-ID and mass-stranding data ($n = 375$ stranding samples and $n = 243$ biopsy samples). Distinct communities of spinner dolphins around French Polynesia were found to have restricted gene-flow but high levels of insular mtDNA genetic diversity. There was no evidence of a bottleneck, suggesting a pattern of metapopulation structure with insular communities. Analysis and comparison of long-finned pilot whale samples from the North Atlantic and the Southern Hemisphere indicated severely restricted gene flow, with a few shared haplotypes but overall low mtDNA diversity, suggesting a recent expansion for this species. Examination of maternal relatedness between stranded pilot whales in New Zealand ($n = 275$) showed that groups are sometimes composed of unrelated maternal lineages. This discounts kinship as the only factor causing large mass-strandings. Rough-toothed dolphins in French Polynesia were found to have local communities with fine-scale population genetic structure. These communities showed a low level of mtDNA haplotype diversity, suggesting the potential influence of a matrilineal social structure.

M. Oremus, R. Constantine and C.S. Baker (UA) completed the analyses of 277 DNA samples of long-finned pilot whales from Tasmania, Australia, in collaboration with R. Gales from the Department of Primary Industries and Water (Tasmania). These samples were compared with 341 samples from New Zealand to investigate the regional population structure and social dynamics of mass strandings of these whales. Strong population differentiation was found between the New Zealand and Tasmanian samples, showing that, for management purposes, the two groups should be considered as separate units. The analysis of kinship within samples from Tasmanian mass strandings confirms the results from previous analyses of New Zealand samples; specifically, that disruption of kinship bonds occurs during large strandings. This could help to explain the behavioural distress of stranded individuals and the tendency of many whales to re-strand after being re-floated.

D. Heimeier and C.S. Baker (UA) completed research on the diversity on the major histocompatability complex (MHC) at two loci—DQA and DQB—in Hector's and Maui's dolphins and long-finned pilot whales. MHC diversity in the Maui's dolphin was surprisingly high at the DQB locus, due to three divergent alleles retained compared with the six alleles found in the South Island Hector's dolphin. Genetic drift was found to be a major force in shaping this genetic diversity, although evidence of balancing selection on an evolutionary timescale was found as well. The MHC diversity in long-finned pilot whales at both loci was higher than what has been reported for a cetacean population so far but, compared with terrestrial mammal populations, still lower than what could be expected. The most likely explanation for reduced MHC diversity might be a combined effect of population expansion and reduced pathogen exposure in

the pelagic environment. The evidence of balancing selection on an evolutionary timescale was present, but influence in the contemporary generations could not be established.

R. Hamner, C.S. Baker and S. Lavery (UA) completed research on the population structure, gene flow and dispersal of South Island Hector's dolphins ($n = 335$) using tissue samples from biopsied and stranded animals. Long-term restrictions in gene flow between the east, west and south coast populations were supported by analyses using mitochondrial DNA and 13 bi-parentally inherited microsatellite markers. Six potential intra-region migrants were identified, all between adjacent local populations. There is a trend for male-biased dispersal on the west and east coast populations. Hector's dolphin populations from Te Waewae and Toetoe Bays (southern South Island) show significant population differentiation based on mtDNA and microsatellites.

C. Olavarría and C.S. Baker (UA) completed research on the structure of humpback whale populations in breeding grounds across the South Pacific and eastern Indian Oceans. The primary aim of this study was to investigate the origins of whales in eastern Polynesia. Analyses were conducted on an extensive collection of mtDNA sequences ($n = 1112$; 470 base pairs) obtained from living whales on six breeding grounds: New Caledonia, Tonga, Cook Islands, French Polynesia (Society Islands), Colombia and Western Australia. The study also reports a similar investigation of a population of humpback whales that migrates along the western South American coast, with breeding grounds mainly off Colombia and Ecuador and feeding areas off the western coast of the Antarctic Peninsula and in the channels and fiords of southern Chile. Finally, the study reports on the genetic diversity of New Zealand humpback whales, comparing their mitochondrial DNA control region sequences with those identified from whales sampled in breeding grounds across the South Pacific and eastern Indian Oceans.

N. Wiseman and C.S. Baker (UA) examined the genetic identity of Bryde's whales in the Hauraki Gulf, using samples ($n = 49$) collected from both beachcast and live individuals (which were remotely sampled using a small biopsy dart). Despite an 'inshore' pattern of habitat use, all individuals were identified as corresponding to the form described for the offshore waters of the western North Pacific (*Balaenoptera brydei*). Seventy-two Bryde's whales (including seven calves, five of these dependent) were individually identified using photographs of their dorsal fins. These 72 animals accounted for 353 documented sightings between October 1996 and February 2006 in the Hauraki Gulf, which seems to be an important area, year-round, for both breeding/calving and feeding.

