Revised 6/4/2018

BAIRD'S BEAKED WHALE (*Berardius bairdii*): California/Oregon/Washington Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Baird's beaked whales are distributed throughout deep waters and along the continental slopes of the North Pacific Ocean (Balcomb 1989, Macleod *et al.* 2006). They have been harvested and studied in Japanese waters, but little is known about this species elsewhere (Balcomb 1989). Along the U.S. west coast, Baird's beaked whales have been seen primarily along the continental slope (Figure 1) from late spring to early fall. They have been seen less frequently and are presumed to be farther offshore during the colder water months of November through April. For the Marine Mammal Protection Act (MMPA) stock assessment reports, Baird's beaked whales within the Pacific U.S. Exclusive Economic Zone are divided into two discrete, non-contiguous areas: 1) waters off California, Oregon and Washington (this report), and 2) Alaskan waters.

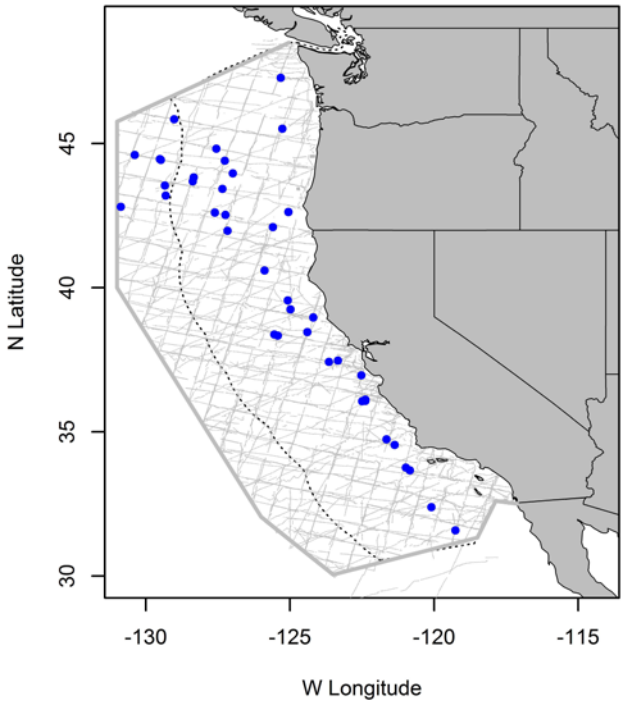

Figure 1. Baird's beaked whale sightings based on shipboard surveys off California, Oregon and Washington, 1991-2014 Dashed line represents the U.S. EEZ, thin lines indicate completed transect effort of all surveys combined.

POPULATION SIZE

Barlow (2016) recently estimated Baird's beaked whale abundance in the California Current at 5,394 (CV=0.83) and 7,960 (CV=0.93) whales for surveys conducted in 2008 and 2014, respectively. These estimates are higher than previously-published estimates for this region because they include lower estimates of trackline detection probability, *g(0)*, based on Beaufort sea state specific estimates of detectability for *Mesoplodon* species (Barlow 2015). A trend-based analysis of line-transect data from all surveys conducted between 1991 and 2014 yielded an estimate of abundance of 2,697 (CV=0.60) whales (Moore and Barlow 2017); these were based on newer (lower) *g(0)* estimates from earlier analyses, but were not as low as those used by Barlow (2016) and thus the abundance estimates are not as high (Moore and Barlow 2017). Based on this analysis and weak evidence for any trend in abundance, the recent 2014 estimate of 2,697 (CV=0.60) Baird's beaked whales is the most appropriate estimate for this stock.

Minimum Population Estimate

The log-normal 20th percentile of the 2014 abundance estimate is 1,633 Baird's beaked whales (Moore and Barlow 2017).

Current Population Trend

The analysis by Moore and Barlow (2013) did not suggest evidence of an abundance trend during 1991–2008 for Baird's beaked whale in waters off the U.S. west coast, but an updated analysis that includes 2014 survey data indicates that the population has remained stable or increased slightly (Moore and Barlow 2017 (Figure 2). An annual growth rate geometric mean (λ) of 1.02 (SD = 0.03) was estimated based on the

latest analysis, with 95% CRI ranging from 0.96 to 1.08 and a 72% chance of being positive (Moore and Barlow 2017).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

No information on current or maximum net productivity rates is available for this species.

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) level for this stock is calculated as the minimum population size (1,633) times one half the default maximum net growth rate for cetaceans (½ of 4%) times a recovery factor of 0.50 (for a species of unknown status with no fishery mortality; Wade and Angliss 1997), resulting in a PBR of 16 Baird's beaked whales per year.

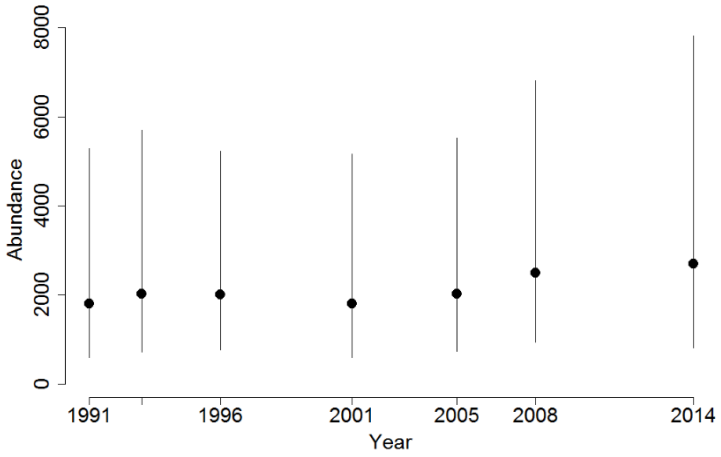

Figure 2. Abundance and trend estimates for Baird's beaked whales in the California Current, 1991-2014 (Moore and Barlow 2017). For each year, the Bayesian posterior median (●) abundance estimates are shown, along with 95% CRIs.

HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fishery Information

The California large mesh drift gillnet fishery has been the only fishery known to interact with this stock. One Baird's beaked whale was incidentally killed in this fishery in 1994 (Julian and Beeson 1998), before acoustic pingers were first used in the fishery in 1996 (Barlow and Cameron 2003). Since 1996, no beaked whale of *any* species have been observed entangled or killed in this fishery (Carretta *et al.* 2008, Carretta *et al.* 2017a). Mean annual takes in Table 1 are based on 2011-2015 data. This results in an average estimated annual mortality of zero Baird's beaked whales (Carretta *et al.* 2017a). Gillnets have been documented to entangle marine mammals off Baja California (Sosa-Nishizaki *et al.* 1993), but no recent bycatch data from Mexico are available.

Table 1. Summary of available information on the incidental mortality and injury of Baird's beaked whales (California/Oregon/Washington Stock) in commercial fisheries that might take this species. The single observed entanglement resulted in the death of the animal. Coefficients of variation for mortality estimates are provided in parentheses. Mean annual takes are based on 2011-2015 data unless noted otherwise.

Fishery Name	Data Type	Year(s)	Percent Observer Coverage	Observed Mortality	Estimated Annual Mortality	Mean Annual Takes (CV in parentheses)
CA/OR thresher shark/swordfish drift gillnet fishery	observer data	2011 2012 2013 2014 2015	20% 19% 37% 24% 20%	0 0 0 0 0	0 0 0 0 0	0
Minimum total annual takes						0

Other mortality

California coastal whaling operations killed 15 Baird's beaked whales between 1956 and 1970, and 29 additional Baird's beaked whales were taken by whalers in British Columbian waters (Rice 1974). One

Baird's beaked whale stranded in Washington state in 2003 and the cause of death was attributed to a ship strike. No other human-caused mortality has been reported for this stock for the period 2011-2015 (Carretta *et al.* 2017b).

Anthropogenic sound sources, such as military sonar and seismic testing have been implicated in the mass strandings of beaked whales, including atypical events involving multiple beaked whale species (Simmonds and Lopez-Jurado 1991, Frantiz 1998, Anon. 2001, Jepson *et al.* 2003, Cox *et al.* 2006). While D'Amico *et al.* (2009) note that most mass strandings of beaked whales are unassociated with documented sonar activities, lethal or sub-lethal effects of such activities would rarely be documented, due to the remote nature of such activities and the low probability that an injured or dead beaked whale would strand. Filadelpho *et al.* (2009) reported statistically significant correlations between military sonar use and mass strandings of beaked whales in the Mediterranean and Caribbean Seas, but not in Japanese and Southern California waters, and hypothesized that regions with steep bathymetry adjacent to coastlines are more conducive to stranding events in the presence of sonar use. In Hawaiian waters, Faerber & Baird (2010) suggest that the probability of stranding is lower than in some other regions due to nearshore currents carrying animals away from beaches, and that stranded animals are less likely to be detected due to low human population density near many of Hawaii's beaches. Actual and simulated sonar are known to interrupt the foraging dives and echolocation activities of tagged beaked whales (Tyack *et al.* 2011). Blainville's beaked whale presence was monitored on hydrophone arrays before, during, and after sonar activities on a Caribbean military range, with evidence of avoidance behavior: whales were detected throughout the range prior to sonar exposure, not detected in the center of the range coincident with highest sonar use, and gradually returned to the range center after the cessation of sonar activity (Tyack *et al.* 2011). Fernández *et al.* (2013) report that there have been no mass strandings of beaked whales in the Canary Islands following a 2004 ban on sonar activities in that region. The absence of beaked whale bycatch in California drift gillnets following the introduction of acoustic pingers into the fishery implies additional sensitivity of beaked whales to anthropogenic sound (Carretta *et al.* 2008, Carretta and Barlow 2011).

STATUS OF STOCK

The status of Baird's beaked whales in California, Oregon and Washington waters relative to OSP is not known, and no abundance trend is evident (Moore and Barlow 2017). They are not listed as "threatened" or "endangered" under the Endangered Species Act nor designated as "depleted" under the MMPA. The average annual human-caused mortality during 2011-2015 is zero animals/year. Because recent fishery and human-caused mortality is less than the PBR (16), Baird's beaked whales are not classified as a "strategic" stock under the MMPA. Moore and Barlow (2017) estimated that there was a 72% probability that this population had a positive growth rate over the period 1991-2014. The total fishery mortality and serious injury for this stock is zero and can be considered to be insignificant and approaching zero. The impacts of anthropogenic sound on beaked whales remains a concern (Barlow and Gisiner 2006, Cox *et al.* 2006, Hildebrand *et al.* 2005, Weilgart 2007).

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