BELUGA WHALE (*Delphinapterus leucas*): Eastern Chukchi Sea Stock

NOTE – April 2022: NMFS is evaluating whether scientific issues raised by co-management partners in November 2021 concerning the Eastern Bering Sea beluga whale Stock Assessment Report may also be applicable to the Eastern Chukchi Sea beluga whale Stock Assessment Report. Any resulting changes will be reflected in a future Stock Assessment Report.

STOCK DEFINITION AND GEOGRAPHIC RANGE

Beluga whales are distributed throughout seasonally ice-covered arctic and subarctic waters of the Northern Hemisphere (Gurevich 1980). In ice-covered regions, they are closely associated with open leads and polynyas (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, eastern Bering Sea (i.e., Yukon River Delta, Norton Sound), eastern Chukchi Sea, and Beaufort Sea (Mackenzie River Delta) (Hazard 1988, O'Corry-Crowe et al. 2018) (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 beluga whales from the Beaufort Sea, Eastern Chukchi Sea, Eastern Bering Sea, and Bristol Bay stocks identify ranges that are relatively distinct month to month for these stocks' summering areas and autumn migratory routes (e.g., Hauser et al. 2014, Citta et al. 2017, Lowry et al. 2019). Transmitters that lasted through the winter showed that beluga whales from these summering areas overwinter in the Bering Sea; these stocks are not known to overlap in space and time in the Bering Sea (Suydam 2009, Citta et al. 2017, Lowry et al. 2019).

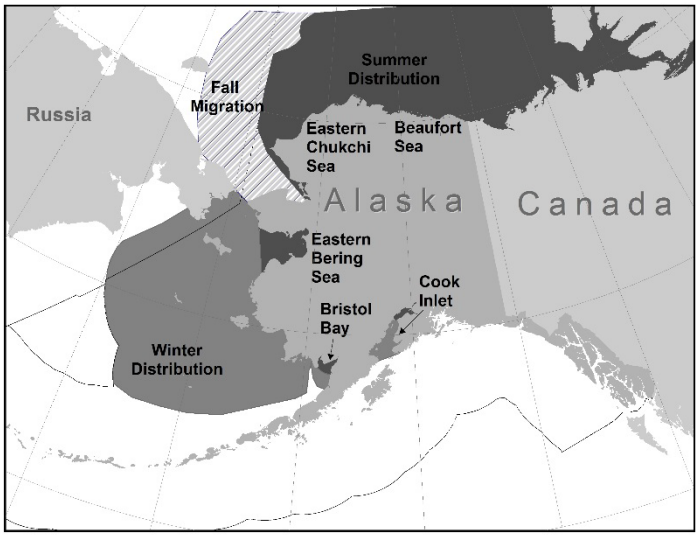

Figure 1. Approximate distribution for all five beluga whale stocks. The Beaufort Sea, Eastern Chukchi Sea, Eastern Bering Sea, and Bristol Bay beluga whale stocks summer in the Beaufort Sea (Beaufort Sea and Eastern Chukchi Sea stocks) and Bering Sea (Eastern Bering Sea and Bristol Bay stocks); they overwinter in the Bering Sea. The Bristol Bay and Cook Inlet beluga whale stocks show only small seasonal shifts in distribution, remaining in Bristol Bay and Cook Inlet, respectively, throughout the year. 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 U.S. Exclusive Economic Zone is delineated by a black line.

New genetic analyses have further defined five of the summering aggregations in the Bering, Chukchi, and Beaufort seas as follows: Bristol Bay, eastern Bering Sea (Norton Sound), eastern Chukchi Sea (Kasegaluk Lagoon), eastern Beaufort Sea (Mackenzie-Amundsen), and Gulf of Anadyr (Anadyr Bay) (O'Corry-Crowe et al. 2018). These genetic analyses, combined with new telemetry data, demonstrate that the demographically distinct summering aggregations return to discrete wintering areas and disperse and interbreed over limited distances but do not appear to interbreed extensively (O'Corry-Crowe et al. 2018).

