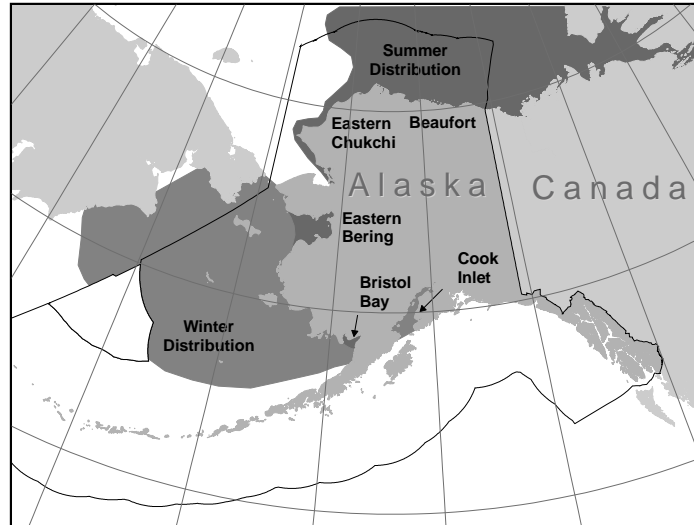


## BELUGA WHALE (*Delphinapterus leucas*): Bristol Bay Stock

### 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). 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, Norton Sound), eastern Chukchi Sea, and the Mackenzie Delta (Hazard 1988). Satellite transmitters attached to whales from the Beaufort Sea, Chukchi Sea and eastern Bering Sea stocks have provided detailed information on distribution and movements. The few transmitters that lasted through the winter showed that beluga whales from these



**Figure 1.** Approximate distribution of beluga whales in Alaska waters. The dark shading displays the summer distribution of the five stocks. Winter distributions are depicted with lighter shading.

summering areas overwinter in the Bering Sea and the stocks may use separate wintering locations (Suydam 2009; Alaska Beluga Whale Committee, unpubl. data). Belugas found in Bristol Bay and the northern Gulf of

Alaska/Cook Inlet remain in those areas throughout the year, showing only small seasonal shifts in distribution (Shelden 1994; Quakenbush 2003; NMFS and ADF&G, unpubl. data). Seasonal distribution is affected by ice cover, tidal conditions, access to prey, temperature, and human activities (Lowry 1985).

The general distribution pattern for beluga whales shows major seasonal changes. During the winter, they occur in offshore waters associated with pack ice. In the spring, they migrate to warmer coastal estuaries, bays, and rivers where they may molt (Finley 1982, Suydam 2009) and give birth to and care for their calves (Sergeant and Brodie 1969). Annual migrations may cover thousands of kilometers (Richard et al. 2001).

Summer movement patterns of Bristol Bay belugas were determined from satellite-linked tags deployed on 10 animals in the Kvichak River during 2002 and 2003, and 5 in the Nushagak River in 2006, 10 in 2008, 5 in 2010, 10 in 2012, and 12 in 2013 (NMFS, BBMMC, ADF&G, unpubl. data). Those whales used the shallow upper portions of Kvichak and Nushagak bays between May and August (Quakenbush, 2003) and remained in the nearshore waters of Bristol Bay through the months of September and October (Quakenbush and Citta 2006). Data from two belugas whose tags lasted into December and January showed that they were in Nushagak and Kvichak bays, suggesting that some belugas do not leave the nearshore waters of Bristol Bay during the winter (L. Quakenbush, Alaska Department of Fish and Game, Fairbanks, AK, pers. comm., 31 March 2008). Tags attached to whales in 2012 and 2013 have confirmed these observations (NMFS, unpubl. data).

