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STOMACH ANATOMY OF THE NEW ZEALAND FUR SEAL

(*Arctocephalus forsteri* Lesson, 1828) AND THE LONG-FINNED PILOT WHALE

(*Globicephala melas* Traill, 1809)

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## Abstract

The New Zealand fur seal (*Arctocephalus forsteri*) and the long-finned pilot whale (*Globicephala melas*) represent two phylogenetically unrelated species that inhabit the same environment and utilise similar prey. The stomach anatomy of the New Zealand fur seal and the long-finned pilot whale has not been well studied. Because of the scarcity of published information on these two species, this study was undertaken to identify differences and similarities between the two species. A literature review considers work on the stomach anatomy of other marine mammal species to allow for comparisons and parallels to be made. The stomachs of 10 New Zealand fur seal and 7 long-finned pilot whale cadavers were examined macroscopically and microscopically.

The single chambered stomach of the New Zealand fur seal was similar to that of other pinnipeds. The stomach was J-shaped: with an elongate proper-gastric region, a sharply bent incisura angularis and narrow pyloric portion that extended cranially to a well-developed pyloric sphincter. The lining of the empty stomach was arranged into well-defined rugae that were sparser and less tortuous beyond the pyloric antrum. The microscopic anatomy of the stomach wall was similar to the typical mammalian carnivore plan. However, some differences were evident, including a narrower cardiac zone, and longer proper-gastric glands because of the numerous mucous neck and parietal cells.

The multi-chambered stomach of the long-finned pilot whale was similar to that of other cetaceans. The stomach consisted of three chambers: a muscular, pear-shaped forechamber followed by a bulbous proper-gastric chamber and a thin walled pyloric chamber divided into a channel-like cranial portion that was further subdivided by a transverse septum and a tubular caudal portion. The orifices between chambers and the chambers themselves progressively decreased in size. The proper-gastric and pyloric chambers are comparable to those zones of the typical mammalian stomach. However some differences were evident, including the abrupt changes in mucosa between chambers, lack of a cardiac zone, a forechamber lined by non-glandular epithelium and a thicker stomach wall.

It is concluded that the stomachs of the New Zealand fur seal and the long-finned pilot whale are macroscopically different but microscopically similar. The stomachs are similar to those of other pinnipeds and cetaceans, respectively. Therefore, anatomical variations are likely to be phylogenetic in origin as otariids are believed to be derived from bear-like carnivorous ancestors whereas cetaceans are from the ancestors of ruminants.

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## Chapter One

### Introduction

The objectives of this study were to describe the macroscopic and microscopic stomach anatomy of the New Zealand fur seal (*Arctocephalus forsteri* Lesson, 1828) and the long-finned pilot whale (*Globicephala melas* Traill, 1809). Specifically, to identify the differences and similarities between the two species and to determine if they conform to the typical pinniped and cetacean plans, respectively.

Marine mammals belong to several morphologically and phylogenetically distinct taxa of which pinnipedia and cetacea are two principal groups. Pinnipedia is comprised of three families: the odobenid (walrus), phocid (earless seals) and otariid (eared seals and sea lions). While cetacea is comprised of two suborders: the odontoceti (toothed whales) and mysticeti (baleen whales) (Barnes *et al.* 1985). Among the marine mammals of New Zealand, the New Zealand fur seal and the long-finned pilot whale are two species representing otariidae and odontoceti and provide an opportunity to compare phylogenetically unrelated species that inhabit the same environment and utilise similar prey.

The stomach is an important organ as it is a major site for digestion (Dyce *et al.* 1996) and provides energy to physiological systems, including thermoregulatory mechanisms. These mechanisms maintain the thermal balance of the body, which is particularly important in marine mammals as they reside in a cold environment (Ridgway 1972).

The stomach anatomy of some marine mammal species has been well studied, but that of the New Zealand fur seal and the long-finned pilot whale have not. For example, there is only a brief description of the New Zealand fur seal stomach in an unpublished Bachelor of Philosophy thesis (Yates 1984) and an early study of a single long-finned pilot whale stomach (Murie 1873). Thus, because of the limited data on the stomachs of these species this study was undertaken.