# Alaska Fisheries Science Center

## Marine Mammal Laboratory

# Marine mammal updates to the NPFMC SSC

John Bengtson

3 June 2020

# Marine mammal updates to the SSC

- Marine Mammal Laboratory and stock assessments
  – John Bengtson
- Steller sea lions and northern fur seals
  – Tom Gelatt
- Harbor seals and ice-associated seals
  – Peter Boveng
- Cook Inlet beluga whales
  – Paul Wade

NOAA FISHERIES

# Alaska Fisheries Science Center

## Marine Mammal Laboratory (MML)

**Director**
John Bengtson

**Operations Management**
Nancy Friday
Acting Deputy Director

**Alaska Ecosystems**
Tom Gelatt
Steller sea lions
Northern fur seals

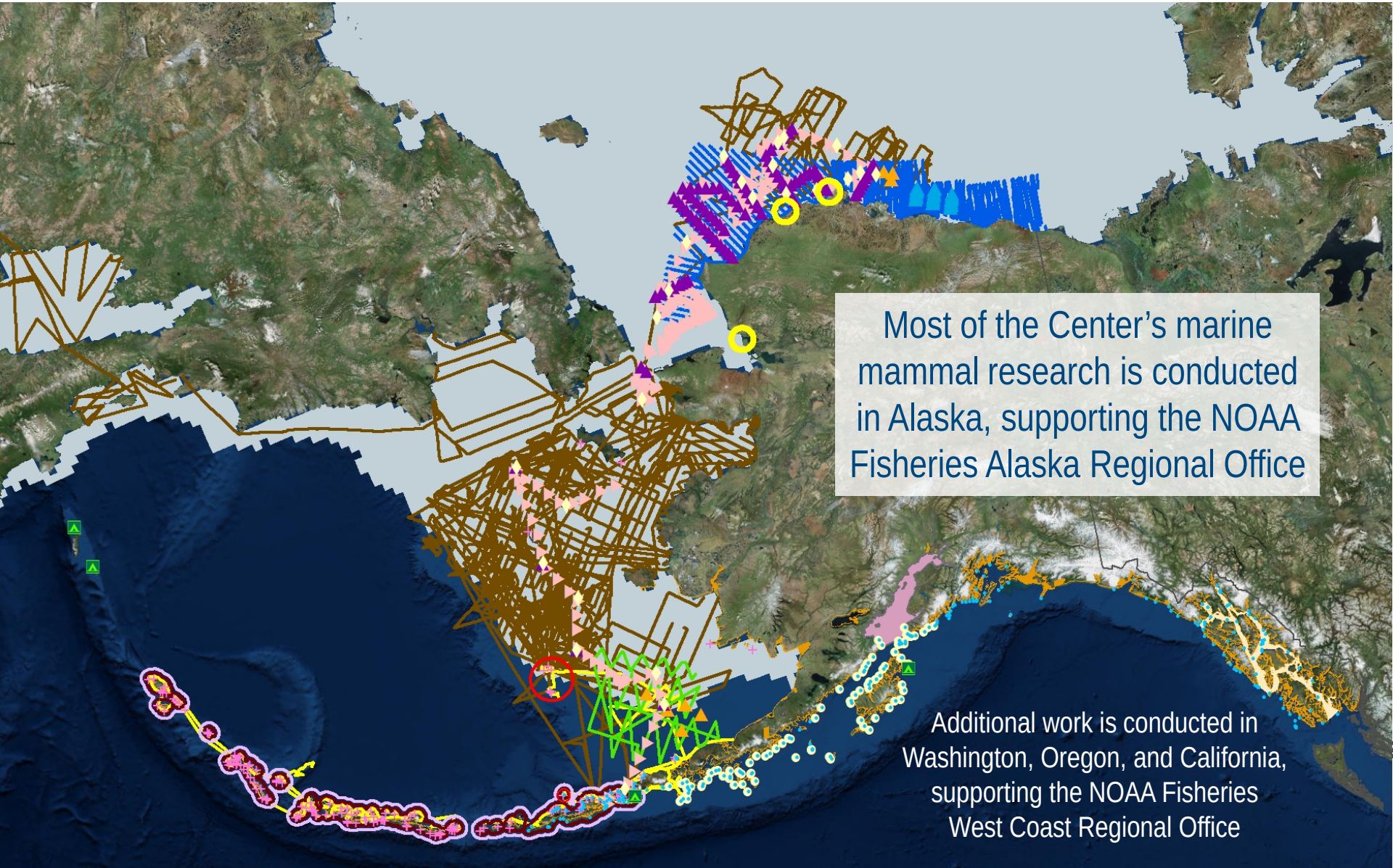
**Polar Ecosystems**
Peter Boveng
Ice-associated seals
Harbor seals

**Cetacean Assessment and Ecology**
Robyn Angliss
Large whales
Beluga whales
Cook Inlet beluga
Harbor porpoise

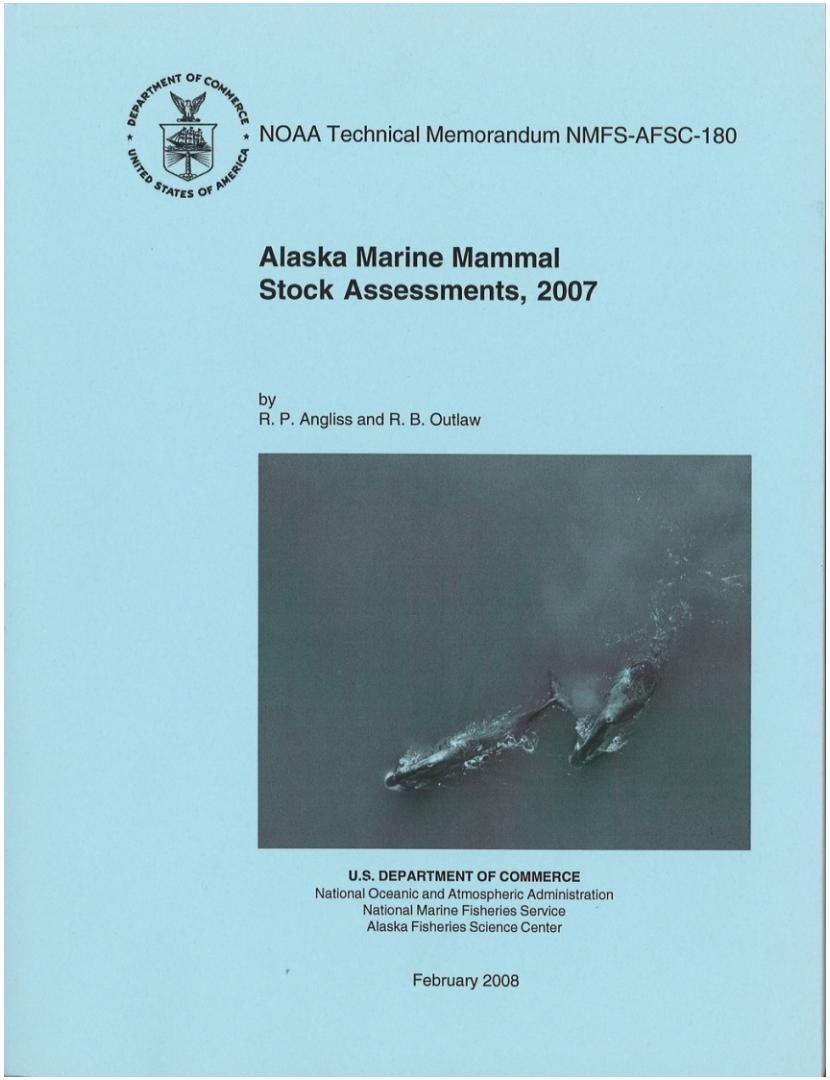
**California Current Ecosystems**
Bob DeLong
Steller sea lions
California sea lions
Northern fur seals
Harbor seals
Gray whales

# Alaska Fisheries Science Center

## Marine Mammal Laboratory (MML)



# Marine Mammal Stock Assessment Reports




Mandated by section 117 of the Marine Mammal Protection Act, as amended in 1994

Draft reports completed by ~ Dec of each year

Draft reports reviewed by

- NMFS AKR & HQ
- Alaska Scientific Review Group
  - John Citta, ADF&G
  - Elizabeth Concepcion, Alaska Seafood Cooperative
  - Thomas Doniol-Valcroze, DFO
  - Greg O'Corry-Crowe, Florida Atlantic University
  - Ari Friedlaender, OSU
  - Mike Miller, Sitka Tribe of Alaska
  - Megan Peterson, Sierra Nevada College
  - Lorrie Rea, UAF
  - Eric Regehr, UW
  - Kate Stafford, US

Draft reports made available via the Federal Register; mandatory 90-day public comment period

Final reports completed annually in ~May

# What goes in a marine mammal stock assessment report:

- Stock definition and geographic range
- Abundance
  - Nmin
  - Current trend
- Current and maximum net productivity rates
- PBR (potential biological removal) level
- Annual human-caused serious injury and mortality level
  - Fisheries information (e.g., federal and state observer programs, self reports)
  - Alaska Native subsistence harvest information
  - Other mortality (vessel strikes, research-related mortalities)
- Status of stock
- Habitat concerns

# Alaska marine mammal stock assessment reports (SARs)

(as of 2015)

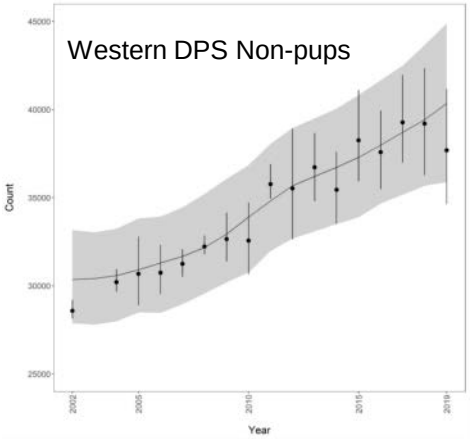
| | Number of stocks | Number of stocks with PBR | Number of stocks with takes: stocks with subsistence takes | Known number of stocks with fishery takes > PBR | Number of SARs with trend data |
|---|---|---|---|---|---|
| Pinnipeds | 20 | 18 | 20 : 19 | 0 | 13 |
| Mysticetes | 6 | 4 | 4 : 1 | 0 | 3 |
| Odontocetes | 20 | 7 | 14 : 5 | 0 | 3 |
| TOTAL | 46 | 29 | 38 : 25 | 0 | 19 |

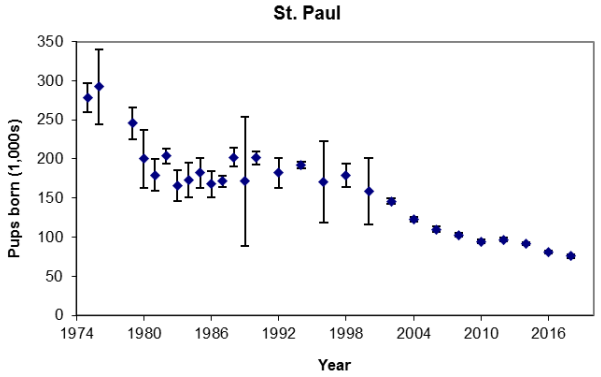
- 47% of AK SARs do not have a PBR level
- 59% of AK SARs to not have trend data

# Update on Steller sea lion and northern fur seal abundance and 2020 field work

**Tom Gelatt**
Alaska Ecosystem Program, Marine Mammal Laboratory
Alaska Fisheries Science Center, NOAA Fisheries

June 3, 2020



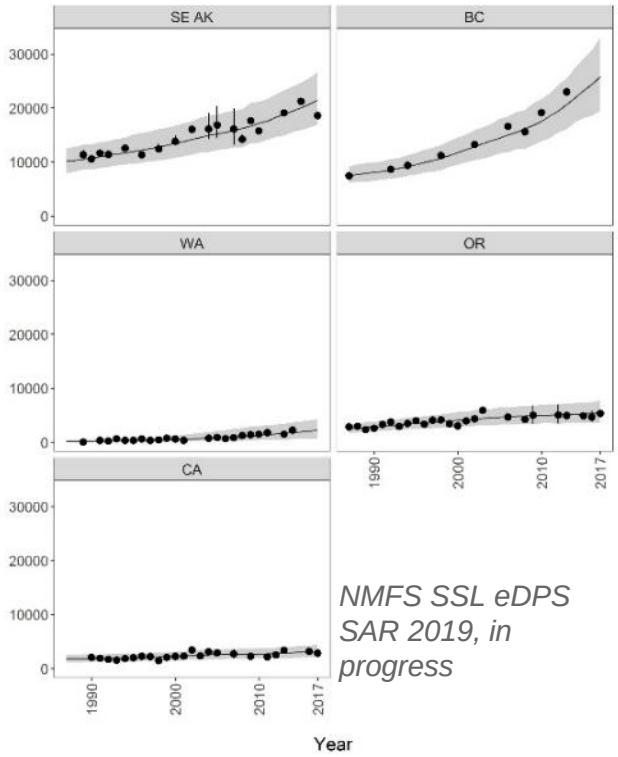



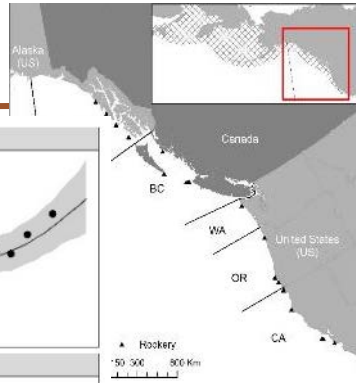

*NPFMC SSC June 2020*

# Eastern DPS Steller Sea lions

Non-pups




*NMFS SSL eDPS SAR 2019, in progress*

- Increased 2.84%/yr from 1989-2015
- SEAK increased 2.53%/yr between 1989 to 2019 (*Sweeney et al. 2019*)

