

Cook Inlet belugas (*Delphinapterus leucas*): history, threats, and conservation

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Conservation and
Management of
Marine Mammals

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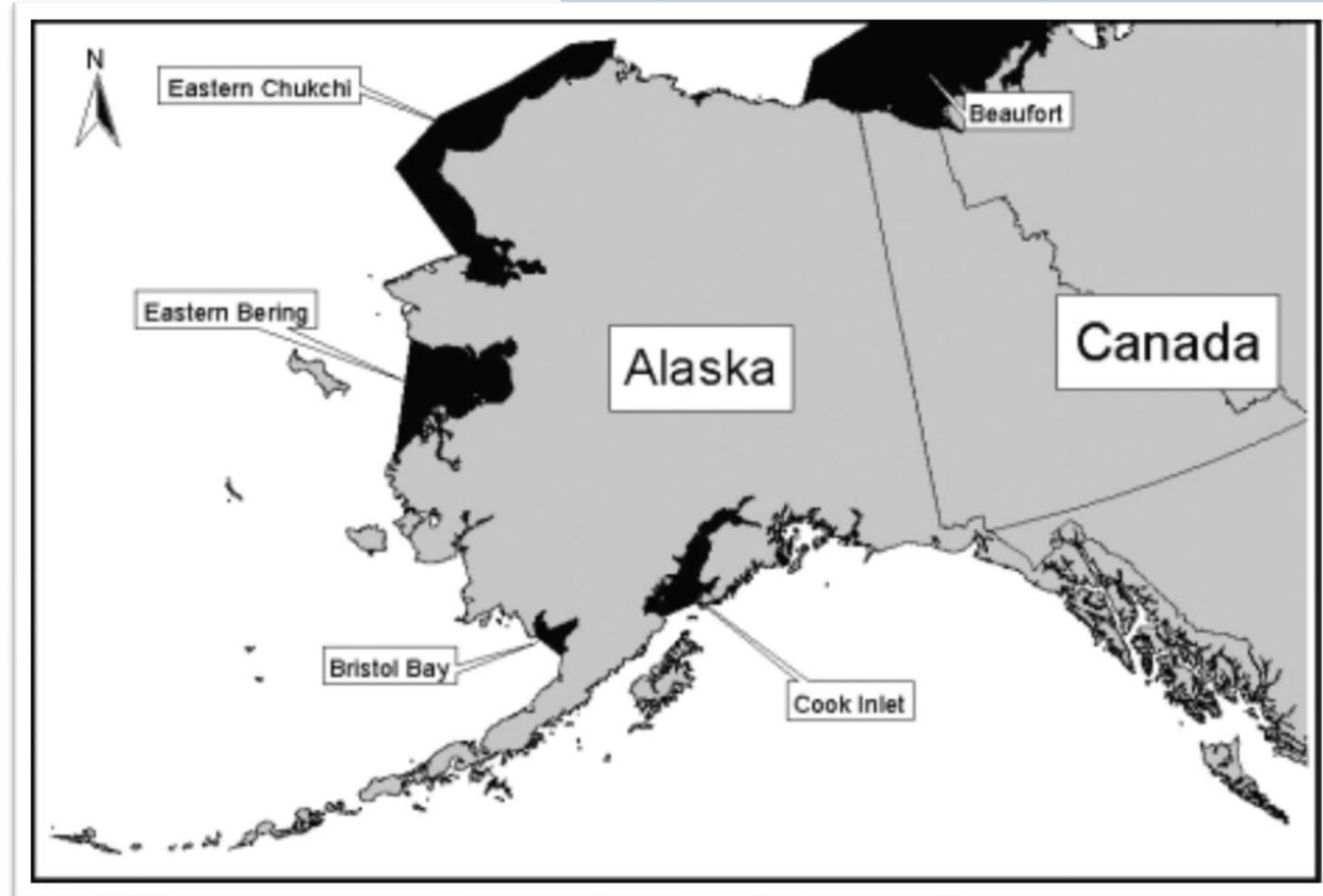


Alaskan beluga stocks

- 5 stocks (Quakenbush et al., 2015)
 - Beaufort Sea
 - Eastern Chukchi Sea
 - Bristol Bay
 - Eastern Bering Sea
 - Cook Inlet (CI)

Stock	Estimated population size
Beaufort Sea	39,000
Eastern Chukchi Sea	4,000
Bristol Bay	3,000
Eastern Bering Sea	1,800
Cook Inlet	279

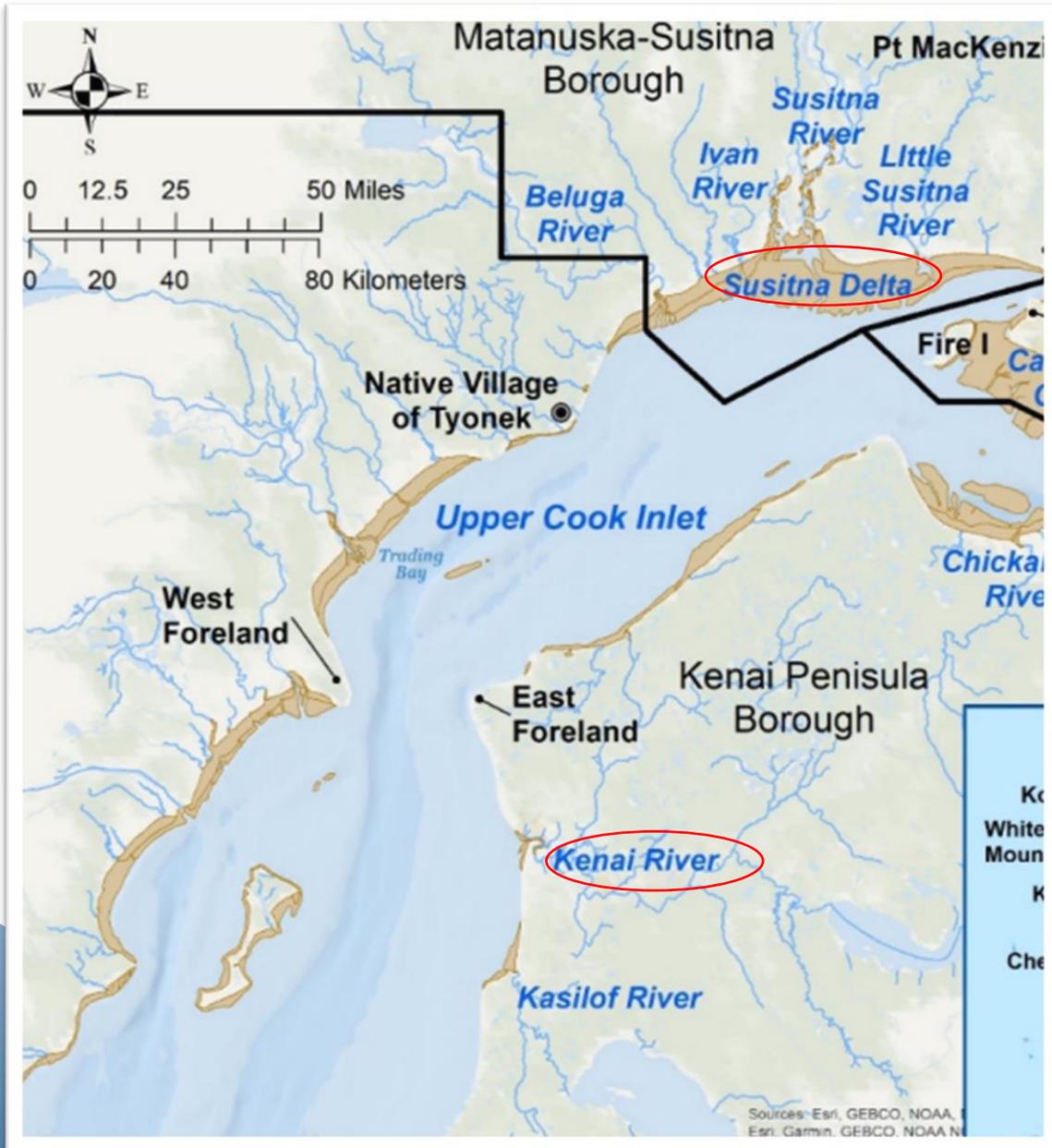
(Quakenbush et al., 2015)



(Moore and DeMaster, 2000)

Cook Inlet belugas (CIBs)

