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Food Habits of the Peale's Dolphin, *Lagenorhynchus australis*; Review and New Information

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ABSTRACT

Peale's dolphin, *Lagenorhynchus australis*, is a common but little known species from southern South America. A review of the literature produced several observations of feeding behaviour, but only four reports on the examination of stomach contents of this species; all four were from the east coast of the continent in the southern South Atlantic. The seven animals sampled had fed on Argentine shrimp (*Pleoticus muelleri*), small octopus, three species of squid (*Loligo gahi; Illex argentinus*), kingklip fish (*Genypterus blacodes*), Argentine hake (*Merluccius hubbsi*) and southern cod (*Salilota australis*). These species are common in the waters of the Patagonian shelf. We report on further observations on dolphin feeding during regular shore-based studies along the central Strait of Magellan and on nine specimens from Tierra del Fuego, seven from the northeastern Atlantic coast and two young animals from the northeastern coast of the Beagle Channel. All nine animals probably died incidentally in shore-based nets set for Patagonian blenny (*Eleginops maclovinus*). We found at least 15 taxa represented in the stomach contents: eight species of fish, three of cephalopods, one bivalve mollusc, two crustaceans and one species of salp. The salps had been taken by the youngest dolphins, which also had milk in their stomachs. The most important prey species were bottom fish: hagfish (*Myxine australis*), southern cod (*Salilota australis*) and Patagonian grenadier (*Macruronus magellanicus*), followed by the red octopus (*Enteroctopus megalocyathus*) and Patagonian squid (*L. gahi.*). The remaining species, among others *Sprattus fuegensis* and *Illex argentinus*, were marginal or perhaps items ingested by the other actual prey species. The feeding ecology of Peale's dolphin off northeastern Tierra del Fuego seems to be associated with demersal and bottom species captured in or near kelp beds.

KEYWORDS: PEALE'S DOLPHIN; SOUTH ATLANTIC; SOUTH PACIFIC; FEEDING; FOOD; PREY; FISH; SQUID

INTRODUCTION

Peale's dolphin (*Lagenorhynchus australis*) is a coastal species found along the shores of southern South America from about 38°S in the southwestern South Atlantic, south around Cape Horn and north to 33°S in the southeastern South Pacific (Goodall *et al.*, 1997a; b). Although it is among the most commonly seen dolphins in the area, especially off the southernmost coasts of Patagonia and Tierra del Fuego, little has been published on its biology and even less is known of its feeding habits or prey species. This paper reviews the available literature and provides new information on the food habits of this dolphin off Tierra del Fuego and the Strait of Magellan.

MATERIALS AND METHODS

Specimens were obtained during a long-term study of stranded and incidentally-captured small cetaceans in Tierra del Fuego (Goodall, 1978; 1989). Most, if not all, were taken in nets set from the coast for Patagonian blenny (róbalo, *Eleginops maclovinus*) (Goodall and Cameron, 1980; Goodall *et al.*, 1994). Stomach contents were available for nine animals taken in this fishery: three females, four males and two animals whose sex could not be determined due to the length of time on the beach (Table 1). Other specimens listed by Goodall *et al.* (1997b) had been gutted by fishermen or partially consumed by predators.

The animals were necropsied using standard methods and the stomach contents were washed with sea or fresh water using a 1mm sieve and stored in 70% ethanol. In the laboratory, the contents were again washed through several sizes of sieves. The items used for identification were separated under a binocular microscope, classified and conserved in 70% ethanol.

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Table 1

Specimens of Peale's dolphins recovered on the coasts of the Isla Grande de Tierra del Fuego for stomach content analysis.

RNP no.	Sex	Total length	Date of death* or date found	Locality
Northern coast of Isla Grande				
836	-	190	23 Oct. 1980	Bahía San Sebastián
1164	F	163	-- Apr. 1984*	South of Río Lainez
1306	M	-	31 Oct. 1986*	Paso de las Cholgas south
1475	F	196	6 Dec. 1989	South of Cabo Espíritu Santo
1476	M	159	6 Dec. 1989	South of Cabo Espíritu Santo
1760	M	187	15 Feb. 1994*	Península Páramo, west
1855	-	172	-- Feb. 1995*	Península Páramo, northwest
Southern coast of Isla Grande				
1752	F	130	12 Feb. 1994*	1km west of Río Moat
1753	M	136	12 Feb. 1994*	1km west of Río Moat

At least 600 sightings forms obtained by the Goodall programme were reviewed for locality and references to feeding (Goodall *et al.*, 1997a).

