Autopsy of cetaceans incidentally caught in fishing operations 1997/98, 1999/2000, and 2000/01

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By Pádraig J. Duignan, Nadine J. Gibbs, and Gareth W. Jones

Part 2 Autopsy report for 1999/2000

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ABSTRACT

Morphological characteristics, estimated age, gender, reproductive status, stomach contents, and cause of death were determined for 16 Hector's dolphins (*Cephalorhynchus hectori*) and 1 common dolphin (*Delphinus delphis*). The common dolphin and one Hector's dolphin were incidentally killed in commercial fishing operations: the common dolphin off the Wanganui coast in October 1999, and the Hector's dolphin off the Canterbury coast in November 1997. The remaining 15 Hector's dolphins were either retrieved from recreational set nets (n = 1) or found beachcast along the west coast of the South Island (n = 3) or east coast of the South Island (n = 7). One North Island Hector's dolphin was found beachcast at Kawhia. Stranding data was not available for another 3 Hector's dolphins. Tissues from major organs were received for one animal that had been autopsied on the beach. The stomachs of all dolphins contained the remains of teleost fish such as otoliths and bones. The Hector's dolphins had also eaten invertebrates (e.g. crab, krill, and squid). Dolphins were aged using thin, stained sections of teeth and counting dentinal growth layer groups. The age frequency distribution for the Hector's dolphins examined was similar to that previously reported for this species, with an over-representation of immature animals. The sex ratio was equal. Six female Hector's dolphins were classified as sexually immature, and estimated to be between 1 and 2.5 years old. Two males were sexually mature and at least 5 years old, while two 5 and 5.5-year-old males were still pubescent. Three males were immature and estimated to be 1.5–3 years old. The gonads of 2 other females and 1 male Hector's dolphin had been scavenged or were too decomposed to determine sexual maturity. The female common dolphin was 5–6 years old, and was sexually immature, as indicated by the absence of *corpora* on the ovaries. Dolphins known to have been entangled in nets all had lesions consistent with death from entanglement and asphyxiation. Of the 15 beachcast Hector's dolphins, 7 had lesions indicative of entanglement, 2 had lesions consistent with trauma and sudden death, 2 were too decomposed to determine the cause of death, 1 was a neonate that probably died following separation, and 1 had severe trauma unrelated to bycatch.

Keywords: dolphins, Hector's, *Cephalorhynchus hectori*, common, *Delphinus delphis,* autopsy, stomach contents, estimated age, North Island, South Island, New Zealand

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1. Introduction

The primary objective of this study was to fulfil the requirements of DOC contract CSL 99/3025 by recording and interpreting data on each animal. These data included species, sex, size, body condition, age, reproductive status, stomach contents, and cause of death. This report details the findings pertinent to this objective and includes data on 16 Hector's dolphins (*Cephalorhynchus hectori)* and one common dolphin (*Delphinus delphis*) killed incidentally in fishing operations or found beachcast.

A second objective was to examine the carcasses for evidence of disease and to collect material for ongoing and future research projects as outlined in Part 1 of this report. Part 1, Section 1 contains general information on Hector's dolphins.

The common dolphin is a pelagic, offshore species and has a very wide distribution, occurring in all warm-temperate, subtropical, and tropical waters worldwide (Leatherwood et al. 1983). In New Zealand, it is frequently found in the coastal waters of both the North and South Islands (Baker 1999a). Group sizes vary seasonally and diurnally, but *D. delphis* are regularly found in herds of hundreds, and sometimes of more than a thousand, individuals (Leatherwood et al. 1983). The causes of mortality for common dolphins include stranding (usually of single animals), entanglement, and capture in direct-drive fisheries (Leatherwood et al. 1983).

2. Material and methods

2.1 MATERIALS

Sixteen Hector's dolphin carcasses were received, consisting of eight females and eight males. One female common dolphin was also received. The Hector's dolphin and common dolphin retrieved from trawl nets were recorded with the catch date, time, and coordinates (Appendix 1, Table 2.1) by CSL observers. The Hector's dolphin was captured off the Canterbury coast, and the common dolphin off the southwest coast of Wanganui (Fig. 2.1). The remaining Hector's dolphins were either removed from set nets (n = 1), found beachcast (n = 11), or are of unknown origin (n = 3).

The Hector's dolphin retrieved from a set net was found off Sumner Bay, Christchurch (Appendix 1, Table 2.2). The remaining dolphins of known origin were found along the west and east coasts of the South Island (n = 10). A single specimen of a North Island Hector's dolphin was found at Kawhia (Table 2.2).

Nine dolphin carcasses (Tables 2.1 and 2.2) were delivered to Massey University frozen and wrapped in clear plastic bags and woven nylon sacks. Four dolphins were identified by Conservation Services Levy (CSL) observer data sheets or by stranding forms inserted into their mouths, seven had orange tags tied to their

Figure 2.1. Capture locations for Hector's and common dolphins incidentally caught in fishing operations, 1999/2000.

tailstocks and five had no identification. Samples from one dolphin (WB00-13Ch) were sent in an insulated bin with a stranding form inside. On receipt, the dolphins were stored at –20°C until necropsy.

2.2 METHODS AND NECROPSY PROTOCOL

See Part 1, Section 2.2 for details.

3. Results for 1999/2000

3.1 MORPHOMETRICS

An extensive set of standard measurements was taken from each carcass (Appendix 1, Table 2.3).