- Stay in CI (Castellote et al., 2020)
- Summer range (McGuire et al., 2022)
 - Shallow, turbid waters
 - Water temperature
- Susitna Delta and Kenai River (McGuire et al., 2022)
 - Prey availability



Modified from Shelden et al., 2021



Modified from Quakenbush et al., 2015

Hunting

- Native villagers, trappers, homesteaders, sportsmen, and commercial operators (Shelden et al., 2021)
- Marine Mammal Protection Act (MMPA) 1972 (Shelden et al., 2021)
- 1979: ~1,293 CIBs (Carter and Nielsen, 2011)
- Early 1980s: six to seven belugas per year (Carter and Nielsen, 2011)
- 1991: ~1,000 CIBs (Shelden et al., 2021)
- Potential Biological Removal (PBR): 14 (Moore et al., 1999)
- 1994-1998: 47% decline in CIBs (Carter and Nielsen, 2011)
- 1994: ~653 CIBs (Moore et al., 1999)
- 1998: ~347 CIBs (Moore et al., 1999)
 - Five times the PBR (Moore et al., 1999)
 - 1994: 49 CIBs being taken, 96 being “struck and lost” (Carter and Nielsen, 2011)

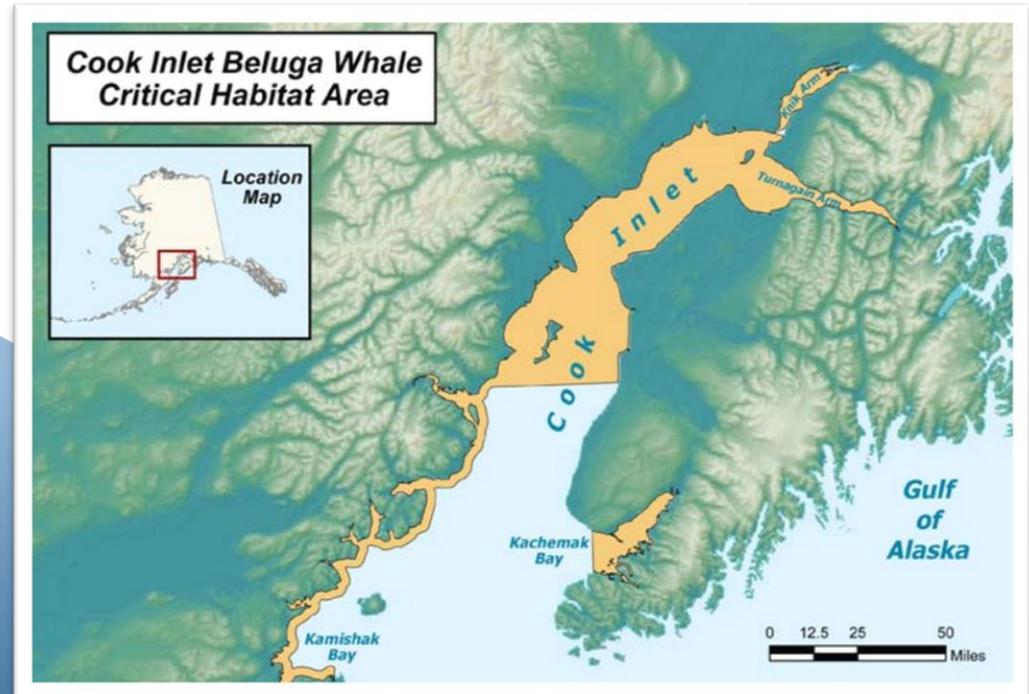


Actions

- National Marine Fisheries Service (NMFS): CIB stock depleted under the MMPA (Shelden et al., 2021)
- 2000: Alaskan Natives stopped hunting CIBs
- 2008: Endangered under Endangered Species Act (ESA)
- Recovery plan and critical habitat established NMFS (Burek-Huntington et al., 2015; Shelden et al., 2021)
- 2018: 279 CIBs (Castellote et al., 2020)
- 2022: 186-224 CIBs (Shelden et al., 2022)



(Burek-Huntington et al., 2015)



(Alaska Department of Fish and Game, 2022)

Threats

Noise
pollution

Prey
reduction

Parasites
and
pathogens

Noise pollution

- Marine seismic surveys, aircrafts, boating vessels, pile driving, oil and gas drilling, dredging, military detonations, and shore construction
- Communication already challenging
 - Natural noise, shallow water
- Find prey, avoid predators, navigate, breathing holes in ice, communicate (Small et al., 2017; Norman et al., 2015)
- CI waters turbid
- Change calls, avoidance, flee, predation, hearing loss, masking (Carter and Nielsen et al., 2011; Lammers et al., 2013; Norman et al., 2015)
- Prey impacted



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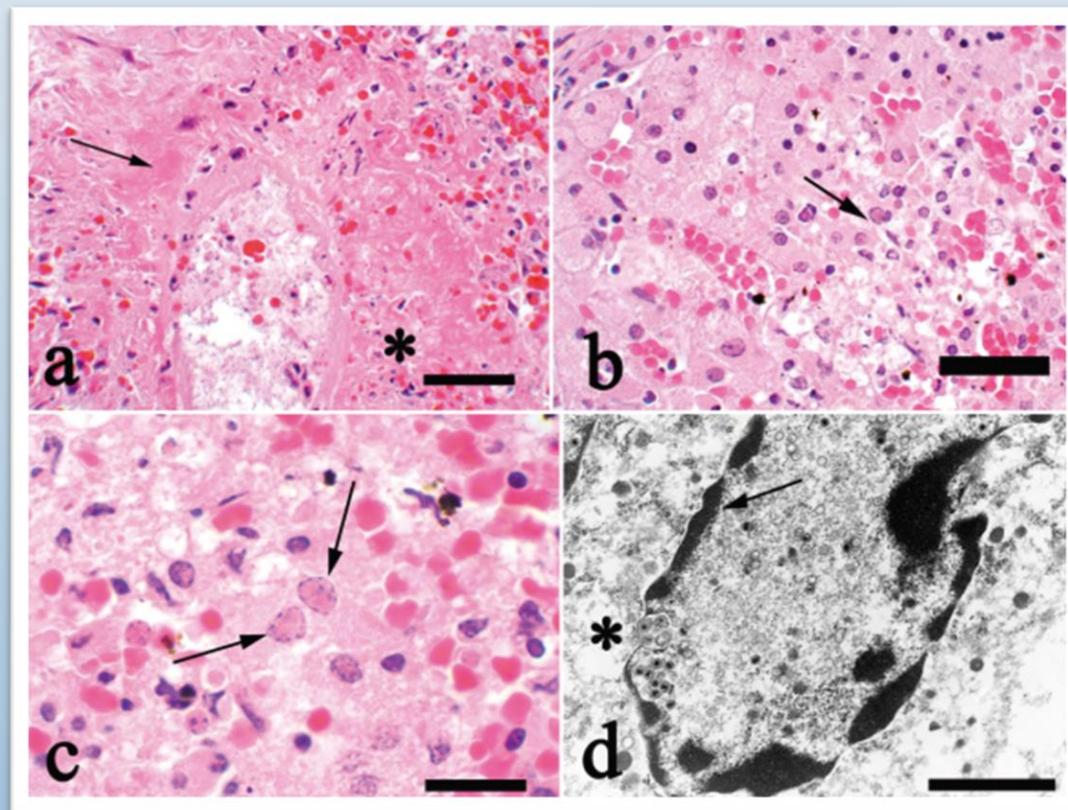
Prey reduction



- Dependent on high nutritional prey (Norman et al., 2015)
- Eulachon (*Thaleichthys pacificus*), salmon, herring (*Clupea pallasii*), smelt (*Spirinchus thaleichthys*), sculpin, flounder, and halibut (McGuire et al., 2022)
- Build up fat for winter (Goetz et al., 2012)
- Fisheries (Carter and Nielsen, 2011)
- Reduced prey, competition (National Marine Fisheries Service, 2016)
- Fish health in decline (Carter and Nielsen, 2011)
- Crooked spine, tumors, parasites, less oil content, smaller size
- Warming temperatures (Carter, 2005; Daly and Brodeur, 2015)

Pathogens and parasites

- *Stenurus arctomarinus*, a species of lungworm
- Death in St. Lawrence Estuary belugas
- Not historically found in CI
- *Crassicauda giliakiana*, a species of nematode
- Not found in any other Alaskan beluga stock
- New to CI
- 90% of CIBs (Norman et al., 2015)
- Affects kidneys
- Bacterial infections of respiratory tract, pneumonia
- Viruses present but not studied
- Contaminants make CIBs susceptible to disease



