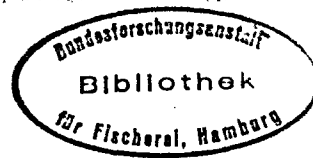


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STOMACH CONTENTS OF TWO SHORT-FINNED PILOT WHALE
(*Globicephala macrorhynchus* Gray, 1846) (CETACEA, DELPHINIDAE)
OFF THE CANARY ISLANDS: A PRELIMINARY NOTE

by

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ABSTRACT

Two short-finned pilot whales were found, one stranded on Lanzarote and the other floating dead off the southwest of Tenerife. On analysis of the stomach contents, the diet composition was ascertained and the role of the cephalopod species in the same which is the object of this paper.

In both animals, the stomach contents were made up entirely of cephalopods. Thus, the stomach of the short-finned pilot whale stranded in Lanzarote had only 7 upper and 5 lower cephalopod beaks. One of the lower beaks belonged to a large *Todarodes sagittatus*. From the whale found off Tenerife the stomach contents were recorded as consisting in three squid specimens, arm crowns, lenses and free beaks (318 upper and 313 lower). The specimens were identified as *Todarodes sagittatus*, and 17 free lower beaks were also identified as pertaining to this species. The most important families by number were Cranchiidae (66.7 %), Cycloteuthidae (8.8 %) and Ommastrephidae (6.3 %); though probably by weight there is a different order of importance, due to the fact that a large proportion of the cephalopods were identified as *Cranchia* and juveniles of *Megalocranchia*.

INTRODUCCION

The Canary Islands are located in the northeast Atlantic Ocean (27°37' - 29°25' N and 13°20' - 18°10' W, Fig. 1). They are islands of volcanic origin and although near to the northwest African coast are surrounded by depths ranging between 1000 and 3000 m. The oceanography in this area is dominated by the Canary Current.

Knowledge of the biology of the cetaceans which inhabit the zones around the Islands, especially with respect to their diet and feeding patterns, and their overall behaviour in the region is poor. This is mainly due to an absence of workers interested in the animals in the area at least up until a few years back. It is for this reason that scarce references can be found in the literature to the subject. It was only at the beginning of the 80s, when Martín *et al.* (1992) started the study of the cetacean specimens stranded on the coast line of the Canary Islands that interest began to emerge with respect to the subject of the cetaceans. However, the coverage was initially not exhaustively carried out along the coast line of the archipelago; this only became possible in 1991 with the onset of the specific "Program of Study of Cetaceans Stranded on the Canary Archipelago". Parallel to this, other studies were carried out on the populations of *Globicephala macrorhynchus* and *Tursiops truncatus* located between Tenerife and La Gomera.