3.2 STOMACH CONTENTS

The stomach weight and the weight of its contents were recorded for each animal (Appendix 1, Table 2.4). The contents were not identifiable to species for any animal. The common dolphin had fish otoliths, fish bones, and squid beaks in the first chamber, but no identifiable items in the remaining two chambers. Thirteen of the Hector's dolphins had fish otoliths, and in most cases fish bones, in at least one stomach compartment. Of these, five animals also had squid beaks in the stomach, two animals had pieces of crab and two had shrimp or krill. The dolphin sampled in the field (WB00-13Ch) had a piece of bubble-wrap plastic in the first stomach compartment along with otoliths and fish bones while the remaining two chambers were empty. Three dolphins had empty stomachs. Otoliths and invertebrate parts have been stored in 70% ethanol for more detailed analysis of diet at or immediately before the time of death. Blubber samples were also stored frozen at –80°C for analysis of fatty acid signatures.

3.3 AGE DETERMINATION

Data on tooth size and the number of dentinal growth layer groups (GLGs) counted are given in Appendix 1, Table 2.5. For those North and South Island Hector's dolphins with teeth (n = 15), the mean tooth weight was 0.09 g, mean length 10.6 mm and mean diameter 2.3 mm. These sizes are similar to those reported previously (Slooten 1991; Part 1 of this report). The teeth did not have obvious incremental layers in the cementum, but there were clearly defined bands in the dentine of most animals. The accepted protocol for small cetaceans is that one dark band (stained) and one light band (unstained) constitute one year's growth (Perrin & Myrick 1980; Slooten 1991). Based on this assumption, the Hector's dolphins ranged in age from 0.5 years to at least 5.5 years old (mean = 2.7 years) and the North Island Hector's dolphin was 2–4 years old. The common dolphin was 5–6 years old. The ages given are minimum estimates based on clearly defined bands. The Hector's dolphin sample was biased, with young animals less than 5 years old over-represented. The age bias is similar to that in a previous investigation of incidentally caught animals (Part 1) and is similar, but even more marked than the age bias reported by Slooten (1991), in which 41 of 60 specimens (68%) were 5 years old or younger.

3.4 REPRODUCTIVE STATUS

Females

Morphometric data on reproductive tracts are given in Appendix 1, Table 2.6. Six of the female Hector's dolphins (0.5–4 years old) had small smooth ovaries with no evidence of corpora. The uterine wall was also histologically immature and there was no evidence of lactation. These findings are similar to those for female Hector's dolphins, 4 years and younger, reported by Slooten (1991). The results are also consistent with those for an immature female dolphin from a previous bycatch report (Part 1). The gonads of two female Hector's dolphins (WB00-16Ch) and (WB00-09Ch) had been scavenged and were not available for examination.

The common dolphin was 5–6 years old. There were no visible corpora in serial sections of the ovaries. The histology of the uterine horns was consistent with this animal being immature, based on criteria given in Part 1, Section 2.2.4. Milk was not present in the mammary glands.

Males

Of the eight male Hector's dolphins, two were classed as mature, two were pubescent, three were immature and one (WB00-13Ch) was too decomposed to determine sexual maturity by microscopic examination of the gonads. The two mature males (WB00-22Ch and WB00-24Ch) were at least 5 years and 5.5 years old and had combined testicular masses (including the epididymis) of 871 g and 374 g, respectively (Appendix 1, Table 2.7). This is within the range of testicular maturity weight reported by Slooten (1991) in which mature males had combined testicular masses ranging from 304 g to 1210 g. The testes of one of these males also had active spermatogenesis and small volumes of spermatozoa in the epididymis, indicating maturity. The two pubescent males were also 5 years and 5.5 years old, but had combined testicular masses of 57 g and 32 g respectively, which is considerably less than the range considered for maturity. A single pubescent male, reported by Slooten (1991), had a combined testicular mass of 65 g. The remaining dolphins (n = 3) in this study were immature with a mean combined testicular mass of 8 g.

3.5 PATHOLOGY

Pathological findings were covered by the terms of the contract for the first time this year. Data on entanglement-related pathology and incidental findings are, therefore, included in this report (Appendix 1, Table 2.8). It should be noted that freezing will compromise the interpretation of subtle pathological changes.

Among the pathological changes associated with death from entanglement are traumatic lesions directly attributable to fishing gear (Garcia Hartman et al. 1994; Kuiken 1994; Kuiken et al. 1994). This includes superficial skin lesions encircling the rostrum, head or any extremity; cleanly-cut pieces from extremities; or deep puncture wounds. Pathological changes in deeper tissues include evidence of blunt trauma such as fractures or contusions. Changes consistent with death from asphyxiation include pulmonary oedema, congestion, alveolar or bullous emphysema, stable froth in airways, and pleural congestion. There may also be congestion of pericardial vessels and ecchymotic haemorrhages (haemorrhagic spots) on the endocardium or epicardium; and on histology, hypercontraction, fibre fragmentation and fibre vacuolation of the myocardium. Less highly associated with entanglement is body condition and evidence for recent feeding (Kuiken 1994). In general, poor body condition and/or lack of food in the stomach might indicate some other cause of death. In all cases, all organ systems should be examined by a pathologist competent in the diagnosis of disease in cetaceans to rule out all possibilities.

The common dolphin entangled in commercial nets had pulmonary pathology and trauma indicative or suggestive of entanglement (Appendix 1, Table 2.8).

Among the Hector's dolphins, one was entangled in commercial nets (WB00-23Ch) and another in recreational nets (WB00-17Ch) and both had distinct skin lesions and pulmonary pathology (Table 2.8). Of the remaining 14 dolphins, the probability of entanglement was high for seven (50%) based on skin lesions and pulmonary lesions that would suggest asphyxiation; it was moderate for two animals, with signs of sudden death/recent trauma; and low for two animals. Two dolphins were too decomposed for conclusive assessment of the cause of death. However, one of them (WB00-16Ch) was a neonate and may have died following separation from its mother. The single North Island Hector's dolphin (WB00-09Ch) was also too decomposed to determine its cause of death, but signs of recent feeding suggested a sudden death, possibly related to entanglement.