Conservation measures

Critical
habitat

Recovery
plan

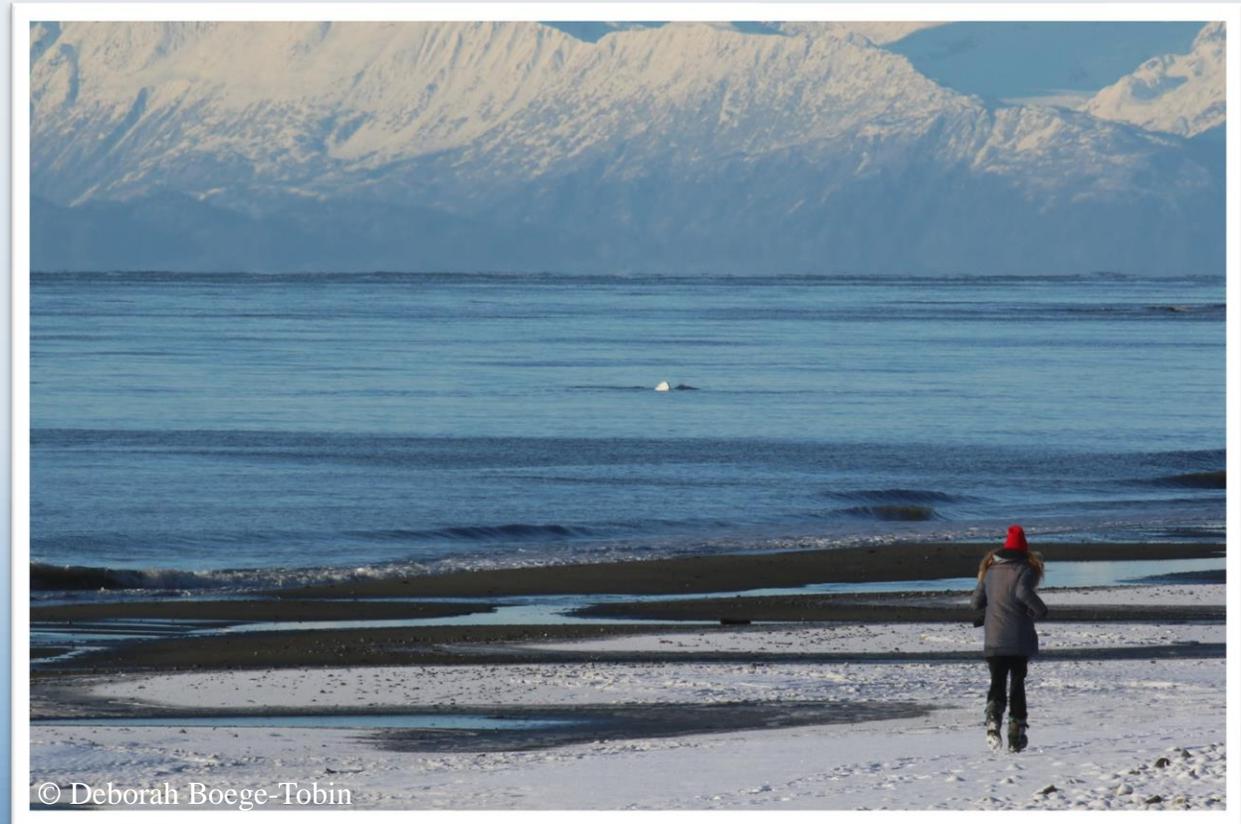
Photo ID

Acoustic
monitoring

Necropsies

Photo ID

- 2005: The Cook Inlet Beluga Whale Photo-ID project
- Scars, markings



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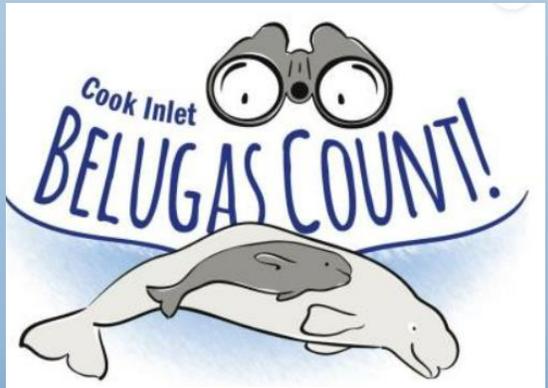
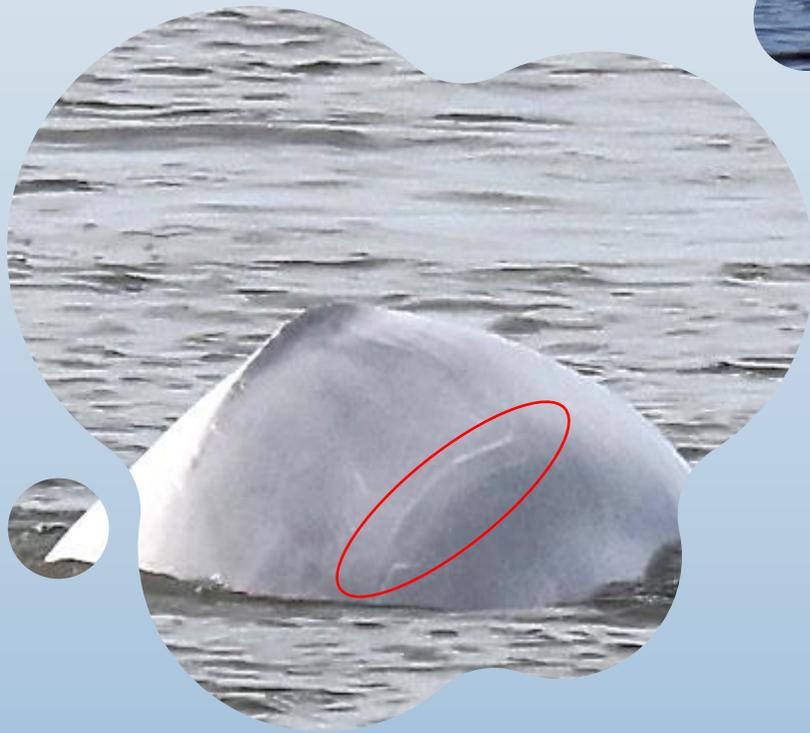


Photo ID





Jabba the Hut



Humperdink



Bandaid



Dimples



Frog



Ropey



Photo ID

- 2005: The Cook Inlet Beluga Whale Photo-ID project
- Scars, markings
- Observers collect data on group size, age, location, behavior, anthropogenic noise, and interspecific interactions

