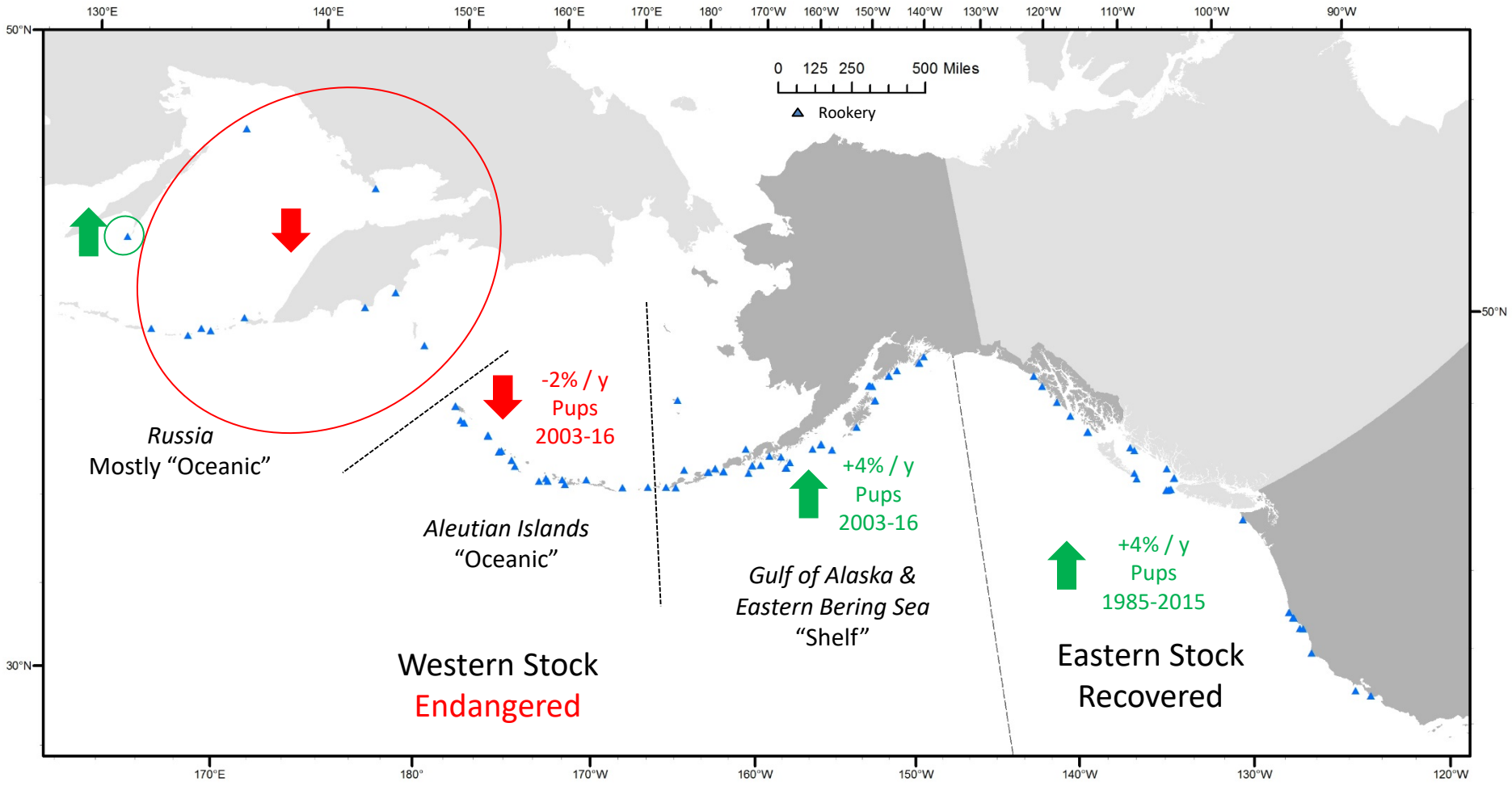
# *Steller sea lions & Northern fur seals in Alaska: Update on research results and management September 2017*

