Beluga Whale - Cook Inlet DPS
(*Delphinapterus leucas*)

5-Year Review:
Summary and Evaluation


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1.0 GENERAL INFORMATION

1.1 Reviewers

Lead Regional Office: Alaska Region (AKR), Protected Resources Division

Lead Science Center: Alaska Fisheries Science Center (AFSC), Marine Mammal Laboratory

1.2 Methodology Used to Complete the Review

The review was completed by the Alaska Region and the Alaska Fisheries Science Center and incorporates the results of research conducted since publication of the previous 5-Year Review in February 2017. Participants in this review were Kim Shelden, Kim Goetz, Manuel Castellote, Paul Wade, and Robyn Angliss (AFSC), Jill Seymour, Bonnie Easley-Appleyard, Mandy Keogh, Barbara Mahoney, Verena Gill, and Jon Kurland (AKR), and Amy Hapeman, Jolie Harrison, Sarah Wilkin, and Deb Fauquier (Office of Protected Resources). Lori Polasek and Jenell Tempel-Larsen from the Alaska Department of Fish and Game reviewed the technical portion of the document (Section 2.3.1).

1.3 Background

Section 4(c)(2) of the Endangered Species Act (ESA) requires, at least once every five years, a review of all threatened and endangered species to determine if they should be removed from the list of threatened or endangered species or changed in their listing status (16 U.S.C. 1533(c)(2)). The 5-Year Review is also used to help track the recovery of a species.

The following information identifies previous documentation of recovery actions, listing decisions, and status updates required under the ESA, and thus provides the foundation for analysis and incorporation of any relevant new information related to the recovery, listing status, and classification of the Cook Inlet beluga whale Distinct Population Segment (DPS).

1.3.1 FR Notice Citation Announcing Initiation of this Review

Federal Register notice: 86 FR 11504, February 25, 2021.

1.3.2 Listing History

Original Listing

Federal Register notice: 73 FR 62919

Date listed: October 22, 2008

Entity listed: Beluga whale (*Delphinapterus leucas*), Cook Inlet Distinct Population Segment

Classification: Endangered

1.3.3 Associated Rulemakings

Stock Depletion Designation

Federal Register notice: 65 FR 34590; May 31, 2000.

Distinct Population Segment Determination

Federal Register notice: 65 FR 38778; June 22, 2000.

Subsistence Harvest Regulations

Federal Register notice: 73 FR 60976; October 15, 2008.

Critical Habitat Designation

Federal Register notice: 76 FR 20180; April 11, 2011.

1.3.4 Review History

Hazard, K. 1988. Beluga whale, *Delphinapterus leucas*, p. 195-235. In J. W. Lentfer (editor), Selected marine mammals of Alaska: Species accounts with research and management recommendations. Mar. Mammal Comm., Washington, D.C. (Note: *this review provided the basis for the listing of Cook Inlet belugas on the 1988 List of Candidate Vertebrate and Invertebrate Marine Species*: 53 FR 33516, August 31, 1988)

NMFS (National Marine Fisheries Service). 1992. Status report on Cook Inlet belugas (*Delphinapterus leucas*). Unpublished report prepared by the Alaska Region, NMFS, 222 W 7th Ave., Box 43, Anchorage, AK 99513. Available at: https://repository.library.noaa.gov/view/noaa/17383 (Note: *the abundance estimate for 1991 provided in this report was revised in Shelden and Mahoney (2016)* Available at*:* https://repository.library.noaa.gov/view/noaa/8690)

Moore, S., D. Rugh, K. Shelden, B. Mahoney, and R. Hobbs. 1999. Synthesis of available information on the Cook Inlet stock of beluga whales. AFSC Processed Rep. 99-06, 22 p. Available at: https://repository.library.noaa.gov/view/noaa/17348 (Note: *the journal Marine Fisheries Review, Volume 62, Issue 3: special issue on beluga whales published in July 2000 includes peer-reviewed papers based on a number of the abstracts presented herein.* Available at: https://spo.nmfs.noaa.gov/marine-fisheries-review/mfr-623-2000)

Hobbs, R. C., K. E. W. Shelden, D. J. Vos, K. T. Goetz, and D. J. Rugh. 2006. Status review and extinction assessment of Cook Inlet belugas (*Delphinapterus leucas*). AFSC Processed Rep. 2006-16, 74 p. Available at: https://repository.library.noaa.gov/view/noaa/8592

Hobbs, R. C., K. E. W. Shelden, D. J. Rugh, and S.A. Norman. 2008. Status review and extinction assessment of Cook Inlet belugas (*Delphinapterus leucas*). AFSC Processed Rep. 2008-02, 116 p. Available at: https://archive.fisheries.noaa.gov/afsc/Publications/ProcRpt/PR%202008-02.pdf

Hobbs, R. C., and K. E. W. Shelden. 2008. 2008 supplemental status review and extinction assessment of Cook Inlet belugas (*Delphinapterus leucas*). AFSC Processed Rep. 2008-08, 94 p. Available at: https://repository.library.noaa.gov/view/noaa/9027

NMFS (National Marine Fisheries Service). 2017. Beluga Whale (Cook Inlet DPS) 5-Year Review: Status and Evaluation. National Marine Fisheries Service, Alaska Fisheries Science Center, Marine Mammal Laboratory, Seattle, WA. https://www.fisheries.noaa.gov/resource/document/status-review-cook-inlet-beluga-whale-dps-delphinapterus-leucas-5-year-review

1.3.5 Species' Recovery Priority Number at start of 5-Year Review

This species has a recovery priority number of "2C."

Source: Recovering Threatened and Endangered Species Report to Congress (FY 2019-2020) (NMFS 2022a).

The recovery priority number "2C" is based on criteria in the Recovery Priority Guidelines (as defined under 84 FR 18243, April 30, 2019). "2C" means: Demographic risk is **high** (based on decreasing trend); recovery potential is **high** (meaning the major threats are well understood and U.S. jurisdiction, authority, or influence exists for management or protective actions to address major threats) but also **low to moderate** (based on the certainty that management or protective actions will be effective); and conflict exists (indicating recovery priority be given to species in conflict with construction or other development projects or other forms of economic activity in terms of recovery plan preparation and implementation).

1.3.6 Recovery Plan or Outline

Name of plan or outline: Recovery Plan for the Cook Inlet Beluga Whale (*Delphinapterus leucas*)

Date issued: December 2016

Dates of previous revisions, if applicable: N/A

2.0 REVIEW ANALYSIS

2.1 Application of the 1996 Distinct Population Segment (DPS) policy

2.1.1 Is the species under review a vertebrate?

Yes

2.1.2 Is the species under review listed as a DPS?

Yes

2.1.3 Was the DPS listed prior to 1996?

No

2.1.4 Is there relevant new information for this species regarding the application of the DPS policy?

No

2.2 Recovery Criteria

2.2.1 Does the species have a final, approved recovery plan[1] containing objective, measurable criteria?

Yes

2.2.2 Adequacy of recovery criteria

2.2.2.1 Do the recovery criteria reflect the best available and most up-to date information on the biology of the species and its habitat?

Yes

2.2.2.2 Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and is there no new information to consider regarding existing or new threats)?

Yes

[1] Although the guidance generally directs the reviewer to consider criteria from final approved recovery plans, criteria in published draft recovery plans may be considered at the reviewer's discretion.

2.2.3 List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information:

Table 1. Criteria for Considering Reclassification (from endangered to threatened, or from threatened to not listed) for Cook Inlet Beluga Whales (source: NMFS 2016).

Status	Demographic Criteria		Threats-based Criteria
Reclassified from Endangered to Threatened (i.e., downlisted)	The abundance estimate for the CI belugas is greater than or equal to 520 individuals, and there is 95% or greater probability that the most recent 25-year population abundance trend (where 25 years represents one full generation) is positive.	AND	The 10 downlisting threats-based criteria are satisfied.
Reclassified to Recovered (i.e., delisted)	The abundance estimate for the CI belugas is greater than or equal to 780 individuals, and there is 95% or greater probability that the most recent 25-year population abundance trend (where 25 years represents of one full generation) is positive.	AND	The 10 downlisting and 9 delisting threats-based criteria are satisfied

In the 2008 listing decision NMFS reviewed the five ESA section 4(a)(1) factors for listing species as endangered or threatened under the Act: present or threatened destruction, modification, or curtailment of its habitat or range (Factor A); over-utilization of the species for commercial, recreational, scientific, or educational purposes (Factor B); disease or predation (Factor C); inadequacy of existing regulatory mechanisms (Factor D); and other natural or manmade factors affecting its continued existence (Factor E). NMFS identified the following threats to survival of the Cook Inlet beluga DPS under each of these factors as follows: oil and gas exploration, development, and production, and pollutants (Factor A); subsistence hunting (Factor B); killer whale predation (Factor C); lack of long-term subsistence hunting regulations and lack of comprehensive regulations addressing the many other issues confronting Cook Inlet beluga whales (Factor D); and stranding (Factor E). The Recovery Plan identified 10 potential threats that could affect the Cook Inlet beluga whale population, linking each to the relevant ESA Factor(s) and including a determination of "relative concern" (presented in *Table 2*).

Table 2. Potential Threats, ESA Factors, and Determination of Relative Concern for Cook Inlet Beluga Whales (source: NMFS 2016).

Threat Type	ESA § 4(a)(1) factor	Major effect	Extent	Frequency	Trend	Probability	Magnitude	Relative concern
Catastrophic events (e.g., natural disasters; spills; mass strandings)	A, D, E	Mortality, compromised health, reduced fitness, reduced carrying capacity	Localized	Intermittent & Seasonal	Stable	Medium to High	Variable Potentially High	High
Cumulative effects	C, D, E	Chronic stress; reduced resilience	Range wide	Continuous	Increasing	High	Unknown Potentially High	High

Threat Type	ESA § 4(a)(1) factor	Major effect	Extent	Frequency	Trend	Probability	Magnitude	Relative concern
Noise	A, D, E	Compromised communication & echolocation, physiological damage, habitat degradation	Localized & Range wide	Continuous, Intermittent, & Seasonal	Increasing	High	Unknown Potentially High	High
Disease agents (e.g., pathogens; parasites; harmful algal blooms)	C	Compromised health, reduced reproduction	Range wide	Intermittent	Unknown	Medium to High	Variable	Medium
Habitat loss or degradation	A	Reduced carrying capacity, reduced reproduction	Localized & Range wide	Continuous & Seasonal	Increasing	High	Medium	Medium
Reduction in prey	A, D, E	Reduced fitness (reproduction and/or survival); reduced carrying capacity	Localized & Range wide	Continuous, Intermittent, & Seasonal	Unknown	Unknown	Unknown	Medium
Unauthorize d take	A, E	Behavior modification, displacement, injury or mortality	Range wide, localized hotspots	Seasonal	Unknown	Medium	Variable	Medium
Pollution	A	Compromised health	Localized & Range wide	Continuous, Intermittent, & Seasonal	Increasing	High	Low	Low
Predation	C	Injury or mortality	Range wide	Intermittent	Stable	Medium	Low	Low
Subsistence hunting	B, D	Injury or mortality	Localized	Intermittent	Stable or Decreasing	Low	Low	Low

In the Recovery Plan, NMFS linked each threat of high or medium concern to a recovery goal, objective, and specific downlisting and delisting criteria under each ESA Factor. These include 10 threats-based downlisting criteria (2 under Factor A, 1 under Factor B, 6 under Factor D, and 1 under Factor E), and 9 delisting criteria (2 under Factor A, 1 under Factor B, 1 under Factor C, 2 under Factor D, and 3 under Factor E). Recovery actions within the Recovery Plan are subdivided into two categories: Population Monitoring, Recovery Plan Implementation, and Education/Outreach actions (12 total), and Threats Management actions (52 total).

As of June 2018, the estimated abundance of the Cook Inlet beluga population was 279 whales (CV = 0.061, 95% PI: 250 to 317) and the 10-year trend (2008-2018) showed a rate of decline of 2.3% (95% PI: -4.1% to -0.6%) with a 99.7% probability of a decline, and a 93.0% probability of a decline that is more than 1% per year (Wade et al. 2019). The abundance time series from 1994 to 2018 now covers the 25-year trend period included in the delisting and downlisting criteria. Using the natural log of abundance in each year, the exponential trend was highly significant ($p = 0.0017$) with an average rate of decline of 2.5% per year from 1994-2018. Therefore, the DPS does not meet the minimum demographic criteria specified in the recovery plan for reclassification from Endangered to Threatened.

2.3 Updated Information and Current Species Status

Since release of the 2016 Recovery Plan and 2017 5-Year Review, additional papers on Cook Inlet belugas have been peer-reviewed and published. Several are summarized under each category of analysis below. This information increases our knowledge but does not change our assessment of the status of the Cook Inlet DPS or the relative concern levels of the threats presented in the 2016 Recovery Plan. Cook Inlet and place names mentioned throughout this Review are shown in *Figure 1*.

Figure 1. Cook Inlet and place names mentioned in the text.

2.3.1 Biology and Habitat

2.3.1.1 New information on the species' biology and life history

Age and Growth

Knowing the ages of animals in a population is necessary to understanding demographics important to modelling recovery such as how long Cook Inlet belugas live (survival) and at what ages they become sexually mature and give birth (fecundity). Ages can be estimated by examining the dentine layers in beluga teeth. Belugas have only one set of teeth in their lifetime. Similar to growth rings in a tree, teeth add a layer of dentine as a dark and light band (referred to as a growth layer group or GLG) each year. Teeth from dead Cook Inlet belugas were thin-sectioned, viewed under a microscope, and each GLG was counted to obtain a minimum age (Vos et al. 2019). Belugas may have up to 10 teeth on each side of the lower jaw and teeth from the back (tooth positions 8 or 9) provide the best ages as these teeth show less wear (by 9 years old prenatal caps on most teeth had worn away, Vos et al. 2019). Comparing ages and body lengths between males and females show sexual dimorphism, with males larger than females (Vos et al. 2019). The oldest Cook Inlet belugas were a 47-year-old female (lactating and post-partum, Shelden et al. 2020a) and 49-year-old male, while the average age of Cook Inlet belugas in the tooth-aged dataset, which include both stranded and subsistence harvested whales, was about 20 years old for both males and females (Vos et al. 2019, McGuire et al. 2021, Shelden et al. 2021). For a species that has a life expectancy of 60-90 years old (Burns and Seaman 1986, Suydam 2009, Ferguson et al. 2020), the lack of older belugas is a concern because the impact of the loss of a disproportionate number of what in other beluga populations would be reproductively mature adults of both sexes in their prime would likely have a greater and longer-term impact on the decline in population numbers than a decline in all ages (Wade 2018, McGuire et al. 2021, Shelden et al. 2021, see Mortality and Morbidity section, below)

While estimating age from teeth can only be done for dead belugas, Bors et al. (2021) developed a molecular method to estimate the age of living Cook Inlet belugas using skin samples and an epigenetic clock. They used a custom methylation array to measure methylation levels at 37,491 cytosine-guanine sites (CpGs) from skin samples of dead whales (n = 67) whose ages were estimated based on tooth GLGs. Using these calibration data, they successfully developed a model to estimate the age of living whales from their methylation levels, and estimated a median absolute age error of plus or minus 2.9 years by a leave-one-out-cross-validation. They then applied the epigenetic clock to an independent data set of 38 skin samples collected by biopsy darts from live, free-swimming belugas between 2016 and 2018, with resulting age estimates that ranged from 11 to 27 years.

Reproduction

Knowledge of Cook Inlet beluga reproductive life history (e.g., timing of mating and calving, age of first reproduction) is key to understanding the potential impact of threats that guide recovery efforts.

Shelden et al (2020a) examined 28 sexually mature female Cook Inlet belugas, which died by harvest or stranding, and ranged from 14-47 years old. Reproductive senescence, which is the transition to menopause (e.g. Ellis et al. 2018), was not evident, possibly because few females were older than 40 year old and declines in ovarian corpora counts and pregnancy rates in other beluga populations suggest senescence begins between 40-50 years old (Burns and Seaman 1986, Suydam 2009, Ferguson et al. 2020). Pregnant Cook Inlet belugas ranged in age from 14 to 41 years old. The uterus of a 10-year-old examined during necropsy was small and thick-walled, suggesting immaturity, though ovaries were not examined. Photo-identification records of a 14-year-old female show close association with a calf at ages 10 and 13 (Shelden et al. 2020a, McGuire et al. 2020a). It was not possible to conclusively determine the earliest age at first reproduction for Cook Inlet belugas because there have been few females younger than 10 years old sampled (Shelden et al. 2020a). However, the age of maturity in other beluga populations is approximately 8 years (see Hobbs et al. 2015a).

To estimate when mating and calving occur, a study was conducted comparing body measurements (length and circumference) from living fetuses using ultrasound in pregnant belugas in aquaria to measurements from deceased Cook Inlet fetuses and newborns (Shelden et al. 2020b). Calculations suggested most Cook Inlet whales were conceived in March-May (58-94% depending on the measurement used) and were born in July-October (44-81%). These periods match when most aquaria females were ovulating and conceiving (Robeck et al. 2005), and when researchers observe newborns in Cook Inlet during photo-identification surveys (McGuire et al. 2020b). Apparent mating behavior was photo-documented on two occasions in Cook Inlet during the spring of 2014 (Lomac-McNair et al. 2015). The timing of these observations, in April and May, corresponds with similar behaviors of aquaria belugas and aligns with peaks in ovulation (Robeck et al. 2005) and testes size (O'Brien et al. 2008, Richard et al. 2017).

