Report #3: Photo-Identification of Beluga Whales in Cook Inlet, Alaska:

Summary of reproduction of identified individuals in 2023

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2023 photo-processing team: John McClung, Amy Willoughby, Chandera Tolley, Mackenzie Garner, Samantha Murk, and Tamara McGuire.

Background

The Cook Inlet Beluga Whale (CIBW) Photo-Identification (ID) Project was contracted by National Marine Fisheries Service (NMFS) to use non-invasive photo-ID techniques to help fill data gaps regarding individual and population characteristics of this endangered beluga population, with the goal of providing information to aid NMFS in conservation and management actions. The contract specified that the CIBW Photo-ID Project would conduct a minimum of 25 photo-ID surveys in 2023, identify individual whales from photographs, and summarize results in a series of six reports. This report, the third in the series, is entitled, *Summary of reproduction of identified individuals in 2023*. Detailed background information and methods for this long-term project are included in previous annual reports, available at www.cookinletbelugas.com.

Results

Possible and presumed mothers

Identified belugas were classified as *presumed mothers* if they appeared in the same uncropped photo frame with a calf alongside them (Figure 1a). When the relationship between a calf and adult was suggestive of a mother-calf relationship but ambiguous, either because other adults were near the pair, little difference in color or size, or more than several meters between the adult and the calf, the larger identified individual was classified as a *possible mother* (Figure 1b).

a.

b.

Figure 1. Photograph of a presumed mother and calf (a) and a possible mother and calf (b).

With the cataloging of the 2023 field season photographs, there are 276 presumed- and possible-mothers in the right-side catalog and 296 presumed- and possible-mothers in the left-side catalog (Table 1). If the ambiguous possible-mother classifications are removed, 232 individuals in the right-side catalog and 241 individuals in the left-side catalog are presumed to be mothers.

Carcass-recovery data indicates four presumed mothers and one possible mother are known to have died between 2005 and 2023. Based on lack of photographic resightings since 2011, 17 of the presumed right-side mothers may have died and 15 of the presumed left side-mothers may have died. This leaves 213 right-side and 222 left-side individuals who are presumed to be mothers and are presumed to be alive in 2023.

Table 1. Summary of presumed and possible mothers in the 2005–2023 CIBW photo-ID catalog.

Number of:	Left-Side Catalog	Right-Side Catalog
Presumed and possible mothers	296	276
Presumed and possible mothers presumed dead[1]	19	18
Presumed and possible mothers known to have died	4	3
Presumed and possible mothers presumed to be alive in 2023	273	255
Presumed mothers	241	232
Presumed mothers presumed dead[1]	15	17
Presumed mothers known to have died	4	2
Presumed mothers presumed to be alive in 2023	222	213

[1] i.e., presumed dead if not photographed since 2011 - using the 12-year maximum inter-annual sighting gap in the catalog; see report #2.

Mothers of known sex and age

Remote biopsy samples collected by NMFS and colleagues between 2016 and 2019 allowed for the genetic sex and approximate age of 51 individual belugas to be determined. Table 2 summarizes the sighting and reproductive history of the seven previously biopsied females who were photographed in 2023. Based on photographic records, these mothers' ages at the birth of their first documented calf were estimated to be between 12 and 21 years old (-/+ 3 years).

Capture for satellite tagging between 1999 and 2000 also allowed for the genetic sex, and in some cases, the approximate age to be determined for a few belugas. One satellite-tagged female of known age has been matched to the CIBW photo-ID catalog. Beluga D111 was captured and satellite tagged by NMFS in 2000, and genetically determined to be female. Age at time of tagging was determined to be 14.3 years old (Keith Hernandez/Scott Baker, Oregon State University) indicating she was born in approximately 1986. She has been photographed every year of the photo-ID study (2005-2023) except 2006. In 2009 she was photographed with a calf that was estimated to be two years old or younger, in 2014 with a calf that was at least two years old, in 2015 with a newborn, and in 2019 with another newborn, which has been photographed maturing in 2020 and 2022. At the time D111 was first photographed with a calf, she would have been approximately 23 years old and likely gave birth to the observed calf between the ages of 21 and 23. She was 33 years old when she was most recently photographed with a newborn. D111's observed inter-birth interval for each of her two most-recent births was four years (i.e., she was photographed with a newborn in 2015 and 2019). She was photographed in 2023 with a submerged beluga next to her that may have been a calf, but could not be confirmed.