# Western DPS Steller Sea lions 2019 update

Non-pups



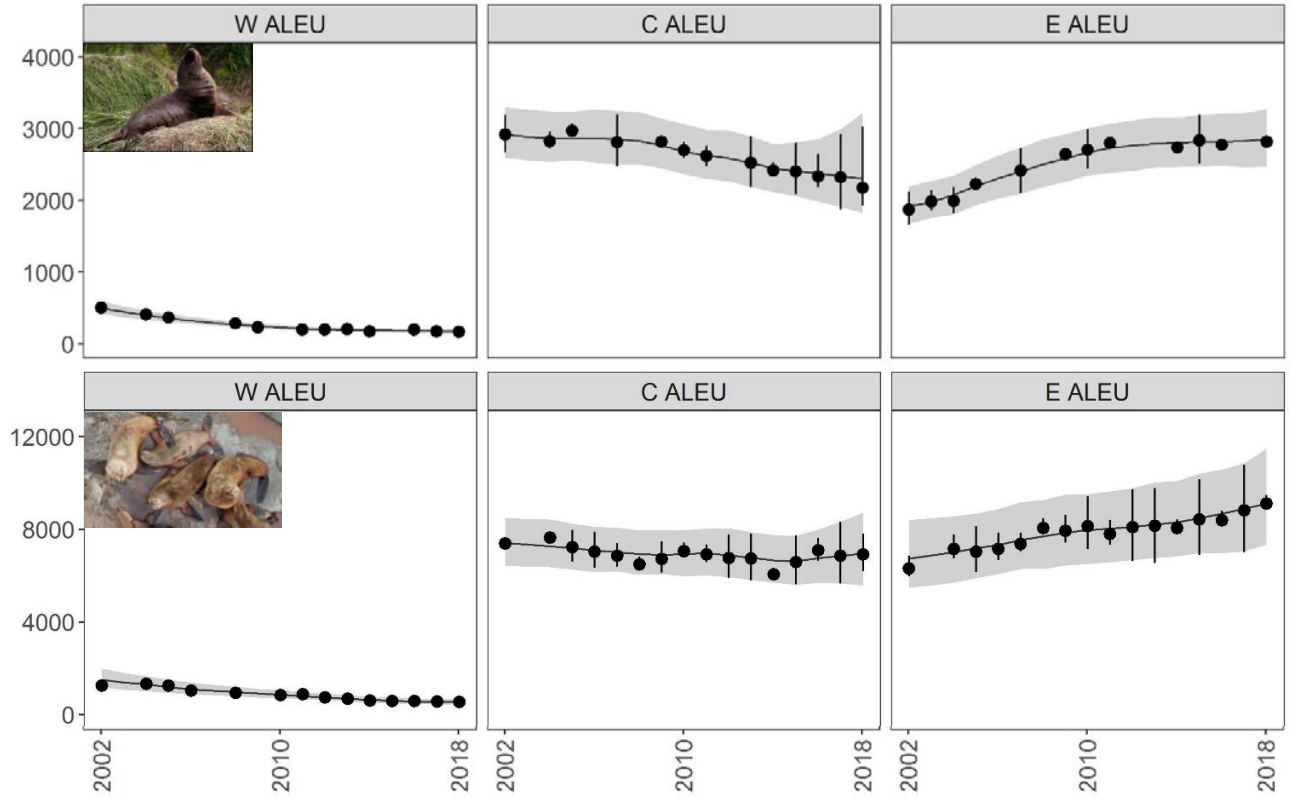

Pups

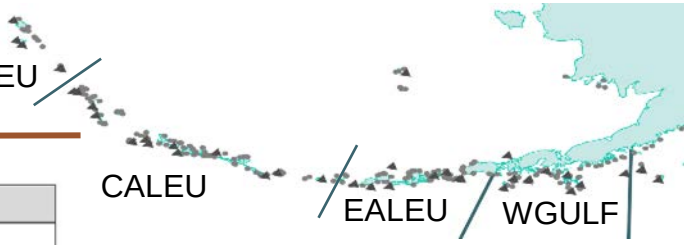



Sweeney et al. 2019

- Increased 1.82%/yr and 1.63%/yr, respectively, since 2002

# Aleutian Islands Steller Sea lions (2018)

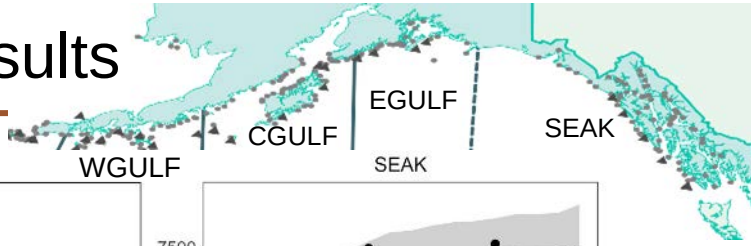


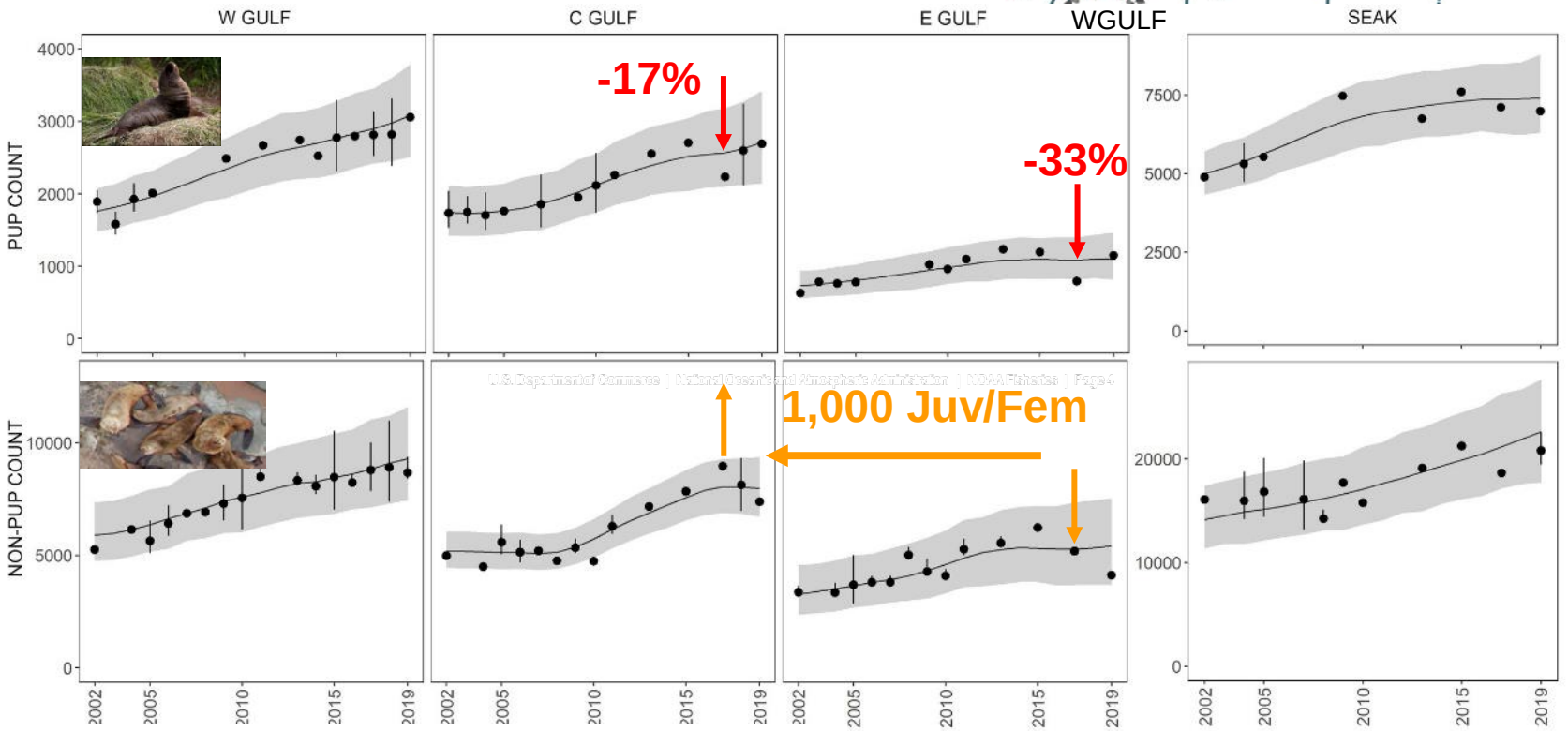




- Westernmost regions showing continued declines in nonpups since 1970s
- West of Samalga Pass nonpups declined 1.22%/yr since 2002
- EALEU region increased 1.76%/yr since 2002

*Sweeney et al. 2018*

# Gulf of Alaska Steller Sea lions 2017 Results

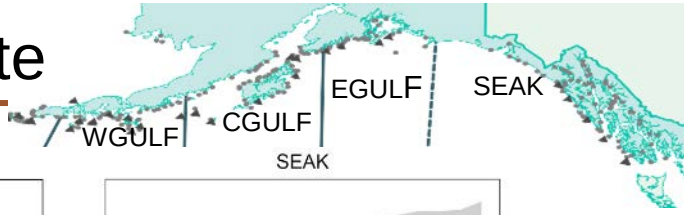


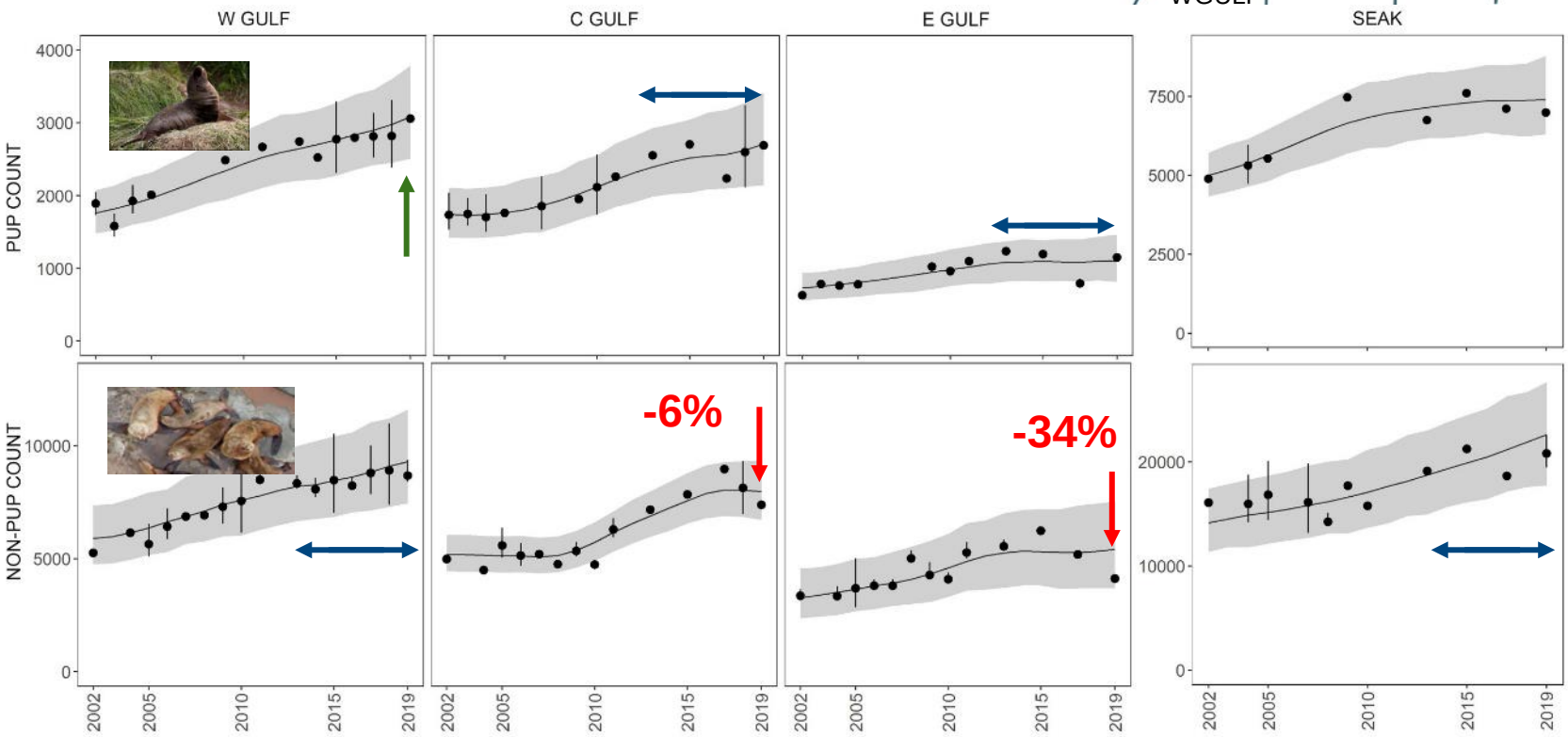




Sweeney et al. 2019.

- 2015 to 2017 pup production decline in E and C GULF
- 2017 movement of ~1000 Fem/Juv from E to C GULF, total non-pup count stable

# Gulf of Alaska Steller Sea lions 2019 Update



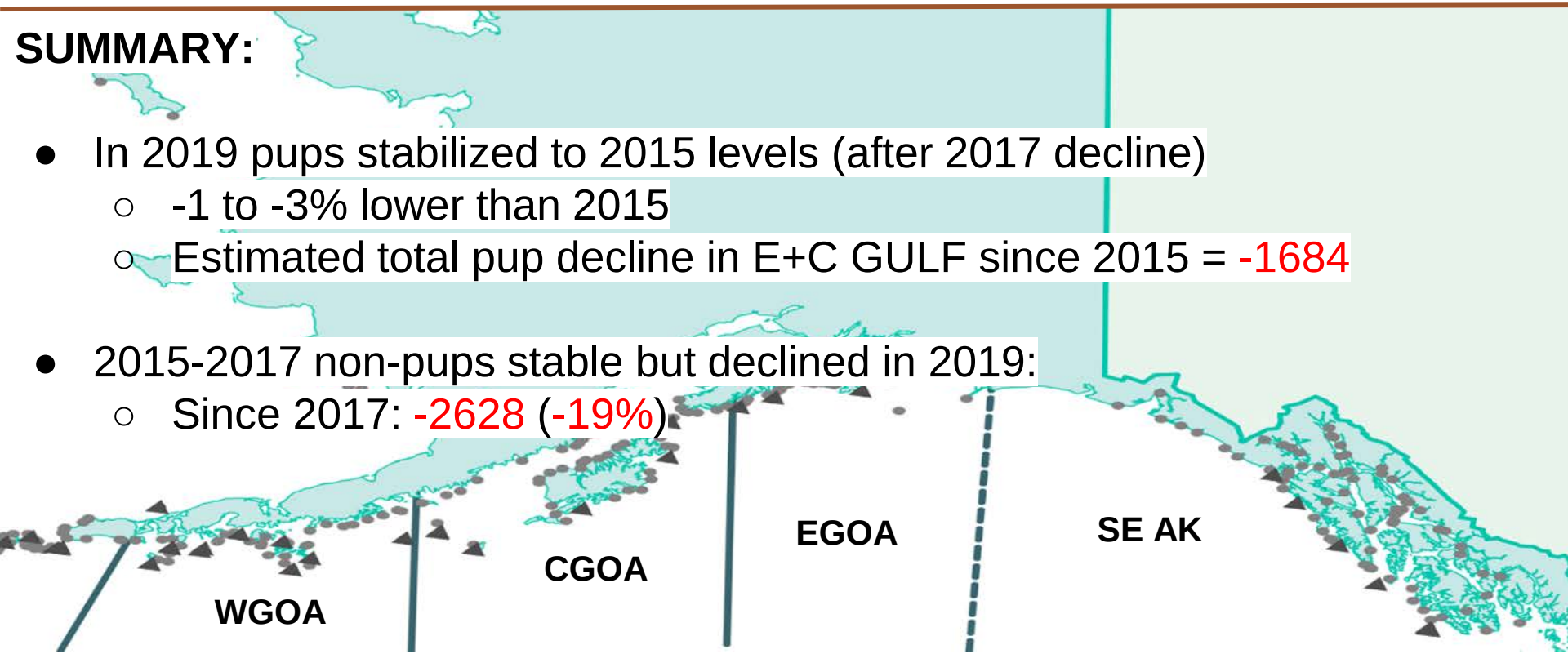

*Sweeney et al. 2019.*

- 2019 pup production went back to 2015 levels. Small spike in WGULF
- 2019 decline in non-pups: WGULF/SEAK stable = no movement?

# Gulf of Alaska Steller Sea Lions - Summary

**SUMMARY:**

- In 2019 pups stabilized to 2015 levels (after 2017 decline)
  - -1 to -3% lower than 2015
  - Estimated total pup decline in E+C GULF since 2015 = -1684
- 2015-2017 non-pups stable but declined in 2019:
  - Since 2017: -2628 (-19%)



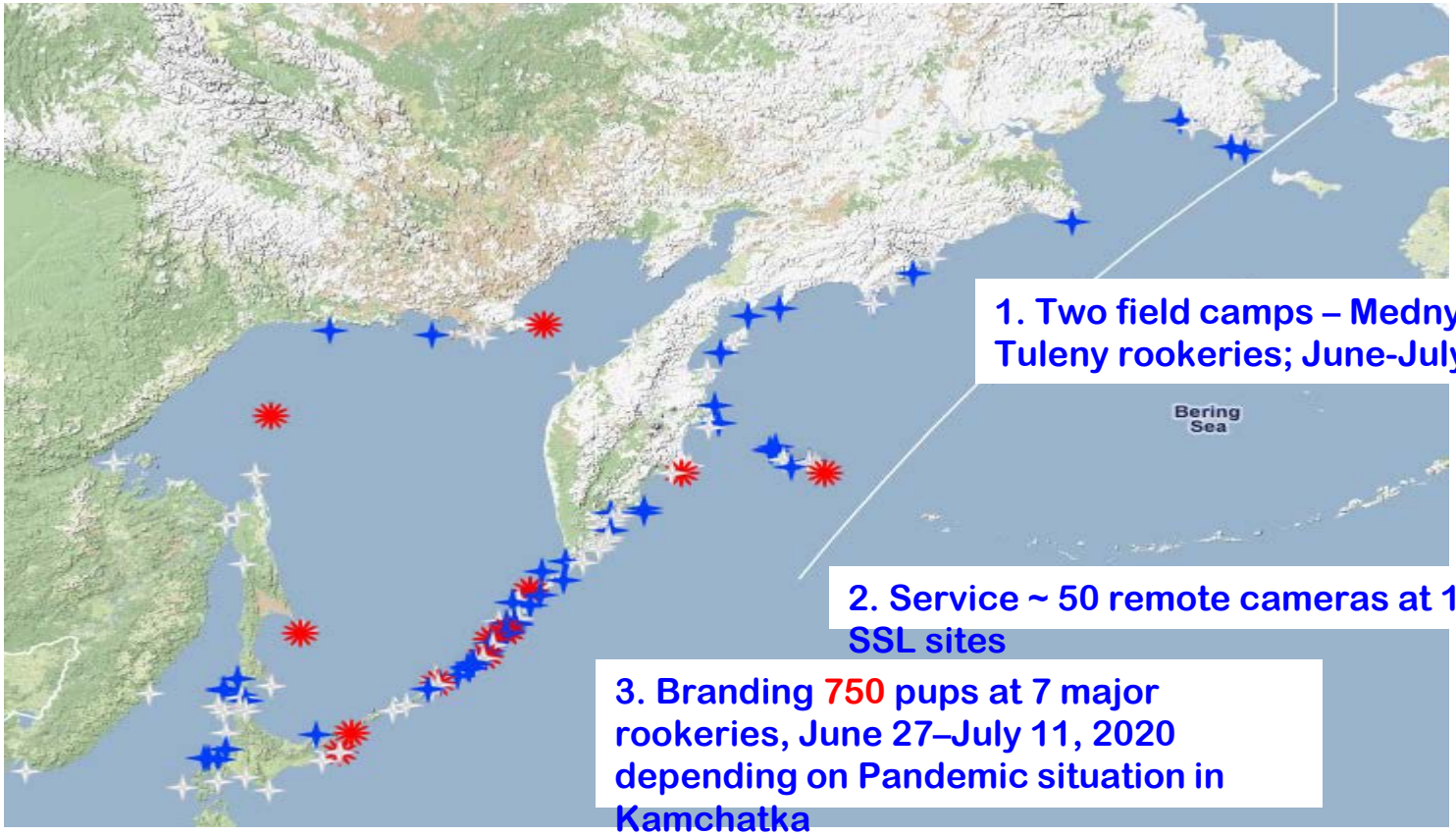
# 2020 Field Work Summary – Steller sea lion


- **May Tiglax cruise to Ugamak Island**: Deploy remote cameras for sighting branded animals and reproductive behavior (vital rates study)


- **June charter cruise in eastern Aleutian Islands**: Sight branded animals in Krenitzen Islands and Amak Island/Sea Lion Rock (vital rates study)

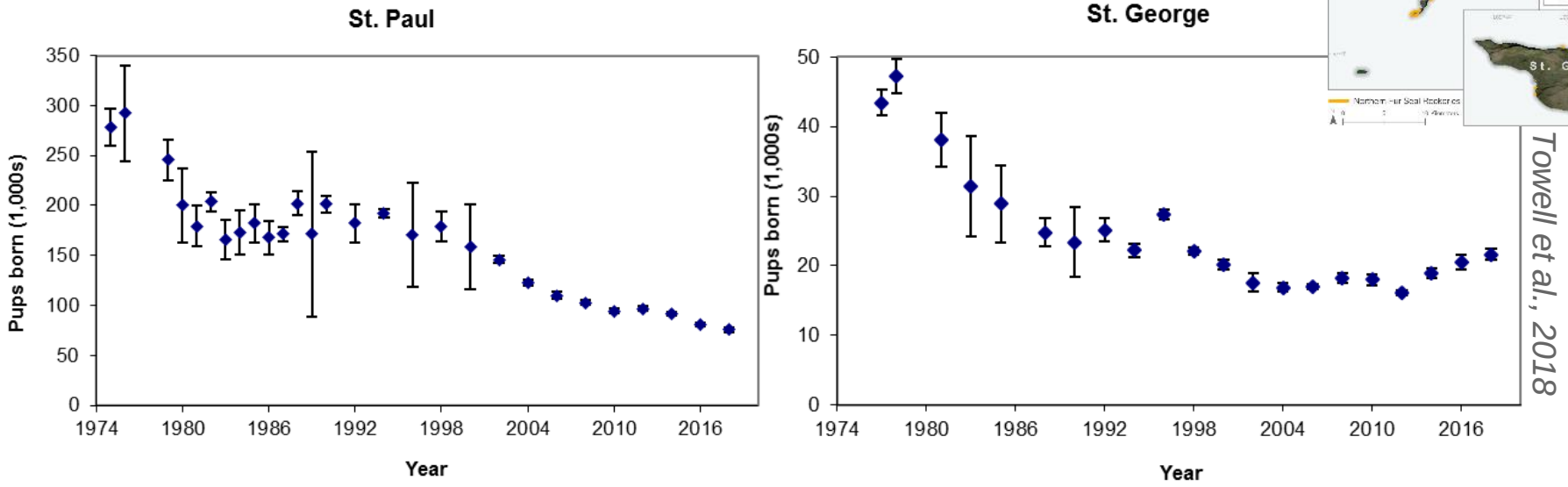

- **June/July Tiglax cruise to central/western Aleutian Islands:** UAS and ground surveys for counts (abundance/monitoring), pup handling for condition and contaminant studies, remote camera maintenance & download (vital rates), scat collection (diet), sight branded animals (vital rates)