The Beaufort Sea and Eastern Chukchi Sea stocks of beluga whales migrate between the Bering and Beaufort seas. Beaufort Sea beluga whales depart the Bering Sea in early spring, migrate 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 depart the Bering Sea in late spring and early summer, migrate through the Chukchi Sea and into the western Beaufort Sea where they remain in the summer, returning to the Bering Sea in the fall. The Eastern Bering Sea beluga whale stock remains in the Bering Sea but migrates 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, Lowry et al. 2019). Beluga whales tagged in Bristol Bay (Quakenbush 2003; Citta et al. 2016, 2017) and Cook Inlet (Goetz et al. 2012; Shelden et al. 2015, 2018; Lowry et al. 2019) remain in those areas throughout the year, showing only small seasonal shifts in distribution.

At least some of the Eastern Chukchi Sea beluga whales move along coastal areas in late June and animals are sighted in the area until about mid-July (Frost and Lowry 1990, Frost et al. 1993, Suydam et al. 2001). Data from satellite tags attached to Eastern Chukchi Sea beluga whales captured in Kasegaluk Lagoon during the summer showed these whales traveled 1,100 km north of the Alaska coastline, into the Canadian Beaufort Sea within 3 months (Suydam et al. 2001, Hauser et al. 2014). These movements indicated overlap in distribution with the Beaufort Sea beluga whale stock during late summer. Satellite-telemetry data from 24 whales tagged from 1998 to 2007 suggest variation in movement patterns for different age and/or sex classes during July to September (Suydam et al. 2005, Hauser et al. 2014). Compared to tagged adult females, tagged adult males used deeper waters and remained there for the summer. All beluga whales that moved into the Arctic Ocean (north of 75°N) were males, and males traveled through 90% pack ice to reach deeper waters in the Beaufort Sea and Arctic Ocean (79-80°N) by late July/early August. In September, males occupied the southern Canada Basin and Beaufort Sea shelf and slope, maintaining a small core area over Barrow Canyon and a larger core area over the eastern Canada Basin slope. In October, the male distribution shifted south and west, with one core area extending over the Beaufort Sea slope into Barrow Canyon and another over Herald Shoal in the Chukchi Sea. Adult females ranged from just offshore of the Kasegaluk Lagoon system to Barrow Canyon in July. In August, the distribution of females was limited to Barrow Canyon and the adjacent western Beaufort Sea shelf and slope. In September, the female distribution expanded to include the southern Canada Basin, before shifting south and west in October to the Chukchi Sea and western Beaufort Sea (Hauser et al. 2014). In late autumn, only six tags continued to transmit and those whales migrated south through the eastern Bering Strait into the northern Bering Sea, remaining north of Saint Lawrence Island during the winter (Hauser et al. 2014, Citta et al. 2017). A whale tagged in the eastern Chukchi Sea in 2007 overwintered in the waters north of Saint Lawrence Island during 2007/2008, then moved towards King Island in April and May before moving north through the Bering Strait in late May and early June (Suydam 2009).

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 summering areas (O'Corry-Crowe et al. 2018); 3) Phenotypic data: unknown; and 4) Genotypic data: mitochondrial DNA analyses indicate distinct differences among the five summering areas (O'Corry-Crowe et al. 2018). 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 (Fig. 1), and 5) Beaufort Sea.

POPULATION SIZE

Frost et al. (1993) estimated the minimum size of the Eastern Chukchi Sea beluga whale stock at 1,200 whales, based on whale counts from aerial surveys conducted from 1989 to 1991. Survey effort was concentrated sea side of the 170-km long Kasegaluk Lagoon, an area known to be regularly used by beluga whales during the open-water season. The offshore areas that these beluga whales are known to frequent were not surveyed. Therefore, the targeted surveys provided only a minimum count. If this count is corrected using radio-telemetry data for the proportion of whales 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 small size and dark coloration (1.18: Brodie 1971), the total corrected abundance estimate for the Eastern Chukchi Sea stock is 3,710 whales (1,200 × 2.62 × 1.18).