One of the Hector's dolphins (WB00-25Ch), for which the probability of entanglement was high, also had a large bite wound on the back of the head and neck region. The presence of a beachcast blue shark (*Prionace glauca*) and gill netting nearby suggests that the shark may have been the cause of this wound while entangled in the net, but pulmonary lesions in the dolphin indicates that asphyxiation was the primary cause of death.

Of the two dolphins for which the probability of entanglement was low, one (WB00-13Ch) had been necropsied at the stranding site (Fig. 2.2). It was emaciated, had a fractured spine, and also had plastic debris in its stomach (Jim Lilley, Marine Watch, Christchurch, pers. comm.). Because the authors of this report did not see the fracture, we cannot comment on when it occurred or how it affected the animal's body condition. The spine will be examined after all the soft tissues have been removed. The second dolphin was less than one year old and may have died after parental separation.

Many of the Hector's dolphins had incidental pathologies including gastrointestinal ulcers (n = 6), tattoo skin lesions (n = 4), lungworms (n = 9), cystic changes in the thyroid gland (n = 1), *Crassicauda* sp. in the pterygoid sinus (n = 1), flukes in the mesenteric lymph nodes (n = 3) and bone fractures

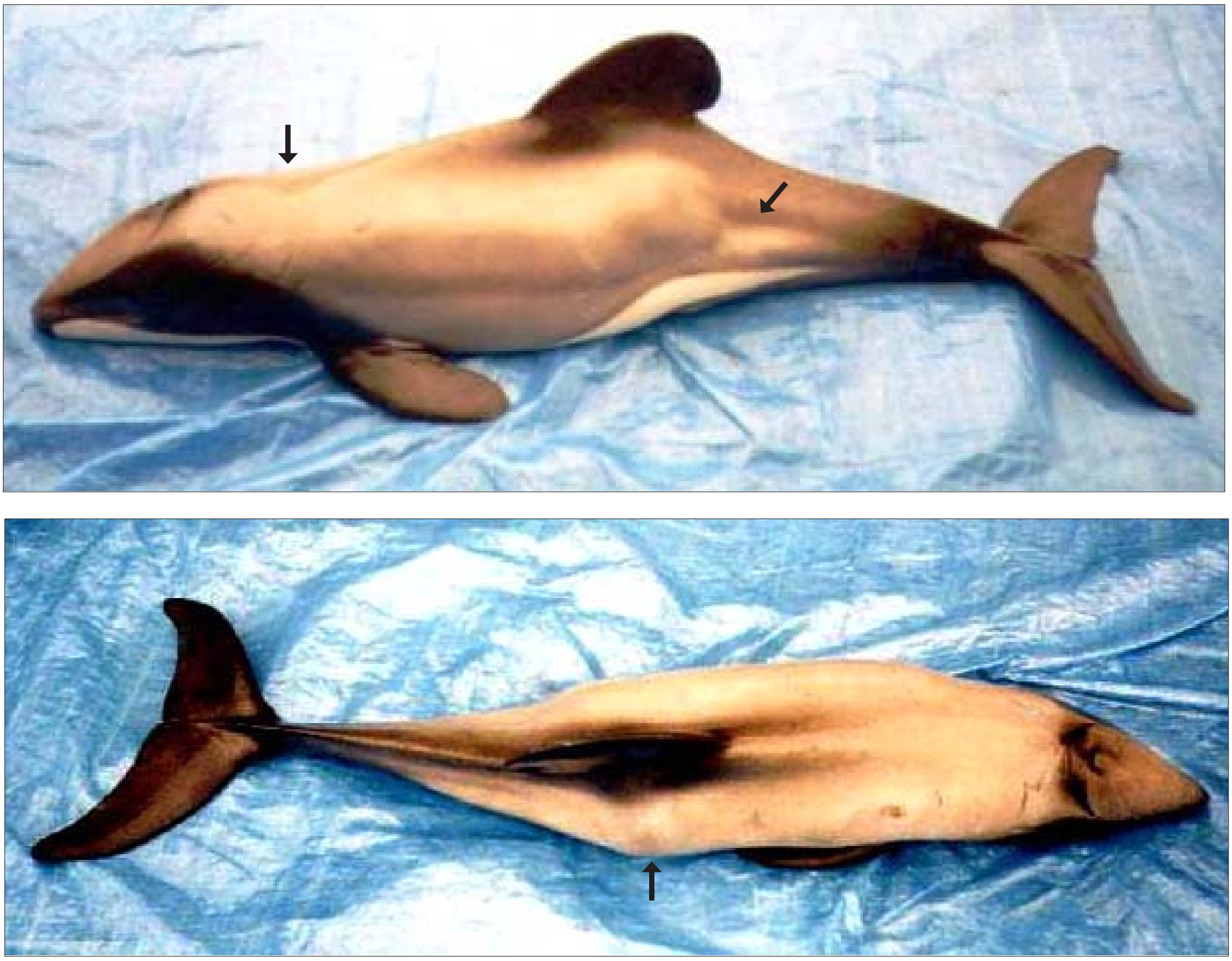

Figure 2.2. *(Top)* Left lateral view of an emaciated Hector's dolphin (WB00-13Ch). Emaciation is apparent from the pronounced 'neck' and also the hollowed out appearance of the dorsal musculature along the spine (both arrowed).
(Bottom) Dorsal view of WB00-13Ch with spinal fracture apparent as an angular deformity to the right (arrowed).

from previous traumas (n = 2) (Table 2.8). There was no evidence that these incidental changes could have caused death. An exception to this may have been the spinal fracture sustained by WB00-13Ch, which could have resulted in its emaciated body condition and subsequent death.