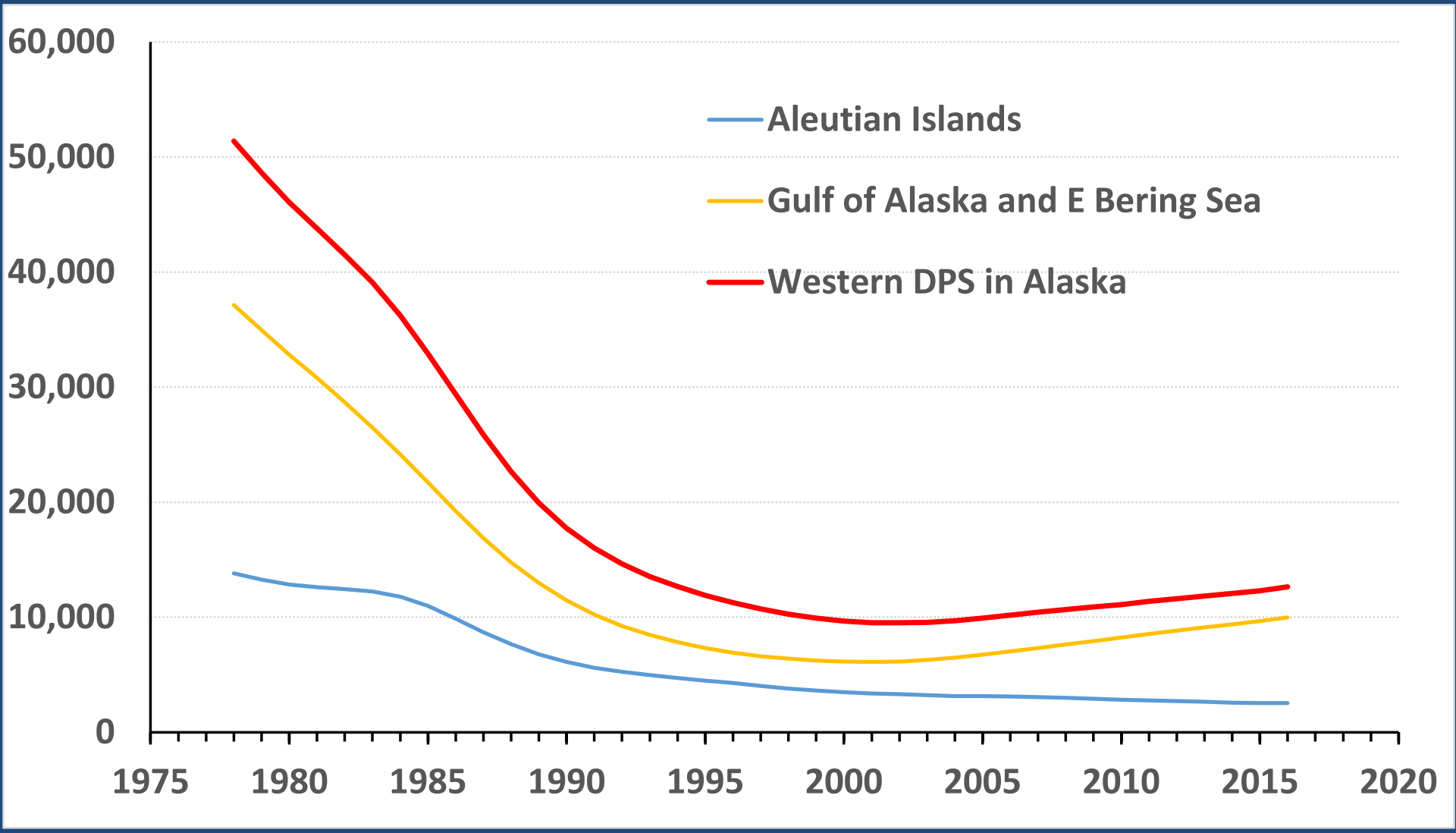
Marine Mammal Laboratory – Alaska Ecosystem Program
NOAA Fisheries Alaska Fisheries Science Center

T. Gelatt, A. Altukhov, V. Burkanov, K. Chumbley, J. Cutler, B. Fadely, L. Fritz, D. Johnson, C. Kuhn, M. Lander, K. Luxa, N. Pelland, R. Ream, B. Sinclair, J. Sterling, K. Sweeney, W. Testa, R. Towell, W. Walker, T. Zeppelin

