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Delphinapterus leucas (Cook Inlet subpopulation), Beluga

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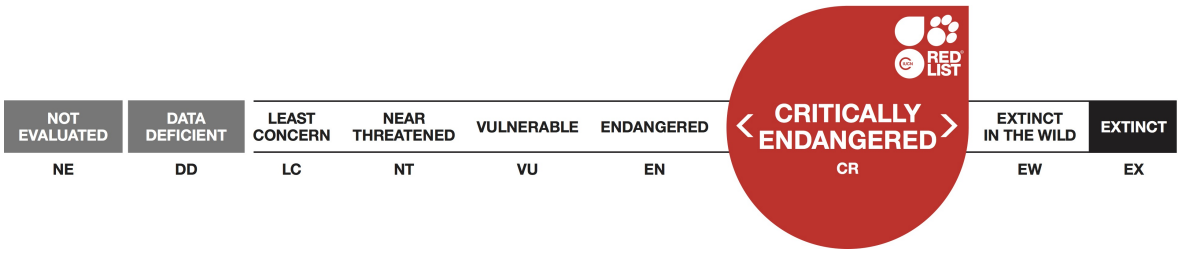

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Taxonomy

Kingdom	Phylum	Class	Order	Family
Animalia	Chordata	Mammalia	Cetartiodactyla	Monodontidae

Taxon Name: *Delphinapterus leucas (Cook Inlet subpopulation)* (Pallas, 1776)

Parent Species: See *Delphinapterus leucas*

Common Name(s):

- English: Beluga, Beluga Whale, White Whale

Taxonomic Notes:

The widely distributed Beluga (*Delphinapterus leucas*) is divided into at least 21 subpopulations (often called stocks) based on genetic relationships, distribution and movements, patterns in exploitation, contaminant levels, and in some cases expert opinion of scientists and indigenous hunters (NAMMCO 2018). Five of those subpopulations occur in Alaskan waters. Studies of mitochondrial DNA and microsatellite markers have shown that Cook Inlet Belugas are genetically distinct from the other four Beluga subpopulations that occur in western and northern Alaska (O'Corry-Crowe *et al*. 1997, 2018). A lack of sightings or reports from local residents indicates that Belugas do not occur along the southwestern portion of the Alaska Peninsula, in Unimak Pass, or near the Aleutian Islands (Frost and Lowry 1990) and there have been few sightings in the Gulf of Alaska outside of Cook Inlet (Laidre *et al*. 2000). This confirms that the 900 km long Alaska Peninsula is an effective barrier to movement and that the Cook Inlet subpopulation is both geographically and reproductively isolated from Beluga subpopulations to the west.

Assessment Information

Red List Category & Criteria: Critically Endangered A2a; C2a(ii) ver 3.1

Year Published: 2019

Date Assessed: August 4, 2018

Justification:

As a species, the Beluga Whale is listed on the IUCN Red List as Least Concern (Lowry em style="font-family: Georgia, serif;">et al. 2017). In a 2012 assessment, the Cook Inlet Beluga subpopulation was listed as Critically Endangered (CR) under Red List criterion C2a(ii) because of low abundance, all individuals in one subpopulation, and a continuing decline observed (Lowry em style="font-family: Georgia, serif;">et al. 2012). Cook Inlet Belugas experienced a precipitous decline during 1994-1998, and since then have continued to decline slowly. Results of aerial surveys flown in 2016 indicated a total abundance of 328 whales which corresponds to an estimated 233 mature animals. The decline has been accompanied by a reduction in the population's summer range. During 1994-1998, excessive harvest by Alaska Native hunters was the major factor responsible for the decline in abundance. A number of factors other than harvest could currently be affecting this subpopulation. Cook Inlet Belugas face a suite of risks common to small populations, amplified by the tendency of Belugas to return annually to specific areas and to congregate in compact groups. At least for the present, the population is being

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monitored by regular biannual surveys as well as boat- and drone-based photographic studies that should allow future evaluations and updates of its status. A reduction in Cook Inlet Beluga abundance of 75% was observed over the period 1979-2016, about 1.3 generations. While there are no useful abundance estimates prior to 1979, the subpopulation was subject to hunting and other threats prior to then and it is very likely that the decline over a three-generation period (1932-2016) was considerably greater than the 80% needed to meet Red List criterion A2a for CR. It also qualifies for CR under criterion C2a(ii) and Endangered under criterion D as the estimated number of mature individuals (231) meets the criterion of <250. The subpopulation is therefore listed as CR.

