BELUGA WHALE (*Delphinapterus leucas*): Beaufort Sea Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Beluga whales are distributed throughout seasonally ice-covered arctic and subarctic waters of the Northern Hemisphere (Gurevich 1980) and are closely associated with open leads and polynyas in ice-covered regions (Hazard 1988). In Alaska, depending on season and region, beluga whales may occur in both offshore and coastal waters, with summer concentrations in upper Cook Inlet, Bristol Bay, the eastern Bering Sea (i.e., Yukon Delta and Norton Sound), eastern Chukchi Sea, and Beaufort Sea (Mackenzie River Delta) (Hazard 1988, O'Corry-Crowe et al. 1997) (Fig. 1). Seasonal distribution is affected by ice cover, tidal conditions, access to prey, temperature, and human interaction (Lowry 1985). Data from satellite transmitters attached to a few whales from the Beaufort Sea, Eastern Chukchi Sea, and Eastern Bering Sea stocks show ranges that are relatively distinct month to month for these populations' summering areas and autumn migratory routes (e.g., Hauser et al. 2014, Citta et al. 2017). The few transmitters that lasted through the winter showed that beluga whales from these summering areas overwinter in the Bering Sea; the stocks may use separate wintering locations and probably remain separated through the winter (Suydam 2009, Citta et al. 2017).

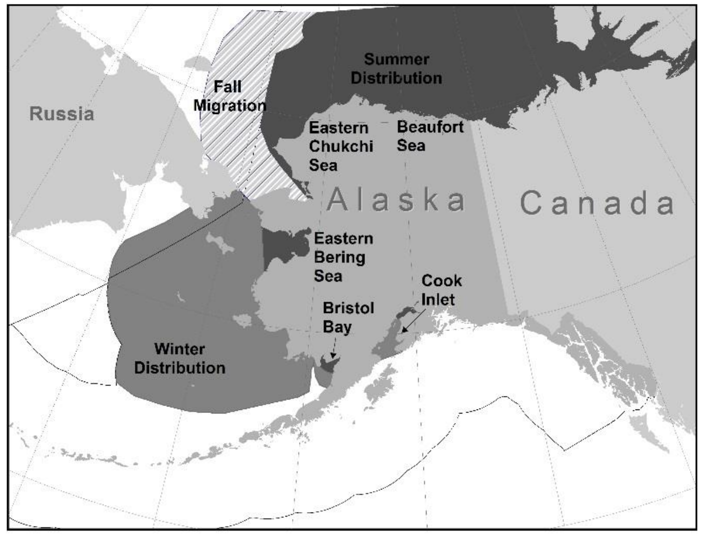

Figure 1. Approximate distribution for all five beluga whale stocks. Summering areas are dark gray, wintering areas are lighter gray, and the hashed area is a region used by the Eastern Chukchi Sea and Beaufort Sea stocks for autumn migration.

The Beaufort Sea and Eastern Chukchi Sea stocks of beluga whales migrate between the Bering and Beaufort seas. Beaufort Sea beluga whales depart from the Bering Sea in early spring, through the Chukchi Sea and into the Canadian waters of the Beaufort Sea where they remain in the summer and fall, returning to the Bering Sea in late fall. Eastern Chukchi Sea beluga whales migrate out of the Bering Sea in late spring and early summer, into the Chukchi Sea and western Beaufort Sea where they remain in the summer, returning to the Bering Sea in the fall. The Eastern Bering Sea stock remains in the Bering Sea but moves south near Bristol Bay in winter and returns north to Norton Sound and the mouth of the Yukon River in summer (Suydam 2009, Hauser et al. 2014, Citta et al. 2017). Beluga whales found in Bristol Bay (Quakenbush 2003; Citta et al. 2016, 2017) and Cook Inlet (Hobbs et al. 2005, Goetz et al. 2012, Shelden et al. 2015) remain in those areas throughout the year, showing only small seasonal shifts in distribution.

