Ziphius cavirostris, G. Cuvier, 1823

English: Cuvier´s beaked whale, Goosebeak whale
German: Cuvier-Schnabelwal
Spanish: Zifio de Cuvier, ballena picuda de Cuvier
French: Ziphius, baleine à bec de Cuvier

Family Ziphiidae

1. Description

The general body shape of *Z. cavirostris* is similar to that of other beaked whales: rather robust, cigar-shaped, small falcate dorsal fin, relatively small flippers. The flippers can be tucked into a slight depression along the body wall. The flukes are proportionately large, as in other ziphiids. The head is rather blunt in profile with a small, poorly defined rostrum that grades into the gently sloping melon. Pigmentation is dark slate grey over most of the body, with a distinctively white head in males and a slight lightening of the skin in females. Light oval patches attributed to cookie-cutter sharks (*Isistius* sp.) and linear marks due to intraspecific fighting between males (which have two apical teeth) are common. The largest adult male was 7m long (Heyning, 2002).

2. Distribution

http://www.iucnredlist.org/details/23211/0/rangemap

Distribution of Ziphius cavirostris*: world-wide distribution in tropical, subtropical, and temperate waters (mod. from Taylor et al. 2008; © IUCN).*

Cuvier's beaked whale is the most cosmopolitan of the beaked whales and is found in all oceans except in the high polar waters (Heyning and Mead, 2009). Rice (1998) includes all temperate and tropical waters around the world, north to Massachusetts, the Shetland Islands, the Mediterranean, Honshu, the Aleutian Islands, and the northern Gulf of Alaska; south to Tierra del Fuego, Cape Province in South Africa, Tasmania, South Island of New Zealand, and the Chatham Islands.

These whales are generally inconspicuous and uncommonly seen at sea. They are known mainly from strandings (see Heyning, 1989, for a detailed list) and are found stranded more often than most other beaked whales. In certain areas, such as the eastern tropical Pacific they seem to be fairly common (Jefferson et al. 1993; Heyning, 1989), however, geographical variation has not been analysed (Rice, 1998). For a detailed account on the Pacific islands Region see Miller et al. (2007).

3. Population size

Abundance has been estimated by various authors and for several study areas in the Pacific Ocean, compiled by Barlow et al. (2006). In the eastern tropical Pacific, over 90,000 animals were estimated from ship surveys conducted between 1986-1990. Other dive-corrected estimates of Cuvier's beaked whale abundance include 1,884 off the U.S. west coast (years

1996-2002) and 15,242 in Hawaiian waters in 2002. In the Atlantic Ocean, US NE coast values are 25 (1978-82 surveys), US SE coast 348 (1998 survey), Gulf of Mexico 95 (1996-2001 survey). Waring et al. (2001) provide a stock assessment for all beaked whales in the western North Atlantic including *Z.cavirostris* and *Mesoplodon* spp. and come up with a minimum figure of 2,400 animals.
Dalebout et al. (2005) estimated rates of female migration among ocean basins to be low (generally less than or equal to 2 individuals per generation). Their results demonstrate a high degree of isolation and low maternal gene flow among oceanic, and in some cases, regional populations of Cuvier's beaked whales.
Taylor et al. (2008) conclude that Cuvier's beaked whales are among the most common and abundant of all the beaked whales, and worldwide abundance is likely to be well over 100,000. There is no information on trends in the global abundance of this species.

4. Biology and Behaviour

Habitat: Off Japan, whaling records indicate that *Z. cavirostris* is most commonly found in waters deeper than 1000m (Heyning, 1989 and refs. therein). *Z. cavirostris* is known around many oceanic islands, and relatively common in enclosed seas such as the Mediterranean and Sea of Japan. It is rarely found close to mainland shores, except in submarine canyons or in areas where the continental shelf is narrow and coastal waters are deep (Carwardine, 1995) and is mostly a pelagic species which appears to be confined by the 10°C isotherm (lower limit) and the 1000-m bathymetric contour (Houston, 1991; Robineau and di Natale,1995).

