

## Updated draft assessment of the conservation status of Cuvier's beaked whales in the Mediterranean Sea

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### BACKGROUND

The initial iteration of this review was prepared for the IUCN-ACCOBAMS workshop on Mediterranean and Black Sea Cetacean Assessment held in Monaco on 5-7 March 2006 (Reeves and Notarbartolo di Sciara 2006). The stated purpose of this workshop was to assess all populations of Mediterranean and Black Sea cetaceans against the 2001 IUCN Red List Categories and Criteria. An updated version prepared in 2009 was published by ACCOBAMS (Notarbartolo di Sciara and Birkun 2010). All of the data and information in those versions was updated for this paper, which is current through 1 May 2011.

The unit assessed in this document is the Mediterranean subpopulation of Cuvier's beaked whale, *Ziphius cavirostris*. The initial assessment in 2006 was "Data Deficient" given that appropriate data on distribution, population structure and abundance in the Mediterranean basin are lacking, except for a very limited areas. Also, the species' biology is very poorly known. The status of Cuvier's beaked whale in the Mediterranean has been therefore impossible to assess on available evidence. But a re-assessment is recommended in late 2011 when new analysis results are available.

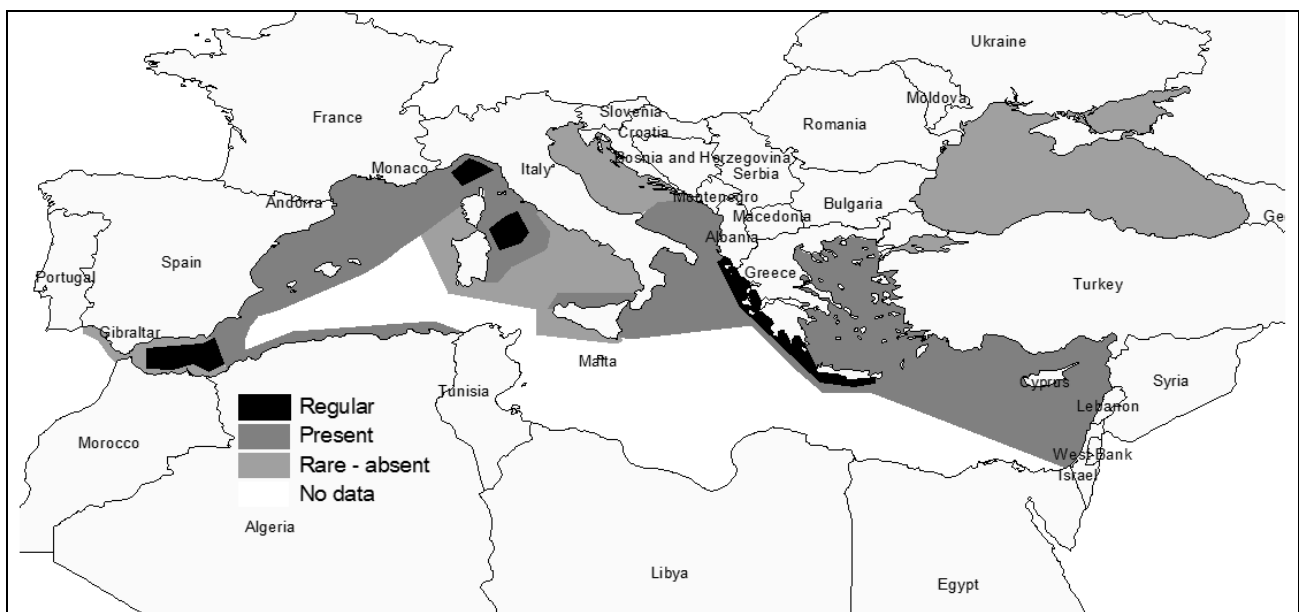
The assessor has been Ana Cañadas and the evaluators the IUCN/ACCOBAMS Workshop on the Red List Assessment of Cetaceans in the ACCOBAMS Area (Monaco, 5-7 March 2006) and Barbara L. Taylor

### SUMMARY DISTRIBUTION

#### Country Names:

Territorial waters of:	Native – presence confirmed	Native – possibly present	Visitor	Possibly Visitor	Vagrant	Possibly vagrant	Other
Albania	X						
Algeria	X						
Bosnia and Herzegovina		X					
Croatia	X						
Cyprus		X					
Egypt		X					
France	X						
Gibraltar (UK)	X						
Greece	X						
Israel	X						
Italy	X						
Lebanon		X					
Libya				X			
Malta		X					

Monaco	X						
Morocco	X						
Palestinian Territory		X					
Montenegro		X					
Slovenia				X			
Spain	X						
Syria		X					
Tunisia		X					
Turkey	X						



Knowledge on the distribution of Cuvier's beaked whales in the Mediterranean and Black Seas (information up to 2009).

