

GERVAIS' BEAKED WHALE (*Mesoplodon europaeus*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Within the genus *Mesoplodon*, there are four species of beaked whales that reside in the northwest Atlantic. These include True's beaked whale, *Mesoplodon mirus*; Gervais' beaked whale, *M. europaeus*; Blainville's beaked whale, *M. densirostris*; and Sowerby's beaked whale, *M. bidens* (Mead 1989). These species are difficult to identify to the species level at sea; therefore, much of the available characterization for beaked whales is to genus level only. Stock structure for each species is unknown. Thus, it is plausible the stock could actually contain multiple demographically independent populations that should themselves be stocks, because the current stock spans multiple eco-regions (Longhurst 1998; Spalding *et al.* 2007).

The distribution of *Mesoplodon* spp. in the northwest Atlantic is known principally from stranding records (Mead 1989; Nawojchik 1994; Mignucci-Giannoni *et al.* 1999; MacLeod *et al.* 2006; Jefferson *et al.* 2008). Off the U.S. Atlantic coast, beaked whale (*Mesoplodon* spp.) sightings have occurred principally along the shelf-edge and deeper oceanic waters (Figure 1; CETAP 1982; Waring *et al.* 1992; Tove 1995; Waring *et al.* 2001; Hamazaki 2002; Palka 2006). Most sightings were in late spring and summer, which corresponds to survey effort.

Gervais' beaked whales are believed to be principally oceanic, and strandings have been reported from Cape Cod to Florida, into the Caribbean and the Gulf of Mexico (NMFS unpublished data; Leatherwood *et al.* 1976; Mead 1989; Moore *et al.* 2005; MacLeod *et al.* 2006; Jefferson *et al.* 2008). This is the most common species of *Mesoplodon* to strand along the U.S. Atlantic coast.

POPULATION SIZE

The total number of Gervais' beaked whales off the eastern U.S. and Canadian Atlantic coast is unknown. Survey platform type influences observer ability to identify species, with differentiation most difficult from aircraft. However, several estimates of the undifferentiated complex of beaked whales (*Ziphius* and *Mesoplodon* spp.) from selected regions are available for select time periods (Barlow *et al.* 2006), as well as two estimates of *Mesoplodon* spp. beaked whales alone. Sightings are almost exclusively in the continental shelf edge and continental slope areas (Figure 1). The best abundance estimate for *Mesoplodon* spp. beaked whales is the sum of the 2011 survey estimates – 7,092 (CV=0.54).

Earlier abundance estimates

Please see Appendix IV for a summary of abundance estimates, including earlier estimates and survey descriptions. Due to changes in survey methodology these historical data should not be used to make comparisons to more current estimates.

Recent surveys and abundance estimates

An abundance estimate of 922 (CV=1.47) undifferentiated beaked whales (*Ziphius* and *Mesoplodon* spp.) was obtained from an aerial survey conducted in August 2006, which covered 10,676 km of trackline in the region from

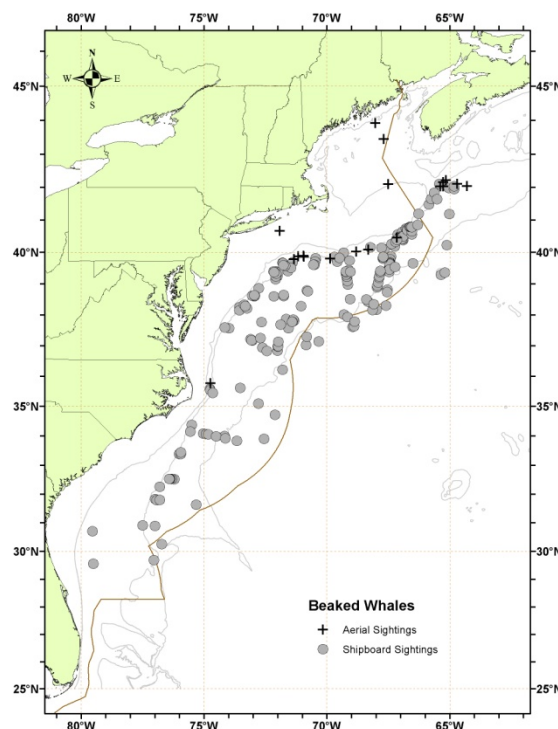


Figure 1. Distribution of beaked whale (includes *Ziphius* and *Mesoplodon* spp.) sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1995, 1998, 1999, 2002, 2004, 2006, and 2007, 2008, 2010 and 2011. Isobaths are the 100-m, 1000-m and 4000-m depth contours.

the 2000 m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence (Table 1; Palka pers. comm.).

