New Zealand Progress Report on cetacean research April 2009 to April 2010

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1. SPECIES AND STOCKS STUDIED

IWC common name	IWC recommended scientific name	Area/stock(s)	Items referred to
Southern right whale	*Eubalaena australis*	NZ subantarctic and mainland	2.1.1; 3.1.1; 4.1
Humpback whale	*Megaptera novaeangliae*	Group E	2.1.1: 2.1.2; 3.1.1; 4.1; 11.1
Common dolphin	*Delphinus delphis*	NZ	2.1.1; 2.1.2; 2.2; 3.1.1; 4.4; 7.3.2; 8; 9; 11
Hector's dolphin	*Cephalorynchus hectori hectori*	NZ	2.1,2.1,2.2; 3.1.1; 4.3; 5.0; 8; 9; 11.1; 11.2
Maui's dolphin	*Cephalorynchus hectori maui*	NZ	2.1.1; 3.1.1; 4.1; 5.0, 11.1
Bottlenose dolphin	*Tursiops truncatus*	NZ	2.1.1; 2.2; 3.1.1 4.3; 7.3.2; 8; 9; 11.1, 11.2
Gray's beaked whale	*Mesoplodon grayi*	NZ	4.3; 8
Long-finned pilot whale	*Globicephala melas*	NZ	4.3; 7.3.2; 8; 9; 11.1
Bryde's whale	*Balaenoptera brydei*	NZ	2.1.1; 2.1.2; 3.1.1; 6.3.1;11.1
Sperm whale	*Physeter macrocephalus*	Kaikoura, NZ	2.1.2, 2.2, 3.1, 9, 11.2
Common dolphin	*Delphinus* sp.	NZ	2.1.1, 2.1.2, 3.1.1, 4.3, 4.4, 9, 11.1, 11.2
Pygmy sperm whale	*Kogia breviceps*	NZ	4.3
Long-finned pilot whale	*Globicephala melas*	NZ	4.3; 5.0, 11.1
Killer whales	*Orcinus orca*	NZ	2.1.2.
Dusky dolphin	Cephalorhynchus hectori	NZ	2.1.1, 2.1.2,3.1, 9.0, 11.1, 11.2

2. SIGHTINGS DATA

2.1 Field work

2.1.1 Systematic

Give brief details of **systematic** surveys, when and where held and references to cruise reports if applicable. A summary table of sightings may be included (e.g. see below).

Target species	Date	Area	No. of sightings	Contact person/institute and references
Southern right whale	15/7-6/8/09	Auckland Islands	401	S.Childerhouse (AAD)
Common dolphin	Jan – March 2010	Hauraki Gulf	33 groups	K. Stockin (MU-A)
Brydes whale	Jan – March 2010	Hauraki Gulf	9 encounters	S. Dwyer (MU-A)
Humpback whale	13 June – 11 July 2009	Cook Strait	46	N Bott (DOC)
Sperm whale	13 June – 11 July 2009	Cook Strait	1	N.Bott (DOC)
Hector's dolphin	2-5 June 2009	Pegasus Bay, Christchurch		R. Mattlin (MWR), D Clement (CAW)
Hector's dolphin	7-11 September 2009	Pegasus Bay, Christchurch		R. Mattlin (MWR), D Clement (CAW)
Hector's dolphin	2-21 March 2010/	Southland Coast (Foveaux Strait)		D Clement (CAW), R. Mattlin (MWR),
Hector's dolphin	8 March 2010/	TeWaeWae Bay (Foveaux Strait)		D Clement (CAW), R. Mattlin (MWR),
Humpback Whales	October 2009	Raoul Island	112	K. Baird (F&B)
Dusky dolphin	01 & 02/2008 01 & 03 2009	Haumuri Bluffs – Waiau River	56	S. Du Fresne (DEL/SMRU Ltd)
Various	Feb-March 2010	Ross Sea area and Balleny Islands		S.Childerhouse and N.Gales(AAD), R.Constantine (UoA)

S. Childerhouse (AAD), E. Carroll (UOA) and W. Rayment (UOO) completed a 15-day trip from 15 July to 6 August 2009 to the Auckland Islands aboard R/V "Evohe". This was the fourth year of a four year research programme involving winter field surveys for Southern Right Whales (SRWs) to the Auckland Islands. Large numbers of SRWs were found in Port Ross and around the northern end of the Auckland Islands. A total of 254 biopsies and a similar number of individual identification photos were collected. These will be matched with the existing material collected from the Auckland Islands in 1995-98 and 2006-2008, and more recently, around mainland New Zealand (under collaborative agreement between Department of Conservation and University of Auckland). Six implantable satellite tags were deployed on southern right whales and is the first time that this work has been undertaken on this species in New Zealand or Australia. Five of the six tags transmitted for an average of 105 days with maximum transmission time of 170 days. Three of the five whales travelled to feeding grounds at approximately 42-45°S South of Australia and the remaining two stayed in the Auckland Islands until their tags stopped. The expedition were generously supported by the supported by the New Zealand Ministry of Foreign Affairs and Trade, Australian Antarctic Division, University of Auckland, University of Otago, Department of Conservation, South Pacific Whale Research Consortium, Fundación CEQUA and Marine Conservation Action Fund.

K. Baird (F&B) in association with DOC conducted a one day Humpback Whale survey at the Kermadec Islands with the objectives to estimate the number of humpback and other whales frequenting the waters off Raoul Island on a given day at the peak of the southern migration. 112 animals were sighted and behaviours recorded.

R Mattlin (MWR), S DuFresne (MWR) and D Clement (CAW) conducted a series of aerial line transect surveys between 2nd and 5th June 2009 to monitoring marine mammal presence within and in the vicinity of a proposed aquaculture farm site and two control sites near Pegasus Bay for one year. The timing of the surveys was equally spaced at three monthly intervals to roughly coincide with spring, summer, autumn and winter – this particular survey represented the winter sampling.

D. Clement (CAW), R. Mattlin (MWR), T Webster (OU), and E Martinez (MU-A) conducted a series of aerial line transect surveys between 2nd and 21st March 2010 to examine the distribution and abundance of Hector's dolphin (*Cephalorhynchus hectori hectori*) along the south coast of the South Island. This study consists of one summer and one winter survey, and will be completed in November 2010. It is hoped this information will assist managers (MFish and DoC) when developing possible future management options aimed at reducing threats, including fishing related threats, to the population.

D. Clement (CAW), R. Mattlin (MWR) and T Webster (OU) undertook helicopter surveys of Hector's dolphin (*Cephalorhynchus hectori hectori*) to collect additional data on dolphin surface intervals in order to obtain an estimate of dolphin availability for later abundance calculations.

K. Stockin (MU-A) in conjunction with G. Machovsky (MU-A), S. Dwyer (MU-A) and D. Raubenheimer (MU-A) continue to examine the behavioural interactions of common dolphins with Bryde's whales and Australasian gannets (*Morus serrator*) in the Hauraki Gulf, Auckland.

S. Dwyer (MU-A) in association with K. Stockin (MU-A) commenced a doctoral study in Jan 2010 investigating the distribution and density of common dolphins in the Hauraki Gulf, Auckland. This study aims to describe the distribution of common dolphins using Hauraki Gulf waters, calculate density estimates and identify hotspots within the region used for feeding and nursing groups. Photo-ID work will continue on from previous research conducted by the New Zealand Common Dolphin Project, initiated by MU-A.

E. Martinez (MU-A) in association with K. Stockin (MU-A); M. Orams (AUT); D. Clement (Cawthron Institute); D. Brunton (MU-A); and E. Slooten (OU) are in the final stages of analysing data collected between 2005 and 2008 austral summers (15 months in total). The aim of this research is to examine 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 three-minute focal group scan sampling methodology from both land- and vessel-based platforms. The doctoral thesis and a final report to the Department of Conservation are scheduled to be submitted before the end of 2010.