Over a 13-year period (2005-2017), a photo-identification study found that the number of calves seen with an individual mother (n = 46) ranged from 1 to 5, with observed inter-birth intervals ranging from 2.6 to 13 years (McGuire et al. 2020a). This corresponds to rates of 0.08–0.38 calves per year per mother. Some mothers (6%) were accompanied by a neonate and an older calf (McGuire et al. 2020a). Calves photographed alongside their mothers were estimated to be 1–8 years old (noted by increasing size and any distinguishing marks), although most were 1–4 years old (McGuire et al. 2020a). Photographs of dead stranded adult females (McGuire et al. 2021) were matched to individuals in the photo-identification catalog. Based on their tooth age at time of death (Vos et al. 2019), ages when they were photographed alive and accompanied by newborns were calculated and ranged from 13 to 31 years, similar to the range of ages observed in the necropsy dataset (Shelden et al. 2020a,b).

Norman et al. (2020) examined whether there was a correlation between a calf production index for the Cook Inlet beluga population and escapement levels of Chinook (*Oncorhynchus tshawytscha*) and coho (*Oncorhynchus kisutch*) salmon in the Deshka River, a major tributary of the Susitna River. The calf production index, cited in Norman et al. (2020) as being from Hobbs and Norman (unpublished manuscript), covered seven years, 2006-2012, and included just one year (2006) where salmon escapement was high. They concluded there was a statistically significant positive correlation between per capita births and prey availability. While prey availability may indeed be of concern, their calving index results were confounded by timing of the August aerial surveys (Hobbs et al. 2015c) which relied on incorrect or outdated assumptions about calving seasonality (see Shelden et al. 2020b, McGuire et al. 2020a,b). Norman et al. (2020) also inappropriately used photo-identification data that did not differentiate older calves from young-of-the-year and neonates in their analysis biasing the results towards overestimating calf production (Shelden et al. 2020b, McGuire et al. 2020b), as well as assuming one-third of the population gives birth at age 7, one-third at age 8, and one-third at age 9 based on beluga populations other than Cook Inlet.

<u>Foraging and Prey</u>

A detailed understanding of diet is critical to determining whether prey-related issues, such as changes in the availability and quality of prey, are influencing the population's ability to recover. Pacific salmon (*Oncorhynchus* sp.) and eulachon (*Thaleichthys pacificus*) are important prey for Cook Inlet belugas when they gather at river mouths of the upper inlet during the summer months, but less is known about diet at other times of the year (Quakenbush et al. 2015). To date, the only specific diet information outside of the summer months comes from stomach samples collected from harvested and stranded belugas (Quakenbush et al. 2015), which indicate a wide diversity of prey may be consumed from March through November, predominantly salmon and eulachon, but also flatfish, shrimp, polychaetes, and amphipods.

Rouse et al. (2017) examined a male beluga in October 2013 that stranded in Turnagain Arm after asphyxiating on a starry flounder. Due to this beluga's fresh condition during the necropsy it was possible to discern both chronic and acute wounds in the larynx, suggesting it may have swallowed other large flatfish prior to this fatal incident. In 2020, another male beluga, in poor body condition (emaciated), stranded in October in Chickaloon Bay. This whale had also asphyxiated on a large flounder (52.3 cm long and 37.7 cm wide; visually identified as a starry flounder (L. Quakenbush, pers. comm.) that was folded lengthwise and lodged in the whale's throat (K. Burek-Huntington, pers. comm.). Another report of a Cook Inlet beluga with a flounder stuck in its throat was reported by hunters (Huntington 2000). Quakenbush et al (2015) detected starry flounder in the stomachs of Cook Inlet belugas sampled between 2002 and 2010 with 6 percent frequency, indicating that this species is a known prey item, which may be more readily available during fall after the end of summer anadromous fish runs.

Although Rouse et al. (2017) did not consider asphyxiating on flounder as a probable contributing factor to the decline of the Cook Inlet beluga population, it is noteworthy that in this small population that two Cook Inlet belugas have been documented dying of asphyxiation due to choking. Whether this form of mortality has increased due to a reduction in other prey type availability in the fall is unknown.

Passive acoustic monitoring has been used to detect locations and timing of beluga foraging. Year-round passive acoustic monitors have been placed throughout Cook Inlet to detect beluga presence and foraging. These locations included Eagle Bay, Fish Creek, Six Mile Creek (Knik Arm), Cairn Point, Ship Creek, Point Woronzof, Little Susitna River, Susitna Delta, Beluga River, Chuitna River, Trading Bay, Point Possession, Bird Point, Six Mile Creek (Turnagain Arm), and Fire Island in the upper inlet; as well as Tuxedni Bay, Kalgin Island, Big River, Kenai River, Kasilof River, Chinitna Bay, Iniskin Bay, Port Graham, Homer Spit, and offshore in the lower inlet (Castellote et al. 2020, unpublished data, see *Figure 2*).

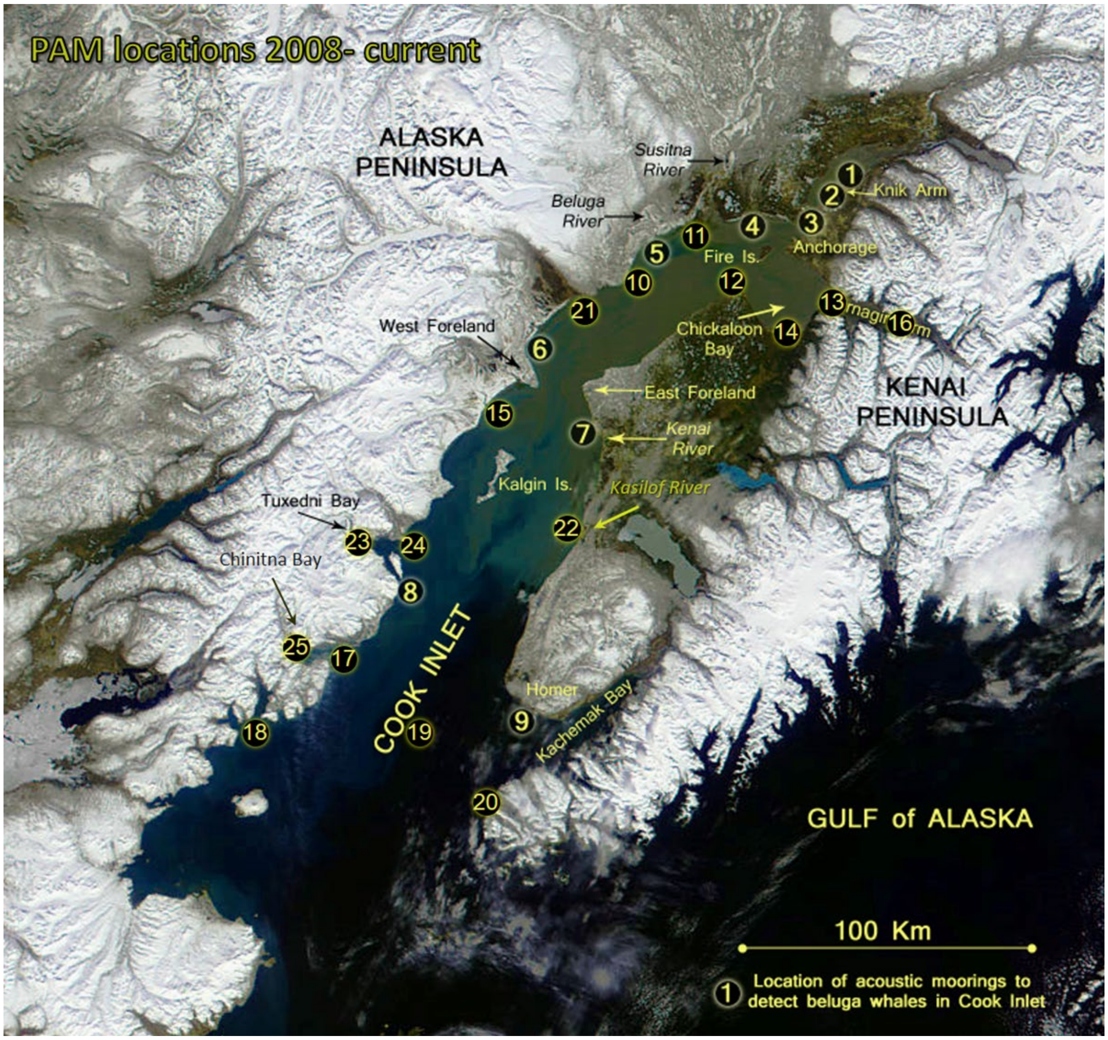

Figure 2. Areas in Cook Inlet, Alaska, where passive acoustic moorings have been deployed. Numbers are in chronological order of deployment during three different projects (2008-2013, numbers 1-9; 2017-2019, numbers 1-4, 6, 10, 14, 15); 2020-present, numbers 1-4, 11-13, 15-20). Note not all areas are sampled concurrently, most moorings were deployed seasonally for open water or overwinter periods.

Increased foraging activity, as determined by an increase in the number of foraging terminal buzzes produced by echolocation, coincided with anadromous fish runs from spring to fall. Feeding activity in winter was at low levels, suggesting that large prey aggregations may be absent, belugas are feeding in unmonitored waters, or are feeding on benthic prey. According to data from acoustic recorders deployed during 2008-2013, the most active foraging occurred at Little Susitna River, in the upper inlet, in May, July, and August, at Beluga River in June, and at Eagle Bay in September (Castellote et al. 2020). Recent data (2018) show intense foraging continued to occur at the Susitna Delta area (near the Beluga River and Little Susitna areas sampled in 2008-2013), with peaks in beluga foraging off the Susitna Delta in May, likely on smelt during the spawning run, and foraging June-September, likely on salmon during Chinook, pink, and coho salmon runs. Red and chum salmon are also present in Cook Inlet but were not available to belugas in 2018 in the Susitna River (Castellote et al. 2021, see *Figure 3*). Cook Inlet belugas are known to eat chum salmon (Quakenbush et al. 2015).

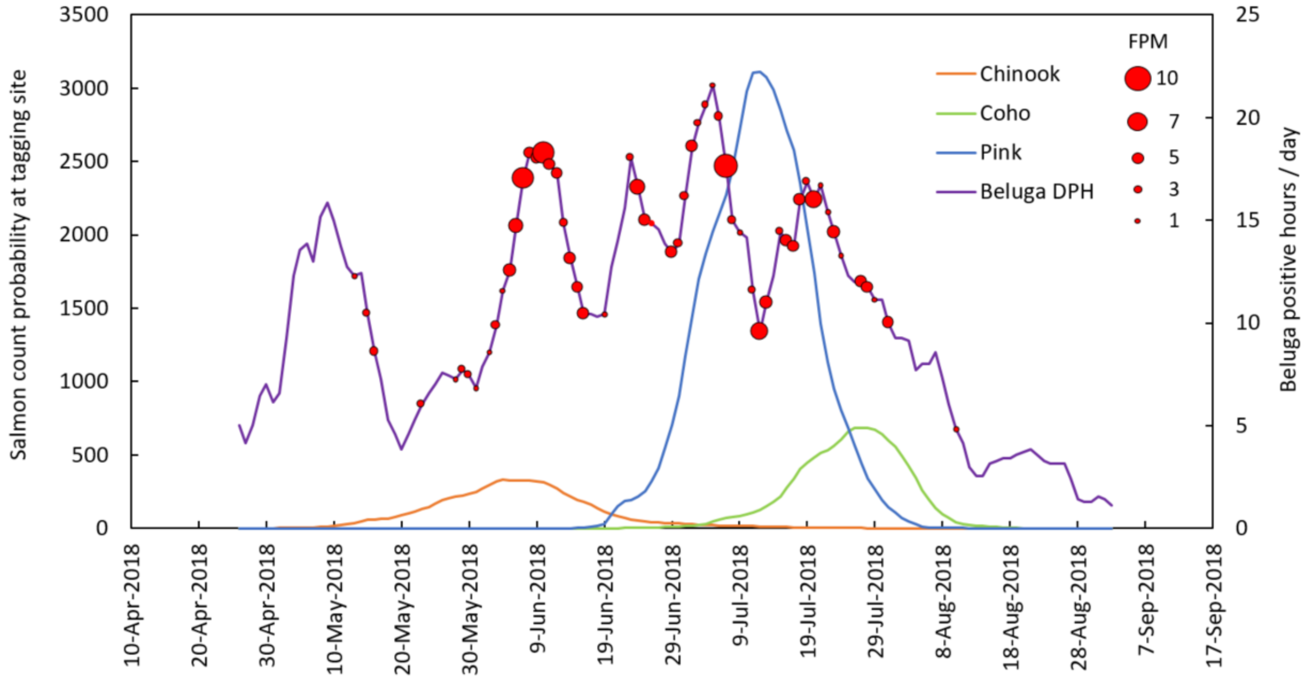

Figure 3. Predicted number of salmon per day at the salmon tagging site at Susitna River for three of the five Pacific salmon species (fish/day), beluga daily presence in detection positive hours (DPH) per day, and feeding occurrence (foraging positive minutes). Note: Salmon tagging site is at river mile 34, and travel time for salmon from mooring site to tagging site is unknown, thus a time lag exists between the salmon time series and the beluga time series. Although present, chum and sockeye had very low predicted numbers of salmon per day at this tagging site during this period and were omitted here. Figure from Castellote et al. (2021).

Active winter foraging was also identified in April at Beluga River and December at Trading Bay in the 2008-2013 study (Castellote et al. 2020). Other winter foraging areas in the upper inlet detected by the acoustic recorders included lower Knik Arm and Eagle Bay. Of the three locations in the lower inlet (Tuxedni Bay, Kenai River, and Homer Spit), the only area where winter foraging terminal buzzes were detected by acoustic recorders was Tuxedni Bay. Belugas were not detected at all on acoustic recorders in the lower inlet at the Homer Spit mooring in Kachemak Bay or during summer in Tuxedni Bay and Kenai River (Castellote et al. 2020). More recent data (2017-2019) in newly monitored areas of the lower inlet (unpublished), again show lower Knik Arm as a winter feeding area, in addition to new areas, some with high numbers of foraging buzzes. New areas include Chickaloon Bay in August to November, and Big River and NW Kalgin Island both in January to April (Polasek et al. 2021).

Stable isotopes have been used to look at shifts in diet for Cook Inlet belugas. A study comparing isotopes in bone (skulls) from 20 Cook Inlet belugas and tooth GLGs from 26 individuals that were alive between 1962 and 2007 showed decreasing trends in both nitrogen (1-2% decline) and carbon (~3% decline) stable isotope ratios (Nelson et al. 2018). The decline in nitrogen was not enough to represent a decline in trophic level (the level an organism occupies in the food web), while the decline in carbon was large enough to indicate a shifted baseline or increased use of freshwater prey. A compound specific analysis of nitrogen from five belugas, and analysis of an additional isotope (strontium) to compare freshwater influence by river on prey, suggested that either whales were foraging in the same areas but the environment had changed or that whales were foraging in different locations with different baselines (Nelson et al. 2018).

Mortality and Morbidity

Since listing as endangered under the ESA in October 2008, there have been 95 confirmed dead stranded Cook Inlet beluga including 3 *in utero* fetuses (7.3 ± 3.5 beluga per year; *Table 3*), with 3 to 13 strandings occurring each year with between 0 and 5 being calves (Figure 4; NMFS 2022b). Similar rates of dead strandings were observed between 1994 and 2002 with between 3 and 13 whales stranding each year, though the yearly average was slightly higher (9.6 belugas; Vos and Shelden 2005). Although the annual number of confirmed strandings varies between years (Figure 4), this may not be indicative of an increase in the overall number of strandings but rather an increase in reporting. For example, the Cook Inlet beluga whale was designated a NOAA Fisheries Species in the Spotlight in 2015, which allocated additional resources for recovering the population, and agency focus on Cook Inlet beluga education and outreach, especially with social media, intensified. Reported mortality between 2009 and 2021 was greatest for adults (36.8%) followed by calves (29.5%), juvenile/adult class (11.6%), juveniles (8.4%), and fetuses (6.3%) with 7.4% belugas being of unknown age class (*Figure 4*). Most reported stranding events occurred in late summer-early fall when Cook Inlet is ice free (*Figure 5*). Reported beluga strandings were in areas visible to the public, near highways, parks, fishing areas, coastal communities and villages, and along flight paths used by recreational and commercial pilots (*Figure 6*). NMFS and the Alaska Marine Mammal Stranding Network consistently respond to an average of 80% of dead Cook Inlet beluga stranding reports. Responses maybe impeded due to the challenging weather and tidal conditions of Cook Inlet, as well as the remote and inaccessible locations where strandings may be observed (e.g., by aircraft pilots). Responses include attempts to locate the dead stranded beluga and, if located, collecting, at a minimum, morphometrics, photos, skin samples, and teeth. Depending on the condition of the animal (i.e., how fresh the carcass), a partial or full necropsy will be completed. Since listing as endangered, the average number of partial or full necropsies completed on Cook Inlet beluga whales has increased (~60%). The condition of the animal at the time of necropsy continues to be a limiting factor in gathering valuable information to determine the health of and the cause of death for these Cook Inlet belugas.

It is important to determine causes of death (mortality) and the extent to which diseases (morbidity) may limit the Cook Inlet beluga population's ability to recover. Live stranding effects were the leading cause of death (23%, n=9) among belugas necropsied between 1998 and 2013 (n=38), though 29% (n=11) had unknown cause of death (Burek-Huntington et al. 2015). Burek-Huntington et al. (2015) also noted that disease may have contributed to cause of death in some events. Other causes of death included trauma, malnutrition, and perinatal mortality (fetus or neonatal calf mortality of unspecified cause).