### ***Geographic Range***

Deep waters of the whole Mediterranean Sea (referring to surveyed areas; large portions of the southern Mediterranean unknown) (see 'Range and Population' below)

### ***Population:***

Population size and structure unknown except for two small areas (Gulf of Genoa and northern Alboran Sea). Relatively common, at least in the Ligurian Sea, northern Thyrrenian Sea, Alborán Sea, Hellenic Trench and northwestern Aegean Sea, but even relative density is unknown for most areas.

There is no information on population trends.

## RANGE AND POPULATION

Cuvier's beaked whales inhabit both the western and eastern basins of the Mediterranean (Notarbartolo di Sciara 2002). Much of the current knowledge of this species in the Mediterranean has come from stranding data. Strandings have been reported in Albania, Algeria, Croatia, Egypt, France, Greece, Israel, Italy, Malta, Spain and Turkey, totalling 316 animals (Podestà *et al.* 2006). Twenty-six percent of the total animals recorded stranded in the Mediterranean have been in mass strandings involving 3 or more animals (Podestà *et al.* 2006). Strandings have been particularly numerous along the Ligurian and Ionian coasts, but it is important not to infer too much about species distribution or relative abundance from strandings data alone. Strandings data are subject to a variety of types of bias.

Cuvier's beaked whales seem to be relatively abundant in the eastern Ligurian Sea, off southwestern Crete and the Alboran Sea, especially over and around canyons (D'Amico *et al.* 2003; Frantzis *et al.* 2003; Ballardini *et al.* 2005; Scalise *et al.* 2005). They appear to be regular although less abundant inhabitants of the western Ligurian Sea (41 sightings in 16 years, Tethys Research Institute, unpublished data; 4.2% of 814 sightings during 10,000 km on effort from 1996 to 2000, Azzellino *et al.* 2008). Cuvier's beaked whales have been described as regular inhabitants of the Hellenic Trench (Frantzis *et al.* 2003), the southern Adriatic Sea based on frequency of strandings (Holcer *et al.* 2003) and the eastern section of the Alborán Sea (Cañadas *et al.* 2005). They also occur in the central Tyrrhenian Sea (Marini *et al.* 1992) and in Spanish Mediterranean waters (Gannier 1999; Raga and Pantoja 2004; M. Castellote, pers. comm.). A focussed survey on Cuvier's beaked whales in the Central Tyrrhenian Sea showed that this area has a high density of these animals (1.9 schools/100 km; Gannier, In press). They have been reported both from strandings and sightings in Israeli, Palestinian and Syrian waters (Aharoni 1944; Saad and Othman 2008; D. Kerem, pers. comm.). No information is available for the remaining areas of the Mediterranean.

There are two abundance estimates for this species in small portions of the Mediterranean Sea. In the Gulf of Genova (eastern Ligurian Sea) mark-recapture analysis (2002-2008) yielded an estimate of 96-100 animals (left and right side identifications respectively) from an open population (Rosso *et al.* 2009). In the northern Alboran Sea, spatial modelling of line transect data (1992-2007) yields an abundance estimate of 102 animals with a CV=32.1% (corrected for availability bias from a D-tagged animal in the Alboran Sea) (Oedekoven *et al.* 2009). Abundance estimates for the whole Alboran Sea have been obtained after analysis of the Sirena08 and MED09 survey cruises. Results highlight a relatively high density (compared to other areas of the world) of Cuvier's beaked whales in the Alboran Sea (44 groups, 89 individuals in 846 km on survey effort in 2008-2009, for an encounter rate of 10.5 individuals per 100km of effort; unpublished data). A density estimate was obtained for the whole Alboran Sea from -0.5W to -6W: 0.025 animals per km<sup>2</sup> with a CV of 32.1% and another estimate for the same area but only for depths greater than 500m: 0.062 animals per km<sup>2</sup> with a CV of 44.2% (both estimates corrected for availability bias from a D-tagged animal in the Alboran Sea; Oedekoven *et al.* 2009) (unpublished data).

There are no data on trends for this species in the Mediterranean.