3.5.1 Gastrointestinal ulcers

Ulceration and inflammation of the stomach can be attributed to parasitic and non-parasitic causes. Most reports of ulceration in marine mammals directly associate the ulcers with parasitism by nematodes, e.g. *Anisakis* sp., *Contracaecum osculatum*, *Pholeter gastrophilus*, and *Phocanema decipiens.* Parasite-induced ulcers are typically shallow and have the anterior end of the worm embedded in the ulcer bed. The ulcers can be acute and haemorrhagic, or chronic with healing by fibrosis and granulation. In severe infections, perforation of the stomach wall can occur, causing peritonitis and death (Geraci & St Aubin 1987). Transmission of the nematodes occurs through the consumption of infected fish, crustaceans or squid, and are normally found free in the stomach or attached to the gastric mucosa (Geraci & St Aubin 1987). Non-parasitic ulceration in captive cetaceans can be attributed to histamine toxicosis (Geraci & St Aubin 1987) where high concentrations of histamine as part of a herring diet may cause excessive gastric acid secretion. Alternatively, starvation, stress or trauma have been proposed as causes of gastric ulcers.

In this study, six dolphins had mild to moderate ulceration of the first and second chambers. Even though parasites were not always present when the stomachs were examined, it is likely that the ulcers were induced by nematode attachment. The absence of perforation of the stomach wall suggests the ulceration was not a contributing cause of death.

3.5.2 Tattoo skin lesions

Tattoo skin lesions were observed in four Hector's dolphins and are characteristic of poxvirus infection documented in several species of other dolphins including dusky and bottlenose dolphins (*Tursiops truncatus*) (Van Bressem et al. 1993). The tattoo skin lesions appear as irregular, slightly depressed, grey to black pits in the skin that often form circles on the head, dorsum or extremities. The means of transmission of the poxvirus is unknown, but presumed to be skin contact, or via the respiratory or oral tracts (Buller & Palumbo 1991). The prevalence of tattoo skin lesions in other species has been correlated with body length, where neonates and juveniles do not show the marks until they reach a certain body length, suggesting that they are protected by antibodies from the mother's milk (passive immunity). Once the animal is weaned, passive immunity wanes and prevalence rates increase. Immunity against the poxvirus gradually develops with body length (and age, by inference) and the prevalence of lesions decreases. The tattoo skin lesions are not thought to compromise the health of the dolphin, although some severe cases have been reported in other species (Van Bressem et al. 1993).

3.5.3 Lungworms

Lungworms have been reported in many species of cetaceans, including the Hector's dolphin (McKenzie & Blair 1983; Balbuena et al. 1994). The nematodes readily colonise the lung with transmission of parasites possibly occurring through the placenta and mammary glands (Balbuena et al. 1994). In this study, the lungs of nine Hector's dolphins were infected with nematodes, and included animals of all age classes. The greater part of each worm was free in the lumen of the bronchi, but the caudal end of the worm was tightly coiled and buried in the lung parenchyma at the end of the terminal bronchioles. Small calcified nodules (a result of the infection) were especially apparent in the sub-pleural lung parenchyma and on histological examination there was either a focal inflammatory response in the affected bronchiole or no significant response. It is unlikely that these nematode infections compromised the health of the dolphins or caused death.

3.5.4 Other parasitic infection

Parasitic infection by *Crassicauda* sp. was observed in the left and right pterygoid sinus of one Hector's dolphin (WB00-05Ch). There was a multi-nodular mass (15 × 4 mm) beneath the sinus epithelium on the right side associated with attachment of the worms. Three Hector's dolphins had parasitic trematodes in the mesenetric lymph nodes that resulted in focal necrosis of the medulla.

3.5.5 Thyroid cysts

One Hector's dolphin (WB00-22Ch) had cystic changes in the left lobe of the thyroid gland. Endocrine pathology is associated with physiological stress in other species. The significance of these changes for Hector's dolphins is unknown, but they indicate that studies on endocrine function are required.

3.5.6 Trauma

One Hector's dolphin (WB00-17Ch) had a fracture of the spine that appeared externally as a marked ventro-lateral deviation of the spine at the level of the dorsal fin caudal insertion and a bony ridge that extended caudo-ventrally towards the anus and the right side. From a dorsal aspect, there was a marked lateral deviation of the spine at this location consistent with spinal fracture and realignment. Dissection revealed the fracture was at the level of the 19^{th} vertebra, or 4^{th} vertebra caudal to the most distal rib. The spine had realigned at approximately 140° and there was contraction amounting to three vertebral body lengths. A well-developed callus surrounded the fractured vertebral body and extended between the two ends of the fracture. The callus is indicative that the trauma occurred several weeks before death. The etiology of the fracture is unknown, but would have required severe trauma that may have been the result of a boat strike, or an attempt at predation by killer whales (*Orcinus orca*), or aggression from bottlenose dolphins. A second dolphin (WB00-13Ch) also had a fractured spine as described above. The etiology is also unknown, but may be similar to the previous case.

4. Discussion

The dolphins examined for this contract were received frozen and double bagged. In general the packaging was of a high standard and the animals were usually identified by the observer's report or stranding form stuck into their oral cavities, or by an orange tag around their tailstocks. However, the data sheet or tag was missing for five Hector's dolphins. The missing details of one dolphin were obtained from D. Neale (DOC Hokitika). In terms of animal identification, the orange tags around the tailstocks were very effective. Samples from a beach autopsy of WB00-13Ch were sent in an insulated bin with a stranding form inside. It was beneficial to have a list of animals being shipped forwarded by e-mail to allow a cross-check between animals shipped and those received. In that way, any animal that arrived without the observer's report or tag could be traced. From a health and safety perspective, the packaging was sufficient to prevent contamination of the environment by the carcasses provided they remained frozen.

