

## ACTIONS FOR THE CONSERVATION OF CUVIER'S BEAKED WHALE: IMPLEMENTATION OF AREAS OF SPECIAL CONCERN FOR BEAKED WHALES IN THE MEDITERRANEAN SEA

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### Abstract

A new mass stranding of Cuvier's beaked whales (Crete, 1-6/04/2014), coincident with a joint exercise of the US, Israeli and Greece navies occurred because scientific advice proposing spatial mitigation of military sonar in the area was disregarded. Despite EU Parliament support for the "adoption of a moratorium and restriction measures in the use of active sonar in naval exercises" and NATO mitigation protocols in the Mediterranean to "focus on avoiding the habitat of beaked whales", spatial mitigation of sonar impacts on beaked whales in the Mediterranean is lacking. In contrast, atypical mass strandings of beaked whales in the Canary Islands were frequent until a moratorium to naval sonar put an end to these events. The relationship between naval sonar and mass-strandings was first noticed in the Mediterranean, where a minimum of 13 mass-mortalities coincident with sonar have been recorded. Numerous calls for sonar mitigation by scientific, political and conservation entities have culminated in the UN body ACCOBAMS mapping *Areas of Special Concern for Beaked Whales in the Mediterranean*, where spatial mitigation should be applied to sonar exercises. The map is based on the location of previous mass-strandings and on the most current scientific information on habitat preferences of beaked whales. The latter was derived from spatial modeling of 1036 sightings of beaked whales gathered in 420050 km of survey by 17 entities. The timely application of the map in the planning phase of naval exercises would have avoided last April 2014 whale mortality. It could be argued that locating exercises with known high risk of killing whales in areas with high concentrations of sensitive species conflicts with both the US Marine Mammal Protection Act (to which the US Navy is beholden) and EU conservation law. Political will to apply science-based mitigation is essential to stop sonar-related whale deaths in the Mediterranean. The conservation of the Cuvier's beaked whale in the Mediterranean concerns international bodies, as the species range crosses the national boundaries of several nationalities.

KEY WORDS: ZIPHIUS CAVIROSTRIS, MASS-STRANDINGS, NAVAL SONAR, SPATIAL MITIGATION, ACCOBAMS

### Background

The Cuvier's beaked whale (*Ziphius cavirostris*) is the only member of the family Ziphiidae with a regular occurrence in the Mediterranean (Podesta *et al.* 2006). Allen *et al.* (2012) review the following human threats to the species worldwide: few targeted captures; some fishery interactions in the form of opportunistic catches or bycatch; ingestion of, or entanglement with, marine debris; and anthropogenic noise related to behavioural effects or mass-strandings. There are records of these impacts on Cuvier's beaked whales in the Mediterranean, but the distribution of the species in deep offshore waters where there is little research effort impedes an accurate assessment of the level of threat. Moreover, the scarcity of data on population distribution and abundance of Cuvier's beaked whales in the majority of the Mediterranean Sea renders a lack of power to detect any potential decline in population size. This is relevant because a decline in the abundance of beaked whales has been recorded in an area where the abundance of these species is monitored regularly (Moore and Barlow 2013). There are no recent reviews about the interactions of beaked whales with fisheries in the Mediterranean, but fourteen Cuvier's beaked whales were reported as having been captured intentionally between 1972 and 1982 (11 in French waters and 3 in Spanish waters) (Northridge 1984). Entanglements with fishing gear and other marine debris have been recorded also, but these reports are opportunistic and there are no data to estimate the actual level of occurrence. The Mediterranean is one of the busiest shipping areas of the world and this may result in ship-strikes and reduce the acoustic quality of the habitat. Again, there are no data on the level of occurrence of ship-strikes in the Mediterranean, but beaked whales are known to be vulnerable to collisions in other parts of the world (Carrillo and Ritter 2010 report that 12% of the strandings with signs of ship-strikes in the Canary Islands are of beaked whales). The increase of ocean background noise produced by shipping noise can mask the ultrasonic vocalizations of beaked whales in some cases (Aguilar de Soto *et al.* 2006). These authors present an