Previously Published Red List Assessments

2012 – Critically Endangered (CR)
http://dx.doi.org/10.2305/IUCN.UK.2012.RLTS.T61442A17691385.en

2006 – Critically Endangered (CR)

Geographic Range

Range Description:

This subpopulation of Belugas occurs in Cook Inlet throughout the year with few reported sightings in the Gulf of Alaska outside of the Inlet (Laidre *et al*. 2000, Lammers *et al*. 2013). During the 1970s, the summer distribution included the upper, central, and parts of the lower regions of the inlet, and both coastal and offshore waters (Harrison and Hall 1978, Murray and Fay 1979). The current summer distribution is restricted to shallow coastal and estuarine areas in the upper inlet (Rugh *et al*. 2000, 2010, Speckman and Piatt 2000). Although winter sightings have been rare historically, Belugas were presumed to move to the lower (i.e., southern) regions of Cook Inlet in winter to avoid heavy ice conditions in the upper Inlet (Calkins 1986). However, more recent results from aerial surveys (Hansen and Hubbard 1999, Rugh *et al*. 2004, 2010), satellite-linked tagging studies (Hobbs *et al*. 2005, Goetz *et al*. 2012b, Shelden *et al*. 2015a), and passive acoustics (Lammers *et al*. 2013, Castellote *et al*. 2016) indicate that most if not all Belugas remain in the upper Inlet throughout the winter. A comparison of distributional information across the records of summer surveys in different years revealed a decrease in sightings of whales in both the offshore areas and the lower regions of the inlet, indicating a reduction in the area of occupancy during this season since the mid-1970s (Rugh *et al*. 2000, 2010, Shelden *et al*. 2015a, 2017).

For further information about this species, see Supplementary Material.

Country Occurrence:

Native: United States (Alaska)

FAO Marine Fishing Areas:

Native: Pacific - northeast

Population

A thorough review of survey effort in the Gulf of Alaska (Laidre *et al*. 2000) produced sightings of Belugas in only two regions: Cook Inlet and Yakutat Bay. The Beluga group in Yakutat Bay is very small, probably numbering only 10-20 individuals (Laidre *et al*. 2000, O'Corry-Crowe *et al*. 2006). Recent studies showed that Yakutat Bay Belugas differed significantly from those in Cook Inlet both in mitochondrial DNA and microsatellites (O'Corry-Crowe *et al*. 2015). That information, along with sightings of Belugas, including calves, reported in all seasons (Lucey *et al*. 2015) indicates that a small reproductive group of whales resides in Yakutat Bay and that this group has had limited exchange with Cook Inlet. The occurrence of Belugas in Yakutat Bay will not be considered further in this evaluation.