The number of common dolphins examined here is too small to make any conclusion about the biology of the species. The only animal submitted was a sexually immature female. Common dolphins are thought to reach sexual maturity at approximately 1.7 m (Leatherwood et al. 1983), but the female in this study exceeded this length. The common dolphin was caught as a result of commercial fishing activities and had pulmonary lesions suggestive of asphyxiation, but did not have unequivocal skin lesions attributable to entanglement. This emphasises that pathological lesions other than skin lesions alone need to be considered in the determination of cause of death.

The Hector's dolphin incidentally caught by commercial fishers was captured off the Canterbury coast, a site within the range of the species (Cawthorn 1988; Slooten & Dawson 1994). The dolphins caught by recreational nets and those found beachcast were in areas off the west and east coasts of the South Island where there are greater numbers of Hector's dolphins (Slooten & Dawson 1994). Three carcasses were not labelled and their origin remains unknown.

Morphological features of the Hector's dolphins were consistent with those reported previously (Mörzer Bryuns & Baker 1973; Slooten 1991; Slooten & Dawson 1994). It was also found that most of the animals were sexually immature, which is consistent with previous reports of incidentally caught Hector's dolphins (Slooten 1991; Dawson 1991; Part 1 of this report). As in a previous study that included 60 Hector's dolphins (Slooten 1991), the sex ratio of animals submitted for this investigation was equal. This differs from the study described in Part 1 of this report where the animals were predominantly males, which was probably a reflection of sampling bias rather than the structure of the population.

Determination of the species of fish and invertebrates ingested by the dolphins was beyond the scope of this investigation, but all hard parts removed from the stomachs were archived for future studies. Most animals had some remains of fish, squid or other invertebrates suggesting that they had eaten shortly before death.

Age determination in cetaceans, based on counting growth layers or annuli in teeth, is commonly used on a variety of species (Perrin & Myrick 1980). Although widely used, the technique is subject to difficulties in methodology, interpretation, reader variability, variability among teeth, and the lack of known-age animals (Dapson 1980). The method used to section teeth can also introduce marked biases into the interpretation of age. For this reason, and because teeth from known-age Hector's dolphins were not available, it was decided to employ a method similar to that used previously on this species (Slooten 1991) and on the related Commerson's dolphin (Lockyer et al. 1988). The results obtained are comparable to those reported by Slooten (1991) and are in agreement with other findings on the animals such as reproductive status and morphology. The pubescent and immature males in this study were of similar ages to the pubescent and immature males reported by Slooten (1991). Two males with large and histologically mature testes in this study had a minimum age of 5 years, but it should be emphasised that their true ages may be greater that this. However, the quality of the tooth sections precluded a more confident estimate of age.

The pathological findings indicate that there is a high probability that entanglement caused the deaths of the common dolphin, and nine of the Hector's dolphins examined. Two other Hector's dolphins appear to have died suddenly and possibly as a result of entanglement. This is based on a consideration of pathological changes, body condition, presence of food material in the stomach and the absence of any other pathology that could have caused death (Garcia Hartmann et al. 1994; Kuiken 1994; Kuiken et al. 1994). The specific details are presented above (Section 3.5) and in Table 2.8. Briefly, some animals had gross evidence of physical trauma immediately prior to death. This took the form of sub-cutaneous and muscular contusion with oedema and haemorrhage. Pathology associated with asphyxiation included acute diffuse congestion and oedema of the lungs, congestion and haemorrhage in the airways, and blood-stained froth in the airways. Obstruction of airflow often resulted in bullous emphysema. Some animals also had congestion of pericardial and cardiac blood vessels. The histological changes in the lungs consisted of congestion and flooding of the alveoli with fluid (oedema). Acute destruction of alveolar walls (alveolar emphysema) was also a common finding. Myocardial haemorrhages were not detected but may have been obscured by freezing artefacts. However, hypercontraction and fragmentation, particularly in the deeper parts of the ventricular walls were common observations suggesting acute hypoxia.

5. References

For details of references quoted in Part 2, see the combined reference list at the end of Part 3 (pp. 58–60).

Appendix 1

TABLES OF RESULTS

TABLE 2.1. CAPTURE DATA FOR HECTOR'S AND COMMON DOLPHINS, 1999/2000.

CODE	PATHOLOGY NO.	CSL NO.	DATE	TIME (24 h)	LATITUDE	LONGITUDE	SEX
Common dolphin							
WB00-06Dd	31067	622	13 Oct 99	2300	39ºS	174ºE	F
Hector's dolphin							
WB00-23Ch	31309	–	27 Nov 97	0745	43ºS	172ºE	F

– Indicates data is not available.

TABLE 2.2. STRANDING DATA FOR HECTOR'S DOLPHINS, 1999/2000.