Moulins et al. (2007) analysed sightings in the Pelagos Sanctuary (north-western Mediterranean Sea) in order to define the favoured habitat of the Cuvier's beaked whale. Forty-eight percent of beaked whales were seen where the depth was between 756 and 1389 m but the encounter rate was higher between depths of 1389 and 2021 m. The sightings were more frequent (34%) where the sea floor slope ranged 31-51 m/km but the encounter rate was higher where the sea floor slope ranged 11 -31 m/km. The encounter rate for Cuvier's beaked whales was higher where the depth anomaly was positive with values between 342 and 586 m.

Behaviour: Cuvier's beaked whales normally avoid boats but are occasionally inquisitive and approachable, especially around Hawaii. Breaching has been observed, though it is probably rare (Carwardine, 1995).

Z. cavirostris hunt by echolocation in deep water between 222 and 1885 m, with average foraging dives and dive times reaching 1070 m and 58 min, respectively, higher values than reported for any other air-breathing species. A series of shallower dives, containing no indications of foraging, followed most deep foraging dives. The average interval between deep foraging dives was 63 min. This long an interval may be required for beaked whales to recover from an oxygen debt accrued in the deep foraging dives, which last about twice the estimated aerobic dive limit (Tyack et al. 2006). Baird et al. (2006) somewhat expand these values and found Cuvier's beaked whales in median depth of 2079 m reaching maximal dive depths of 1450m in dives regularly lasting 48-68 min.

Schooling: Cuvier's beaked whales are found mostly in small groups of 2 to 7, but are not uncommonly seen alone (Jefferson et al. 1993). Mc Sweeny et al. (2007) confirms that group sizes are small and most groups have only a single adult male present. In the NW Mediterranean mean herd size observed was 2.3 (range=1-11; Moulins et al. 2007).

Food: Cuvier's beaked whales, like all beaked whales, feed mostly on deep sea squid, but also take fish and some crustaceans (Jefferson et al. 1993). MacLeod et al. (2003) compiled stomach content data: 46 species of cephalopods from 15 families, and two species of crustaceans, were reported from the stomachs of *Z. cavirostris*. Eighty-seven per cent of the individuals contained the remains of cephalopods, while 13% contained crustacean remains and 8% contained the remains of fish. Blanco and Raga (2000) investigated the stomach contents of two Cuvier's beaked whales stranded on the western Mediterranean coast. Food consisted exclusively of hard cephalopod remains, which agrees with their offshore and deep diving behaviour. Nishiwaki and Oguro (1972) found that stomach contents from *Z. cavirostris* caught off Japan varied consistently with a predominance of squid from animals taken in waters slightly under 1000m in depth, with fish being the most abundant prey item found in animals taken in deeper waters. *Z. cavirostris* could thus be somewhat opportunistic in its feeding habits. Most of the prey items found were either open ocean, mesopelagic, or deep-water benthic organisms, reflecting that *Z. cavirostris* is an offshore, deep-diving species (Heyning, 1989).

Cuvier's beaked whales in the Canary Islands mainly feed of oceanic cephalopods, the most numerous being *Taonius pavo, Histioteuthis* sp., *Mastigoteuthis schmidti* and *Octopoteuthis sicula*. Many of the cephalopod species found in the diet appear to undertake diel vertical migrations, being found in shallower waters during the night and moving to deeper waters during the day. Clearly, *Z. cavirostris* in these waters specialises on cephalopods (Santos et al. 2007).

5. Migration

Robineau and di Natale (1995) summarise that there are seasonal differences in strandings recorded from the French coast with peaks in winter and spring, whereas strandings in the Mediterranean seem to peak in winter. MacLeod et al. (2004) found that strandings of Cuvier's beaked whales occurred almost exclusively on the Atlantic coasts of the UK and in Ireland. There were significantly more Cuvier's beaked whale strandings than expected in January and February and in June and July. A specimen which stranded in northern Scotland in February contained similar prey to two whales stranded in northwestern Spain at the same time of year, suggesting this animal could have been feeding in more southern waters prior to stranding.