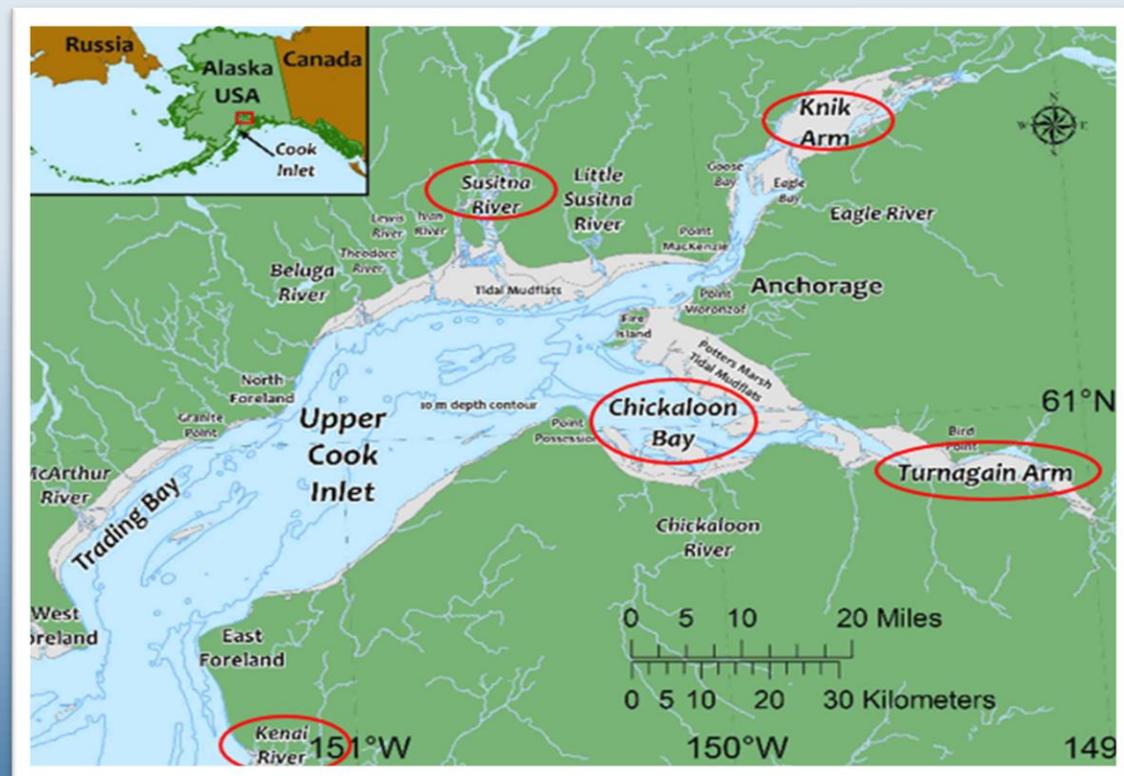
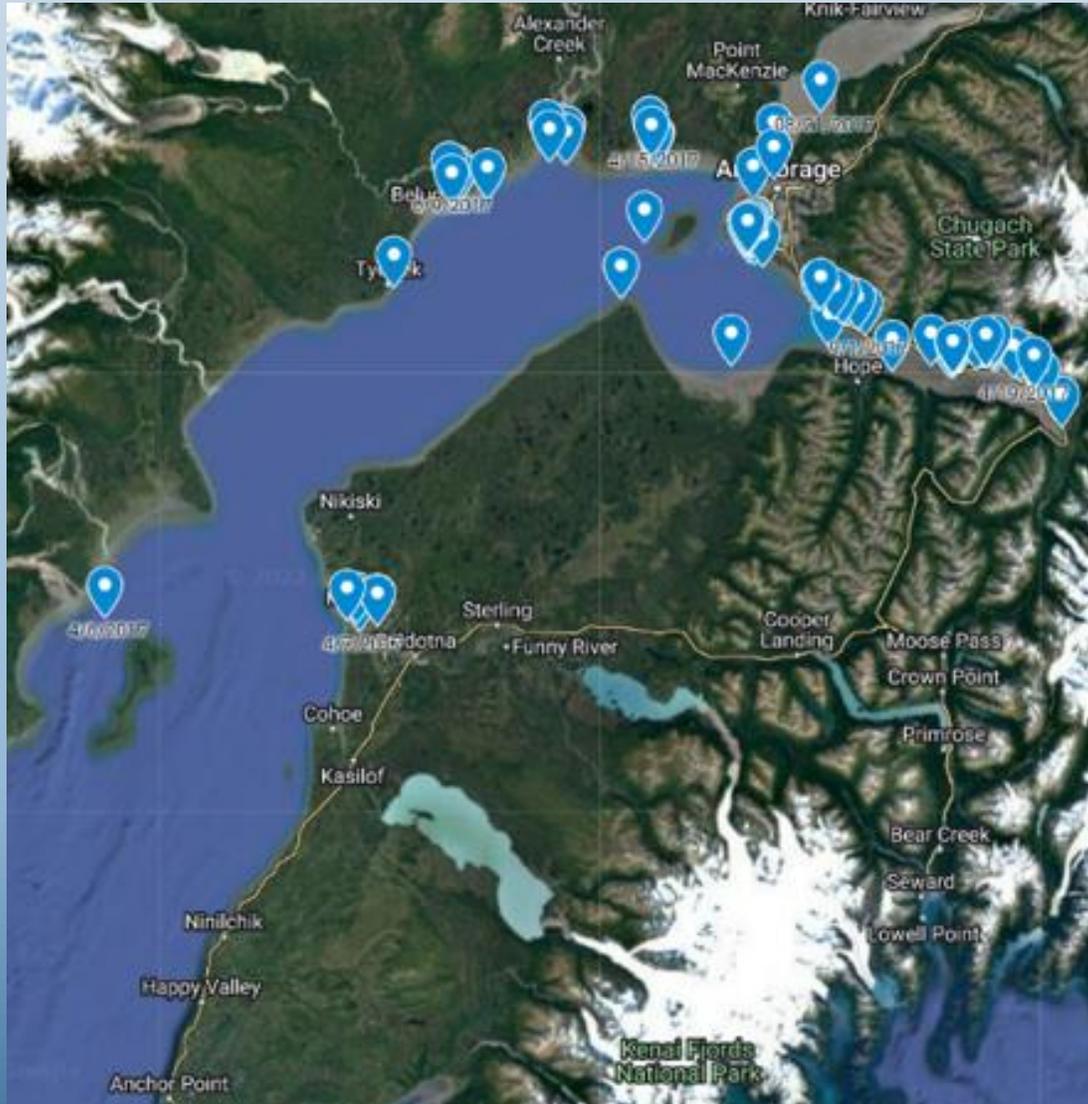


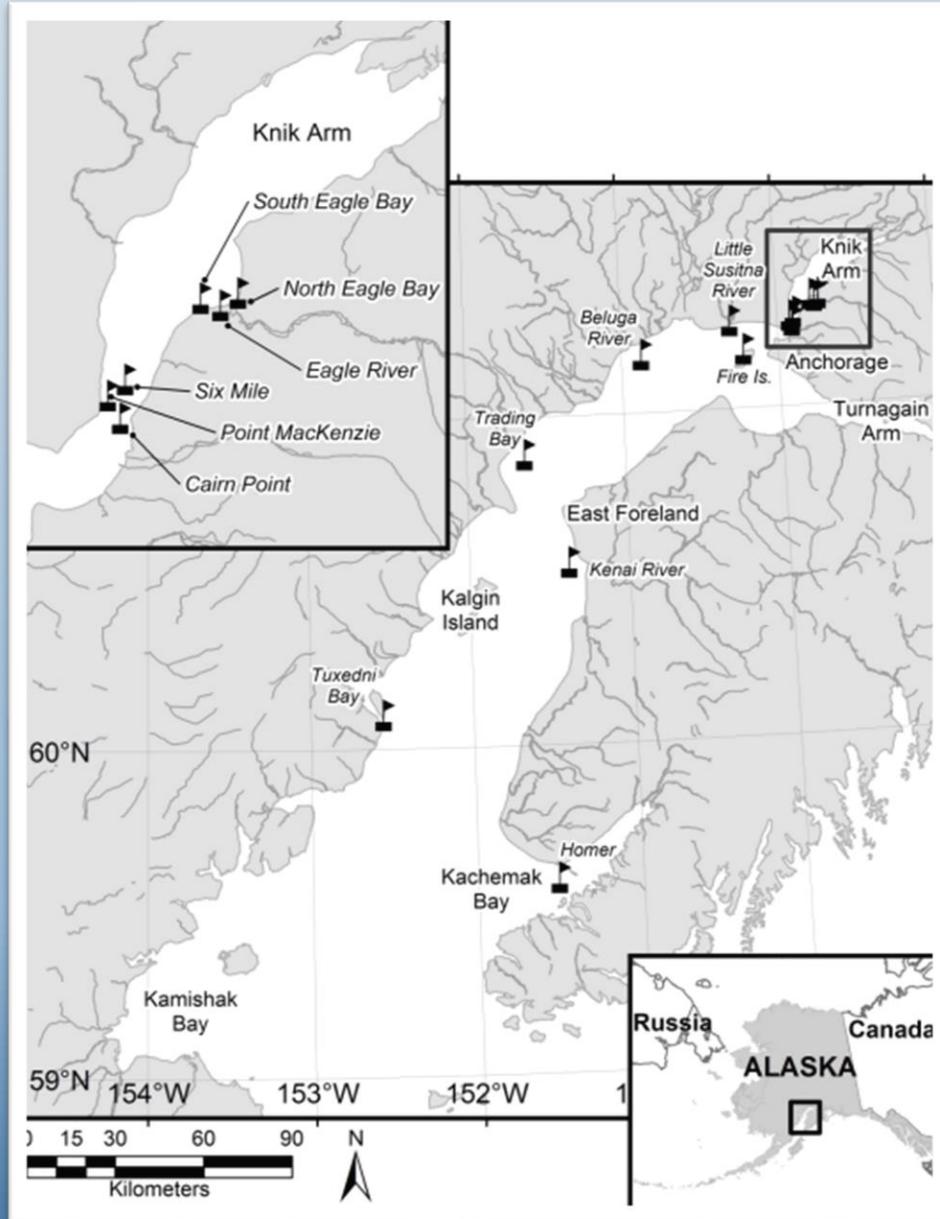
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(Cook Inlet Beluga Whale Photo-ID Project, 2017)