A shore-based long-term observation programme on Peale's dolphins was begun by A-K Lescrauwaet (AKL) along the east-central Strait of Magellan in March, 1989. This study, from 10km North of Punta Arenas to 45km South, encompassed 1,450 hours over 55 months (to December 1995) and was augmented by a series of boat surveys (Lescrauwaet, 1997).

Identification of materials

The scientific and common names of the prey species recorded for *L. australis* are given in Appendix 1.

The remains of fish were identified by their otoliths and cranial, mandibular, maxillary and pectoral girdle bones, using the reference collection at the Centro Austral de Investigaciones Científicas (CADIC) in Ushuaia and the catalogue of Gosztonyi and Kuba (1996). The species *Sprattus fuegensis* (austral sprat) was identified on the basis

of structural characteristics, such as capsules present in the crania. The remains of hagfish (*Myxine australis*) were identified by the neurocranial cartilage and the branchial skeleton, as well as by the presence of lingual dental plates.

The remains of cephalopods were identified from the reference collection in CADIC and the literature (Clarke, 1980; 1986; Ré, 1981; Fischer and Hureau, 1985). Bivalve molluscs were identified by S. Gordillo of CADIC. Crustacean remains were identified through reference collections and the assistance of L. Comoglio of CADIC. Salp remains were identified by examining the tunic stained with Toludine Blue.

Evaluation of the importance in the diet

The diet was examined using the frequency of occurrence (FO%), the index of numerical dominance (ID%) and the index of relative importance (IRI) (Pinkas *et al.*, 1971; Hyslop, 1980), replacing the item of volume by the estimated wet weight (Castley *et al.*, 1991) and restricted to certain taxa.

Estimation of wet weight

The wet weight of the prey species was evaluated in a different way for each taxon. For the Patagonian grenadier or hoki (*Macruronus magellanicus*), we employed Aguayo's (1971) formula, which permits the determination of total length as a function of the length of the otolith, as well as the relationships published by IFOP (1979), which give individual weight on the basis of body length.

For the southern cod (*Salilota australis*), we adjusted a relationship between body length and length of otolith (p of F for regression = 0.0004) and weight in relation to body length (p of F for regression = 0.0002), on the basis of five specimens of this species.

In studying the austral sprat (*Sprattus fuegensis*) we used an estimated weight/body length/length of otolith (Gru and Cousseau, 1982). We estimated the average size of a sample of sprats from the Beagle Channel ($n = 11$) and used this to estimate the weights of sprats in the stomachs of the dolphins.

For the hagfish (*Myxine australis*), we used a relationship of weight to body length for *Myxine* sp. from Patagonia, applied to the median length of the hagfish captured in the Beagle Channel (Lloris and Rucabado, 1991). For the *Austrolycus*, we used an average of the body weight of two CENPAT specimens which were slightly larger and smaller than our specimen.

The cephalopods were studied using the relationship of dorsal mantle length (DML) as a function of the lower rostral length (LRL) or lower hood length (LHL). In the case of the red octopus, *Enteroctopus megalocyathus*, we used weight as a function of LHL as described by Clarke (1986) for *Octopus vulgaris*.

If the fish otoliths were very worn, if the lower beaks of squid and octopus were too broken to measure, or if more upper identifiable beaks than lower were found, the weight was estimated using the average weight of the other specimens of the same species. The formulae used are summarised in Table 2.

RESULTS

Observations of feeding behaviour

Previous studies

There are few observations in the literature on the feeding behaviour of Peale's dolphins. The earliest feeding observation is one of the most interesting (Hamilton, 1952):

> .... [the] first specimen which I collected was one of a party which was swimming and diving slowly and even lying on the surface with the blowhole open, in a bed of *Macrocystis*. The stomach of the animal killed contained pieces of Octopod molluscs, which were presumably being caught as they climbed about the *Macrocystis* plants. The deliberation of the movements of the dolphins is of course to be explained by the time required to search the weed thoroughly. I have seen the species behaving in exactly the same way in other beds of the plant, their behaviour being varied by sudden rushes and plunging about on the surface.