6. Pollution studies

K. Stockin (MU-A) and colleagues examined trace elements, polychlorinated biphenyls (PCBs) and organochlorine (OC) pesticides in common dolphins. Pollutant levels were determined in tissues collected from stranded and bycaught animals from New Zealand waters between 1999 and 2005. The concentrations of mercury (Hg), selenium (Se), chromium (Cr), zinc (Zn), nickel (Ni), cadmium (Cd), cobalt (Co), manganese (Mn), iron (Fe), copper (Cu), tin (Sn), lead (Pb), arsenic (As) and silver (Ag) were determined in blubber, liver and kidney tissue. PCBs (45 congeners) and a range of OC pesticides including dieldrin, hexachlorocyclohexane (HCH) and dichlorodiphenyltrichloroethane (DDT) and its metabolites DDE and DDD were determined in blubber samples. Cr and Ni were not detected in any of the samples, and concentrations of Co, Sn and Pb were generally low. Concentrations of Hg ranged from 0.17 to 110 mg/kg wet weight. Organochlorine pesticides dieldrin, HCB, o,p′-DDT and p,p′-DDE were present. Sum-DDT concentrations in the blubber ranged from 17 to 337 and 654 to 4430 µg/kg wet weight in females and males, respectively. Similarly, Σ45CB concentrations ranged from 49 to 386 µg/kg and 268 to 1634 µg/kg wet weight in females and males, respectively. The mean transmission of ΣDDTs and ICES7CBs between a genetically determined mother–offspring pair was calculated at 46% and 42%, respectively. Concentrations of organochlorine pesticides determined in the present study are similar in range to those previously reported for Hector's dolphins.

K. Stockin (MU-A) and collaborators are currently investigating PCB and OC levels in dusky and Hectors's dolphins.

7. Statistics for large cetaceans

7.1 CORRECTIONS TO EARLIER YEARS' STATISTICS FOR LARGE WHALES

Some incorrect statistics were presented to the Conservation Committee last year (2006/07) relating to ship strike data in paper IWC/59/CC10—agenda Item 6. This dataset has since been re-investigated and the revised data are now available. In paper IWC/59/CC10, the following statement was made:

> *A review has been undertaken of data of Balaenopteridae whale deaths due to ship strike in the Hauraki Gulf 1997–2007. Of the 25 large baleen whale deaths identified, 23 were Bryde's whales, in addition to one sei whale and one pygmy blue whale.*

This statement should be retracted and replaced with the following:

> *Up to 18 whales, including confirmed, probable and possible cases may have been killed by vessels in the Hauraki Gulf 1997–2007. Of the 18 large baleen whale deaths identified, 16 were Bryde's whales (2 confirmed, 13 suspected and 1 possible vessel strike fatality), in addition to one sei whale (confirmed) and one baleen whale of unknown species (suspected).*

7.2 DIRECT CATCHES OF LARGE WHALES (COMMERCIAL, ABORIGINAL AND SCIENTIFIC PERMITS) FOR CALENDAR YEAR 2007

None.

7.3 ANTHROPOGENIC MORTALITY OF LARGE WHALES FOR CALENDAR YEAR 2007

7.3.1 Observed or reported ship strikes of large whales (including non-fatal events)

None.

7.3.2 Fishery bycatch of large whales

None.

8. Statistics for small cetaceans

8.1 CORRECTIONS TO EARLIER YEARS' STATISTICS FOR SMALL CETACEANS

None.

8.2 DIRECT CATCHES OF SMALL CETACEANS FOR THE CALENDAR YEAR 2007

None.

8.3 ANTHROPOGENIC MORTALITY OF SMALL CETACEANS FOR CALENDAR YEAR 2007

8.3.1 Observed or reported ship strikes of small cetaceans (including non-fatal events)

None.

8.3.2 Fishery bycatch of small cetaceans

Details of small cetaceans (e.g. dolphins) caught in fisheries in calendar year 2007 are provided in Table 7. Note: these bycatch reports represent only those individuals that were reported to DOC or the Ministry of Fisheries and were confirmed as fisheries bycatch from government observers in fisheries or from autopsies of beachcast specimens. There is no estimate of total bycatch in New Zealand and the individuals reported here represent a minimum.

TABLE 7. DETAILS OF SMALL CETACEANS CAUGHT IN FISHERIES IN CALENDAR YEAR 2007.

SPECIES	SEX	NO.	DATE	LOCATION	FATE	TARGETED FISH SPECIES	GEAR	HOW OBSERVED	SOURCE OR CONTACT (INSTITUTE)
Hector's dolphin	?	1	13 Feb 2008	MFish stat area 022	Dead	Shark spp.	Set gillnets (anchored)	Govt. observer	S. Rowe (DOC)
Pilot whale	?	1	01 Jan 2008	MFish mgmt area AKW	Released alive	Shark spp.	Set gillnets (anchored)	Govt. observer	S. Rowe (DOC)
Common dolphin	?	5	05 April 2007	MFish mgmt area CHA	Dead	Jack mackerel	Midwater trawls (not specified)	Govt. observer	S. Rowe (DOC)
Common dolphin	?	22	?? Dec 2007	MFish mgmt area 7	Dead	Jack mackerel	Midwater trawls (not specified)	Govt. observer & industry observer	S. Rowe (DOC)

9. Strandings

A. van Helden (TP) continued to maintain the New Zealand National Stranding database. The total number of reported strandings for the period April 2007 to March 2008 was 83 incidents involving 144 animals. This excludes those animals that have been reported but for which stranding data forms had not been received by the TP before the end of March 2008. At least 18 different species were recorded in the database for this period. The representation in the number of incidents of strandings for the different families that stranded in this period are: Neobalaenidae (3.6%), Balaenopteridae (6%), Ziphiidae (14.5%), Delphinidae (55.4%), Physeteridae (7.2%), Kogiidae (9.6%), Phocoenidae (1.2%). The number of animals for the different families that stranded in this period are: Neobalaenidae (0.02%), Balaenopteridae (1.1%), Ziphiidae (3.2%), Delphinidae (85.4%) and Physeteridae (4.4%). The species with the highest number of strandings was common dolphins, with 16 incidents. The largest number of animals of a species to strand was 37 for long-finned pilot whales. The total number of animals refloated in this period was 48. Seven of these restranded and died; therefore, 41 are presumed to have survived. The period 2007/08 had very few large mass stranding events. The largest was 34 long-finned pilot whales. The only other notable mass stranding was of 18 bottlenose dolphins. Details of the numbers and species of cetaceans that stranded in 2006/07 are provided in Table 8.