In the north-eastern Pacific from Alaska to Baja California, Mitchell (1968) summarised the stranding record to date and found no obvious pattern of seasonality to the strandings. Mc Sweeny et al. (2007) used a 21-yr photographic data set from the west coast of the island of Hawaii and found that resightings of individuals spanned 15 yr, suggesting long-term site fidelity to the area. Long-term resightings were documented primarily from adult females.

6. Threats

Direct catches: In the past, there have been a few small cetacean fisheries that have taken *Z. cavirostris*. In the Japanese *Berardius bairdii* fishery, *Z. cavirostris* have been taken on an opportunistic basis with catches varying from 3 to 35 animals taken yearly. Although the *B. bairdii* fishery still continues, there have been no takes of *Z. cavirostris* in recent years.

Incidental catches: Mignucci et al. (1999) conducted an assessment of cetacean strandings in waters off Puerto Rico, the United States and the British Virgin Islands to identify the factors associated with reported mortality events between 1867 and 1995. Cuvier's beaked whale were the second most commonly stranded species, with an increase in the number of strandings averaging 63.1% per year over 20 years. Between 1990 and 1995, the average number of cases per year increased from 2.1 to 8.2. The seasonal pattern of strandings was not found to be uniform, with a high number of strandings occurring in the winter and spring. The most common human-related cause categories observed were entanglement and accidental captures, followed by animals being shot or speared. However, estimates for the western North Atlantic are very low, with one animal reported between 1994 and 1998 (Waring et al. 2001).
Occasional bycatches are reported from many areas, e.g. in artisanal gillnet fisheries in Colombia (Mora-Pinto et al., 1995), Peru (Van Waerebeek et al.,1988), St Vincent, Barbados (Caldwell et al., 1971), Ghana (Van Waerebeek et al., 2009) and in the Italian swordfish fishery (Notarbartolo di Sciara, 1990). , Baker et al. (2006) report on Cuvier's beaked whales detected by molecular monitoring of 'whalemeat' markets in the Republic of (South) Korea, assumed to be incidental fisheries mortalities.

Pollution: Analysis of tissues from a male from New Zealand found no traces of lead or organophosphates, but the following levels of potential toxins were noted: DDE, 1.2-mg/kg; DDT, 1.2-mg/kg; DDD, 0.25-mg/kg; and mercury, 1.9-mg/kg (Fordyce et al. 1979, in Heyning, 1989).

Colin McLeod (2002, pers. comm.) reviewed stomach contents in beaked whales and found that at least 50% of Cuvier's beaked whales stranding on European coasts contain some plastic debris, while it is much rarer in northern bottlenose whales and *Mesoplodon* species. One possibility for this is that floating plastic sheets and bags either at the surface or at depth will act as fish attractors, providing shelter from predatory fish. Beaked whales being suction feeders may then ingest the bag/plastic sheeting while 'hoovering' up actual prey which are hanging around close to the floating debris. For these suction feeders there would be little chance to "select" prey based on taste or feel as it will be in the mouth and swallowed before it is noticed.

Acoustic pollution: Frantzis (1998) found that a mass-stranding of 12 Cuvier's beaked whales in the Ionian Sea (Mediterranean) coincided closely in time and location with military tests of an acoustic system for submarine detection being carried out by the North Atlantic Treaty Organisation (NATO). The connection between military tests and strandings is supported by the stranding of at least 12 specimens during a naval exercise off The Bahamas in March 2000 (Waring et al. 2001). Another seven *Z. cavirostris* died in September 2002 during a naval exercise conducted around Gran Canaria, Spain (Vidal Martin, pers. comm.). High intensity Low Frequency Active Sonar (LFAS) was used by US and NATO vessels in these areas, respectively, which led to stranding of other species as well, including *M. densirostris*. Finally, Arbelo et al. (2008) report on an event in 2004 involving two stranded Cuvier beaked whales on the coast of Almería, Southeast Spain in this series of strandings caused by naval exercises.

According to K. Balcomb (NMFS, pers. comm.), NATO and the US Naval Under-sea Warfare Center have calculated the resonance frequency of airspaces in Cuvier's beaked whales to be about 290 Hz at 500 meters depth, which is almost precisely the middle frequency of the sonar systems that were tested. Whale mortality during tests could therefore be due to resonance phenomena in the whales' cranial airspaces that are tearing apart delicate tissues around the brains and ears.