An abundance estimate of 5,500 (CV=0.67) *Mesoplodon* spp. beaked whales (not including *Ziphius*) was generated from a shipboard and aerial survey conducted during June–August 2011 (Palka 2012). The aerial portion that contributed to the abundance estimate covered 5,313 km of tracklines that were over waters north of New Jersey from the coastline to the 100-m depth contour, through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy. The shipboard portion covered 3,017 km of tracklines that were in water offshore of North Carolina to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the U.S. EEZ). Both sighting platforms used a double-platform data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers, 2004). Shipboard data were inspected to determine if there was significant responsive movement to the ship (Palka and Hammond 2001). Because there was an insignificant amount of responsive movement for this species, the estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

An abundance estimate of 1,570 (CV=0.65) *Mesoplodon* spp. beaked whales (not including *Ziphius*) was generated from a shipboard survey conducted concurrently (June–August 2011) in waters between central Virginia and central Florida. This shipboard survey included shelf-break and inner continental slope waters deeper than the 50-m depth contour within the U.S. EEZ. The survey employed two independent visual teams searching with 25× bigeye binoculars. A total of 4,445 km of tracklines were surveyed, yielding 290 cetacean sightings. The majority of sightings occurred along the continental shelf break with generally lower sighting rates over the continental slope. Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

Although the 1990–2011 surveys did not sample exactly the same areas or encompass the entire beaked whale habitat, they did focus on segments of known or suspected high-use habitats off the northeastern U.S. coast. The collective 1990–2011 data suggest that, seasonally, at least several thousand beaked whales are occupying these waters, with highest levels of abundance in the Georges Bank region. NMFS surveys suggest that beaked whale abundance may be highest in association with Gulf Stream and warm-core ring features (Waring *et al.* 2001; Hamazaki 2002).

Because the estimates presented here were not dive-time corrected, they are likely negatively biased and probably underestimate actual abundance. Given that *Mesoplodon* spp. prefers deep-water habitats (Mead 1989) the bias may be substantial.

Table 1. Summary of abundance estimates for <i>Mesoplodon</i> spp. ^a or the undifferentiated complex ^b of beaked whales which include <i>Ziphius</i> and <i>Mesoplodon</i> spp. ^a Month, year, and area covered during each abundance survey, and resulting abundance estimate (N _{best}) and coefficient of variation (CV).			
Month/Year	Area	N _{best}	CV
Aug 2006 ^b	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	922	1.47
Jun-Aug 2011 ^a	Central Virginia to lower Bay of Fundy	5,500	0.67
Jun-Aug 2011 ^a	Central Florida to Central Virginia	1,592	0.67
Jun-Aug 2011 ^a	Central Florida to lower Bay of Fundy (COMBINED)	7,092	0.54
^a 2011 estimates are for <i>Mesoplodon</i> spp. beaked whales alone.			
^b 2006 estimate includes <i>Mesoplodon</i> and <i>Ziphius</i> .			

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for *Mesoplodon* spp. (not including *Ziphius*) beaked whales is 7,092 (CV=0.54). The minimum population estimate for *Mesoplodon* spp. beaked whales (not including *Ziphius*) is 4,632.

Current Population Trend

A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% ($\alpha = 0.30$) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. *Mesoplodon spp.* life history parameters that could be used to estimate net productivity include: length at birth is 2 to 3 m, length at sexual maturity 6.1 m for females, and 5.5 m for males, maximum age for females were 30 growth layer groups (GLG's) and for males was 36 GLG's, which may be annual layers (Mead 1984).

For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for *Mesoplodon spp.* beaked whales is 4,632. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.5. PBR for *Mesoplodon spp.* beaked whales (not including *Ziphius*) is 46.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The 2007-2011 total average estimated annual mortality of Gervais' beaked whales in observed fisheries in the U.S. Atlantic EEZ is zero.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al.* 2008; NOAA 2012). NMFS defines serious injury as an “injury that is more likely than not to result in mortality”. Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

Total fishery-related mortality and serious injury cannot be estimated separately for each beaked whale species because of the uncertainty in species identification by fishery observers. The Atlantic Scientific Review Group advised adopting the risk-averse strategy of assuming that any beaked whale stock which occurred in the U.S. Atlantic EEZ might have been subject to the observed fishery-related mortality and serious injury.

Estimated annual average fishery-related mortality or serious injury of this stock in 2007–2011 in U.S. fisheries was zero. Detailed fishery information is reported in Appendix III.