example of a large vessel passing in the vicinity of a Cuvier's beaked whale diving at 700 m depth in the Gulf of Genoa. The noise produced by the ship reduced the distance at which the whale could echolocate for prey by more than 50%, while the distance at which the whale could detect communication signals from conspecifics was reduced by more than five times. The passage of the vessel coincided with a shorter dive containing half of the usual prey capture attempts than in normal dives by the same animal, suggesting that *Z. cavirostris* could react to high level shipping noise by changing its foraging and diving behavior. Thus, human activities in the Mediterranean Sea may pose a number of chronic threats for beaked whales, with the potential for synergic effects. In addition, there are records of acute impact events of mass mortalities related to naval activities (Frantzis 1998, historical records revised in ACCOBAMS MOP 2013). These mortalities stand out as being of special concern for the conservation of beaked whales in some areas of the Mediterranean Sea.

There have been a number of initiatives to prevent mortalities of beaked whales resulting from the use of intense anthropogenic noise sources. In the Mediterranean, the NATO Undersea Research Centre (NURC) developed in 2009 the document "NURC Marine Mammal Risk Mitigation Rules and Procedures" (here subsequently referred to as the NURC-Mammal Rules), which was written "*in support of NATO's principles and policies of environmental protection*". NURC-Mammal Rules can be found at: <http://solmar.nurc.nato.int/policy/NURC-SP-2009-002.pdf> NURC is now the Centre for Maritime Research and Experimentation (CMRE). One of the main targets of NURC-Mammal Rules is to reduce the risk of mass strandings and other impacts on beaked whales in the Mediterranean related to NATO activities. For this, it states: "*NURC's precautionary policy is therefore to reduce the temporal and spatial interactions of sounds and beaked whales*" and "*Objective 1 focuses on the potential risk of beaked whales stranding as a result of the use of sound sources. As the specific behavioral reaction that results in the stranding of beaked whales in proximity to the use of sounds is unknown, the risk mitigation of NURC focuses on avoiding the habitat of beaked whales.*" This means spatial mitigation, i.e. avoidance of areas with known concentrations of beaked whales, which has already been proposed as an effective measure to mitigate acoustic impacts (Dolman 2007). An example of the effectiveness of spatial mitigation is the moratorium on the use of military sonar within 50 nautical miles (nm) of the Canary Islands that was established in 2004; since then, no atypical mass strandings of beaked whales have been recorded in the archipelago (Fernandez *et al.* 2013).

The NURC-Mammal Rules (2009) state that in the Mediterranean, "*since the establishment of this policy, no deleterious effects as a result of Centre research are known to have resulted. Continued application of this policy and recommended mitigation measures will minimize the potentially harmful effects of sounds on marine mammals.*" However, in 2011 and 2014 (after the above statement was made) two new mass strandings of beaked whales linked to naval activities in the Mediterranean resulted in the mortality of at least 12 whales in Greece and Italy in 2011, and at least 5 whales in Crete in 2014 (Annex 1), underlining the need for all navies to strengthen and apply the NURC-Mammal Rules in the ACCOBAMS region.

Here we report on a key scientific and political effort to prevent new mortalities in areas with a history of strandings and in other high risk areas. Occurrence data of Cuvier's beaked whales in the Mediterranean, collected by 17 research bodies (420,050 km of cetacean survey effort, 1036 sightings of Cuvier's beaked whales) were used to model the preferred habitats of this species in the area (Cañadas *et al.* 2011). The results together with the locations of mass strandings of beaked whales in the Mediterranean were used by ACCOBAMS to map Areas of Special Concern for Beaked Whales where sonar should be avoided to prevent further mass mortalities. Also, other intense human sound sources should be avoided or subject to strict mitigation. This information is in the final report of the ACCOBAMS 5<sup>th</sup> Meeting of the Parties (MOP, Tangier, November 2013) and Resolution 5.13 of this MOP includes bringing the map to the attention of relevant authorities.