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 between 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 belugas in the waters of western and northern Alaska have included both opportunistic and systematic observations. Frost and Lowry (1990) compiled data collected

from aerial surveys conducted between 1978 and 1987 that were specifically designed to estimate the number of beluga whales. Surveys did not cover the entire habitat of belugas, but were directed to specific areas at the times of year when belugas are known to concentrate during summer. Frost and Lowry (1990) reported an estimate of 1,000-1,500 whales for Bristol Bay, similar to that reported by Seaman et al. (1985). In 1994, the number was estimated at 1,555 belugas (Lowry and Frost 1998). That estimate was based on a maximum count of 503 animals, which was corrected using radio-telemetry data for the proportion of animals that were diving and thus not visible at the surface (2.62; Frost and Lowry 1995), and for the proportion of newborns and yearlings not observed due to their small size and dark coloration (1.18; Brodie 1971). The Alaska Department of Fish and Game and the Alaska Beluga Whale Committee conducted beluga surveys in Bristol Bay in 1999, 2000, 2004 and 2005, with maximum counts of 690, 531, 794, and 1,067 whales (Lowry et al. 2008). Using the correction factors described above and the maximum counts for 2004 and 2005 gives population estimates of 2,455 and 3,299 whales, with an average annual estimate of 2,877 (L. Lowry, University of Alaska Fairbanks, pers. comm., March 2011).

### **Minimum Population Estimate**

The survey technique used for estimating the abundance of beluga whales in this stock is a direct count which incorporates correction factors. Given this survey method, estimates of the variance of abundance are unavailable. The abundance estimate is thought to be conservative because no correction has been made for whales that were at the surface but were missed by the observers, and the dive correction factor is probably negatively biased (Lowry and Frost 1998). Consistent with the recommendations of the Alaska Scientific Review Group (DeMaster 1997), a default CV(N) of 0.2 was used in the calculation of the minimum population estimate ( $N_{MIN}$ ).  $N_{MIN}$  for this beluga whale stock is calculated using Equation 1 from the PBR Guidelines (Wade and Angliss 1997):  $N_{MIN} = N / \exp(0.842 \times [\ln(1 + [CV(N)]^2)]^{1/2})$ . Using the average estimate for 2004 and 2005 (N) of 2,877 and the default CV (0.2),  $N_{MIN}$  for the Bristol Bay stock of beluga whales is 2,467.

### **Current Population Trend**

A survey program involving replicate aerial counts using standardized methods was conducted during 1993-2005. Data from 28 complete counts of Kvichak and Nushagak bays made in good or excellent survey conditions were analyzed, and results showed that the population had increased by 65% over the 12-year period (Lowry et al. 2008).

### **CURRENT AND MAXIMUM NET PRODUCTIVITY RATES**

The estimated rate of increase in abundance of belugas in Bristol Bay during 1993-2005 was 4.8% per year (95% CI = 2.1%-7.5%; Lowry et al. 2008). This estimate exceeds the default cetacean maximum net productivity rate ( $R_{MAX}$ ) of 4% (Wade and Angliss 1997). It is currently not clear why this stock should be increasing at such a high rate, but possibilities include recovery from research kills in the 1960s, a reduction in subsistence harvests, and a delayed response to increases in salmon stocks (Lowry et al. 2008).

### **POTENTIAL BIOLOGICAL REMOVAL**

Under the 1994 reauthorized Marine Mammal Protection Act (MMPA), the 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:  $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$ . As this stock is known to be increasing (Lowry et al. 2008), the recovery factor ( $F_R$ ) is 1.0 (Wade and Angliss 1997, DeMaster 1997; see discussion under PBR for the eastern Bering Sea stock). Thus, for the Bristol Bay stock of beluga whales,  $PBR = 59$  animals ( $2,467 \times 0.024 \times 1.0$ ).

### **ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY**

#### **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.

**Fisheries Information**

Three different commercial fisheries that could have interacted with beluga whales in Bristol Bay were monitored for incidental take by fishery observers during 1990-1997: Bering Sea (and Aleutian Islands) groundfish trawl, longline, and pot fisheries. Observers did not report any mortality or serious injury of beluga whales incidental to these groundfish fisheries.

Observers have never monitored the Bristol Bay commercial salmon set gillnet and drift gillnet fisheries which combined had 2,845 active permits in 2010. These fisheries are known to have caused mortality of beluga whales from this stock in the past (Frost et al. 1984). However, they have never been monitored by an observer program so there is no reliable information on the number of animals that have been or are being taken.