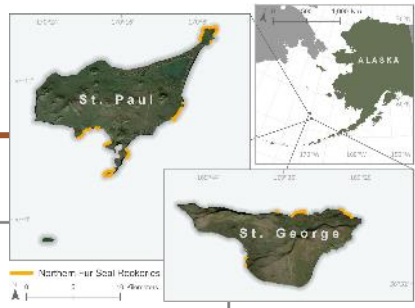
# SSL Russian Field Research Plan 2020 – North Pacific Wildlife Consulting *(NOAA Fisheries funding)*



# Northern fur seals – Pribilof Islands 2018

## Results



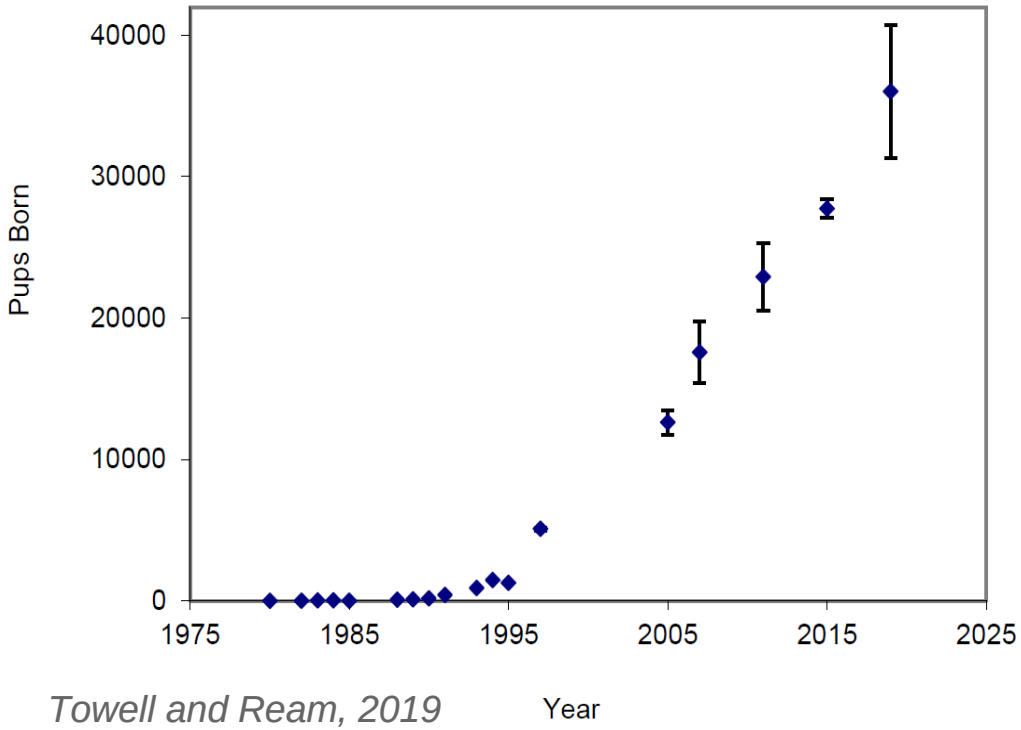




*Towell et al., 2018*

- 2016 to 2018: St. Paul declined 6.1% & St. Paul increased 5.8%
- 2016 to 2018 in total: Declined 3.7% from; lowest pup production >100 years
- Estimated 75,725 & 21,625 pups born on St. Paul & St. George (respectively)

# Northern fur seals – Bogoslof Island

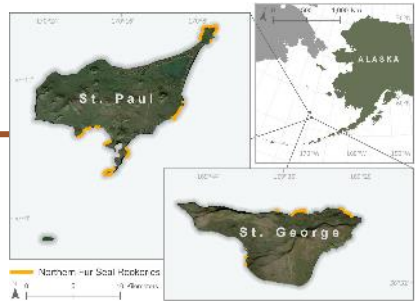
**2019 Results**




*Towell and Ream, 2019*

- First pups observed in 1980s
- Increased 30%/year until 1997
- Increasing 9.2%/year (since 1997)
- 52 eruptions over 9 months ending in August 2017
- August 2019 surveys: Estimated 36,015 pups born
- Two main rookery areas now on Island (red and blue circles)

# 2020 Field Work Summary – Northern fur seal





**Pribilof July bull counts:** Counting territorial bulls on rookeries


**Pribilof Island August Shearing/pup survey**: mark-recapture pup production study, pup weights, dead pup counts, scat collection


**Pribilof Islands tag resights**: Deploy re-sighters for longer term tag resight on St. Paul and St. George


**Pribilof Islands September tagging trip:** Tag adult females and pups for demographic studies and to assist St. Paul Eco researchers


Thank
You

# Monitoring and Research on Harbor Seals and Ice-associated Seals

Scientific and Statistical Committee

North Pacific Fisheries Management Council

3 June 2020

Peter Boveng
Polar Ecosystems Program Leader
Marine Mammal Laboratory
Alaska Fisheries Science Center
Seattle, Washington
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NOAA FISHERIES

Polar Ecosystems Program

Ribbon Seal

Spotted Seal

Ringed Seal

Bearded Seal

Harbor Seal

# Highlights of Monitoring and Research on Phocid Seals in Alaska

- Updates to stock assessments of harbor seals in Alaska
- Initial estimates of abundance for bearded and ringed seals in the Chukchi Sea
- Unusual Mortality Event (UME) in bearded, spotted and ringed seals of Alaska, 2018-2019
- Declining body condition of spotted, ribbon, and harbor seals, 2014 - 2018

# Harbor Seals in Alaska

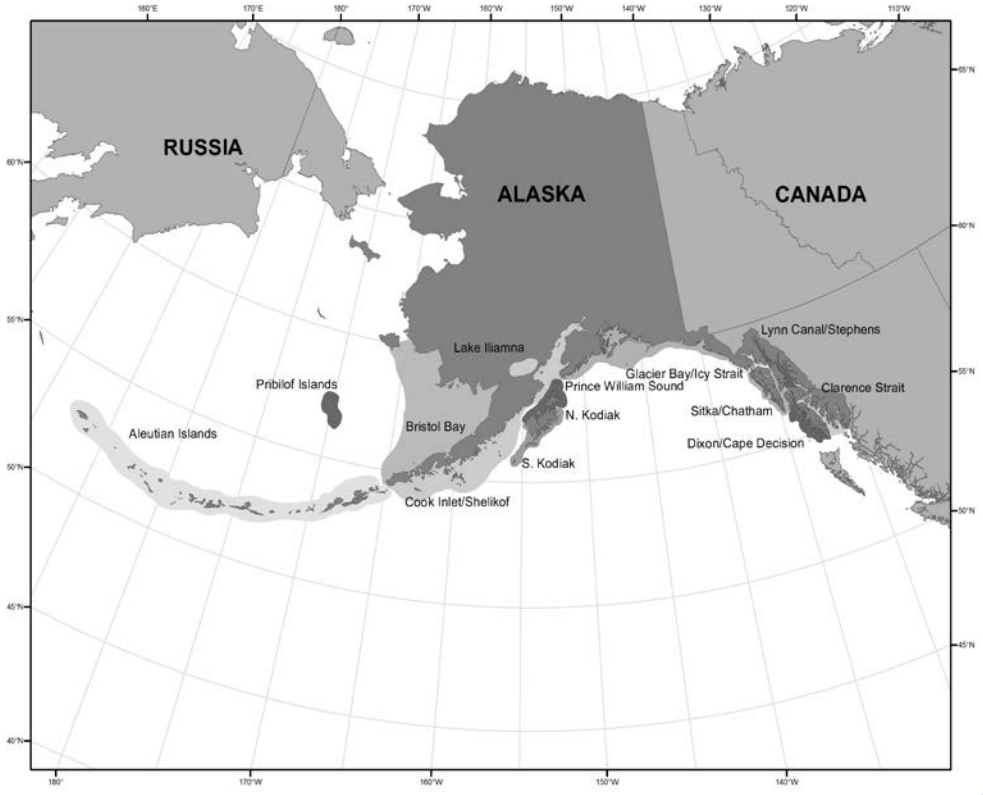
Stocks: 12

Abundance: ~244,000 statewide

Trend: varies by stock

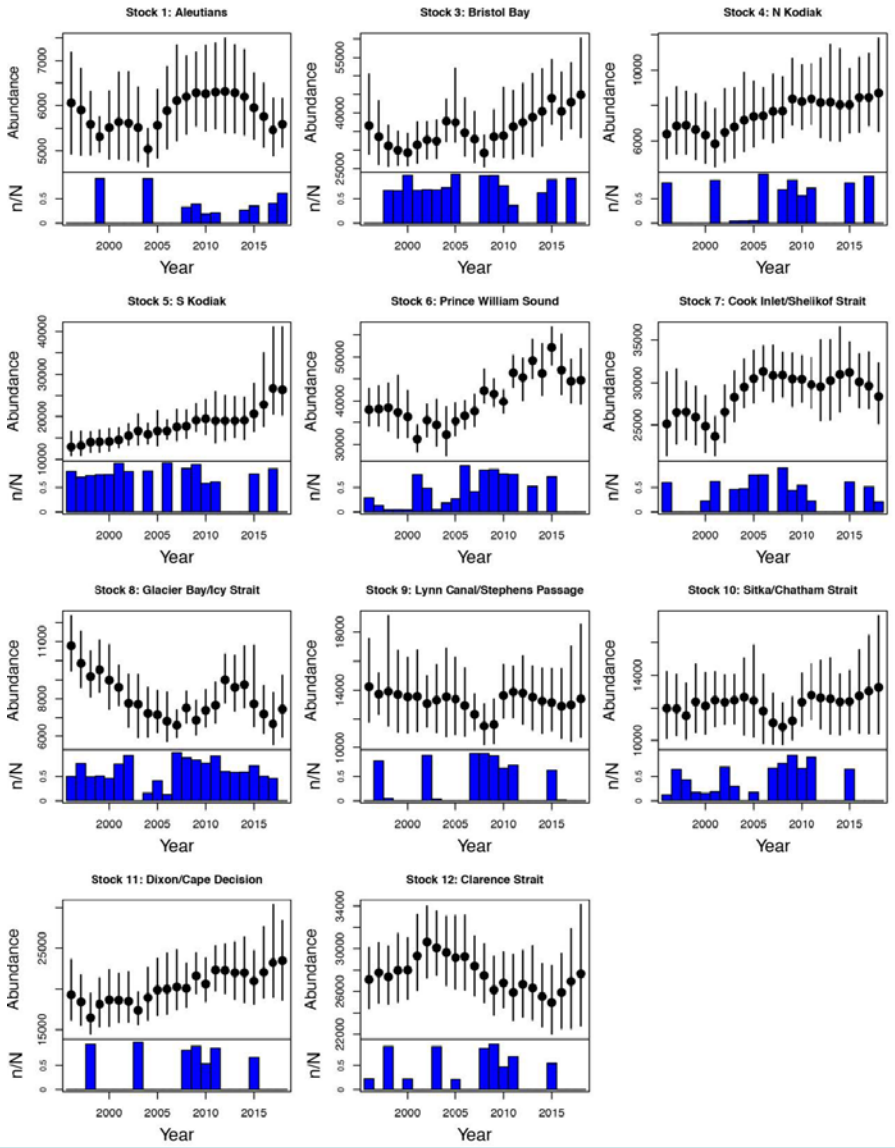
Habitat and life history: Coastal distribution; pupping in June, molting in August; modest movements in response to prey availability outside breeding/molting periods

Legal status, threats, mandates: MMPA not Depleted; ESA not listed; unknown factors have caused regional declines (86% in western Aleutians); Pribilofs also 'At-risk' due to small size and isolation



# Harbor Seal Abundance and Trends – All Stocks

- Abundance estimates for every year (note different scales)
- Precision or confidence varies by stock
- Consider aggregating data into time series for Ecosystem Status Report Card Indicators?



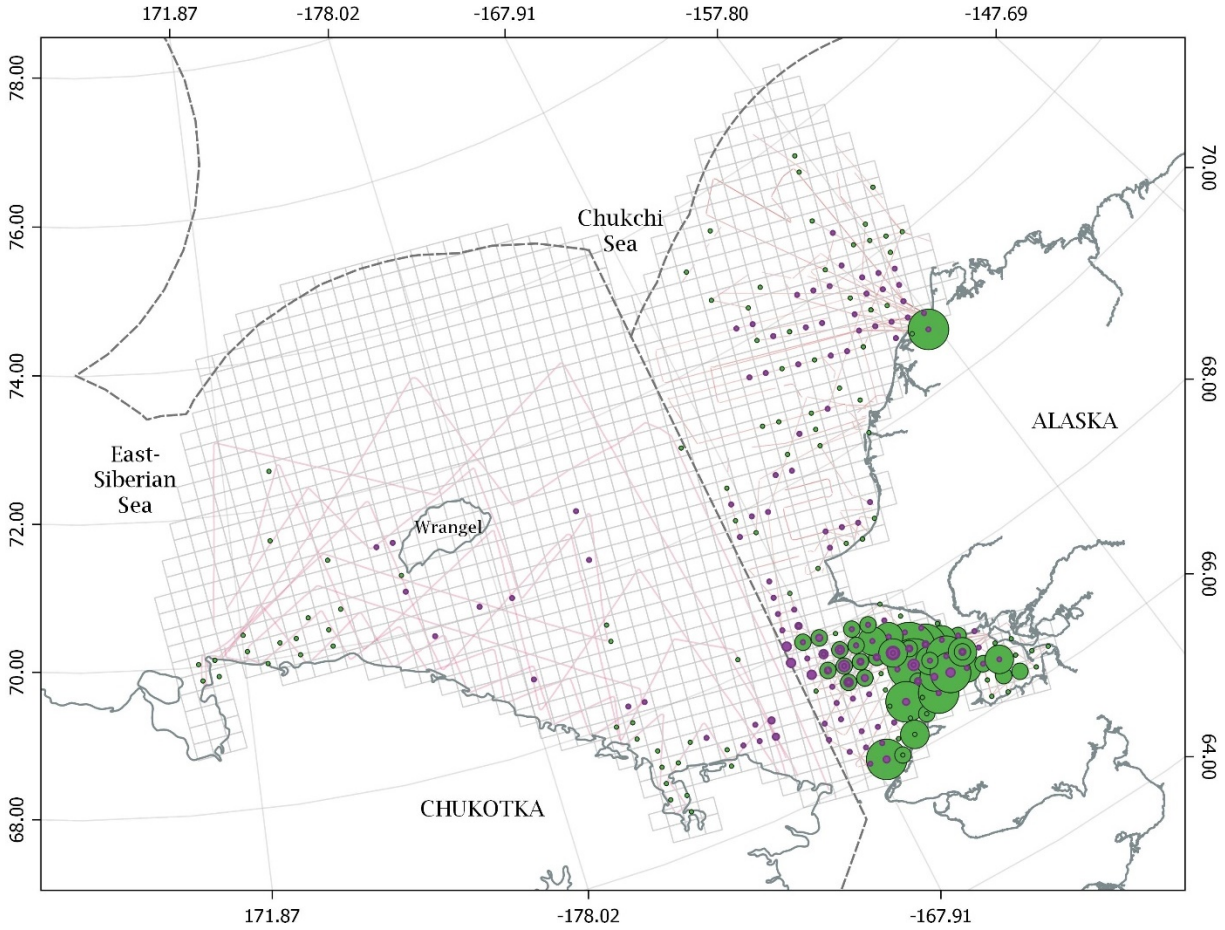
# Highlights of Monitoring and Research on Phocid Seals in Alaska

- Updates to stock assessments of harbor seals in Alaska
- Initial estimates of abundance for bearded and ringed seals in the Chukchi Sea (ChESS)
- Unusual Mortality Event (UME) in bearded, spotted, and ringed seals of Alaska, 2018-2019
- Declining body condition of spotted, ribbon, and harbor seals, 2014 - 2018