E. Beatson, S. O'Shea and colleagues (AUT) continued to investigate strandings of cetaceans in New Zealand. Specifically, they continued to collect stomach and tissue samples of teuthophagous whales to investigate diet through a combination of stomach content and stable isotope analyses.

C. Schweder-Goad (BOP) has geographically referenced all reported cetacean strandings in New Zealand (1846–2007) for DOC and TP.

K. Stockin (MU-A) and Wendi Roe (MU-P) continued to investigate strandings of common dolphins around New Zealand.

TABLE 8. DETAILS AND NUMBERS OF STRANDED CETACEANS IN 2007/08.

SPECIES:	NO. STRANDINGS	NO. ANIMALS	NO. ANIMALS REFLOATED	NO. ANIMALS RESTRANDED	NO. ANIMALS RESCUED
Andrew's beaked whale	1	3	0	0	0
Bottlenose dolphin	9	26	20	1	19
Brydes whale	1	1	0	0	0
Common dolphin	16	17	1	1	0
Common minke whale	3	3	0	0	0
Cuvier's beaked whale	2	2	0	0	0
Dusky dolphin	4	5	1	1	0
Gray's beaked whale	7	12	2	0	2
Hector's dolphin	7	7	0	0	0
Humpback whale	1	1	0	0	0
Killer whale	4	4	0	0	0
Mesoplodon sp.	2	2	0	0	0
Long-finned pilot whale	4	37	21	1	20
Pygmy right whale	3	3	0	0	0
Pygmy sperm whale	8	8	3	3	0
Southern right whale dolphin	2	2	0	0	0
Spectacled porpoise	1	1	0	0	0
Sperm whale	6	6	0	0	0
Unknown	2	4	0	0	0
Total	83	144	48	7	41

10. Other studies and analyses

B. Miller, S. Dawson and E. Slooten (OU) continued research on the acoustic behaviour of sperm whales at Kaikoura. Development of passive acoustic arrays to determine the whales' underwater movements has continued. This research programme includes the design, implementation, and deployment of a portable passive sonar system for 3D tracking of vocalising cetaceans. B. Miller and S.M. Dawson (OU) have developed a passive sonar array for localising sperm whales in 3D. The system is being used to measure acoustics and behaviour of sperm whales diving into the Kaikoura Canyon. From a 6-m boat, three free-floating hydrophones are deployed at depths of 20–30 m, and a stereo hydrophone array is deployed at 100 m. Each whale audio track is time-aligned using custom software written in Matlab. The whale audio track from each hydrophone is analysed for sperm whale clicks using the program Ishmael (MobySoft).

M. Pinkerton, S. Hanchet and colleagues (NIWA) continued work on an ecosystem model of the Ross Sea, Antarctica, as part of a Foundation for Research, Science and Technology (FRST) contract (CO1X0505). The aim of the work is to understand food-web relationships between organisms in the Ross Sea, their response to environmental drivers and anthropogenic influences, and the key factors influencing the sustainability of the ecosystem. This includes the modelling of whale populations in the Ross Sea; in particular, an energetic and population model of type-C killer whales (orca); an estimation of the seasonal occurrence of baleen whales in the Ross Sea region based on IWC sighting data; and estimation of trophic overlap of whales and Antarctic toothfish (*Dissostichus mawsoni*) in the Ross Sea.

T. Webster (OU) worked on completing research on the Hector's dolphin population at Banks Peninsula for her MSc thesis. An underwater pole-camera setup has been used to determine the gender of marked individuals as well as group composition. Gender determination of marked individuals was increased by 450% when the pole-camera method was used. Research has shown a strong tendency for small groups of individuals to segregate by sex, and that the population has a sex ratio of approximately 1:1. A small sample (n = 7) of nursery groups were also found to segregate by sex and contained only females or females with calves. A laser photogrammetric system mounted on a digital camera was trialled. This enables dorsal fin dimensions to be obtained in the field. Using this system resulted in a mean CV of 3.71% for dorsal fin base length and 3.76 % for fin height. Dorsal fin base length was found to be a better predictor of total length (females r^2 = 0.732, males r^2 = 0.678). Using Von Bertalanffy growth curves, fin length was used to estimate total body length to within an average of 7% (males) and 8% (females) of the actual values. Broad age categories (juvenile, intermediate and adult) were also able to be assigned to all of the individuals measured using the laser photogrammetric technique, showing that it has promise for use in stage-structured modelling. The spatial and temporal distribution of mother and calf pairs was also investigated. Average group size was significantly smaller in nursery groups (2.65) than groups without calves (3.57) (Wilcoxon: Z = –6.716, P < 0.0001). Mother-calf groups used inshore areas of Banks Peninsula differently from non-calf groups (G = 177.34, df = 14, P < 0.001). This research has identified potential nursery areas or preferred areas, as well as regions that appear to be avoided or used only occasionally, which has implications for the management of this species.