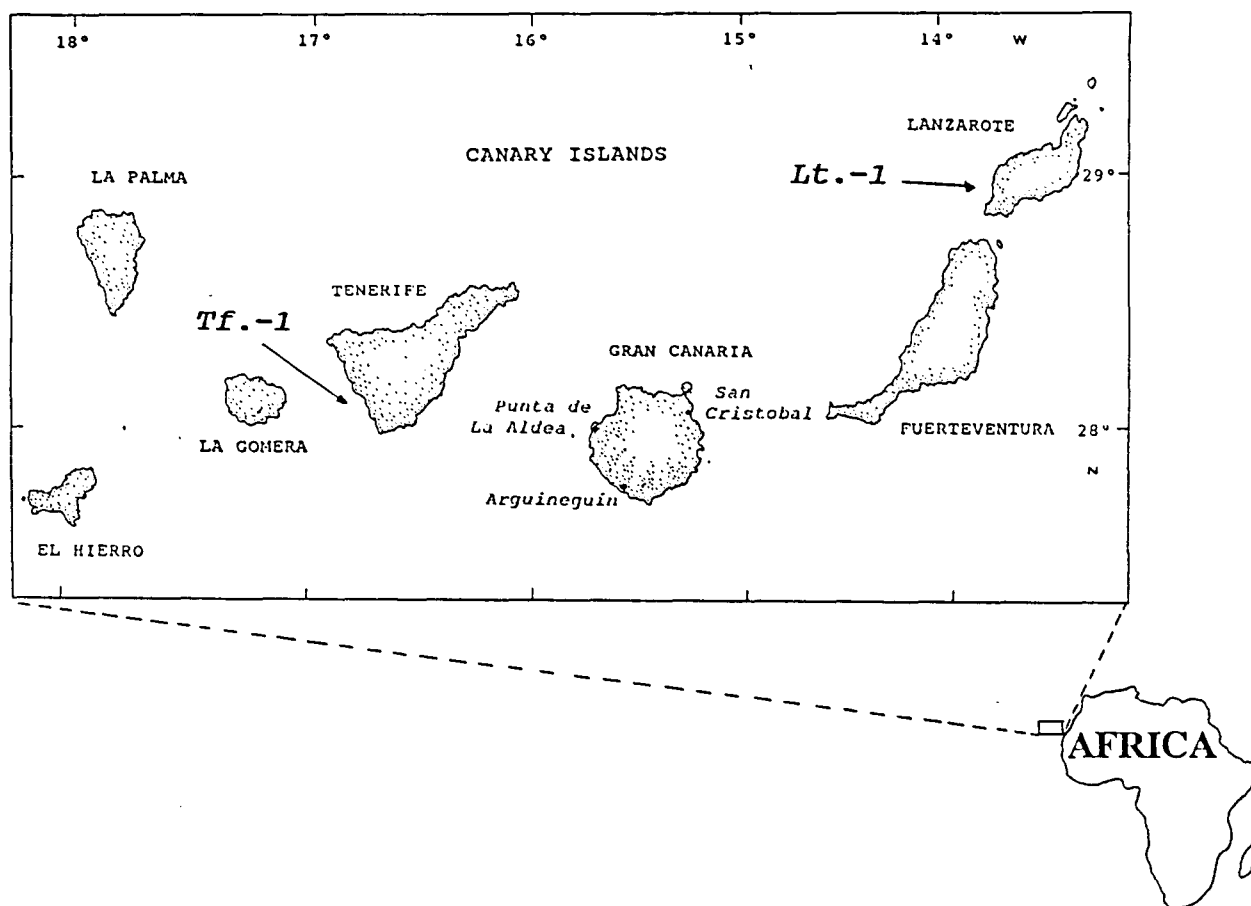


Figure 1.- Geographical positions where the short-pilot whale were found.

As part of the results of those work, we now know that some 19 species currently may inhabit the regions around the Islands, from the records of stranded species and occasional sightings (Martín *et al.*, 1992); although the species *Balaenoptera borealis* and *Pseudorca crassidens* have been recorded recently (Martín, unpublished data). Moreover, Heimlich-Boran & Heimlich-Boran (1992) showed that a part (nearly 300 specimens) of the short-finned pilot whale (*Globicephala macrorhynchus*) population inhabit the southwest coast of Tenerife constitute a year round or "resident animal" population.

This note, about the food of the short-finned pilot whales, is aimed at giving an outline of the feeding ecology of this species. This is considered to be an important element in the life history of the species.

MATERIAL AND METHODS

Specimens

Two short-finned pilot whales (*Globicephala macrorhynchus* Gray, 1846) were found dead. The first of these (hereinafter referred to as *Lt.-1*) was found stranded on the coast of El Golfo (Lanzarote), on 28.5.1991, and it was a male. The caudal part of the animal was divided up. The second specimen (hereinafter referred to as *Tf.-1*) was found floating with a large cut in the dorsal side, off the southwest coast of Tenerife on 26.2.1992. It was a female measuring 340 cm total length (TL) and belonged to the resident population. During necropsies, special care was devoted to removing the stomach contents, parasites and gonads.

Stomach contents preservation and analysis

All food remains were taken including the hard parts found in the stomach wall folds (very small beaks and lenses of cephalopods, otoliths were not found). Then, the contents of each specimen was fixed with formalin 4 % and then preserved in 70 % ethyl alcohol.