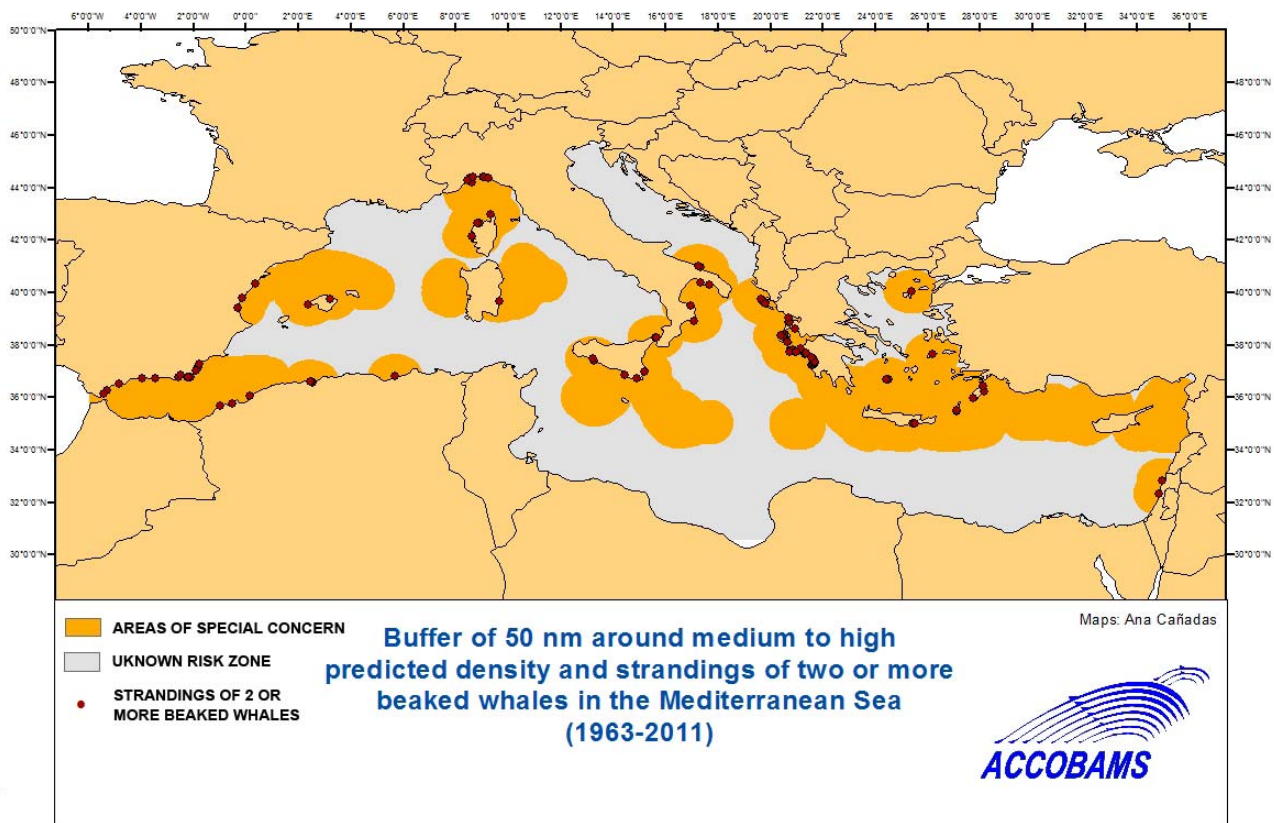
## **Method**

Efforts to apply spatial mitigation in the Mediterranean are hindered by a scarcity of beaked whale distribution data. To help identify areas of preference of beaked whales in the Mediterranean, the Scientific Committee of ACCOBAMS undertook a collaborative exercise to collate existing distribution data on beaked whales, and model beaked whale habitat use in the region (Cañadas *et al.* 2011). This resulted in the identification of several areas where concentrations of beaked whales have been recorded or are predicted to exist. In many areas the scarcity of data made it impossible to predict beaked whale distribution. However, while stressing the importance of validating and enhancing the results of the model with further systematic surveys in the Mediterranean as time and resources allow, the study by Cañadas *et al.* (2011) has already allowed the definition of several high-use areas for beaked whales with reasonable reliability. But atypical beaked whale mass strandings associated with naval activities have also occurred at locations in the Mediterranean outside of areas of observed and predicted concentrations. Some strandings of two or more beaked whales have been recorded in the region without any information about potentially harmful human activities occurring at the time. Independently of the cause of these mortalities, the locations of these strandings were used as indicators of