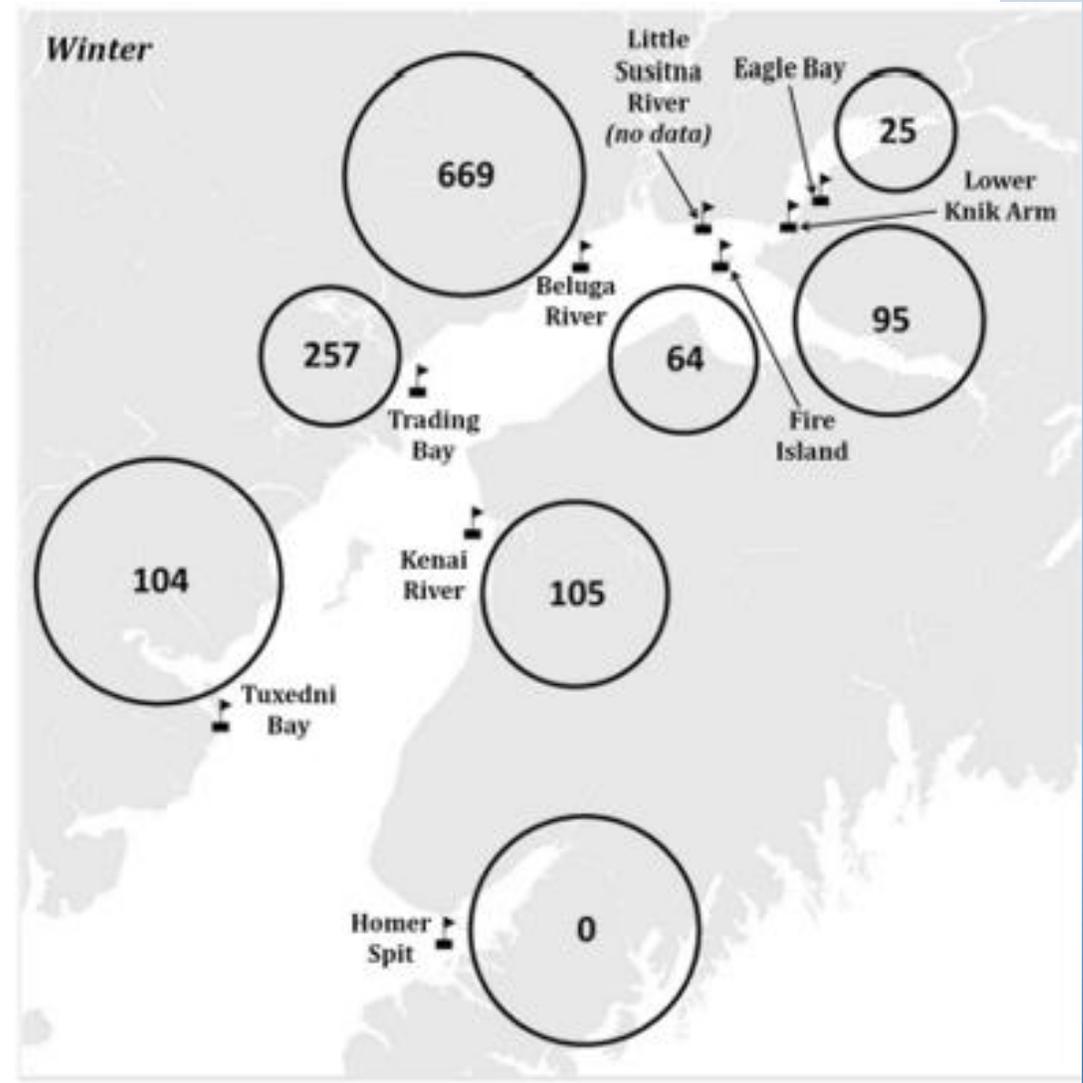
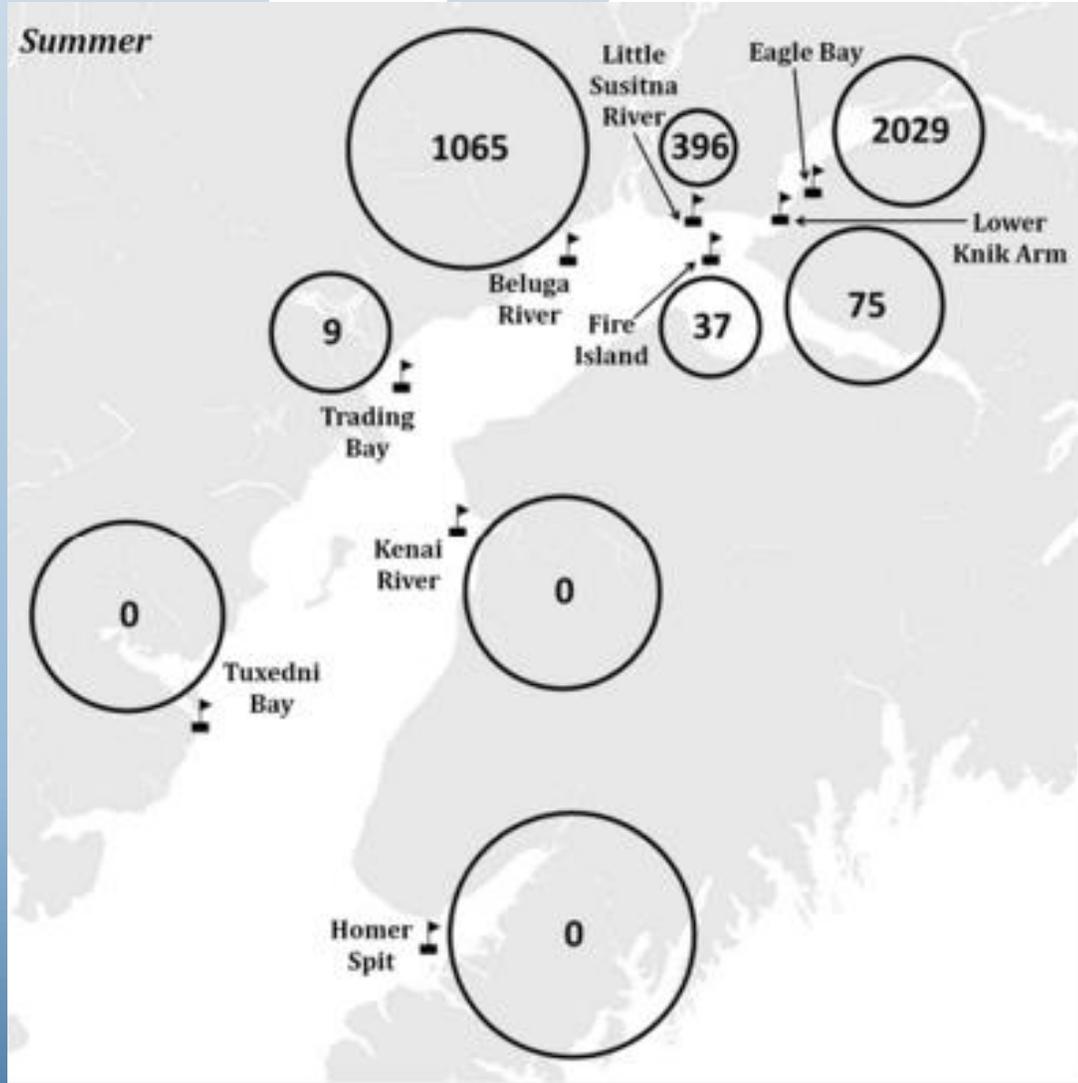
- Discovered: feeding and calving grounds, rearing of calves, use of habitat, and movement of individuals
- CIBs found seasonally in different areas, less site fidelity within their critical habitat
- Calves found throughout CI
- CIBs also moved with the tides
- Hotspots: Susitna Delta River, Knik Arm, Turnagain Arm, and the Kenai Delta River