# Current Steller sea lion population trends & ESA status

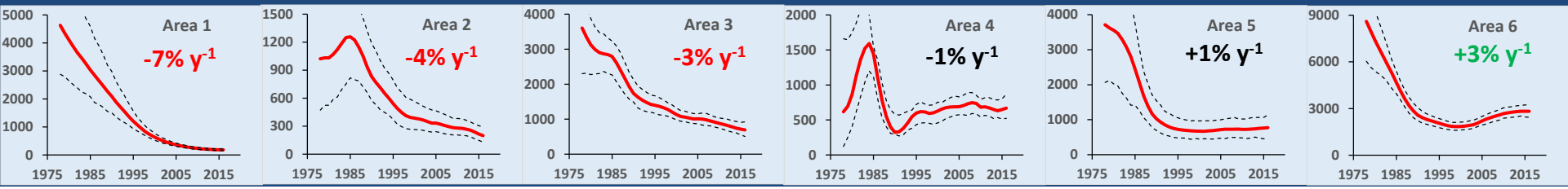


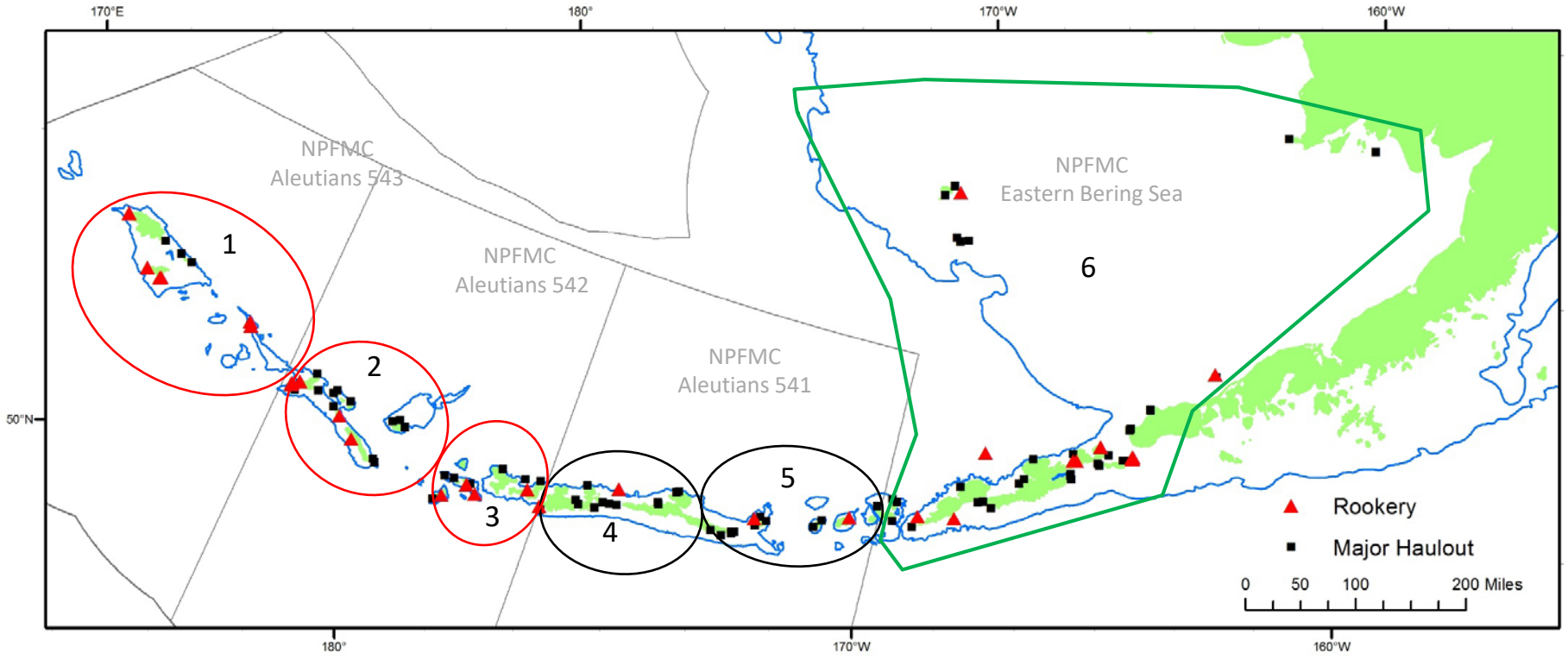
# Steller sea lion Pup Counts 1978-2016
# Western DPS in Alaska



