Stomach contents of two Cuvier’s beaked whales (Ziphius cavirostris) stranded in the Adriatic Sea

IVA KOVAČIĆ1, MARTINA ĐURAS GOMERČIĆ2, HRVOJE GOMERČIĆ2, HRVOJE LUCIĆ2
AND TOMISLAV GOMERČIĆ2

1Biology Department, The Faculty of Science, Rooseveltov trg 6, 10 000 Zagreb, Croatia, 2Department of Anatomy, Histology and Embriology, The Faculty of Veterinary Medicine, Heinzelova 55, 10 000 Zagreb, Croatia

The stomach contents of two Cuvier’s beaked whales (Ziphius cavirostris) stranded along the eastern Adriatic coast were examined. One was a male stranded in 2004 and the other was a newborn stranded in 2008. Milk was found in the newborn’s stomach. The prey of the male was only cephalopods belonging mainly to the Teuthoidea. Five families and seven species were identified. Octopoteuthis sicula represented about 50% of estimated prey weight and Chiroteuthis veranyi was the most frequent species (estimated from the quantity of lower beaks). Three species are not listed in the Adriatic fauna, while the other species are found in middle and lower slope cephalopod assemblages in the southern Adriatic Sea.

Keywords: Cuvier’s beaked whale, diet, Adriatic Sea

Submitted 30 June 2009; accepted 18 November 2009

INTRODUCTION

Cuvier’s beaked whale (Ziphius cavirostris G. Cuvier, 1823) has a cosmopolitan distribution in all oceans except in high polar waters, but low encounter rates through most of its range (Heyning, 1989; MacLeod & Mitchell, 2006). It is the only species of the Ziphiidae family present in the Mediterranean Sea that may be isolated from the Atlantic population (Dalebout, 2005).

The Adriatic Sea is a semi-enclosed sea separated from the Ionian Sea by the Otranto Strait (780 m deep, 72 km length; Cushman-Rosin et al., 2001) (Figure 1).

The southern basin, deeper than the northern one, reaches depths of 1223 m and according to Holcer et al. (2007) it is probably a suitable habitat for Cuvier’s beaked whale, which dives regularly to depths greater than 800 m (Baird et al., 2006). Dives deeper than 500 m are considered to be foraging dives (Tyack et al., 2006). The diet of the species is described from patchy data only (Santos et al., 2001). There are only four publications on stomach contents of Cuvier’s beaked whale stranded in the Mediterranean Sea: two analysed from single strandings and two from mass strandings (Podestà & Meotti, 1991; Carlini et al., 1992; Lefkaitou & Pouloupolou, 1998; Blanco & Raga, 2000). No information is yet available on diet in the Adriatic Sea.

The aim of this paper is to provide the dietary data of this species in the Adriatic Sea by presenting the analysis of two stomach contents obtained from four specimens stranded along the Croatian coast, and if results are able to establish that the species feeds in this area.

MATERIALS AND METHODS

The gastro-intestinal tracks analysed in this study came from two whales stranded on Croatian coasts, between 17°00’E and 18°20’E; 42°30’N and 42°55’N (Figure 2): a male, quite decomposed, stranded on Mljet Island (on the southern shore) on 19 April 2004 and a newborn (estimated to be less than one week old according to H. Gomercić) stranded on 11 June 2008 in Trstenica Bay near Orebić. Also a 5.10 m long male stranded on 2 February 2002 on Korčula Island but could not be considered for the study due to its very advanced state of decomposition. The two most distant strandings were 50 km apart.

The two decomposed carcasses had been identified using DNA analysis to confirm the identifications (Gomerčić et al., 2006).

Cephalopod beaks were identified using published cephalopod guides (Clarke, 1986) and a reference collection of oceanic cephalopod beaks. The total number of prey items per species was estimated according to Clarke (1986) as the number of lower or upper beaks, whichever was higher. Rostral length (LRL) measurements of lower beaks were taken using calipers to an accuracy of 0.01 mm. Mantle length (ML) and body mass of prey were estimated using regression equations given by Clarke (1986). Overall diet composition was calculated expressing the proportion of each cephalopod species number and mass in the total of all prey species.

RESULTS

Stomach contents were found in two whales: a newborn and one male.

The newborn had only milk in its stomach. The stomach of the male contained food remains consisting only of...
cephalopod beaks: 99 lower and 90 upper beaks belonging to five families and seven species (Table 1).

The higher weight percentage was obtained for Octopoteuthis sicula (Ruppel, 1844) and Histioteuthis reversa (Verrill, 1880) (Table 1); while Chiroteuthis veranyi (Férrusac, 1834) dominated in terms of prey numbers (N = 48). The estimated ML ranged between 46 and 75 mm for H. reversa with a mode of 66; between 59 and 119 mm with a mode of 95 and 115 for Histioteuthis bonnellii (Férrusac, 1834); and between 89 and 170 mm with a mode of 148 for C. veranyi (Figure 3).

DISCUSSION

The prey items found in the stomach of the Mljet Island whale are pelagic cephalopods associated with middle and lower slopes.

Histioteuthis reversa and Histioteuthis bonnellii have been found in the southern Adriatic basin at depths between 296–567 and 116–787 m respectively, but are also present down to 1000 m deep (Voss et al., 1998).

Chiroteuthis veranyi, the main prey in number, has also been found in Jabuka Pit and the southern Adriatic basin (Bello, 1990; Krstulović Šifner et al., 2005). The adults of this species are bathypelagic living deeper than 700 m, while the young individuals are found between 300 and 600 m deep (Kaspiris & Tsiambaos, 1984). The ML of C. veranyi in the male stomach was less than half of the maximum species size according to Voss et al. (1998).