The following information was considered in classifying beluga whale stock structure based on the Dizon et al. (1992) phylogeographic approach: 1) Distributional data: geographic distribution discontinuous in summer (Frost and Lowry 1990); 2) Population response data: distinct population trends among regions occupied in summer; 3) Phenotypic data: unknown; and 4) Genotypic data: mitochondrial DNA analyses indicate distinct differences among the five summering areas (O'Corry-Crowe et al. 1997). Based on this information, five beluga whale stocks are recognized within U.S. waters: 1) Cook Inlet, 2) Bristol Bay, 3) Eastern Bering Sea, 4) Eastern Chukchi Sea, and 5) Beaufort Sea (Fig. 1).

POPULATION SIZE

The sources of information to estimate abundance for beluga whales in the waters of northern Alaska and western Canada have included both opportunistic and systematic observations. Duval (1993) reported an estimate of 21,000 beluga whales for the Beaufort Sea stock, similar to that reported by Seaman et al. (1985). The most recent aerial survey was conducted in July 1992 and resulted in an estimate of 19,629 beluga whales (CV = 0.229) in the eastern Beaufort Sea (Harwood et al. 1996). To account for availability bias, a correction factor (CF), which was not data-based, has been recommended for the Beaufort Sea beluga whale stock (Duval 1993), resulting in a population estimate of 39,258 whales (19,629 × 2). A coefficient of variation (CV) for the CF is not available; however, this CF was considered negatively biased by the Alaska Scientific Review Group (SRG) considering that aerial survey CFs for this species have been estimated to be between 2.5 and 3.27 (Frost and Lowry 1995). Additionally, the 1992 surveys did not encompass the entire summer range of Beaufort Sea beluga whales (Richard et al. 2001), thus, are negatively biased.

Minimum Population Estimate

For the Beaufort Sea beluga whale stock, the minimum population estimate (N_{MIN}) is calculated according to Equation 1 from the potential biological removal (PBR) guidelines (Wade and Angliss 1997): $N_{MIN} = N/\exp(0.842\times[\ln(1+[CV(N)]^2)]^{½})$. Using the population estimate (N) of 39,258 whales and an associated CV(N) of 0.229, N_{MIN} for this stock would be 32,453 whales. However, because the survey data are more than 8 years old, it is not considered a reliable minimum population estimate for calculating a PBR and N_{MIN} is considered unknown.

Current Population Trend

The current population trend of the Beaufort Sea stock of beluga whales is unknown. Aerial surveys off the Mackenzie River Delta between 1982-1985 and 2007-2009 indicate that the stock in that area is at least stable or increasing (Harwood and Kingsley 2013).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate is unavailable for the Beaufort Sea beluga whale stock. Hence, until additional data become available, the default maximum theoretical net productivity rate (R_{MAX}) for cetaceans of 4% will be used for this stock (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

PBR is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$. The recovery factor ($F_R$) for this stock is 1.0, the value for cetacean stocks that are thought to be stable in the presence of a subsistence harvest (Wade and Angliss 1997). However, the 2016 guidelines for preparing Stock Assessment Reports (NMFS 2016) state that abundance estimates older than 8 years should not be used to calculate PBR due to a decline in confidence in the reliability of an aged abundance estimate. Therefore, the PBR for this stock is considered undetermined.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Detailed information for each human-caused mortality, serious injury, and non-serious injury reported for NMFS-managed Alaska marine mammals in 2011-2015 is listed, by marine mammal stock, in Helker et al. (2017); however, only the mortality and serious injury data are included in the Stock Assessment Reports. The total estimated annual level of human-caused mortality and serious injury for Beaufort Sea beluga whales in 2011-2015 is 139 beluga whales: 47 in subsistence takes by Alaska Natives and 92 in subsistence takes by Canadian Natives.

Fisheries Information

Detailed information (including observer programs, observer coverage, and observed incidental takes of marine mammals) for federally-managed and state-managed U.S. commercial fisheries in Alaska waters is presented in Appendices 3-6 of the Alaska Stock Assessment Reports.

There are no reports of mortality or serious injury of this stock incidental to U.S. commercial fisheries.

Alaska Native Subsistence/Harvest Information

The subsistence take of beluga whales from this stock within U.S. waters is reported by the Alaska Beluga Whale Committee (ABWC). The most recent Alaska Native subsistence harvest estimates for the Beaufort Sea beluga whale stock are provided in Table 1 (ABWC, unpubl. data, 2016). Given these data, the annual subsistence take by Alaska Native hunters averaged 47 beluga whales landed during 2011-2015.