# Chukchi Sea ringed and bearded seal counts, 2016

**Ringed seal**
- 94

**Bearded seal**
- 53

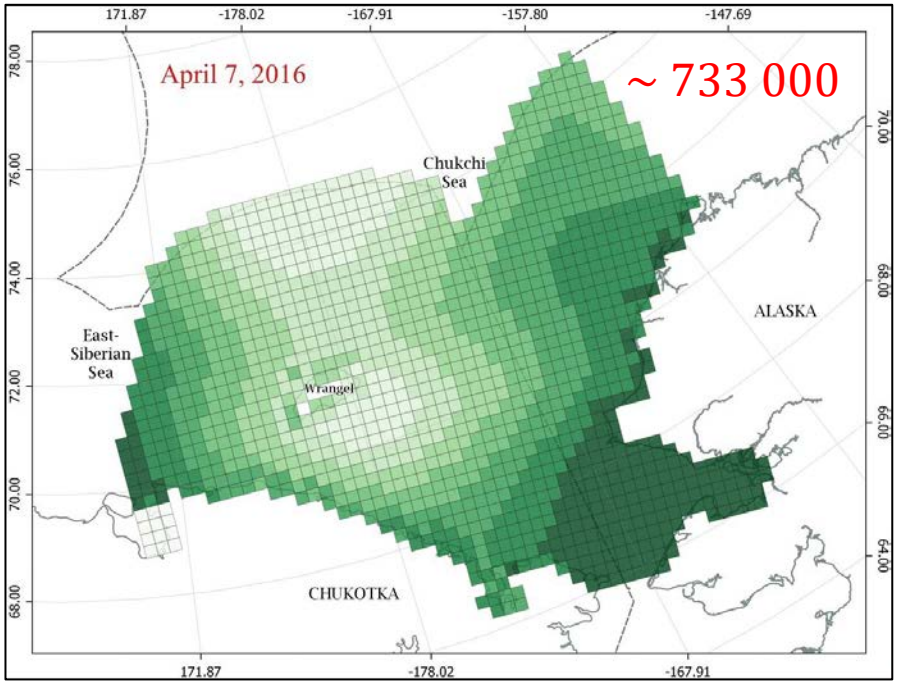



**Ringed seal**
- 4670

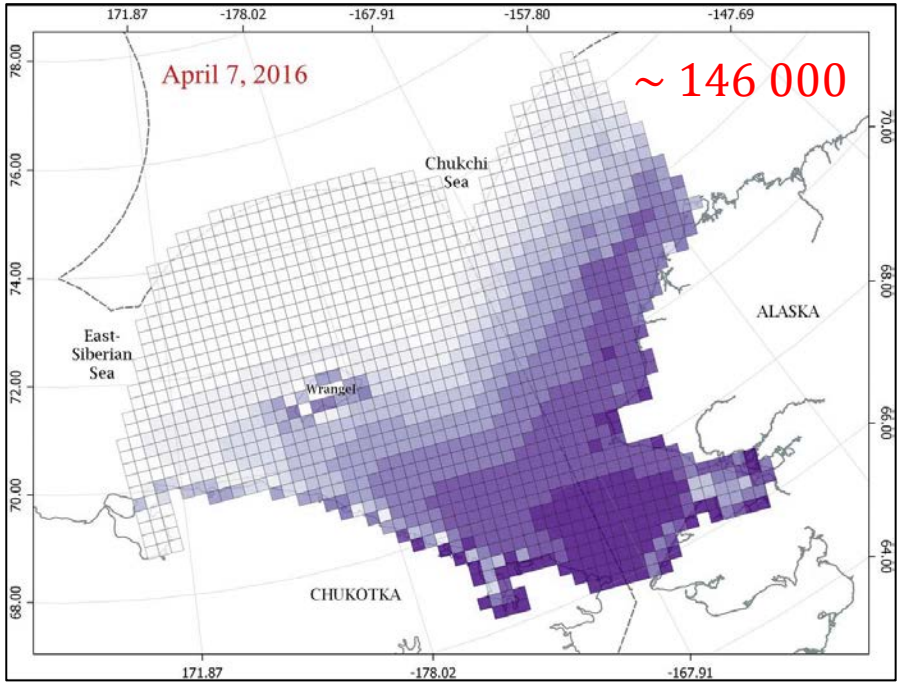
**Bearded seal**
- 1040

# Estimated ringed and bearded seal distributions

Ringed seal




Bearded seal



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# February

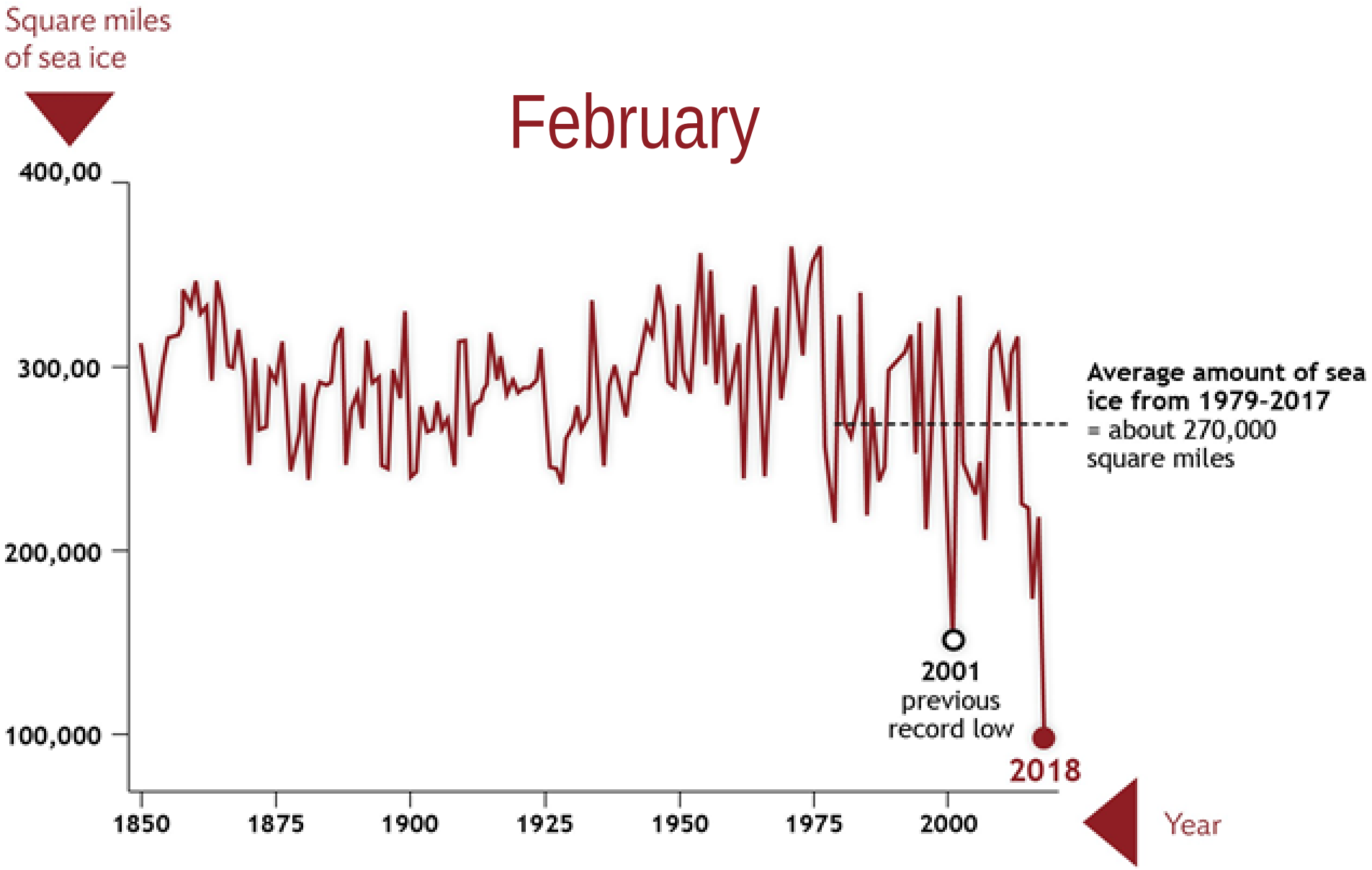


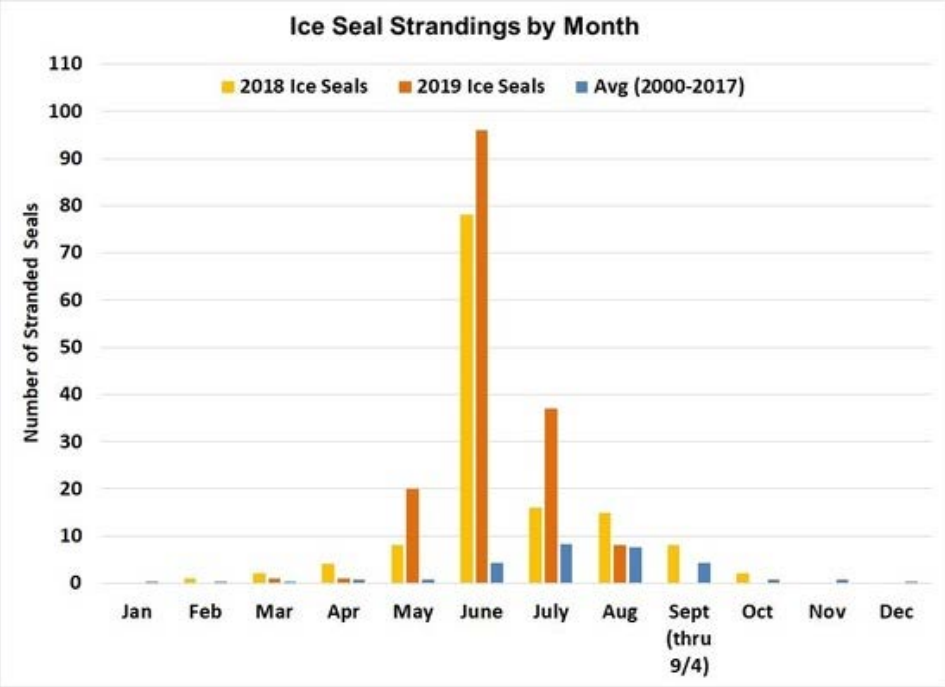

*Figure by International Arctic research Center (IARC).*
*Zachary Labe (University of California-Irvine), and Heather McFarland (University of Alaska, Fairbanks)*

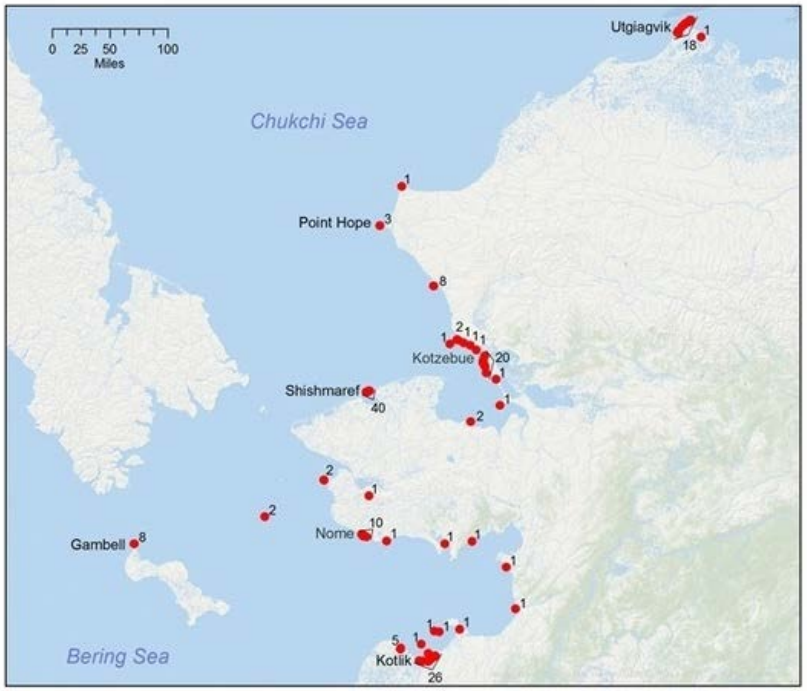
# Recent loss of sea ice

- In 2018 and 2019, the April sea ice in the Bering Sea was a small fraction of its historical extent. A NOAA expedition in 2018 found no ribbon or spotted seals in their historical breeding areas.


# Another unusual mortality event

- In spring and summer of 2018 and 2019, 282 bearded, ringed, spotted, and unidentified seal carcasses were reported from beaches of the Bering and Chukchi seas.
- 5 to 7 times the yearly average from 2000-2017, prompting NOAA to declare a UME.



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- Updates to stock assessments of harbor seals in Alaska
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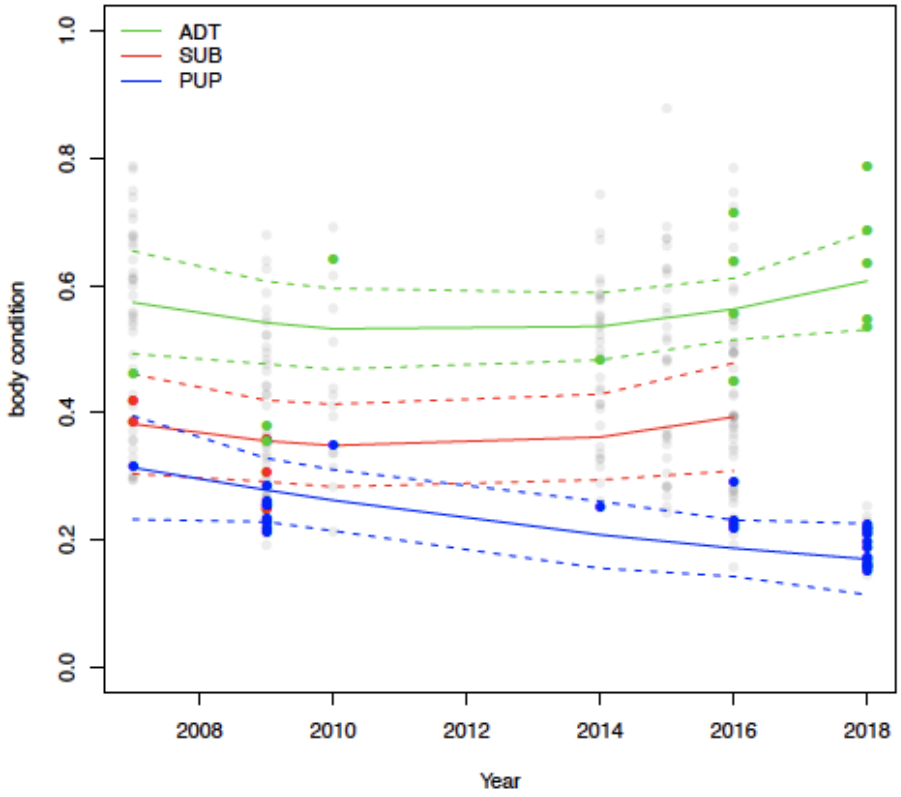
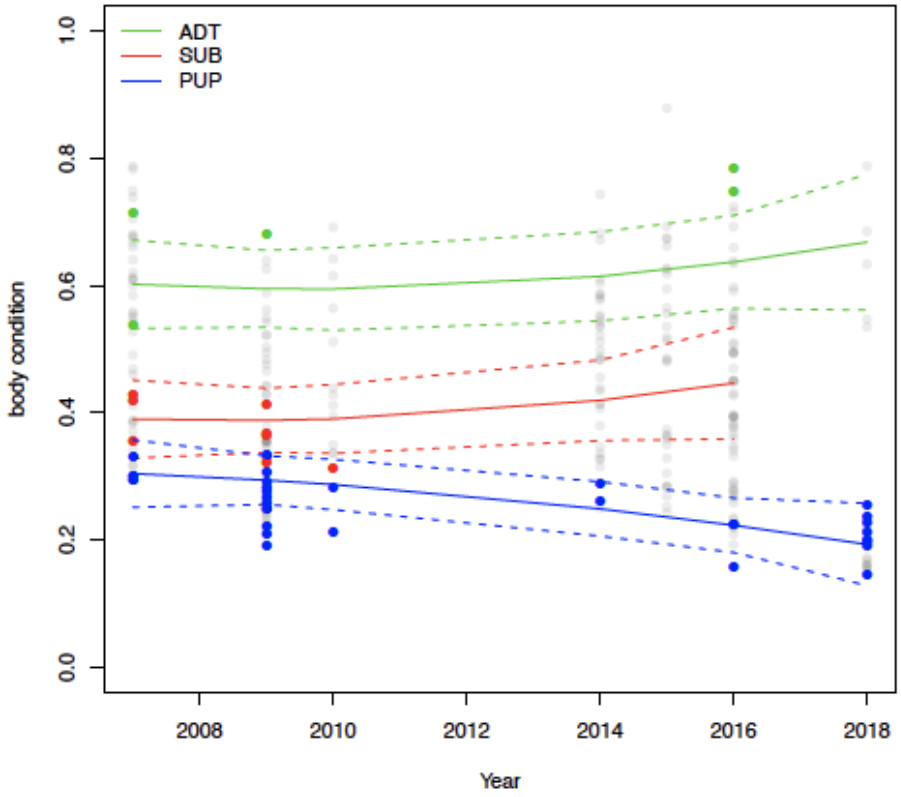
- Unusual Mortality Event (UME) in bearded, spotted and ringed seals of Alaska, 2018-2019
- Declining body condition of Bering Sea spotted and ribbon seal pups, 2007-2018, and Aleutian harbor seals, all ages, 2014 - 2018

