Reproductive natural history of endangered Cook Inlet beluga whales: Insights from a long-term photo-identification study

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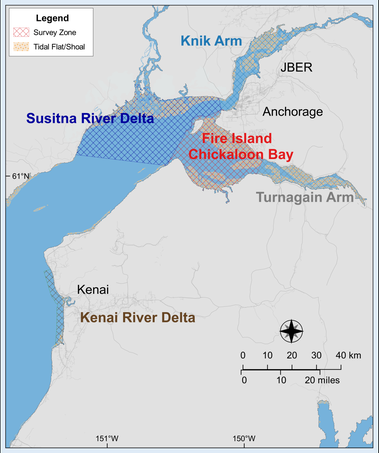
Introduction and Methods

- Information on Cook Inlet beluga whale (CIBW) reproductive parameters is currently sparse but needed for population assessment and recovery planning
- We present results of a long-term photo-identification project providing insight into CIBW reproductive natural history.



- **Survey Data:**
  - We conducted **438 photo-ID surveys** from 2005-2017
  - We documented group location, size, and composition including presence of calves and neonates.
- **Catalog Data:**
  - We identified **>400 individual CIBWs**
    - **423** CIBWs identified from right-side photographs (i.e. the right-side catalog)
    - **431** CIBWs identified from left-side photographs (i.e. the left-side catalog)
    - **82** CIBWs with right- and left-side photos linked (i.e. the dual catalog)
- We classified CIBW in photos as:
  - **Presumed mother**—calf or neonate alongside and unambiguous relationship.
  - **Possible mother**—calf near but ambiguous relationship.
  - **Calf**—gray, relatively small (2/3 total length of adult), and photographed near lighter-colored adult.
  - **Neonate**—visible fetal folds and often a "peanut-shaped" head and/or dark eye ring.
- We augmented the photo-ID data with biological data from **stranding, biopsy, and satellite tagging records.**

All photo-ID vessel surveys conducted under NMFS MMPA/ESA Scientific Research Permit #18016 and #14210.

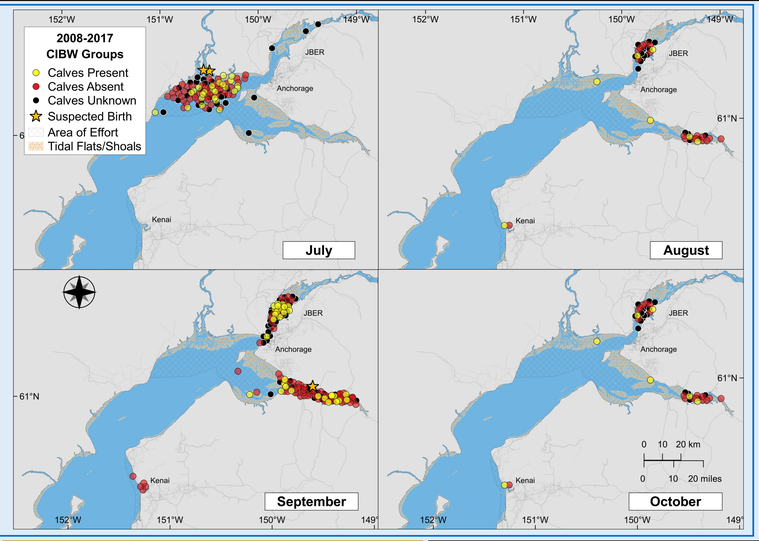
Occurrence of neonates and seasonality of reproduction

Neonates were:

- **Observed in 30% of 425 encountered groups**
- Differentiated from calves beginning in 2008
- Observed from early July to mid-October
- Observed with largest group of the year

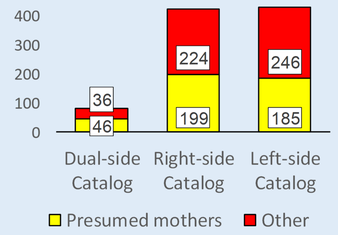
3 possible births observed:

- 2 in Susitna River Delta in July
- 1 in Turnagain Arm in September



What percentage of the catalog is reproductive females?

- Presumed mothers—based on close association with a calf:
  - Dual-side catalog = 56%
  - Right-side catalog = 47%
  - Left-side catalog = 43%
- No strong laterality in calf swim position:
  - 71% of mothers had calves on both sides



Are all confirmed-sex females reproducing?