During 25 June to 6 July 1998, aerial surveys were conducted in the eastern Chukchi Sea (DeMaster et al. 1998). The maximum single day count (1,172 whales) was derived from a photographic count of a large aggregation near Icy Cape (1,018 whales), plus whales counted along an ice edge transect (154 whales). This count is an underestimate, because it was clear to the observers that many more whales were present along and in the ice than they were able to count and only a small portion of the ice edge habitat was surveyed. Furthermore, only one of five beluga whales equipped with satellite tags a few days earlier remained within the survey area when the peak count occurred (DeMaster et al. 1998). It is not possible to estimate abundance from the 1998 survey. Not only were a large number of whales unavailable for counting, but the large Icy Cape aggregation was in shallow, clear water (DeMaster et al. 1998) and a correction factor (to account for missed whales) does not exist for beluga whales encountered in such conditions.

In July 2002, aerial surveys were conducted again in the eastern Chukchi Sea (Lowry and Frost 2002). Those surveys resulted in a peak count of 582 whales. A correction factor for whales that were not visible for this

count is not available. Offshore sightings during this survey combined with satellite-tag data collected in 2001 (Lowry and Frost 2001, 2002) indicate that nearshore surveys for beluga whales will only result in partial counts for this stock.

A new strategy for deriving a population abundance estimate for the Eastern Chukchi Sea stock of beluga whales was based on summer aerial survey data from the Beaufort Sea, after the stock had migrated through the eastern Chukchi Sea. Analyses of satellite telemetry data from beluga whales belonging to the Eastern Chukchi Sea and Beaufort Sea stocks (Hauser et al. 2014) identified an area in the Beaufort Sea (140°W to 157°W) and period (19 July-20 August) when the two stocks did not overlap (Lowry et al. 2017). These aerial surveys were conducted as part of the Aerial Surveys of Arctic Marine Mammals (ASAMM) project in the northeastern Chukchi and Alaska Beaufort seas from 19 July to 20 August 2012-2017 (Clarke et al. 2018). A geographically stratified line-transect analysis that was based on the assumption that the Beaufort Sea and Eastern Chukchi Sea stocks are geographically segregated from mid-July through August (Hauser et al. 2014) resulted in the following population estimates of the Eastern Chukchi Sea beluga whales in the study area for each year from 2012 to 2017, respectively: 7,355 (CV=0.47), 6,813 (CV=0.47), 16,598 (CV=0.49), 6,456 (CV=0.48), 6,965 (CV=0.49) and 13,305 (CV=0.51) (Givens et al. 2019). These estimates incorporate a correction factor of 1.85 (Lowry et al. 2017) for whales that were submerged and, therefore, not visible to the aerial observers. These estimates do not account for whales that might have been outside the project area during the survey period.

The assumption that Eastern Chukchi Sea beluga whales are isolated from Beaufort Sea beluga whales is possibly flawed based on three lines of evidence: the assumption of a lack of overlap within the Alaska Beaufort Sea from late July to late August is based on satellite-tag data that are dated (few beluga whales from either stock have been tagged in the last decade); the assumed distribution of all Eastern Chukchi Sea and Beaufort Sea beluga whales in July and August cannot be determined from tags that were deployed at the same time and in locations that were too far apart for the tagged whales to overlap in July and August (all Eastern Chukchi Sea beluga whales were tagged near Point Lay in July and all Beaufort Sea beluga whales were tagged in the Mackenzie Delta mainly in July and in August, although numbers in these areas indicate the stocks were more wide-spread at this time); and genetic evidence from harvested beluga whales indicates that Beaufort Sea beluga whales are sometimes found in the Chukchi Sea in late July (O'Corry-Crowe et al. 2018). However, the Givens et al. (2019) abundance estimate reflects the best available data for Eastern Chukchi Sea beluga whales at this time.