McGuire et al. 2021 reviewed stranding data between 2005 and 2017 including photographs from 41 whales and 33 necropsy reports to identify patterns of mortality with respect to age, sex, geographic range, cause of death, and to estimate minimum annual mortality rates (McGuire et al. 2021). Photographs from 12 dead belugas were matched to one of the 420 individual belugas in the long-term photo-identification dataset (https://www.cookinletbelugas.com/), and decomposition state likely prevented matching other stranded whales. Annual mortality estimated from reported carcasses averaged 2.2% (SE = 0.36%) of the total population size (McGuire et al. 2021), which is likely an underestimate as not all mortalities are expected to be reported.

Table 3. Cook Inlet beluga whale stranding totals, reported from 2009-2021

Reported Cook Inlet Beluga Whale Strandings 2009 - 2021			
Year	**Confirmed Carcasses**	**Confirmed Live Events (~# of animals per event)**	**Number of Unconfirmed Reports[c]**
2009	6[a]	3 (16-21, Unknown[b])	2
2010	5	2 (11, 2)	0
2011	3	1 (2)	0
2012	3	3 (12, 23, 3)	0
2013	5	0	1
2014	11[a]	2 (Unknown[b], 76)	1
2015	3	1 (2)	2
2016	8	0	0
2017	12	1 (1)	0
2018	7	0	0
2019	13	1 (6)	0
2020	9	3 (2, 2, 17)	1
2021	10	0	1
Total	95	17 live events[b] (177 - 182 belugas)	8

[a] Two females in 2009 and one female in 2014 were pregnant, the fetuses are included as separate carcasses in total strandings.
[b] In 2009, no live strandings were reported in October, but necropsy of two belugas found on different days suggested a live stranding may have contributed to death. In 2014, no live strandings were reported in May but necropsy of two belugas found near each other suggested a live stranding may have contributed to death.
[c] Unconfirmed reports of live or dead stranded animals are not included in annual totals.

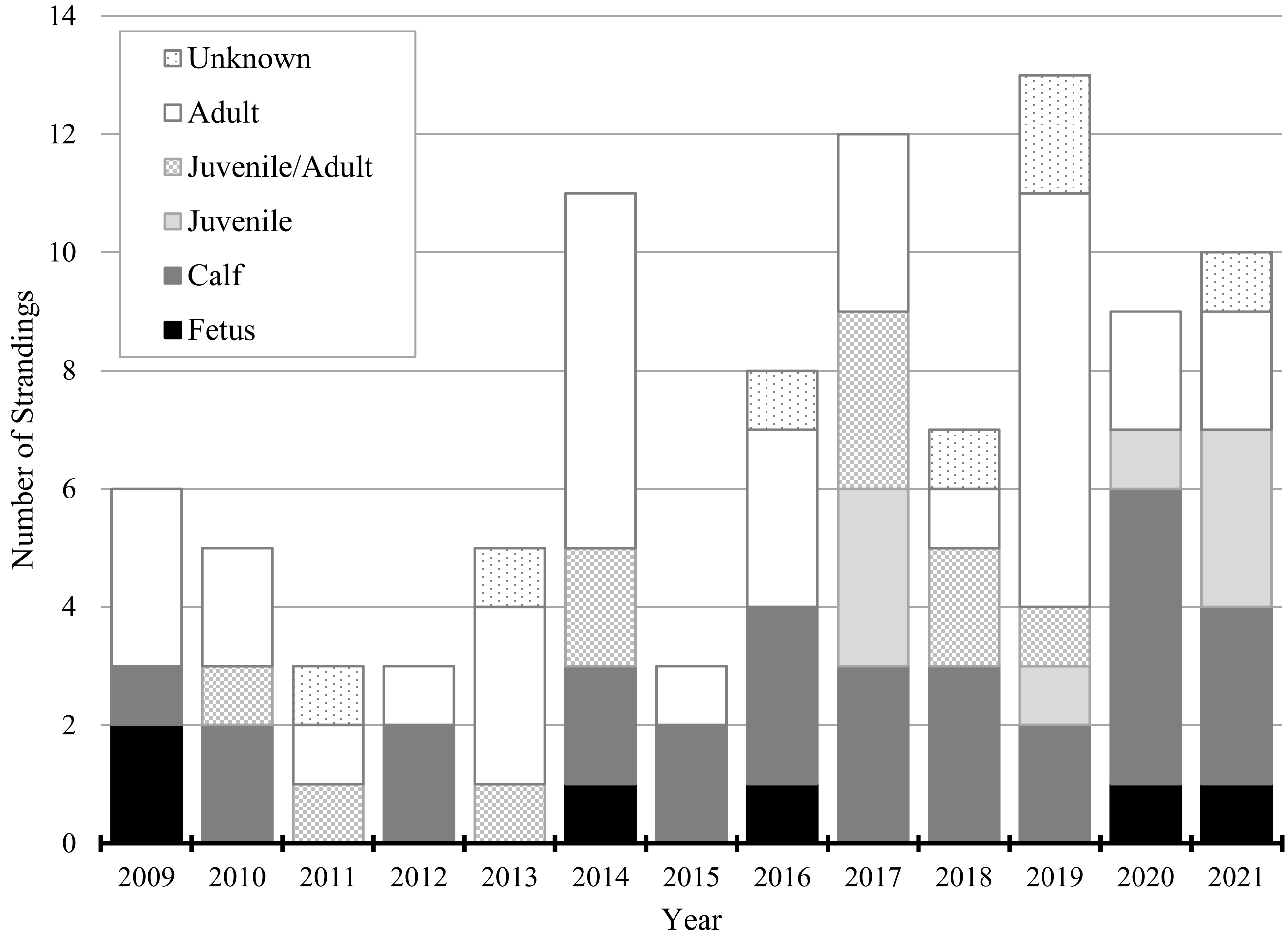

Figure 4. Confirmed dead strandings of Cook Inlet beluga whales by age class and year, 2009-2021 (n=95 whales; NMFS 2022b). Fetuses included three *in utero* (2009, 2014) and two aborted (2016, 2020).

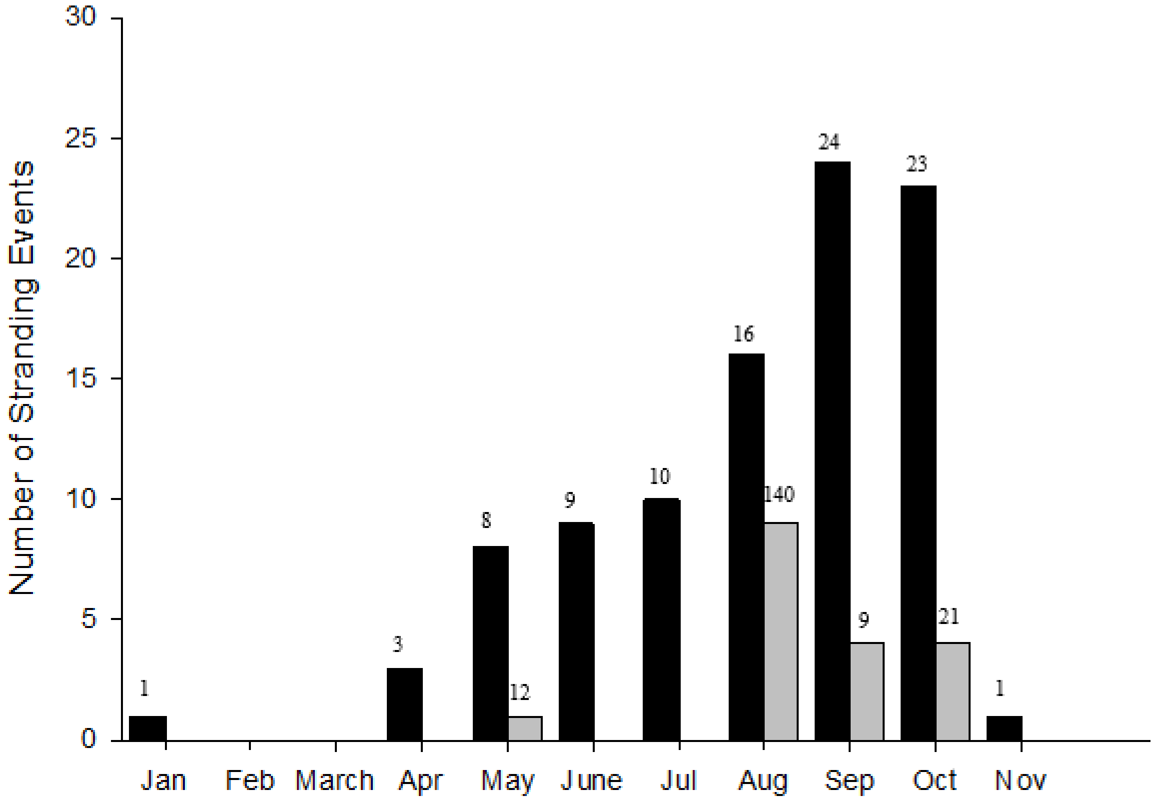

Figure 5. Confirmed Cook Inlet beluga whale stranding events reported by month, 2009-2021 (n=95 dead whales, 182 live whales; NMFS 2022b). Total number of belugas are shown above the events bar for dead stranded (black bars) and live stranded (gray bars) belugas.

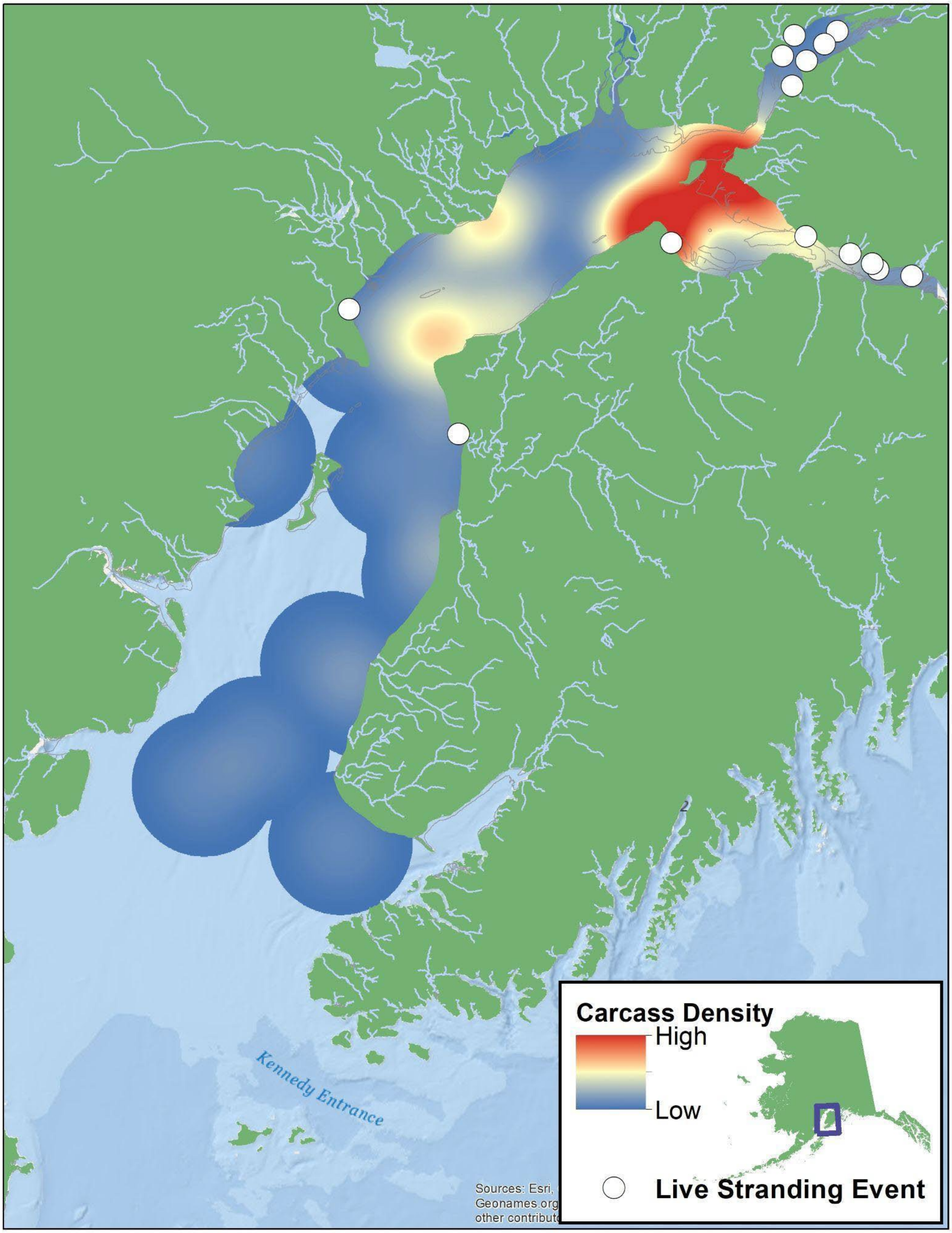

Figure 6. Live stranding event locations (white circles) and kernel density (color coded) of dead stranded Cook Inlet beluga whales reported from 2009 to 2021.

Harmful algal blooms (HABs) create toxins (e.g., domoic acid and saxitoxin) that affect the central nervous system of vertebrates. The potential for health effects on Alaskan marine mammals may be high considering more than 40% of marine mammal unusual mortality events (UMEs) in the contiguous USA during the last 20 years were attributed to algal toxin exposure (Lefebvre et al. 2016). Burek-Huntington et al (2015) (and also reported in Lefebvre et al. (2016)) found HABs toxins in a small percentage of Cook Inlet belugas. Two whales tested positive for domoic acid and one whale for saxitoxin. Placental transfer of domoic acid was found for 1 of 3 fetuses sampled. Typically these toxins accumulate in lower trophic level prey (e.g., plankton, shellfish), and beluga prey consists of fewer planktivorous fish and invertebrate species, which may explain why only a small percentage of Cook Inlet belugas were affected. Lefebvre et al. (2016) also tested harbor porpoise that had stranded in Cook Inlet for both toxins and found 2 of the 5 porpoise tested were positive for domoic acid (including placental transfer) but none for saxitoxin.

To further examine the health of Cook Inlet beluga whales, the epidermal microbiota were compared to the Bristol Bay beluga population (Van Cise et al. 2020). Microbiome composition differed significantly between populations and years so that no conclusions regarding Cook Inlet versus Bristol Bay beluga health could be made. The microbiomes of individual Bristol Bay belugas of known health status revealed 11 potentially pathogenic genera of microbes that differed in abundance between healthy individuals and those with skin lesions or dermatitis. For Cook Inlet belugas, no genera were common across individuals and microbiotas were found to vary spatially and temporally, indicating a strong environmental effect on the microbial community. Strong differences in the epidermal microbiome associated with sampling location around Cook Inlet may be driven by differences in ecological behavior or local environmental conditions.

Infection and disease are of particular concern for Cook Inlet belugas and every effort is made to test tissues and lesions from stranded whales for potential viruses such as herpesvirus and brucella. Histopathology suggested the presence of virus in both the mammary gland and brain (as indicated by possible inclusion bodies) in a pregnant beluga that stranded near Anchorage in 2014 (Burek-Huntington et al. 2021). Initially, a polyomavirus was suspect but additional testing determined no virus was present. These types of viruses, particularly in immunocompromised animals and humans, can cause cancers and compromise fetal development. Two instances of congenital defects were documented in Cook Inlet belugas (Burek-Huntington et al. in review(a)). These are the first records of such defects in free-ranging belugas. One aborted fetus lacked flukes, anus and urogenital openings and associated internal organs. The second, a newborn male calf less than a month old, had a perineal groove defect that resulted in peritonitis and also had a systemic herpesvirus infection. Further studies are needed to determine if such defects may be due to genetic mutation, infectious diseases, nutritional imbalances, or contaminant exposure.

Prevalence of contaminants has been investigated in a number of beluga populations including Cook Inlet (Becker et al. 2000, Reiner et al. 2011, Hoguet et al. 2013). However, sample sizes have been small and it is important that stranded whales be fresh dead as pollutants that are found in fats (lipid) such as the blubber tend to leach away quickly following death. Recent reanalysis of pollutant data from blubber and liver samples collected from harvested Cook Inlet belugas, excluding stranded whales, produced results similar to those in Hoguet et al. (2013) and Reiner et al. (2011) and additional insights with the inclusion of female reproductive status (Burek-Huntington et al. in review(b)). A suite of persistent organic pollutants (POPs) and per- and polyfluroalkyl substances (PFAs) were examined. Overall, pollutant values were greater in males than females, though among females POPs were higher in those that were pregnant versus lactating while the opposite was seen with PFAs. Polybrominated diphenyl ethers (PBDE), alpha-Hexabromocyclododecane (α-HBCD), and Perfluorononanoic acid

(PFNA) concentrations significantly increased from 1995 to 2005 for both sexes, with α-HBCD and PFNA concentrations being higher for males than females (Burek-Huntington et al. in review(b)). Since 2004, two of the three PBDEs are no longer used and the third was phased out in 2013. As such, more data are needed to determine if PBDE concentrations in belugas have decreased since the cessation of their use. The temporal increase in α-HBCD may be more worrisome. Overall, PFA concentrations have been shown to be higher than other beluga populations which may be due to their close proximity to the city of Anchorage where anthropogenic disturbance is higher (Reiner et al. 2011). Poirier et al. (2019) examined the occurrence of intestinal polycyclic aromatic hydrocarbon (PAH) DNA-adducts in beluga populations. Many PAHs are classified as chemical carcinogens, while DNA adducts are an indicator of carcinogen exposure. These adducts are necessary for tumor formation; however, their presence does not necessarily equate to present or future incidence of cancer (Poirier et al. 2019). Poirier et al.'s study focused on St. Lawrence Estuary belugas, which have a known high incidence of cancers, but included samples from 4 dead stranded Cook Inlet belugas. The researchers found significantly higher incidences of intestinal PAH DNA-adducts in the St. Lawrence Estuary and Cook Inlet beluga whale samples relative to samples from Arctic and captive beluga populations; however, the authors note that no cancer was observed in the Cook Inlet whales and that the sample size is too small to provide robust analysis. This finding suggests that further exploration into the potential impact to the population from PAHs would be valuable in better understanding the threat of pollutants to Cook Inlet beluga health.