- **10 of 15 confirmed-sex females classified as mothers**
- 1 confirmed-sex female classified as possible mother

Age of mothers

- **Combined photo-ID, tagging, and tooth aging data indicate a minimum female reproductive period from age 13-47**
- Age of satellite-tagged mothers estimated from length during capture (Shelden *et al.* 2019)
- Dead-stranded mothers age estimated from tooth growth layer groups (Vos *et al.* 2019, Shelden *et al.* 2019)

Source of biological sample information for sex & aging of	Photo-ID catalog number/NMFS #	# of calves/ Individual	Age (yrs) when first photographed with calf	Age (yrs) when last photographed with calf
genetic sex & length at capture for satellite tagging (ages based on length of mother)[1]	D111/CI-0002	3	between 10-19	between 16-25
	D103/CI-0106	2	17+	20+
	D243/CI-0101	1	between 17-26	between 17-26
	L2191/RCF339	0	No calf	No calf
length & tooth aging during dead-stranding (ages based on growth layer groups of teeth)[2]	D157/107	1	13	14 (dead with fetus)
	L1849/113	1	31	31
	R16/103	0	No calf	No calf
	R197/102	0	No calf	No calf
dead-stranded photos show sex[3,4]	L2634	1		
	L265	1		
remote biopsy[4]	R18703/DL-CIB16-31	0		
	L18698/DL-CIB16-33	0		
	D16854/DL-CIB16-34	1		
	D154/DL-CIB16-35	3		
	D220/CIB16-36	3		

1. Lengths and sex of satellite-tagged whales from Shelden *et al.* (2018).
2. Lengths and reproductive status of stranded whales from Shelden *et al.* (2019) and Vos *et al.* (2019).
3. Photographs courtesy of the NMFS Alaska Marine Mammal Stranding Network.
4. No length or age available.

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Inter-birth interval

- **As little as 2 years**
- **Some slightly longer (3-5 years)**
- **For some, as much as 13 years**
- Conservative estimates since many factors affect ability to identify mothers and calves

Estimated calving rate

- **0.08-0.38 calves/year/mother**
- **0.04-0.19 fecundity (assumes 1:1 calf sex ratio)**
- 31 presumed mothers from dual-side catalog who were photographed over 13-year study
- 1-5 calves each

Estimated period of maternal care/association

- **3-5 years = period of maternal association between identified calves and identified mother**
- 3 calves identified by their own marks
- Some mothers photographed simultaneously with newborn and older calf

Conclusions

- After 13 years, CIBW photo-ID catalog likely contains majority of the population
- July-October calving season based on photo-ID (this study) and harvested and stranded CIBW database (K. Shelden *et al.* 2019)
- Photo-ID methods likely underestimate the number of presumed mothers
- Confirmed-sex females with longer sighting records more likely to be classified as mothers
- Variation in age of first reproduction may reflect individual and/or population health
- Mother-calf associations were made at the level of the photo frame—ongoing work to identify calves will allow us to examine how often calf and mother are photographed in the same group
- Photographic tracking of individuals provides important insight into reproductive natural history of this population and basic parameters needed for more complex population models
- We've cautiously reported many values due to a multitude of potential biases

Future Work

- We are currently collaborating with several teams to use both photo-ID and survey data to model reproductive rates
- We are working towards developing models to quantify and adjust for uncertainty in the data in order to better assess CIBW population dynamics

References

Shelden KEW, Burns JJ, McGuire TL, Burek-Huntington KA, Vos DJ, Goertz CEC, O'Corry-Crowe G, Mahoney BA (2019) Reproductive status of female beluga whales from the endangered Cook Inlet population. Marine Mammal Science early online: DOI:10-1111/mms.12648.

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- Database Development: Axiom Consulting and Design.
- Biological samples from stranding, tagging and biopsy were collected under NMFS permits #932-1905/MA-009526 (stranding), #957 and 782-1438 (Amendment 3; satellite tagging), #14245-04 (biopsy), and samples were analyzed by Nick Kellar (hormones from 2016 biopsy), Greg O-Corry Crowe (genetics from 1999-2002 satellite tagging), contaminants from biopsy during satellite tagging (Gina Ylitalo) tooth aging (Dan Vos), and necropsy (Kathy Burek Huntington and Carrie Goertz).
- We are grateful to the Alaska Native hunters who reported and shared samples with NMFS. CIBW photo-id surveys were conducted under General Authorization, Letter of Confirmation No. 481-1759, and NMFS Scientific Research Permits #14210 and #18016.
- All CIBW Photo-ID Project reports are publicly available at www.cookinletbelugas.org.