STRANDING OF A CUVIER'S BEAKED WHALE, *ZIPHIUS CAVIROSTRIS* CUVIER, 1823, AT NEW BRIGHTON, NEW ZEALAND

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ABSTRACT

A 6.18 m adult (n = 36 ± 2 cementum growth lines) male *Ziphius cavirostris* which became stranded at New Brighton, New Zealand on 25 April 1978, possessed an unusually large supernumary tooth. Squid beaks from the stomach indicated that it had been feeding probably beyond the continental shelf, east of Canterbury. The numbers of parasites in the alimentary tract, and heavy metal and pesticide concentrations in the blubber, were low. The presence of marked arteriosclerosis could reflect parasite infestation or advanced age or both. Twelve other records of *Z. cavirostris* from the New Zealand region are given.

INTRODUCTION

Cuvier's beaked whale, *Ziphius cavirostris* Cuvier, 1823 (Ziphiidae: Odontoceti) often has been recorded from New Zealand (Gaskin 1968: Table 16, Oliver 1922). It is a cosmopolitan species which occurs in all but high latitude oceans (Hershkovitz 1966). The osteology of *Z. cavirostris* is well known (Kernan 1918, Omura 1972), and recent discussions of strandings and biology were given by Mitchell (1968) and Mitchell and Houck (1967). The aim of this article is to present and discuss observations made on a specimen of *Z. cavirostris* recently stranded at New Brighton, New Zealand. Preliminary notice of the stranding appeared in *Scientific Event Alert Network Bulletin* (SEAN 1978).

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OBSERVATIONS AND DISCUSSION

At about 1200 h on 25 April 1978, a large cetacean, later identified as *Ziphius cavirostris*, was noticed moving in shallow water off the gently sloping sand beach at New Brighton, South Island, New Zealand (NZMS 1 S84: 088595, 43°30.5'S, 172°43.7'E). By about 1500 h, when we first saw the animal, it was alternately stranded and rolled around in the surf. At this time, it showed no signs of respiration or voluntary movement, and was presumed dead. An unsuccessful attempt was made to tow the carcass out to sea. Permission to measure and dissect the whale was obtained late in the day, and study was initiated after dark, at about 2000 h.

EXTERNAL FEATURES

The specimen was an adult male, assigned field number REF 114 and permanent collection number Mm 1825, National Museum of New Zealand. Data were recorded in the format outlined by Mitchell (1975: Appendix E, Cetacean Data Record) and are presented here in Table 1. The carcass was twisted and too heavy to move, so

TABLE 1. EXTERNAL MEASUREMENTS OF *Z. CAVIROSTRIS*, Mm 1825, TAKEN OVER THE CURVE OF THE BODY (TO NEAREST 5 mm).

Measurement	Distance, m
Total length, snout to fluke notch	6.180
Snout to tip of dorsal fin	4.360
Fluke notch to centre of anus	1.690
Fluke notch to centre of genital slit	2.100
Left flipper, length of anterior edge	0.640
Left flipper, maximum width	0.185

that some measurements could not be recorded in conventional fashion and most were made over the curve of the body. The body was a uniform dark grey ventrally, and dorsally posterior to the dorsal fin. Anterior to the dorsal fin, the dorsal surface was grey to creamy white. The flippers were dark grey dorsally with blackish posterodorsal borders and grey ventral surfaces. The body was traversed by long, usually parallel (typically 40 - 50 mm apart) straight or gently to abruptly curved white scars, predominantly on the dorsal surface. A few single striations were present. That many of the scars were parallel is compatible with their probable infliction by the mandibular teeth of other members of the species. Oval (width half to two-thirds length) to round white scars were scattered over the dorsal surface and flanks. Most of the oval scars possessed an irregular radial pigmentation and, in cross-

section, were seen to be distinctly lighter in colour than the adjacent blubber. Both the long striations and the oval scars were like those illustrated by Mitchell and Houck (1967: Fig. 3).