E. Martinez (MU-A) in association with M. Orams (AUT) conducted a pilot study for the Department of Conservation to assess whether the use of stones by swimmers to attract dolphins during swim-with-dolphin encounters in Akaroa, is inducing a change in the Hector's dolphins' behaviour. Data were collected between 01/11/08 and 07/12/08 from commercial swim-with-dolphin vessels. The outcomes of this study indicate that the use of stones by tourists to create underwater sounds results in changes in the dolphins' proximity to swimmers and in dolphins' behaviour. When using stones or being active, swimmers were significantly more likely to have Hector's dolphins in close proximity. A report to the Department of Conservation was submitted in May 2009 (see Martinez and Orams 2009).

V. Petrella (MU-A) in association with K. Stockin (MU-A) and D. Brunton (MU-A) completed a doctoral study investigated the vocal repertoire of common dolphins in the Hauraki Gulf, Auckland. This study assessed whistle characteristics of New Zealand common dolphins for the first time, describing their vocal repertoire in relation to feeding and non-feeding activities. This research is now being expanded to examine changes in vocal behaviour in relation to the presence of associated species and boat traffic within the region.

N. de la Brosse (MU-A) in conjunction with K. Stockin (MU-A) completed a master research project which investigated the role of mother-offspring common dolphin pairs within foraging aggregations in the Hauraki Gulf, Auckland. Between 18 March and 27 July 2009, at total of 198 hr on-effort survey time was conducted, resulting in 86 independent encounters with common dolphin groups. Mother-offspring pairs predominantly engaged in cooperative rather than individual foraging strategies, with water depth, sea surface temperature, and group size having no influence on foraging strategies employed by mother-offspring pairs. Cooperative foraging strategies employed by focal groups had no significant influence on the location of the young within a group. Mother-offspring pairs were observed in association with Australasian gannets and Bryde's whales during 68.4% and 8.4% of encounters, respectively. While neither species were found to affect the foraging strategies employed by mother-offspring pairs, diving gannets did have an affect on the location of mother-offspring pairs within feeding groups, with offspring typically located on the peripheral edge of focal group. Since mothers permit offspring in the centre of mono-specific feeding groups, the use of peripheral regions maybe associated with the presence of mixed-species feeding aggregations.

N.Bott (nee Gibbs) (DOC) with the support of ex-whalers led a four week survey in June and July 2009 in the Cook Strait. This was the sixth year of a dedicated humpback whale survey in Cook Strait, New Zealand. From 230 hours of land based observation, 29 pods of humpback whales were observed. Fifteen photo-IDs and 20 genetic samples were obtained. These will be matched to existing material collected from Cook Strait in previous years and in the wider Oceania humpback whale population. One sperm whale was also encountered during the survey. This project receives generous support from OMV NZ Ltd, Transact Management Ltd and Canon NZ Ltd.

K. Preston, E. Hutchison, E. Slooten and S. Dawson (UOO) carried out photographic identification surveys of Hector's dolphins at Banks Peninsula. These data are used to estimate survival and reproductive rates, movements and other population dynamics parameters. K. Preston is also studying offshore distribution, mark rate, causes and rate of accumulation of identifying marks (including shark bites, net entanglements, etc.) and how mark rate affects estimates of survival, reproduction and associations among individuals.

E. Hutchison, S. Dawson and E. Slooten (OU) are investigating Hector's dolphin diet and habitat selection. Diet is being described using the complementary methods of stomach content and stable isotope analysis. Preliminary results indicate feeding throughout the water column on a wide variety of species, with benthic prey having the highest contribution. Concurrent dolphin, benthic prey and oceanographic surveys are being undertaken seasonally to assess which factors influence habitat use throughout Banks Peninsula waters. Techniques include both visual and acoustic surveys to assess dolphin distribution, and the use of fish traps and stereo-video to determine prey availability. The preliminary habitat results allow us to begin examining these predators in a wider ecosystem context.

R. Elliott (UOO) is using acoustic data loggers (T-PODs) in Doubtful Sound to carry out year-round monitoring of bottlenose dolphin habitat use. Presence and behaviour was quantified and compared between sites to provide data on critical areas for the population, to help improve conservation of the population. Results showed significant correlation of dolphin presence with surface water temperatures in Doubtful Sound. Dolphins actively avoided low surface water temperatures, which occurred in inner fiord sites during snow melt and high freshwater inputs in winter and spring. Freshwater input includes rain, streams emptying into Doubtful Sound and freshwater from a hydro-electric power station. In summer, dolphins inhabited inner fiord sites mostly, where surface water temperatures were highest. Foraging behaviour identified from the T-POD data indicates that site-specific foraging was not occuring in Doubtful sound. Foraging was opportunistic, with dolphins appearing to feed continuously when prey were available.

A. Growcott (UOO) collected sound recordings and stereo-photographs of sperm whales off Kaikoura to acoustically and photogrammetrically estimate their length. Sperm whale echolocation clicks are multi-pulsed and the distance between these pulses is used to estimate whale head length. Using the correlation between head length and total length, sperm whale length is estimated from their vocalisations. Acoustic length estimates were compared to those made using a boat-based stereo photogrammetry system, that enabled the measurement of the distance between the blowhole and dorsal fin (also highly correlated to total length). The two measurement methods produced similar length estimates and the equation describing this relationship was based on the largest number of sperm whales when compared to those previously published. These acoustic and photographic estimates of whale length will be compared with previously collected data to acoustically estimate individual growth rates. This is possible as many whales have been recorded on separate occasions over a period of 17 years. Von Bertalanffy growth curves fit the data well and show that most individuals were still growing.

S. Henderson (UOO) is carrying out fieldwork to estimate differences in dolphin survival, habitat use and ecology for resident bottlenose dolphin populations in Doubtful and Dusky sounds, in order to assess human impacts. His first year's research has seen the continuation of the long-term monitoring project in both Dusky (4 trips totaling 38 field days) and Doubtful Sound (4 trips totaling 27 field days). The monitoring project updates a dorsal fin ID database and enables mark-recapture based population estimation for both fiords. As of March the Dusky Sound bottlenose dolphin population is estimated to be 113 individuals, including 8 new calves this summer, while the Doubtful Sound bottlenose dolphin population is estimated at 57 individuals, including 6 new calves this summer. Seven temperature moorings, each with seven Hobo Temp temperature loggers have been positioned in Dusky Sound. These temperature moorings compliment the moorings in Doubtful Sound (run by Meridian energy) to enable a comparative approach to be taken to the seasonal movement of the dolphins in both fiords. The understanding of dolphin movements in relation to both temperature and salinity is being enhanced by the real time collection of surface water temperatures and salinities during all monitoring trips into both fiords. Preliminary testing has begun with a forward facing sonar unit (Interphase 200se) with the aim of monitoring dolphin movements in the water column. The goal is to establish whether their travelling dive profiles are influenced by the depth of the surface freshwater layer. The combination of photo-ID surveys, water temperature and salinity data and forward scaning sonar is being used to quantify whether dolphins minimise their time in the colder low salinity layer that lies on top the well mixed saltwater. The LSL is much more prominent in Doubtful Sound than in Dusky Sound, due to additional freshwater input from the hydroelectric power station.