areas of high risk for beaked whale atypical strandings (Annex 2). Finally, a 50 nm buffer zone was defined around the locations of these strandings and the moderate and high use areas resulting from Cañadas *et al.* (2011). This buffer was based on the success of spatial mitigation in the Canary Islands. Since Spain adopted in 2004 a moratorium to the use of military sonar within 50 nautical miles of the archipelago, no atypical mass strandings of beaked whales have been recorded in the Archipelago (Fernández *et al.* 2013).

## Results

A map of Areas of Special Concern for Beaked Whales in the Mediterranean Sea (Figure 1) was presented by the ACCOBAMS Scientific Committee to the Meeting of the Parties (Tangier, Morocco, November 2013) and published as an Annex to the report of this MOP.



**Figure 1:** Map of Areas of Special Concern for Beaked Whales (ASC-BW) in the Mediterranean (orange) not including existing Marine Protected Areas (MPAs). ASC-BW and MPAs deserve the application of spatial mitigation for naval sonar and, whenever possible, for other intense anthropogenic sound sources. ASC-BW include: i) the locations of recorded beaked whale mass strandings (red circles) included in Table 1 (see Annex 2); ii) known and/or predicted high use areas for beaked whales (Cañadas *et al.* 2011); and iii) a buffer zone of 50 nm around both i) and ii), based on the existing moratorium on the use of naval sonar within 50 nm of the Canary Islands archipelago succeeding in preventing further mass strandings (Fernández *et al.* 2013). Areas of unknown risk (grey) are those where further data are required to assess beaked whale presence prior to, and during, human activities of potential impact, according to Resolution 4-17 of ACCOBAMS and NURC Marine Mammal Mitigation Rules and Procedures. Map from ACCOBAMS MOP 5 Final Report (2013), pp 147 <http://www.accobams.org/images/stories/MOP/MOP5/Documents/mop5%20final%20report.pdf>

## Discussion

Last 1-6th of April 2014, a new mass mortality of Cuvier's beaked whales in Crete coincided, once more, with naval exercises in the area. In this case the USA, Israel and Greece joint exercise "Noble Dina" (Frantzis pers. comm). Greece has suffered repetitive mass strandings of beaked whales linked with naval exercises in the last decades. It could be argued that locating activities with known high risk of killing whales in areas with known high concentrations of sensitive species conflicts with both the US Marine Mammal Protection Act and EU conservation law (e.g. Habitat

Directive). This paper points to the contradiction between theoretical mitigation protocols aimed to comply with regulations on the conservation of protected species, and the practical application of these protocols to actually protect fauna. It describes a recent science-based initiative from the UN body ACCOBAMS (Agreement for the Conservation of Small Cetaceans in the Mediterranean and Black Seas) proposing to apply spatial mitigation in areas of high risk, and remarks how lack of action, i.e. not applying scientific-based mitigation, results in the repetitive occurrence of mass strandings of whales in the Mediterranean.

The map of areas of special concern presented here summarises what has been known in the scientific and regulatory community for a long time: there are a number of areas in the Mediterranean where beaked whales are often found and are at great risk. The deep waters off Greece are one such area. The relationship between whale mortalities and naval sonar was first noticed here (Frantzis 1998) and there have been four mass strandings in Greece coincident with naval sonar use. But the number of mortalities could be much higher because the probability of discovery of carcasses of deep diving species can be as low as 3% (Williams et al. 2011). The scientific community has called for caution in Greece and other high-risk areas in the Mediterranean several times over the last decades, culminating in the ACCOBAMS MOP reported here. But this information appears to have had little influence on the planning and execution of naval exercises so far.