In 2021, Mathavarajah et al. published the results of a desktop analysis of wastewater pollution sources in Cook Inlet relative to beluga habitat, overlaying marine mammal population information from Lefebvre et al. (2016) with geo-mapping data of state-permitted wastewater treatment plant outfall locations, treatment types, maximum daily flow, and other spatial information. While the article identified potential wastewater sources that could introduce waterborne pathogens into Cook Inlet beluga whale habitat, the exercise focused solely on assessing the risk of the beluga population being exposed to SARS-CoV-2 (i.e., COVID-19)[2]. Additionally, wastewater treatment plants operating under federally granted National Pollutant Discharge Elimination System (NPDES) permits were not included in the dataset, omitting a potential pollutant source from the analysis. The only location identified by the study as a potential source of wastewater effluent to which belugas might be exposed was Palmer, where the authors describe that primary-treated effluent flows into the Talkeetna River. However, the Talkeetna River does not flow past Palmer, and closer inspection of supplemental information provided by the authors (Supplemental Table 2 *in* Mathavarajah et al. 2021) suggests that Palmer was identified as a source location because it is the seat of the Matanuska-Susitna Borough, which is permitted to release wastewater effluent from the Talkeetna Sewer & Water System into the Talkeetna River. The Talkeetna River intersects with the Susitna River approximately 85 miles from the mouth of the Susitna, therefore wastewater effluent from this source, albeit much diluted, does enter Cook Inlet beluga habitat; however, additional research, including water sampling, would be necessary to assess the extent to which any pollutants from wastewater are entering Cook Inlet beluga habitat and impacting the population.

2.3.1.2 Abundance, population trends (e.g., increasing, decreasing, stable), demographic features (e.g., age structure, sex ratio, family size, birth rate, age at mortality, mortality rate, etc.), or demographic trends

<u>Abundance and Trend</u>

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[2] To date, 10 dead-stranded Cook Inlet beluga whales from 2020 through 2021 have been tested for SARS-CoV-2 exposure. All results were negative for exposure to the virus (M. Keogh, pers. comm.)

Cook Inlet beluga population abundance and trends over time is vital for understanding the status of the population and its recovery. A new method to estimate group size during aerial surveys was developed by Boyd et al. (2019) and replaces the method developed by Hobbs et al. (2000a,b, 2015b) that was previously applied to abundance estimates during 1994-2016 (Hobbs et al. 2015b, Shelden et al. 2015a, 2017). This new method has only been applied to aerial surveys after 2003 due to changes in survey methods introduced in 2004 (i.e., increasing the number of days flown per survey and considering the upper inlet as one not several sectors). These changes addressed the concern that beluga groups could move between sectors during a survey and bias the estimate. Although Hobbs et al. (2015b) compared estimates with and without sectors and determined that the overall trend was not affected, there were too few days with thorough coverage of the upper inlet prior to 2004 for a robust analysis. Therefore, Boyd et al. (2019) methods cannot be applied prior to 2004 survey data. Since 2004, there have been no revisions to the aerial survey methods; the only revisions that occurred were to analysis methods that were introduced following the 2016 abundance estimate and applied retrospectively to the survey data from 2004-2018 (Wade et al. 2019).

In addition to improving the group size estimation process by incorporating the uncertainty of correction factors within a Bayesian framework (Boyd et al. 2019), another change made was that the overall abundance estimate for each year was calculated using the median of all acceptable survey days. Previously the mean of survey days was used; the decision to change to use the median was to limit the potential effects of outliers in the daily abundance estimates, which might have substantial negative or positive biases. The definition of acceptable survey days was also changed to now be defined as those days having a thorough coverage of all known beluga high-use areas not compromised by weather or sighting conditions. Previously, low abundance day(s) were removed prior to calculating the overall abundance even if the survey area had been adequately covered, and some days with poor weather were included if the abundance estimate was high (Hobbs et al. 2015b). The change to the definition of an acceptable survey day led to three additional days being included in the annual abundance estimates, and one day that had previously been included being excluded. The excluded day (from 2004) had a particularly high abundance estimate, which substantially lowered the annual estimate for 2004; this contributes to the revised trend showing an apparent increase from 2004 to 2010 (*Figure 7*), which was not apparent in the previous trend analysis by Shelden et al. (2017). Another change from the trend showing in Shelden et al. (2017) is a substantial decline after 2010 (*Figure 7*); this change happened primarily because the revised abundance for 2016 using the new group size estimation method is lower than before (i.e., see *Figure 8*), and because the newly added estimate for 2018 is also relatively low.

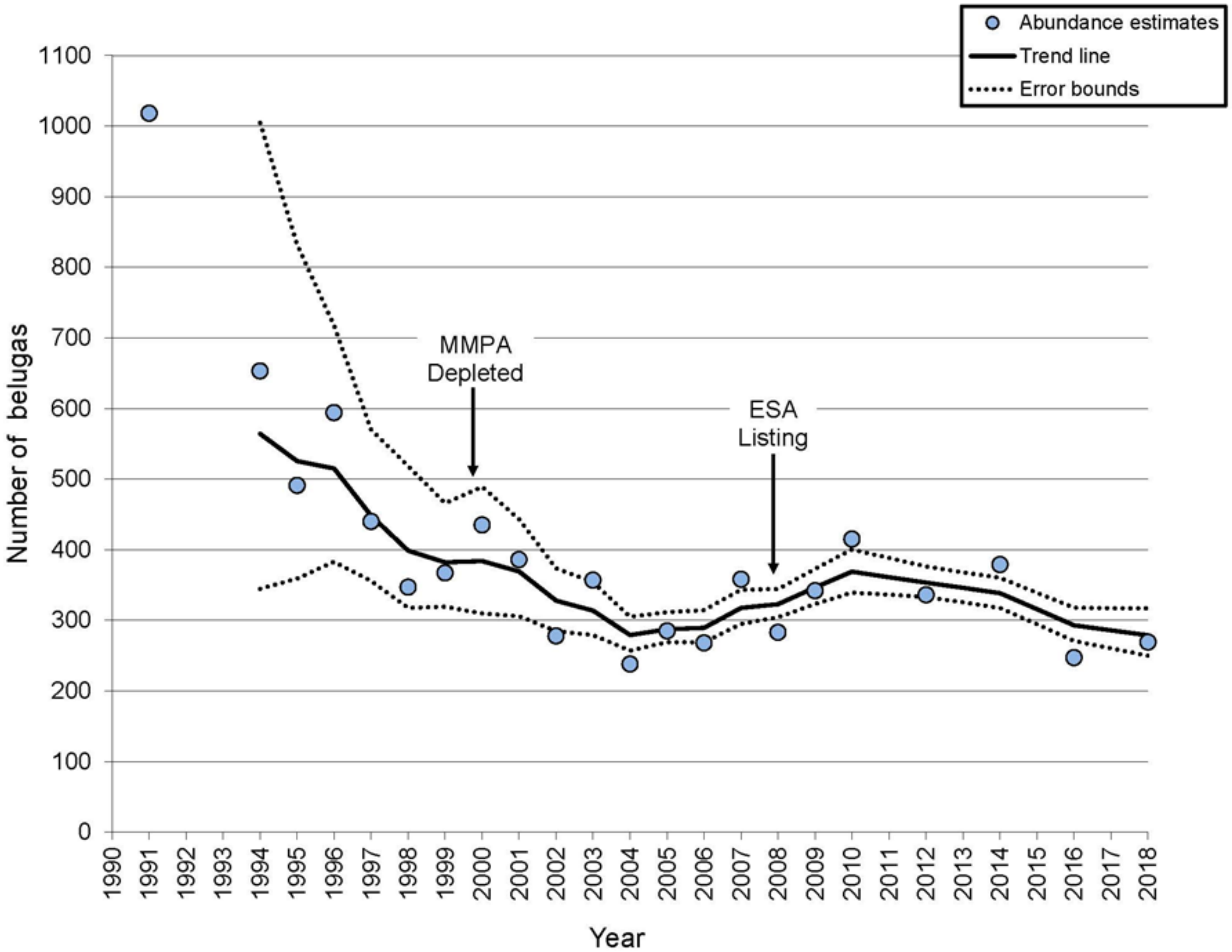


Figure 7. Cook Inlet beluga population abundance and trend for 1991-2018 based on analyses presented in Wade et al. (2019). The estimate from 1991 is from Shelden and Mahoney (2016) and estimates from 1994-2003 are from Hobbs et al. (2015b).

After applying the new criteria for acceptable days and medians for abundance to both methods (i.e., those presented in Hobbs et al. 2015b and Boyd et al. 2019), trends between the two group size estimation methods were similar (*Figure 8*). The smoothed trend in both cases shows an increase followed by a decline. There are still some differences, notably that the year of peak abundance is now 2 years later (2010 versus 2008) using the Boyd et al. (2019) group sizes, and the recent decline is more severe, though this latter point is partially due to the low 2018 estimate (*Figure 8*). The previous estimate of the trend in the population, after the 2016 survey estimate was calculated, resulted in a roughly stable trend with only a slight decline that was not significant (e.g., Shelden et al. 2017). The new method applied to the 2004-2018 surveys showed an increase from 2004 to ~2010 followed by a highly significant decline. Over the most recent 10-year period (2008-2018), the estimated trend shows a population decline of -2.3%/year (95% PI -4.0% to -0.1%), with a high probability the abundance is declining by at least -1% per year (93.0%), and a moderate probability (64.8%) the abundance is declining by at least -2% per year (Shelden and Wade 2019).

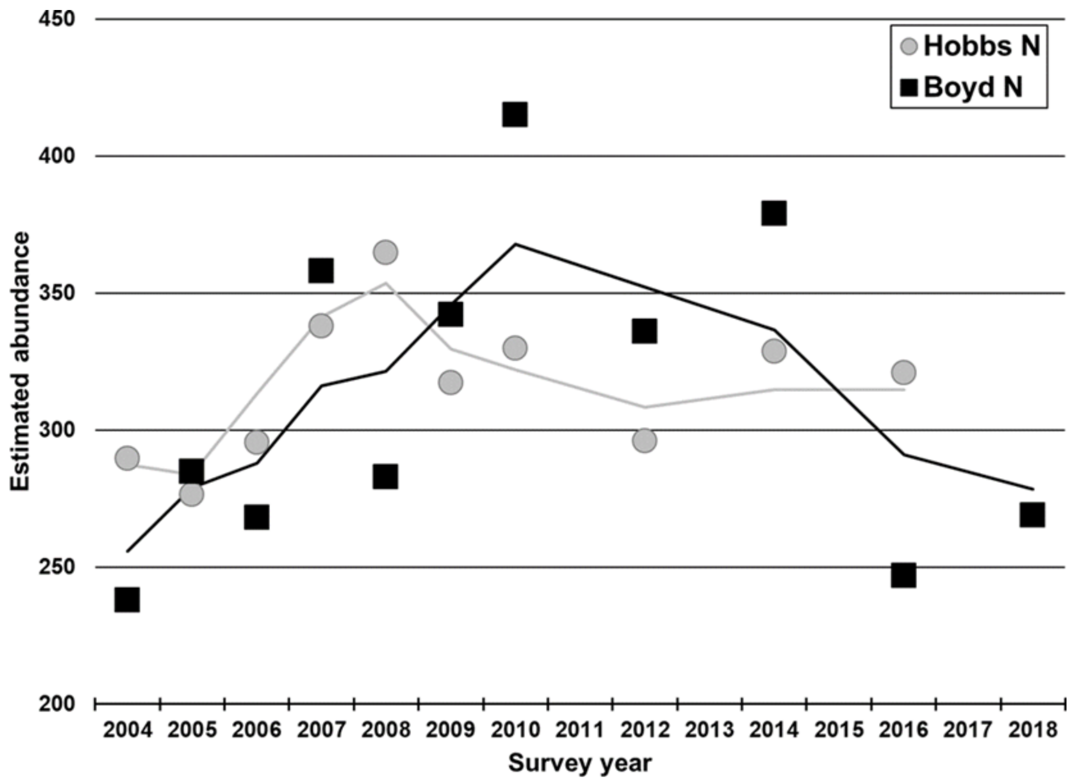


Figure 8. Revised abundance estimates (i.e., Boyd in black squares) after applying medians and acceptable day criteria to the Hobbs et al. (2015b) method (gray circles) (Figure 5 from Wade et al. 2019).

Jacobson et al. (2020) developed an Integrated Population Model (IPM) that included a population process model and three observational submodels: (1) a group detection model to describe group size estimates from aerial survey data; (2) a capture–recapture model to describe individual photographic capture–recapture data; and (3) a Poisson regression model to describe historical harvest data. The estimated population growth rate from 2006 to 2016 was marginally positive at 0.8% per year (95% CI -0.5% to 2.1%) but less than expected for a recovering population (*Figure 9*). The estimated juvenile/adult survival rate was also low at 0.80 (95% CI 0.71–0.91) for young-of-the-year, 0.91 (95% CI 0.85–0.93) for calves, and 0.93 (95% CI 0.93–0.94) for juveniles/adults) compared to other cetacean populations, indicating that low survival may be impeding recovery. There are key differences between the Jacobson et al. (2020) and Wade et al. (2019) analyses that lead to different estimates of trend and current population size. Jacobson et al. (2020) used only the highest estimate from a single day's survey as the annual abundance estimate, whereas Wade et al. (2019) included all the survey data and used the median across all days as the annual abundance estimate. In addition, Jacobson et al. (2020) did not include the most recent abundance data from 2018, their model used constant survival and maximum fecundity over the entire period, and they estimated the average trend for a 17-year period (2000-2016), whereas Wade et al. (2019) estimated the trend over the most recent ten-year period (2008-2018). It appears that the constant trend model of Jacobson et al. (2020) cannot track the increase and then decrease that occurred in the abundance estimates (*Figure 9*). This is evident in the poor fit of the model at the end of the time series, where the model is stable while the abundance estimates are declining, suggesting the Jacobson et al. (2020) model would over-estimate current abundance. In contrast, Wade et al. (2019) use a weighted moving average to estimate current abundance, which, by definition, fits the recent abundance estimates closely (*Figure 7*).

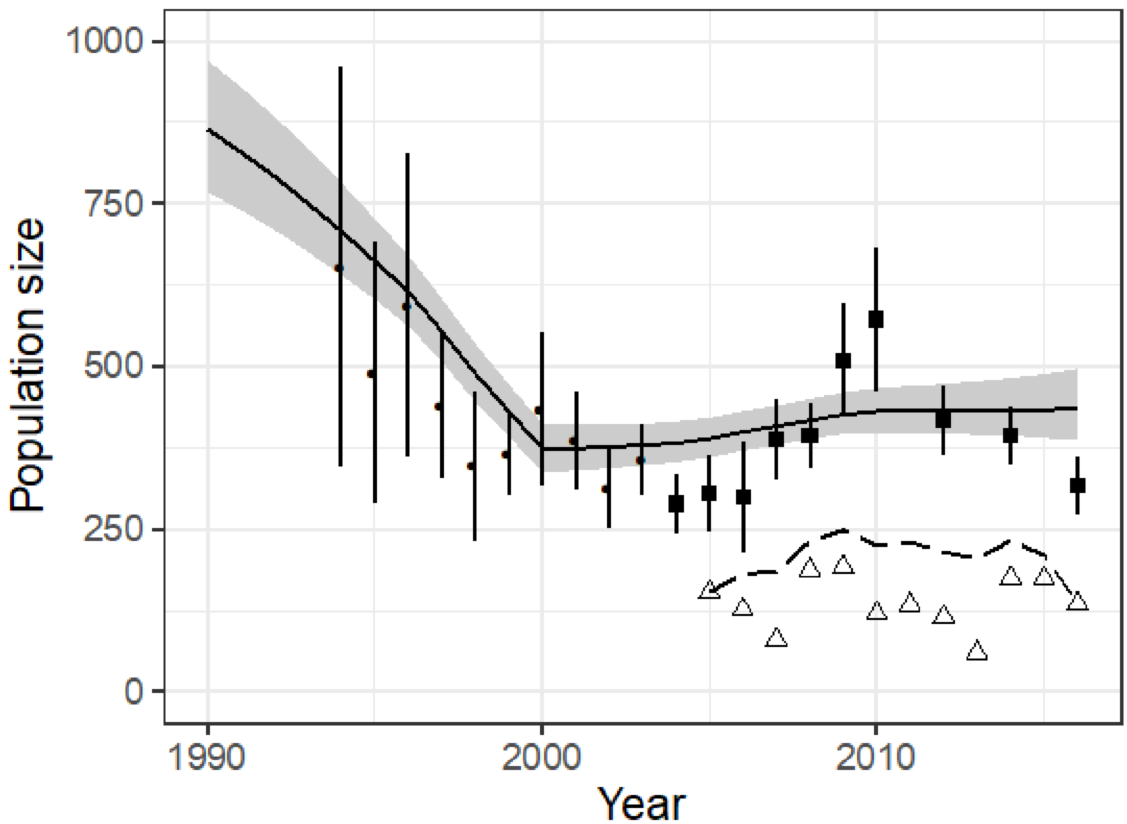


Figure 9. Trend in Cook Inlet beluga abundance using Integrated Population Model (IPM) results that include Cook Inlet beluga harvest, aerial counts (black symbols with error bars), and photo-identification (triangles) data. Overall trend is bounded in gray and ends with the 2016 estimates, the dashed line indicates the minimum number of whales known to be alive based on capture-recapture histories (Figure 2 from Jacobson et al. 2020).