In association with the Australian Antarctic Division and the National Institute of Water and Atmospherioc Research (NIWA), a six-week collaborative cruise funded by the governments of New Zealand and Asutralia was conducted to the Ross Sea area and the Balleny Islands by the R.V.Tangaroa, as part of the Southern Ocean Research partnership. Full details are provided in IWC62/SC/

2.1.2 Opportunistic, platforms of opportunity

Primary species	Area	Data type/method	Collected by	Platform	Location of archive (if applicable)	Contact person/institute and refs
Common dolphin	Hauraki Gulf	Location, group size, composition, associated species, behaviour, Photo-ID	K. Stockin	Commercial dolphin-watching vessel	MU-A	K. Stockin
Common dolphin	Hauraki Gulf	Location, group size	S. Dwyer	Coast guard vessels	MU-A	K. Stockin
Common dolphin	Hauraki Gulf	Mother-offspring dynamics (focal follows)	N. de la Brosse	Commercial dolphin-watching vessel	MU-A	K. Stockin
Common dolphin	Hauraki Gulf and Bay of Islands	Acoustic recordings, location, group size, behaviour,	V. Petrella	DOC research vessel and Commercial dolphin-watching vessel	MU-A	K. Stockin
Bottlenose dolphins	Hauraki Gulf	Location, group size, group composition, photo-ID	K. Stockin S. Dwyer N. de la Brosse	Commercial dolphin-watching vessel	MU-A	K. Stockin
Hector's dolphin	Banks Peninsula	Location, group size, photo-ID	E. Martinez (MU-A)	Commercial dolphin-watching and swim-with dolphin vessels	MU-A	E. Martinez
Bryde's whale	Hauraki Gulf	Location, group size, group composition, photo-ID	S. Dwyer K. Stockin	Massey University Research Vessel and Commercial dolphin-watching vessel	MU-A	S. Dwyer
Humpback whale	Akaroa Heads	Photo-ID*	Vessel crew	Dolphin watching vessel	DOC	N.Bott (DOC)
Hectors bottlenose, dusky and common dolphins and orca	Marlborough Sounds and the western Cook Strait area	Photo-ID	Vessel Crew	Dolphin watching vessel	NA	Dan & Amy Engelhaupt, Dolphin Watch Ecotours
Bryde's whale	Hauraki Gulf	Photo-ID; sightings	Crew & students	Whale-watching vessel	University of Auckland	R. Constantine (UA)
Dusky dolphin	Kaikoura	Behaviour / Group focal/Photo identification	Researcher	Dolphin swim tour vessel	Department of Conservation	W. Markowitz / MU D. Lundquist/OU
Sperm whale	Kaikoura	Behaviour / Individual focal/Photo identification	Researcher	Whalewatch tour	Department of Conservation	T. Markowitz PACENZRP
Sperm whale	Kaikoura	Behaviour / Interaction with vessels	Researcher	Wings Over Whales Airplane tout	Department of Conservation	T. Markowitz PACENZRP

E. Martinez (MU-A) analysed data collected during opportunistic surveys on board dolphin watching/swimming vessels in Akaroa Harbour as part of her doctoral research. Data collection focused on the behavioural ecology of Hector's dolphins in the presence of vessels and/or swimmers in Akaroa Harbour. A total of 254 photo-ID surveys conducted opportunistically from dolphin-watching and dolphin-swimming vessels were retained for analysis. 374 groups encountered resulting in a final catalogue of 50 unique marked individuals. When compared with the University of Otago photo-id catalogue (curated by E. Slooten and S. Dawson), 12% were new individuals. The doctoral thesis is scheduled for submission in 2010.

E. Martinez (MU-A), K. Stockin (MU-A) and F. Jordan (MU-A) undertook GIS mapping and data analyses as part of a Department of Conservation contract to analyse opportunistic data from tour and university vessels relating to killer whale and bottlenose dolphin occurrence in the Hauraki Gulf, Auckland.

T. Gaborit-Havenkort (MU-A) in conjunction with K. Stockin (MU-A) commenced an master study examining the occurrence of demographics of delphinids off Tauranga, Bay of Plenty. Using a historical 10 year data set in addition to new data collected from this region, this study will focus primarily on common and bottlenose dolphins, providing a baseline description of occurrence, demographics and habitat use for these waters. Opportunistic sightings and photo-ID research on Hector's, bottlenose, dusky and common dolphins and orca in the Marlborough Sounds and the western Cook Strait area. Preliminary findings suggest the Queen Charlotte Sound area is an area where high numbers of Hector's transit through as there are new photo-ids and varied seasonal sightings. Five separate groups of orca were seen in the Queen Charlotte Sound feeding along the shore on stingrays this year. Small groups of common dolphins (5-20) were sighted more often than usual during January and February this year and dusky dolphins were primarily encountered during the spring months. All species have photo-ID pictures, GPS lat and long, group size, behaviour, etc. information taken during encounters when possible using an employee or volunteer researcher on the tours.

2.2 Analyses/development of techniques

E. Carroll (UA) is conducting genetic profiling of New Zealand southern right whales. The dataset comprises samples collected from southern right whales from the NZ subantarctic during winter field surveys 1995-1998 (N=354) and 2006-2009 (N=833) and also from whales opportunistically sampled by the NZ Department of Conservation from around the New Zealand mainland from 2003 onwards (N=63). The genetic profile of these samples, comprising microsatellite genotype, mitochondrial haplotypes and sex, has been constructed for the samples collected from NZ subantarctic (1995-1998 & 2006-2008) and Mainland (2003-2007) and population structure within NZ waters has been examined (see SC/62/BRG16). The data generated will also be used to examine the population structure of southern right whales in NZ and Australia, and to investigate paternity and mating systems.

L. Hartel, R. Constantine (UA) and L. Torres (NIWA) studied the demographics and habitat use of bottlenose dolphins in the Bay of Islands. Habitat use was investigated via focal-group follows using a scan sampling methodology. Geographic Information Systems, kernel methods and Mantel tests were used to investigate whether (1) dolphin spatial distribution changed over time, (2) group composition affected habitat use, and (3) dolphin behaviour was influenced by environmental characteristics. When compared to the 1996-2000 study, the data showed a considerable change in the dolphins' spatial distribution, most likely due to the change in individuals using the area. However, movements to deeper water in the warm season remained consistent, as did calf groups frequenting areas with shallower water and less benthic slope. The consistency of seasonal movements and calf group preferences suggest they are both governed by something more than the change in individuals, such as migratory movements of prey and predation risk and food availability. Foraging locations changed between study periods, shifting from frequent foraging in mud in 1996-2000 to rocky areas in 2007-2010. Changes in prey type and distribution or changes in foraging strategies or preferences by individual dolphins could explain this shift. These results will be used by the Department of Conservation to re-evaluate the Bay of Islands management plan for this dolphin population.

A. Gormley (UOO) used data from line transect and photographic identification surveys to construct a Bayesian population model for Hector's dolphin. He estimated that the survival rate of Hector's dolphins at Banks Peninsula has increased by about 5% since the Banks Peninsula Marine Mammal Sanctuary was created. To our knowledge this is the first study which demonstrates an increase in survival (or any other demographic parameter) following the creation of a Marine Mammal Protected Area. The 5% increase suggests that Marine Mammal Protected Areas can be highly effective for small cetaceans. However, survival would need to increase by at least one more percent to prevent continued declines in this population.

W. Rayment (UOO) published data from three years of population surveys at Banks Peninsula (3 summers and 3 winters). This analysis (Rayment et al. 2009a) helps explain why survival rates in this area have improved, but not sufficiently to allow population recovery (or even stability). Dolphin sightings were concentrated close to shore in shallow water in summer, but were more evenly distributed throughout the area in winter. A greater proportion of dolphins were sighted outside the 4 nautical mile offshore boundary of the Banks Peninsula Marine Mammal Sanctuary in winter (mean 56%) than in summer (mean 19%; G 88.25, df 1, $P<0.001$). Partial Mantel tests revealed the effects of distance offshore and depth on dolphin occurrence while controlling for spatial autocorrelation and multicollinearity within the data. Distance offshore had the strongest and most consistent effect on dolphin presence, while depth had a strong effect in summer only. The Banks Peninsula Marine Mammal Sanctuary will need to be extended in order to reduce bycatch of Hector's dolphins to a sustainable level. A new offshore boundary of the Sanctuary would be best defined by distance from the coast (e.g. at least 15 nautical miles offshore).