W. Rayment (OU) is completing research for a PhD thesis on distribution and ranging of Hector's dolphins, as detailed in previous reports. Aerial surveys of Hector's dolphin distribution have been completed at Banks Peninsula and in the Buller region of the West Coast. At Banks Peninsula, Hector's dolphins were sighted up to 19 n.m. offshore. On average, 19% of dolphins were outside the 4 n.m. boundary of the Banks Peninsula Marine Mammal Sanctuary (BPMMS) in summer, and 56% in winter. On the West Coast, all dolphins were sighted within 6 n.m. of the coast. Photo-ID has been continued at Banks Peninsula to study alongshore movements of Hector's dolphins. The mean kernel density estimate of alongshore home range for the 20 most frequently sighted dolphins was 49.69 km, and 15% of dolphins in the sample had home ranges which extended beyond the northern boundary of the BPMMS. Acoustic monitoring of Hector's dolphins was trialled with T-PODs. T-PODs detected dolphins reliably within 100 m and had a maximum detection range of 430 m. T-PODs were deployed around Banks Peninsula to study inshore habitat use by Hector's dolphins. There was a significant difference between detection rates in summer and winter, although winter use of inshore habitats was higher than expected. Recommendations are made for improvements to the design of the BPMMS.

B. Bollard-Breen and colleagues (AUT) currently hold the contract for verifying public sightings of Maui's dolphins and developing a spatial database of public sightings of Maui's dolphins from 2000 to present. This means that every time a member of the public sees a Maui's dolphin and then calls the Maui's hotline, contact is made with the observer to verify whether or not it was the correct species and how reliable the sighting is. Sighting information is then transferred into GIS and provided to WWF-NZ and DOC.

L. Rowe (OU) conducted laser photogrammetry of the dorsal fins of bottlenose dolphins in Doubtful Sound/Patea and Dusky Sound, Fiordland, in spring 2007 and summer 2008. In Doubtful Sound/Patea, the dorsal fins of adult males were larger than those of females, and were more scarred and nicked. The severity of epidermal lesions was higher for females. A logistic regression model using dorsal fin surface area, the proportion of fin covered in scarring, and the number of nicks, was used to determine the gender of bottlenose dolphins from Doubtful Sound/Patea with 93% accuracy. This model was applied to dorsal fin photographs of bottlenose dolphins from Dusky Sound to predict their genders and produced the first demographic information for the population.

B. Madon (UA) continued joint modelling of two sources of live-recapture data—genetics and photo-ID—to estimate population size of the South Pacific humpback whale population. A likelihood-based model that would allow these two data sources to be combined in population assessment is being developed. The idea is to join the likelihood using the genetic data, the likelihood using the photo-ID data and the likelihood using the data of individuals that have been simultaneously captured by genetics and photo-ID. But because there is an overlap between the first two datasets (some whales will be recorded in both, but the researchers will not be able to identify them), the probability of individuals being in both datasets has to be addressed.

L. Meynier (MU-P) and K. Stockin (MU-A) examined the stomach contents of 53 common dolphins: 42 stranded and 11 bycaught dolphins sampled between 1997 and 2006 were investigated. Prevalent prey items included arrow squid (*Nototodarus* spp.), jack mackerel (*Trachurus* spp.) and anchovy (*Engraulis australis*). Common dolphins commercially by-caught within neritic waters had fed on both neritic and oceanic prey, suggesting daily inshore/offshore movements. Reports on all stomach content analyses are currently in press.

K. Stockin (MU-A) and colleagues continued research on the life history and skull morphometrics of common dolphins sampled from around New Zealand.

K. Stockin (MU-A), in association with collaborators Wendi Roe (MU-P) and colleagues, undertook a radiographic assessment of the pectoral flippers of a dead Bryde's whale retrieved from the Hauraki Gulf. Radiographs revealed that the specimen was immature, as evidenced by open physes, incompletely ossified epiphyses and incompletely ossified cuboidal bones of the carpus. Fractures evident in the distal right antebrachium of left flipper were considered typical of acute blunt trauma.

E. Hutchison and E. Slooten (OU) have been investigating the diet of Hector's dolphin. Species and sizes of prey currently eaten throughout New Zealand have been identified from stomach contents of recently stranded specimens. Stable isotope analysis of archived individuals from throughout the Canterbury region will now be used to compare Hector's diet before and after the creation of the Banks Peninsula Marine Mammal sanctuary.