Acoustic monitoring



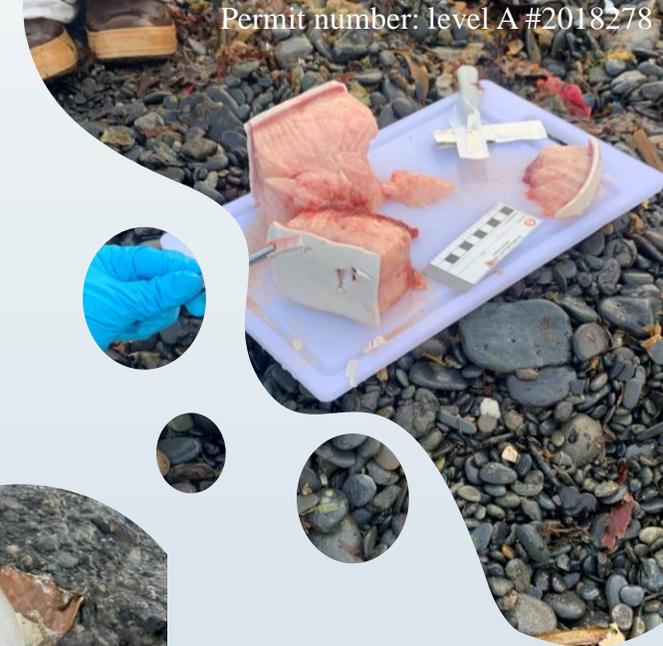
- 2008: NOAA Fisheries started the Cook Inlet Beluga Acoustics project
- Hydrophones and other acoustic devices
- Determine where they are found, feeding areas, social interactions, and orca predation (Blevins-Manhard et al., 2017; Castellote et al., 2015; Lammers et al., 2013)
- Calves communicating with their mothers → where calves are located within CI (Blevins-Manhard et al., 2017)
- Orca presence in CI and found orcas to be present at Homer Spit where no belugas are found (Lammers et al., 2013)

Acoustic monitoring



Necropsies

- Important to determine cause of death
- Main source of information on predation, parasitism, disease, and environmental change threats
- 2003: 20 CIBs stranded, only two had known cause of death (Vos and Shelden, 2005)
- 1998, 2000, and 2001: Disease was a large cause of death
- 2006-2008: Perinatal mortality and malnutrition
- 2011: 62% of photo-IDed belugas had evidence of disease from scarring (National Marine Fisheries Service, 2016)



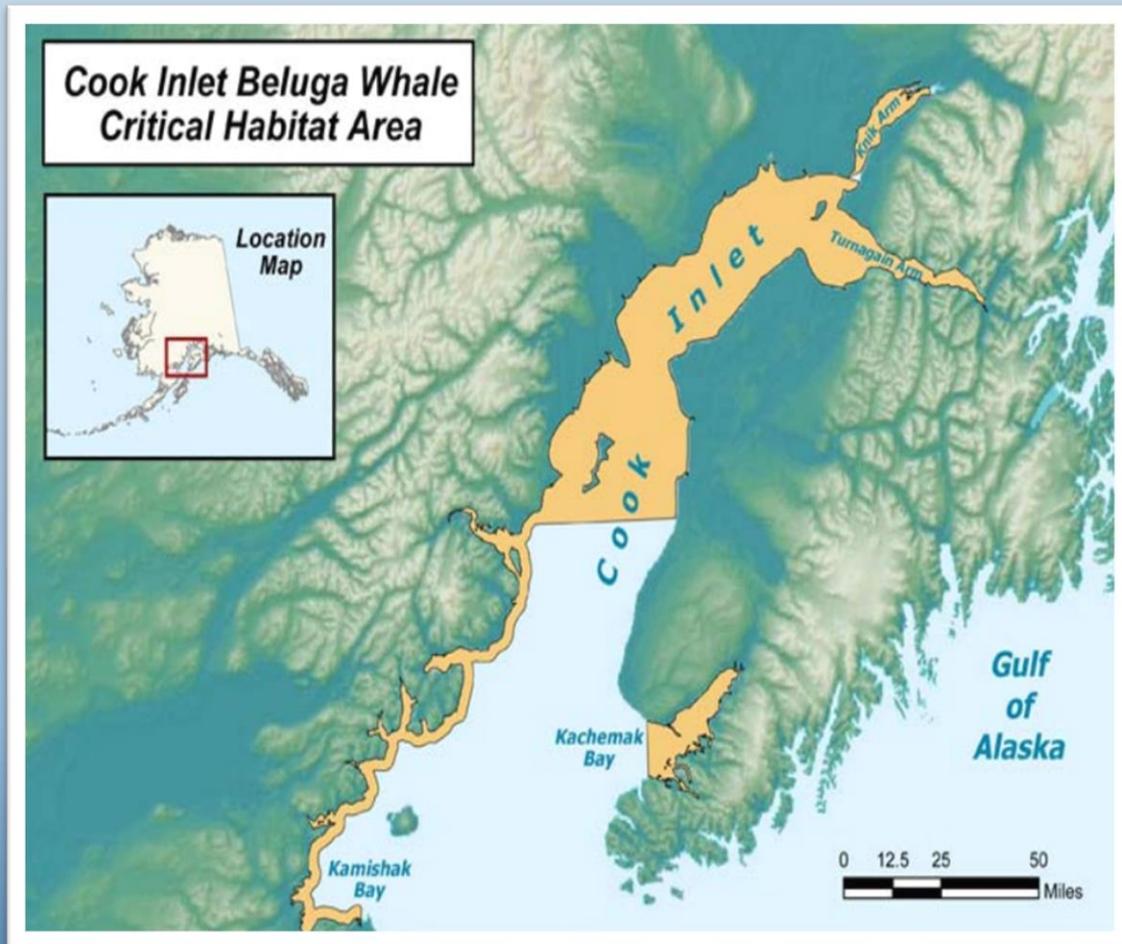
Critical habitat

“Specific geographic areas that contain physical or biological features essential to the conservation of the species and that may require special management considerations or protection”
-ESA

- 2008: Listed as endangered → NMFS creates critical habitat



Critical habitat



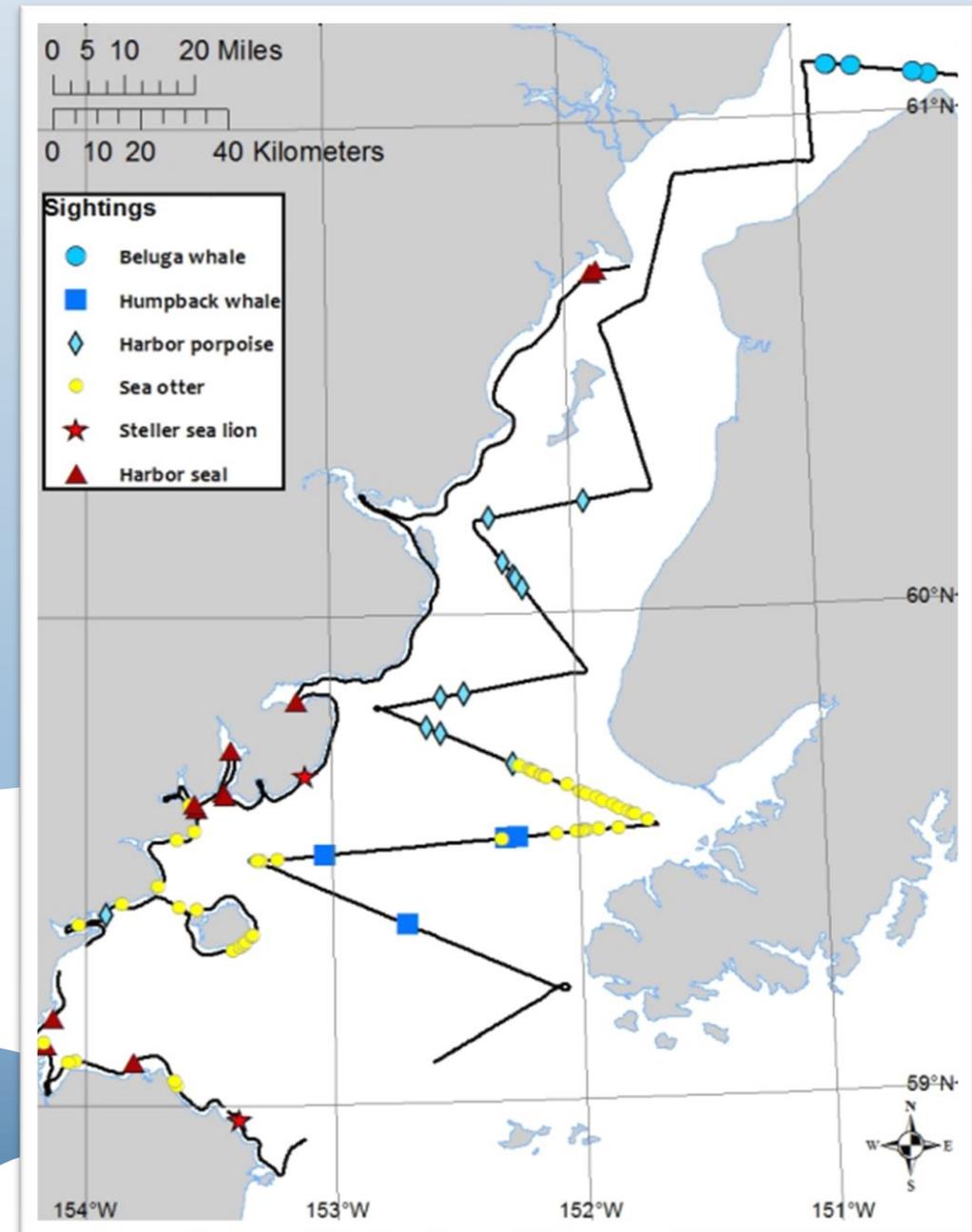
(Alaska Department of Fish and Game, 2022)