# W. Steller Sea Lion Pups in the Aleutian Islands

## Predicted Counts (1978-2016) and Annual Rates of Change (2003-16)



# Field work and Publications in 2017

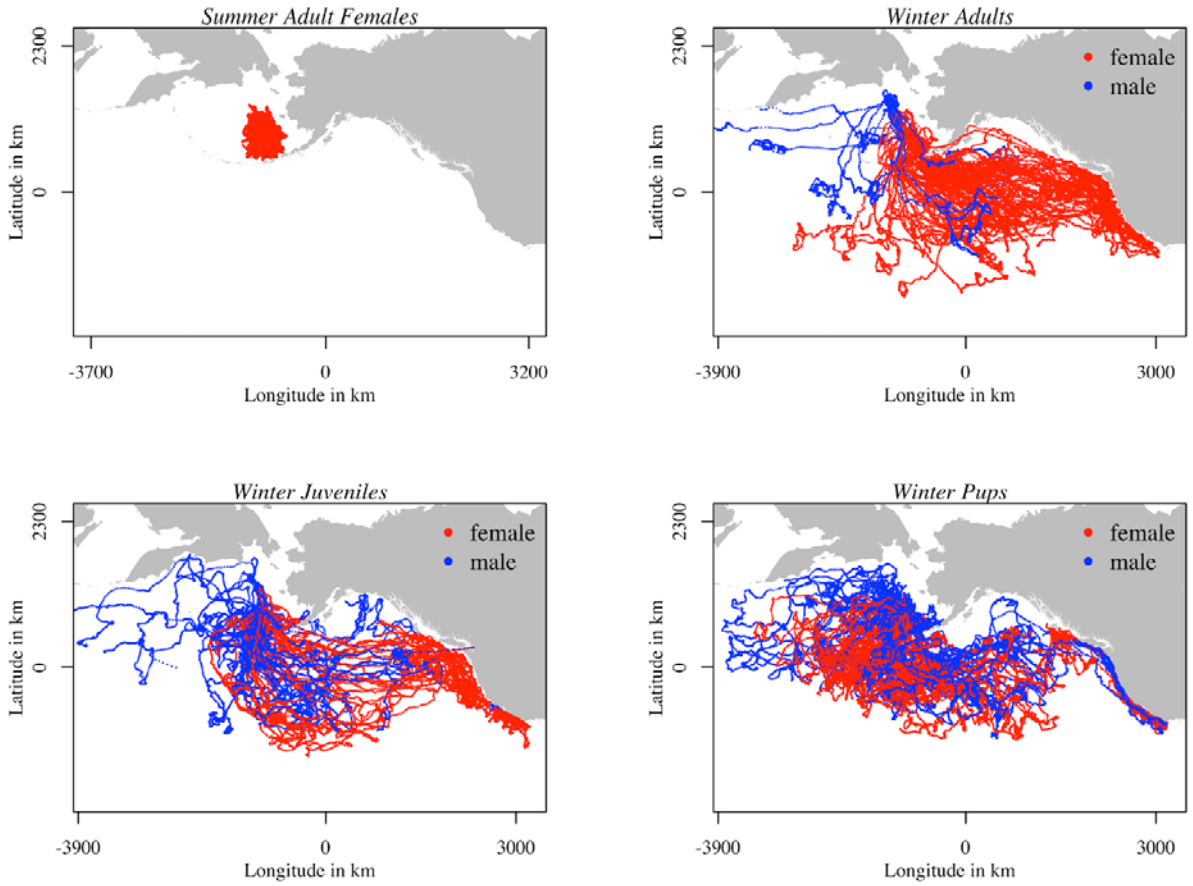
- Population Trend Monitoring - Aerial Survey
  - Twin Otter- SE Alaska through Shumagin Islands, June-July
  - Hexacopter- Portions of the Aleutian Islands, June-July
  - Results available late fall 2017
  - PRELIMINARY: Pup production lower than 2015 in C GULF and E GULF: first decline since early 2000s
- Vital Rates – Survival and Reproduction
  - Observation of marked animals
    - Rookery field camps, May-August
    - Cruise in eastern Aleutians, July
    - 20 autonomous cameras in Aleutians, 100s of 1000s of pictures
      - Zooniverse – citizen science website to help us screen images
  - Branded pups at 3 rookeries in Aleutians (Agattu, Ulak, Ugamak)
- Publications
  - KUHN, C. E., K. CHUMBLEY, D. JOHNSON, and L. FRITZ. 2017. A re-examination of the timing of pupping for Steller sea lions Eumetopias jubatus breeding on two islands in Alaska. Endang. Species Res. 32:213-222. https://doi.org/10.3354/esr00796
  - TOLLIT, D, L. FRITZ, R. JOY, K. MILLER, A. SCHULZE, J. THOMASON, W. WALKER, T. ZEPPELIN, and T. GELATT. 2017. Diet of endangered Steller sea lions in the Aleutian Islands: new insights from DNA detections and bio-energetic reconstructions. Can. J. Zool. https://doi.org/10.1139/cjz-2016-0253