Degollada et al. (2003) performed necropsies on ten carcasses in Gran Canaria between 24 and 72-h postmortem following standard procedures. The most remarkable features were inner ear hemorrhages and edema starting in the VIIIth cranial nerve and extending into the spiral ganglion and the cochlear channels. In addition, inner ear structural damages were found. These findings are consistent with the lesions observed in other organs, in particular the brain, confirming an acoustically induced trauma as the only non-discarded cause of death.
Seismic surveys have also been linked to stranding events. In 2002 two Cuvier's beaked whales stranded on Isla San Jose, in the Gulf of California, at a time when the US National Science Foundation was conducting seismic surveys from R/V Maurice Ewing. It is possible that seismic surveys are also the causative factor for cetacean strandings in other areas, such as the Galápagos Islands (Parsons et al. 2007).

7. Remarks

Known and inferred **range states** (Taylor, 2008):
Albania; American Samoa; Anguilla; Antigua and Barbuda; Argentina; Aruba; Australia; Bahamas; Bangladesh; Barbados; Belize; Benin; Bermuda; Brazil; Brunei Darussalam; Cambodia; Cameroon; Canada; Cape Verde; Cayman Islands; Chile; China; Cocos (Keeling) Islands; Colombia; Comoros; Congo; Congo, The Democratic Republic of the; Cook Islands; Costa Rica; Croatia; Cuba; Côte d'Ivoire; Denmark; Djibouti; Dominica; Dominican Republic; Ecuador; El Salvador; Equatorial Guinea; Falkland Islands (Malvinas); Faroe Islands; Fiji; France; French Guiana; French Polynesia; Gabon; Gambia; Germany; Ghana; Gibraltar; Greece; Grenada; Guadeloupe; Guam; Guatemala; Guinea; Guinea-Bissau; Guyana; Haiti; Honduras; India; Indonesia; Iran, Islamic Republic of; Ireland; Italy; Jamaica; Japan; Kenya; Kiribati; Korea, Republic of; Kuwait; Liberia; Madagascar; Malaysia; Maldives; Marshall Islands; Martinique; Mauritania; Mexico; Micronesia, Federated States of; Monaco; Morocco; Mozambique; Myanmar; Namibia; Nauru; Netherlands; Netherlands Antilles; New Caledonia; New Zealand; Nicaragua; Nigeria; Niue; Northern Mariana Islands; Norway; Oman; Pakistan; Palau; Panama; Papua New Guinea; Peru; Philippines; Pitcairn; Portugal; Puerto Rico; Russian Federation; Saint Helena; Saint Kitts and Nevis; Saint Lucia; Saint Pierre and Miquelon; Saint Vincent and the Grenadines; Samoa; Senegal; Seychelles; Sierra Leone; Singapore; Solomon Islands; Somalia; South Africa; Spain; Sri Lanka; Sudan; Suriname; Sweden; Taiwan, Province of China; Tanzania, United Republic of; Thailand; Timor-Leste; Togo; Tonga; Trinidad and Tobago; United Kingdom; USA; Uruguay; Vanuatu; Venezuela; Viet Nam; Virgin Islands, British; Virgin Islands, U.S.; Wallis and Futuna; Western Sahara; Yemen

Listed by the IUCN as "Least concern" (Taylor et al. 2008) and listed in Appendix II of CITES. Not listed by CMS.

Very little is known about this species. However, mass strandings after military sonar tests are a matter of concern and should be further investigated. Due to a lack of abundance data, the effects of by-catches in fisheries cannot be evaluated.

Z. cavirostris also occurs in southern South America, therefore the recommendations iterated by the scientific committee of CMS for small cetaceans in that area (Hucke-Gaete, 2000; Appendix 1) also apply. For recommendations concerning south-east Asian stocks, see Perrin et al. (1996) in and Appendix 2.