- 2008: Listed as endangered → NMFS creates critical habitat
- 2011: 7,800 km² of CI critical habitat
- Essential components to CIB survival
 - Primary prey species protected
 - Areas near fish streams protected
 - Areas with > 30 ft of water protected
 - Unpolluted waters
 - Minimal noise pollution
 - Unrestricted travel
- CIBs still in decline

(McGuire et al., 2020)

Recovery Plan

- 2016: NMFS created a recovery plan
 - Identifying threats resulting in CIB decline
 - Ways to mitigate these threats to allow for recovery of CIBs
- The goal is for CIBs to recover to the point where they are no longer considered endangered under the ESA
- Stakeholder panel
- List of 64 actions taken



(Shelden et al., 2017)

Recovery plan

To achieve this, five factors were established important to their recovery:

Their habitat must be suitable for their recovery with prey abundance

Any commercial, scientific, recreational, and educational activities do not inhibit recovery

Diseases are not causing CIB decline

Regulatory mechanisms are equipped to manage threats outside of the ESA

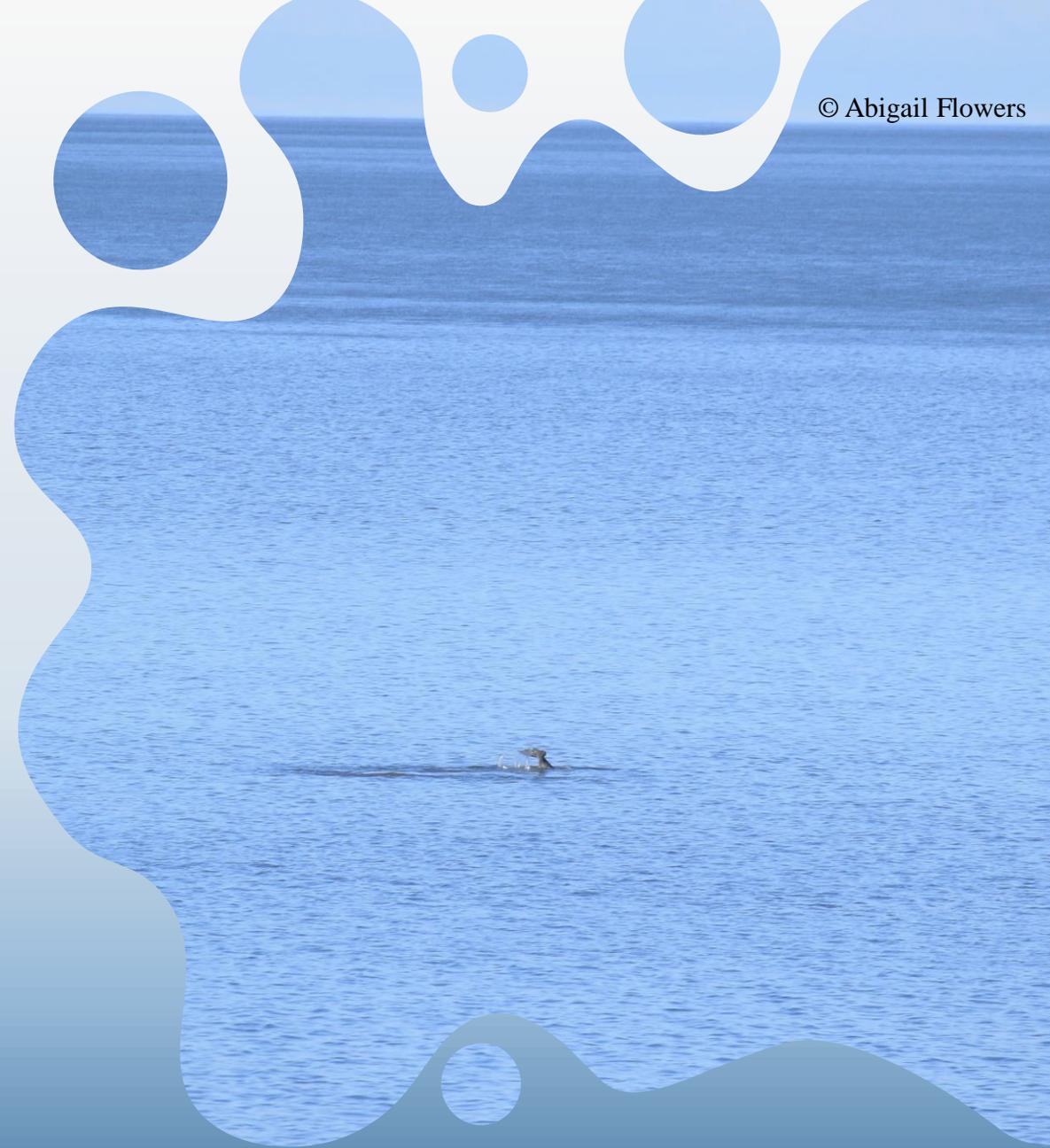
Any new threats that could affect the recovery of CIBs are monitored

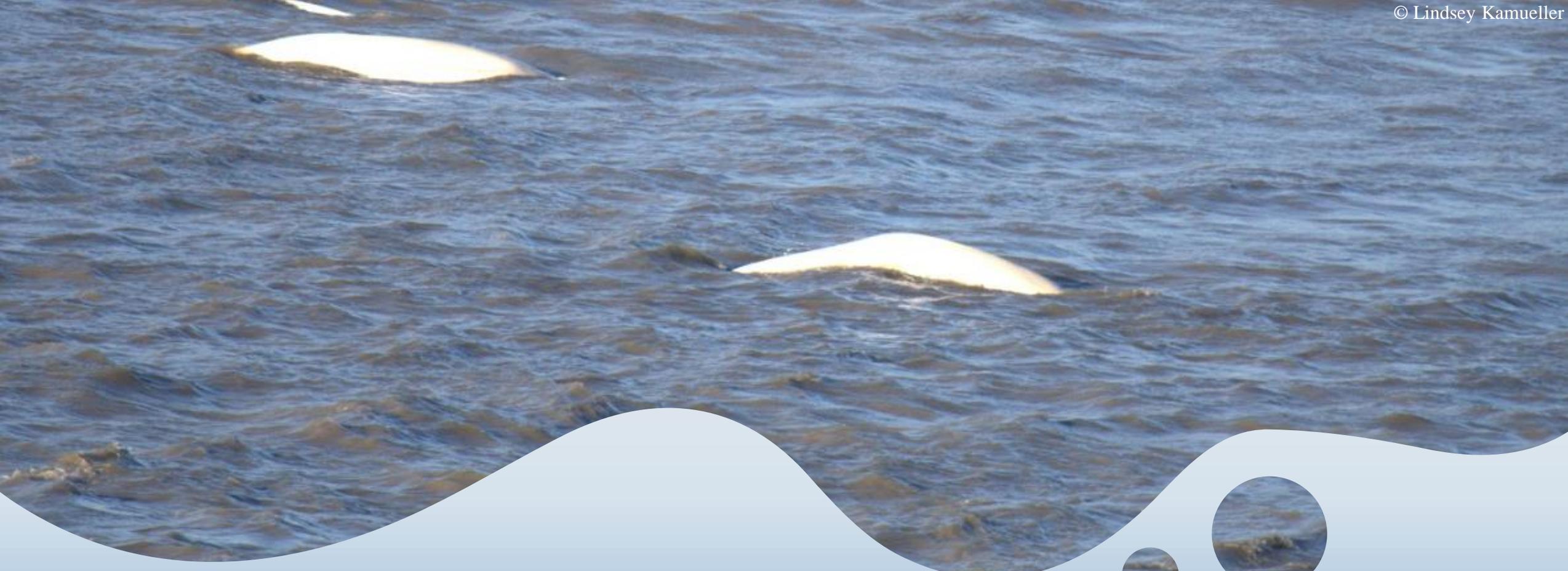
Recovery could take up to 50 years

Discussion

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- CIBs have declined by 80% since the 1970s and continue to decline at around 2.3% annually (Migura and Bollini, 2022)
- Lack of data (McGuire et al., 2020)
- Stakeholders
 - Recovery plan (National Marine Fisheries Service, 2016)
 - Knik Arm Ferry (Kendall and Cornick, 2015)
- Use data from all methods to create marine protected areas/stricter protection and enforcement
- Look at multiple threats
- Understand Bristol Bay belugas (Lowry et al., 2008)
 - Increase salmon abundance
 - Decrease orca predation
 - Decrease hunting and lethal research take





Questions?

