Update Ice seal Health Studies - North Slope Borough, Department of Wildlife management, Ice seal Committee annual Meeting 2025

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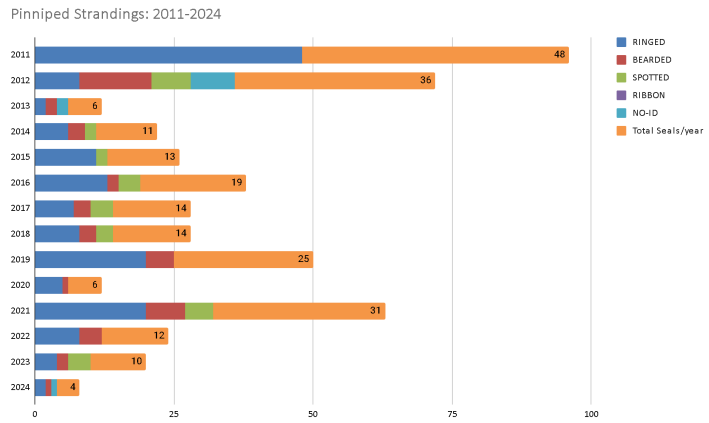
Background: There is little information available about natural causes of morbidity and mortality of ice seals. The North Slope (NSB DWM) Marine mammal health program works with hunters and communities to continually monitor the health of animals so we can detect diseases and contaminants early on that are of concern to people, provide veterinary medicine - science based information to hunters regarding "healthy" and "hunter concern" catches, and address individual and "big picture" concerns about native food health, food safety, and food security. The following provides an update on findings from ongoing and completed ice seal health studies.

Regional Stranding Response

Similar to last year sea ice conditions near Utqiagvik again resulted in a very late break up; Beach surveys in Utqiagvik commenced in mid-July (07/12/2024) and continued until October 16, 2024. Stranding numbers for seals remained extremely low with only five seals observed. There is a declining trend starting in 2022.

Fig.1a. Multiyear pinniped stranding data, Utqiagvik, North Slope, Alaska



Ice Seal Research & Collaboration

We are coordinating with NOAA and other research partners to collect, archive and analyze marine mammal tissue samples to investigate non-subsistence harvest related sources of sickness and mortality among harvested and found dead seals. A brief summary of ongoing and completed ice seal research is provided below.

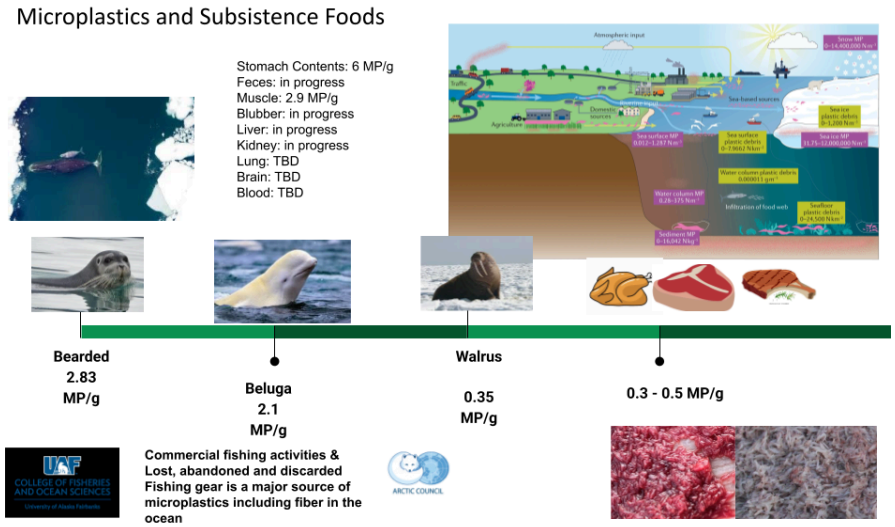
HARMFUL ALGAL TOXIN; We have continued our research partnership with Dr. Kathi Lefevbre (NOAA-WARRN-West, NWFSC) through the ECOHAB program on marine mammal biotoxin monitoring research in Alaska. Preliminary findings from the 2023 and 2024 walrus cruises update and HABS detection is summarized below.

- Both DA and STX were detected in the Chukchi Sea food web (snails, clams, sea anemone and walrus feces) during June of 2023 and 2024

- STX was detected in most samples, with concentrations ranging from low to above the human seafood safety limit (>80 g STX equiv./ 100 g sample). STX concentrations were highest in snails, walrus feces, clams, and the sea anemone; DA was found in fewer samples, with only low concentrations detected Note: None of the tunicate (sea squirt) samples had detectable levels of STX or DA
- STX detected in the food web, low algal cell counts, and variable cyst counts suggest that benthic invertebrates may accumulate STX either from eating cysts or holding onto toxins from previous algae blooms (or both).