There are areas, especially in the southern portions of the basin, where Cuvier's beaked whales have not been recorded from either strandings or sightings. However, it must be borne in mind that their long dive times, usually inconspicuous appearance at the surface and typical avoidance of vessels make them difficult to spot (Heyning 1989). In addition, sighting effort and the efficiency of stranding networks vary throughout the Mediterranean: many areas have little or no effort to make and record sightings or to detect strandings. Therefore, a comprehensive basin-wide survey and an efficient basin-wide stranding network are needed before reaching firm conclusions about presence and absence. It is nevertheless possible, based on available data, to identify at least some areas as good habitat, and probably hot-spots, for Cuvier's beaked whales, such as the eastern Ligurian Sea, the eastern Alborán Sea and the Hellenic Trench. The species is probably also common in several other unexplored areas.

Only two haplotypes were found in the Mediterranean ( $n = 12$ ) and those haplotypes were found nowhere else (Dalebout *et al.* 2005). Because samples from this species are relatively rare, there are no samples from the area in the Atlantic closest to the Mediterranean. Until such sample are gathered and show otherwise, the current best evidence suggests that the low haplotypic diversity together with haplotypes found only in the Mediterranean meet the subpopulation definition of less than a migrant per year (Dalebout *et al.* 2005). There have been 23,004 km of effort from 1999 to 2006 (all seasons) in the Straits of Gibraltar in conditions where *Ziphius* could be sighted (Beaufort 3 or less) with no sightings (de Stephanis *et al.* 2007). This is consistent with little movement through this area. The current best available data, genetic and lack of sightings, suggests that the definition for subpopulation is met. Future acoustic monitoring in the Straits could better resolve this question.

## HABITAT AND ECOLOGY

Cuvier's beaked whale is a predominantly oceanic species often associated with steep slope habitat and a marked preference for submarine canyons and escarpments (D'Amico *et al.* 2003; MacLeod 2005; Podestá *et al.* 2006; Azzellino *et al.* 2008). In the Alborán Sea, Cuvier's beaked whales are encountered in areas of  $>600$  m depth and  $>40$  m km<sup>-1</sup> of slope, especially around the 1000 m isobath in an area of steep canyons off southern Almería, SE Spain (Cañadas *et al.* 2002; Cañadas *et al.* 2005). In the Hellenic Trench, Cuvier's beaked whales are sighted in areas of between 500 and 1500 m depth; it is not known if they are also present farther offshore over the abyssal plain (Frantzis *et al.* 2003). They seem to be present over all steep topographic features of the Aegean Plateau (Frantzis *et al.* 2003). In the eastern Ligurian Sea (Gulf of Genoa) they are especially abundant around canyons (D'Amico *et al.* 2003). In this area, Scalise *et al.* (2005) reported a mean depth at encounters of 1358 m (range=641-2545, se=514) and a mean slope of 77.1 m km<sup>-1</sup> (range=3-256.5, se=57). In the same area, cruises organised by SACLANTCEN encountered Cuvier's beaked whales in waters 500-2600 m deep, with a peak encounter rate in waters 1000-1500 m deep over steep slopes (M. Carron, pers. comm.). In the western Ligurian Sea, they are strongly associated to well defined depth and slope gradient characteristics of the shelf-edge and the upper and lower slope and sightings have been in waters of an average of 1722m deep (range=795-2500, se=276) (Azzellino *et al.* 2008).

A habitat modelling of Cuvier's beaked whales was done under the umbrella of ACCOBAMS incorporating data on effort and sightings of this species from 1990 to 2010 as a collaborative effort by many organizations collecting cetaceans data in the Mediterranean. The best model highlights three areas with the highest relative density of beaked whales: the Alboran Sea, the Northern Ligurian Sea, and the Hellenic Trench and north of Crete. In addition, the Tyrrhenian Sea, the Southern Adriatic Sea and some areas to the north of the Balearic islands and south of Sicily show relatively high predicted density compared to the rest of the Mediterranean. There is additionally an area in the far east of the Mediterranean, in front of Syria, with a relatively high prediction, but this area has no survey effort; this area should be explored before any conclusions about the relative abundance of beaked whales are drawn (Cañadas *et al.*, in prep).

Mean group size is fairly constant across the whole basin where data have been collected, ranging from 2.2 to 2.6 individuals (Cañadas *et al.* 2005, Ballardini *et al.* 2005, Scalise *et al.* 2005), except in the western Ligurian Sea with a mean of 4 (sd=2) (Azzellino *et al.* 2008). Social organization is unknown, although the intermediate levels of mtDNA diversity observed in Cuvier's beaked whales suggest that social groups are unlikely to be strongly matrifocal (Dalebout *et al.* 2005).