# New Critical Habitat for Western DPS of Steller sea lions in Alaska

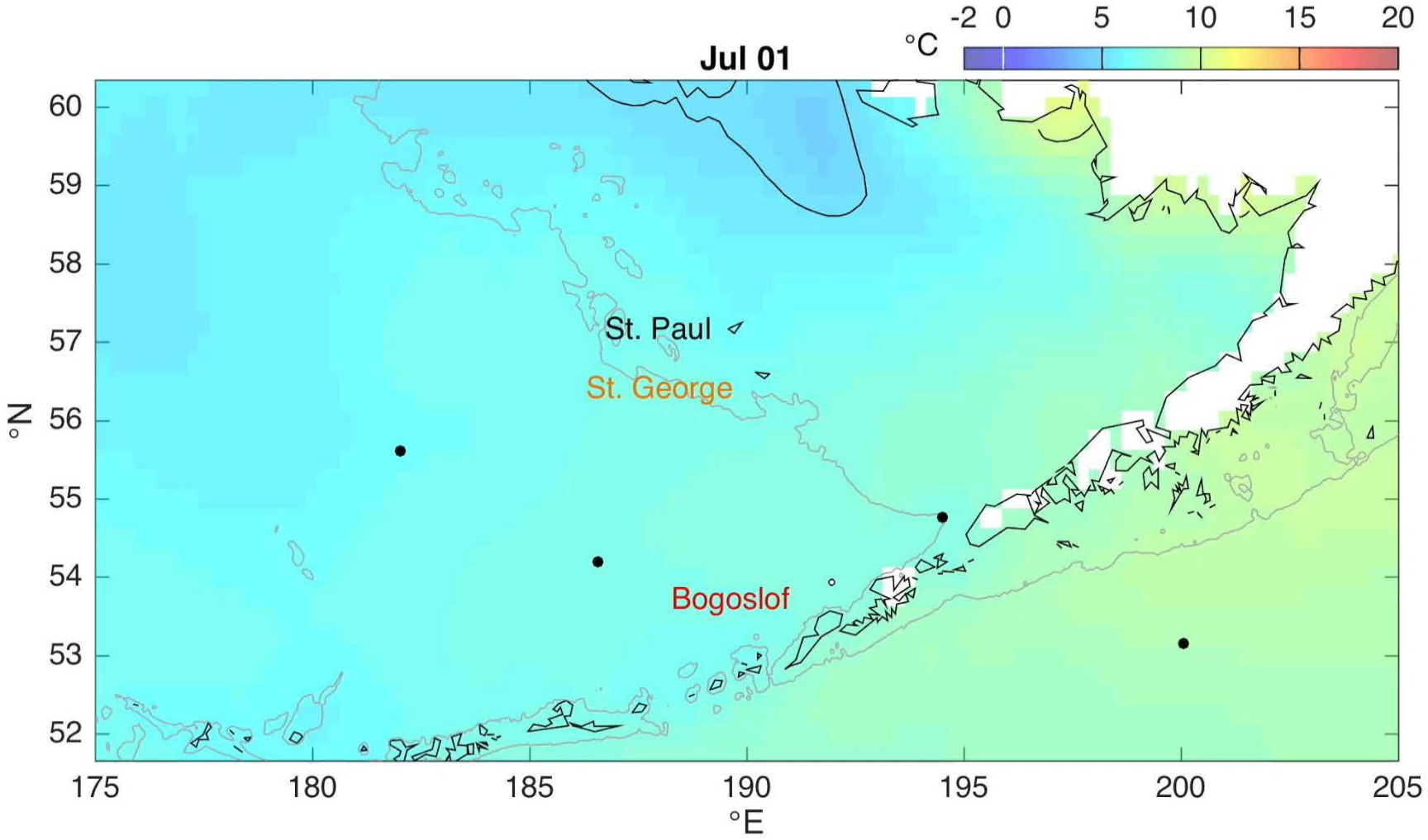
- 1993: Critical habitat designated for species range-wide
- 1997: E and W stocks recognized
- 2013: E stock recovered and removed from ESA protection
- New critical habitat will only be for endangered W stock
- New information on marine and terrestrial habitat use, diet, and distribution
- 28 August 2015: Draft Biological Report by CH Review Team given to AKR
- 1 Sept 2017: PR briefing for AKR following GC review and revisions by Team
- Next steps
  - Additional AKR comments
  - External peer review of Biological and Economics Reports
  - AKR analysis re: exclusions
  - Proposed rule
  - Timeline uncertain