<u>Survival and Fecundity Rates</u>

Understanding survival and fecundity are key to interpreting population recovery or the lack thereof. Lowry et al.'s 2019 IUCN report on the Cook Inlet beluga whale population estimated the proportion of mature whales in the population as 0.70 based on a revised estimate of generation length (stated as 28 or 29 years). Using the 2016 abundance estimate of 328 Cook Inlet belugas from Shelden et al. (2017), Lowry et al. (2019) "estimate[ed] 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." However, this IUCN assessment was completed in 2018 and, therefore, was not based on the revised abundance time series presented in Wade et al. (2019). Also, the IUCN assessment relies on life history parameters from beluga populations other than Cook Inlet (i.e., Suydam 2009, Burns and Seaman 1986). As mentioned above and in the previous section (2.3.1.1), annual mortality estimated from reported carcasses relative to total population size averaged 2.2% (SE = 0.36%) with most whales being of reproductive age (McGuire et al. 2021), which can serve as a minimum estimate of mortality, given that all carcasses are not recovered. The Jacobson et al. (2020) model estimated survival for Cook Inlet belugas based in part on photo-identification data. Adult/subadult survival ranged from 0.93-0.94, and calf and juvenile survival was somewhat less than that (but estimates were imprecise for calves and confounded with fecundity estimates: median maximum fecundity of 0.23 (95% CI 0.16–0.33) and a realized annual fecundity of 0.16–0.22). From the photo-identification data, inter-birth intervals spanned 2 to 13 years with birth rates ranging from 0.08–0.38 calves per year per mother (McGuire et al. 2020a). Analyses to estimate Cook Inlet beluga adult/subadult survival, calf survival, and reproductive parameters using a novel Bayesian state-space multi-event mark-recapture model are currently underway (Himes Boor et al. in review).

2.3.1.3 Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.)

Genetic information can provide critical information for understanding endangered populations. Genetic analysis has been used to determine the distinctness of the Cook Inlet beluga population relative to other beluga populations in Alaska that led to it being listed as a DPS. Further analyses of the migratory culture, population structure, and stock identity of North Pacific beluga whales (O'Corry-Crowe et al. 2018) confirmed that the Cook Inlet DPS is "both reproductively and demographically isolated from all other beluga whale populations, and likely has been over evolutionary time frames."

Bors et al. (2021) developed a new genetic method to estimate the age of living Cook Inlet belugas using an epigenetic clock. The methylation data set generated to estimate the ages of living whales can potentially be used for other purposes, such as investigating gene expression.

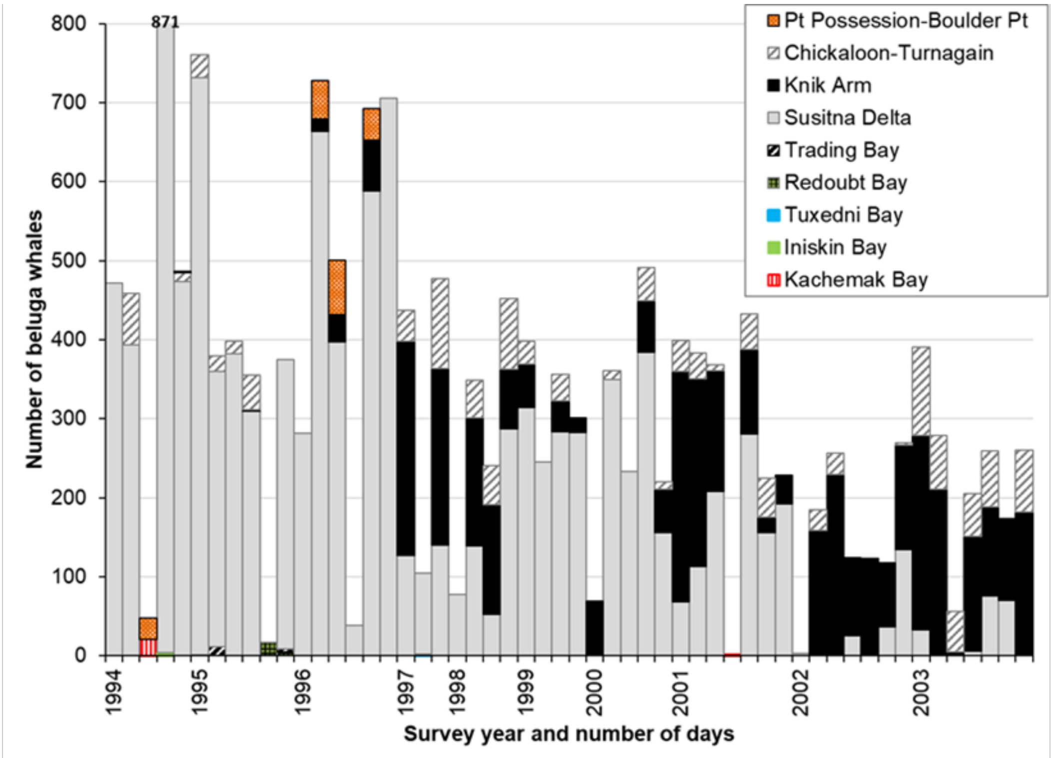
A small number of beluga whales (fewer than 20 animals) reside in Yakutat Bay. Based on genetic analyses, traditional ecological knowledge spanning 80 years, and observations reported year-round, the Yakutat belugas likely represent a small, resident group that is reproductively separated from Cook Inlet (Lucey et al. 2015, O'Corry-Crowe et al. 2015). Mitochondrial DNA and microsatellites differed significantly between Cook Inlet and Yakutat Bay whales. Furthermore, the Yakutat Bay group appears to show signs of inbreeding and low diversity due to their isolation and small numbers (O'Corry-Crowe et al. 2015). Yakutat Bay belugas were included as part of the Cook Inlet stock for the designation of "depleted" under the MMPA (75 FR 12498, 16 March 2010); however they were not included as part of the Cook Inlet DPS for listing as endangered under the ESA.

2.3.1.4 Taxonomic classification or changes in nomenclature

No additional information is available.

2.3.1.5 Spatial distribution, trends in spatial distribution (e.g., increasingly fragmented, increased numbers of corridors, etc.), or historic range (e.g., corrections to the historical range, change in distribution of the species' within its historic range, etc.)

Monitoring changes in Cook Inlet beluga spatial distribution provides valuable information on how the population is using habitat and what stressors, including anthropogenic impacts, the population may be exposed to. Historically many belugas were seen in both upper and lower Cook Inlet in June and July (Rugh et al. 2000, 2010, Shelden et al. 2015b). However, between 1993 and 1995, during the first 3 years of the NMFS abundance surveys, very few belugas (less than 3% of all of the annual sightings) were observed in the lower inlet, south of East Foreland and West Foreland (Rugh et al. 2000). During surveys conducted in subsequent years, in June 1996-2011 (*Figure 10*), only three belugas (one in Tuxedni Bay in 1997 and two in Kachemak Bay in 2001) were seen in the lower inlet. Furthermore, in the southern half of the upper inlet, south of North Foreland and Point Possession, sighting rates dropped from an annual average of 1.5% during 1993-1995, to zero for all subsequent years until June 2012 (Shelden et al. 2019). With the exception of June 2012, 2018, and 2021 (when belugas were found in Trading Bay), the only places where belugas were consistently found during the abundance surveys were waters north of North Foreland and Boulder Point (*Figure 11*). A steep decline in the number of June sightings in both Knik Arm and Turnagain Arm also occurred after 2007 (*Figure 11*).



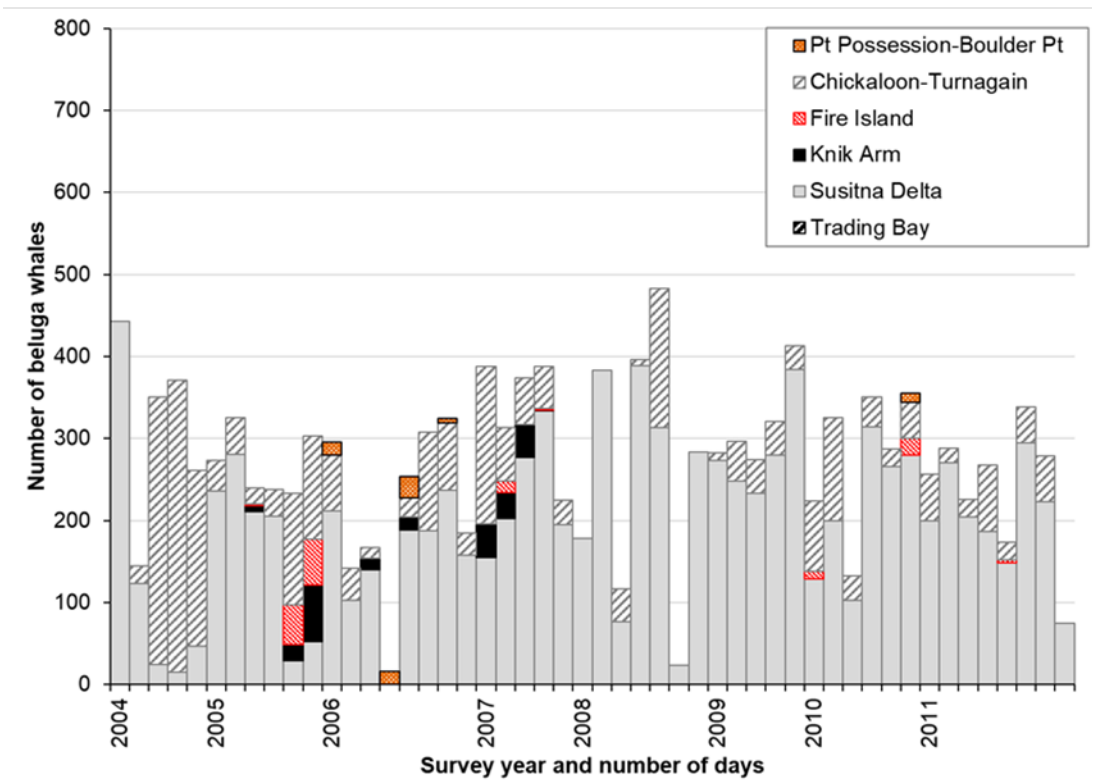


Figure 10. Regions occupied by belugas in Cook Inlet, Alaska, each day of the NMFS abundance survey during the period 1994 to 2003 (top panel) and 2004 to 2011 (bottom panel). Each survey day is represented as a single bar above and following the year indicated on the x-axis (originally published in Shelden et al. 2019).

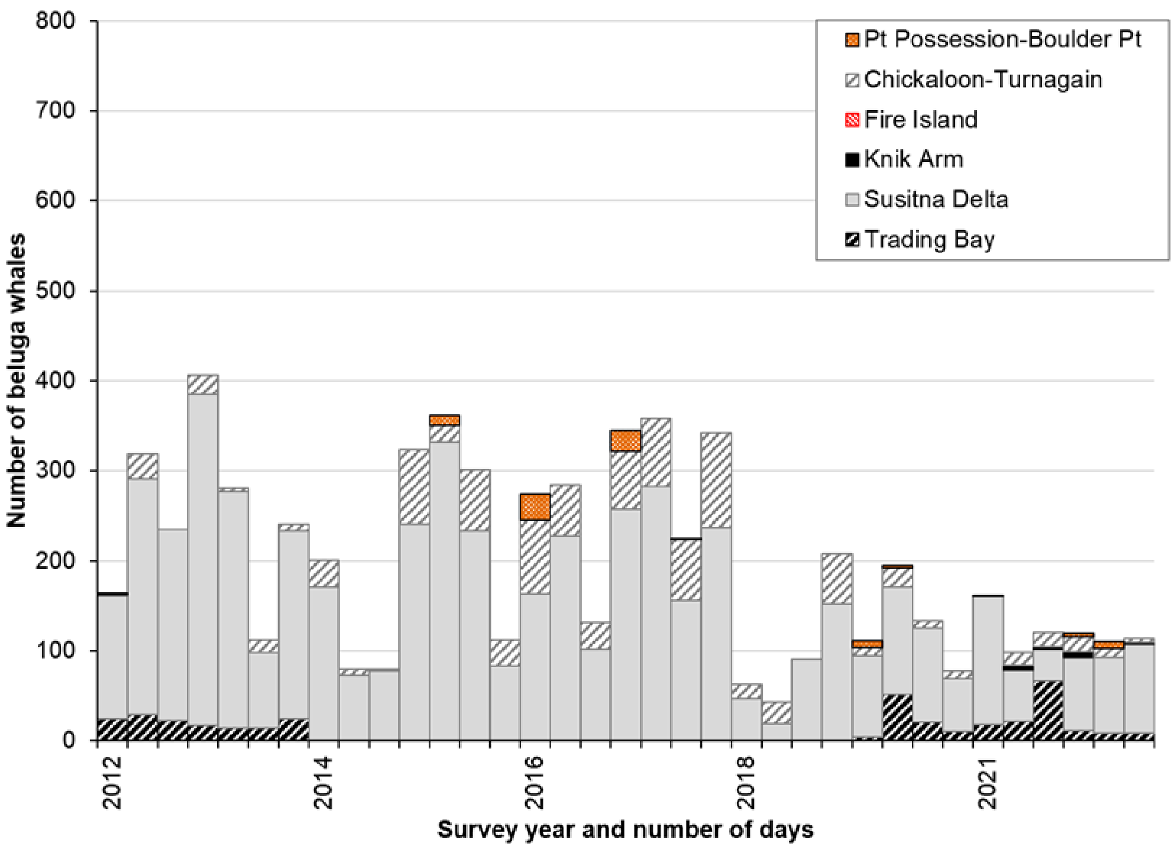


Figure 11. Regions occupied by belugas in Cook Inlet, Alaska, each day of the NMFS abundance survey during the period 2012 to 2021. Each survey day is represented as a single bar above and following the year indicated on the x-axis (earlier version originally published in Shelden et al. 2019).

Review of beluga presence data from aerial surveys, satellite-tagging, and opportunistic sightings collected in Cook Inlet from the late 1970s shows their range has contracted remarkably since then (Shelden et al. 2015b). This differs markedly from surveys in the early 1970s when whales were found in, or would disperse to, lower Cook Inlet by midsummer. Since 2008, on average 81% of the total population occupied the Susitna Delta in early June during the aerial survey period, compared to roughly 50% in the past (1978-79, 1993-97, 1998-2008). Cook Inlet beluga range during 2009-18 was estimated to be only 29% of the range observed in 1978-79 (Shelden et al. 2019) (*Figure 12*), similar to the 2009-16 range (Shelden et al. 2017) and a slight increase from the 2009-14 range of 25% presented in Shelden et al. (2015a). Rugh et al. (2000) first noted that whales had not dispersed to the lower inlet in July during surveys in the mid-1990s. This was also evident during aerial surveys conducted in July 2001 (Rugh et al. 2004). Whales transmitting locations from satellite tags during July in 1999 and 2002 also remained in the northern reaches of the upper inlet (Shelden et al. 2015b, 2018). During surveys in the 1970s, large numbers of whales were scattered throughout the lower inlet in August (Shelden et al. 2015b). This was not the case in 2001, when counts in the upper inlet were similar to those reported in June and July of that same year (Rugh et al. 2004). Only two of ten tagged whales spent time in offshore waters and the lower inlet in August (Shelden et al. 2015b, 2018). Numbers of whales observed during August calf index surveys conducted from 2005 to 2012 were also within the range of counts reported during the June surveys (Hobbs et al. 2015c, Shelden et al. 2015b).

This contraction in range appears to have continued into late summer. While surveys were not conducted in September during the 1970s and 1980s, aerial surveys in 1993 suggest some dispersal into lower inlet waters by late September (Shelden et al. 2015b). However, surveys in September and October of 2001 resulted in counts that were within the range of counts made in June that same year (Rugh et al. 2004), indicating that late summer/early autumn movement into the lower inlet did not occur. With the exception of three whales that spent brief periods of time in the lower inlet in September and/or October, most whales transmitting locations in 1999, 2000, 2001, and 2002 remained in the upper inlet north of East and West Foreland (Shelden et al. 2015b, 2018). Counts during aerial surveys in September 2008 were also within the range of counts obtained during surveys in June (Shelden et al. 2015b), showing continued lack of early autumn dispersal into the lower inlet.

Wolf et al. (2018) conducted weekly aerial surveys of upper Cook Inlet from April to November in 2013 and 2014. They concluded that: "Deeper investigation is needed to monitor seasonal and annual variability in habitat use by Cook Inlet belugas, but analyses based upon 2013 and 2014 survey data suggest potential to exploit regular beluga movement patterns to schedule the timing and locations of planned activities to reduce the probability of beluga disturbances. It should be noted; however, that aerial surveys described in this work did not include Turnagain Arm or Knik Arm. Both of these locations have been highlighted in previous work as use areas for Cook Inlet beluga whales (Hobbs et al. 2006)" (Wolf et al. 2018). The importance of these regions has clearly been stated in a number of publications not cited in the paper (e.g., Hobbs et al. 2015c, Shelden et al. 2015b) that describe Cook Inlet beluga habitat use in months other than June. Photo-identification studies conducted since 2005 have also played an important role describing seasonal and annual variability in habitat use.