Research funded by NOAA's ECOHAB program will continue, with emphasis on determining how HAB toxins impact the subsistence foods that are most important to Arctic and subarctic indigenous communities. Engagement and collaboration between researchers and communities who depend on food from the ocean will be essential. As the Arctic seas continue to warm, we expect harmful algae blooms to become more frequent and toxic, posing a greater risk to walruses and other benthic-feeding marine wildlife (e.g. bearded seal, gray whale) in the future. Analysis of bowhead whale fecal samples over a 19 year period provide strong evidence that with increasing temperature toxins increased (Lefebvre et al. 2025 "19 years of bowhead bowel samples show increasing algal toxins in Arctic food web due to warming ocean conditions" submitted to Nature and is currently out for review.

MICROPLASTICS: Plastic pollution is a global and an arctic issue. To better understand the fate of MPS in the arctic food web we are collaborating with Lara Horstman, UAF College of Fisheries and Ocean Sciences, on characterizing microplastics in tissues of key marine mammal subsistence species. Briefly initial analysis of a limited number of samples confirm that MP are detectable in variable concentrations in muscle and other tissues from subsistence hunted whales, seals, and Pacific walrus (see figure below). Further research is required to better understand the potential chronic effects of microplastic exposure on marine mammals and people's health.



INFECTIOUS ZOONOTIC DISEASES & PARASITES: The focus this year as in the previous year has been on collecting additional samples (blood; nasal swabs; lung & brain tissue) for HPAI (bird flu; avian influenza) and sars-cov-2 (coronavirus) surveillance from stranded and harvested ice seals. Throughout 2024 we have continued to monitor for seabird mortality events and other wildlife mortality. We had several small scale mortality events mostly involving short tailed shearwaters on the North slope (reported from Point Hope, Point Lay and Barrow). Birds were

collected in Barrow and sent for HPAI testing to the AK state veterinarian. None of these birds, most in fair body condition, and with food in their stomachs tested positive. Carcass condition of the few found dead seal carcasses precluded necropsies, but nasal/rectal and or brain swabs were collected (to be analyzed). Of note is the detection of HPAI H5N1 in a found dead female polar bear cub near Utqiagvik, during summer; this marks the second case for free-ranging polar bears in Alaska and the first detection of HPAI H5N5 in 1 found dead ringed seal in Nunavut, Canada. Given the shared habitat between seabirds and ringed seals, and the known susceptibility of seals to avian influenza viruses including this particular strain, spillover probability was high.

SARS-cov2/HPAI: We have recently shipped archived serum samples from subsistence harvested ice seals (n=35; 2021-2024) to Dr. Bortz (UAA) for analysis under the Spasak project. Spasak funding is through an USDA APHIS grant under the American Rescue Plan "SARS-CoV2 in animals". Serological results are pending. The study will provide important insights into the occurrence of silent spillovers into key Arctic marine mammals. For 2025 we will work with North Slope communities to collect samples from harvested ice seals and collect samples from found dead seals through our stranding program. Findings from our ongoing HPAI monitoring work were published in these open access papers.

- *Andersen-Ranberg E, Nymo IH, Jokelainen P, Emelyanova A, Jore S, Laird B, Davidson RK, Ostertag S, Bouchard E, Fagerholm F, Skinner K, Acquarone M, Tryland M, Dietz R, Abass K, Rautio A, Hammer S, Evengård B, Thierfelder T, Stimmelmayr R, Jenkins E, Sonne C. Environmental stressors and zoonoses in the Arctic: Learning from the past to prepare for the future. Sci Total Environ. 2024 Dec 20;957:176869. doi: 10.1016/j.scitotenv.2024.176869.*

- *Ahlstrom CA, Torchetti MK, Lenoch J, Beckmen K, Boldenow M, Buck EJ, Daniels B, Dilione K, Gerlach R, Lantz K, Matz A, Poulson RL, Scott LC, Sheffield G, Sinnett D, Stallknecht DE, Stimmelmayr R, Taylor E, Williams AR, Ramey AM. Genomic characterization of highly pathogenic H5 avian influenza viruses from Alaska during 2022 provides evidence for genotype-specific trends of spatiotemporal and interspecies dissemination. Emerg Microbes Infect. 2024 Dec;13(1):2406291. doi: 10.1080/22221751.2024.2406291.*