M. van der Linde (OUU) analysed data from systematic sighting surveys of sperm whales off Kaikoura. Data from the last 17 years include sightings and sound recordings from 4,845 individual encounters with sperm whales. The digital photo-ID catalogue, encounter data, sound recording information and boat track data were integrated into a relational database. A total of 233 individuals (comprising 112 returning residents and 121 transients) were identified. Mark- recapture abundance estimates indicated that abundance of sperm whales in Kaikoura waters has declined significantly from 97 individuals (95% CI: 62 to 153) in 1991 to 46 individuals (95% CI: 36 to 60) in 2007. Similarly, annual abundance of the resident portion of the population declined significantly from 89 individuals (95% CI: 62 to 128) in 1991 to 50 individuals (95% CI: 40 to 62) in 2007. Pradel's reverse-time capture-recapture models were used to assess changes in population growth rate in relation to recruitment (additions of individuals through immigration) and survival rates. Survival was found to contribute 8-9 times more to changes in population growth rate. The apparent decline in abundance, combined with our limited knowledge of the cause of the decline suggests that a cautious management approach is warranted.

J. Rodda (UOO) is carrying out Geographically Weighted Temporal Regression (GWTR) analysis to analys habitat use of Hector's Dolphins in Te Waewae Bay, Southland. She is also using Mark-Recapture analysis to estimate population size and survival rates in this area.

R. Currey, E. Slooten and S. Dawson (UOO) carried out a quantitative threat assessment requested by the IUCN and using IUCN threat categories for the Fiordland bottlenose dolphin population. The population classifies as at least Endangered for all categories and met the criteria for Critically Endangered on the basis of the number of mature individuals and the predicted rate of subpopulation decline over one and three generations (Criteria A3 and C1; Currey et al. 2009). The dolphins of Doubtful Sound in Fiordland are declining in abundance, due in part to a recent halving of calf survival (Currey et al. 2009) which coincided with the commissioning of the second tailrace tunnel from the Manapouri hydroelectric power station. Nearby Dusky Sound also has a resident dolphin population, but has no anthropogenic input of fresh water.

L. Rowe (UOO) used dorsal fin identification photographs of bottlenose dolphins in Doubtful Sound and Dusky sound to compare levels of epidermal disease and laser photogrammetry to measure the dorsal fin base length of calves (<1 yr old) to assess differences in calf size and birth seasonality between the two populations. Epidermal lesions were common in both populations (affecting >95% of individuals), but lesion extent was 4 times higher in Doubtful Sound. Lesion extent was higher for female dolphins than for males in Doubtful Sound, but not in Dusky Sound. In Dusky Sound, calves were larger at first observation and were born over a longer period. The short calving season in Doubtful Sound may be an adaptation to localized temperature conditions. Anthropogenic impacts may contribute to the higher levels of epidermal disease in the Doubtful Sound population. The higher extent of epidermal lesions in females and the smaller size of calves in Doubtful Sound may be a factor in the low survival of calves in the population. The bottlenose dolphin Tursiops truncatus population in Doubtful Sound, New Zealand, has declined by over 34% since 1995 and is subject to potential impacts from tourism and habitat modification via freshwater discharge from a hydroelectric power station. The bottlenose dolphin population in neighbouring Dusky Sound is exposed to much lower levels of tourism and the fiord receives only natural freshwater runoff.

E. Slooten and S. Dawson (UOO) completed an analysis of the new Hector's dolphin protection measures (Slooten and Dawson, 2010). Estimates of catch rates in commercial gillnets from an observer programme (there are no quantitative estimates of bycatch by amateur gillnetters or in trawl fisheries) were used in a simple population viability analysis to predict the impact of this fishery under three scenarios: Option (A) status-quo management, (B) new regulations announced by the Minister of Fisheries in 2008 and (C) total protection. Uncertainty in estimates of population size and growth rate, number of dolphins caught and other model inputs were explicitly included in the analysis. Sensitivity analyses are carried out to examine the effect of variation in catch rate and the extent to which fishing effort is removed from protected areas but displaced to unprotected areas. The current Hector's dolphin population is clearly depleted, at an estimated 27% of the 1970 population. Population projections to 2050 under Options A and B predict that the total population is likely to continue declining. In the case of Option B this is driven mainly by continuing bycatch due to the much weaker protection measures on the South Island west coast. Without fishing mortality (Option C) all populations are projected to increase, with the total population approximately doubling by 2050 and reaching half of its 1970 population size in just under 40 years. By comparison, the current protection measures result in either declining populations or recovery to half of the 1970 population size taking more than 1000 years.

Target species	Date	Area	Methods/effort	Parameters/ factors measured	Contact person/institute; refs
Southern right whale	ongoing	NZ subantarctic & Mainland NZ	Genetic profiling / population structure analyses	Genetic identity and differentiation	S.Baker/ E. Carroll (UA); SC/62/BRG16
Bottlenose dolphin	Mar 2007-Jan 2010	Bay of Islands	Photo-ID; GIS	Distribution; sighting frequency	R. Constantine and L. Hartel (UA)

3. MARKING DATA

3.1 Field work

3.1.1 Natural marking data

Provide this in the form of a table, e.g.

Species	Feature	Area/stock	No. photo-id'd	Catalogue (Y/N)	Catalogue total	Contact person/institute; refs
Southern right whale	Callosities	Auckland Is, NZ	~250	Y	>600	W.Rayment, UO
Southern right whale	Head callosities	Mainland NZ	~26 (2009 and 2010)	Y	85	L. Boren, DOC
Bottlenose dolphin	Dorsal fins	Hauraki Gulf	10	In progress	~200	G. Tezanos-Pinto
Humpback whale	Fluke	Cook Strait	15	Y	84	N.Bott (DOC)
Bottlenose dolphin	Dorsal fin	Bay of Islands	121	Y	479	R. Constantine and L. Hartel (UA)
Bryde's whale	Dorsal fin	Hauraki Gulf	5	Y	77	R. Constantine (UA)
Humpback whale	Fluke	Tonga; Group E2	48	Y	685	R. Constantine (UA)
Humpback whale	Fluke	Ross Sea/Balleny Islands	61	Y		S. Childerhouse (AAD)
Common dolphin	Dorsal fin	Hauraki Gulf	ca 100	Y	ca 700	K. Stockin (MU-A)
Hector's dolphin	Dorsal fin/body	Akaroa Harbour	50	Y	50	E. Martinez (MU-A)
Common dolphin	Dorsal fin	Hauraki Gulf	ca 100	Y	ca 700	K. Stockin (MU-A)
Hector's dolphin	Dorsal fin/body	Akaroa Harbour	50	Y	50	E. Martinez (MU-A)
Hector's Dolphin	Dorsal fin	Kaikoura/New Zealand		Y		
Dusky Dolphin	Dorsal fin	Kaikoura, New Zealand		Y		W. Markowitz/MU
Sperm whale	fluke	Kaikoura		Y	23	M. Fernandez/UC

S.Smith and L. Boren (DOC) coordinated the collection of opportunistic sightings of southern right whales around the NZ mainland provided by researchers, the public and DOC staff. In addition to opportunistic sightings, genetic sample collection (n=22) was also undertaken around NZ. These were analysed along with existing archived samples to determine whether individuals seen around the main two islands of NZ are genetically or geographically isolated from our sub-Antarctic populations.
Trish O'Callaghan is continuing compilation and matching of the NZ long-finned pilot whale Photo-Id catalogue. Most image come in from stranded animals (both live and dead). No matches have been found as yet.

G. Tezanos-Pinto (UA), K. Stockin (MU-A), J. Berghan (independent) and collaborators are investigating the annual abundance of bottlenose dolphins (*T. truncatus*) in the Hauraki Gulf using mark-recapture through individual identification photographs. Photo-identification data collected in the Haruaki Gulf will be further analysed with data collected in the Bay of Islands during 2002-06 to investigate the level of interchange between regions and provide an abundance estimate for the larger north-eastern North Island population.