CODE	PATHOLOGY NO.	DOC TAG NO.	DATE	TIME (24 h)	CIRCUMSTANCES	LOCATION	COMMENTS
North Island Hector's dolphin—Female							
WB00-09Ch	31122	–	10 Mar 00	–	Beachcast	Albatross Bay, Kawhia	Scavenged
South Island Hector's dolphin—Female							
WB00-16Ch	31296	H29/00	22 Jan 00	0945	Beachcast	1.3 km N of Waimairi Surf Club	Scavenged
WB00-17Ch	31298	H24/98	Summer 98	–	Incidental bycatch	Sumner Bay, Christchurch	
WB00-20Ch	31304	H31/00	11 Mar 00	1100	Beachcast	PC Bay, Akaroa	
WB00-21Ch	31305	–	18 Aug 99	0947	Beachcast	Gillespie Beach	
WB00-25Ch	31312	–	6 Feb 99	–	Beachcast	Takutai Beach, Hokitika	No data
WB97-61Ch	38737	–	–	–	–	–	
South Island Hector's dolphins—Male							
WB00-05Ch	31046	–	7 Jan 00	1630	Beachcast	Irongate, Sth of Rakatura, Kaikoura	
WB00-10Ch	31126	H28/00	22 Dec 99	–	Beachcast	Caroline Bay Beach, Timaru	
WB00-11Ch	31157	H33/00	27 Mar 00	0725	Beachcast	100 m S of South Brighton Surf Club	
WB00-13Ch	31130	97/97	4 Dec 97	0655	Beachcast	Mouth of Avon/Heathcote Estuary	Scavenged
WB00-18Ch	31299	H25/98	–	–	–	Banks Penisula	No data
WB00-19Ch	31300	H32/00	19 Mar 00	1000	Beachcast	Opihi River Mouth	
WB00-22Ch	31308	–	16 Jul 98	–	Beachcast	Westport	
WB00-24Ch	31311	–	–	–	–	–	No data

– Indicates data is not available.

TABLE 2.3. MORPHOMETRIC DATA FOR HECTOR'S AND COMMON DOLPHINS, 1999/2000.

CODE	PATHOLOGY No.	Wt (kg)	Std L (m)	Sn–An (m)	Sn–Gen (m)	Sn–ODF (m)	Sn–OF (m)	F L (m)	F W (m)	DF Ht (m)	DF BL (m)	Flk W (m)	Gt Pec (m)	Blub.D (m)	Blub.L (m)	Blub.V (m)
North Island Hector's dolphin—Female																
WB00-09Ch	31122	–	1.45	1.05	0.97	0.67	–	0.21	0.070	0.090	0.270	0.32	–	–	–	–
South Island Hector's dolphins—Female																
WB00-16Ch	31296	28.6	0.79	0.58	0.54	0.39	0.22	0.16	0.054	0.056	0.180	0.20	–	0.015	0.008	0.008
WB00-17Ch	31298	35.2	1.21	0.85	0.82	0.61	0.31	0.23	0.078	0.084	0.220	0.35	0.79	0.017	0.009	0.017
WB00-20Ch	31304	18.9	1.19	0.84	0.77	0.56	0.28	0.20	0.065	0.081	0.175	0.30	0.66	0.011	0.010	0.011
WB00-21Ch	31305	18.1	1.21	0.85	0.81	0.59	0.30	0.21	0.065	0.055	0.170	0.20	0.60	0.001	0.001	0.002
WB00-23Ch	31309	37.4	1.20	0.92	0.89	0.60	0.30	0.22	0.080	0.080	0.190	0.38	0.80	0.012	0.010	0.012
WB00-25Ch	31312	36.0	1.29	0.94	0.91	0.64	0.34	0.23	0.085	0.105	0.230	–	0.86	0.015	0.014	0.015
WB97-61Ch	28737	–	0.77	0.55	0.52	0.39	0.23	0.19	0.090	0.090	0.140	0.29	0.51	0.009	0.008	0.009
South Island Hector's dolphin—Male																
WB00-05Ch	31046	31.1	1.15	0.85	0.73	0.56	0.28	0.20	0.075	0.075	0.175	0.38	0.79	0.018	0.011	0.013
WB00-10Ch	31126	30.9	1.18	0.85	0.73	0.57	0.30	0.21	0.080	0.070	0.210	0.39	0.77	0.017	0.015	0.016
WB00-11Ch	31157	12.6	0.86	0.61	0.53	0.43	0.23	0.17	0.060	0.070	0.160	0.27	0.54	0.014	0.016	0.016
WB00-13Ch	31130	–	1.16	0.84	0.70	–	0.31	0.22	0.075	0.088	–	0.38	0.61	–	–	–
WB00-18Ch	31299	26.4	1.14	0.82	0.71	0.53	0.24	0.19	0.064	0.070	0.170	0.36	0.74	0.018	0.012	0.018
WB00-19Ch	31300	15.5	0.91	0.67	0.60	0.44	0.21	0.16	0.060	0.065	0.145	0.21	0.66	0.016	0.015	0.014
WB00-22Ch	31308	34.8	1.18	0.86	0.72	0.56	0.28	0.22	0.080	0.095	0.205	0.40	0.82	0.016	0.014	0.015
WB00-24Ch	31311	39.0	1.23	0.88	0.76	0.60	0.30	0.22	0.080	0.100	0.200	0.46	0.81	0.010	0.009	0.010
Common dolphin—Female																
WB00-06Dd	31067	86.2	1.93	1.40	1.34	0.80	0.45	0.28	0.095	0.160	0.360	0.32	1.10	0.011	0.007	0.009

Wt = weight; Std L = standard body length; Sn-An = snout to anus length; Sn-Gen = snout to genital slit length; Sn-ODF = snout to origin of dorsal fin length; Sn-OF = snout to origin of flipper; FL = flipper length; FW = flipper width; DF Ht = dorsal fin height; DF BL = dorsal fin length at base; Flk W = fluke width; Gt Pec = girth at pectoral flippers; Blub. D = dorsal blubber depth; Blub .L = lateral blubber depth; Blub.V = ventral blubber depth.

– Indicates data is not available.

TABLE 2.4. STOMACH MORPHOMETRICS AND CONTENTS FOR HECTOR'S AND COMMON DOLPHINS, 1999/2000.