Various other authors mention that Peale's dolphins feed in the kelp (Leatherwood *et al.*, 1988; Iñíguez and de Haro, 1993). Lescrauwaet (1990; 1997) found a high degree of association of the dolphins with the kelp zone, especially by mothers with young and by animals that were obviously foraging. She found that the dolphins used different strategies depending on the type of prey and that there was a relationship between the migrations of prey and the movements of the dolphins.

Lescrauwaet (1997) proposed that the dolphins 'screen' the kelp beds throughout the year. When in the kelp they dive deeper and stay down longer, apparently searching among

Table 2

Relationships employed in the estimates of weight for prey items of Peale's dolphins. W, weight (gr); LHL, lower hood length (mm); LRL, lower rostral length (mm); DML, dorsal mantle length (cm); TL, total length (cm); OL, otolith length (mm).

Species	Relationship/Data	Source
Enteroctopus megalocyathus (*Octopus vulgaris*)	$\ln W = -1.36 + 3.45 * \ln LHL$	Clarke, 1986
Illex argentinus	$DML = 8.257\ 10^{-2} + 6.009\ LRL$, $W = 9.82\ 10^{-3}\ DML^{3.328}$	Koen Alonso *et al.* 1997
Loligo gahi	$DML = -0.712 + 4.622 * LHL$, $W = 0.026 * DML^{2.753}$	Koen Alonso *et al.* 1997
Macruronus magellanicus	$TL = 7.587 + 3.52 * OL$, $W = 3.28 * 10^{-3} * TL^{2.445}$	Aguayo, 1971 IFOP, 1979
Salilota australis	$TL = -259.837 + 39.866 * OL$, $W = 3.28 * 10^{-4} * TL^{2.445}$ $n=5$	CENPAT
Sprattus fuegensis	Average TL (SD) 79mm (27mm) $n=11$ $W = 3.751 * 10^{-6} * TL^{2.942}$	This paper, Lloris and Rucabado, 1991 Gru and Cousseau, 1982
Myxine sp.	Average TL (SD) 51 mm (6mm) $n=5$ $W = 2.943 * 10^{-3} * TL^{2.811}$	This paper, Lloris and Rucabado, 1991

CENPAT = Marine Mammal Lab, Centro Nacional Patagónico, Puerto Madryn, Chubut, Argentina.

the holdfasts; experienced divers claim that the dolphins search for octopus there. She also reported dolphins feeding cooperatively on species such as *pejerrey* at some distance from the kelp and joining in large circular feeding formations.

At Cabo Virgenes, Argentina, de Haro found that the dolphins fed in the kelp beds mainly during the mid and high tide. They cruised slowly at the edge or inside the kelp, using small, clear channels. When searching for food they arch their backs highly when diving (de Haro and Iñíguez, 1997).

Olivos and Delgado (1990) observed Peale's dolphins for four days in March 1990 at Santa Bárbara (42°51'S). On this occasion the dolphins seemed to be feeding slowly near the coast (1-50m) from 0900-1200hs. Then they disappeared until returning in an active, jumping, leaping and playing session from 1600-1900hs.

This study

We have seen Peale's dolphins apparently feeding in the kelp many times. Their favourite spot seems to be just inside (shoreward), or just outside, the beds of giant kelp, *Macrocystis pyrifera* (*cachiyuyo* in Argentina, *huiro* in Chile) that line the southern channels. In the Strait of Magellan, the *róbalo* move southward in summer toward the mouths of rivers that empty into the strait and the dolphins follow them closer to shore.

In November 1958, near Quellón, Chiloé, K.S. Norris (pers. commn) saw Peale's dolphins actively feeding on large, flat fish. At San Julián on east coast, M.A. Iñíguez (pers. commn) observed Peale's dolphins feeding in the shallows of a high tidal area, close to rocks and a reef. They were apparently taking fish such as *pejerrey* or Fuegian sprats. Two dolphins swam with coordinated movements, then crossed each other, moved straight to the rocks and reef, seemed to feed, then formed a circle. Sometimes they swam on their sides. The average of shortest diving times during feeding was 10.36s, that of the longest diving times was 1.46min.