Aerial counts of Belugas in Cook Inlet date to the early 1960s (Klinkhart 1966) but those efforts generally produced only minimum counts and/or rough estimates of abundance. The best available estimate of historical population size is based on an aerial survey count of 479 whales made in August 1979 (Calkins 1989), and a correction factor for missed animals of 2.7 that was derived from studies of radiotagged Belugas in Bristol Bay, Alaska (Frost *et al*. 1985). Using those figures, the National Marine Fisheries Service (NMFS) calculated a minimum abundance estimate of 1,293 whales (NMFS 2003). Annual systematic surveys to estimate total abundance began in 1993, and the protocols used have been consistent since 1994. Systematic aerial surveys were conducted by NMFS in June of each year from 1993 to 2012 (Rugh *et al*. 2000, 2005; Shelden *et al*. 2013) followed by biennial surveys in 2014 (Hobbs 2013, Shelden *et al*. 2015b) and 2016 (Shelden *et al*. 2017). The 2016 survey resulted in an estimate of 328 whales (coefficient of variation = 0.083; Shelden *et al*. 2017). Over the entire period 1979-2016 the observed population reduction was 75%. An unregulated hunt of these whales by Alaska Native subsistence hunters resulted in a documented decline in abundance of 47% between 1994 (643) and 1998 (347) (Hobbs *et al*. 2000) after which time hunting was limited to just 1-2 whales per year. No hunting has been allowed since 2005 (Mahoney and Shelden 2000, NMFS 2016). During the period that the hunt has been limited or prohibited, 1999 to 2016, Beluga abundance estimates have continued to decline at -0.4% per year (Shelden *et al*. 2017) indicating that factors other than hunting are preventing the recovery of this subpopulation. Hobbs *et al*. (2015a) found lower numbers of calves than expected in all but one year of calf surveys between 2006 and 2012 suggesting that low birth rates rather than high mortality rates are limiting population growth. Wade *et al*. (2012) postulated that a lack of recovery of depleted Beluga populations could be partly due to disruption of behavioural patterns and social systems.

To evaluate taxa based on Red List Criteria, IUCN defines population size as the number of mature individuals. There are no data available on the sex and age composition of the Cook Inlet Beluga subpopulation or on the fecundity at age. Such information is available from other harvested Beluga subpopulations, and although the data may be subject to biases from non-random distribution of sex/age classes and harvest selectivity it can be used to estimate generation time and the number of animals that are mature. In the time since the 2012 Red List assessment the method of age estimation for Belugas has changed from an earlier assumption of two GLG/yr to one GLG/yr (Stewart *et al*. 2006, Lockyer *et al*. 2007, Waugh *et al*. 2018). The life history parameters used to estimate generation length and fraction mature in a previous report (Taylor *et al*. 2007) have consequently been revised. The revised estimate of generation length is 28 years and the fraction of mature animals in the population is estimated to be 0.70. We estimate the size of the mature population in 2016 to be 231 Belugas (95% confidence interval 194 to 273) with an 82% probability that there are fewer than 250 reproductive

adults. Hobbs *et al*. (2015b) also estimated the risk of extinction in the next 100 years to be between 0% and 14% and the likelihood of further decline to be between 42% and 71%.

For further information about this species, see Supplementary Material.

Current Population Trend: Decreasing

Habitat and Ecology (see Appendix for additional information)

Cook Inlet is a very dynamic environment with large tides, strong currents, and seasonal sea ice cover (Moore *et al*. 2000). During aerial surveys flown in June and July, Belugas were seen almost exclusively in shallow, nearshore, low-salinity waters of upper Cook Inlet, especially off the mouths of large rivers and in Knik and Turnagain arms (Rugh *et al*. 2000, 2010, Goetz *et al*. 2012a, Shelden *et al*. 2015a). Belugas are believed to concentrate in those areas to feed on out-migrating Pacific salmon (*Onchorhynchus* spp.) smolt and spawning runs of salmon and other anadromous fishes (Calkins 1984, 1986, Rugh *et al*. 2000, Moore *et al*. 2000). Using an expanded dataset of Beluga distribution and group size observed from 1994-2008, Goetz *et al*. (2012a) developed predictive summer habitat models revealing that Cook Inlet Belugas avoided areas with anthropogenic disturbance and were positively associated with habitats with high seasonal fish availability as well as tidal flats and sandy substrate. Also, the shallow waters of the upper Inlet and coastal zone may provide refuge from Killer Whales (*Orcinus orca*) and suitable habitat for calving and nursing (Rugh *et al*. 1999, Moore *et al*. 2000). Satellite-linked telemetry studies showed a tendency for Belugas to spend more time in deeper offshore waters of the upper Inlet during winter months, although they continued to use Knik and Turnagain arms (Hobbs *et al*. 2005, Shelden *et al*. 2015a). Dives recorded were relatively shallow with mean depths of 2-7 meters during June-November and 6-12 meters in December to May. Maximum recorded dive depths were 38-175 meters (Goetz *et al*. 2012b). In addition to Pacific salmon, their diet includes Eulachon (*Thaleichthys pacificus*), Saffron Cod (*Eleginus gracilis*), Walleye Pollock (*Gadus chalcogrammus*), shrimp, and other fishes and invertebrates (Quakenbush *et al*. 2015). A recent study examining stable isotopes in Beluga bone and teeth spanning a roughly 50 year timeframe (1950s-2007) revealed a long-term shift in the diet of Cook Inlet Belugas that likely reflects an increase in freshwater prey over time (Nelson *et al*. 2018) concomitant with the ongoing range contraction of this population to the upper Inlet and closer to fresh water (Rugh *et al.* 2010).