# Spotted seal body condition, Bering Sea, 2007-2018

female

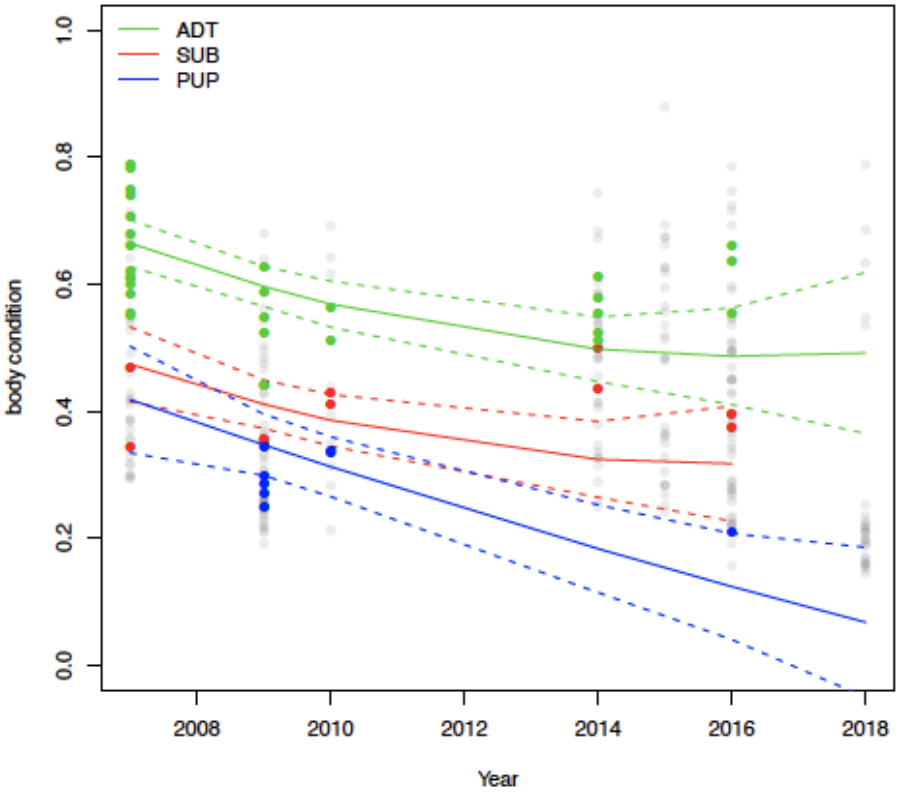



male

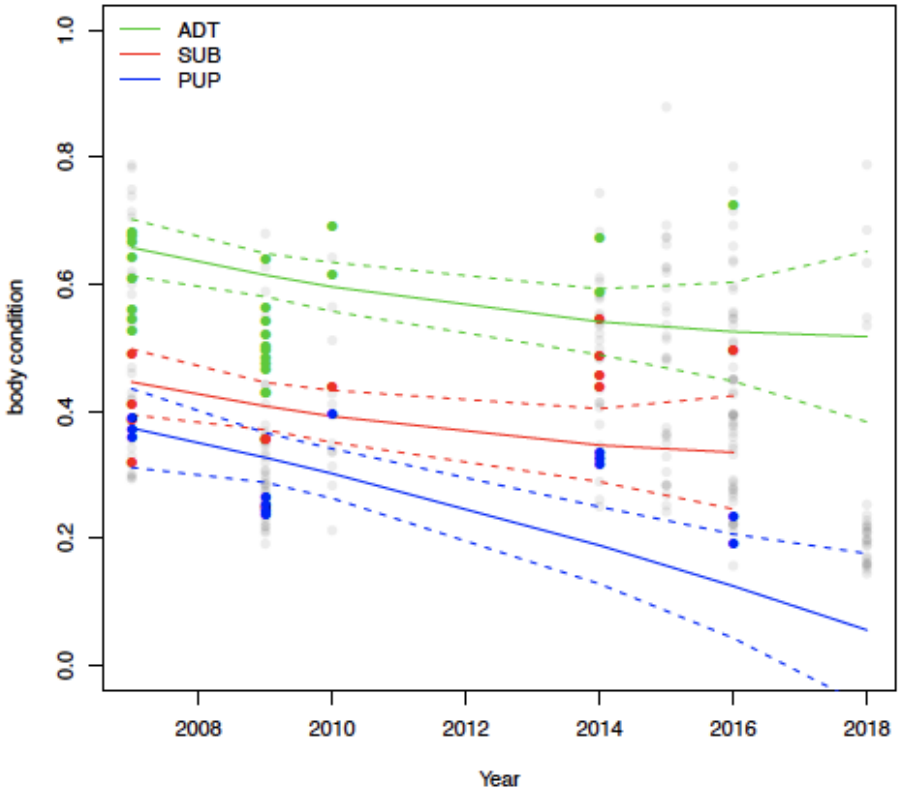


# Ribbon seal body condition, Bering Sea, 2007-2018

female

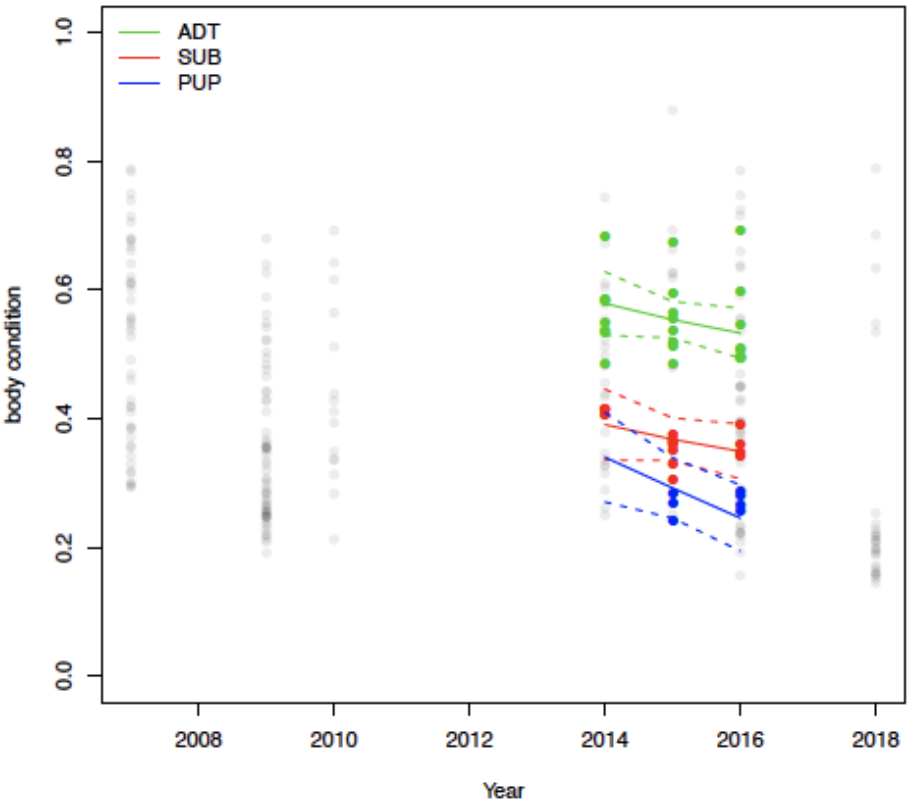



male

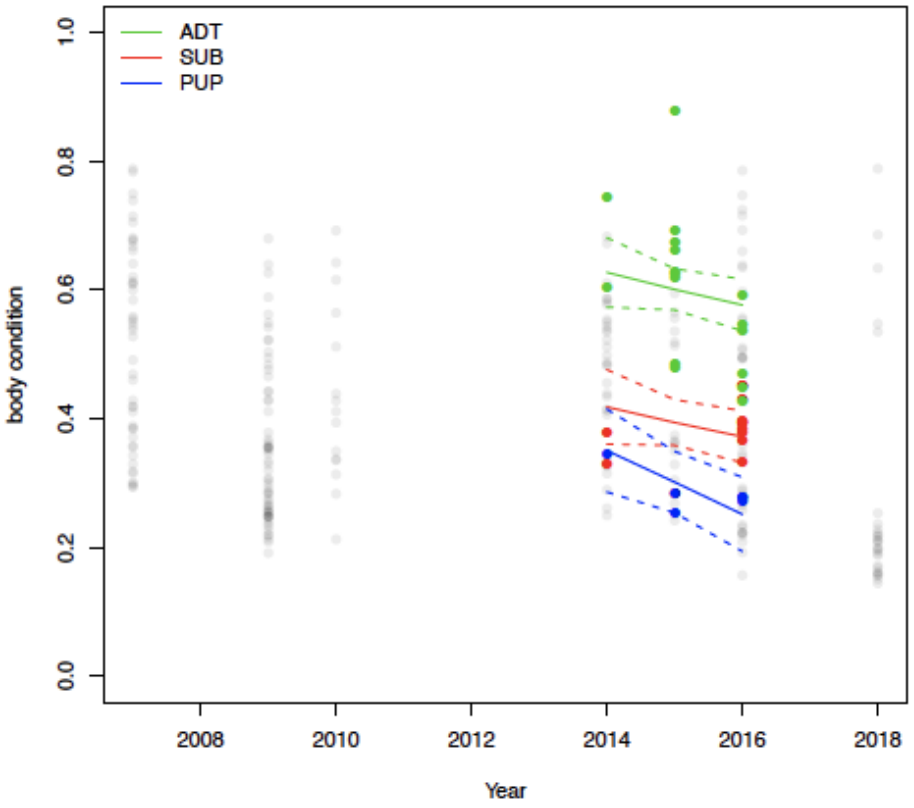


# Harbor seal body condition, Aleutian Islands, 2014-2016

female




male



# Summary

- Harbor seal stocks in Alaska are monitored and assessed, though less frequently than in the past.
- Annual estimates of abundance could be considered for ecosystem status indicators.
- Ice-associated seals in Alaska are inadequately assessed but abundance estimates for at least the Bering and Chukchi seas breeding populations of will be determined from surveys in 2012-2016.
- Beaufort Sea survey planned for 2021.

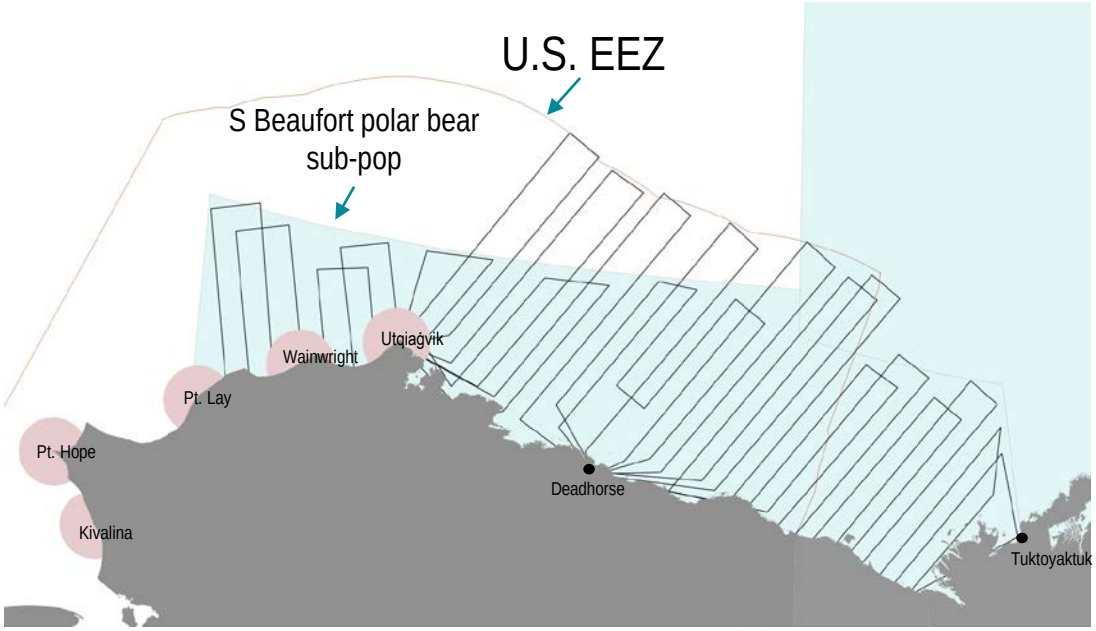
# Summary (continued)

- Body condition of spotted and ribbon seal pups appear to have declined, possibly driven by ecosystem changes during the recent warm period.
- An unusual mortality event in 2019-2019 seems also likely to be related to warm conditions.
- A decline in Aleutian harbor seal body condition also occurred during the recent warm period but there is no clear link to the longer term decline in spotted and ribbon seal pup condition.

# Marine Mammal Laboratory plans for 2020-2021

- Aerial Survey for Bearded Seals, Ringed Seals, and Polar Bears In Beaufort Sea (canceled due to COVID-19).
- Monitoring cruise for ribbon, spotted, bearded and ringed seals (canceled due to COVID-19).
- Long-range ('beyond line of sight') unmanned aerial surveys for harbor seals and Steller sea lions in the western Aleutian Islands (seeking funding).
- Aerial surveys for harbor seals in glacial fjords (GOA and SE AK) planned for August 2021.

# Aerial Survey for Bearded Seals, Ringed Seals, and Polar Bears In Beaufort Sea




Purpose:

1. Use infrared, visual and ultraviolet images to detect and count seals and polar bears.
2. Complete the series of Bering-Chukchi-Beaufort seas surveys for ice seals in Alaska waters.

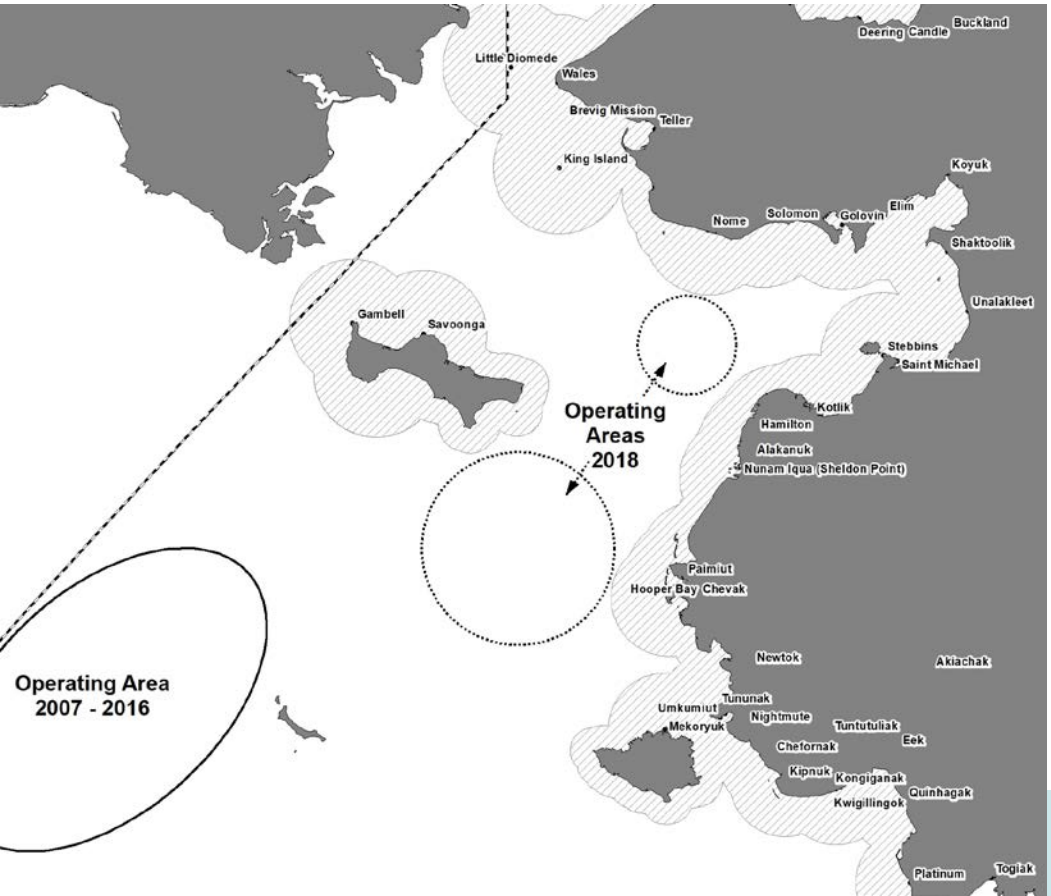
Area of operations

Base in Deadhorse, Utqiaġvik, and (possibly) Tuktoyaktuk for surveys of seals in the Beaufort Sea out to the U.S. EEZ, and Southern Beaufort polar bear subpopulation.

Dates: April 8 – June 5, 2020 (canceled for 2020)

POC: Peter Boveng, NMFS/AFSC

# Monitoring survey for ice-associated seals (ribbon, spotted, bearded and ringed seals)

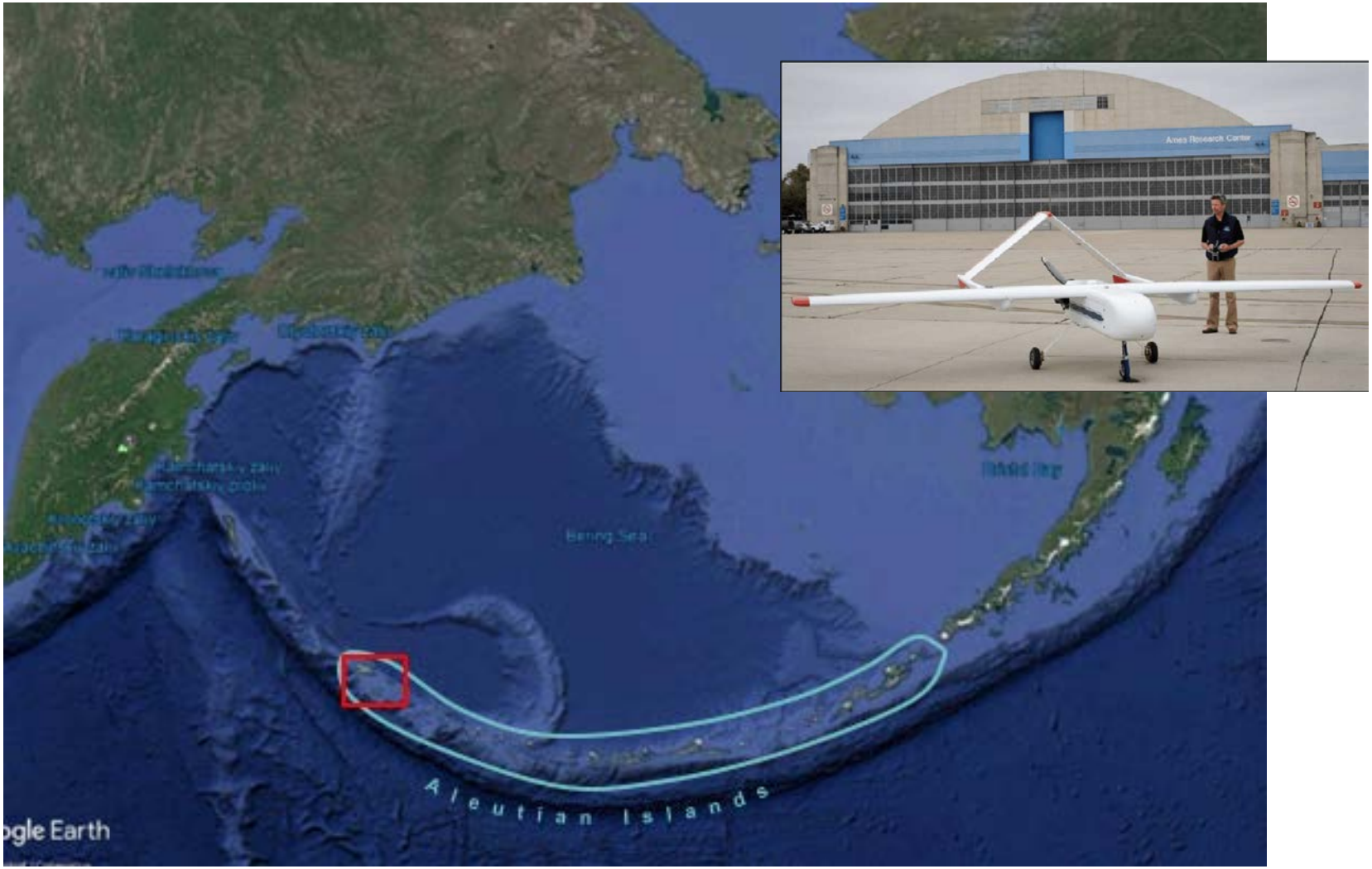



**Vessel:** Oscar Dyson (DY-20-04)
**Dates:** 28 March-24 April, 2020 (canceled for 2020)
**Location:** Bering Sea ice edge
**POC:** Peter Boveng (NMFS/AFSC)