There is substantial effort in a subsistence gillnet fishery for salmon in Bristol Bay. Belugas are occasionally entangled and killed in this fishery, but there is no established protocol for non-commercial takes to be reported to NMFS. During 2008-2012, one mortality of a beluga in a subsistence salmon net was reported to the stranding network (Table 1). Based on this stranding report, the minimum annual mortality estimate due to fishery interactions over the 5-year period from 2008 to 2012 was 0.2 per year. However, this figure is clearly an underestimate because subsistence fishers are not required to report marine mammal takes, and the commercial fishery has not been observed. Also, it should be noted that in this region of western Alaska, belugas taken incidental to the personal-use or commercial salmon fisheries may be used by Alaska Natives for subsistence and may be included in the subsistence harvest data reported below.

A reliable estimate of the mortality rate incidental to commercial fisheries is currently unavailable.

**Table 1.** Summary of the Bristol Bay stock of beluga whale mortalities and serious injuries by year and type reported to the Alaska Regional Office, marine mammal stranding database, for the 2008-2012 period (Allen et al. 2014, Helker et al. 2015). Only cases of serious injury were recorded in this table; animals with non-serious injuries have been excluded.

Cause of Injury	2008	2009	2010	2011	2012	Mean Annual Mortality
Entangled in Bristol Bay subsistence king salmon set gillnet	0	1	0	0	0	0.2
Minimum total annual mortality						0.20

**Subsistence/Native Harvest Information**

Data on the subsistence take of beluga whales from the Bristol Bay stock is provided by the ABWC. The most recent subsistence harvest estimates for the stock are provided in Table 2 (Alaska Beluga Whale Committee, 18 February 2010). These data show that the annual subsistence take by Alaska Natives averaged 24 belugas from the Bristol Bay stock during the 5-year period 2008-2012.

**Table 2.** Summary of the Alaska Native subsistence harvest from the Bristol Bay stock of beluga whales, 2008-2012. N/A indicates the data are not available.

Year	Reported total number landed
2008	19
2009	20
2010	27
2011	22
2012	32
Mean annual number of animals landed (2008-2012)	24.0

## STATUS OF STOCK

It is unknown whether the U.S. commercial fishery-related mortality level is insignificant and approaching zero mortality and serious injury rate (i.e., 10% of PBR; less than 5.9 per year) because a reliable estimate of the mortality rate incidental to commercial fisheries is currently unavailable. Bristol Bay beluga whales are not designated as “depleted” under the MMPA or listed as “threatened” or “endangered” under the Endangered Species Act. Based on currently available data, the estimated annual rate of human-caused mortality and serious injury ( $24 + 0.2 = 24.2$ ) is not known to exceed the PBR (59). Because the population size has been increasing at a rate near  $R_{MAX}$ , the sum of human impacts on the population are not a problem at this point (Lowry et al. 2008). Therefore, the Bristol Bay stock of beluga whales is not classified as a strategic stock. However, as noted previously, the estimate of fisheries-related mortality is unreliable and likely to be underestimated.

## HABITAT CONCERNS

Evidence indicates that the Arctic climate is changing significantly and that one result of the change is a reduction in the extent of sea ice in most regions of the Arctic (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, may be sensitive to changes in arctic weather, sea-surface temperatures, or ice extent, and the concomitant effect on prey availability. Currently, there are insufficient data to make reliable predictions of the effects of arctic climate change on beluga whales, but Laidre et al. (2008) and Heide-Jørgensen (2010) concluded that on a worldwide basis belugas 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 increasing oil and gas exploration and development, and increased nearshore development, have the potential to impact habitat for beluga whales (Moore et al. 2000, Lowry et al. 2006), but predicting the type and magnitude of the impacts is difficult at this time. Because the population size has been increasing (Lowry et al. 2008), habitat impacts most likely have been minimal during recent years.

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