Cuvier's beaked whale is mainly teuthophagic. The most common prey species in the Mediterranean are from the family Histiotteuthidae (MacLeod 2005 and references therein), which are oceanic and meso- or bathypelagic, inhabiting depths of around 1000 m, with a preference for escarpments. Fish may also be an important component of their diet (MacLeod 2005).

## THREATS

Owing to their offshore occurrence and tendency to feed on deep-sea squid, Cuvier's beaked whales are probably little exposed to human activities that occur in coastal waters (tourism, many types of fisheries, etc.). However, the few studies carried out on this species highlight one main threat: certain forms of man-made underwater noise. This threat affects the species world-wide and it has been responsible for some of the observed mortality in the Mediterranean. Military sonars and possibly high-energy sounds from other anthropogenic sources have repeatedly resulted in the stranding and death of Cuvier's beaked whales. The implications of this mortality at the population level are uncertain. Two other concerns are bycatch in drift gillnets and the ingestion of plastic debris (e.g. Kovacic et al. 2009).

Recent atypical mass strandings of beaked whales have been linked to high-powered navy sonar and seismic exploration (e.g. Frantzis 1998; Jepson *et al.* 2003; Fernández et al. 2005). Deployment of military sonar has led to strandings of beaked whales suffering from chronic and acute tissue damage due to the *in vivo* formation of gas bubbles, possibly the result of decompression sickness (Jepson *et al.* 2003; Fernández et al. 2005). Cuvier's beaked whale is the species most commonly involved in these atypical mass strandings (Brownell *et al.* 2005). Of 224 recorded stranding events of Cuvier's beaked whales in the Mediterranean, 15 involved 2 animals (9.8% of the total) and 12 involved 3 or more animals (totalling 80 animals; 26.1% of the total) (Podestà *et al.* 2006). Four of these strandings were definitely associated with naval activity so far: 1) Valencia, Spain in February 1996 (Filadelfo et al. 2009), 2) Kyparissiakos Gulf, Greece in May 1996 (Frantzis 1998), 3) Ionian Islands, Greece in October 1997 (Frantzis 2004, Filadelfo 2009), 4) Algerian coasts, in 2001 (Filadelfo et al. 2009).. In the other cases, either no appropriate data were collected or the analyses were inadequate for assessing the potential association (Podestà et al. 2006). An atypical mass stranding of 4 Cuvier's beaked whales occurred in SE Spain in January 2006. This event was coincident in time and space with military manoeuvres of NATO (Draft EIS/OEIS 2007), and necropsies of the animals showed "Gas and Fat Embolic Syndrome", previously associated with anthropogenic acoustic activities, most probably anti-submarine active mid-frequency sonar used during the military naval exercises (Jepson *et al.* 2003, Fernandez *et al.* 2004, 2005, Cox *et al.* 2006). The Mediterranean Sea is a militarily strategic area and is also of increasing interest for hydrocarbon exploration and exploitation. All military or geological or oceanographic activities involving high-intensity noise carried out in the proximity of Cuvier's beaked whales are of concern.

Although the population-level implications of the use of military sonar are uncertain, there is evidence suggesting that they could be at least locally significant. A photo-identification study that preceded and followed the Bahamas mass stranding showed that previously photo-identified, resident beaked whales either left the area or died, since they were never re-captured (photographically) after the event (Balcomb and Claridge 2001). In the Mediterranean Sea, no surveys had been conducted in the Kyparissiakos Gulf before the mass stranding following a naval military sonar exercise (Frantzis 1998). However, strandings of Cuvier's beaked whales had been common in that area (average rate of one per semester) and have become extremely rare (none or only one) in the 9 years since the event. Two international surveys that covered the Kyparissiakos Gulf (IFAW 2003 and MVO in 2004) as well as a survey that has crossed the same area twice yearly since 2002 have failed to record any sightings of Cuvier's beaked whales.

Cuvier's beaked whales are occasionally taken incidentally in driftnets in the Mediterranean Sea. During the MED09 survey in the Alboran Sea, a Cuvier's beaked whale was found alive recently (probably) entangled in a driftnet (and two Moroccan driftnetters were spotted a few miles away), see picture below. After several hours of attempts, it was not possible to approach the animal close enough to release it from the net.