M. Oremus, R. Constantine, C.S. Baker (UA) conducted a total of 12 small-vessel surveys were conducted along the west coast of the North Island From the 4th of February to 2nd March 2010, between North Kaipara and South Tirua point. A total of 35 groups of Maui's dolphins were encountered during these surveys, with an average of 3.2 groups encountered per day (ranging from 0 to 7 groups per day). A total of 37 biopsy samples were collected from dolphins encountered from south of Kaipara Harbour to north of Raglan, the most extensive range of sampling to date. Dolphins showed little or no obvious behavioural response and typically re-approached the boat within a minute following the biopsy event. Samples will be used to estimate current abundance and trends using genetic capture-recapture methods by extending the previous study of samples collected from 2001 to 2006.

L. Hartel, R. Constantine (UA) and L. Torres (NIWA) studied the demographics and habitat use of bottlenose dolphins in the Bay of Islands. Boat surveys were conducted from an independent research vessel between March 2007 and January 2010. Demographic and photo-identification data were collected on 75 groups (121 individuals) to assess the population status. Group size ranged from 1-50 dolphins (median = 19), but groups of 9-12 dolphins were most common. Re-sight rates identified 25% of the dolphins (*n* = 30) as core users, suggesting the Bay of Islands is an important part of their home-range.

M. Donoghue (DOC), T. O'Callaghan, G. Soljak (UA) and E. Garland (UQ) conducted an 11-day field season in Vava'u, Tonga from 22nd September – 2nd October. Forty-six individual whales were photo-identified by fluke nine whales matched to previous years. Four tissue samples were collected from humpback whales and two from Cuvier's beaked whales. A total of 4 hrs 42 mins of song was recorded and will be analysed at University of Queensland. Data are analysed and curated by R. Constantine and K. Thompson (UA).

3.1.2. Artificial marking data
Nil

3.1.3 Telemetry data

Species	Tag type	No. successfully deployed	Maximum time transmitting	Contact person/institute; refs
Southern right whale	ARGOS satellite tag	6	170	S.Childerhouse, AAD

3.2 Analyses/development of techniques

G. Tezanos-Pinto (UA) completed a PhD study under the supervision of C. Scott Baker that investigated the population structure, abundance and reproductive parameters of bottlenose dolphins in the Bay of Islands. Genetic analysis suggested three different regional populations of bottlenose dolphins in New Zealand with low levels of female migration. Surprisingly, New Zealand populations have high levels of genetic diversity, which has been attributed to long-distance connectivity with other populations (Tezanos-Pinto et al., 2009). Analyses of individual identification photographs collected in the Bay of Islands from 1997-99 to 2003-05, suggested a very dynamic pattern of habitat use, with some animals changing their way they use the area over time. Overall, fewer dolphins were sighted in the Bay of Islands more frequently. However, a significant 38% decline in apparent adult abundance was detected from 204 (CV=0.03) dolphins using the Bay of Islands in 1998 to 126 (CV=0.02) in 2004. Additionally, mortality rates of calves were considerably higher than values reported in other regions (age 1+ 0.42, CI=0.27-0.57; age 2+=0.22 CI=0.08-0.58). Results presented in this thesis highlight the vulnerability of bottlenose dolphins along the north-eastern North Island. A precautionary approach to managing the sources of impact is needed throughout the range of this population.

G. Tezanos-Pinto (UA), D. Steel (OSU) and Scott Baker (OSU and UA) investigated the genetic diversity and levels of reproductive isolation among three bottlenose dolphins populations of New Zealand, by analyzing nuclear microsatellite markers. Skin biopsy samples collected in the three regions from 2003 to 2006 (n=219) were analysed at 11 microsatellite loci. The relative levels of genetic diversity were assessed by comparing values of allelic diversity and heterozygosity with other populations of bottlenose dolphins including an insular population from the Phoenix Islands in the Republic of Kiribati (n=28). A revised analysis of mtDNA haplotypes (after removal of a small number of replicate samples) confirmed a previously published finding of maternal isolation among the three regional populations ($F_{ST} = 0.15$, $\Phi_{ST} = 0.20$; $p < 0.001$). Pairwise tests of differentiation ($F_{ST} = 0.091$; $p < 0.001$) and Bayesian clustering analyses of the 11 nuclear microsatellite loci supported findings from the mtDNA haplotypes confirming reproductive isolation among the three regional populations. The north-eastern North Island presented the highest levels of genetic diversity (nuclear microsatellite alleles and mtDNA haplotypes) and Fiordland presented the lowest. Nevertheless, the genetic diversity of the Fiordland sample was not as low as might be expected from the very small reported census size (reported to be 54 animals by Currey et al., 2009) and assumed effective size of this population.

4. TISSUE/BIOLOGICAL SAMPLES COLLECTED

4.1 Biopsy samples (summary only)

Species	Area/stock	Calendar year/ season - no. collected	Archive d (Y/N)	No. analysed	Total holdings	Contact person/institute
Humpback whale	Cook Strait	2009/20	Y			N.Bott (DOC)
Southern right whale	Auckland Islands	2009/4 - 254	Y	0	1187	S.Baker/ E. Carroll (UA)

Southern right whale	Mainland NZ	2009/27	Y	0	50+	S.Baker/ E. Carroll (UA)
Maui's dolphin	West Coast, North Island	2010/summer - 37	Y	70	107 (2001-2010)	R. Constantine, C.S. Baker UA
Humpback whale	Ross Sea/Balleny Islands	2010 summer	Y	64		S. Childerhouse (AAD)