Systems: Marine

Use and Trade

Prior to 1972 there were periodic commercial and sport hunts for Belugas in Cook Inlet (Mahoney and Shelden 2000, NMFS 2003), but those activities ceased with passage of the Marine Mammal Protection Act (MMPA). Native Alaskans have hunted Belugas in Cook Inlet from earliest times (Huntington 2000, Mahoney and Shelden 2000). During much of the last century, subsistence removals appear to have been modest. A number of factors, including rapid human population growth and improvements in hunting equipment, resulted in an increase in subsistence hunting in Cook Inlet during the 1980s. By the mid to late 1990s, the level of removals was unsustainable. It has been estimated that an average of 67 Belugas were removed each year from 1994-1998, and that level was considered sufficiently high to account for most of the decline in abundance observed during that period (NMFS 2003). No legal harvest was allowed in 1999. From 2000, NMFS entered into annual co-management agreements with Alaska Native organizations to allow a limited hunt. Five whales total were harvested during 2000–2005

and none since 2005 (Muto *et al*. 2016).

Threats (see Appendix for additional information)

Availability of prey likely has a strong influence on the Cook Inlet Beluga subpopulation (Moore *et al*. 2000). Few data are available on prey abundance within their range except for the commercially harvested species of Pacific salmon. Speckman and Piatt (2000) speculated that availability of Beluga prey species may have changed in the lower Inlet as part of a general regime shift in the Gulf of Alaska. Local residents perceive that there was a general decline in the abundance of fish in Cook Inlet in the 1990s (Huntington 2000). A study of stable isotope ratios in individual GLGs of teeth representing the period from 1962 to 2007 found that the diet of the Cook Inlet Belugas had shifted over that period to more freshwater species (Nelson *et al*. 2018). While this confirms a diet change it does not distinguish between a change in the fauna of Cook Inlet or a diet shift resulting from a change in distribution as the Cook Inlet Belugas have concentrated in the river mouths of the upper Inlet in recent years. It is possible, if not likely, that climatic warming has changed characteristics of the Cook Inlet environment and fauna in ways that affect Beluga Whales, but currently there are no data that can be used to evaluate such changes.

Shelden *et al*. (2003) reviewed data on Killer Whale predation in Cook Inlet, and although they accounted for 21 Belugas killed between 1985 and 2002 the authors concluded that predation was a small contribution to overall mortality. More recent studies have concluded that predation by Killer Whales may be a significant source of mortality for Cook Inlet Belugas (Vos and Shelden 2005, Burek-Huntington *et al*. 2015). Because this population is currently at a very low size, otherwise normal fluctuations in prey availability and predation may affect its ability to recover (Hobbs *et al*. 2015b).