During a photo-identification study that spanned from 2005-2017 and included the months of April-October, Cook Inlet belugas were found seasonally in distinct areas where they aggregated in large groups of both sexes and all age classes while rearing calves and feeding (McGuire et al. 2020b). These areas included the Susitna River Delta, Knik Arm, Chickaloon Bay-Fire Island, and Turnagain Arm in the upper inlet, and the Kenai River Delta in the lower Inlet. The authors emphasized that these areas, and the general corridors connecting them, represent important beluga habitat that warrants focused management attention and protection efforts. Aerial surveys funded by the Bureau of Ocean Energy Management (BOEM) and conducted in early spring and late autumn 2018-2021 have provided additional information on beluga distribution outside of the summer months (V.A. Gill, pers. comm.) (*Figure 13*). Groups were still present in the upper inlet during early spring and late autumn but belugas were also observed in the Kenai and Kasilof rivers, Tuxedni Bay, and near Kalgin Island in the lower inlet (*Figure 13*).

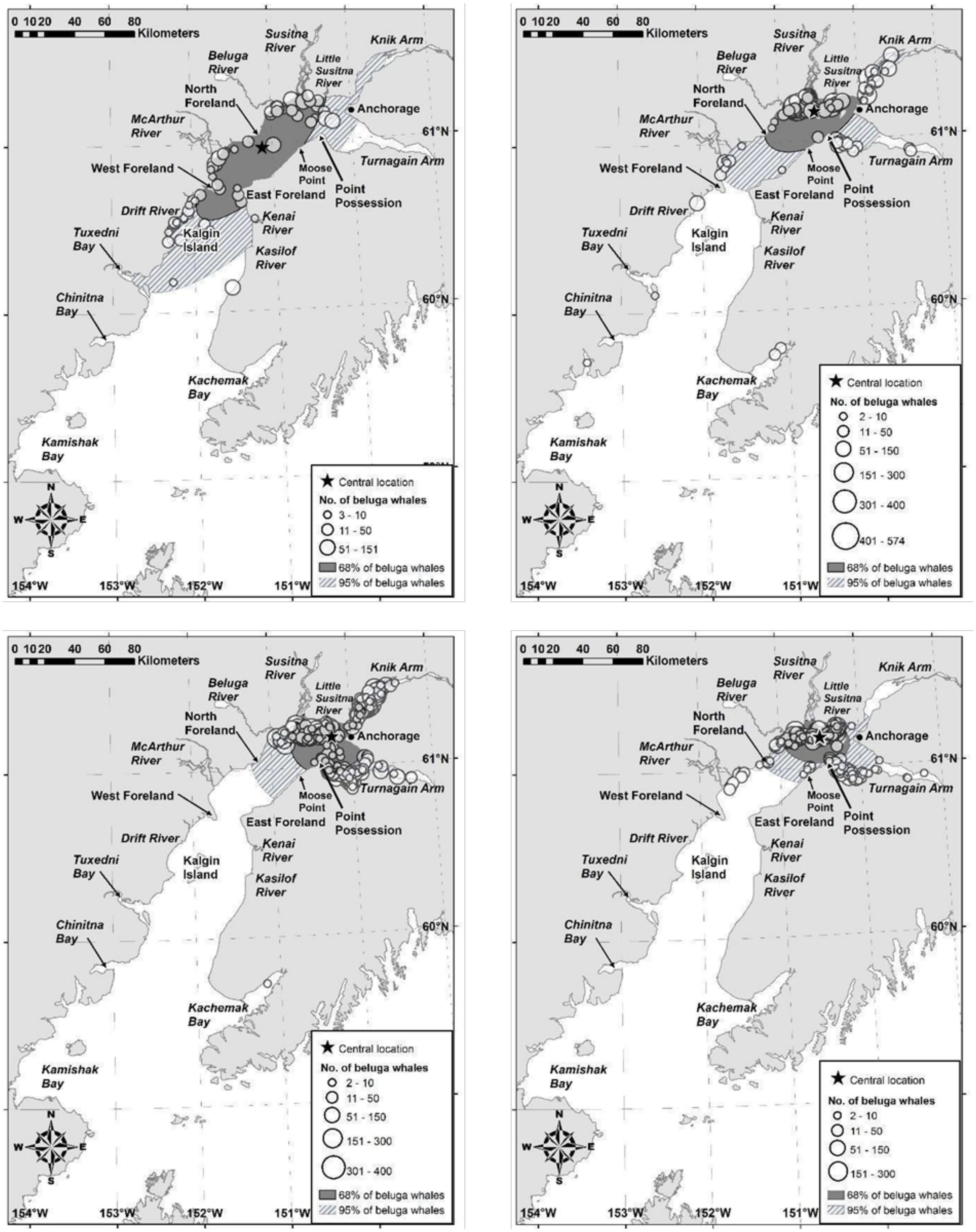


Figure 12. Areas occupied by belugas in Cook Inlet, Alaska, during systematic aerial surveys in 1978–79 (upper left panel), 1993–97 (upper right panel), 1998–2008 (lower left panel), and 2009–18 (lower right panel). The distribution of belugas around each central location for each period was calculated at 1 and 2 SD (capturing ca. 68% and 95% of the whales; shaded regions). (Figure 18 in Shelden et al. 2019)

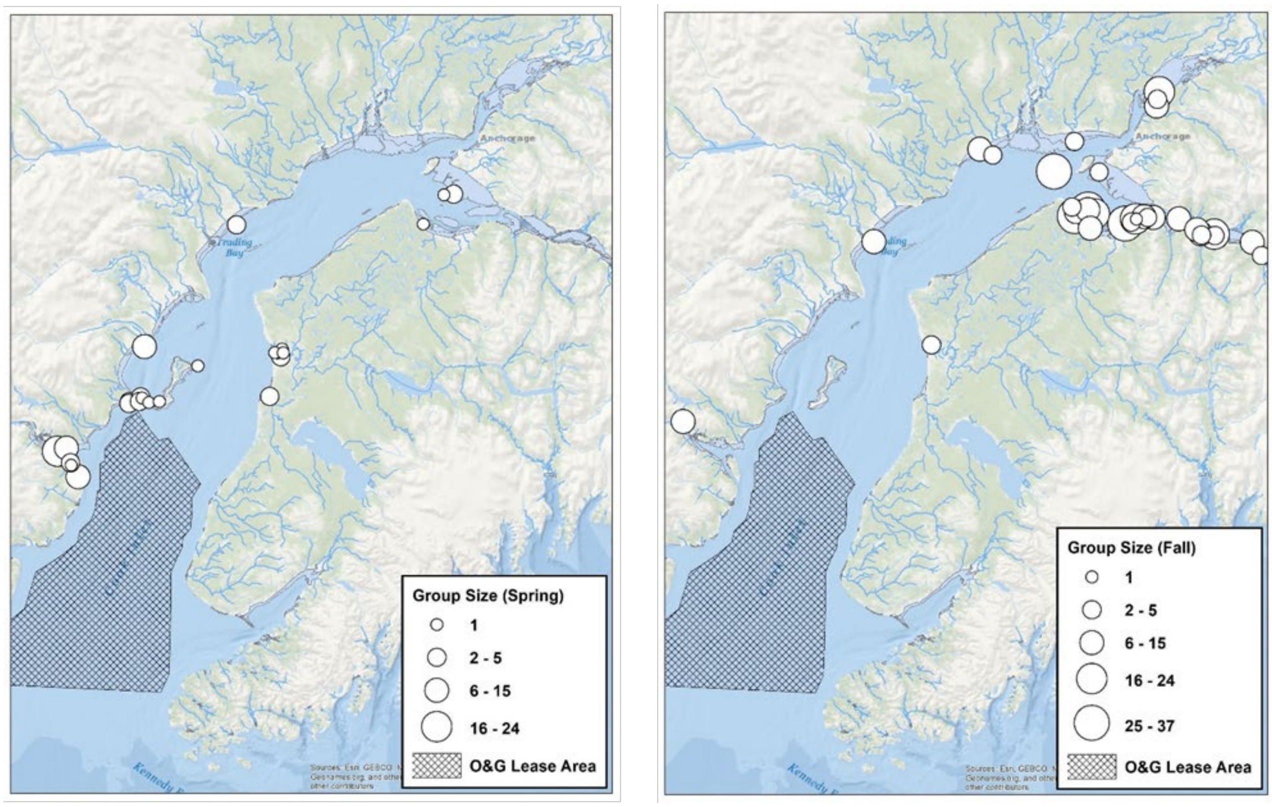


Figure 13. Beluga whale sighting locations (white circles) during aerial surveys conducted in spring (March-April) and fall (Sept/Oct-Nov/Dec) 2018-2021.

Winter distribution (December – February) for Cook Inlet belugas has been difficult to quantify given the combination of poor sighting conditions (low light levels in winter and white whales among ice floes) and whale behavior (close association with ice, longer, deeper diving patterns, and smaller groups). Tagging data and opportunistic sightings show belugas continued to enter coastal areas of the upper inlet despite occasional heavy ice conditions (Shelden et al. 2015b, 2018).

Acoustic monitoring studies have been conducted to detect belugas in Cook Inlet year-round since 2008 (e.g., Castellote et al. 2011, 2020, 2021). These studies found that acoustic detections of beluga presence within ~3.3 km of an acoustic mooring (*Figure 2*) remained high in the upper inlet during the winter period (November to April), in particular the coastal areas from Trading Bay to Little Susitna River, with foraging behavior detected in lower Knik Arm and Chickaloon Bay, and also detected in several areas of the lower inlet such as the Kenai River, Tuxedni Bay, Big River, and NW Kalgin Island (Castellote et al. 2020, unpublished). Acoustic monitoring at the mouth of Eagle River has also documented beluga presence in Eagle Bay and thus Knik Arm during all months of the year with the exception of February (C. Garner, pers. comm.). These results highlight how beluga presence in areas of the upper inlet, including Knik Arm, is more prevalent than previously suggested (Castellote et al. 2020). The population appears to now be consolidated into habitat in the upper-most reaches of Cook Inlet for much longer periods of time, habitat that is most prone to effects of anthropogenic development (e.g., Kendall and Cornick 2015, Norman et al. 2015, Castellote et al. 2018).

2.3.1.6 Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem)

The loss or degradation of habitat has been identified as a potential threat to Cook Inlet beluga recovery and understanding this threat is a priority focus of recovery work (NMFS 2016). Goetz et al.

(2012a,b) built upon previously published work (Goetz et al. 2007, Hobbs et al. 2005) to provide updated information on the spatial distribution, movement, and dive behavior of Cook Inlet belugas. Since publication of Goetz et al. (2007), additional parameters and models have been considered when quantifying preferred habitat during the early summer period (Goetz et al. 2012a). Goetz et al. (2012a) modeled habitat preferences using the NMFS 1994–2008 abundance survey data. They found that in large areas, such as the Susitna Delta and Knik Arm, there was a high probability of beluga presence, and, when present, group sizes were likely to be larger. Presence also increased closer to rivers with salmon runs (such as the Susitna River), which also supports two major spawning migrations of eulachon in May and July. The importance of areas with known salmon runs is further supported by the presence of Pacific salmon in the stomachs from belugas that stranded during the same period as NMFS abundance surveys (Quakenbush et al. 2015).

McGuire et al. (2020b) found predictable seasonal patterns in distinct habitat hotspots that persisted during the years of their photo-identification studies from 2005-2017. They also found distinguishable patterns of beluga movement during tidal cycles within these hotspots. Areas where belugas aggregated in large numbers included: the Susitna River Delta from mid-May – early June and mid-July – mid-August, traveling up rivers with the incoming tide; and Knik and Turnagain Arms from mid-August into autumn, moving farther into these areas on incoming tides. Whales departed Turnagain Arm on the low tide but did not always follow this pattern in Knik Arm. The Kenai River Delta was important to small groups in spring and autumn, but whales were not present every day or during extreme low tides. Whales in Chickaloon Bay tended to travel across the upper inlet into the Susitna River Delta on the rising tide in spring; then followed a similar pattern in autumn but instead traveled into Turnagain Arm. Calf-rearing habitat was not limited to a single nursery area, instead all areas with aggregations of belugas included not only neonates but older calves as well (McGuire et al. 2020b). Individual belugas identified during this study moved among areas and did not display any strong fidelity to a particular zone, though a few individuals were never photographed in some areas (i.e., Turnagain Arm) possibly indicating preference for other areas. Groups did not appear to segregate by age class or sex, though the largest groups sometimes included more homogenous subgroups, which may be driven by prey size, as females and subadults consume smaller prey than adult males. Feeding behavior was observed during this study in all survey zones (i.e., the upper inlet north of Chuitna River and Point Possession, and near shore in the Kenai River area) (McGuire et al. 2020b), though not within the confines of Chickaloon Bay (instead closer to the southern end of Fire Island). However, it was not possible to access river mouths with the vessel in this area, and acoustic recorders moored near the river detected foraging terminal buzzes from May through December with peaks in September and October (Castellote et al. 2020).

To date, there is no obvious reason why belugas were not visually observed in Knik Arm during aerial surveys in June from 2008 to 2018 (Shelden et al. 2019). This was not evident in the analyses presented by Goetz et al. (2012a) because analyses ended with the June 2008 survey. Similar patterns were also found in the opportunistic sighting databases maintained by the AFSC Marine Mammal Laboratory and the Cook Inlet Beluga Whale Photo-ID Project. Although whales were observed near Anchorage, by the Port of Alaska and boat launch and sometimes in Ship Creek, no opportunistic sightings have been reported north of these areas in June since 2007. Belugas have not been observed in Knik Arm in June since 2005 during photo-identification surveys conducted from 2005-2019 (McGuire et al. 2020b, T. McGuire, unpublished data). During the 2021 abundance survey, which occurred in late June, small numbers of belugas were observed in Knik Arm in Goose Bay and Eagle Bay (K.E.W. Shelden, pers comm). Knik Arm was not abandoned for the entire summer, however, as large groups were observed there during photo-identification surveys conducted in other months (McGuire et al. 2020b), every August during aerial surveys in 2008–2012 (Hobbs et al. 2015a), and late August and

September during unmanned aircraft and biopsy surveys 2016-2019 (McGuire et al. 2017, 2018, P.R. Wade, unpublished data). However, while belugas have rarely been visually observed in Knik Arm in June acoustic results show variable presence of beluga whales in Knik Arm in May and June in 2010, 2011, and 2012 (Castellote et al. 2020), and more recent unpublished acoustic data show detections in Knik Arm in June 2018 (mouth of Ship Creek and Cairn Point).

Goetz et al. (2012a) noted that anthropogenic disturbance, inferred by distance from coastal cities and oil development, was a significant predictor of beluga presence. Though presence increased with distance from these areas, the authors cautioned that many of the anthropogenic disturbance sources were south of the Susitna Delta, and that prey preferences rather than avoidance of development may be a stronger driver for this predicted distribution. A study focused on understanding whether anthropogenic noise could drive beluga habitat preference was conducted in Eagle River, Trading Bay, and Tuxedni Bay (Small et al. 2017). Even though noise metrics (sound pressure level and noise duration) appeared in high-ranking models as covariates for occupancy probability, the data were insufficient to indicate better predictive ability beyond those models that only included environmental covariates, thus the study was inconclusive (Small et al. 2017). Castellote et al. (2018) evaluated the diversity and acoustic properties of anthropogenic noise detected in 8,756 hours of acoustic recordings from 7 different locations within beluga critical habitat. Nine total sources of noise were identified: commercial ship, dredging, helicopter, jet aircraft (commercial or military non-fighter), fighter jet, propeller aircraft, outboard motor, pile driving, and sub-bottom profiler, as well as four repetitive noises of unidentified mechanical origin. Several anthropogenic noise sources were reported at levels with the potential to chronically mask beluga communication and hearing in most of the locations and periods sampled in the study. Sounds from activities such as shipping and dredging exceeded behavioral harassment levels on a daily basis. Ship noise was identified as the top priority focus for noise mitigation management actions (Castellote et al. 2018). A high concentration of noise sources was identified in the lower region of Knik Arm, and this area was recommended by the authors for further research to evaluate the potential for beluga displacement and the basis to start considering cumulative impact effects in permitting processes. Additional acoustic research in Cook Inlet beluga habitat, including Knik Arm, is ongoing and will explore these recommendations.

Belugas appear to have stronger site fidelity during the early summer period, as evidenced by a single tagged whale and aerial survey records (Shelden et al. 2015b). The one whale tagged during May transmitted locations throughout the entire summer period, remaining in the Susitna Delta from late May to late July, before moving to Turnagain Arm in late July, and Knik Arm in August (Shelden et al. 2018). While some of the whales tagged in late July and August moved throughout the upper inlet in August, others remained for long periods in a few locations such as Knik Arm, the Susitna Delta, and Turnagain Arm (Shelden et al. 2015b, 2018). Similar patterns have been observed during the Cook Inlet beluga Photo-ID project, with whales remaining within specific regions such as the Susitna Delta for long periods during the early summer (T. McGuire, pers. comm.) but then beginning to move between regions (e.g., Knik and Turnagain arms), sometimes in the same day, later in the summer (McGuire et al. 2020b).