References

- Alaska Department of Fish and Game. (2022). *Cook Inlet beluga whale (Delphinapterus leucas) critical habitat*. Accessed 2022, November 15. <http://www.adfg.alaska.gov/index.cfm?adfg=specialstatus.fedhabitat&species=cookinletbeluga>
- Blevins-Manhard, R., Atkinson, S., & Lammers, M. (2017). Spatial and temporal patterns in the calling behavior of beluga whales, *Delphinapterus leucas*, in Cook Inlet, Alaska. *Marine Mammal Science*, 33(1), 112-133.
- Burek-Huntington, K. A., Dushane, J. L., Goertz, C. E., Romero, C. H., & Raverty, S. A. (2015). Morbidity and mortality in stranded Cook Inlet beluga whales *Delphinapterus leucas*. *Diseases of Aquatic Organisms*, 114(1), 45-60.
- Carter, B. T., & Nielsen, E. A. (2011). Exploring ecological changes in Cook Inlet beluga whale habitat through traditional and local ecological knowledge of contributing factors for population decline. *Marine Policy*, 35(3), 299-308.
- Carter, K. (2005). The effects of temperature on steelhead trout, coho salmon, and Chinook salmon biology and function by life stage. *California regional water quality control board*, 1-26.
- Castellote, M., Small, R. J., Lammers, M. O., Jenniges, J., Mondragon, J., Garner, C. D., Atkinson, S., Delevaux, J. M. S., Graham, R., & Westerholt, D. (2020). Seasonal distribution and foraging occurrence of Cook Inlet beluga whales based on passive acoustic monitoring. *Endangered Species Research*, 41, 225-243.
- Castellote, M., Small, R. J., Mondragon, J., Jenniges, J., & Skinner, J. (2015). Seasonal distribution and foraging behavior of Cook Inlet belugas based on acoustic monitoring. *NOAA Fisheries website*.

References

Cook Inlet Beluga Whale Photo-ID project. (2017, October 31). *2017 Cook Inlet beluga whale sightings*.

<https://www.google.com/maps/d/u/0/viewer?mid=1OnTTpWX4-6YC7qMIUNoVIZ2wEA&ll=60.11125607407807%2C-149.10963045633815&z=7>

Daly, E. A., & Brodeur, R. D. (2015). Warming ocean conditions relate to increased trophic requirements of threatened and endangered salmon. *PLoS One*, *10*(12).

Goetz, K. T., Robinson, P. W., Hobbs, R. C., Laidre, K. L., Huckstadt, L. A., & Shelden, K. E. (2012). Movement and dive behavior of beluga whales in Cook Inlet, Alaska. *NOAA Fisheries website*.

Kendall, L. S., & Cornick, L. A. (2015). Behavior and distribution of Cook Inlet beluga whales, *Delphinapterus leucas*, before and during pile driving activity. *Marine Fisheries Review*, *77*(2), 106-115.

Lammers, M. O., Castellote, M., Small, R. J., Atkinson, S., Jenniges, J., Rosinski, A., Oswald J., & Garner, C. (2013). Passive acoustic monitoring of Cook Inlet beluga whales (*Delphinapterus leucas*). *The Journal of the Acoustical Society of America*, *134*(3), 2497-2504.

Lowry, L. F., Frost, K. J., Zerbini, A., Demaster, D., & Reeves, R. R. (2008). Trend in aerial counts of beluga or white whales (*Delphinapterus leucas*) in Bristol Bay, Alaska, 1993-2005. *Journal of Cetacean Research and Management*, *10*(3), 201-207.

McGuire, T. L., Himes Boor, G. K., McClung, J. R., Stephens, A. D., Garner, C., Shelden, K. E., & Wright, B. (2020). Distribution and habitat use by endangered Cook Inlet beluga whales: patterns observed during a photo-identification study, 2005-2017. *Aquatic Conservation: Marine and Freshwater Ecosystems*, *30*(12), 2402-2427.

References

- Migura, M., & Bollini, C. (2022). To take or not take? Examination of the status quo process for issuing take authorizations of endangered Cook Inlet beluga whales and implications for their recovery. *Conservation Science and Practice*, 4(2).
- Moore, S. E., & DeMaster, D. P. (2000). Cook Inlet belugas, *Delphinapterus leucas*: status and overview. *Marine Fisheries Review*, 62(3), 1-5.
- Moore, S., Rugh, D., Shelden, K., Mahoney, B., & Hobbs, R. (1999). Synthesis of available information on the Cook Inlet stock of beluga whales. *Alaska Fisheries Science Center, National Marine Fisheries Service*.
- National Marine Fisheries Service. (2016). Recovery plan for the Cook Inlet beluga whale (*Delphinapterus leucas*). National Marine Fisheries Service, Alaska Region, Protected Resources Division, Juneau, AK. *NOAA Fisheries website*.
- Norman, S. A., Hobbs, R. C., Goertz, C. E., Burek-Huntington, K. A., Shelden, K. E., Smith, W. A., & Beckett, L. A. (2015). Potential natural and anthropogenic impediments to the conservation and recovery of Cook Inlet beluga whales, *Delphinapterus leucas*. *Marine Fisheries Review* 77(2), 89-105.
- Quakenbush, L. T., Suydam, R. S., Bryan, A. L., Lowry, L. F., Frost, K. J., & Mahoney, B. A. (2015). Diet of beluga whales (*Delphinapterus leucas*) in Alaska from stomach contents, March–November. *Marine Fisheries Review*, 77(1), 70-84.
- Shelden, K. E. W., Goetz, K. T., Brower, A. A., Willoughby, A. L., & Sims, C. L. (2022). Distribution of belugas (*Delphinapterus leucas*) in Cook Inlet, Alaska, June 2021 and June 2022. *NOAA Fisheries website*.

References

- Shelden, K. E. W., Mahoney, B. A., O'Corry-Crowe, G., Stanek, R. T., & Frost, K. J. (2021). Beluga, *Delphinapterus leucas*, harvest in Cook Inlet, Alaska, 1987 to 2022. Shelden, K. E., Hobbs, R. C., Sims, C. L., Vate Brattström, L., Mocklin, J. A., Boyd, C., & Mahoney, B. A. (2017). Aerial surveys, abundance, and distribution of beluga whales (*Delphinapterus leucas*) in Cook Inlet, Alaska, June 2016. *NOAA Fisheries website*.
- Shelden, K. E. W., Mahoney, B. A., O'Corry-Crowe, G., Stanek, R. T., & Frost, K. J. (2021). Beluga, *Delphinapterus leucas*, harvest in Cook Inlet, Alaska, 1987 to 2022. *NOAA Fisheries website*.
- Small, R. J., Brost, B., Hooten, M., Castellote, M., & Mondragon, J. (2017). Potential for spatial displacement of Cook Inlet beluga whales by anthropogenic noise in critical habitat. *Endangered Species Research*, 32, 43-57.
- Vos, D. J., & Shelden, K. E. (2005). Unusual mortality in the depleted Cook Inlet beluga (*Delphinapterus leucas*) population. *Northwestern Naturalist*, 86(2), 59-65.
- Wade, P. (2022). *Measuring whales from the air - hexacopter photogrammetry of Cook Inlet beluga whales*. NOAA Fisheries. Accessed 2022, November 25. https://origin-archive-afsc.fisheries.noaa.gov/Science_blog/Cook_Inlet_beluga_whales_main.htm