4.2 Samples from directed catches (commercial, aboriginal and scientific permits) or bycatches

Nil

4.3 Samples from stranded (and captive) animals

Species	Area/stock	Tissue type(s)*	No. collected	Archived (Y/N)	No. analysed	Contact person/institute
Hector's dolphin		formalin fixed	12	Y	ongoing	W Roe, Massey University
Hector's dolphin		frozen tissues	12	Y	ongoing	W Roe
Sperm whale	NZ	Skin, blubber	2	Y	0	E.Beatson/ AUT
Sperm whale	NZ	Stomach	1	Y	0	E.Beatson/ AUT
Sperm whale	NZ	Muscle	1	Y	0	E.Beatson/ AUT
Pygmy sperm whale	NZ	Skin, blubber	2	Y	0	E.Beatson/ AUT
Pygmy sperm whale	NZ	Stomach	3	Y	0	E.Beatson/ AUT
Pygmy sperm whale	NZ	Muscle	2	Y	0	E.Beatson/ AUT
Pygmy sperm whale	NZ	Liver	2	Y	0	E.Beatson/ AUT
Pygmy sperm whale	NZ	Kidney	2	Y	0	E.Beatson/ AUT
Long-finned pilot	NZ	Skin, blubber	101	Y	0	E.Beatson/ AUT
Long-finned pilot	NZ	Stomach	86	Y	0	E.Beatson/ AUT
Long-finned pilot	NZ	Muscle	88	Y	0	E.Beatson/ AUT
Long-finned pilot	NZ	Liver	63	Y	0	E.Beatson/ AUT
Long-finned pilot	NZ	Kidney	35	Y	0	E.Beatson/ AUT
Long-finned pilot	NZ	Reproductive	35	Y	0	E.Beatson/ AUT
Long-finned pilot	NZ	Teeth	99	Y	0	E.Beatson/ AUT
Cuvier's beaked whale	NZ	Stomach	1	Y	0	E.Beatson/ AUT
Gray's beaked whale	NZ	Skin, blubber	3	Y	0	E.Beatson/ AUT
Gray's beaked whale	NZ	Stomach	2	Y	0	E.Beatson/ AUT
Gray's beaked whale	NZ	Muscle	3	Y	0	E.Beatson/ AUT
Gray's beaked whale	NZ	Liver	3	Y	0	E.Beatson/ AUT
Gray's beaked whale	NZ	Kidney	2	Y	0	E.Beatson/ AUT
Gray's beaked whale	NZ	Reproductive	2	Y	0	E.Beatson/ AUT
Unidentified beaked	NZ	Skin, blubber	1	Y	0	E.Beatson/ AUT
Unidentified beaked	NZ	Stomach	1	Y	0	E.Beatson/ AUT
Unidentified beaked	NZ	Muscle	1	Y	0	E.Beatson/ AUT
Unidentified beaked	NZ	Liver	1	Y	0	E.Beatson/ AUT
Unidentified beaked	NZ	Kidney	1	Y	0	E.Beatson/ AUT
Unidentified beaked	NZ	Reproductive	1	Y	0	E.Beatson/ AUT
Hector's dolphin	NZ	Stomach	5	Y	5	E.Beatson/ AUT
Common dolphin	NZ	Skull	14	Y	In	K. Stockin (MU-A)
Common dolphin	NZ	Skin, blubber	17	Y	In	K. Stockin (MU-A)
Common dolphin	NZ	Liver, kidney,	14	Y	In	K. Stockin (MU-A)
Common dolphin	NZ	Teeth	12	Y	12	K. Stockin (MU-A)
Common dolphin	NZ	Stomach	13	Y	In	K. Stockin (MU-A)
Common dolphin	NZ	Repro tissues	12	Y	12	K. Stockin (MU-A)
Common dolphin	NZ	Fixed tissues	7	Y	7	K. Stockin (MU-A)
Common dolphin	NZ	Pectoral	14	Y	In	K. Stockin (MU-A)
Bottlenose dolphin	NZ	Skull	3	Y	In	K. Stockin (MU-A)
Bottlenose dolphin	NZ	Skin, blubber	3	Y	In	K. Stockin (MU-A)
Bottlenose dolphin	NZ	Liver, kidney,	14	Y	In	K. Stockin (MU-A)
Bottlenose dolphin	NZ	Teeth	2	Y	In	K. Stockin (MU-A)
Bottlenose dolphin	NZ	Stomach	3	Y	In	K. Stockin (MU-A)
Bottlenose dolphin	NZ	Repro tissues	3	Y	In	K. Stockin (MU-A)

Bottlenose dolphin	NZ	Fixed tissues	2	Y	2	K. Stockin (MU-A)
Bottlenose dolphin	NZ	Pectoral	3	Y	3	K. Stockin (MU-A)
Pygmy sperm whale	NZ	Skull	3	Y	In	K. Stockin (MU-A)
Pygmy sperm whale	NZ	Skin, blubber	3	Y	In	K. Stockin (MU-A)
Pygmy sperm whale	NZ	Liver, kidney,	3	Y	In	K. Stockin (MU-A)
Pygmy sperm whale	NZ	Teeth	1	Y	In	K. Stockin (MU-A)
Pygmy sperm whale	NZ	Stomach	3	Y	In	K. Stockin (MU-A)
Pygmy sperm whale	NZ	Repro tissues	3	Y	In	K. Stockin (MU-A)
Pygmy sperm whale	NZ	Fixed tissues	3	Y	In	K. Stockin (MU-A)
Pygmy sperm whale	NZ	Pectoral	3	Y	In	K. Stockin (MU-A)
Long-finned pilot	NZ	Fixed tissues	1	Y	In	K. Stockin (MU-A)
Long-finned pilot	NZ	Skin, blubber	2	Y	In	K. Stockin (MU-A)
Long-finned pilot	NZ	Liver, Kidney	2	Y	In	K. Stockin (MU-A)
Long-finned pilot	NZ	Pectoral	2	Y	In	K. Stockin (MU-A)
Long-finned pilot	NZ	Skull	2	Y	In	K. Stockin (MU-A)
Long-finned pilot	NZ	Pectoral	2	Y	In	K. Stockin (MU-A)
Humpback whale	New Zealand	Skin	2	Y	3	R. Constantine, C.S. Baker (UA)
Sperm whale	New Zealand	Skin	3	Y	0	R. Constantine, C.S. Baker (UA)
Blue whale	New Zealand	Skin	2	Y	2	R. Constantine, C.S. Baker (UA)
Bryde's whale	New Zealand	Skin	1	Y	1	R. Constantine, C.S. Baker (UA)
Minke whale	New Zealand	Skin	3	Y	0	R. Constantine, C.S. Baker (UA)
Strap-toothed beaked	New Zealand	Skin	1	Y	0	R. Constantine, C.S. Baker (UA)
Shepherd's beaked	New Zealand	Skin	1	Y	0	R. Constantine, C.S. Baker (UA)
Cuvier's beaked whale	New Zealand &	Skin	4	Y	0	R. Constantine, C.S. Baker (UA)
Gray's beaked whales	New Zealand	Skin	8	Y	0	R. Constantine, C.S. Baker (UA)
Pygmy sperm whale	New Zealand	Skin	8	Y	0	R. Constantine, C.S. Baker (UA)
Pilot whale	New Zealand	Skin	139	Y	0	R. Constantine, C.S. Baker (UA)
Killer whale	New Zealand	Skin	1	Y	0	R. Constantine, C.S. Baker (UA)
Dusky dolphin	New Zealand	Skin	3	Y	0	R. Constantine, C.S. Baker (UA)
Bottlenose dolphin	New Zealand	Skin	4	Y	0	R. Constantine, C.S. Baker (UA)
Common dolphin	New Zealand	Skin	16	Y	0	R. Constantine, C.S. Baker (UA)
Hector's dolphin	New Zealand	Skin	5	Y	0	R. Constantine, C.S. Baker (UA)
Unknown species	New Zealand	Skin	9	y	0	R. Constantine, C.S. Baker (UA)

4.4 Analyses/development of techniques

W. Roe (MU-P) continues to undertake necropsies on all beachcast Hector's dolphins. A cause of death is ascertained, where possible, on gross necropsy, and samples are collected and archived for genetic, histopathological, microbiological, toxicological, and dietary analysis.

W. Roe and K. Buckle (MU-P) are currently investigating the role of *Brucella sp.* in disease of Hector's dolphins.

E. Beatson, S. O'Shea (AUT) and colleagues continue to investigate strandings of cetaceans in NZ, in particular, they continue to collect stomach and tissue samples of teuthophagous whales to investigate diet through a combination of stomach content, fatty acid and stable isotope analyses.

K. Stockin (MU-A) continues to undertake necropsies on all beachcast common dolphins. A cause of death is ascertained, where possible, on gross necropsy, and samples collected and archived for genetic, histopathological, toxicological, and dietary analyses. In collaboration with colleagues, K. Stockin (MU-A) also commenced the sampling of beach cast bottlenose dolphins for sampling of life history, toxicological, and dietary samples.

K. Stockin (MU-A) in association with J. Cockrem (MU-P) developed a technique for the extraction of progesterone from blubber samples recovered from stranded and/or bycaught marine mammals. Laboratory work to extract and quantify blubber progesterone levels in common dolphin at known stages of pregnancy is now complete and data are being used to assess the preliminary threshold levels to determine pregnancy in archived tissue samples.

M. Merriman (MU-A) in association with K. Stockin (MU-A) and David Raubenheimer (MU-A) began a doctoral study examining the diet of common dolphins bycaught or beach cast within New Zealand using stomach content and stable isotope analyses.

K. Stockin (MU-A) in association with A. Natoli (independent) and A. Amaral (Macquarie University and University of Lisbon) and are in the final stages of completing microsatellite analysis on common dolphins examined in Stockin (2008). Both mitochondrial and nuclear markers have been applied to assess population structure within the New Zealand *Delphinus*.