Preliminary analyses of the dive data collected by satellite tags indicate that whales made shorter, shallower dives during June to November compared to the longer, deeper dives recorded during December to May (Goetz et al. 2012b, Shelden et al. 2018). A whale tagged in late May 1999 showed time at surface increased daily from 31 May to 11 June (Hobbs et al. 2015b). This would be expected as belugas follow anadromous fish runs into shallow channels within the tidal flats of the Susitna Delta. Spending more time at the surface also increases the likelihood of aerial observers detecting these whales. Near the end of August, two of the tagged whales spent brief periods in the lower inlet. In all three years, a few whales spent time in mid-inlet waters of the upper inlet in August (Shelden et al. 2018). Although only a few animals were tagged, individual movement and dive behavior may reflect those of a much larger group of whales. Unfortunately, lower inlet and most mid-inlet tag locations did not coincide with aerial survey effort or opportunistic sightings (Shelden et al. 2015b).

Despite the possibility of ice entrapment, belugas remain in upper inlet waters during winter (Shelden et al. 2015b, Castellote et al. 2020). Large tidal fluctuations create a dynamic ice environment such that whales were able to access the upper reaches of Knik Arm and Turnagain Arm during the winter period. Although whales tagged in 2001 never entered these areas, opportunistic sightings confirmed whales were present (Shelden et al. 2015b). Goetz et al. (2012b) found that movements of tagged belugas were influenced by the presence of ice in Cook Inlet during the winter. Examining the biweekly proportion of ice type (ranging from very open pack to compact ice) and percent cover for the entirety of Cook Inlet, from December 2001–March 2002 and December 2002–April 2003, showed that total ice cover was always less than 50%. When ice was present, belugas were most commonly found in open pack ice (winter of 2001–02) and very open pack ice (winter of 2002–03). During the winter of 2001–02, belugas (n = 2) preferred open water only 2% of the time when ice was present compared to 30% during the winter of 2002–03 (n = 3). On most occasions when belugas preferred open water, ice covered less than 10% of Cook Inlet.

In addition to a close association with ice, increased dive duration may decrease the detection of beluga whales during winter aerial surveys. Analysis of the dive data from tagged whales indicates that whales were diving deeper and longer during the period December–May compared to the period June–November (Goetz et al. 2012b). Average depth (m) and duration (minutes) increased almost three times, from 3.0 m (SD = 4.7) to 8.2 m (SD = 12.3) and 1.6 minutes (SD = 1.9) to 5.2 minutes (SD = 5.5) for the 11 whales equipped with ST-16 tags (Goetz et al. 2012b). In spring, when the ice breakup begins, whales aggregate as they regain access to river mouths (Shelden et al. 2015b). In early spring, whales continued to move throughout mid-inlet waters. Not until late spring and early summer, when anadromous fish return to natal streams, did whale dive behavior shift to shorter and shallower diving patterns (Hobbs et al. 2015b; Goetz et al. 2012b). Group sizes tended to be smaller in spring, until the end of May when whales began to coalesce into larger groups at the river mouths (Shelden et al. 2015b).

2.3.1.7 Other

A number of other studies that support Cook Inlet beluga whale recovery efforts have been undertaken since the previous 5-year review, including visual monitoring and citizen science, baseline data collection of the beluga auditory sensory system, and photograph analysis of physical trauma. These are further described below.

Additional monitoring studies have occurred, and in some cases are continuing in Cook Inlet. These included the use of video cameras to monitor whales within the Little Susitna River (Polasek et al. 2015), and a citizen science study conducted in collaboration with AFSC Marine Mammal Laboratory scientists collecting shore-based observations along Turnagain Arm and Knik Arm (Carlson et al. 2015). A second citizen science study is ongoing: Established in 2019, the Alaska Beluga Monitoring Program (AKBMP) is a collaboration between NOAA Fisheries and the Alaska Wildlife Alliance, the Alaska Wildlife Conservation Center, the Beluga Whale Alliance, Defenders of Wildlife, and the Kenai Peninsula College of the University of Alaska, Anchorage. Public volunteers are trained and deployed to visually monitor for belugas at six sites (Kenai and Kasilof rivers, 20 Mile Creek, Portage Creek, Bird Point, and Ship Creek) accessible from the road system. Monitoring occurs during the fall, and, beginning in 2021, the spring. Data collected include: location, group size, age class, behavior, and the presence and types of nearby anthropogenic activities. Photographs are also collected. All data are compiled and photographs are shared with the Cook Inlet Beluga Whale Photo-ID Project. Visual monitoring is also conducted in compliance with mitigation required by section 7 consultation on federal actions, with beluga sightings and other relevant information (e.g., group size, behavior, location) reported to NOAA Fisheries Alaska Region and the Cook Inlet Beluga Whale Photo-ID Project.

For the first time, auditory evoked potentials were used to measure the hearing of a wild, stranded Cook Inlet beluga whale (now in captivity) as part of its rehabilitation assessment (Mooney et al. 2020). The beluga showed broadband (4–128 kHz) and sensitive hearing (<80 dB) for a wide-range of frequencies (16–80 kHz), reflective of a healthy odontocete auditory system. Hearing was similar to healthy, wild adult belugas from the Bristol Bay stock measured during health assessments (Castellote et al. 2014, Mooney et al. 2018). Mooney et al. (2020) compared their hearing data with measurements of pile driving and container ship noise in Cook Inlet, two sources of concern, and determined that masking is likely at ecologically relevant distances.

Individual belugas photographed during the period 2005-2017, along with stranding records, were examined to determine prevalence of scars indicative of anthropogenic trauma (McGuire et al. 2020c). Scars were classified by likely source (e.g., entanglements, vessel strikes, puncture wounds, and research). Out of 78 whales examined, 7 had signs of trauma confirmed or possibly from entanglement with rope or lines, 6 had signs of trauma that were possibly from entanglement or from a vessel collision, 3 had signs of trauma possibly from a vessel collision or a predation attack, 4 had signs of possible puncture scars consistent with bullets, arrows, or harpoons, and 2 had signs of trauma consistent with a vessel collision. The authors concluded the sample did not allow them to reliably infer the rate of anthropogenic trauma at the population level, but the study does provide evidence of the types and level of trauma experienced by a subset of the population.

2.3.2 Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)

Below is an updated analysis of the five factors that determine listing status per section 4(a)(1) of the ESA, as applied to Cook Inlet beluga whales.

2.3.2.1 The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range

Habitat for this species has been modified by municipal, industrial, and recreational activities throughout Cook Inlet. It is possible that the range of Cook Inlet beluga whales has been diminished by these activities, either individually or cumulatively. Rugh et al. (2000, 2010) indicated that the summer occurrence of Cook Inlet beluga whales shifted to the upper Inlet in recent decades, whereas historically, belugas were also found in the mid- to lower inlet. Such a change could be due to habitat alteration or development, but could also be attributed to other factors. For example, the population reduction may have resulted in Cook Inlet beluga whales inhabiting only the preferred feeding areas (i.e., the upper Inlet) within their normal range. Therefore, the change in distribution does not necessarily reflect any reduction in habitat or habitat quality in the mid- to lower inlet. No information exists that beluga habitat has been modified or curtailed to an extent that it is likely to have caused the population declines observed within Cook Inlet. However, concern is warranted regarding the project-specific effects of continued development within and along upper Cook Inlet as well as the cumulative effects on important beluga habitat. Several significant developments within both the upper and lower Inlet are permitted, planned, or underway, which may have adverse consequences, including: (1) major expansion to the Port of Alaska, which requires filling more than 135 acres of intertidal and subtidal habitat, with increased in-water noise from pile driving, dredging, and expanded port operations; (2) continued oil and gas exploration, development, and production in state waters and oil and gas exploration in state and federal waters; and (3) activities that discharge or accidentally spill pollutants (e.g., petroleum, seafood processing, ship ballast, municipal wastewater treatment systems, runoff from urban, mining, and agricultural areas). The extinction risk assessment (Hobbs et al. 2008) indicates that very small increases in mortality for this DPS would have large effects on its continued existence. Destruction and modification of habitat may reduce carrying capacity or fitness for individual whales, with the same consequence to the population survival as direct mortalities. Therefore, threatened destruction and modification of Cook Inlet beluga whale DPS habitat continues to contribute to the population's endangered status.

2.3.2.2. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

A brief commercial whaling operation existed along the west side of upper Cook Inlet during the 1920s, where 151 belugas were harvested in 5 years (Mahoney and Shelden 2000). There was also a sport (recreational) harvest for beluga whales in Cook Inlet prior to enactment of the MMPA in 1972. We have no record on this harvest level. The 1979 whale survey by the Alaska Department of Fish and Game (Calkins 1989) provided an abundance estimate of 1,293 whales. Although we are uncertain of the level of depletion and exploitation in 1979, this remains the largest population abundance estimate for the Cook Inlet beluga DPS. Based on this estimate, NMFS used 1,300 belugas as the carrying capacity in the population viability analysis (PVA) for the extinction risk assessment (Hobbs et al. 2006). With protections offered by the MMPA, commercial and recreational beluga harvests are no longer allowed.

Due in part to the extreme tidal conditions of Cook Inlet, commercial whale watching ventures are absent from Cook Inlet and little recreational boating occurs. Therefore, any impacts from these types of activities to Cook Inlet beluga whales are considered to be minimal.

Under the MMPA and ESA, NOAA may authorize 'takes' of Cook Inlet beluga whales for certain specific purposes. Under the MMPA, to "take" means "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal" (16 U.S.C. 1362(13)),[3] and there are two statutory levels of "take" by harassment: Level A and Level B (16 U.S.C. 1362(18)).[4] For all activities other than military readiness activities, Level A harassment is defined as any act of pursuit, torment, or annoyance that has the potential to injure a marine mammal or marine mammal stock in the wild. Level B harassment for non-military readiness activities is any act of pursuit, torment, or annoyance that has the potential to disturb (but not injure) a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering. Under sections 101(a)(5)(A) & (D) of the MMPA, upon request, NMFS issues authorizations that allow incidental (unintentional) take of marine mammals to U.S. citizens, provided those takes will not have more than a "negligible impact" on the species or stock (16 U.S.C. 1371(a)(5)) and other requirements are met. Authorizations under section 101(a)(5)(A) can include mortality and serious injury; authorizations under section 101(a)(5)(D) are limited to harassment. Any such authorization must include measures to ensure the least practicable adverse impact on the affected species or stock and its habitat, and expanded measures are typically included for belugas (e.g., restricting activities at the Susitna delta to avoid more severe disruptions of foraging in an important

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[3] The ESA definition of "take" is similar: "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." 16 U.S.C. 1532.

[4] Based on NMFS guidance, the term "harass" under the ESA means to: "create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering" (Wieting 2016).

area). The MMPA incidental take authorization process includes agency review and analysis of potential impacts to the whales and the NMFS Office of Protected Resources tracks all takes that the agency authorizes. Issuance of MMPA incidental take authorizations also must comply with all requirements of the ESA.

The Office of Protected Resources' Incidental Take Program issued 7 incidental take authorizations from 2017 to 2021, authorizing a total of 346 instances of take of Cook Inlet beluga whales, by Level B harassment only, for activities including seismic airgun operation, construction, and fisheries research. One of the 7 projects, which authorized 120 of the 346 total harassment takes, ultimately did not occur. Pursuant to the remaining authorizations, of the 226 takes authorized, only 1 of the 6 projects, for construction, reported visual or acoustic detections within an estimated harassment zone (here assumed to equate to incidental takes), with 26 such detections reported, though we recognize that not all occurrences of whales within estimated harassment zones are likely detected. Reports for two projects authorizing incidental take in 2021 are not yet available. Of all the takes authorized (research, discussed below, and incidental combined), 0.4% or less in any year from 2017 to 2021 were for incidental harassment. No incidental or directed take authorizations were issued that included authorization of take by mortality or serious injury.

Section 104 of the MMPA allows for the permitting or authorization of the directed take of marine mammals for research, enhancement, or public display, and as with incidental take authorizations, any such permit or authorization must comply with the ESA. Scientific research and enhancement permits that authorize take of ESA listed marine mammals, including Cook Inlet beluga whales, are issued as joint permits under section 104 of the MMPA and section 10(a)(1)(A) of the ESA. In limited situations, permits may be issued under the MMPA only for endangered species if the permit authorizes Level B harassment and it has been determined that the activities will not likely adversely affect the species under the ESA. From 2017 through 2021, 11 MMPA/ESA research and enhancement permits authorized directed take of Cook Inlet beluga whales; these permits on average authorized approximately 20,680 takes per year, the majority of which are for aerial and vessel surveys to conduct population monitoring (see discussion of takes below). In 2019, to support ESA section 7 consultation, the Office of Protected Resources completed a programmatic biological opinion with an extensive analysis of research impacts on endangered cetaceans (NMFS 2019). A key conclusion of that biological opinion was that proposed research efforts directed at any cetacean population listed as endangered or threatened under the ESA, including Cook Inlet beluga whales, were unlikely to cause a change in abundance or reproduction.

Migura and Bollini (2021), asserted that an increase in the authorized number of takes of Cook Inlet belugas when projected to occur through 2025 is statistically correlated with the decreasing population size of this population. However, the authors did not evaluate the severity of the potential impacts from the authorized take. For instance, the vast majority of the authorized research takes (which comprise over 99% of the total authorized take in any year) are for remote, non-invasive methods such as photo-identification during aerial and vessel surveys that have the potential to result in only a minor degree of Level B harassment under the MMPA. Further, the programmatic biological opinion (NMFS 2019) prepared for NMFS' cetacean research and enhancement permitting program determined that these methods (aerial and vessel surveys) are not likely to adversely affect any ESA-listed populations or species, including Cook Inlet beluga whales. For example, permitted researchers conducting aerial or vessel-based surveys are directed to count each sighting that is closer than the distances of NMFS wildlife viewing guidelines as a take because the activities have the potential to harass animals, regardless of the likely severity of those takes. Further, for research activities, authorized takes are typically a larger number than the actual takes that occur. For example, 22,090 takes were authorized for Cook Inlet beluga research occurring in 2019 but only 2,405 takes occurred. Given this difference, it is unlikely that the correlation Migura and Bollini (2021) strive to make (between projected future authorized take numbers and the Cook Inlet beluga whale population decline) exists. In addition, long-term trend analysis of authorized take levels is not advisable because there have been changes in how take is interpreted and characterized in research permits. This means that, in some cases, take numbers across permits and across years are not directly comparable and at face value may seem like an increase in authorized take numbers. In recent years, managers have simplified how take numbers in research permits are determined to provide a more consistent approach to counting take across incidental and directed take permitting programs. OPR will continue to closely analyze the number of takes requested and used by researchers each year.

In addition to activities involving free-ranging Cook Inlet belugas, a single individual is currently housed in captivity. “Tyonek,” a young calf, live-stranded near Trading Bay in Cook Inlet in 2017. With authorization from NMFS, the Alaska Sealife Center and partners provided rehabilitative care; however, NMFS determined that the animal was non-releasable due to underlying medical problems. Tyonek is now permanently located at Seaworld San Antonio, Texas, pursuant to a scientific research and enhancement permit, which includes an educational component. NMFS considers this to be a unique incident; there are no plans to house additional Cook Inlet beluga whales in captivity in the foreseeable future. Therefore, the long-term holding of Tyonek in captivity does not contribute to the DPS’s endangered status.

2.3.2.3 Disease or Predation

A considerable amount of information now exists on the occurrence of diseases in beluga whales, including Cook Inlet belugas, and the effects of these diseases on the species. This information is described in the Conservation Plan, with more recent information provided earlier in this 5-year review. Diseases and parasites occur in Cook Inlet beluga whales. Despite the considerable pathology testing that has been done on belugas, nothing indicates that the occurrence of diseases or parasites has had a measurable impact on their survival and health. Therefore, diseases and parasites are not known to be factors that contribute to the current status of the Cook Inlet beluga whale DPS.

Transient killer whales are a natural predator on beluga whales in Cook Inlet. Killer whale sightings in the upper inlet are relatively infrequent, and not all killer whales prey on marine mammals. However, killer whales are thought to take at least one Cook Inlet beluga per year (Shelden et al. 2003). Assessing the impact of killer whale predation on Cook Inlet beluga whales is difficult. Anecdotal reports often highlight the more sensational mortalities on beluga whales due to killer whales, thereby overemphasizing their impact. Further, some reports are from the early 1980s when beluga whales were more abundant and more widely distributed. Consequently, the predation reports are of minimal value in evaluating current killer whale impacts to the Cook Inlet beluga whale DPS. The loss of more than one beluga whale annually could impede recovery, particularly if total mortality due to predation would be near the recruitment level in the DPS. The best available information does not allow us to accurately quantify the mortality level due to killer whale predation or its effect on the DPS. However, continued removal of belugas in excess of one per year would have a significant effect on the extinction probability for the Cook Inlet beluga whale. While disease and predation occur in the Cook Inlet beluga population and may affect reproduction and survival, neither appears to be a likely contributor to the observed decline. However, the present low population abundance and the gregarious nature of beluga whales predispose the population to significant consequences from disease and predation, which may impede recovery and contribute to the probability of extinction, and, therefore, to the classification as endangered under the ESA.