- *Stimmelmayr R, Rotstein D, Torchetti MK, Gerlach R. Highly Pathogenic Avian Influenza Virus A(H5N1) Clade 2.3.4.4b Infection in Free-Ranging Polar Bear, Alaska, USA. Emerg Infect Dis. 2024 Aug;30(8):1660-1663. doi: 10.3201/eid3008.240481.*

SARCOCYSTIS: As mentioned in the previous report we have partnered with Dr. Shapiro (UC Davis) on molecular characterization of sarcocystis spp. found in various marine mammals including seals, bowhead whales, beluga whales, and polar bears. Sarcocystis spp, a microscopic tissue dwelling protozoa have been found in the muscles of a number of marine mammals and are often not associated with any recognized clinical signs. However in some seal species (California sea lion ; grey seals) it can cause disease. Updated key findings from our ongoing study were presented at the 72 WDA "Phylogenetic relationships among Sarcocystis spp.in free-ranging Alaskan marine mammals". Chiu et al. 2024. Briefly, Sarcocystis spp. in Alaskan marine mammals clusters within four groups. The majority of Sarcocystis spp. identified in ringed, bearded, and spotted seals as well as polar bears were identical to Sarcocystis pinnipedi. Few sequences were identical to Sarcocystis canis previously detected in black, brown, and polar bears. Sequences recovered from a beluga whale, two polar bears, and seven ringed, bearded, and spotted seals were most closely related to an uncharacterized Sarcocystis species previously identified in a sperm whale (Physeter macrocephalus) and fur seal (Arctocephalus pusillus). We anticipate a final manuscript being submitted in early 2025.

SEAL POPULATION HEALTH, CONTAMINANTS & GENETICS

We have had a long standing collaboration between the ADFG biomonitoring program and the NSB DWM seal harvest monitoring program. We are pleased to report on the progress of several publications (see below) related to our collaborative ice seal research work. Key findings on seal productivity, contaminants, and genetics are summarized below:

- Productivity: no change in body condition, a stable or younger age of maturity, high pregnancy rates, and pup survival past weaning, indicating seal populations remain healthy in the Pacific Arctic. As predicted with warmer water, fewer ringed seals are eating Arctic cod, and more are eating saffron cod.
- Contaminants: though present are generally low and show declining trends in subsistence harvested seals. Contaminant burden from found dead seals during the 2011-2016 UME fell within the range of healthy subsistence harvested seals with the exception of 2 older seals in poor body condition that exceeded detected levels. Detected levels were unlikely to be a causative factor in the 2011-2016 pinniped UME.

- Genetics: significant genetic structure between the Pacific and the Atlantic subspecies, which diverged during the Penultimate Glacial Period (~193 kya); fine-scale genetic structure within both subspecies, with at least two distinct populations in the Pacific and three in the Atlantic.

- Close kin mark recapture method: using this novel method with subsistence harvested bearded seals provides estimates of abundance with the added opportunity to acquire information about adult survival, fecundity, and breeding success that could be applied to other ice seal species.

    - Quakenbush L, Bryan AL, Crawford J, , Olnes J, Stimmelmayr R. Ice seals of Alaska 2024 NOAA Arctic report card https://arctic.noaa.gov/report-card/report-card-2024/ice-seals-of-alaska/).

    - Olnes J, Quakenbush L, Bryan AL, Stimmelmayr R. Trace elements in Alaska's ice seals in the 2000s and 2010s. Sci Total Environ. 2025 Jan 1;958:178126. doi: 10.1016/j.scitotenv.2024.178126.

    - Olnes J, Bryan AL,Stimmelmayr R, Quakenbush L. Organochlorine concentrations in ice seals harvested in Alaska in the 2000s and 2010s Marine Pollution Bulletin (in review).

    - McCarthy M, Martínez AR, Ferguson S, Rosing-Asvid A, Dietz R, De Cahsan B, Schreiber L, Lorenzen E, Hansen R, Stimmelmayr R, Bryan A. Circumpolar population structure, diversity and recent evolutionary history of the bearded seal in relation to past and present icescapes. Molecular ecology issue pending

    - Taras BD, Conn PB, Bravington MV, Kilian A, Lang AR, Bryan A, Stimmelmayr R, Quakenbush L. Estimating Demographic Parameters for Bearded Seals, Erignathus barbatus, in Alaska Using Close-Kin Mark-Recapture Methods. Evol Appl. 2024 Nov 8;17(11):e70035. doi: 10.1111/eva.70035.