Minimum Population Estimate

For the Eastern Chukchi Sea beluga whale stock, the minimum population estimate (N_{MIN}) is calculated according to Equation 1 from the potential biological removal (PBR) guidelines (NMFS 2016): $N_{MIN} = N/\exp(0.842\times[\ln(1+[CV(N)]^2)]^{½})$. Using the 2017 population estimate of 13,305 and the associated coefficient of variation (CV) of 0.51, N_{MIN} for this stock is 8,875 whales; however, this N_{MIN} may be positively biased due to possible overlap between the Eastern Chukchi Sea and Beaufort Sea stocks of beluga whales during the survey in late July to late August.

Current Population Trend

There is no statistically significant trend in the abundance of the Eastern Chukchi Sea beluga whale stock inside the ASAMM study area from 19 July to 20 August in 2012-2017 (Givens et al. 2019). However, the interannual variation among the abundance estimates and the estimated CVs are both large.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate (R_{MAX}) is not available for the Eastern Chukchi Sea beluga whale stock. Until additional data become available, the default cetacean maximum theoretical net productivity rate of 4% will be used for this stock (NMFS 2016).

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, a value that may be used for stocks that are not known to be decreasing and are taken primarily by aboriginal subsistence hunters, provided there have not been recent increases in the levels of takes (NMFS 2016). Therefore, the PBR for this stock is 178 beluga whales (8,875 × 0.02 × 1.0).

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Information for each human-caused mortality, serious injury, and non-serious injury reported for NMFS-managed Alaska marine mammals between 2014 and 2018 is listed, by marine mammal stock, in Young et al. (2020); however, only the mortality and serious injury data are included in the Stock Assessment Reports. The minimum estimated mean annual level of human-caused mortality and serious injury for Eastern Chukchi Sea beluga whales between 2014 and 2018 is 56 beluga whales in subsistence takes by Alaska Natives. Potential threats most likely to result in direct human-caused mortality and serious injury of this stock include entanglement in fishing gear.

Fisheries Information

Information for federally-managed and state-managed U.S. commercial fisheries in Alaska waters is available in Appendix 3 of the Alaska Stock Assessment Reports (observer coverage) and in the NMFS List of Fisheries (LOF) and the fact sheets linked to fishery names in the LOF (observer coverage and reported incidental takes of marine mammals: https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-protection-act-list-fisheries, accessed December 2020).

In the nearshore waters of the southeastern Chukchi Sea, substantial efforts occur in gillnet (mostly set nets) and personal-use fisheries. Although a potential source of mortality, there have been no reported beluga whale takes as a result of these fisheries and such incidental takes could be counted as subsistence harvest.

There were no reports of mortality or serious injury of this stock incidental to U.S. commercial fisheries or subsistence fisheries in Alaska between 2014 and 2018.

Alaska Native Subsistence/Harvest Information

NMFS signed an agreement with the Alaska Beluga Whale Committee (ABWC; 2000) to co-manage western Alaska beluga whale populations in the Bering Sea (including Bristol Bay), Chukchi Sea, and Beaufort Sea. This co-management agreement promotes full and equal participation by Alaska Natives in decisions affecting the subsistence management of beluga whales (to the maximum extent allowed by law) as a tool for conserving beluga whale populations in Alaska (https://www.fisheries.noaa.gov/alaska/marine-mammal-protection/co-management-marine-mammals-alaska, accessed December 2020).