Other factors that could have an adverse effect on Cook Inlet Belugas include fishery interactions, contaminants and noise associated with oil and gas exploration and production, vessel traffic, and municipal activities such as waste management and urban runoff (Moore *et al*. 2000, Norman *et al*. 2015, NMFS 2003, 2016). The quality and quantity of data for describing impacts or predicting effects of such factors vary greatly. Levels of heavy metals, PCBs, and chlorinated pesticides are much lower in Cook Inlet Belugas than in other Beluga subpopulations in Alaska (Becker *et al*. 2000). Observer programs and other reports indicate that current incidental take in commercial fisheries is very low (Moore *et al*. 2000). The potential effects of anthropogenic noise on Cook Inlet Belugas has received substantial research effort (Lammers *et al*. 2013, Castellotte *et al*. 2014, 2016), however further investigation is required to quantify impacts and identify mitigation measures (Small *et al*. 2017). Determining the impact of municipal discharges is difficult (Norman *et al*. 2015), and data are not adequate to describe or predict the effects of an oil spill on Belugas. Nonetheless, the fact remains that Cook Inlet is no longer a remote, pristine area. Over 350,000 people live in the municipality of Anchorage and the two adjacent boroughs, and there are two large military bases in the area (NMFS 2003). An analysis by NMFS concluded that: "A significant part of the habitat for this species has been modified by municipal, industrial, and recreational activities in Upper Cook Inlet" (NMFS 2003). A number of other significant habitat modifications are likely to occur in the near future. Random demographic, environmental, and genetic factors can accelerate or even cause the extinction of small populations. Catastrophic events such as mass die-offs due to stranding, disease, or acute exposure to toxic substances (e.g., oil spills) could push depleted populations of Belugas to extinction (O'Corry-Crowe and Lowry 1997, Hobbs *et al*. 2015b). Mass strandings of Belugas are relatively common in the shallow tidal areas of upper Cook Inlet. Although most stranded individuals manage to swim away on

the rising tide, some are known to die (Moore *et al*. 2000, Burek-Huntington *et al*. 2015). The viability of small populations is further compromised by the increased risk of inbreeding and the loss of genetic variability through drift, which reduces their ability to cope with disease and environmental change (Lacy 1997, O'Corry-Crowe and Lowry 1997). Estimates of genetic variation do not, at present, suggest that Cook Inlet Belugas are highly inbred or that a critical amount of genetic variation has been lost through drift (O'Corry-Crowe *et al*. 1997, 2018), but this subpopulation is already in a size range where eventual loss of genetic variability is expected.

Conservation Actions **(see Appendix for additional information)**

Belugas, like all marine mammals, are protected in the United States by the MMPA which prohibits all taking. Exemptions to the taking prohibition are allowed for subsistence hunting by Alaska Natives, scientific research, incidental take in commercial fisheries, and a few other activities. In May 1999, the U.S. Congress passed legislation that prohibited the taking of Cook Inlet Belugas for subsistence unless such taking was authorized by a cooperative agreement between NMFS and the affected Alaska Native organization. In May 2000, NMFS, having determined that the Cook Inlet Beluga subpopulation was below its optimum sustainable population level, designated it as depleted under the MMPA, and the depleted listing provided NMFS with the regulatory authority to limit the Alaska Native subsistence harvest. An interim harvest regime was agreed upon through an Administrative Law Judge hearing, whereby the harvest during 2001–2004 would be limited to six strikes. Other provisions limited the hunting season, protected calves and adults with calves, prohibited sales of Beluga parts and products, and provided for an emergency suspension of the hunt if an unusual number of non-hunting mortalities were to occur (NMFS 2003). Hunting would only be allowed through cooperative agreements between NMFS and Alaska Native organizations.

In June 2001, the Cook Inlet Beluga subpopulation was added to the list of taxa considered candidates for listing as threatened or endangered under the U.S. Endangered Species Act (ESA). After conducting a status review (Hobbs *et al*. 2008, Hobbs and Shelden 2008), NMFS listed Cook Inlet Belugas as “endangered” in October 2008 and developed a Recovery Plan for the species (NMFS 2016).

Credits

Assessor(s): Lowry, L., Hobbs, R. & O’Corry-Crowe, G.

Reviewer(s): Reeves, R. & Taylor, B.L.

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External Resources

For Supplementary Material, and for Images and External Links to Additional Information, please see the Red List website.