**Purposes**

- Attach satellite tracking tags
  - Seasonal movements and habitat preferences
  - Abundance estimates
- Morphometrics & bio-sampling
  - Assess health and condition
  - Disease, diet, contaminants, population structure, etc.
  - UME and HAB investigations
  - Assess impacts of sea ice loss and a changing climate

# Long-range UAS surveys for harbor seals and Steller sea lions in the western Aleutian Islands, September 2020 (seeking funds)



# Thank you

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Alaska Fisheries Science Center
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SPECIES *in the* SPOTLIGHT

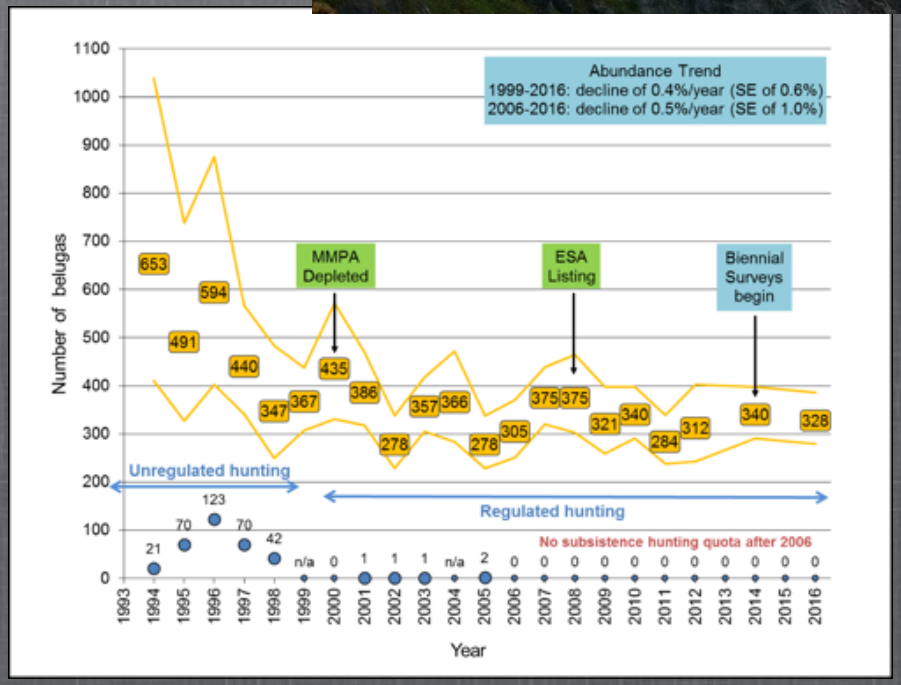
# Abundance and Trends of Cook Inlet Beluga Whales

NOAA FISHERIES

Paul R. Wade
Marine Mammal Laboratory, AFSC, NOAA Fisheries

# Abundance and Population Assessment

- Aerial surveys flown since 1994
- Census of groups in the upper Cook Inlet, with video data used to estimate group sizes
- Consistent methods since 2004
- Most recent survey conducted in 2018

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Shelden, K. E. W. and P. R. Wade (editors). 2019. Aerial surveys, distribution, abundance, and trend of belugas (*Delphinapterus leucas*) in Cook Inlet, Alaska, June 2018. AFSC Processed Rep. 2019-09, 95 p. Alaska Fish. Sci. Cent., NOAA, Natl. Mar. Fish. Serv., 7600 Sand Point Way NE, Seattle WA 98115.

CHAPTER 2: Group Size Estimates and Revised Abundance Estimates and Trend for the Cook Inlet Beluga Population

P. R. Wade, C. Boyd, K. E. W. Shelden, and C. L. Sims

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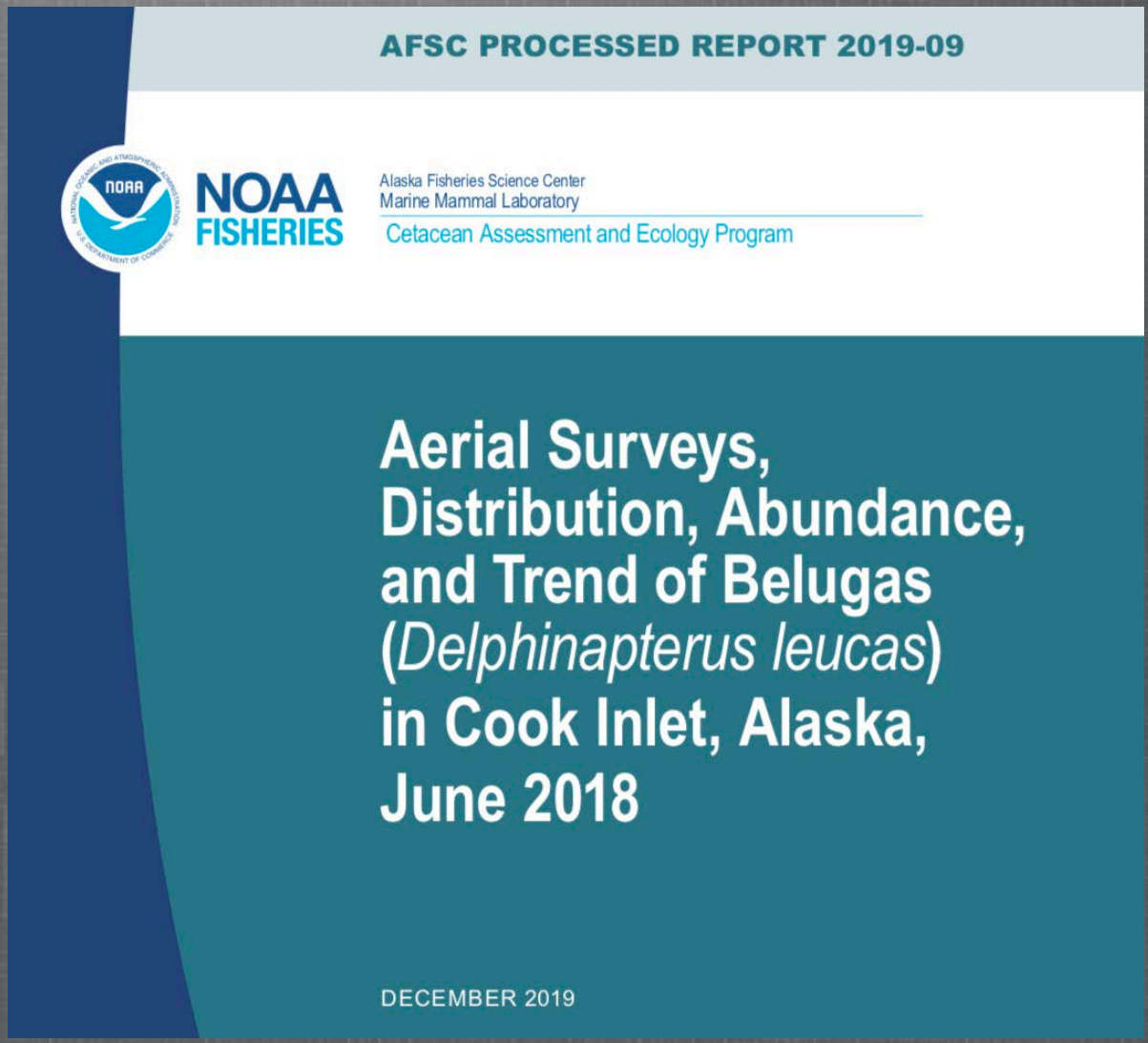

# Changes since the previous trend estimate

- A new year of aerial survey data was added to the analysis.
  - The 2018 abundance estimate is the lowest estimate since 2004
- Consistent criteria were used to determine whether a survey day should be included or excluded from the analysis
  - This effected only a small number of days previously used
- A change was made to use the median versus the mean values of all acceptable survey days for producing an annual estimate
- A new modeling approach was applied for estimating group size from video data collected during the aerial survey

Marine Mammal Science

MARINE MAMMAL SCIENCE, 9999(9999): 1–25 (2019)

DOI: 10.1111/mms.12592

# Bayesian estimation of group sizes for a coastal cetacean using aerial survey data

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## Abstract

Many small cetacean, sirenian, and pinniped species aggregate in groups of large or variable size. Accurate estimation of group sizes is essential for estimating the abundance and distribution of these species, but is challenging as individuals are highly mobile and only partially visible. We developed a Bayesian approach for estimating group sizes using wide-angle aerial photographic or video imagery. Our approach accounts for both availability and perception bias, including a new method (analogous to distance sampling) for estimating perception bias due to small image size in wide-angle images. We demonstrate our approach through an application to aerial survey data for an endangered population of beluga whales (*Delphinapterus leucas*) in Cook Inlet, Alaska. Our results strengthen understanding of variation in group size estimates and allow for probabilistic statements about the size of detected groups. Aerial surveys are a standard tool for estimating the abundance and distribution of various marine mammal species. The role of aerial photographic and video data in wildlife assessment is expected to increase substantially with the widespread uptake of unmanned aerial vehicle technology. Key aspects of our approach are relevant to group size estimation for a broad range of marine mammal, seabird, other waterfowl, and terrestrial ungulate species.

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# Correction factors for group size estimation

- Availability bias due to diving behavior
  - individuals unavailable in video data because submerged ("availability bias")
- Perception bias
  - individuals not detected because of small image size in video data
- Availability bias due to proximity in video data
  - individuals unavailable because concealed by another animal ("proximity bias")
- Individual observer bias
  - the tendency for individual observers to under- or over-count whales – only applied to estimate group size if no video available

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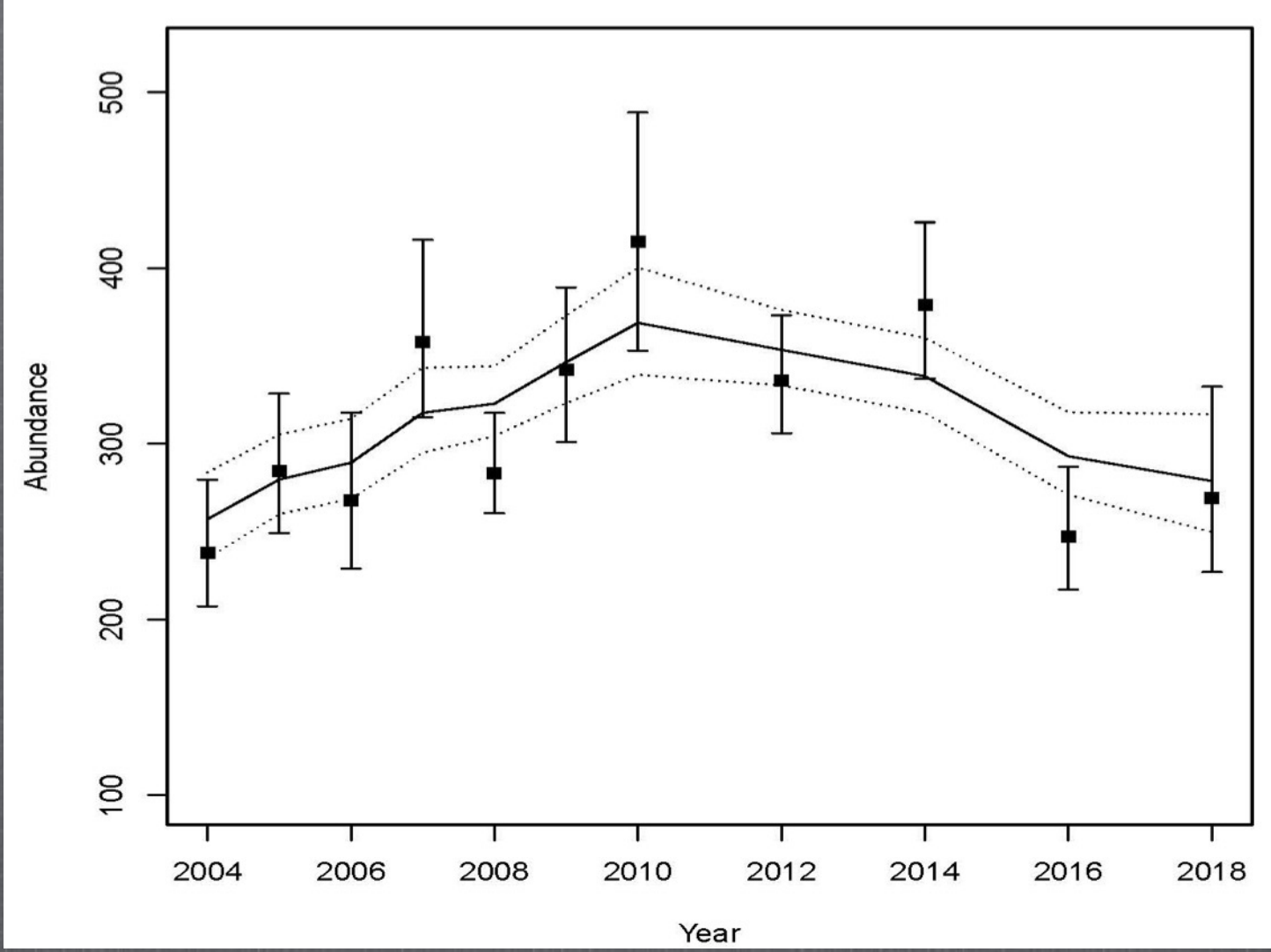
# Improvements to the group size estimation

- The important assumption was added that the true group size was the same for all video passes
  - i.e., observations of the same group surveyed on a particular day
- A broad distribution for mean dive time was used instead of a single fixed value to better capture uncertainty
- To correct for whales too small to be seen in the video image (perception bias), two distributions are simultaneously estimated rather than using *ad hoc* methods as was previously done
- Uncertainty in the parameter estimates is more fully accounted for using more modern statistical methods (i.e., Bayesian hierarchical modeling).

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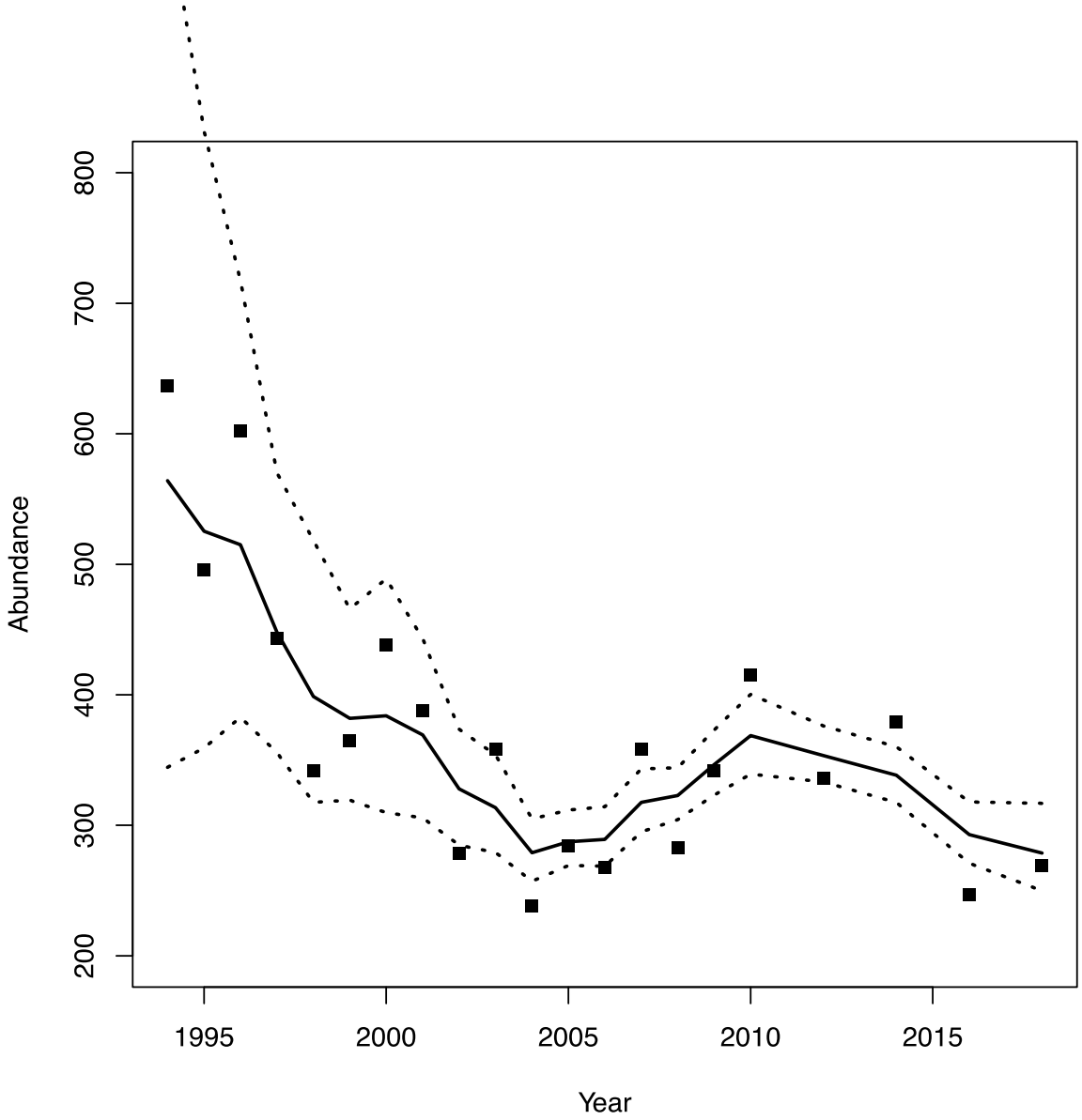
Abundance
200
300
400
500
600
700
800
1995
2000
2005
2010
2015
Year

**Diet of Beluga Whales, *Delphinapterus leucas*, in Alaska from Stomach Contents, March–November**

LORI T. QUAKENBUSH, ROBERT S. SUYDAM, ANNA L. BRYAN, LLOYD F. LOWRY, KATHRYN J. FROST, and BARBARA A. MAHONEY

Quakenbush et al. 2015. Marine Fisheries Review 77(1):70-84

Cook Inlet beluga stomachs, 2000-2010, March to November
N=24 (6 were empty, so 18 with prey contents)

| % stomachs occurrence | |
|---|---|
| Salmonids (coho, chum, chinook) | 67% |
| Gadids (Saffron cod, pollock, P. cod) | 42% |
| Shrimp (Caridea, Crangonidae) | 39% |
| Eulachon | 11% |

| Numerical % of all fish (sums to 100%) (Shrimp not included) | |
|---|---|
| Gadids | 42% |
| Salmonids | 38% |
| Eulachon | 12% |
| Other | 8% |

Another 24 stomachs looked at qualitatively in 1992-2001 were found to only have eulachon and chinook.