5. POLLUTION STUDIES

K. Stockin (MU-A), E. Martinez, (MU-A), B. Jones (MU-A), L. Meynier (MU-P), W. Roe (MU-P) and collaborators completed a Department of Conservation contract to investigate PCB and OC levels present in Hectors and Maui dolphins (genus *Cephalorhynchus*) – refer to Stockin et al (in press) for results.

K. Stockin (MU-A) in collaboration with E. Beatson (AUT), Anton van Helden (Te Papa) and R. Law (CEFAS) are currently analyzing trace elements in stranded pilot whales from around the New Zealand coast.

6. STATISTICS FOR LARGE CETACEANS

6.1 Corrections to earlier years' statistics for large whales

Nil

6.2 Direct catches of large whales (commercial, aboriginal and scientific permits) for the calendar year 2009

6.3 Anthropogenic mortality of large whales for the year 1 April 2009 – 31 March 2010

Whale species	Sex	No.	Date	Location	Vessel type	Speed	Fate	How observed	Contact person/ institute and refs
Blue Whale	F	1	26/5/09	Tehapu, West Coast South Is	Rope entan-glement		Dead	Washed up	Andrew Baxter

6.3.2 Fishery bycatch of large whales

Nil

7. STATISTICS FOR SMALL CETACEANS

7.1 Corrections to earlier years' statistics for small cetaceans

Nil

7.2 Direct catches of small cetaceans for the calendar year 2009 or the season 2009/10

Nil

7.3 Anthropogenic mortality of small cetaceans for the calendar year 2009 or the season 2009/10

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

Nil

7.3.2 Fishery bycatch of small cetaceans

The bycatch of small cetaceans in fishing operations recorded by government observers for the period Jan 2009 – Dec 2009* was as follows:

Species	Sex	No.	Date	Location	Fate	Targeted fish species	Gear	How observed?	Source or contact
Common Dolphin	M	1	7/2/2009	West Coast South Island	Dead		Bottom Trawl	Observer	
Common Dolphin	F	1	7/2/2009	West Coast South Island	Dead		Bottom Trawl	Observer	
Common Dolphin	F	1	17/2/2009	West Coast South Island	Dead		Bottom Trawl	Observer	

Common Dolphin	M	1	17/2/2009	West Coast South Island	Dead		Bottom Trawl	Observer	
Common Dolphin	M	1	21/2/2009	West Coast South Island	Dead		Bottom Trawl	Observer	
Common Dolphin	F	2	26/2/2009	West Coast South Island	Dead		Bottom Trawl	Observer	
Common Dolphin	M	3	26/2/2009	West Coast South Island	Dead		Bottom Trawl	Observer	
Hector's Dolphin	M	1	8/5/2009	East Coast South Island	Dead		Setnet	Observer	
Common dolphin		1	25/10/2009	West Coast North Island	Dead	Jack mackerel	Mid-water Trawl	Observer	
Hector's Dolphin	M	1	1/11/2009	East Coast South Island	Dead		Setnet	Observer	
Dusky Dolphin		1	1/12/2009	East Coast South Island	Dead		Setnet	Observer	

* Full data for the period Apr 2009-Mar 2010 was not available at the time of writing, so the 2009 calendar year was used to ensure complete reporting is provided.

8. STRANDINGS

C. Schweder-Goad (BOP) has continued with georeferencing and updating the New Zealand Whale Strandings database(1846-2009) for DOC and the Museum of New Zealand, Te Papa Tongarewa.

The Department of Conservation (DoC), often in association with local Maori, has the statutory responsibility for managing cetacean stranding events, and maintains a comprehensive coverage of the New Zealand coastline through its area offices, field centres and local networks. All stranding events are reported to the Museum of New Zealand, *Te Papa Tongarewa*, which maintains a stranding database (dating back to 1840).

NEW ZEALAND WHALE STRANDING SUMMARY REPORT

FOR THE PERIOD : 01-Apr-08 TO 31-Mar-09

FROM: Anton van Helden, Museum of New Zealand Te Papa Tongarewa

Species name	Number of Strandings	Number of animals stranded	Number Refloated	Number Restranded	Number successfully refloated
Balaenoptera musculus	2	2	0	0	0
Balaenoptera sp	1	1	1	0	1
Beaked whale	1	1	0	0	0
Caperea marginata	1	1	0	0	0
Cephalorhynchus hectori	3	3	0	0	0
Delphinus delphis	24	28	6	0	6
DOLPHIN	1	1	0	0	0
Globicephala malaena	10	254	80	1	79
Kogia breviceps	2	3	0	0	0
Lagenorhynchus obscurus	2	2	1	1	0
Megaptera novaeangliae	2	2	0	0	0
Mesoplodon grayi	9	10	2	2	0
Mesoplodon sp	2	2	0	0	0
Orcinus orca	1	1	0	0	0
Physeter macrocephalus	2	2	0	0	0
Tasmacetus shepherdi	1	1	0	0	0

Tursiops truncatus	3	4	4	1	3
Unknown	1	1	0	0	0
Ziphius cavirostris	2	2	1	1	0
TOTAL	70	321	95	6	89

The total number of reported strandings for this period is 70 incidents involving 321 animals. This excludes those animals that have been reported but for which stranding data forms had not been received by the Museum of New Zealand *Te Papa Tongarewa* before the end of March. At least 16 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: *Balaenopteridae* 7.1%, *Neobalaenidae* 1.4%, *Ziphiidae* 21.4%, *Delphinidae* 62.9%, *Physeteridae* 2.9%, *Kogiidae* 2.9% and unknown represent unidentifiable whales, or parts of whales 1.4%. The representation in number of animals for the different families that stranded in this period are: *Balaenopteridae* 1.5%, *Neobalaenidae* 0.3%, *Ziphiidae* 5%, *Delphinidae* 91.3%, *Kogiidae* 0.9%, *Physeteridae* 0.6% and unknown 0.3%. The species with the highest incidents of strandings were common dolphins *Delphinus delphis*, with 24 incidents. The largest number of animals of a species to strand was 254 for long-finned Pilot whales G*lobicephala melas*. The total number of animals refloated for this period was 95, 6 of which restranded and died, therefore 89 are presumed to have survived. the largest was 105 long-finned pilot whales *G. melas.*

9. OTHER STUDIES AND ANALYSES

Will Rayment (University of Otago) has secured funding from the Foundation for Research Science and Technology for a 3 year study of southern right whales. Photo-ID studies will be carried out at the Auckland Islands and around the NZ mainland to study population recovery and linkages between populations. Habitat preferences will be studied on the Auckland Islands' calving grounds to facilitate predictions of likely areas of importance for southern right whales around the mainland.

Ewan Fordyce continues work on cetacean evolution, systematics, skeletal functional morphology, and calibration of molecular clocks, recently involving the Delphinidae, Balaenopteridae, and Caperea. Published a monograph on the osteology of the bottlenose dolphin *Tursiops* - Mead and Fordyce 2009, below.
The following PhD students are working on cetacean systematics and evolution largely through museum skeletal material, modern and/or fossil:
Felix Marx: Evolution of structural disparity in the Cetacea
Gabriel Aguirre: Evolution of the Delphinidae
Moyna Müller: Skeletal evolution in the Southern Ocean dolphin genus Cephalorhynchus
Carolina Loch: Comparative study of modern and fossil cetacean dentitions (Cetacea: Delphinoidea and Platanistoidea)

S. O'Shea, in collaboration with J. Brooks, D.Bryant and E.Beatson (AUT), has embarked on a research programme to determine the persistence and pathological nature of bacterial communities occurring over and adjacent to sites of whale burial. Indications are that numbers of both aerobic and anaerobic bacteria, and their communities at sites of whale burial differ significantly from those of non-burial sites. The health and safety implications of these findings are currently being determined. However, it is envisaged recommendations will be made to minimise the actual (as opposed to perceived) risk these whale-sourced pathogens pose to beach users.