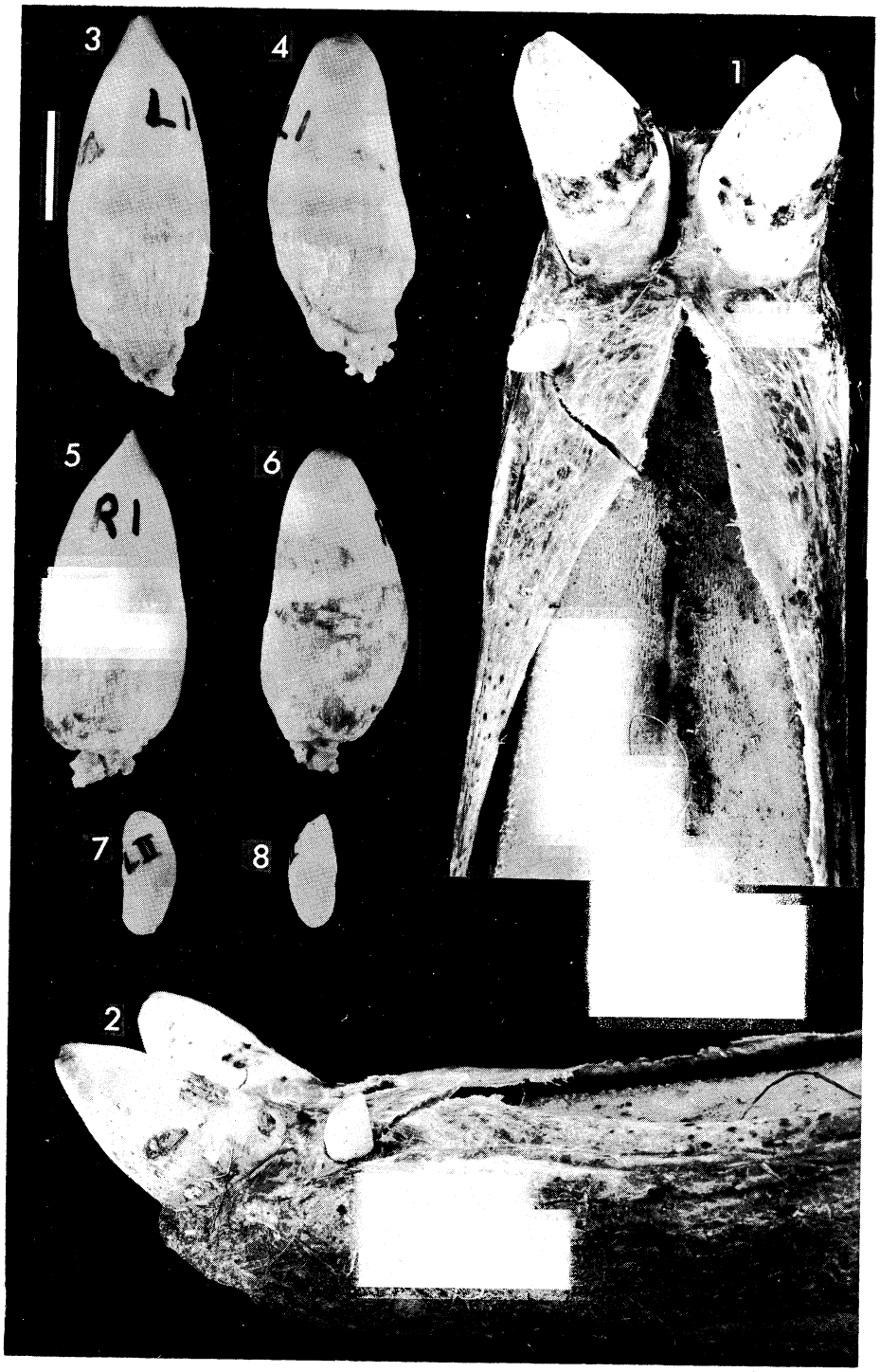
DENTITION

The dentition of this individual is unusual in that three teeth are erupted in the mandible (Figs. 1, 2). The large apical tooth present in each mandibular ramus is typical of *Z. cavirostris*, but the second, small, postapical tooth present in the left ramus, where it is separated by a diastema of 10 mm from the apical tooth, is atypical. Normally, only in *Berardius* spp. and *Tasmacetus shepherdi* is more than one pair of teeth erupted (Kirino 1956, Moore 1968). No other calcified teeth were found in the gum tissue. The measurements of the teeth are given in Table 2.

TABLE 2. DIMENSIONS (mm) OF TEETH OF *Z. CAVIROSTRIS*, Mm 1825.