CODE	PATH-OLOGY NO.	STOMACH FULL WT (kg)	STOMACH EMPTY WT kg	COMPARTMENT 1 CONTENTS WT (kg)	COMPARTMENT 1 COMPOSITION	COMPARTMENT 2 CONTENTS WT (kg)	COMPARTMENT 2 COMPOSITION	COMPARTMENT 3 CONTENTS WT (kg)	COMPARTMENT 3 COMPOSITION	PARA-SITES	ULCERS
North Island Hector's dolphin—Female											
WB00-09Ch	31122	0.643	–	0.176	Fish bones, otoliths	–	–	–	–	N	–
South Island Hector's dolphin—Female											
WB00-16Ch	31296	–	–	–	–	–	–	–	–	N	–
WB00-17Ch	31298	1.097	0.486	–	Fish bones, otoliths, lenses, 1 shrimp	TLTM	Fish lenses	TLTM	Fish otoliths,lenses, squid beak	Y	C3
WB00-20Ch	31304	0.394	0.391	TLTM	Fish otoliths,lenses	TLTM	Squid beak	–	–	Y	C3
WB00-21Ch	31305	0.291	–	–	Fish otoliths,lenses, arthropods	TLTM	Fish otoliths,lenses	–	–	Y	–
WB00-23Ch	31309	1.547	0.503	0.481	Fish bones, otoliths, lenses, squid beak, crab, krill	–	Fish otoliths,lenses, squid beak, krill	–	–	Y	C2, 3
WB00-25Ch	31312	0.628	0.566	–	Fish bones,otoliths, pieces	TLTM	Fish otoliths, bivalves	–	–	Y	C2
WB97-61Ch	28737	–	–	–	–	–	–	–	–	N	–
South Island Hector's dolphin—Male											
WB00-05Ch	31046	–	–	0.539	Fish bones,otoliths, squid beaks	TLTM	Fluid only	TLTM	Fluid only	Y	C2, 3
WB00-10Ch	31126	0.870	–	0.390	Fish bones,otoliths, pieces	TLTM	Fish otoliths	TLTM	Fluid only	N	C2
WB00-11Ch	31157	0.830	0.830	–	–	–	–	–	–	N	–
WB00-13Ch	31130	–	–	–	Fish bones,otoliths,plastic	–	–	–	–	Y	–
WB00-18Ch	31299	0.486	0.307	0.060	Fish bones, otoliths, lenses, Squid beaks	–	–	–	–	N	–
WB00-19Ch	31300	0.106	0.099	0.001	Fish otoliths, lenses, gravel,	0.002	Fish otoliths, gravel	–	–	N	–
WB00-22Ch	31308	0.391	0.381	–	fish otoliths,lenses	–	–	–	–	Y	C1, 3
WB00-24Ch	31311	0.685	0.554	0.008	Fish otoliths, lenses, crab	TLTM	Fish otoliths, lenses	–	–	N	C2
Common Dolphin—Female											
WB00-06Dd	31067	2.053	1.225	0.296	Otoliths, fish bones, squid beaks	–	–	TLTM	Fluid only	N	–

TLTM = too little to measure; C1, C2, etc. = compartment 1, 2, etc.

– Indicates data is not available.

TABLE 2.5. AGE ESTIMATION BASED ON DENTINAL GROWTH LAYER GROUPS FOR HECTOR'S AND COMMON DOLPHINS, 1999/2000.

CODE	PATHOLOGY NO.	WT (g)	L (mm)	W (mm)	AGE (years)	COMMENTS
North Island Hector's dolphin—Female						
WB00-09Ch	31122	0.11	12.3	3.2	2–4	
South Island Hector's dolphin—Female						
WB00-16Ch	31296	0.02	6.2	2.1	0.5	Neonate
WB00-17Ch	31298	0.10	9.0	5.0	2.5	
WB00-20Ch	31304	0.08	11.0	2.5	1.5	
WB00-21Ch	31305	0.07	10.2	2.4	2.0	
WB00-23Ch	31309	0.10	18.0	2.2	1.5	
WB00-25Ch	31312	0.11	12.6	3	1.5	
WB97-61Ch	28737	–	–	–	< 1	Neonate
South Island Hector's dolphin—Male						
WB00-05Ch	31046	0.10	11.5	2.5	5.0	
WB00-10Ch	31126	0.12	12.4	2.5	5.5	
WB00-11Ch	31157	0.07	8.2	2.1	3+	
WB00-13Ch	31130	0.11	12.2	2.5	3–4	
WB00-18Ch	31299	0.10	11.0	1.0	1.5–3	
WB00-19Ch	31300	0.02	5.0	1.0	2.0	
WB00-22Ch	31308	0.09	9.0	1.0	5.5	
WB00-24Ch	31311	0.13	11.0	1.0	5+	Difficult to read
Common dolphin—Female						
WB00-06Dd	31067	0.18	14.7	3.1	5–6	

– Indicates data is not available.

TABLE 2.6. FEMALE REPRODUCTIVE TRACT MORPHOMETRICS AND CHARACTERISTICS FOR HECTOR'S AND COMMON DOLPHINS, 1999/2000.

CODE	PATH-	RIGHT OVARY				LEFT OVARY				UTERINE		MILK
	OLOGY NO.	Wt (g)	L×W×D (mm)	CA	CL	Wt (g)	L×W×D (mm)	CA	CL	MATUR-ITY	GRAVID*	PRES-ENT
North Island Hector's dolphin												
WB00-09Ch	31122[†]	–	–	–	–	–	–	–	–	–	N	N
South Island Hector's dolphins												
WB00-16Ch	31296[†]	–	–	–	–	–	–	–	–	–	–	–
WB00-17Ch	31298	1	27 × 13 × 3	–	–	1	26 × 14 × 3	–	–	IM	N	N
WB00-20Ch	31304	< 1	20 × 12 × 2	–	–	< 1	21 × 11 × 2	–	–	IM	N	N
WB00-21Ch	31305	< 1	24 × 7 × 1	–	–	< 1	20 × 9 × 1	–	–	IM	N	N
WB00-23Ch	31309	< 1	30 × 12 × 2	–	–	< 1	30 × 14 × 3	–	–	IM	N	N
WB00-25Ch	31312	< 1	26 × 12 × 3	–	–	< 1	27 × 14 × 4	–	–	IM	N	N
WB97-61Ch	28737	< 1	13 × 6 × 1	–	–	< 1	14 × 8 × 2	–	–	IM	N	N
Common dolphin												
WB00-06Dd	31067	5	26 × 20 × 13	–	–	2	26 × 13 × 9	–	–	IM	N	N

CA = Corpus albicens; CL = Corpus luteum; IM = Immature.