Avoiding use of naval sonar within ASC-BW will indubitably reduce the risk of exposure to noise hazard and mortalities for a significant part of the population of beaked whales in the Mediterranean. However, until further data are available to refine the identification of ASC-BW, it cannot be guaranteed that some areas identified as “of unknown risk” (Figure 1), do not host beaked whale populations susceptible to sonar. Thus, in “areas of unknown risk”, and in particular in the areas identified as beaked whales suitable habitat, mitigation should always be applied before, during and after activities emitting intense noise sources. The mitigation requirements should include dedicated surveys and monitoring efforts of all potential beaked whale habitats with 50 nm around the planned sonar activities. Mitigation requirements should be included in national regulations and take the form of rigorous and transparent planning, consultation and permitting processes with Environmental Impact Assessments (EIAs) whenever the use of these intense sound sources are planned in the Mediterranean. This should take include at least the following specific measures:

- a. Gather bibliographic data on marine biodiversity in the planned area of activity and whenever possible avoid areas where there are documented concentrations of beaked whales.
- b. Perform acoustic (24 h) and visual surveys and monitoring in the planned area of activity before and during the activity. These surveys and monitoring should use appropriate, independently assessed, equipment and protocols.
- c. Model three-dimensional sound transmission and based on this define acoustic safety zones. Develop shut-down protocols for all protected species known to occupy the area of activity. The detection of beaked whales within safety zones should result in the shut down of activities involving intense sound production, as specified by NURC-Mammal Rules. These rules state: “*Stop transmissions and use of explosives if a beaked whale is identified within the monitoring range. Contact the MMRM Project Leader prior to resuming operations.*”
- d. Perform monitoring of sound-production activities during the activity. Carry out real-time public reporting of both activity progress and encounters with protected species during the activity.

## References

- Aguilar Soto, N., Johnson, M., Madsen, P. T., Tyack, P. L., Boconcelli, A. & Borsani, F. 2006. Does intense ship noise disrupt foraging in deep diving Cuvier’s beaked whales (*Ziphius cavirostris*)? *Marine Mammal Science*, 22 (3), 690-699.
- Allen, B.M., Brownell, R.L., Mead, J.G., 2012. Species review of Cuvier’s beaked whale, *Ziphius cavirostris*. Reports of International Whaling Commission. [http://iwcoffice.co.uk/\\_documents/sci\\_com/SC63docs/SC-63-SM17.pdf](http://iwcoffice.co.uk/_documents/sci_com/SC63docs/SC-63-SM17.pdf)
- Cañadas, A., Fortuna, C., Pulcini, M., Lauriano, G., Bearzi, G., Cotte, C., Raga, J.A., Panigada, S., Politi, E., Rendell, L., Nagy, A., Pastor, X., Frantzis, A., Mussi, B., 2012. ACCOBAMS collaborative effort to map high-use areas by beaked whales in the Mediterranean. Reports of International Whaling Commission SC/63/SM17. [http://archive.iwcoffice.org/\\_documents/sci\\_com/SC63docs/SC-63-SM8.pdf](http://archive.iwcoffice.org/_documents/sci_com/SC63docs/SC-63-SM8.pdf)
- Carrillo, M. and Ritter, F. 2010. Increasing numbers of ship strikes in the Canary Islands: proposals for immediate action to reduce risk of vessel-whale collisions. *Journal of Cetacean Research and Management* 11(2): 131–138.
- Fernández, A., Martín, V., Arbelo, M. 2013. *Nature* **497**: 317 doi:10.1038/497317d
- Frantzis, A. 1998. Does acoustic testing strand whales? *Nature*, 392