	Right apical	Left apical	Left supernumary
Total height	69.1	74.2	24.1
Maximum anteroposterior diameter	31.6	30.6	10.0
Maximum buccolingual diameter	27.5	26.9	10.2
Height above root tip of position of maximum diameter	*c.* 30	*c.* 33	*c.* 14

The apical teeth are oriented anterodorsally and slightly buccally. In anterior view, each apical tooth is more or less bilaterally symmetrical, with gently convex buccal and lingual faces. The convexity is most pronounced basally and lingually (Figs. 3-6). Each apical tooth is markedly asymmetrical in buccal or lingual view (Figs. 4, 6). The anterior profile is strongly convex, while the posterior profile is slightly convex to flat, to faintly concave in the mid point. Anteroposterior diameter of each tooth exceeds bucco-lingual diameter, and the profile on any part of the apical half of the tooth is convex (as noted by Moore 1968: 239). The enamel is worn off the crown apices, and the exposed dentine is worn buccally and lingually so that the crowns are keeled anteroposteriorly. On the tooth surfaces, the positions of the boundary between the dentine and cementum, and of the insertion level in the gum are not obvious. Basally, the cementum on both teeth is irregularly, vertically wrinkled. The openings of the pulp cavities are occluded by irregularly knobbled cementum. The alveoli are prominent, deep, and conical, and are formed of dendritic bone into which well-developed blood vessels open. The teeth were not anchored firmly in the alveoli. There was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limited interdigitation of the knobbly root cementum and the dendritic bone, and the teeth were secured mainly by the gum tissue.

The small second tooth of the left mandibular ramus is oriented buccally and slightly posterodorsally. In anterior view (Fig. 7) its axis is concave lingually. The buccal face is markedly convex, while the lingual face is more or less straight. In buccal or lingual view, the tooth has a fusiform appearance (Fig. 8), although the profile of the anterior of the apical surface is worn obliquely so that dentine is exposed. An enamelocementum boundary is not apparent. The basal cementum possesses irregular fine vertical wrinkles, and no opening is visible for the pulp cavity. There is no obvious alveolus present in the left mandibular ramus, and the tooth was found to sit loosely in the gum tissue.

Supernumary teeth often have been recorded in ziphiids, although, with the exception of *Berardius* spp., they are usually radically smaller than the normal erupted teeth (Boschma 1951, Kirino 1956). In *Berardius* spp., more than one pair of supernumary teeth may be present (Kirino 1956), in addition to the normal two erupted pair, and this perhaps reflects derivation of extant ziphiids from forms, like *Tasmacetus shepherdi* Oliver, 1937, with polydont dentitions. According to Boschma (1951), multiple pairs of unerupted and often uncalcified teeth may occur in the gum tissue of *Z. cavirostris*. Clear, uncalcified, peg-shaped structures noted in the mandibular gum tissue of the present specimen during flensing may correspond to such rudimentary teeth. The large, erupted, supernumary tooth described here is unusual in that it is relatively larger than any recorded by Boschma. However, as the ontogenetic development of this tooth, the frequency of occurrence of such teeth, and the action of such teeth during feeding are unknown, further comment on its significance is not warranted.

Figs. 1-8. Dentition of *Ziphius cavirostris* (Mm 1825)

Fig. 1 Apex of mandible, dorsal view. Dried tissue covers much of the bone. Scale bar = 100 mm.

Fig. 2 Apex of mandible, left lateral view. Scale as for Fig. 1.

Fig. 3 Left apical tooth, anterior view. Scale bar = 20 mm. Figs. 4-8 also at this scale.

Fig. 4 Left apical tooth, buccal view.

Fig. 5 Right apical tooth, anterior view.

Fig. 6 Right apical tooth, buccal view.

Fig. 7 Left supernumary tooth, anterior view.

Fig. 8 Left supernumary tooth, buccal view.

The right apical tooth was bisected longitudinally, and one half was etched in 5% formic acid for about 22 hours in order to emphasize growth layers. The number of layers in the cementum was counted independently by two persons experienced in this procedure (R.H. Mattlin and M.W. Cawthorn). In neither case could the readers decide upon one specific number of layers, although the range decided on by each was similar: 34-38, and 35-38. We are not aware of any studies on the rate of cementum deposition in the teeth of *Z. cavirostris* which would aid in the interpretation of the growth layers in our specimen. It has been concluded that dentinal layers in *Hyperoodon ampullatus* and cementum layers in *Berardius bairdii* are deposited annually (Christensen 1973, Kasuya 1977). If the rate of deposition of cementum layers in *Z. cavirostris* is analogous with the rates of tissue deposition in *H. ampullatus* and *B. bairdii*, this suggests an age of 36 ± 2 years for our specimen. The occlusion of the pulp cavity and wear of all but a relatively small amount of dentine from the tooth apex provide further evidence that this was an old animal. Although the mean longevity of *Z. cavirostris* is unknown (Mitchell 1975: 900), it is likely that individuals may live more than 36 years and that our specimen was not necessarily senile. For example, one tooth of *Z. cavirostris* (United States National Museum specimen USNM 295129) examined by R.E. Fordyce possesses 61-62 growth layers in the cementum. The interpretation of growth layers in other ziphiids indicates that the life span of *H. ampullatus* may exceed 37 years (Christensen 1973), and that of *B. bairdii*, 71 years (Kasuya 1977).