2.3.2.4 Inadequacy of Existing Regulatory Mechanisms

The MMPA exempts Alaska Natives from the prohibitions on the taking of marine mammals for subsistence purposes and for purposes of creating and selling authentic native articles of handicraft, including all beluga whale stocks in Alaska, providing such takes are not wasteful (16 U.S.C. 1371(b)). Sections 101(b) and 103 of the MMPA authorize the prescription of regulations for the subsistence harvest of marine mammal stocks designated as depleted under that Act, after notice and administrative hearings as prescribed by the MMPA. Prior to May 1999, excessive harvests of Cook Inlet beluga whales occurred (see Section 2.3.2.5 below). This prompted the passage of Public Law 106–31, section 3022, requiring any taking of Cook Inlet beluga whales by Alaska Natives to occur pursuant to a cooperative agreement between NMFS and affected Alaska Native organizations (Shelden et al. in press) or would otherwise be considered a violation of the MMPA. This law, later made permanent by Public Law 106–553, did not specify a harvest level, nor present a harvest management plan. In May 2000, NMFS designated the Cook Inlet belugas as a depleted stock under the MMPA (65 FR 34590; May 31, 2000). NMFS promulgated interim harvest regulations that provided a harvest management plan from 2001 through 2004 (69 FR 17973; April 6, 2004). Harvests from this population were restricted thereafter via cooperative efforts by Native hunters and NMFS, and in 2008, NMFS issued final regulations establishing long-term limits on the maximum number of Cook Inlet beluga whales that may be taken by Alaska Natives for subsistence and handicraft purposes (73 FR 60976; 50 CFR 216.23(f)). These regulations are intended to conserve and manage Cook Inlet belugas under applicable provisions of the MMPA until the whales are no longer depleted under the MMPA. Since 2006, there has been no lethal take of Cook Inlet beluga whales for subsistence purposes (see also Section 2.3.2.5, below).

Under Section 7 of the ESA, federal agencies consult with NMFS on actions they authorize, fund, or undertake that may adversely affect Cook Inlet beluga whales. NMFS also issues MMPA permits and authorizations for activities that may incidentally take Cook Inlet belugas, and for allowable intentional take (e.g., for research purposes, as discussed in Section 2.3.2.2). These regulatory processes provide opportunities for the development and implementation of mitigation measures that reduce or avoid take, such as vessel speed limits and shutdown zones for activities that produce underwater noise that could disturb or injure marine mammals. In addition, monitoring programs implemented by industry in accordance with measures required pursuant to the MMPA or ESA have supported conservation and recovery by collecting information that has increased our understanding of local occurrence and habitat use by Cook Inlet belugas, the regular acoustic conditions in different areas of Cook Inlet, and the properties of sound sources used in Cook Inlet and their likely impacts on belugas.

The NMFS Alaska Region tracks all incidental takes of Cook Inlet belugas that occur as a result of activities that have undergone Section 7 consultation, while the NMFS Office of Protected Resources tracks all authorized takes of Cook Inlet belugas, as well as information relating to the effects of activities associated with MMPA take authorizations. Section 2.3.2.2, above, provides additional information about the NMFS MMPA research permit process and authorized take.

2.3.2.5 Other Natural or Manmade Factors Affecting its Continued Existence

<u>Impacts of Past Subsistence Harvest Efforts</u>

The Cook Inlet beluga whale has been hunted by Alaska Natives for subsistence purposes and for the creation of traditional handicrafts. The MMPA allows for the harvest of marine mammals for subsistence purposes, as well as the limited sale of edible portions of marine mammals and of authentic native articles of handicraft made from marine mammals (50 C.F.R. 216.23(b)). Muktuk (whale skin and underlying blubber layer) from Cook Inlet belugas was sold in Anchorage markets prior to 1999. The effect of past harvest practices on the Cook Inlet beluga whale was significant. The reported annual subsistence take by Alaska Natives during 1995–1998 averaged 77 whales (Angliss and Lodge 2002). Reanalysis of published harvests and of unpublished accounts of Cook Inlet beluga whales during the late 1980s and throughout the 1990s indicates that annual harvests were substantially larger than initially reported, cumulatively taking more than half of the estimated 1,300 whales in the population (Shelden et al. 2021). The harvest, which was as high as 20 percent of the population in 1996, was sufficiently high to account for the 14 percent annual rate of decline in the population during 1994 through 1998 (Hobbs et al. 2000). As their overall abundance decreased, whales continued to congregate in the Susitna River delta in large numbers (Rugh et al. 2010, Shelden et al. 2015b, McGuire et al. 2020a), so classic catch per unit effort (CPUE) models that predict a decline in catch rates with declining abundance did not apply (Shelden et al. 2021). Timing of the hunt may also have inadvertently targeted pregnant females. Although hunters avoided whales accompanied by calves, calving may occur throughout the ice-free period (April-October), and recent studies on seasonality of breeding and calving in Cook Inlet indicated most births occur between late July and October (Shelden et al. 2020a,b, McGuire et al. 2020a,b). Females harvested late in spring or early summer could be newly pregnant or carrying near term fetuses (Shelden et al. 2020a,b). This, in part, may explain the continued decline observed in the population after the 1999 hunting moratorium. No harvest occurred in 1999 as a result of a voluntary moratorium by the hunters and the passage of Public Law 106-31, which became permanent in 2000. During 2000-2003 and 2005-2006 NMFS entered into co-management agreements for the Cook Inlet beluga subsistence harvest. Only five whales were taken between 1999 and 2005 and no whales have been harvested since that time. The removal of young, reproductively mature belugas of both sexes potentially had a much greater impact than population decline alone, with the loss of future reproductive potential, elimination of important sources of cultural transmission (e.g., O'Corry-Crowe et al. 2018) and individuals that may have maintained social cohesion in the population (e.g., O'Corry-Crowe et al. 2020). The net effect on the population likely continues to impede its recovery.

Impacts of Mass Live Stranding Events

Cook Inlet beluga whales are known to become live stranded along the shorelines and mudflats of Cook Inlet. Live stranding events are not uncommon and have been reported nearly every year records have been kept (Vos and Shelden 2005, NMFS 2016, NMFS 2022b). Mass stranding events are most frequently reported in Knik Arm and Turnagain Arm (*Figure 6;* NMFS 2016, Vos and Shelden 2005), and often coincide with large spring tides and/or killer whale sighting reports (Shelden et al. 2003). Other mass strandings have been reported in the Susitna Delta (Vos and Shelden 2005). Belugas are usually able to survive a live stranding event and return to deeper water on the rising tide. However, deaths may occur during or following these events. For example, in August 2003, at least 46 belugas live stranded in Turnagain Arm for more than 10 hours, and at least five whales are thought to have died from this event. In another case, 58 belugas live stranded in two events in Turnagain Arm the following month with no identified mortalities (Vos and Shelden 2005). Catastrophic mortality (the deaths of a large number, such as 20 percent of the population) due to a mass stranding event or other events, such as ice entrapment, oil spill, or volcanic activity, was considered in PVA simulations for Cook Inlet belugas (Hobbs et al. 2015a). Almost all model scenarios that included mass mortality events had probabilities of extinction within 50 years, ranging from 2–18%. Such mortality, if it occurred, could significantly impede recovery or force the population below a threshold to which it would not otherwise be vulnerable and from which it could not recover; however, such catastrophic mortality has not been reported in Cook Inlet. Although live mass stranding events have occurred, between 1988 and 2000, only 12 belugas were thought to have died out of 650 belugas that live stranded (Moore et al. 2000). Mass stranding events are not believed to be a factor that caused, or had a significant role in, the decline of the Cook Inlet beluga whale DPS, but mass strandings continue to be a threat to the population's recovery (NMFS 2016).

Inbreeding and Loss of Genetic Viability

Small populations, such as the Cook Inlet beluga whale DPS, may face inherent risks that large populations do not, simply as a result of their small population size. These small population dynamics may manifest in various ways, including inbreeding, loss of genetic or behavioral diversity, or Allee effects. The 2016 Recovery Plan detailed the potential impacts of small population dynamics on Cook Inlet belugas, including increased susceptibility to disease; increased risk of epidemic disease; decreased resilience to environmental change at both individual and population levels; and decreased fecundity due to failed pregnancies and birth defects (NMFS 2016). Based on a PVA, NMFS determined that the Allee effect is not a relevant concern for the Cook Inlet beluga whale unless the population falls to less than 50 individuals and that inbreeding depression and loss of genetic diversity do not pose a significant risk unless the population is reduced to fewer than 200 individuals (Hobbs et al. 2006). To date, no new data have become available that suggest this assessment should be revisited.

Climate Change

The impacts of climate change on Cook Inlet beluga whales and their prey are currently not well known, but potential impacts are explored in the Recovery Plan (NMFS 2016). This regional warming is part of a larger Arctic-wide warming trend that is projected to increase over time (IPCC 2021). Alterations in habitat use by belugas, triggered by climatic changes, as well as direct impacts of climate change to prey populations, could change the availability and nutritional quality of prey, potentially leading to nutritional stress and diminished reproduction. Additionally, changing water temperature and currents could impact the timing of environmental cues important for navigation and the location of important habitat for the DPS. Climate change has the potential to affect the frequency of catastrophic events (e.g., intense storms, disease outbreaks), which could result in habitat degradation or loss, and in illness, injury or death of individuals. Skovrind et al. (2021) compared beluga genomes from populations throughout the Arctic with habitat models, and found a past association between climate, genetics, population size, and available habitat. The authors concluded that, across all beluga populations, habitat loss from climate change is expected to be more substantial in the southern part of the current range; however, local populations will not be impacted similarly and a population-specific approach that accounts for variables such as site fidelity, spatial flexibility in prey availability, and anthropogenic activities is key to understanding how climate change may impact individual populations such as Cook Inlet belugas (Skovrind et al. 2021). Continued research is needed to provide quantitative data on possible changes that could occur as a result of climate change, and what impacts, if any, would occur to the Cook Inlet beluga whale population and to their prey.

2.4 Synthesis

Recovery criteria outlined in the Recovery Plan (NMFS 2016) are current and meet the ESA standards of objective and measurable recovery criteria by including both biological criteria on abundance and trends or risk analysis, and threats-based criteria that address the five factors outlined in section 4(a)(1) of the ESA. Currently, the Cook Inlet beluga whale DPS does not meet the minimum demographic criteria for reclassification to threatened (i.e., the abundance estimate for Cook Inlet belugas is not greater than or equal to 520 individuals, and there is not 95% or greater probability that the most recent 25-year population abundance trend (where 25 years represents one full generation) is positive).

Given that the Cook Inlet beluga whale population is extremely small and the cause of the population's decline in numbers remains unknown at this time, recovery is not anticipated in the foreseeable future (e.g., several decades to a century or more). Life history characteristics such as low reproductive rates, delayed sexual maturity, and reliance on high juvenile survivorship make long-lived species such as whales particularly vulnerable to demographic risks posted by anthropogenic-related mortalities. Risks from catastrophic events, cumulative effects, and noise currently pose the highest level of direct threat to Cook Inlet beluga whales, followed by disease, habitat loss or degradation, reduction in prey, and unauthorized take, and finally pollution and predation; however, information regarding many of these threats (e.g., pollution, reduction in prey) is quite limited, and additional research is needed to fully understand their potential impact to the population.

This five-year review considered the best scientific and commercial data available and concludes that the data do not support downlisting or delisting the Cook Inlet beluga whale DPS. As outlined in this review, the DPS is not extinct, meets the statutory definition of a species, and meets the definition of an endangered species (50 CFR 424.11(e)). Therefore, based on the available new information and existing conservation and management measures, the Cook Inlet beluga whale DPS should retain its status as endangered.

3.0 RESULTS

3.1 Recommended Classification:

_____ Downlist to Threatened
_____ Uplist to Endangered
_____ Delist
_____ *Extinction*
_____ *Recovery*
_____ *Original data for classification in error*
__X__ **No change is needed**

3.2 New Recovery Priority Number: NOAA Fisheries will continue to apply the existing recovery priority number of 2C (see also Section 1.3.5).

3.3 Listing and Reclassification Priority Number: NA

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

The most urgent need is to continue addressing priority 1 actions identified in the Recovery Plan (i.e., actions necessary to prevent extinction), including continuing to monitor the population to estimate abundance and analyze population trends, calving rates, and distribution (Action 1), supporting a recovery implementation task force (Action 3), and conducting an annual review workshop (Action 7). The majority of recovery actions were assigned priority 2, and include obtaining life history data, which continues to be lacking for this population, and assessing or mitigating anthropogenic impacts. Progress on priority 2 actions is also highly recommended as their implementation is necessary to prevent significant decline in population level/habitat quality and key to the population's recovery.

In the next five years, particular emphasis should also focus on the following management and research actions:

- Continue to improve Cook Inlet beluga whale stranding response through:
  - Updating and revising the existing stranding response plan to include sample collection protocols;
  - Training key stranding response personnel during regular drills and scenarios;
  - Preparing stranding response kits in advance of a stranding;
  - Improving communications and plans for faster response times;
  - Accessing laboratory space sufficient to examine a dead beluga whale and having the means to transport carcasses to the laboratory;
  - Incorporating new or improved technology into the response program; and
  - Promoting the use of citizen science and encouraging reporting of strandings by the public.
- Reduce the threat of anthropogenic noise in Cook Inlet beluga whale habitat, including through:
  - Conducting year-round monitoring of background noise in present-day and historical key areas for Cook Inlet belugas (e.g., Susitna River Delta and the Kenai River) to identify areas where the acoustic environment may no longer be suitable for belugas, either seasonally or year-round;
  - Continuing to work with other agencies and stakeholders to minimize the likelihood of noise having adverse impacts on these whales and to minimize the possibility of injury or abandonment of critical habitats;
  - Encouraging the resource development community in Cook Inlet to expand efforts to collaboratively compile data to share for consultation, permitting, project planning, and mitigation processes; and
  - Supporting the development, testing, and routine incorporation of sound-reducing technologies.
- Protect habitats that support foraging or reproduction of Cook Inlet beluga whales, including through:
  - Continuing to improve understanding of which habitat areas in Cook Inlet contribute most to successful foraging and reproduction of beluga whales and the anthropogenic impacts whales may be exposed to in those areas;
  - Exploring the application of modeling approaches to determine what is driving the population's reduction of habitat use in Cook Inlet;
  - Consideration and potential adoption of additional specific habitat protection measures for vulnerable habitat areas during sensitive times of year for feeding or reproduction.
  - Encouraging entities across governmental agencies and the private sector operating in the Cook Inlet region to assess and develop effective protection measures for

    - habitat used directly by belugas as well as habitats that benefit belugas indirectly (e.g., salmon spawning and rearing habitat up-river).

- Gain a better understanding of population characteristics of Cook Inlet beluga whales to ensure effective management actions result in recovery, including through:
    - Continued population monitoring through methods such as aerial surveys, photo-identification and unmanned aircraft to understand the status of the species, the effects of threats, and the effectiveness of management and recovery actions;
    - Continued support for and implementation of studies that examine:
        - health indicators (e.g., gene expression or skin microbiomes),
        - contaminant loads,
        - endocrine disruption,
        - population age structure,
        - mortality rates and causes (including disease and anthropogenic trauma),
        - reproductive status, and
        - stress levels of beluga whales
    - Comparison of Cook Inlet beluga whale life history and health data with other, similar cetacean populations.
- Ensure healthy and plentiful prey are available, including through:
    - Continuing to support research on the energetic/metabolic requirements of Cook Inlet belugas, which likely vary by sex and life stage;
    - Increasing our understanding of the extent to which the quantity or quality of available prey is limiting Cook Inlet beluga whale recovery by continuing to develop and support studies and review of existing data on:
        - Availability of Cook Inlet beluga whale prey species (e.g., population trends, seasonal abundance and distribution), including standardized surveys to determine the spatial and seasonal distribution of beluga prey, especially in upper Cook Inlet;
        - Quality of Cook Inlet beluga prey resources (e.g., energy content, contaminants, stable isotopes, and fatty acids);
        - Seasonal and long-term variation or other changes in Cook Inlet beluga whale diet.

These overarching priorities are detailed in the Cook Inlet Beluga Whale Species in the Spotlight Priority Action Plan for 2021-2025 (NMFS 2021). Recent and ongoing projects are highlighted in that Plan as well as the FY 2019-2020 Recovering Threatened and Endangered Species Report to Congress (NMFS 2022a).

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NATIONAL MARINE FISHERIES SERVICE
5-YEAR REVIEW
Beluga Whale - Cook Inlet DPS (*Delphinapterus leucas*)

Current Classification: Endangered

Recommendation resulting from the 5-Year Review

- [ ] Downlist to Threatened
- [ ] Uplist to Endangered
- [ ] Delist
- [x] No change is needed

Review Conducted By (Name and Office):

Kim Shelden, Kim Goetz, Manuel Castellote, Paul Wade, and Robyn Angliss {AFSC), Jill Seymour, Bonnie Easley-Appleyard, Mandy Keogh, Barbara Mahoney, Verena Gill, and Jon Kurland (AKR), and Amy Hapeman, Jolie Harrison, Sarah Wilkin, and Deb Fauquier (Office of Protected Resources). Lori Polasek and Jenell Tempel-Larsen from the Alaska Department of Fish and Game reviewed the technical portion of the document (Section 2.3.1).

REGIONAL OFFICE APPROVAL:

Lead Regional Administrator, NOAA Fisheries

Approve KURLAND.JONATHAN.M.1365896514 Digitally signed by KURLAND.JONATHAN.M.1365896514 Date: 2022.09.08 16:40:07 -08'00' Date: 9/8/22

Cooperating Regional Administrator, NOAA Fisheries

[ ] Concur [ ] Do Not Concur [x] N/A

Signature____ Date: _______

HEADQUARTERS APPROVAL:

Assistant Administrator, NOAA Fisheries

[x] Concur [ ] Do Not Concur

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