Peale's dolphins engage in cooperative feeding. Up to ten dolphins may swim in a straight line formation, then break to circle back and feed. Off the Páramo Peninsula in Tierra del Fuego, we saw them use the 'flower' or 'star-burst' method of feeding, coming together to the centre of a circle, then creating a whirlpool of bodies flailing as they fed. They also form a circle to concentrate prey, then take turns passing through it. The RNP team saw these behaviours on the Atlantic coast of northeastern Tierra del Fuego, where there is little kelp. Kelp is abundant along the shore of the Strait of Magellan, but AKL always saw this behaviour in areas where the kelp belt was discontinuous or when the dolphins were distant from the kelp. This superficial feeding strategy seems to be related to pelagic prey species.

Fishermen north of the Río Deseado estuary claimed that a group of five animals beached themselves while pursuing fish, but returned to sea on the next wave (Iñíguez, pers. commn).

Peale's dolphins have been thought to occur mainly in shallow waters of less than 200m, although they are often seen off sea mounts such as the Burdwood Bank (Webber and Leatherwood, 1990; Goodall *et al.*, 1997a). In the Archipelago of Tierra del Fuego, where Peale's dolphin appears to be the most common species of small cetacean in the southern and western areas, the wider canals with ocean exposure and deep waters are also an important habitat. In ship-based surveys, AKL has recorded animals in deep waters, but usually near a steep coastline with a 0-50m wide kelp belt. The distance these animals move from the coast seems to be related to the kelp beds, at least in the west.

In reporting these results, we recognise the limitations of observations from shore or occasional ship-based surveys, which cannot take into account movements or feeding habits during darkness or in areas not covered by the surveys. Likewise, few surveys have been carried out in offshore waters off the southwestern coast of the channel region.

Stomach contents

Previous studies

In the literature, we found only four descriptions of stomach contents of Peale's dolphins, all from the southern South Atlantic. Hamilton (1952) found remains of octopus in one stomach. R. Bastida (in Goodall and Galeazzi, 1985) made a preliminary examination of the stomach contents of two Peale's dolphins from the Tierra del Fuego collection. One contained cephalopods (probably *Loligo gahi*), hydroids and algae. The other animal had remains of fish, possibly *Eleginops*. The first animal, RNP 649, had a large compacted ball of food remains, mostly brown algae, in the second stomach. The samples from this animal were not available for re-examination, but those of the second animal, RNP 836, have been included with the present sample.

The stomach contents of a 218cm male, the largest animal known to date (Goodall *et al.*, 1997b), captured in the Golfo San Jorge, Santa Cruz, were reported by Lichter (1992) and given in more detail by Iñíguez (1991). This animal had fed on southern cod (*Salilota australis*), Argentine hake (*Merluccius hubbsi*) and squid (*Illex* sp.).

The only other study of stomach contents is that of Iñíguez and de Haro (1993), who examined three female Peale's dolphins taken in mid-water trawls at 46°25'S off the Province of Santa Cruz. They found only four prey items: Argentine shrimp (*Pleoticus muelleri*); a squid (*Loligo gahi*); kingklip fish (*Genypterus blacodes*); and an unidentified bivalve. The shrimp was found in all stomachs and was the most numerous food item, followed by squid and kingklip fish (Table 3). These prey species live over the Patagonian continental shelf. On the basis of their data, these authors suggest that Peale's dolphin is a coastal generalist predator, at least off southern Patagonia in spring (late September), when the dolphins were taken. However, MKA (unpubl. data) found eggs of hagfish (*Myxine* sp.) among samples of parasites from the stomachs of these dolphins sent to CENPAT for study. Therefore, these dolphins may also have fed on the sea floor.

This study

In our Tierra del Fuego sample of nine stomachs, we identified a total of 427 prey items, corresponding to 15 taxa (Table 4): eight species of fish (hagfish, southern cod, Patagonian grenadier, austral sprat, *Notothenidae* sp., *morenita* and two unidentified species); three cephalopods (Patagonian squid, shortfin squid and red octopus); two crustaceans (lobster krill *Munida* sp. and a crab *Peltarion spinosulum*); one bivalve mollusc (*Mactridae* sp.); and one salp (*Salpidae* sp.). Over 63% of the prey items corresponded to the salp contents of specimen RNP 1753.

All the dolphins with these prey species in the stomachs (except those with salps) were collected on the northeastern coast of Tierra del Fuego, which is open to the effects of the ocean and where there is less kelp than in the channels. Salps were present in only two stomachs, those of the only two animals from the southeastern coast of Tierra del Fuego.