# Northern fur seal rookeries

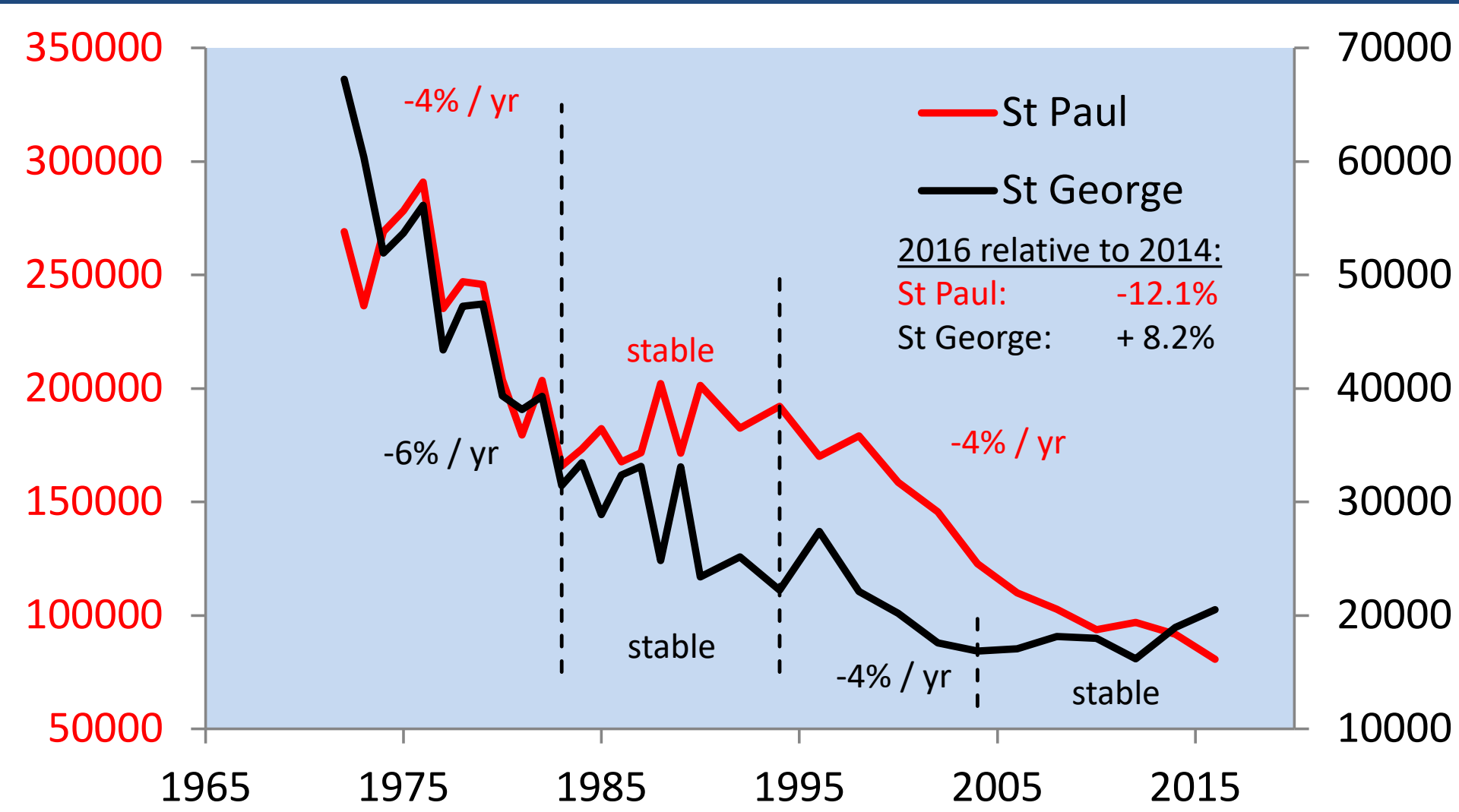
# Annual Cycle



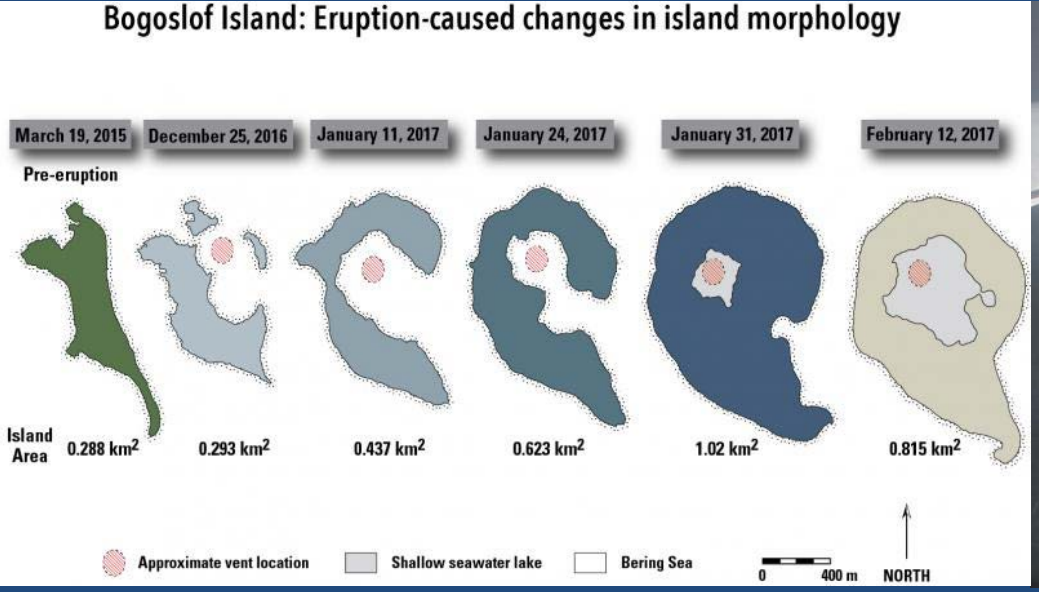