* Determined by the presence of a grossly detectable embryo or foetus.

† Scavenged.

– Indicates data is not available.

TABLE 2.7. MALE REPRODUCTIVE MORPHOMETRICS AND CHARACTERISTICS FOR HECTOR'S DOLPHINS, 1999/2000.

CODE	PATH-OLOGY NO.	RIGHT TESTIS Wt+epid (g)	RIGHT TESTIS Wt–epid (g)	RIGHT TESTIS L×D (mm)	LEFT TESTIS Wt+epid (g)	LEFT TESTIS Wt–epid (g)	LEFT TESTIS L×D (mm)	TESTIS MATUR-ITY	COMBINED TESTICULAR MASS* (g)
South Island Hector's dolphin									
WB00-05Ch	31046	29	20	73 × 24	28	20	72 × 23	P	57
WB00-10Ch	31126	16	9	60 × 18	16	9	66 × 19	P	32
WB00-11Ch	31157	2	1	41 × 6	3	1	51 × 5	IM	5
WB00-13Ch	31130	–	–	–	–	–	–	–	–
WB00-18Ch	31299	6	4	53 × 14	6	4	46 × 13	IM	12
WB00-19Ch	31300	4	3	66 × 10	3	–	51 × 18	IM	7
WB00-22Ch	31308	432	397	191 × 77	439	403	193 × 74	MI	871
WB00-24Ch	31311	188	153	151 × 55	186	145	151 × 50	MA	374

IM = Immature; MA = Mature-active; MI = Mature-inactive; P = Pubertal;.

* Includes epididymis weight.

– Indicates data is not available.

LEGEND TO SYMBOLS ON TABLE 2.8

1 = Respiratory congestion and oedema
2 = Pulmonary emphysema
3 = Trauma (contusion, free blood in abdomen)
4 = Foreign matter in lungs
5 = External net entanglement marks

I = Tracheal and bronchial congestion/haemorrhage
II = Bronchiole excessive mucus
III = Pulmonary interlobular/ lobular oedema/ congestion
IV = Pulmonary aveolar emphysema
V = Cardiac fibre hypercontraction
VI = Cardiac fibre fragmentation

A = Gastrointestinal ulcers
B = Tattoo skin lesions
C = External wound—shark bite
D = Thyroid cysts
E = Lungworm
F = Crassicouda in Pterygoid sinuses
G = Fluke in mesenteric lymph node
H = Previous trauma (bone fractures)
I = Foreign matter in stomach (plastic)

AI = Pulmonary multi-focal inflammation
AII = Bronchiole focal supprative inflammation
AIII = Bronchiole nematode with pyogranulomatous inflammation
AIV = Pulmonary sub-pleural granulomatous inflammation
AV = Bronchiole lymphoid nodules
AVI = Bronchial and bronchiole nematodes
BI = Pox inclusion bodies
CI = Cardiac nuclear rowing
CII = Cardiac non-suppurative inflammation

TABLE 2.8. PATHOLOGY OF HECTOR'S AND COMMON DOLPHINS, 1999/2000.

CODE	PATH-OLOGY NO.	ENTANGLEMENT-RELATED PATHOLOGY			INCIDENTAL FINDINGS	
		GROSS	HISTO-LOGICAL	PROBAB-ILITY	GROSS	HISTO-LOGICAL
North Island Hector's dolphin—Female						
WB00-09Ch	31122	*	–	*	–	–
South Island Hector's dolphin—Female						
WB00-16Ch	31296	–	*	*	–	–
WB00-17Ch	31298	1, 5	III, IV, V	High	E, G, H	AIII
WB00-20Ch	31304	1, 2, 5	III, IV, V	High	E	–
WB00-21Ch	31305	–	*	*	–	–
WB00-23Ch	31309	1, 2, 3, 5	III, IV, V	High	A,G	AI, AIV
WB00-25Ch	31312	1, 2, 5	III, IV, V	High	A, C, E	AIII, AIV, AV
WB97-61Ch	28737	–	*	Low	E	AVI‡
South Island Hector's dolphin—Male						
WB00-05Ch	31046	3, 4, 5	III, V, VI	High	A, B, E, F	AI, BI, CI
WB00-10Ch	31126	1, 3, 5	III, IV, V	High	A, B, E	AII, AIII, BI
WB00-11Ch	31157	1, 5	III	High	B, E	AIII
WB00-13Ch	31130	–	–	Low	H, I	–
WB00-18Ch	31299	1, 3, 5	II, III, IV, V, VI	High	E, G	–
WB00-19Ch	31300	3	–	Mod	B, E	BI
WB00-22Ch	31308	–	I, III†	Mod	A, D	–
WB00-24Ch	31311	1, 4, 5	III†	High	A	AIV
Common dolphin—Female						
WB00-06Dd	31067	1, 2, 3	III, IV, V	High	–	CII

* Too decomposed to determine pathology/probability.
† Heart too decomposed.
‡ Too decomposed to tell if accompanied by inflammation.
– Indicates data is not available.

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