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# Main prey by month

## Summary of data, TEK, inference from aggregations of whales

| Month | Main Prey | Location |
|---|---|---|
| All months | Saffron cod | Various locations |
| | Shrimp | Various locations |
| March | ?Herring | Lower and Middle inlet (Kamishak Bay) |
| April | Eulachon | Tyonek, Beluga River |
| | ?Unknown | Kenai River |
| May | Eulachon | Susitna Delta rivers<br>upper Turnagain Arm |
| June/early July | Chinook | Susitna Delta rivers |
| Late July/early Aug | Chum | Susitna Delta rivers |
| Late Aug/Sept | Coho | Knik Arm<br>Turnagain Arm<br>Chickaloon Bay |
| | Eulachon | Kenai River |
| October | Coho | Turnagain Arm (6 Mile)<br>Chickaloon River |
| November | ?Longfin smelt | Knik Arm |

esa ECOSPHERE

# Relationship between per capita births of Cook Inlet belugas and summer salmon runs: age-structured population modeling

Stephanie A. Norman [1,5,†] Roderick C. Hobbs,[2] Laurel A. Beckett,[3] Stephen J. Trumble,[4] and Woutrina A. Smith[1]

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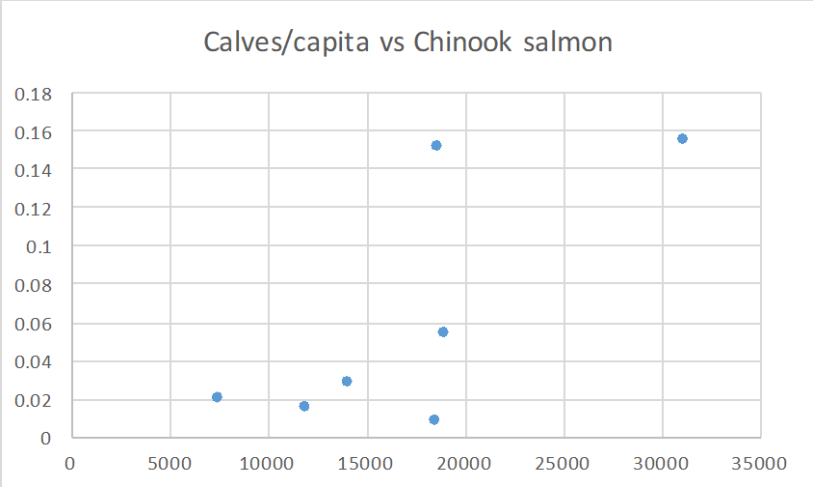
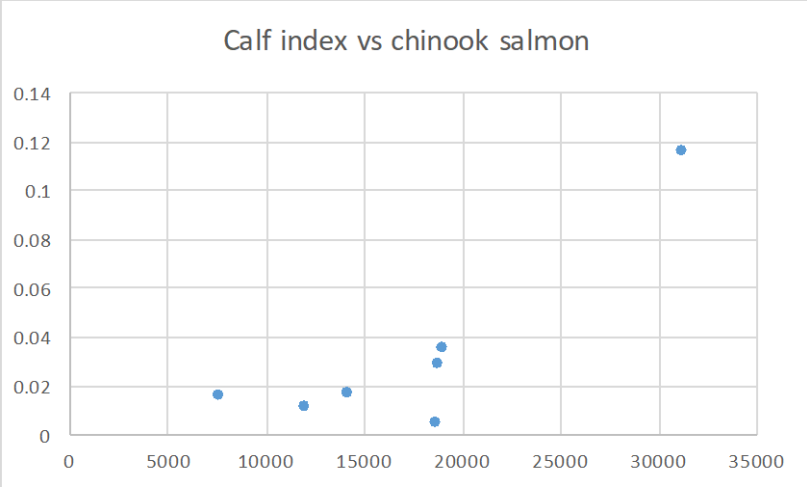
[2]Marine Mammal Laboratory, Alaska Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Seattle, Washington 98115 USA
[3]Division of Biostatistics, Department of Public Health Sciences, School of Medicine, University of California, Davis, Davis, California 95616 USA
[4]Department of Biology, Baylor University, Waco, Texas 76798 USA

**Citation:** Norman, S. A., R. C. Hobbs, L. A. Beckett, S. J. Trumble, and W. A. Smith. 2019. Relationship between per capita births of Cook Inlet belugas and summer salmon runs: age-structured population modeling. Ecosphere 11(1): e02955. 10.1002/ecs2.2955

Concerns regarding results they report:

1. Only 7 years data (2006-2012)
2. Calf index based on proximity to adult, so smears across multiple age classes (~0-4 year olds)
3. Calf index is modified in an un-described way to account for calves born after calf survey in August.
4. Salmon data are only chinook and coho escapement from Deshka River.
5. Model selection is based on unmodified $R^2$.
6. They do not show the correlation (see below).
7. Relationship driven by just 2 high values.



A. M. Reiner and N. A. DeCovich
ADF&G Fishery Manuscript No. 20-01

Susitna River Chinook Salmon Run Reconstruction and Escapement Goal Analysis

"…All stocks have been near historical minimums in the last 10 years…"

Appendix C1-4
Annual abundance estimates
Total inriver run size estimates

2004-2009: 121,552
2010-2017: 72,221 (59% of previous)

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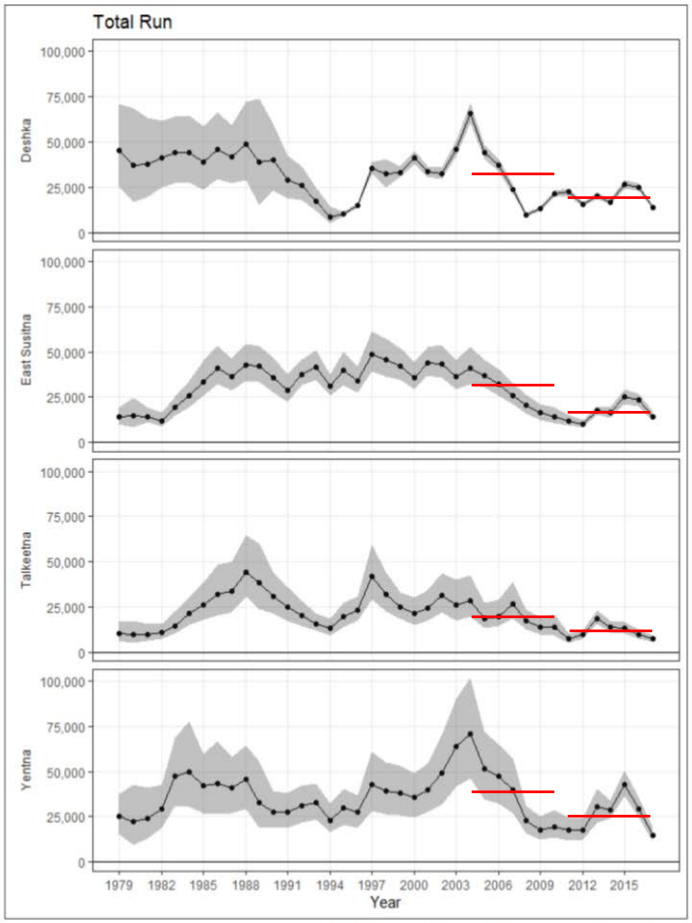



Figure 23.–Point estimates (posterior medians; solid lines) and 95% credibility intervals (shaded areas) of total run abundance from a state-space model by stock, 1979–2017.

66

Way too soon to draw any firm conclusions yet.

It would be worthwhile to undertake a comprehensive look at possible correlations in potential prey of Cook Inlet beluga with the population trend, to generate hypotheses of why the population is currently declining.

ADF&G recently received a Section 6 grant from NOAA Fisheries OPR to study foraging and prey of Cook Inlet beluga.

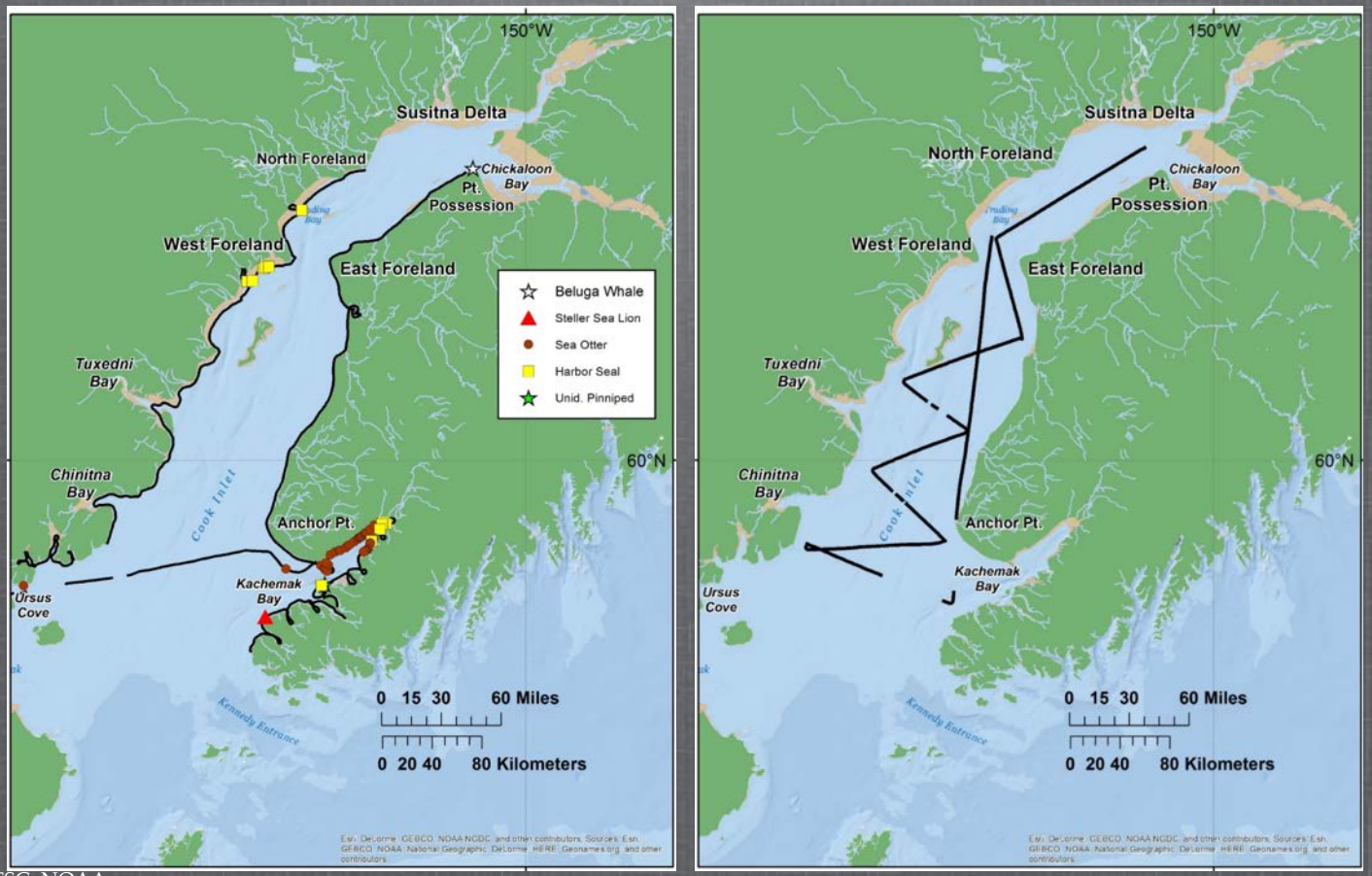
# 2020 MML Cook Inlet beluga field work

- Canceled: June 2020 aerial survey
  - For abundance and trends
- Canceled:  July-Aug UAS (drone) photo-ID and photogrammetric surveys
  - Calf production, mark-recapture abundance
- Canceled:  July biopsy survey
- Still scheduled:  Aug 27 – Sept 7 biopsy survey


NMFS ESA/MMPA Permit #20465


NMFS ESA/MMPA Permit #20465

Lower Cook Inlet Surveys
One day nearshore, one day zig-zag in open water

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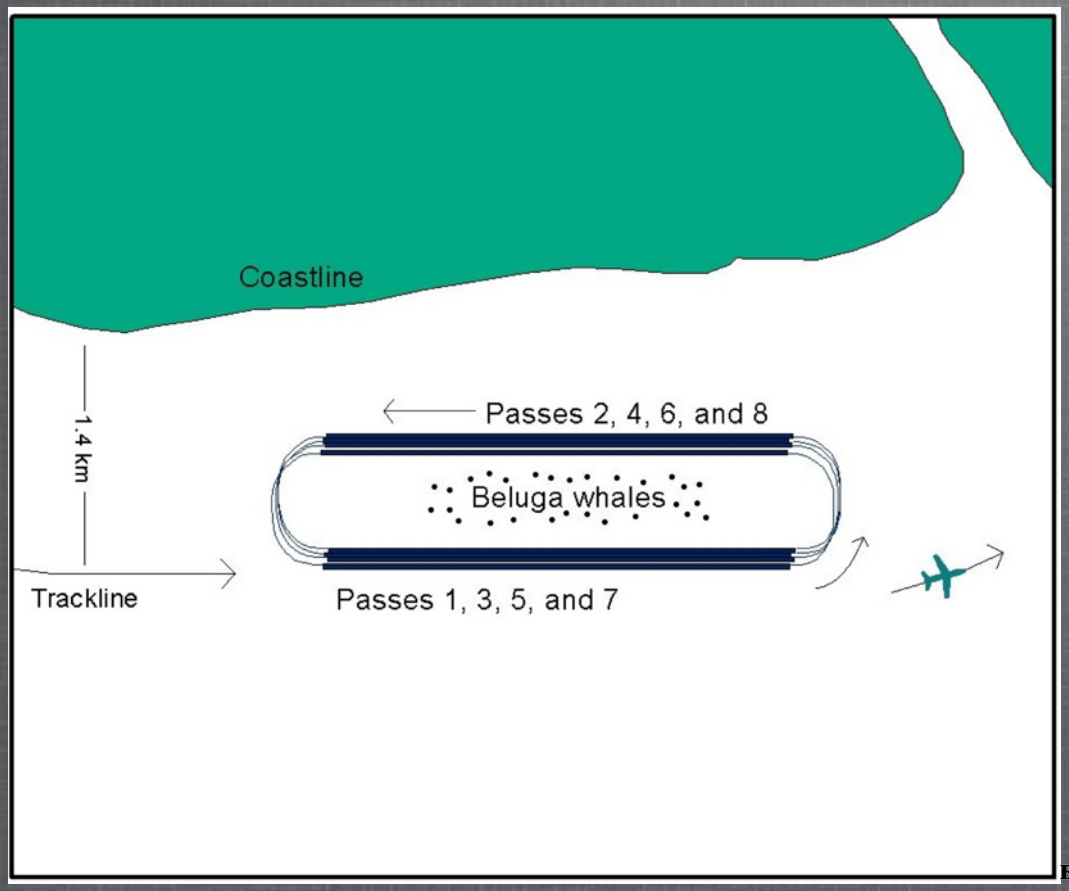


B.