A preliminary analysis consisted in cleaning and separating the fleshy fragments from the refractarial structures. The results proved that all the food remains came from cephalopods and that there were no fish or crustacean remains (i.e. bones, otoliths and lenses, or external skeleton of crustaceans) to be found. Beaks were sorted into upper and lower. Nematodes were found, but these were assumed to be parasites and were not considered as prey.

The specimen *Lt.-1* had only 7 upper and 5 lower beaks. On the other hand, the specimen *Tf.-1* had three fresh cephalopods, a semicomplete body, parts of two different crowns of arms, beaks (318 upper and 313 lower), several lenses and many pieces of pens. Nearly all the beaks collected were fresh.

Cephalopod specimens were identified by using morphological characteristics and beaks. Lower beaks (LB) were used as the primary means for clasification of cephalopods preyed upon. Beak identity was established by methods described by Clarke (1962, 1980,

1986) and supplemented by comparison with a collection of cephalopod beaks (including some beaks removed from locally caught cephalopods) and general knowledge of cephalopod distribution (Nesis, 1987). All lower beaks were sorted into groups which were identified as far as possible into species. Moreover, the "Lower Rostral Lengths" (LRL, defined by Clarke, 1962) were measured by digital caliper (for those beaks with LRL over 2 mm) or with a stereoscopic microscope and eyepiece micrometer to an accuracy of 0.01 mm.

RESULTS

SPECIMEN *Lt.-1*

The stomach of this short-finned pilot whale had only 7 upper and 5 lower cephalopod beaks. From the lower beaks it was estimated that four families of cephalopods had been preyed upon:

The Ommastrephidae Family

The species *Todarodes sagittatus* was identified from a large lower beak (LRL= 10.64 mm). Moreover, a small upper beak (URL= 4.6 mm) may belong to another *T. sagittatus*. Another lower beak which had distorted wings and lateral walls (with LRL= 6.33 mm) belonged to an ommastrephid species.

The Lepidoteuthidae Family

The genus *Lepidoteuthis* has a single species, *Lepidoteuthis grimaldi*. A beak with LRL= 9.64 mm was assigned to this family. The beak had no wings.

The Cranchiidae Family

A small beak (LRL= 2.74 mm) without wings was identified as belonging to *Taonius* sp.

The Chiroteuthidae Family (?)

A lower beak with LRL= 7.05 mm was found. This had nearly the same shape as the *Chiroteuthis* although in the lateral walls there is a ridge whereas this genus has a distinct thickened fold. There are probably a number of *Chiroteuthis* species which have not yet been described and others which are scarcely defined (Clarke, 1986). Therefore, this beak has only been tentatively assigned to the genus for the time being.

SPECIMEN *Tf.-1*

The entire contents consisted of cephalopod remains. From the specimens and beaks, it was estimated that 321 cephalopods were ingested by this short-finned pilot whale. Two of the three cephalopod specimens still had chromatophores on some areas of their bodies and

all three were identified as *Todarodes sagittatus*, two females and one male. Measurements and data of these are given in Table 1. The semicomplete body (a mantle), from its shape could have belonged to a *Histioteuthis* species.

Table 1.- Data of specimens of *Todarodes sagittatus* from the stomach of the short-finned pilot whale *Tf.-1*. DML is the "Dorsal Mantle Length" and i/j is the rostral width ratio.

SPECIMEN	DML (cm)	SEX	LRL (mm)	I/J	NOTES
<i>T. sagittatus</i> 1M	25.4	♂	8.61	1.36	Suckers on stalk along 14 cm.
<i>T. sagittatus</i> 2F	31.5	♀	10.78	1.39	Tip of the lower beak round. Oviducts with eggs.
<i>T. sagittatus</i> 3F	30.6	♀	11.10	-	Tip of the lower beak pointed.