Table 3

Summary of food habits and prey species of Peale's dolphin to date. In each record, the items are listed in order of prevalence

Area	No.	Prey species	Common names	Reference
Falkland (Malvinas) Islands	1	Octopod mollusks	octopus	Hamilton, 1952
Tierra del Fuego	2	? *Loligo gahi*	Patagonian squid	R. Bastida *in*
		? *Eleginops*	*róbalo*	Goodall and Galeazzi 1985
		Hydroids		
		Algae		
Puerto Deseado	3	*Pleoticus muelleri*	shrimp*	Iñiguez, 1991
		Loligo patagonica [=L. gahi]	Patagonian squid**	Iñiguez and de Haro, 1995
		Genypterus blacodes	kingklip	de Haro and Iñiguez, 1996
		Unidentified bivalve		
Golfo San Jorge AAL 014, M.	1	*Salilota australis*	*bacalao criollo*	Lichter, 1992; Iñiguez, 1991
		Merluccius hubbsi	*merluza patagónica*	A.A.Lichter, pers. comm.
		Illex sp.	squid	

* In Iñiguez (1991) and de Haro and Iñiguez (1996) this is given as *Arthromysis magellanica*. In Iñiguez and de Haro (1995), it is called Argentine shrimp, *Pleoticus blacodes* = *P. muelleri*, the species we have given in the Appendix.
***Loligo patagonica* is now considered to be a synonym of *L. gahi* (Brakoniecki, 1984).

Table 4

Prey species identified in stomach contents of Peale's dolphins from Tierra del Fuego.

RNP specimen no.	836	1164	1306	1475	1476	1752	1753	1760	1855
Myxine australis	-	1	46	8	-	-	-	39	3
Saliota australis	-	2	4	7	4	-	-	-	-
Macruronus magellanicus	-	1	2	1	-	-	-	5	-
Sprattus fuegensis	-	-	-	4	-	-	-	-	-
Notothenidae	-	-	-	1	1	-	-	1	-
Unidentified fish 1	-	-	-	-	-	-	-	3	-
Unidentified fish 2	-	1	-	-	-	-	-	-	-
Austrolycus laticinctus	1	-	-	-	-	-	-	-	-
Loligo gahi	-	1	1	3	1	-	-	-	-
Illex argentinus	-	-	-	1	-	-	-	-	-
Enteroctopus megalocyathus	1	-	-	5	1	-	-	1	-
Munida sp.	1	-	-	-	-	-	-	-	-
Peltarium spinosulum	-	1	-	1	-	-	-	-	1
Mactridae	-	-	-	1	-	-	-	-	-
Salpidae	-	-	-	-	-	3	269	-	-

Both of these animals were young juveniles with milk in the stomach, probably just learning to feed. The smaller animal, with teeth only partially erupted, had eaten fewer salps.

The FO% for all taxa (Fig. 1) is affected by the small sample size, in which taxa such as crustaceans are present with 11% and 33%. The ID% for all taxa (Fig. 1) shows salps, fish and cephalopods as the main prey types, with salps and hagfish being the most numerous prey species. The mean (± standard deviation) and range of estimated length and weight of prey are shown in Tables 5 and 6.

Several taxa (salps, crustaceans, bivalves, *Illex*, the Notothenid and unidentified fish 1 and 2) were excluded from the IRI calculation for the following reasons. Salps were present in only two stomachs (and in one of those, only in trace amounts) and we could not estimate a weight for them. The crustaceans and bivalves could have been consumed secondarily with other prey, such as hagfish or cod (Lloris and Rucabado, 1991). The *Illex* specimen had an estimated wet weight of 1.6gr, so it also could have been secondary prey. The Notothenid and unidentified fish 1 and 2 were excluded from this analysis because we could not obtain weight data for the calculation.

The IRI analysis for cephalopods and identified fish (Fig. 2) reveals three groups of prey in order of IRI magnitude. The most important prey are the bottom fish, *Myxine australis*, *S. australis* and *Macruronus magellanicus*. In second place were the red octopus, *E. megalocyathus* and the squid, *L. gahi*. The fish *S. fuegensis* could represent marginal prey, or they may have been ingested by the other prey species. The lengths and weights of the species taken are given in Table 5.