S. Dawson, E. Slooten and S. Scali (OU) used passive echolocation detectors (T-PODs) at three sites in Akaroa harbour to monitor dolphin presence through the period 16 February 2007 to 18 February 2008. The three sites represent inner, mid- and outer harbour habitats, and are areas in which amateur gillnetting takes place. Each echolocation detector successfully collected data over

336–359 days (average = 350). Dolphins used the outer harbour site consistently throughout the year, with dolphins detected on every day but one while T-PODs were operating. Dolphins were detected on 90% of days in the mid harbour site. Although a weak seasonal pattern of more detections in summer was observed, dolphins were still detected in the mid harbour on most days during winter. The inner harbour site had a more strongly seasonal pattern, with detections on almost every day during summer, but dolphins were also present on many days in winter. This area is routinely used by flounder gillnetters. Dolphins were detected on 41% of the days during the period when such gillnetting is legal. T-PODs are very conservative indicators of dolphin habitat use, mostly because they monitor a very small area (average = 200-m radius, max. = 400 m). Therefore, lack of detection by T-PODs does not imply that dolphins are not present. The results for Robinson's Bay show clearly that the concession that allows unattended amateur gillnetting in winter is unsafe. Dolphins use this area routinely in winter, and are at risk of entanglement when they do so.

E. Slooten (OU) used a stochastic population model to evaluate the effectiveness of four options for managing Hector's dolphin bycatch. The catch rate in commercial gillnets was used in a population viability analysis to estimate past and future population sizes. However, estimates of bycatch were not available for trawls and recreation gillnets, and were therefore not included in the model. Total Hectors' dolphin population in 2007/08 (7873, CV 0.16) was estimated to be 27% of the population in 1970 (29 316, CV 0.16), which was before a major expansion in commercial gillnetting occurred. The model indicates that current management, which includes two protected areas, is not sufficient to halt population declines. Hector's dolphin populations are predicted to continue to decline (to 5475 (CV 0.20) by 2050). Modelling showed that creating four more strategically placed protected areas would allow population recovery towards 1970 levels, with an estimated 47% probability of reaching 50% of the 1970 population size by 2050. For Hector's dolphins, reducing fisheries-related mortality to levels approaching zero shows the strongest promise as a means of meeting national and international guidelines for managing dolphin bycatch. If this could be achieved, the model indicates that there is a 59% probability of the population reaching 50% of its 1970 population size by 2050.

Recent modelling work by Davies and others (Davies et al. 2008) has estimated that 110–150 Hector's dolphins are killed each year in the commercial gillnet fishery, plus an unknown number in trawl fisheries and recreational gillnets. This result has major implications for management of the species (with the caveat that the work is still subject to formal science peer-review). It is worth noting, however, that the two most recent risk analyses for Hector's dolphin used different methods, but came to very similar conclusions. The risk of population decline under current management was estimated at 86% by Slooten (OU) (Slooten 2007) and at 82% by Davies et al. (2008). The risk of decline drops to around 14% if gillnetting is restricted to areas with >100 m water depth (i.e. Option 3 in the draft Threat Management Plan (DOC & MFish 2007)) or 2% if dolphins are completely protected from fisheries mortality. By 2050, populations are predicted to decline to 5475 (Slooten 2007) or 5631 (Davies et al. 2008) if current management continues, and to recover to 14 650 (Davies et al. 2008) or 15 411 (Slooten 2007) if fisheries mortalities are reduced to zero. Likewise, Davies et al.'s (2008) estimate of current population depletion compared to 1970

population size (34%) is very similar to Slooten's (2007) estimate (27%). Both analyses indicate that Hector's dolphin is Endangered (reduction to < 50% over three generations—39 years for Hector's dolphin, IUCN 2001, 2007).

E. Slooten and S. Dawson (OU) estimated Potential Biological Removals (PBRs) for Hector's dolphins as an indication of the level of bycatch that, if exceeded, is likely to cause population decline. PBRs were less than one individual per year for most populations and the total for the whole species is less than 10 per year. Current estimated bycatch is on the order of 10–35 times higher than these PBRs. This is consistent with several population viability analyses which indicate that, under current management, Hector's dolphin populations are declining rapidly.

In winter 2007, S. Childerhouse (OU), C.S. Baker (UA), G. Dunshea (AAD) and colleagues undertook a 3-week survey of southern right whales (SRWs) at the Auckland Islands. More than 200 SRWs were counted during a systematic survey of Port Ross and the northern end of the Auckland Islands. Two hundred and forty-three biopsies and more than 350 photo-IDs were collected. These will be matched with existing material collected from the Auckland Islands in 1995–98, 2006 and, more recently, from around mainland New Zealand.

The 9th Annual Meeting of the South Pacific Whale Research Consortium (SPWRC) was held at the University of Auckland on 5–8 February, 2007. Over 30 participants attended, including researchers and wildlife managers from throughout the region. As usual, much of the meeting was devoted to the consideration of data collected during synoptic humpback whale research programmes, including the matching of fluke catalogues and genetic analyses. Several new matches were made between existing catalogues, demonstrating a significant degree of interchange between over-wintering grounds.

11. References

Bejder, L.; Dawson, S. 2001: Abundance, residency, and habitat utilisation of Hector's dolphins (*Cephalorhynchus hectori*) in Porpoise Bay, New Zealand. *New Zealand Journal of Marine and Freshwater Research 35*: 277–287.

Childerhouse, S. 2002: Cetacean research in New Zealand 2001. *DOC Science Internal Series 87*. Department of Conservation, Wellington. 18 p.

Childerhouse, S. 2004: Cetacean research in New Zealand 2002/03. *DOC Science Internal Series 158*. Department of Conservation, Wellington. 21 p.

Childerhouse, S. 2005: Cetacean research in New Zealand 2003/04. *DOC Research & Development Series 214*. Department of Conservation, Wellington. 20 p.