STOMACH CONTENTS

Squid beaks found in the stomach were forwarded to M.J. Imber (Wildlife Service, Department of Internal Affairs, Wellington, New Zealand), whose identifications are given in Table 3.

TABLE 3. SQUID BEAKS FROM THE STOMACH OF *Z. CAVIROSTRIS*, Mm 1825.

	No. upper beaks	No. lower beaks	Total No. of squids represented	Percentage of Total
Onychoteuthidae				8
Moroteuthopsis ingens	2	6	6	
Kondakovia longimana	2	-	2	
Brachioteuthidae				1
Brachioteuthis picta	1	1	1	
Pholidoteuthidae				1
Pholidoteuthis ? boschmai	1	1	1	
Histioteuthidae				8
Histioteuthis atlantica	4	4	5	
Histioteuthis macrohista	1	-	1	
Histioteuthis eltaninae	1	-	1	
Cranchiidae				81
Taonius cymoctypus	27	20	29	
Teuthowenia megalops impennis	31	41	43	
Teuthowenia antarctica	4	3	4	
Mesonychoteuthis hamiltoni	-	1	1	

Mr Imber commented (pers. comm. to R.H. Mattlin, 2 March 1979) that the proportion of Cranchiidae squids is unusually high. Apparently, all the squids tabulated are oceanic, and occur on or beyond the continental slope. This is consistent with the absence of *Nototodarus sloani sloani*, a shelf species abundant from January to April. *Histioteuthis atlantica* and *Teuthowenia megalops impennis* are among the most abundant pelagic squids. The histioteuthids and cranchiids taken by the whale are, generally, diurnal vertical migrants which occur at 350-700 m by day and 0-400 m at night, and they are all bioluminescent. The seasonal occurrences are unknown. Mr Imber interpreted the stomach sample as indicating that the *Z. cavirostris* specimen had lived oceanically, and probably had been feeding east of Canterbury, as *T. m. impennis* becomes very rare south of the subtropical convergence.

PARASITES

Some parasites were recorded. At least one large limpet-shaped ectoparasite (?), about 30 mm long, seen only briefly by us at a distance, and described by an anonymous bystander as a "limpet", was present on a tailfluke at about 1500 h. This ectoparasite (?) was gone shortly thereafter. Stalked barnacles (*Conchoderma* ?) were attached to the two apical teeth. No other ectoparasites were seen around the mouth, and none was seen around the eyes, blowhole, genital slit, anal slit, or appendages. Brief examinations of the insides of the genital and anal slits revealed no macroscopic parasites. No macroscopic parasites were seen in the nasal diverticula, pterygoid air sacs, or the middle ear. The kidneys, liver, bile duct, lungs, heart, and brain were not examined. Professor W.C. Clark (Department of Zoology, University of Canterbury) examined the stomach and intestine. Parasites were found only in the small intestine and these consisted of a few adult and several juvenile nematodes. He identified these as a species of the genus *Arisokis*, possibly undescribed.

TISSUE ANALYSES

Limited amounts of tissue were analysed. A blubber sample from the mid lateral region was analysed for heavy metals and pesticides by the Animal Health Laboratory, New Zealand Ministry of Agriculture and Fisheries (Wallaceville). M.W. Cawthorn (pers. comm.) reported that no lead (Pb) or organophosphates were found. The mercury (Hg) concentration was 1.9 mg/Kg, and pesticide levels were: DDE, 1.2 mg/Kg; DDT, 1.2 mg/Kg; DDD, 0.25 mg/Kg. Mesenteric tissue which contained small calcareous nodules was forwarded to the Animal Health Laboratory, Ministry of Agriculture and Fisheries, Lincoln (Animal Health Laboratory accession number L 78/1689). Mr. J.B. Hutton (pers. comm. to W.C. Clark) reported that a mesenteric blood vessel shows marked calcification or ossification of the walls, analogous to the arteriosclerosis called Mönckberg sclerosis in man. There are degenerative and inflammatory changes in the muscle wall, and the ossification occurs on the lumen side of this just below the endothelium. As some inflammatory foci in the vessel walls

include a number of eosinophils, it is possible that parasites are involved in the pathogenesis, according to Hutton. A piece of mesenteric plexus also shows evidence of inflammation perhaps attributable to parasite migration.