Appendix

Habitats

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Habitat	Season	Suitability	Major Importance?
9. Marine Neritic -> 9.1. Marine Neritic - Pelagic	Resident	Suitable	Yes
9. Marine Neritic -> 9.10. Marine Neritic - Estuaries	Resident	Suitable	Yes
10. Marine Oceanic -> 10.1. Marine Oceanic - Epipelagic (0-200m)	Resident	Suitable	Yes
10. Marine Oceanic -> 10.2. Marine Oceanic - Mesopelagic (200-1000m)	Resident	Suitable	Yes

Threats

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Threat	Timing	Scope	Severity	Impact Score
1. Residential & commercial development -> 1.2. Commercial & industrial areas	Ongoing	Whole (>90%)	Causing/could cause fluctuations	Medium impact: 7
11. Climate change & severe weather -> 11.1. Habitat shifting & alteration	Ongoing	Whole (>90%)	Unknown	Unknown
3. Energy production & mining -> 3.1. Oil & gas drilling	Ongoing	Whole (>90%)	Causing/could cause fluctuations	Medium impact: 7
4. Transportation & service corridors -> 4.3. Shipping lanes	Ongoing	Whole (>90%)	Causing/could cause fluctuations	Medium impact: 7
5. Biological resource use -> 5.4. Fishing & harvesting aquatic resources -> 5.4.1. Intentional use: (subsistence/small scale) [harvest]	Past, unlikely to return	-	-	-
5. Biological resource use -> 5.4. Fishing & harvesting aquatic resources -> 5.4.4. Unintentional effects: (large scale) [harvest]	Ongoing	Whole (>90%)	Negligible declines	Medium impact: 6
6. Human intrusions & disturbance -> 6.3. Work & other activities	Ongoing	Whole (>90%)	Unknown	Unknown
7. Natural system modifications -> 7.2. Dams & water management/use -> 7.2.10. Large dams	Future	Whole (>90%)	Slow, significant declines	Low impact: 5
9. Pollution -> 9.1. Domestic & urban waste water -> 9.1.1. Sewage	Ongoing	Whole (>90%)	Unknown	Unknown
9. Pollution -> 9.1. Domestic & urban waste water -> 9.1.2. Run-off	Ongoing	Whole (>90%)	Unknown	Unknown
9. Pollution -> 9.3. Agricultural & forestry effluents -> 9.3.3. Herbicides and pesticides	Ongoing	Whole (>90%)	Slow, significant declines	Medium impact: 7

9. Pollution -> 9.6. Excess energy -> 9.6.3. Noise pollution	Ongoing	Whole (>90%)	Unknown	Unknown

Conservation Actions in Place

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Conservation Actions in Place
In-Place Research, Monitoring and Planning
Action Recovery plan: Yes
Systematic monitoring scheme: Yes
In-Place Land/Water Protection and Management
Conservation sites identified: Yes, over entire range
Occur in at least one PA: Yes
In-Place Species Management
Harvest management plan: Yes

Conservation Actions Needed

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Conservation Actions Needed
1. Land/water protection -> 1.1. Site/area protection
1. Land/water protection -> 1.2. Resource & habitat protection
2. Land/water management -> 2.1. Site/area management
3. Species management -> 3.2. Species recovery

Research Needed

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Research Needed
1. Research -> 1.3. Life history & ecology
1. Research -> 1.5. Threats
3. Monitoring -> 3.1. Population trends
3. Monitoring -> 3.4. Habitat trends

Additional Data Fields

Distribution
Continuing decline in area of occupancy (AOO): Yes
Extreme fluctuations in area of occupancy (AOO): No
Continuing decline in extent of occurrence (EOO): Yes
Extreme fluctuations in extent of occurrence (EOO): No
Number of Locations: 1
Continuing decline in number of locations: No
Extreme fluctuations in the number of locations: No
Upper elevation limit (m): 0
Lower depth limit (m): 175
Population
Number of mature individuals: 231
Extreme fluctuations: No
Population severely fragmented: No
Habitats and Ecology
Continuing decline in area, extent and/or quality of habitat: Yes
Generation Length (years): 29
Movement patterns: Not a Migrant

The IUCN Red List Partnership

The IUCN Red List of Threatened Species™ is produced and managed by the IUCN Global Species Programme, the IUCN Species Survival Commission (SSC) and The IUCN Red List Partnership.

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