8. Sources

- Arbelo, M; De Quiros, YB; Sierra, E; Mendez, M; Godinho, A; Ramirez, G; Caballero, MJ; Fernandez, A (2008) Atypical beaked whale mass stranding in Almeria's coasts: Pathological study. Bioacoustics 17: 295-297
- Baird RW, Webster DL, McSweeney DJ, Ligon AD, Schorr GS, Barlow J (2006) Diving behaviour of Cuvier's (*Ziphius cavirostris*) and Blainville's (*Mesoplodon densirostris*) beaked whales in Hawai'i. Can J Zool 84: 1120-1128
- Baker CS, Lukoschek V, Lavery S, Dalebout ML, Yong-un M, Endo T, Funahashi N (2006) Incomplete reporting of whale, dolphin and porpoise 'bycatch' revealed by molecular monitoring of Korean markets Anim Conserv 9: 474-482
- Barlow J, Ferguson MC, Perrin WF, Ballance L, Gerrodette T, Joyce G, Macleod CD, Mullin K, Palka DL, Waring G (2006) Abundance and densities of beaked and bottlenose whales (family Ziphiidae). J Cetacean Res Manage 7: 263–270
- Blanco C, Raga JA (2000) Cephalopod prey of two *Ziphius cavirostris* (Cetacea) stranded on the western Mediterranean coast. J Mar Biol Ass U K 80: 381-382.
- Caldwell, D. K., M. C. Caldwell, W. F. Rathjen, and J. R. Sullivan. 1971. Cetaceans from the Lesser Antilles Island of St. Vincent. Fishery Bulletin, U.S 69:303–312.
- Carwardine M (1995) Whales, Dolphins and Porpoises. Dorling Kindersley, London, UK, 257 pp.
- Dalebout ML, Robertson KM, Frantzis A, Engelhaupt D, Mignucci-Giannoni AA, Rosario-Delestre RJ; Baker CS (2005) Worldwide structure of mtDNA diversity among Cuvier's beaked whales (*Ziphius cavirostris*): implications for threatened populations. Mol Ecol 14: 3353-3371
- Degollada E, Arbelo M, André M, Blanco A, Fernández A (2003) Preliminary ear analysis report of the 2002 Canary Islands *Ziphius* mass stranding. Annual Meeting of the European Cetacean Society, Tenerife, Spain.
- Frantzis A (1998) Does acoustic testing strand whales? Nature 392: 29.
- Houston J (1991) Status of Cuvier's beaked whale, *Ziphius cavirostris*, in Canada. Can Field Nat 105: 215-218.
- Jefferson TA, Leatherwood S, Webber MA (1993) FAO Species identification guide. Marine mammals of the world. UNEP/FAO, Rome, 320 pp.
- Heyning JE (1989) Cuvier's beaked whale – *Ziphius cavirostris*. In: Handbook of Marine Mammals (Ridg-way SH, Harrison SR, eds.) Vol. 4: River Dolphins and the Larger Toothed Whales. Academic Press, London, pp. 289-308
- Heyning JE (2002) Cuvier's beaked whale – *Ziphius cavirostris*. In: Encyclopedia of marine mammals (Perrin WF, Würsig B, Thewissen JGM, eds.) Academic Press, San Diego, pp. 305-307.
- Heyning JE, Mead JG (2009) Cuvier's beaked whale – *Ziphius cavirostris*. In: Encyclopedia of marine mammals (Perrin WF, Würsig B, Thewissen JGM, eds.) Academic Press, San Diego, pp. 294-296
- Hucke-Gaete R (2000) Review of the conservation status of small cetaceans in southern South America. UNEP/CMS Secretariat, Bonn, Germany, 24 pp.
- McSweeney DJ, Baird RW, Mahaffy SD (2007) Site Fidelity, Associations, and Movements of Cuvier's (*Ziphius cavirostris*) and Blainville's (*Mesoplodon densirostris*) Beaked Whales Off the Island of Hawai'i. Mar Mamm Sci 23: 666-687
- Mignucci Giannoni AA, Pinto Rodriguez B, Velasco Escudero M (1999) Cetacean strandings in Puerto Rico and the Virgin Islands. J Cet Res Man 1: 191-198.
- Macleod CD, Santos MB, Pierce GJ (2003) Review of data on diets of beaked whales: Evidence of niche separation and geographic segregation. J Mar Biol Ass UK 83: 651-665.
- MacLeod, CD; Pierce, GJ; Santos, MB (2005) Geographic and temporal variations in strandings of beaked whales (Ziphiidae) on the coasts of the UK and the Republic of Ireland from 1800-2002. J Cetacean Res Manag 6: 79-86
- Miller, C. 2007. Current State of Knowledge of Cetacean Threats, Diversity and Habitats in the Pacifi c Islands Region. WDCS Australasia Inc. pp. 98
- Mora Pinto D M, Munoz Hincapie M F, Mignucci Giannoni A A, Acero (1995) Marine mammal mortality and strandings along the Pacific Coast of Colombia. Rep Int Whal Comm 45: 427-429.