- MOP ACCOBAMS 2013. Final Report of the 5<sup>th</sup> Meeting of the Parties, pp 147  
<http://www.accobams.org/images/stories/MOP/MOP5/Documents/mop5%20final%20report.pdf>
- Moore, J.E., Barlow, J.P., 2013. Declining Abundance of Beaked Whales (Family Ziphiidae) in the California Current Large Marine Ecosystem. PLoS ONE 8, e52770. doi:10.1371/journal.pone.0052770
- Northridge S.P. 1984. World review of interactions between marine mammals and fisheries. Fisheries Technical paper 251. Food and Agriculture Organization of the United Nations, Rome. 191 p.
- NURC-Mammal Rules (2009): <http://solmar.nurc.nato.int/policy/NURC-SP-2009-002.pdf>
- Podestá, M., D'Amico, A., Pavan, G., Drouga, A., Komnenou, A., & Portunato, N. 2006. A review of *Ziphius cavirostris* strandings in the Mediterranean Sea. Journal of Cetacean Research and Management, 7(3): 251-261.
- Williams, R., Gero, S., Bejder, L., Calambokidis, J., Kraus, S.D., Lusseau, D., Read, A.J., Robbins, J., 2011. Underestimating the damage: interpreting cetacean carcass recoveries in the context of the Deepwater Horizon/BP incident. Conservation Letters. 1-6.



## Annex 1: Mediterranean beaked whale mortality events associated with naval manoeuvres and use of military sonar

**Anthropogenic noise**, especially when originating from military sonar, has been identified as a major threat to beaked whales. This vulnerability seems to be due to their extreme diving behavior<sup>1</sup>. Multiple mass stranding and mortality events, all associated with naval sonar training, have occurred in many locations around the world. However the Mediterranean Sea is a region where numerous mass strandings of beaked whales have been recorded related to naval exercises, and where it was first discovered that these strandings are linked with the use of military sonar<sup>2,3</sup>. Atypical mass strandings and mortalities involving beaked whales that closely coincided with naval exercises in the Mediterranean include:

- Gulf of Genoa, Italy (1963); naval exercise: **15** beaked whales<sup>11,4</sup>
- Corsica, France (1974); naval exercise: **3** beaked whales, 1 striped dolphin<sup>5</sup>
- Valencia, Spain (1996); naval exercise: **2** beaked whales<sup>11,12,6</sup>
- Kyparissiakos Gulf, Greece (1996); SACLANTCEN experimental testing of low and mid-frequency sonar: **21** beaked whales<sup>10</sup>
- Ionian Sea, Greece (1997); NATO Naval exercise: **9** beaked whales<sup>11,12,7</sup>
- Ionian Sea, Greece (2000); NATO Naval exercise: **1** beaked whale stranded alive<sup>8</sup>
- Oran, Algeria (2001); naval exercise: **2** beaked whales<sup>11,12</sup>
- Almería, Spain (2006); NATO exercise: **4** beaked whales<sup>9</sup>
- Fontane Bianche, Sicily, Italy (February 2011); NATO naval exercise : **2** beaked whales<sup>10</sup>
- Ionian Sea, Greece and Italy (December 2011); Italian naval exercises and seismic surveys: **12** beaked whales.<sup>11</sup>
- Crete, Greece (April 2014): USA and Israel naval exercises “Noble Dina” in Crete. At least **5** Cuvier’s beaked whales, including a pregnant female<sup>12</sup>

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<sup>1</sup> Tyack P.L., Johnson M., Aguilar de Soto N., Sturlese A., Madsen P. Extreme diving of beaked whales. *J. Exp. Biol.*, 209, pp. 4238-4253 (2006).

<sup>2</sup> Frantzis A. Does acoustic testing strand whales? *Nature* 392:29 (1998), Frantzis, in prep.

<sup>3</sup> D’Amico *et al.* Beaked whale strandings and naval exercises. *Aquat. Mamm.* 35(4): 453-472 (2009).

<sup>4</sup> Filadelfo *et al.* Correlating military sonar use with beaked whale mass strandings: what do the historical data show?. *Aquat. Mamm.* 35(4), 435-444 (2009).

<sup>5</sup> Taylor *et al.* A call for research to assess risk of acoustic impact on beaked whale populations. SC/56/E36. <http://cet.usd.edu/Publications/Reports/TaylorIWCSC-56-E36-2004.pdf> (2004).

<sup>6</sup> Blanco, C. and Raga, J.A. 2000. Cephalopod prey of two *Ziphius cavirostris* (Cetacea) stranded on the western Mediterranean coast. *J.Mar. Biol. Assoc. UK* 80:381-2.