In a study of cetacean by-catch by the Spanish Mediterranean longlining fleet, only one unidentified beaked whale was found entangled (released alive) out of 798 sets (CPUE < 0.001 ind/1000 hooks; Valeiras and Camiñas 2001). In Italy 13 animals were reported as having been by-caught between 1986 and 1997 (Podestá and Bortolotto 1997; Centro Studi Cetacei 1998).

Fourteen Cuvier's beaked whales were reported as having been captured intentionally between 1972 and 1982 – 11 in French and 3 in Spanish waters, all shot and 1 also harpooned (Northridge 1994). No pingers are in use in this area to avoid beaked whales bycatch.

With regard to plastic debris, two stranded animals in Greece had stomachs full of pieces of plastic bags (A. Frantzis, pers. comm.), as did a stranded animal in Croatia (Holcer *et al.* 2003). Poncelet *et al.* (1999) described a considerable amount of plastic debris in the stomach of a Cuvier's beaked whale washed ashore on the French Atlantic coast. Together with pilot whales (and some other teuthophagous species), Cuvier's beaked whale seems to be attracted by plastic debris that may be mistaken for squid.

Toxic pollution is also a threat to Cuvier's beaked whales as is for all cetacean species. High concentrations of mercury, selenium and cadmium have been found in this species from the Ligurian Sea (Capelli *et al.* 2008)

Climate change effects on prey might be a potential threat but we don't know whether the net effects will be positive or negative. No competition with fisheries is reported in the Mediterranean, where cephalopods fisheries are not very important (e.g. squids represent less than 1% of the catches in the Spanish waters of the Alboran Sea, <http://www.juntadeandalucia.es/agriculturaypesca/agraria/estagric.html>).

## CONSERVATION MEASURES

The main and most effective conservation measure for this species should be the identification of the areas of high density to avoid or minimise as much as possible man-made noise in them affecting negatively (fatally often) these animals. Based on existing knowledge of noise disturbance thresholds, beaked whales should not be exposed to received levels greater than SPL 140 dB re 1  $\mu$ Pa @ 1 m (ACCOBAMS SC Meeting report,

2011). Therefore, risk mapping should be done and effective management actions should be implemented in this sense in the areas where Cuvier's beaked whales are expected to inhabit, if the conservation of this species in the Mediterranean is intended (e.g. Dolman *et al.* 2009; In press).

One probable hot-spot for Cuvier's beaked whales in the Mediterranean, the eastern section of the Ligurian Sea, is included within the Pelagos Sanctuary created by Italy, France and Monaco. However, no management or conservation measures have been taken as yet specifically for this species.

A SPAMI (Specially Protected Area of Mediterranean Importance) under the Barcelona Convention has been proposed for the northern half of the Alborán Sea and Gulf of Vera in southern Spain (Cañadas *et al.* 2005), but it has not yet been designated or even evaluated by the Spanish administration. This proposed area includes another of the probable hot-spots for Cuvier's beaked whales: the deep waters off southern Almería. The Hydrographic Office of the Spanish Navy has agreed not to use active sonar in that area (C. Gamundi, Subdirector of the Hydrographic Office of the Spanish Navy, pers. comm.).

The Second Meeting of the Parties to ACCOBAMS adopted Resolution 2.16 on 'Assessment and Impact Assessment of Man-made Noise' (ACCOBAMS 2004). In this Resolution, and by recommendation of the Scientific Committee of ACCOBAMS, Parties are urged to 'to take a special care and, if appropriate, to avoid any use of man made noise in habitat of vulnerable species and in areas where marine mammals or endangered species may be concentrated, and undertake only with special caution and transparency any use of man made noise in or nearby areas believed to contain habitat of Cuvier's beaked whales (*Ziphius cavirostris*), within the ACCOBAMS area'. Parties are also urged to facilitate national and international research on this subject, to provide protocols/guidelines developed by military authorities with respect to use of sonar in the context of threats to cetaceans, and to consult with any profession conducting activities known to produce underwater sound with the potential to cause adverse effects on cetaceans, recommending that extreme caution be exercised in the ACCOBAMS area. Resolution 2.16 also encourages 'the development of alternative technologies and require the use of best available control technologies and other mitigation measures in order to reduce the impacts of man-made noise sources in the Agreement area'. The Scientific Committee of ACCOBAMS therefore has been charged to develop a common set of guidelines for conducting activities known to produce underwater sound with the potential to cause adverse effects on cetaceans.

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