- Moulins A, Rosso M, Nani B, Wuertz M (2007) Aspects of the Distribution of Cuvier's Beaked Whale (*Ziphius cavirostris*) in Relation to Topographic Features in the Pelagos Sanctuary (North-Western Mediterranean Sea). J Mar Biol Assoc UK 87: 177-186
- Notarbartolo Di Sciara G (1990) A note on the cetacean incidental catch in the Italian driftnet swordfish fishery, 1986-1988 (SC/41/SM3). Rep Int Whal Comm 41: 459-460.
- Parsons ECM, Clark J, RossA, Simmonds MP (2007) The Conservation of British Cetaceans: A review of the threats and protection afforded to whales, dolphins and porpoises in UK Waters. Whale and Dolphin Conservation Society, 122 pp.
- Perrin WF, Dolar MLL, Alava MNR (1996) Report of the workshop on the biology and conservation of small cetaceans and dugongs of Southeast Asia. East Asia Seas Action Plan. UNEP(W)/EAS WG. 1/2, Bangkok, Thailand, 101 pp.
- Rice DW (1998) Marine mammals of the world: systematics and distribution. Society for Marine Mamma-logy, Special Publication Number 4 (Wartzok D, ed.), Lawrence, KS. USA.
- Robineau D, Di Natale A (1995) *Ziphius cavirostris* – Cuvier-Schnabelwal. In: Handbuch der Säugetiere Europas. Meeressäuger. Teil IB: Wale und Delphine 2 (Robineau D, Duguy R and Klima M, eds.) Aula-Verlag, Wiesbaden, pp. 526-543.
- Santos MB, Martin V, Arbelo M, Fernandez A, Pierce GJ (2007) Insights Into the Diet of Beaked Whales from the Atypical Mass Stranding in the Canary Islands in September 2002. J Mar Biol Assoc UK 87: 243-251.
- Taylor BL, Baird R, Barlow J, Dawson SM, Ford J, Mead JG, Notarbartolo di Sciara G, Wade P, Pitman RL (2008). *Ziphius cavirostris*. In: IUCN 2009. IUCN Red List of Threatened Species. Version 2009.1. <www.iucnredlist.org>
- Tyack PL, Johnson M, Soto NA, Sturlese A, Madsen PT (2006) Extreme diving of beaked whales. J Exp Biol 209: 4238-4253
- Van Waerebeek K, Reyes JC, Luscombe BA (1988). Revisión de la distribución de pequeños cetáceos frente al Perú. pp. 345-51. In: H. Salzwedel, A. Landa (eds.). Recursos y Dinámica del Ecosistema de Afloramiento Peruano. Boletín del Instituto del Mar del Perú, Callao, Volumen Extraordinario.
- Van Waerebeek K, Ofori-Danson PK, Debrah J (2009) The cetaceans of Ghana: a validated faunal checklist. West African Journal of Applied Ecology 15: 61-90.
- Waring GT, Quintal JM, Schwartz SL (eds.) (2001) U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments – 2001. NOAA Technical Memorandum NMFS-NE-168.(http://www.nefsc.noaa.gov/nefsc/publications/tm/tm168/index.htm)
- Willis PM, Baird RW (1998) Sightings and strandings of beaked whales on the west coast of Canada. Aquat Mamm 24: 21-25.