Table 1. Summary of Beaufort Sea beluga whales landed by Alaska Native subsistence hunters in 2011-2015 (ABWC, unpubl. data, 2016). These are minimum estimates of the total number of beluga whales taken, because struck and lost data are not consistently provided.

Year	Reported total number landed
2011	42
2012	92
2013	35
2014	24
2015	43
Mean annual number landed	47

Canadian Native Subsistence/Harvest Information

The subsistence take of beluga whales within the Canadian waters of the Beaufort Sea is reported by the Fisheries Joint Management Committee (FJMC). The data are collected through on-site harvest monitoring conducted by the FJMC at Inuvialuit communities in the Mackenzie River Delta, Northwest Territories. The Canadian Inuvialuit subsistence harvest estimates for the Beaufort Sea beluga whale stock in 2011-2015 are provided in Table 2 (FJMC Beluga Monitor Program, FJMC, Inuvik, NT, Canada). Given these data, the annual subsistence take in Canada averaged 92 beluga whales in 2011-2015. Thus, the estimated mean annual subsistence take of Beaufort Sea beluga whales in U.S. and Canadian waters in 2011-2015 is 139 whales (47 + 92).

Table 2. Summary of the Canadian subsistence harvest of Beaufort Sea beluga whales in 2011-2015 (FJMC, unpubl. data).

Year	Landed	Struck and lost	Total (landed + struck and lost)
2011	98	4	102
2012	73	2	75
2013	90	2	92
2014	104	2	106
2015	82	1	83
Mean annual number taken (landed + struck and lost)			92

STATUS OF STOCK

No fishery-related mortality or serious injury has been reported for the Beaufort Sea stock of beluga whales; therefore, the mean annual U.S. commercial fishery-related mortality and serious injury rate can be considered insignificant and approaching zero mortality and serious injury rate. The total estimated annual level of human-caused mortality and serious injury for this stock is 139 beluga whales. Beaufort Sea beluga whales are not designated as depleted under the Marine Mammal Protection Act or listed as threatened or endangered under the Endangered Species Act. Therefore, the Beaufort Sea beluga whale stock is classified as a non-strategic stock. At this time, it is not possible to assess the status of this stock relative to its Optimum Sustainable Population.

There are key uncertainties in the assessment of the Beaufort Sea stock of beluga whales. The most recent surveys were conducted more than 8 years ago and did not cover the entire population; given the lack of information on population trend, the abundance estimates are not used to calculate an N_{MIN} and the PBR level is undetermined.

HABITAT CONCERNS

Evidence indicates that the arctic climate is changing rapidly and significantly, and one result of this change is a reduction in the extent and duration of sea ice in at least some regions (ACIA 2004, Johannessen et al. 2004). These changes are likely to affect marine mammal species in the Arctic. Ice-associated animals, such as the beluga whale, are sensitive to changes in arctic weather, sea-surface temperatures, and ice extent, and the concomitant effect on prey availability. There are indications that decreases in seasonal sea ice have influenced beluga whale phenology; however, Beaufort Sea beluga whales did not show a statistically significant change in the timing of their southward migration in response to changes in sea ice (Hauser et al. 2017). An offshore shift in distribution of Beaufort Sea beluga whales between an earlier sample in 1982-1985 and a later sample in 2007-2009 was attributed either to increased habitat due to more open water or potentially a response to industrial activity

(Harwood and Kingsley 2013). Decreases in seasonal sea ice may also increase the risk of killer whale predation (O'Corry-Crowe et al. 2016). There are insufficient data to make reliable predictions of the effects of arctic climate change on beluga whales; however, Laidre et al. (2008) and Heide-Jørgensen et al. (2010) concluded that on a worldwide basis beluga whales were likely to be less sensitive to climate change than other arctic cetaceans because of their wide distribution and flexible behavior. Increased human activity in the Arctic, including increased oil and gas exploration and development and increased nearshore development, has the potential to impact beluga whale habitat (Moore et al. 2000, Lowry et al. 2006). However, predicting the type and magnitude of the impacts is difficult.

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