The lower beaks allowed for the identification of 8 families and 11 genus (Table 2) It is to be remarked upon that three genus belonged to the family Cranchiidae (*Cranchia*, *Megalocranchia* and *Taonius*):

The Ommastrephidae Family

A total of 17 lower beaks identified belong to *Todarodes sagittatus*. They showed a short range of LRL, with a minimum of 7.95 and a maximum of 11.36 mm. These beaks were fresh, without bent wings. Thus, they were probably part of the same population as the other three specimens found.

The Pholidoteuthidae Family

Eleven beaks were identified and measured and were assigned to the genus *Pholidoteuthis*. The range of the LRL was between 8.41 and 9.75 mm. Nearly all the beaks had bent wings. The beaks were mainly of two different shapes with the most important difference in the jaw edge area. However, in general, they were the same shape as a beak removed from a specimen of *Pholidoteuthis adami*.

The Lycoteuthidae Family (?)

Four beaks with LRL between 2.33 and 2.60 mm were tentatively assigned to the genus *Selenoteuthis*. These beaks are characterized by the fact that they had a well defined step below the jaw angle, no clearly distinct anglepoint, the lateral wall with a ridge (nearly a fin), wings thin near the shoulder and no wing fold. Nesis (1987) considers that the single species, *S. scintillans* Voss, 1958, inhabits the northeast Atlantic region also.

The Histioteuthidae Family

Histioteuthis meleagroteuthis

This species was represented by nine specimens as estimated from the lower beaks. The range of the LRL was between 1.73 and 3.86 mm. Those beaks whose LRL were larger than 2.30 had near fully darkened wings, and one beak with LRL = 1.86 mm was in the early phases of darkening.

Histioteuthis A spp.

Six beaks were identified as belonging to this genus, and at least two species can be included herein. Three beaks (LRL = 7.79, 7.62, and 7.02 mm) had cartilage on the shoulder and the smaller one had had its wings partially digested by the gastric juices. Another beak, with a LRL = 5.07, had darkened wings and a shape similar to type A4 (type described in Clarke, 1980). Another two beaks were broken, but they showed the characteristic A shape. Thus, probably the three are *Histioteuthis bonnellii bonnellii* and A4 is very probably *H. dofleini* which has also been found in the stomachs of *Xiphias gladius* in this zone.

The Ctenopterigidae Family

A group of five beaks were identified as *Ctenopteryx* sp., and their LRL ranged between 1.70 and 2.60 mm. Those beaks whose LRL were under 2.40 mm had darkened wings only over a thin band in the region of the shoulder.

The Cycloteuthidae Family

Cycloteuthis sp.

A total of 24 beaks were identified as belonging to this genus. The LRL range was between 2.80 and 6.80 mm. The largest specimen had wings in the first phases of darkening.

Discoteuthis sp.

Four beaks with LRL between 2.40 and 3.33 mm were identified.

The Chiroteuthidae Family (?)

Two distinct types of lower beaks were approximately of the same shape as the beaks of the genus *Chiroteuthis*. The most important difference was the thickened fold of the lateral wall which, in these beaks, is nearly a ridge. The LRL range was between 4.9 and 5.8 mm.

The Cranchiidae Family

Cranchia scabra

This species is represented by 79 lower beaks, and amounted to 25.0 % of all the squids estimated. The LRLs measured between 1.27-2.37 mm with the specimens under 1.53

mm corresponding to beaks without darkened wings.

Table 2.- Percentage of cephalopods estimated from Lower Beaks (LB) (and the three specimens of *Todarodes sagittatus*) and their LRL range in mm.