DISCUSSION

The prey species

The Patagonian grenadier is found mainly over the southern part of the Patagonian shelf in waters less than 200m deep. Large concentrations occur close to Tierra del Fuego (Otero *et al.*, 1982). The winter concentrations seem to be closer to shore than the summer ones (INIDEP, 1986). In the Beagle Channel, these fish were captured at depths of between 0.5-110m (Lloris and Rucabado, 1991). Grenadiers come into the Beagle Channel in late summer and early fall, following great numbers of sprats (called fuegian sardines locally), which may strand on the coasts. This phenomenon is also observed in the Strait of Magellan in February and March, when the sprats come in with the grenadiers behind them and the Peale's dolphins taking advantage by feeding on both (Lescrauwaet, pers. comm.). The stomachs of grenadiers captured in the Beagle Channel contained sprats; their feeding seems to be concentrated on small notothenids (Lloris and Rucabado, 1991).

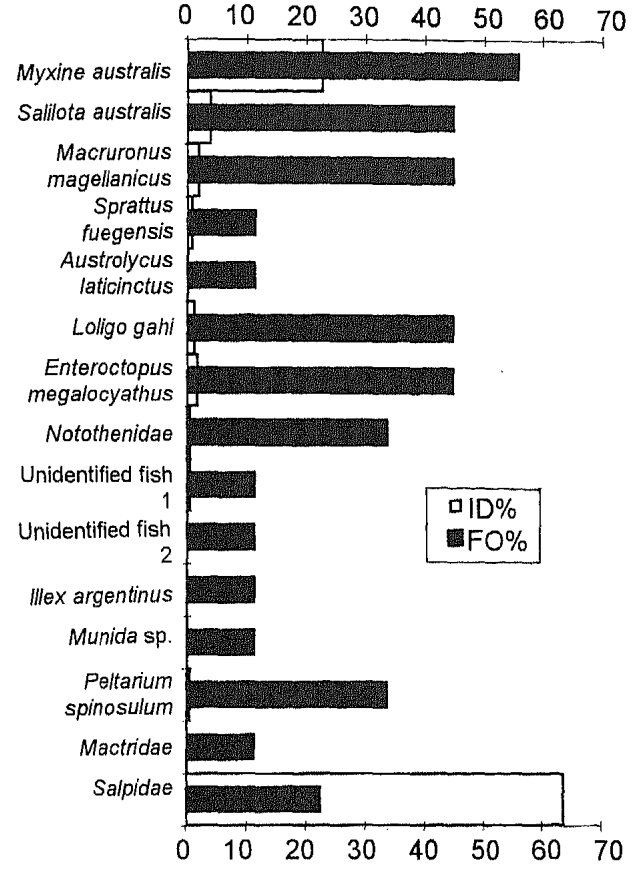

Fig. 1. Index of Frequency of Occurrence (FO%) and Index of Dominance (ID%) for stomach contents of Peale's dolphins from Tierra del Fuego.

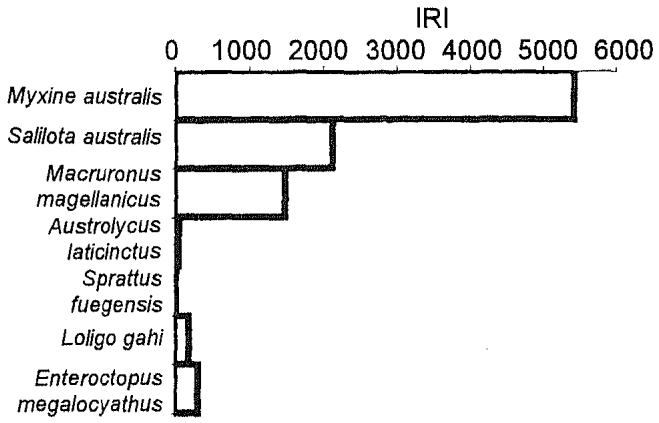

Fig. 2. Index of Relative Importance (IRI) for stomach contents of Peale's dolphins from Tierra del Fuego.

The habitat of the southern cod also includes the Patagonian shelf near Tierra del Fuego (about 20n.miles offshore), with the winter nearer-shore concentrations larger than the summer ones (INIDEP, 1986). Juveniles have been detected close to the coast (Otero *et al.*, 1982). In the Beagle Channel, these fish have been captured at depths between 10-100m. Their prey seems to be principally small notothenids (Lloris and Rucabado, 1991).

