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The New Zealand common dolphin
(*Delphinus* sp.)

- *Identity, ecology and conservation*

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requirements for the Degree of Doctor of
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In loving memory of
Innis Jeanette Stockin

1946 - 2007

This thesis is dedicated to a remarkable lady I am so very proud to call my mom. Without her belief, her support, her dedication and love, none of this would have been possible. I owe all I am and everything I have achieved, to her. She remains my guiding light, my determination, my inspiration.

"The real voyage of discovery consists not in seeing new landscapes but in having new eyes"

PROUST

She gave me new eyes, she instilled strength and conviction so I could strive for all that I believe in - we did this together. To her, I shall remain indebted for eternity.

Frontispiece

SAINT DELPHINUS *Bishop of Bordeaux*

(†403)

Little is known of the origins of Saint Delphinus; it is after his elevation to the episcopate that he became famous among the bishops of his time as a vigilant protector of the truth. We have written evidence, however, that his piety and learning made him so celebrated that the saintliest bishops of the church were honored to be his friends and to correspond with him.

He was present at the Council of Saragossa in 380, at which the Priscillian heretics were condemned. Later he assembled a council in Bordeaux, his episcopal city, which the heretics had entered and where they were working havoc; this assembly condemned once again the same propagators of error. The bishop's force and preaching so reduced their influence that they abandoned the region entirely and fled to Italy.

Saint Delphinus baptized Saint Paulinus, later Bishop of Nola, in 388, and inspired in him the desire to live a life of perfection. He, in several letters, speaks of Saint Delphinus as his father and his master. Saint Delphinus died on the 24th of December, at the beginning of the fifth century.

Source: *Les Petits Bollandistes: Vies des Saints*, by Msgr. Paul Guérin (Bloud et Barral: Paris, 1882), Vol. 14.

Abstract

Common dolphins (genus *Delphinus*) are poorly understood within New Zealand waters. Prior to this study, most information relating to the taxonomy, population structure, diet and pollutant loads of this genus relied upon untested assumptions. Furthermore, factors affecting the occurrence, demographics and habitat use of common dolphins in the Hauraki Gulf remained unknown. This lack of empirical data has resulted in the inadequate recognition and management of New Zealand *Delphinus*. Inappropriately classified by the New Zealand Threat Classification System, the anthropogenic impacts that affect this genus have clearly been overlooked. The present study examines behaviour of common dolphins in the Hauraki Gulf and details analyses undertaken on tissue samples collected from around New Zealand. Results detailed here challenge many of the untested assumptions about this genus within New Zealand waters.

The taxonomy of New Zealand common dolphins was assessed using 92 samples analysed for 577 base pairs (bps) of the mtDNA control region (D-loop). New Zealand samples were compared with 177 published sequences from eight other populations from around the world. New Zealand *Delphinus* exhibited a high genetic variability, sharing haplotypes with both short- (*D. delphis*) and long-beaked (*D. capensis*) populations. Indeed, the New Zealand population showed significant genetic differentiation when compared with most other populations world-wide. Furthermore, intrapopulation analyses revealed significant genetic differentiation between Hauraki Gulf individuals and other common dolphins sampled within New Zealand waters. Results suggest habitat choice and site fidelity may play a role in shaping the fragmented population structure of New Zealand *Delphinus*.

Data relating to the occurrence and demographics of common dolphins in the Hauraki Gulf region were collected during boat-based surveys between February 2002 and January 2005. In total, 719 independent encounters, involving one to > 300 common dolphins were recorded. Dolphin presence was significantly affected by month, latitude and depth. Group size varied significantly by month, season, depth, sea surface temperature (SST) and latitude, and was highly skewed towards smaller groups comprising fewer than 50 animals. Calves were observed throughout the year but were

most prevalent in the austral summer months of December and January. Group composition was significantly affected by month, season, depth and SST. The year-round occurrence and social organisation of *Delphinus* in Hauraki Gulf waters suggest this region is an important nursery and potential calving area.

The effects of diel, season, depth, sea surface temperature, and group size and composition on dolphin behaviour were investigated using activity budgets. Foraging and social were the most and least frequently observed behaviours, respectively. A correlation between group size and behaviour was evident, although behaviour did not vary with the composition of dolphin groups. Resting, milling and socialising animals were more frequently observed in smaller groups. Foraging behaviour was prevalent in both small and large groups, suggesting foraging plasticity exists within this population. Behaviour differed between single- and multi-species groups, with foraging more frequent in mixed-species aggregations, indicating the primary mechanism for association is likely prey-related.

Stomach contents analysed for forty-two stranded and eleven commercially by-caught individuals collected from around North Island, New Zealand between 1997 and 2006, revealed arrow squid (*Nototodarus* spp.), jack mackerel (*Trachurus* spp.) and anchovy (*Engraulis australis*) as the most prevalent prey. Stranded individuals and dolphins by-caught within neritic waters fed on both neritic and oceanic prey. Moreover, a mixed prey composition was evident in the diet of common dolphins by-caught in oceanic waters, suggesting inshore/offshore movements of New Zealand *Delphinus* on a diel basis. Additionally, prey differences were also evident in the stomach contents of common dolphins sampled from within the Hauraki Gulf.

Trace elements, polychlorinated biphenyls (PCBs) and organochlorine (OC) pesticide levels were determined in five stranded and fourteen by-caught *Delphinus* sampled from around New Zealand between 1999 and 2005. Generally, levels of trace elements were low. However, concentrations of OC pesticides were similar in range to those previously reported for Hector's (*Cephalorhynchus hectori*) and common bottlenose dolphins (*Tursiops truncatus*). Organochlorine pesticides dieldrin, hexachlorobenzene (HCB), *o,p'*-DDT and *p,p'*-DDE were present at the highest concentrations.

Markov chain models were used to assess the impact of tourism activities on *Delphinus* within the Hauraki Gulf. Foraging and resting bouts were significantly disrupted by boat interactions. Both the duration of bouts and the time spent in these two behavioural states decreased during boat interactions. Additionally, foraging dolphins took significantly longer to return to their initial behavioural state in the presence of a tour boat. Impacts identified are similar to those previously reported for the common bottlenose dolphin, a coastal species typically considered to be more susceptible to cumulative anthropogenic impacts.

Data presented here reveal the nature and apparent susceptibility of New Zealand common dolphins to human-induced impacts, namely fisheries by-catch, pollution and tourism. This in conjunction with taxonomic uncertainty, lack of abundance estimates and the year-round use of inshore waters for feeding, clearly warrants immediate attention from managers. Furthermore, the current threat classification of New Zealand *Delphinus* should be reconsidered in light of population uncertainties, and in view of the susceptibility to human-induced impacts revealed by the present study.

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You raised me up so I could walk on mountains,
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