Childerhouse, S. 2006: Cetacean research in New Zealand 2004/05. *DOC Research & Development Series 235*. Department of Conservation, Wellington. 20 p.

Childerhouse, S. 2010a: Cetacean research in New Zealand 2005/06. *DOC Research & Development Series 321*. Department of Conservation, Wellington. 24 p.

Childerhouse, S. 2010b: Cetacean research in New Zealand 2006/07. *DOC Research & Development Series 323*. Department of Conservation, Wellington. 24 p.

Childerhouse, S.; Donoghue, M. 2002: Cetacean research in New Zealand 1997–2000. *DOC Science Internal Series 46*. Department of Conservation, Wellington. 48 p.

Dahood, A.; Würsig, B.; Vernon, Z.; Bradshaw, I.; Buurman, D.; Buurman, L. 2008: Tour operator data illustrate long term dusky dolphin (*Lagenorhynchus obscurus*) occurrence patterns near Kaikoura, New Zealand. Unpublished paper SC/60/WW2 presented to the Scientific Committee, IWC, June 2008. 9 p.

Davies, N.M.; Bian, R.; Starr, P.; Lallemand, P.; Gilbert, D.; McKenzie, J. 2008: Risk analysis for Hector's dolphin and Maui's dolphin subpopulations to commercial set net fishing using a temporal-spatial age-structured model. Ministry of Fisheries, Wellington, New Zealand. www.fish.govt.nz.

DOC (Department of Conservation) & MFish (Ministry of Fisheries) 2007: Hector's dolphin draft threat management plan. Department of Conservation (www.doc.govt.nz) and Ministry of Fisheries (www.fish.govt.nz).

Freidheim, R.L. (Ed.) 2001: Towards a sustainable whaling regime. University of Washington Press, Seattle, WA. 382 p.

Green, E. 2003: Population biology and the effects of tourism on Hector's dolphins (*Cephalorhynchus hectori*), in Porpoise bay, New Zealand. Unpublished MSc thesis, University of Otago, Dunedin.

Slooten, E. 2007: Criticism is unfounded: reply to Middleton et al. (2007). *Endangered Species Research 3*: 335–339.

Appendix 1

ASSOCIATED LITERATURE 2007/08

This is a summary of published, 'in press' and unpublished reports relating to cetacean research in 2006/07, as compiled for the New Zealand National Progress Report on Cetacean Research and presented to the Scientific Committee of the International Whaling Commission.

Published or 'in press' papers (as at March 2008)

Baker, C.S.; Cooke, J.; Lavery, S.; Dalebout, M.L.; Ma, Y-U.; Funahashi, N.; Carraher, C.; Brownell, R.L. Jr. 2007: Estimating the number of whales entering trade using DNA profiling and capture-recapture analysis of market products. *Molecular Ecology 16*: 2617–2626.

Barlow, J.; Rankin, S.; Dawson, S.M. in press: A guide to constructing hydrophones and hydrophone arrays for monitoring marine mammal vocalisations. *NOAA Tech Memo 417*.

Beatson E.L. 2007: The diet of pygmy sperm whales, *Kogia breviceps*, stranded in New Zealand: implications for conservation. *Reviews in Fish Biology & Fisheries 17(2–3)*: 295–303.

Beatson, E.L.; O'Shea, S.; Ogle, M. 2007: The diet of long-finned pilot whales, *Globicephala melas*, stranded in New Zealand: implications for conservation. *New Zealand Journal of Zoology 34(1)*: 51–56.

Beatson, E.L.; O'Shea, S.; Stone, C.; Shortland, T. 2007. Notes on New Zealand mammals 6. Second report on the stomach contents of long-finned pilot whales, *Globicephala melas*. *New Zealand Journal of Zoology 34(4)*: 359–362.

Caballero, S.; Trujillo, F.; Vianna, J.; Barrios-Garrido, H.; Montiel, M.; Beltran-Pedreros, S.; Marmontel, M.; Santos, M.; Rossi, M.; Santo, F.; Baker, C.S. 2007: Taxonomic status of the genus Sotalia: species level ranking for "tucuxi" (*Sotalia fluviatilis*) and "costero" (*Sotalia guianensis*) dolphins. *Marine Mammal Science 23*: 358–386.

Constantine, R.; Bejder, L. 2008: Managing the whale- and dolphin-watch industry: time for a paradigm shift. In: Higham, J.; Luck, M. (Eds): Marine wildlife and tourism management. CABI Press, Oxford.

Constantine, R.; Russell, K.; Gibbs, N.; Childerhouse, S.; Baker, C.S. 2007: Photo-identification of humpback whales in New Zealand waters and their migratory connections to breeding grounds of Oceania. *Marine Mammal Science 23*: 715–720.

Currey, R.J.C.; Dawson, S.M.; Slooten, E. 2007: New abundance estimates suggest Doubtful Sound bottlenose dolphins are declining. *Pacific Conservation Biology 13*: 265–273.

Dalebout, M.L.; Baker, M.L.; Steel, D.; Robertson, K.; Chivers, S.; Perrin, W.; Mead, J.; Grace, R.; Schofield, D. 2007: A divergent mtDNA lineage among Mesoplodon beaked whales: molecular evidence for a new species in the tropical Pacific? *Marine Mammal Science 23*: 954–966.