The rock eel (*morenita*) is known from coastal and shallow waters along the Atlantic coast of southern South America and in the Strait of Magellan (Gosztonyi, 1977). It is one of the largest zoarcids, reaching a total length of about 700mm. When adult, it is mainly ichtyvorous; they prey on notothenids, zoarcids and polichets as well as amphipods (Gosztonyi, 1977). The specimen found was large, with an estimated weight of 3,000gr.

Hagfish (called *babosa de mar* or slimy eels locally) inhabit sandy or muddy bottoms at depths of 20-700m. They are elusive, nocturnal and carnivorous. In addition to attacking injured fish, they feed on dead fish, gastropods and bivalves (Lloris and Rucabado, 1991). Fisheries researchers at CADIC have found that hagfish prey on fish entangled in trammel nets. So, although they are known as bottom animals, they also leave the bottom to feed on netted fish. Peale's dolphins can then easily feed on the hagfish which have left their sandy or muddy substrate. Hagfish have been reported in the diet of harbour porpoises in Canada (Smith and Gaskin, 1974) and in Scandinavian waters (Aarefjord *etal.*, 1995), but not with the relative importance found in Peale's dolphins.

The red octopus inhabits caves and cracks in rocks. On rare occasions it is found on sandy bottoms (Ré, 1981, L. Comoglio, pers. comm.). Odhner (1923, in Ré, 1981) found specimens in the algae at 7m depth, in sand at 17m depth and on sand and rock bottoms of up to 140m depth near the Falkland (Malvinas) Islands and Tierra del Fuego. *Peltarion spinosulum*, a small crab, was found in their diet (Ré, 1981), which may explain the presence of this species in the stomach contents of Peale's dolphins.

Table 5

Estimated total length (TL) and dorsal mantle length (DML) in cm for prey species found in stomachs of Peale's dolphins off Tierra del Fuego. SD = standard deviation.

Fish TL	Mean	SD	*n*	Min.	Max.
Myxine	50.9	5.6	5	42.7	57.0
Sprattus	7.9	2.6	11	61.0	153.0
Macruronus	88.7	6.5	8	77.0	97.3
Salilota	48.8	10.7	11	33.8	57.1

Cephalopods DML	Mean	SD	*n*	Min.	Max.
Loligo	13.8	2.4	5	11.8	17.8
Illex	4.5	-	1	-	-
Enteroctopus	not estimated				

Table 6

Estimated weights (in gr) for prey species found in stomachs of Peale's dolphins off Tierra del Fuego. SD = standard deviation.

Species	Mean	SD	*n*	Min.	Max.
Myxine	185.0	55.0	5	113.0	253.0
Sprattus	2.7	0.8	6	1.7	3.9
Macruronus	1886.0	393.0	8	1644.0	2451.0
Salilota	1323.0	641.0	11	501.0	1799.0
Loligo	37.9	19.0	5	23.0	72.0
Illex	1.6	-	1	-	-
Enteroctopus	131.0	92.0	6	14.2	233.0

The Patagonian squid inhabits the Patagonian shelf from 38°-55°S (INIDEP, 1986). As described for fish, above, early winter aggregations are found closer to the coast than summer ones, although both seasonal distributions are near the Fuegian coast. The few beaks recovered (six), were of an estimated range of 11.8 to 17.8cm in DML, a size which corresponds to maturing or mature animals.

The shortfin squid has a neritic oceanic habitat, but its range does not extend as far south as that of *Loligo* (INIDEP, 1986; Rodhouse and Hatfield, 1990). Because only one small individual was found (with a DML of 4.5mm), it was probably the prey of another species. Nevertheless, juvenile shortfin squid are pelagic and occur between the 50m and 100m isobaths (Brunetti and Ivanovic, 1992).

The sprat is a coastal and pelagic species. Austral sprats apparently approach the coast during late summer-early fall, in certain years entering the Beagle and other channels in great shoals which often strand, a phenomenon well-known to local residents (Lloris and Rucabado, 1991; our own observations). The sprat is an important prey item for other top predators of the area, such as Commerson's dolphins *Cephalorhynchus commersonii* (Bastida *et al.*, 1988) and seabirds such as the Magellanic penguin *Spheniscus magellanicus* (Frere *et al.*, 1996). There is a large colony of these penguins at Cabo Vírgenes, close to where our northernmost samples were taken. Being apparently an abundant resource in the area for at least part of the year, the low representation of sprats in the stomach contents of our specimens of Peale's dolphins is remarkable. This point may lead us to consider that the Peale's dolphin may not be a generalist predator, at least in the area off southern Santa Cruz and northern Tierra del Fuego. On the other hand, the results presented by Iñíguez and de Haro (1993) suggest that Peale's dolphins may act as generalist predators when they prey offshore.