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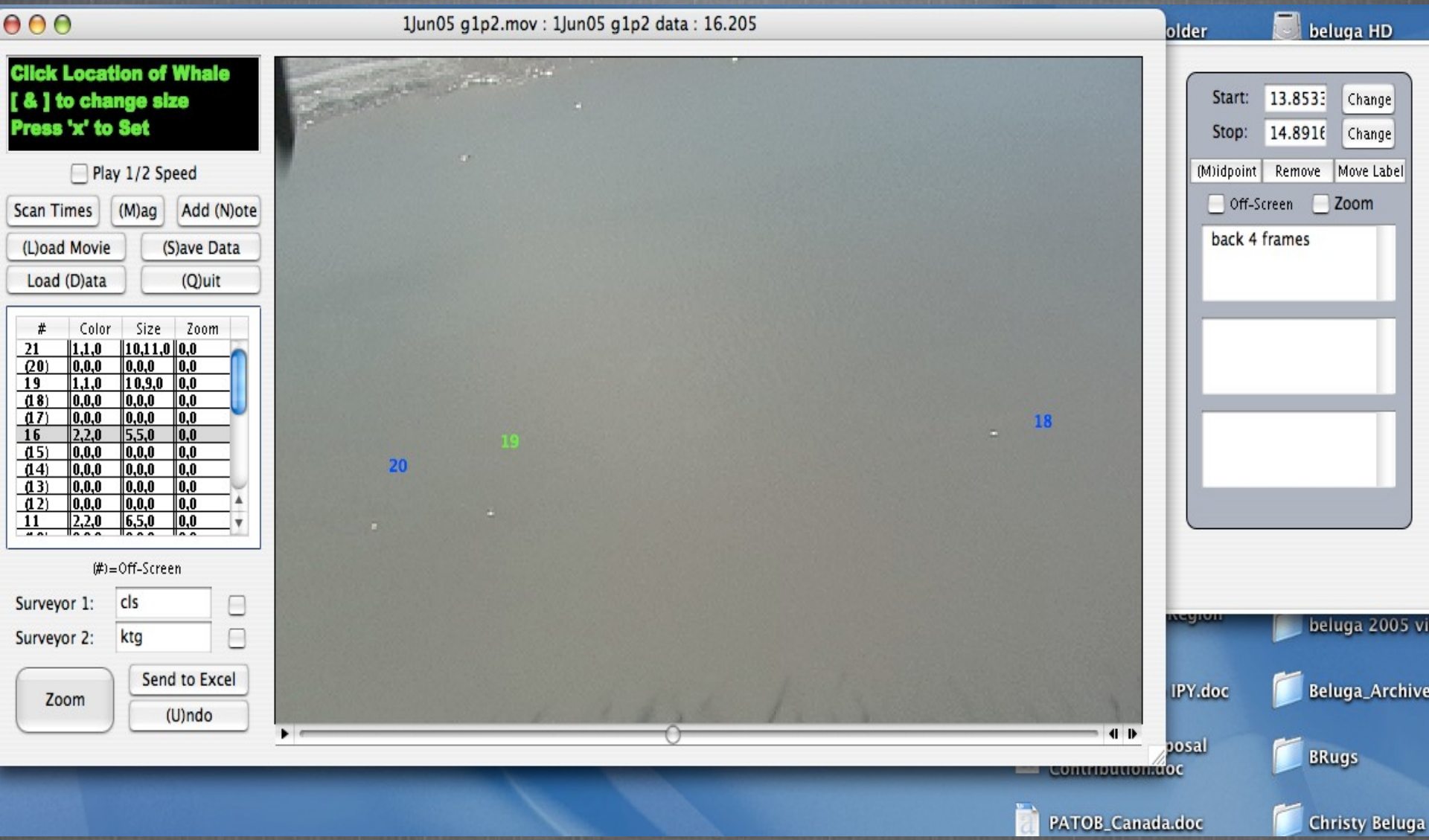
1Jun05 g1p2.mov : 1Jun05 g1p2 data : 16.205
Click Location of Whale
[ & ] to change size
Press 'x' to Set
Play 1/2 Speed
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21 1,1,0 10,11,0 0,0
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19 1,1,0 10,9,0 0,0
(18) 0,0,0 0,0,0 0,0
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16 2,2,0 5,5,0 0,0
(15) 0,0,0 0,0,0 0,0
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11 2,2,0 6,5,0 0,0
(#)=Off-Screen
Surveyor 1: cls
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18
19
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Start: 13.853
Stop: 14.891
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(M)idpoint
Remove
Move Label
Off-Screen
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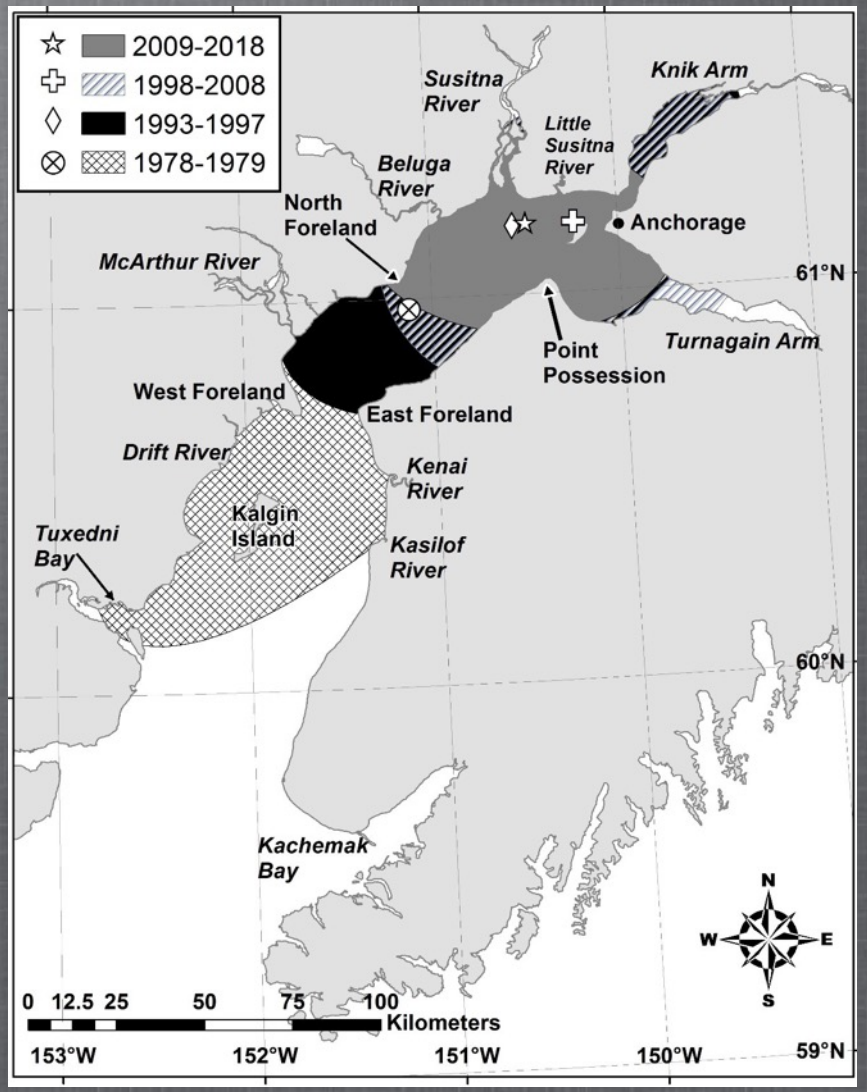
back 4 frames
beluga 2005 vi
IPY.doc
Beluga_Archive
BRugs
PATOB_Canada.doc
Christy Beluga

Cook Inlet belugas have contracted their summer range into the upper Cook Inlet (Rugh et al. 2010, Shelden et al. 2020).

Nelson et al. (2018) examined stable isotopes in annual Growth Layer Groups in Cook Inlet beluga teeth.

Both δ15N and δ13C values from CIBW declined during the study period (1950s to 2007) in both bone and teeth, providing definitive evidence that a change in CIBW feeding ecology occurred, and strontium isotopes suggested a shift to more fresh-water prey.

They concluded this was likely due to the contraction in range to the upper Inlet, and consumption of more fresh-water influenced prey.

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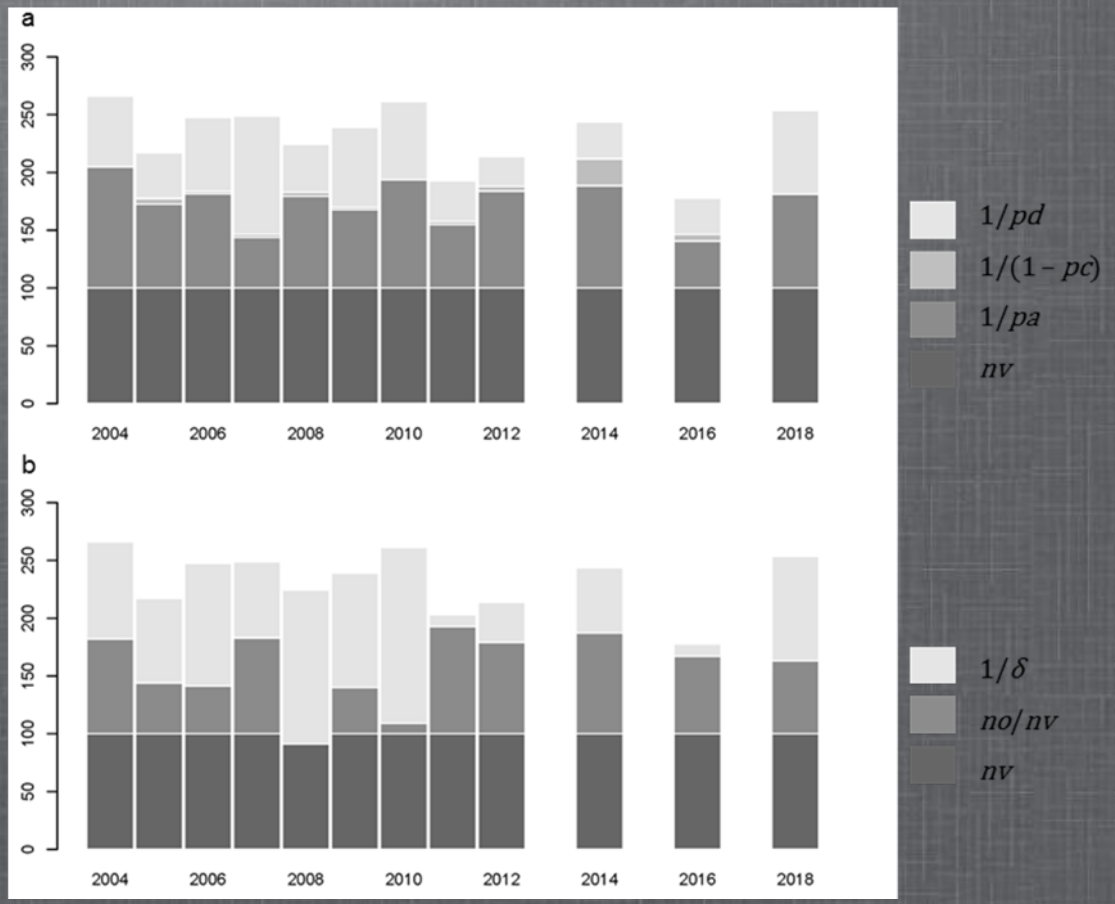
(a) Standardized representation of median correction factors for video counts by survey year (pa is availability bias; pc is proximity bias; and pd is detection bias), based on 100 hypothetical individuals detected in a wide-angle video clip (nv) in each survey year.

(b) (b) Standardized representation of the median correction factor for observer bias (δ) by survey year

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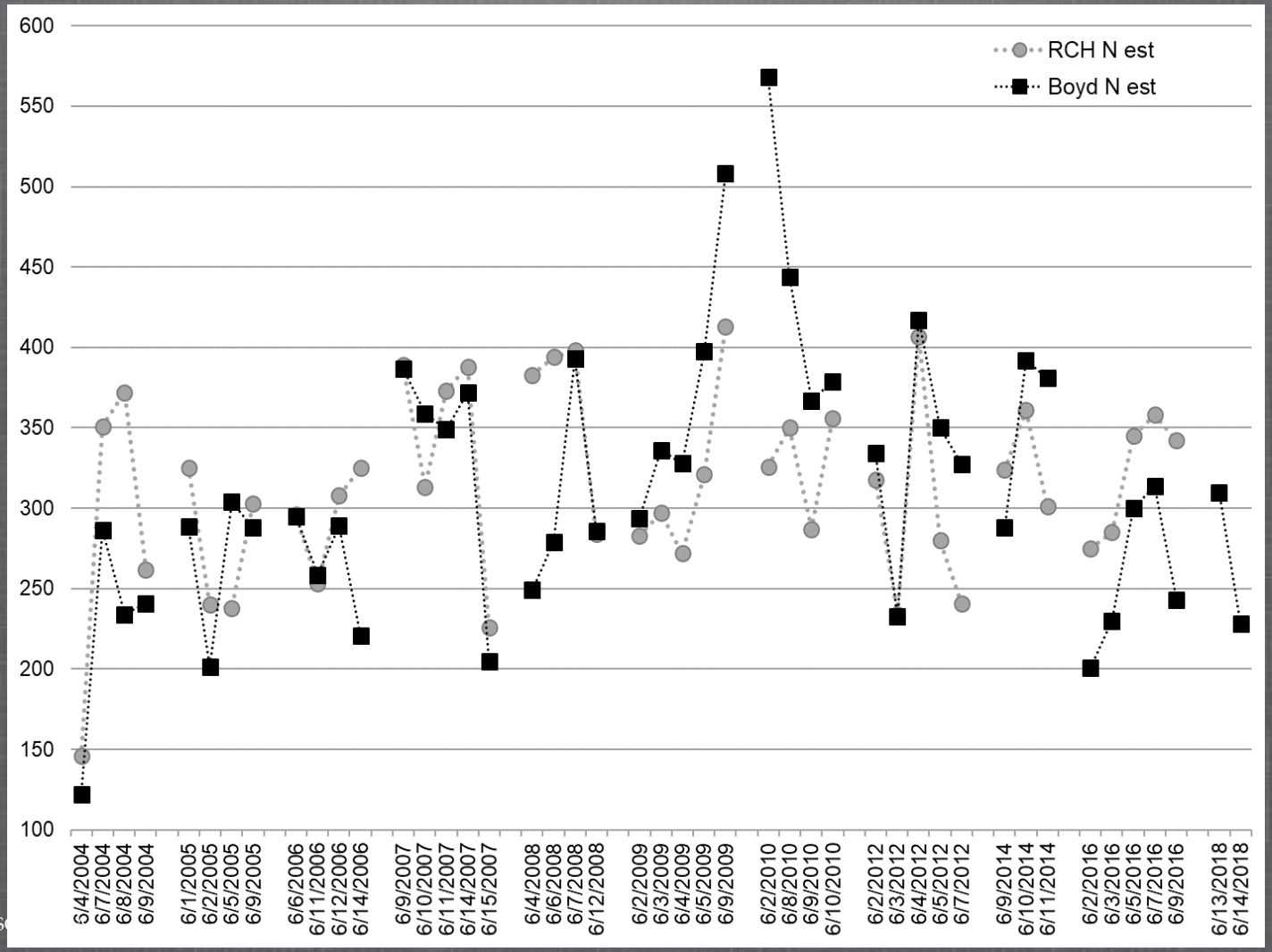


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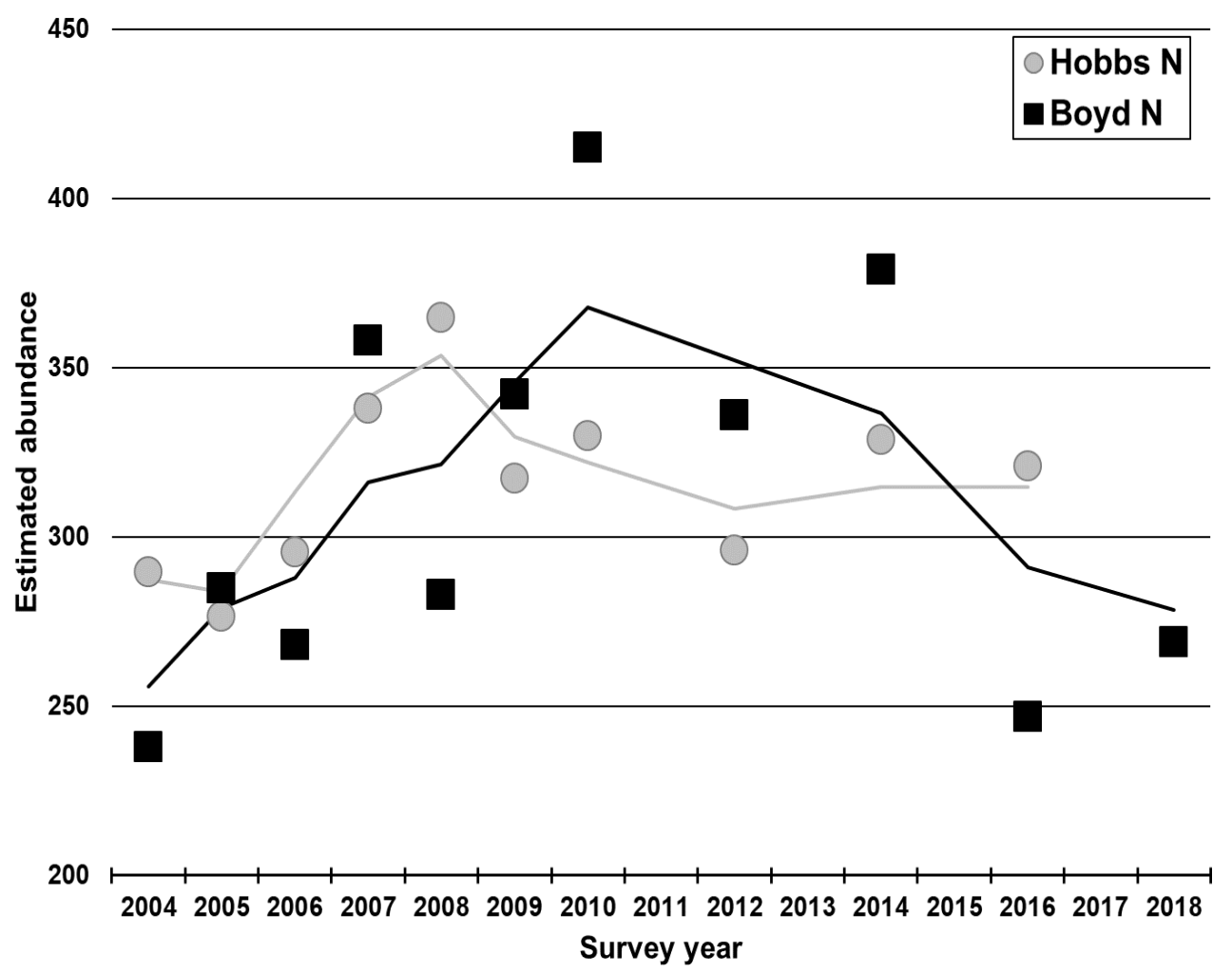


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