Table 2. Photographic sightings in 2023 of seven females sampled remotely during the 2016–2019 Cook Inlet Beluga Biopsy Study. U = unknown, either because sample was not collected, not analyzed, or results were not available. Matches between the CIBW Photo-ID Project catalog and biopsy photos are updated semi-annually; please contact Tamara McGuire (tamaracookinletbelugas@gmail.com) before using the data in this table as results may have changed.

Biopsy Date	Biopsy ID	Photo-ID Catalog #	First Identified	Genetic Sex[1]	Photographed w/calf 2005 – biopsy[2]	Pregnant at biopsy[3]	Female seen w/ calf after biopsy[3]	Epigenetic age at biopsy (years)[4]	Estimated year biopsied whale born[5]	Estimated age at first documented birth [6]	Evidence of pregnancy at or before biopsy[7]
Aug 20, 2016	DLCIB 16-36	D220	2005	F	2007 J1+	Yes	2019 YOY; 2020 J1; 2021 J2; 2022 J2+; 2023 YOY	22	1994	12 (assumed birth 2006)	Yes
Sep 2, 2017	DLCIB 17-02	D19173	2014	F	2017 J1- pre biopsy	No	2019 J3+ & YOY; 2021 J2-	13	2004	12 or 13	Yes
Sep 9, 2017	DLCIB 17-10	D326	2005	F	2009 J1-; 2010 J1+ ; 2014 YOY; 2016 YOY	No	2018 J2; 2019 J3 ; 2020 J1-; 2023 J1-	21	1996	12 or 13	Yes
Sep 9, 2017	DLCIB 17-11	D3813	2010	F	2014 J1+ ; 2016 J2-; 2017 J2-	Yes	2023 J1-	23 (appears younger in photos by as much as a decade)	1994	19 (or younger)	Yes
Sep 10, 2018	DLCIB 18-09	R17121	2014	F	2014 possible; 2018 J1- prebiopsy	U skin only	2020 J1- 2023 J1+	21	1997	20 or 21, (17 possible)	Yes
Sep-11, 2018	DLCIB 18-14	D17286	2014	F	2017 J1+	No	2019 J3+; 2020 YOY ; 2023 J3	17	2001	15 or 16	Yes
Aug 31, 2019	DLCIB 19-10	D3833	2009	F	2015 J1-;2017 J2+ ;2018 J1- 2019 J2-	No	2021 J1-;2023 J2+	23	1996	18 or 19	Yes

[1] Genetic sex from biopsy samples analyzed by Nick Kellar, NMFS Southwest Fisheries Science Center, and Kim Parsons, NMFS Northwest Fisheries Science Center

[2] Exact calf ages determined from year first seen as a neonate and estimated calf ages based on physical appearance. YOY = young of year; J1- calf is one year old or younger; J1+ calf is at least one year old; J2- calf is two years old or younger; J3+ calf is at least three years old (Himes Boor et al. 2023).

[3] Pregnancy status from hormones in blubber samples analyzed by Nick Kellar, NMFS Southwest Fisheries Science Center; delayed due to pandemic.

[4] Epigenetic aging from biopsy samples (Bors et al. 2021)

[5] Estimated birth year = Biopsy year - epigenetic age.

[6] Age of mother at birth of first calf in the photographic record or when biopsied when pregnant**.** -/+ 3 years for epigenetic aging range.

[7] Evidence of pregnancy from hormonal status at biopsy [3,] or photographic documentation [2] with calf born before biopsy