Peale's dolphins and kelp beds

The results of this study are intriguing. The high degree of association of Peale's dolphins with the coastal kelp zone has been emphasised by all observers of the species. Most of our own observations of these dolphins have been near the kelp (Goodall *et al.*, 1997a), which would be consistent with a diet including octopus, as described by Hamilton (1952). Lescrauwaet (1997) found that Peale's dolphins spent 70% of their time near the kelp, which covered only 10% of her study area. Divers (for sea urchins) told her they had watched the dolphins eating octopus among the kelp holdfasts.

Kelp forests ring Tierra del Fuego but are more abundant in the rocky southern regions. The animals examined here were from areas with less kelp, except for RNP 1164 and the two from the south coast. However, even those animals taken near Bahía San Sebastián and the eastern mouth of the Strait of Magellan, both with high tidal ranges (10.6m), would not have had to travel far to find kelp.

These dolphins may spend a lot of time searching for food in or near the kelp and close to the bottom, which would explain the high percentage of *Myxine* in the stomach contents. In addition, they may move offshore into slightly deeper waters to procure demersal species such as *Salilota* and *Macruronus*. The presence of *Sprattus* may be explained by the approach of this species to the coast in summer, although *Sprattus* may have been a secondary catch via *Macruronus*. What is offshore for a Peale's dolphin in relation to water depth? From Cabo Espíritu Santo to the Río Lainez, where our specimens were taken, the 20m isobath is at about 10 n.miles and the 50m isobath at about 60 n.miles offshore. The 100m depth contour is as at over 70 n.miles and the 200m line at 120 to 180 n.miles offshore.

The presence of *Loligo* and *Sprattus* in the stomachs suggest a pelagic diet, but the latter, or even both species, may have been secondary prey from the stomachs of *Macruronus* and/or *Salilota*.

In spite of the fact that several of the prey species found in the stomachs of our Tierra del Fuego sample move coastward in winter, most Peale's dolphins are thought to move offshore in winter, with a few staying near the coast (Andrade and von Meyer, 1992; Goodall *et al.*, 1997a; Lescrauwaet, 1997). More observations are needed on seasonal movements of these dolphins and of their food habits in different parts of their range and throughout the year.

In summary, the feeding ecology of Peale's dolphins off the northeastern coast of Tierra del Fuego seems to be associated with demersal and bottom species in or close to the *Macrocystis pyrifera* kelp beds, although their feeding range may extend out over the Patagonian shelf, as the diet in the northern part of their range in the southwestern South Atlantic seems to be more pelagic.

Although this species has been considered to feed in coastal waters, these are the first published data that confirm this. The sample size is small and does not represent the offshore habitat or a large extent of the range of the species, but it adds to the slowly growing knowledge of this species.

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Appendix 1

SCIENTIFIC AND COMMON NAMES OF SPECIES MENTIONED IN THE TEXT

This is the total list of prey species known to date for *Lagenorhynchus australis*.

Fish		
anguila viscosa, babosa de mar	*Myxine australis*	hagfish, slimy eel
róbalo	*Eleginops maclovinus*	Patagonian blenny
abadejo	*Genypterus blacodes*	kingklip
merluza de cola	*Macruronus magellanicus*	Patagonian grenadier, hake
merluza patagónica	*Merluccius hubbsi*	Argentine hake
bacalao austral, criollo	*Salilota australis*	southern cod, morid cod
pejerrey	*Austroantherina nigricans**	silverside
morenita?	*Austrolycus laticinctus*	rock eel?
sardina fueguina	*Sprattus fuegensis*	austral sprat, sardine
Invertebrates		
pulpo colorado	*Enteroctopus megalocyathus*	red octopus
calamar	*Illex argentinus*	Argentine shortfin squid
calamarete	*Loligo gahi*	Patagonian squid
bogavante	*Munida* sp.	lobster krill
langostino	*Pleoticus muelleri*	Argentine shrimp
cangrejo	*Peltarion spinosulum*	crab
almeja	Mactridae	clam
salpa	Salpidae	salp
hidroideos	-	hydroids

* The taxonomy of the species of *Austroantherina* is not yet clear.