K. Stockin (MU-A) in collaboration with M. Perrott (MU-P) and S. Murphy (SMRU) continue to research the growth and reproduction of New Zealand common dolphins. Aged animals (assessed via examination of GLGs) have now been examined in relation to morphometric measures and reproductive status in order to calculate growth, age and TBL of sexual maturity, pregnancy rate and calving interval for the New Zealand *Delphinus* population.

G. Machovsky Capuska (MU-A) in association with K. Stockin (MU-A), David Raubenheimer (MU-A) and Leon Huyen (MU-A) are undertaking comparative molecular analysis of LWS rhodopsin in different marine mammal species in order to assess vision in relation to diving capabilities.

K. Stockin (MU-A) in association with A. Hartman (MU-P), K. Dittmer (MU-P), A. van Helden (Te Papa) and A. Watson (OSU) completed a radiological examination of gray's and straptoothed beaked whale flippers collected from a number of beach cast carcasses around North Island, New Zealand. A histological examination of extracted bone tissues is currently underway.

K. Stockin (MU-A) in association with A. Amaral (Macquarie University and University of Lisbon) has analyzed DNA collected from common dolphins bycaught in the commercial jack mackerel fishery in order to assess kinship and relatedness.

T. Markowitz (UTB/TSC), W. Markowitz (MU), D. Lundquist (OU), B. Würsig (TAMU) and S. DuFresne (DEL/SMRU Ltd) completed a 3-year study of dusky dolphin interactions with tour vessels at Kaikoura. Behaviour and movement data were collected from shore, a research vessel, and tour vessels. The final report was submitted to the Department of Conservation in June 2009 and new regulations are currently under negotiation. (Markowitz, T., Du Fresne, S. and Würsig, B. (Eds) 2009. Tourism effects on dusky dolphins at Kaikoura, New Zealand. Report submitted to the New Zealand Department of Conservation. 30 June 2009. 93pp.Available online: [http://www.doc.govt.nz/getting-involved/consultations/closed/tourism-effects-on-duskydolphins- at-kaikoura/view-the-dusky-dolphin-tourism-report/](http://www.doc.govt.nz/getting-involved/consultations/closed/tourism-effects-on-duskydolphins-at-kaikoura/view-the-dusky-dolphin-tourism-report/))

W. Markowitz (MU), in association with D. Armstrong (MU) and B. Würsig (TAMU) continued with Ph.D. study of dusky dolphins off Kaikoura. Dissertation topics include interactions with tour vessels, abundance, residency patterns, social structure, behaviour, reproduction and behavioural comparisons with Hector's dolphins off Kaikoura. Methods include focal group behavioural follows and photo-identification of individuals. Ph.D. submission is scheduled for 2010.

D. Lundquist (OU), in association with N. Gemmell (OU) and B. Würsig (TAMU) continued with his Ph.D. fieldwork investigating the long-term effects of tour vessel interactions on dusky dolphin behaviour and movement patterns at Kaikoura. The study uses theodolite tracking to compare current movement patterns to those recorded by other researchers over the past 25 years. Ph.D. submission is scheduled for 2011.
off Kaikoura. Methods include focal group behavioural follows and photo-identification of individuals. Ph.D. submission is scheduled for 2010.

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E. Hutchison, S. Dawson and E. Slooten (OU) are investigating Hector's dolphin diet and habitat selection. Diet is being described using the complementary methods of stomach content and stable isotope analysis. Preliminary results indicate feeding throughout the water column on a wide variety of species, with benthic prey having the highest contribution. Concurrent dolphin, benthic prey and oceanographic surveys are being undertaken seasonally to assess which factors influence habitat use throughout Banks Peninsula waters. Techniques include both visual and acoustic surveys to assess dolphin distribution, and the use of fish traps and stereo-video to determine prey availability. The preliminary habitat results allow us to begin examining these predators in a wider ecosystem context.

T. Markowitz (UTB/TSC), C. Richter (QU), J. Gordon (SA), W. Markowitz (MU), M. Fernandez (UC), and S. Isojunno (SA) began a 3-year study of sperm whale interactions with tour vessels at Kaikoura. Behaviour and movement data were collected from shore, a research vessel, tour boats and planes. A towed hydrophone array was used to track and monitor diving whales from a small research vessel. A combination of theodolite tracking and digital video mounted to binoculars are being used to monitor whales from shore. GPS data loggers have been deployed on tour vessels and aircraft, and observers collect information from these platforms of opportunity when space is available. An initial status report and subsequent progress report were submitted to the Department of Conservation in July 2009 and March 2010. Multi-platform research is ongoing.

M. Fernandez (UC) working with T. Markowitz (UTB/TSC) and X. Nelson (UC) began his Ph.D. research investigating individual whale behaviour, foraging strategies, and responses to vessels. S. Isojunno (SA) working with J. Gordon (SA) initiated her New Zealand field work for her Ph.D. on sperm whale acoustic behaviour. A third Ph.D. student, O. Sagnol (UC) is beginning her shore- and tour-vessel based field work working with T. Markowitz (UTB/TSC), F. Reitsma (UC), and L. Field (UC).

B. Miller (UOO) used a large aperture hydrophone array comprising a vertical stereo array and four drifting GPS-referenced sonobouys to study the 3-D diving behaviour of indivdiualy identified sperm whales at Kaikoura (Miller and Dawson, 2009). Automated methods were developed for measuring hydrophone position, click detection at all real (and virtual) hydrophones, hyperbolic and isodiachronic localisation of whales, and interpolation of 3D whale locations. The data show that sperm whales at Kaikoura use the entire water column for foraging, however, there is a strong mode in the distribution of maximum depths at 400 - 550 m, with a second mode centred on 800 m. The deepest dive recorded was to 945 m. The results indicate that sperm whales often actively chase mobile prey but also target slower moving or unsuspecting prey. Miller also developed a plugin for the open-source acoustic software Pamguard which computes IPIs (via the method of Teloni et al. 2007) in sperm whale clicks. This has been used to measure growth in identified individuals over periods up to 11.2 years.

B. Miller has created software to automatically and objectively measure the inter-pulse interval (IPI) of sperm whale echolocation clicks in real time. There is an established relationship between IPI and whale size, thus such software can be used to estimate the size of individual whales, or populations encountered during an acoustic survey. The software is freely available, open source and has been released as a Pamguard plugin.

B. Miller, A. Growcott, L. Slooten, and S. Dawson have measured growth rates for 30 sperm whales using acoustic recordings of photographically identified whales. The inter-pulse interval (IPI) was measured and used as a proxy for whale size. Von Bertalanffy growth curves were fit to the IPIs of individual whales and were an excellent fit for 25 of the 30 whales. The five remaining whales for which Von Bertalanffy curves were a poor fit had either a constant IPI, or recordings spanning a small number of years.

B. Miller and R. Vennell developed automated analytical techniques for estimating the 3D underwater movements of sperm whales using acoustic data from an unlinked hydrophone array (Miller and Dawson 2009). The analysis consisted of a particle filter combined with radial basis function (RBF) interpolation. The use of RBFs (a type of least squares spline interpolant) smoothed the data and allowed comparison of 3D data with time depth profiles from tagging studies conducted previously in other parts of the world.

B. Miller and S. Dawson investigated 3D underwater movements of sperm whales in the Kaikoura Canyon. Visual observations and vocal behaviors of whales supplemented position data for 78 dive tracks. Additionally, foraging behavior was determined by the presence of creak vocalizations. Whale movements before and after creak vocalisations reveal a variety of "foraging" strategies including "swooping down" on midwater prey from above, actively "chasing" midwater prey, "foraging"
along the canyon floor at depths of over 900 m, and actively chasing and catching fish at the sea surface. During some recording sessions several whales could be tracked simultaneously, and while there was no clear indication of cooperative behaviour among whales, maximum dive depths were similar among all whales during these dives. This suggests that whales may be exploiting the same (relatively abundant) food source when diving together at these depths.

10. LITERATURE CITED

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