Dawson, S.M. in press: *Cephalorhynchus* dolphins. In Perrin, W.F.; Würsig, B.; Thewissen, J.G.M. (Eds): Encyclopedia of marine mammals. Academic Press, San Diego. 2nd Edition.

Dawson, S.M. in press: Marine mammals. In: Knox, G.; Scott, R. (Eds): The natural history of Canterbury. Canterbury University Press, Christchurch.

Dawson, S.M.; Wade, P., Slooten, E.; Barlow, J. in press: Design and field methods for sighting surveys of cetaceans in coastal and riverine habitats. *Mammal Review*.

DuFresne, S.; Grant, A.; Norden, W.; Pierre, J. 2007: Factors affecting cetacean bycatch in a New Zealand trawl fishery. *DOC Research & Development series 282*. Department of Conservation, Wellington. 18 p.

Endo, T.; Ma, Y.-U.; Baker, C.S.; Funahashi, N.; Lavery, S.; Dalebout, M.L.; Lukoschek, V.; Haraguchi, K. 2007: Contamination level of mercury in red meat products from cetaceans available from South Korea markets. *Marine Pollution Bulletin 54*: 669–677.

Gomez-Villota, F. in press: Sperm whale diet in New Zealand: implications for conservation. VDM Publishing.

Harlin-Cognato, A.D.; Markowitz, T.M.; Würsig, B.; Honeycutt, R.L. 2007: Multi-locus phylogeography of the dusky dolphin (*Lagenorhynchus obscurus*): passive dispersal via the west-wind drift or response to prey species and climate change? *BMC Evolutionary Biology 7*: 131.

Jackson, J.A.; Patenaude, N.J.; Carroll, E.L.; Baker, C.S. 2007: How few whales were there after whaling? Inference from contemporary mtDNA diversity. *Molecular Ecology 17*: 236–251.

Mehta, A.V.; Allen, J.; Constantine, R.; Garrigue, C.; Jann, B.; Gill, P.; Jenner, C.; Marx, M.; Matkin, C.; Mattila, D.; Minton, G.; Mizroch, S.; Olavarría, C.; Robbins, J.; Russell, K.; Seton, R.; Steiger, G.; Vikingsson, G.; Wade P.R.; Witteveen, B.R.; Clapham, P. 2007: Baleen whales are not important as prey for killer whales (*Orcinus orca*) in high latitudes. *Marine Ecology Progress Series 348*: 297–307.

Meynier, L.; Stockin, K.A.; Bando, M.K.H.; Duignan, P.J. in press: Stomach contents of common dolphins (*Delphinus* sp.). *New Zealand Journal of Marine and Freshwater Research*.

Olavarría, C.; Baker, C.S.; Garrigue, C.; Poole, M.; Hauser, N.; Caballero, S.; Flórez-González, L.; Brasseur, M.; Bannister, J.; Capella, J.; Clapham, P.J.; Dodemont, R.; Donoghue, M.; Jenner, C.; Jenner, M.N.; Moro, D.; Oremus, M.; Paton, D.A.; Russell, K. 2007: Population structure of humpback whales throughout the South Pacific and the origins of the eastern Polynesian breeding grounds. *Marine Ecology Progress Series 330*: 257–268.

Oremus, M.; Poole, M.M.; Steel, D.; Baker, C.S. 2007: Isolation and interchange among insular spinner dolphin communities in the South Pacific revealed by individual identification and genetic diversity. *Marine Ecology Progress Series 336*: 275–289.

Patenaude, N.J.; Portway, V.A.; Schaeff, C.M.; Bannister, J.L.; Best, P.B.; Payne, R.S.; Rowntree, V.J.; Rivarola, M.; Baker, C.S. 2007: Mitochondrial DNA diversity and population structure among southern right whales (*Eubalaena australis*). *Journal of Heredity 98*: 147–157.

Slooten, E. 2008: Conservation management in the face of uncertainty: effectiveness of four options for managing Hector's dolphin bycatch. *Endangered Species Research 3*: 169–179.

Stockin, K.A.; Binedell, V.; Wiseman, N.; Brunton, D.H.; Orams M.B. in press: The behavioural ecology of free-ranging common dolphins (*Delphinus* sp.) in the Hauraki Gulf, New Zealand. *Marine Mammal Science*.

Stockin, K.A.; Law, R.J.; Duignan, P.J.; Jones, G.W.; Porter, L.; Mirimin, L.; Meynier, L.; Orams, M.B. 2007: Trace elements, PCBs and organochlorine pesticides in New Zealand common dolphins (*Delphinus* sp.). *Science of the Total Environment 387(1–3)*: 333–345.

Stockin, K.A.; Lusseau, D.; Binedell, V.; Wiseman, N.J.; Orams, M.B. 2008: Tourism affects the behaviour budget of common dolphins (*Delphinus* sp.) in the Hauraki Gulf, New Zealand. *Marine Ecology Progress Series 355*: 287–295.

Stockin, K.A.; Pierce, G.J.; Binedell, V.; Wiseman, N.J.; Orams, M.B. (in press): Occurrence and distribution of common dolphins (*Delphinus* sp.) in the Hauraki Gulf, Auckland. *Aquatic Mammals*.