The subsistence take of Eastern Chukchi Sea beluga whales is reported by the ABWC. The most recent subsistence harvest estimates for the Eastern Chukchi Sea stock are provided in Table 1 (ABWC, unpubl. data, 2020). The annual subsistence take by Alaska Native hunters averaged 56 Eastern Chukchi Sea beluga whales landed between 2014 and 2018. It should be noted that beluga whales harvested at Utqiaġvik (formerly Barrow) in spring are assumed to be from the Beaufort Sea stock, while those harvested in summer are assumed to be from the Eastern Chukchi Sea stock.

Table 1. Summary of Eastern Chukchi Sea beluga whales landed by Alaska Native subsistence hunters between 2014 and 2018 (ABWC, unpubl. data, 2020). It should be noted that these harvest levels include takes from Kotzebue Sound (10 in 2014, 1 in 2015, 9 in 2016, 2 in 2017, and 15 in 2018; no data are available for struck and lost animals in Kotzebue Sound) which are likely from a population that is genetically distinct from the Eastern Chukchi Sea beluga whale stock. These are minimum estimates of the total number of beluga whales taken, because not all landed whales and struck and lost whales are consistently reported.

Year	Number landed	Number struck and lost	Total (landed + struck and lost)
2014	60	no data	60
2015	72	4	76
2016	23	0	23
2017	40	2	42
2018	80	0	80
Mean annual number (landed + struck and lost)			56

STATUS OF STOCK

No fishery-related mortality or serious injury has been reported for the Eastern Chukchi Sea stock of beluga whales between 2014 and 2018; therefore, the mean annual mortality and serious injury rate incidental to U.S. commercial fisheries can be considered insignificant and approaching a zero mortality and serious injury rate. The minimum estimated mean annual level of human-caused mortality and serious injury (56 beluga whales) is less than the PBR (178 whales). Eastern Chukchi 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 Eastern Chukchi Sea stock of beluga whales is not classified as a strategic stock. The historical level and overall population trend is unknown and, given the uncertainty of the data, we are unable at this time to assess the status of this stock relative to its Optimum Sustainable Population. Recent data indicate no statistically significant trend from 2012 to 2017 (Givens et al. 2019).

There are key uncertainties in the assessment of the Eastern Chukchi Sea stock of beluga whales. The proportion of the stock within the ASAMM study area during the survey period used in the Lowry et al. (2017) and Givens et al. (2019) abundance analyses is unknown. The assumption that the Eastern Chukchi Sea and Beaufort Sea stocks are geographically segregated during the July-August time period used in Lowry et al.'s (2017) and Givens et al.'s (2019) abundance estimates is based on a relatively limited number of whales tagged between 1993 and 2007. Beaufort Sea beluga whales are found in Kotzebue (Chukchi Sea) in July of some years, indicating that the two stocks may overlap in July. This may result in a positive bias in the estimate of abundance for the Eastern Chukchi Sea stock. Coastal subsistence fisheries can occasionally cause incidental mortality or serious injury of a beluga whale; these incidental takes used for subsistence purposes are not always reported to the ABWC as a fishery interaction and may be included in the subsistence harvest reports for the stock.

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 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 sea-ice extent, and the concomitant effect on prey availability. There are indications that decreases in seasonal sea ice have influenced beluga whale phenology. Eastern Chukchi Sea beluga whales tagged between 2004 and 2012 were distributed farther north and east in September-November than those tagged between 1993 and 2002 (Hauser et al. 2017). Further, the median date at which tagged whales departed the Beaufort and Chukchi seas during their southbound migrations was 14-33 days later overall in 2004-2012 versus 1993-2002 (Hauser et al. 2017). 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. Stafford et al. (2016) found that dive behavior of Eastern Chukchi Sea beluga whales was correlated to wind speed and direction. When winds were from the WSW, whales made shallow dives likely exploiting the front developed by the Alaska Coastal Current between the coast and the deep Arctic basin. Strong winds from the ENE resulted in deeper, longer dives (Stafford et al. 2016). East winds are increasing in the Arctic (Pickart et al. 2009), thus, beluga whales may be spending more time diving at greater depths. 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 these impacts is difficult.

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