Earlier Interactions

There is no historical information available that documents incidental mortality in either U.S. or Canadian Atlantic coast fisheries (Read 1994). The only documented bycatch prior to 2003 of beaked whales is in the pelagic drift gillnet fishery (now prohibited). The bycatch only occurred from Georges Canyon to Hydrographer Canyon along the continental shelf break and continental slope during July to October (Northridge 1996). Forty-six fishery-related beaked whale mortalities were observed between 1989 and 1998. These included: 24 Sowerby's; 4 True's; 1 Cuvier's; and 17 undifferentiated beaked whales. Recent analysis of biological samples (genetics and morphological analysis) has been used to determine species identifications for some of the bycaught animals. Estimates from the 1989 to 1993 period are for undifferentiated beaked whales. The estimated annual fishery-related mortality (CV in parentheses) was 60 in 1989 (0.21), 76 in 1990 (0.26), 13 in 1991 (0.21), 9.7 in 1992 (0.24) and 12 in 1993 (0.16). Estimates of bycatch mortality by species are available for the 1994–1998 period, although none of the animals were identified as Gervais' beaked whales. Estimated annual fishery-related mortality for unidentified *Mesoplodon*

beaked whales during this period was 0 in 1994, 3 (0) in 1995, 2 (0.25) in 1996, and 7 (0) in 1998. There was no fishery during 1997. During July 1996, one beaked whale was entangled and released alive with “gear in/around a single body part”.

One unidentified beaked whale was seriously injured in the U.S. Atlantic pelagic longline fishery in 2003. This interaction occurred in the Sargasso Sea fishing area. The estimated fishery-related combined mortality in 2003 was 5.3 beaked whales (CV=1.0). No serious injury or mortality interactions have been reported since 2003.

Other Mortality

During 2007–2011, 21 Gervais’ beaked whales stranded along the U.S. Atlantic coast (Table 2). None of these animals displayed signs of human interaction.

Several unusual mass strandings of beaked whales in North Atlantic marine environments have been associated with naval activities (D’Amico *et al.* 2009; Filadelfo *et al.* 2009). During the mid- to late 1980’s multiple mass strandings of Cuvier’s beaked whales (4 to about 20 per event) and small numbers of Gervais’ beaked whale and Blainville’s beaked whale occurred in the Canary Islands (Simmonds and Lopez-Jurado 1991). Twelve Cuvier’s beaked whales that live stranded and subsequently died in the Mediterranean Sea on 12-13 May 1996 was associated with low frequency acoustic sonar tests conducted by the North Atlantic Treaty Organization (Frantzis 1998; A’Amico *et al.* 2009; Filadelfo *et al.* 2009). In March 2000, 14 beaked whales live stranded in the Bahamas; 6 beaked whales (5 Cuvier’s and 1 Blainville’s) died (Balcomb and Claridge 2001; NMFS 2001; Cox *et al.* 2006). Four Cuvier’s, 2 Blainville’s, and 2 unidentified beaked whales were returned to sea. The fate of the animals returned to sea is unknown, since none of the whales have been resighted. Necropsy of 6 dead beaked whales revealed evidence of tissue trauma associated with an acoustic or impulse injury that caused the animals to strand. Subsequently, the animals died due to extreme physiologic stress associated with the physical stranding (i.e., hyperthermia, high endogenous catecholamine release) (Cox *et al.* 2006). Fourteen beaked whales (mostly Cuvier’s beaked whales but also including Gervais’ and Blainville’s beaked whales) stranded in the Canary Islands in 2002 (Cox *et al.* 2006, Fernandez *et al.* 2005; Martin *et al.* 2004). Gas bubble-associated lesions and fat embolism were found in necropsied animals from this event, leading researchers to link nitrogen supersaturation with sonar exposure (Fernandez *et al.* 2005).

State	2007	2008	2009	2010	2011	Total
New Jersey	0	1	0	1	0	2
Maryland	0	0	1	1	0	2
Virginia	1	0	1	1	0	3
North Carolina	1	0	1	1	2	5
South Carolina	0	0	0	0	1	1
Georgia	0	0	0	1	0	1
Florida	1	2	2	1	1	7
Total	3	3	5	6	4	21

STATUS OF STOCK

Gervais’ beaked whales are not listed as threatened or endangered under the Endangered Species Act and the western North Atlantic stock of Gervais’ beaked whale is not considered strategic under the Marine Mammal Protection Act. No habitat issues are known to be of concern for this species, but questions have been raised regarding potential effects of human-made sounds on deep-diving cetacean species such as Gervais’ beaked whales (Richardson *et al.* 1995). There are insufficient data to determine the population size or trends, and, while a PBR value has been calculated for the *Mesoplodon* genus, PBR cannot be calculated for this species independently. The permanent closure of the pelagic drift gillnet fishery has eliminated the principal known source of incidental fishery mortality, and no fishery-related mortality and serious injury has been observed during the recent 5-year (2007–2011) period. Therefore, the total U.S. fishery mortality and serious injury rate can be considered to be insignificant and approaching zero. The status of Gervais’ beaked whales relative to OSP in U.S. Atlantic EEZ is unknown.

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