<sup>7</sup> Frantzis A. The first mass stranding that was associated with the use of active sonar (Kyparissiakos Gulf, Greece, 1996). In: Proceedings of the workshop: "Active sonar and cetaceans " ECS newsletter 42 (Special Issue): pp. 14-20 (2004).

<sup>8</sup> A. Frantzis pers. comm. One whale stranded alive while NATO vessels were observed from the coast.

<sup>9</sup> Atypical beaked whale mass stranding in Almería’s coasts: pathological study. *Bioacoustics*, 17: 295-297 (2008).

<sup>10</sup> [http://www.manp.nato.int/news\\_releases/mcnaples/pressreleases11/NR\\_03\\_11.html](http://www.manp.nato.int/news_releases/mcnaples/pressreleases11/NR_03_11.html). NATO Anti-submarine Warfare Exercise – NATO Allied Maritime Command Naples (A. Barlotta, pers. comm.).

<sup>11</sup> <https://lists.uvic.ca/pipermail/marmam/2011-December/003963.html>. Exercises Italian Navy, MARE APERTO/AMPHEX 2011 (A. Frantzis, pers. comm.; S. Mazzariol, pers. comm.).

<sup>12</sup> Frantzis, A. (*Pelagos Institute*) comm. pers. Necropsy performed by *Arion*.

## Annex 2: Mass strandings of beaked whales in the Mediterranean as an indication of high risk areas

Strandings do not necessarily provide an accurate representation of the distribution of deep-diving cetaceans such as beaked whales, since animals may die at some distance from their stranding location, which is ultimately also affected by oceanographic and geomorphologic factors. In spite of this bias in the use of strandings as predictors of density, mass strandings provide unambiguous indications of the presence of high risk areas. Table 1 summarises the strandings recorded in the Mediterranean involving two or more beaked whales. More information about these strandings is available from the ACCOBAMS Scientific Committee.

**Table 1:** Strandings of two or more beaked whales recorded in the Mediterranean Sea (1963-2014). Strandings for which there is information about spatial and temporal coincidence with naval exercises are marked with an asterisk (see Annex 1 for details). Data from the review by Podestà *et al.* (2006)<sup>13</sup>, the databases of Pelagos Cetacean Research Institute<sup>14</sup>, the Italian Stranding Database<sup>15</sup> and MEDACES<sup>16</sup> (with data from CSET, CREMA, ICBIBE, GECM, IMMRAC). Detailed information about the strandings included in this table is available from the ACCOBAMS Scientific Committee.

Month	Year	Country		Month	Year	Country
May	1963	ITALY *		January	1999	GREECE
November	1963	ITALY		July	1999	ITALY
August	1962	GREECE		August	1999	ITALY
November	1966	ITALY		February	2001	ALGERIA *
December	1974	FRANCE *		July	2001	ALGERIA *
November	1979	ALGERIA		April	2003	FRANCE
February	1987	ITALY		February	2004	ISRAEL
September	1987	GREECE		April	2005	ITALY
July	1988	GREECE		June	2005	ITALY
November	1991	GREECE		July	2005	SPAIN
January	1992	ITALY *		September	2005	ITALY
April	1993	GREECE		January	2006	SPAIN *
November	1993	GREECE		April	2006	ITALY
February	1994	GREECE		April	2007	SPAIN
February	1996	SPAIN *		January	2008	SPAIN
March	1996	SPAIN		October	2008	FRANCE
May	1996	GREECE *		February	2011	ITALY *
August	1997	GREECE		November	2011	GREECE *
October	1997	GREECE *		December	2011	ITALY*
November	1998	SPAIN		April	2014	GREECE *

<sup>13</sup> Podestà *et al.* A review of Cuvier's beaked whale strandings in the Mediterranean Sea. *J. Cetacean Res. Manage.* 7(3):251–261 (2006)

<sup>14</sup> Pelagos Cetacean Research Institute. <http://www.pelagosinstitute.gr/>

<sup>15</sup> Monitoraggio degli spiaggiamenti di cetacei sulle coste italiane. <http://mammiferimarini.unipv.it/>

<sup>16</sup> Mediterranean Dataset of Cetacean Strandings. <http://medaces.uv.es/>