CEPHALOPOD FAMILY	ESTIMATED SQUID %	LRL range (mm)
Family Ommastrephidae		
<i>Todarodes sagittatus</i>	6.33	7.95 - 11.36
Family Pholidoteuthidae		
<i>Pholidoteuthis adami</i> ?	3.48	8.41 - 9.75
Family Lycoteuthidae		
<i>Selenoteuthis</i> ? <i>scintillans</i>	1.26	2.33 - 2.60
Family Histioteuthidae		
<i>Histioteuthis meleagroteuthis</i>	2.85	1.73 - 3.86
<i>Histioteuthis</i> A spp.	1.89	5.07 - 7.79
Family Ctenopterygidae		
<i>Ctenopteryx</i> sp.	1.58	1.70 - 2.60
Family Cycloteuthidae		
<i>Cycloteuthis</i> sp.	7.59	2.80 - 6.80
<i>Discoteuthis</i> sp.	1.26	2.40 - 3.33
Family Chiroteuthidae		
<i>Chiroteuthis</i> sp.	1.58	4.90 - 5.80
Family Cranchiidae		
<i>Cranchia scabra</i>	25.00	1.27 - 2.37
<i>Megalocranchia</i> sp.	37.34	1.60 - 8.88
<i>Taonius</i> sp.	4.43	2.90- 5.47
No identified Oegopsid squids	5.37	-

Megalocranchia sp.

This is the most important genus of lower beaks to be found in the stomach content (37.34% , Table 2). The LRL range of these beaks is between 1.60 and 8.88 mm although 114 beaks had LRLs under 6.33 mm and undarkened wings.

Taonius sp.

It was determined that 14 specimens of the genus *Taonius* were preyed upon by the whale. The beaks found belonging to these squids ranged in LRL between 2.9 and 5.47 mm.

Oegopsid cephalopods no identified:

A group of 17 LB belonging to different species, some of them with LRL as small as 0.85 mm, were not identified. New beaks removed from more cephalopod specimens could be aid in their identification.

DISCUSSION

There are not many references to the feeding habits of the short-finned pilot whale. Most of the studies were carried out using stranded specimens of the long-finned pilot whale (*Globicephala melas*) (Orsi-Relini & Garibaldi, 1992); though, Overholtz & Waring (1991) studied the stomach contents of five pilot whales (*Globicephala* sp.) that were taken incidental to fishing operations, and Clarke (1985) gave some data of *G. melas* and *G. macrorhynchus*. These workers showed that *Globicephala* spp. often include cephalopod in the diet.

After the preliminary results of this work, the short-finned pilot whale seems to reveal a preference for squids as prey in this area, though only two stomachs have been analysed here. Nevertheless, we should perhaps mention in order to corroborate this information that a specimen was observed vomiting a large number of cephalopod beaks when it was at 5 m depth. Moreover, the same result was observed by Orsi-Relini and Garibaldi (1992) in *Globicephala melas*. This is understandable given that the shape of the odontocete skull and jaw is closely related to the method of food capture (Evans, 1987) and therefore is adapted to the most suitable prey. Moreover, the structure and shape of the jaws and muscles in pilot whales (broad jaws and a small number of teeth concentrated towards the front region of each jaw) seem to be adequate for grasping squids (Evans, 1987).

The stomach contents of specimen *Tf.-1* are probably as representative of the typical diet of the species as can be found because the animal would be healthy before being hit. It is interesting to bear in mind that the three *Todarodes sagittatus* specimens were fresh and a large number of the free beaks still had cartilage on the shoulder and some undarkened wings were not dissolved. Therefore, the cephalopod remains belonged to more than one meal but with a relatively short time difference between the two. Therefore, and considering that this animal (*Tf.-1*) was a member of the resident population in the area (southwest off Tenerife) it could be expected that all the cephalopod fauna represented in the stomach were from the zone. However, further analysis of this material should be carried out and more especially if fresh cephalopod specimens are caught.

The great importance of the Cranchiidae family with regards to number (nearly 67 %) does not correspond with the importance by weight. This could be expected if it is considered that the estimated weight of the largest specimen of the genus *Cranchia* is 21.9

g, and the majority (96.6 %) of the beaks of *Megalocranchia* had LRL under 6.33 mm and therefore a weight of under 138 g. As compared with this species, the specimens of the Ommastrephidae family (*Todarodes sagittatus*) with the same LRL (between 8 and 11 mm) weighed between 900 and 1100 g in this zone. Moreover, the specimens of *Pholidoteuthis* and *Histioteuthis* contribute in a relatively important extent to the weight of the flesh represented by the beaks.

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