The presence of arteriosclerosis does not necessarily mean that the animal was senile or that the pathology would have been fatal had the animal not fortuitously stranded. The frequency of occurrence of arteriosclerosis and its development with age is unknown for *Z. cavirostris*. J.G. Mead (pers. comm. to R.E. Fordyce) reported that two out of four specimens of this species which he or others had examined for arteriosclerosis exhibited the pathology but, unfortunately, the small size of this sample precludes further discussion. Arteriosclerosis has been recognised in many other species of Cetacea (Roberts *et al.* 1964, Cowan 1966, Sweeney and Ridgway 1975) but, as yet, the significance of its occurrence has not been explained.

OTHER NEW ZEALAND RECORDS OF *Z. CAVIROSTRIS*

Some post-1959 records of Cuvier's beaked whale in the New Zealand region are given in Table 4. Earlier records were outlined by Oliver (1922) and Gaskin (1968). The sample reported here is not large enough to indicate any real trends in seasonality of strandings or sightings of the type reported by Mitchell (1968) for the northeast Pacific. The only point in this table worthy of comment is the length of 9.1 m reported for the specimen stranded at Paraparaumu Beach on 7 December 1972. As *Z. cavirostris* reaches a maximum length of about 7 m (Mitchell 1968, Mitchell and Houck 1967), it is likely that a value of 9.1 m was derived from a visual estimate of length.

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TABLE 4. POST-1959 RECORDS OF *ZIPHIUS CAVIROSTRIS* IN THE NEW ZEALAND REGION. BASED PREDOMINANTLY ON DATA ASSEMBLED BY A.N. BAKER AND C.D. PAULIN.

Date	Locality	Grid Reference	Length (m)	Sex	Item	Source
pre-1961	"Napier"	39°30'S, 176°56'E	?	?	Cranium	NMNZ Ma 1436
14 Apr 1964	Haumoana Beach	39°36'S, 176°57'E	?	?	Skull, juvenile	NMNZ Ma 1606
23 Mar 1969	Otakaha Stream, Palliser	41°32'S, 175°12'E	6.0	Male	Dorsal fin, flippers	NMNZ Ma 1603
25 Feb 1972	Southeast of Auckland Is.	52°08'S, 166°45'E	?	?	Live sighting	Baker 1977: Table 2
Mar 1972	Paterson Inlet, Stewart Island	46°56'S, 168°05'E	?	?	Skull	NMNZ Ma 1653
Jun 1972	White Rock, Wairarapa	41°34'S, 175°34'E	5.8	Male	Skull	NMNZ Ma 1662
7 Dec 1972	Paraparaumu Beach	40°53'S, 174°58'E	9.1	?	--	Wellington "Evening Post", 7 Dec 1972
May 1976	Long Beach, Chatham Is.	43°49'S, 174°58'W	?	?	Skull	NMNZ Ma 1695
20 Oct 1976	Wanganui	39°56'S, 174°58'E	?	?	--	NMNZ File MS/Z4
2 Feb 1977	Tangoio River, Napier	39°20'S, 176°54'E	7.1	Male	--	SEAN 1977a:25
4 Nov 1977	Gisborne-Napier	38°40'S, 178°10'E - 39°30'S, 177°00'E	about 7	?	Live sighting	SEAN 1977b:14
2 Feb 1978	Kakaramea, Taranaki	39°42'S, 174°24'E	6.7	?	--	TM;NMNZ File WS/Z10
25 Apr 1978	New Brighton, Canterbury	43°30.5'S, 172°43.7'E	6.18	Male	Skeleton, tissues	Specimen discussed herein; NMNZ Mm 1825; SEAN 1978:19

FOOTNOTE:- NMNZ Ma (Mm) = National Museum of New Zealand Mammal specimen.
SEAN = Scientific Event Alert Network Bulletin, cited in reference.
TM = Taranaki Museum.

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