Octopoteuthis sicula, the main prey in weight, is not listed in the Adriatic fauna (Bello, 1990), but was found in the eastern Mediterranean Sea (Salaman & Katag˘an, 2002). This species was also found in the stomachs of Cuvier’s beaked whales mass stranding in the Ionian Sea (Lefkaditou & Poulopoulos (1998).

Galiteuthis armata (Joubin, 1898), absent from the Adriatic Sea (Bello, 1990) is rarely found in the eastern Mediterranean Sea (Lefkaditou et al., 2003) but was in both stomachs of the Adriatic whale and the two whales stranded on the Spanish Mediterranean coast (Blanco & Raga, 2000). They reported ten cephalopod prey species: five also found in the Adriatic male (O. sicula, H. bonnellii, H. reversa, C. veranyi and G. armata) and Todarodes sagittatus (Lamarck, 1798), Chenteryx sicula (Véray, 1851), Ancistrocheirus lesueurii (Orbigny, 1842), Heteroteuthis dispar (Rüppell, 1844) and Ancistroteuthis lichtensteinii (Ferrusac, 1835).

Ancistroteuthis lichtenstenii was found in both whales stranded on the west coast of Italy. Podestà & Meotti (1991)
also found Histioteuthidae and Cranchiidae, and the only
octopod found in stomachs of Cuvier’s beaked whales
stranded in the Mediterranean: *Eledone* sp.

Prey of other specimens stranded in the same area were
*H. bonnellii*, *H. reversa*, *T. sagitattus*, *A. lichenstenii*,
*O. sicula*, *C. veranyi* and *Heteroteuthis dispar* (Rüppell, 1844),
*Ommastrephes barramii* (LeSueur, 1821) (Carlini et al., 1992).

*Histioteuthis bonnellii* had been found in Cuvier’s beaked
whales’ stomachs from all stranding locations in the
Mediterranean Sea where stomach contents were examined,
suggesting that this species, found in the whole of the
Mediterranean Sea (Bello, 1990; Salaman & Katağan, 2002;
Lefkaditou et al., 2003), could be an important prey of
Cuvier’s beaked whale in the area.

*Octopoteuthis sicula*, the
most important species in weight in the Adriatic whale, was
absent only in one whale stranded in Italy.

*Octopoteuthis sicula* and *G. armata*, both species being
absent in the Adriatic Sea, their stomach content quantity
suggests that the whale fed before entering the Adriatic Sea.
However, as the distribution of the deep sea cephalopods is
insufficiently known, we cannot exclude feeding in the
Adriatic Sea.

ACKNOWLEDGEMENTS

We kindly thank B. Torres for his comments on the manus-
script and assistance with the figures. Two anonymous refer-
ees provided very helpful comments on the manuscript. This
work was supported by the Croatian Ministry of Science,
Education and Sport.

REFERENCES

Baird R.W., Webster D.L., McSweeney D.J., Ligon A.D., Schorr G.S.
and Barlow J. (2006) Diving behaviour of Cuvier’s (*Ziphius caviro-
stris*) and Blainville’s (*Mesoplodon densirostris*) beaked whales in

275–291.

Blanco C. and Raga J.A. (2000) Cephalopod prey of two *Ziphius caviro-
stris* (Cetacea) stranded on the western Mediterranean coast. *Journal of
the Marine Biological Association of the United Kingdom* 80, 381–382.

Carlini R., Pulcini M. and Wurtz M. (1992) Cephalopods from the
stomach of a Cuvier’s beaked whale, *Ziphius cavirostris*, (Cuvier,
1823) stranded at Fiumicino, Central Tyrrenhian Sea. In Evans
P.G.H. (ed.) *Proceedings of the Fifth Annual Conference of the
European Cetacean Society, San Remo, Italy, 20–22 February 1992*
[European Research on Cetaceans, no. 6.]


Physical oceanography of the Adriatic Sea. Past, present and future.

Gomercić H., Gomercić M.D., Gomercić T., Lucić H., Dalebout M.,
Biological aspects of Cuvier’s beaked whale (*Ziphius cavirostris*)
recorded in the Croatian part of the Adriatic Sea. *European Journal
for Wildlife Research* 52, 182–187.

Heyning J.E. (1984) Cuvier’s beaked whale *Ziphius cavirostris* G. Cuvier,
mammals. Volume 4. River dolphins and the larger toothed whales*.

Holcer D., Notarbartolo di Sciara G., Fortuna C.M., Lazar B. and
Onofri V. (2007) Occurrence of Cuvier’s beaked whales in the
southern Adriatic Sea: evidence of an important Mediterranean
habitat. *Journal of the Marine Biological Association of the United
Kingdom* 87, 359–362.

from western Korinthiakos Gulf (Molusca–Dibranchiata). *Institut za

Krstulović Šifner S., Lefkaditou E., Ungaro N., Ceriola L., Osmani K.,
Kavadas S. and Vrgoč N. (2005) Composition and distribution of the
cephalopod fauna in the eastern Adriatic and eastern Ionian Seas.

Lefkaditou E., Mytilineou Ch., Maiorano P. and D’Onghia G. (2003)
Cephalopod species captured by deep-water exploratory trawling in


and


Correspondence should be addressed to:
I. Kovačić
Biology Department, The Faculty of Science,
Rooseveltov trg 6, 10 000 Zagreb, Croatia
email: koiva@inet.hr