Stockin, K.A.; Wiseman, N.; Hartman, A.; Moffat, N.; Roe, W.D. (in press): The use of radiography to assist with vessel collision diagnostics in a dead Bryde's whale (*Balaenoptera brydei*) in New Zealand waters. *New Zealand Journal of Marine and Freshwater Research*.

Tezanos-Pinto, G.; Baker, C.S.; Russell, K.; Martien, K.; Baird, R.; Hutt, A.; Stone, G.; Mignucci-Giannoni, A.; Caballero, S.; Endo, T.; Lavery, S.; Oremus, M.; Olavarría, C.; Garrigue, C. (in press): A worldwide perspective on the population structure and genetic diversity of bottlenose dolphins (*Tursiops truncatus*) in New Zealand. *Journal of Heredity*.

Vaughn, R.L.; Würsig, B.; Shelton, D.E.; Timm, L.L.; Watson, L.A. in press: Dusky dolphins influence prey accessibility for seabirds in Admiralty Bay, New Zealand. *Journal of Mammalogy 89(4)*.

Vaughn, R.L.; Shelton, D.E.; Timm, L.L.; Watson, L.A.; Würsig, B. 2007: Dusky dolphin (*Lagenorhynchus obscurus*) feeding tactics and multi-species associations. *New Zealand Journal of Marine and Freshwater Research 41*: 391–400.

Würsig, B.; Duprey, N.; Weir, J. 2007: Dusky dolphins (*Lagenorhynchus obscurus*) in New Zealand waters: present knowledge and research goals. *DOC Research & Development Series 270*. 28 p.

Unpublished literature (as at March 2008)

Beatson, E.L.; O'Shea, S.; Ngatiwai Trust Board 2007: Report on the stomach contents of long-finned pilot whales stranded on the Ruakaka Coast, New Zealand. New Zealand Marine Sciences Society Annual Conference, 29–31 August 2007, Hamilton.

Duprey, N. 2007: Dusky dolphin (*Lagenorhynchus obscurus*) behaviour and human interactions: implications for tourism and aquaculture. Unpublished MSc thesis, Texas A&M University, Texas. 73 p.

Hamner, R.M. 2008: Population structure, gene flow and dispersal of Hector's dolphin (*Cephalorhynchus hectori hectori*) around the South Island of New Zealand. Unpublished MSc thesis, University of Auckland, Auckland.

Markowitz, T.M. 2007: Tourism effects on dusky dolphins at Kaikoura: progress report January to June 2007. Kaikoura Dusky Dolphin Tourism Research Project for the New Zealand Department of Conservation, Nelson (unpublished). 13 p.

Markowitz, T.M.; Markowitz, W.J. 2007: Tourism effects on dusky dolphins at Kaikoura: progress report July to December 2007. Kaikoura Dusky Dolphin Tourism Research Project, for the New Zealand Department of Conservation, Nelson (unpublished). 15 p.

Olavarría, C. 2008: Population structure of southern hemisphere humpback whales. Unpublished PhD thesis, University of Auckland, Auckland.

Oremus, M.; Ward, J.; Penaia, L.; Ifopo, P.; Bell, L.; Pesaleli, T. 2007: Report on whale and dolphin watching feasibility survey in Samoa and biopsy training, May–June 2007. Copies of report available from M. Oremus, Auckland University.

Oremus, M. 2008: Genetic and demographic investigation of population structure and social system in four Delphinid species. Unpublished PhD thesis, University of Auckland, Auckland.

Oremus, M.; Gales, R.; Constantine, R.; Baker, C.S. 2008: Population structure of long-finned pilot whales in Tasmania and social dynamics of mass strandings. ACAMMS report. Copies of report available from M. Oremus, Auckland University.

Pinkerton, M.H.; Hanchet; S.; Bradford-Grieve, J. 2006: Progress towards a trophic model of the ecosystem of the Ross Sea, Antarctica, for investigating effects of the Antarctic toothfish fishery. Paper EMM-06-14 presented to the Ecosystem Monitoring and Modelling Working Group, CCAMLR, 17–28 July 2006, Walvis Bay, Namibia. 23 p.

Pinkerton, M.H.; Hanchet; S.; Bradford-Grieve; J.; Cummings; V.; Wilson, P.; Williams, M. 2006: Modelling the effects of fishing in the Ross Sea. Final Report to Ministry of Fisheries Project ANT2004–05. 169 p.

Pinkerton, M.H.; Hanchet, S.M.; Bradford-Grieve, J.M. 2007: A balanced trophic model of the ecosystem of the Ross Sea, Antarctica for investigating effects of the Antarctic toothfish fishery. Paper EMM-07-18 presented to the Ecosystem Monitoring and Modelling Working Group, CCAMLR, 16–27 July 2007, Christchurch, New Zealand. 24 p.

Shelton, D.E. 2007: Dusky dolphins in New Zealand: group structure by sex and relatedness. Unpublished MSc thesis, Texas A&M University, Texas. 75 p.

Weir, J. 2007: Dusky dolphin nursery groups off Kaikoura. Unpublished MSc thesis, Texas A&M University, Texas. 75 p.

Wiseman, N. 2008: Genetic identity and ecology of Bryde's whales in the Hauraki Gulf, New Zealand. Unpublished PhD thesis, University of Auckland, Auckland.

Würsig, B.; Würsig, M. (Eds) in prep.: Master acrobats: dusky dolphins off different shores. Academic Press.