# Northern fur seal annual cycle



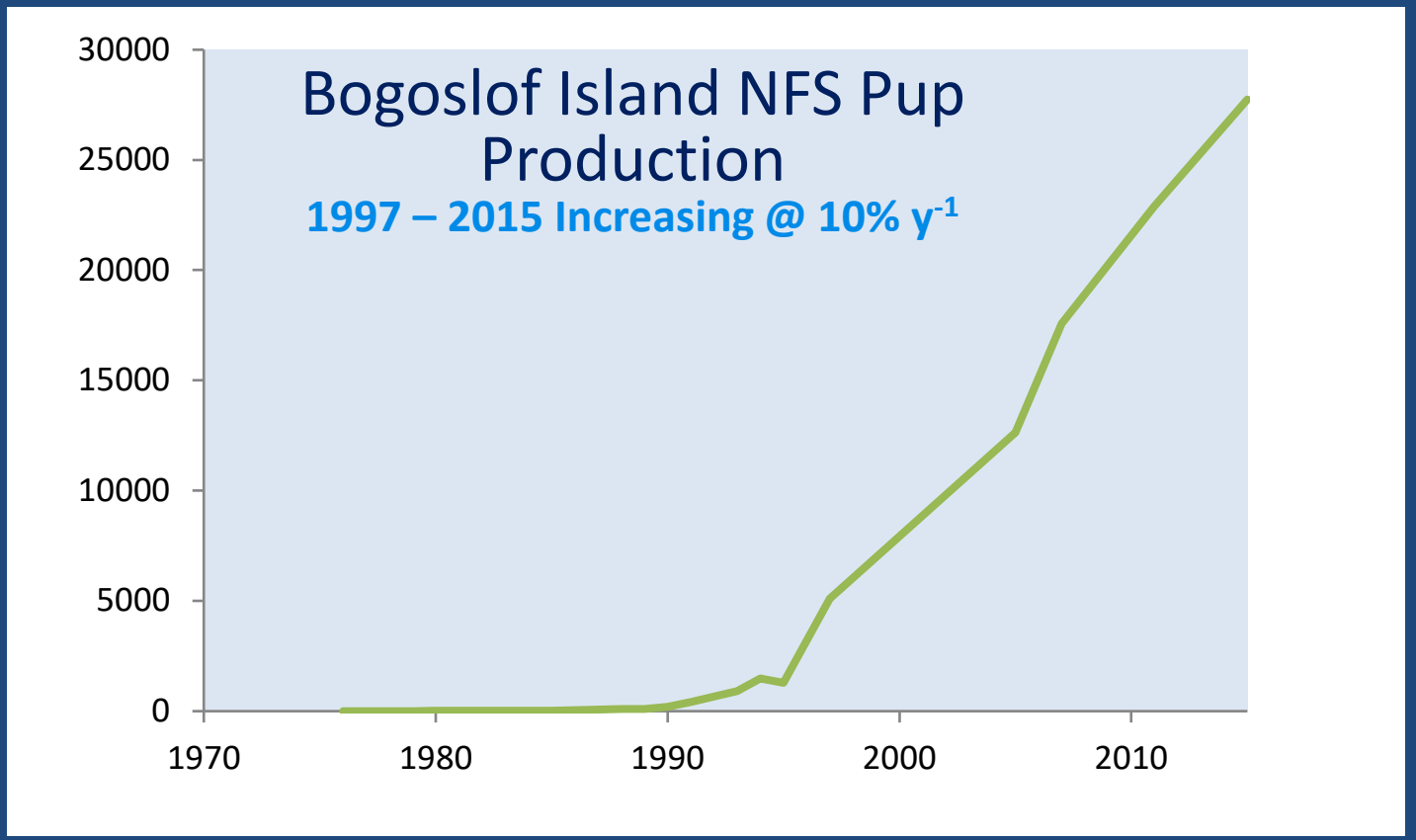
# Pribilof Island NFS Pup Production



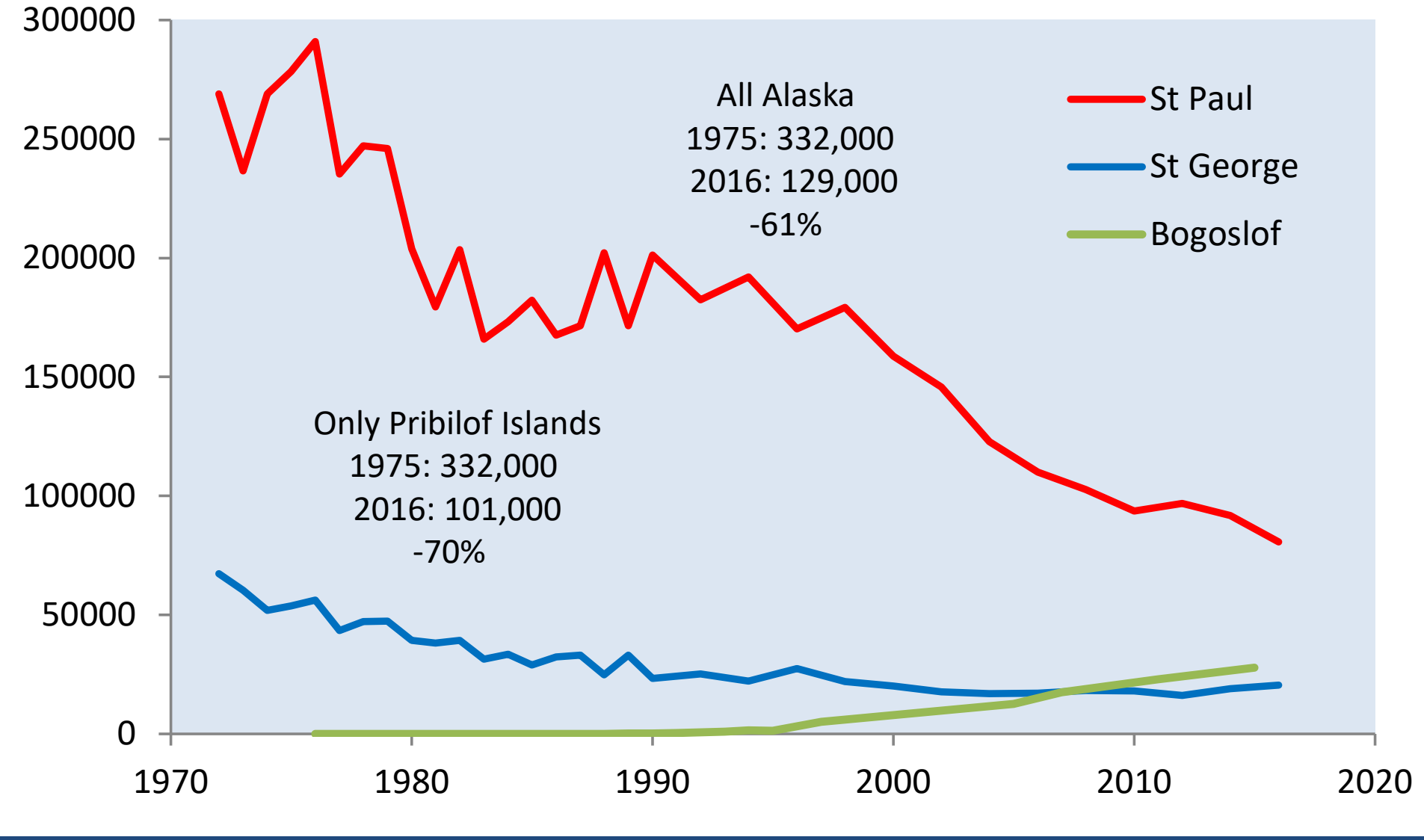

2016 pup production on St Paul is lowest since 1915


Bogoslof Island: Eruption-caused changes in island morphology
March 19, 2015
December 25, 2016
January 11, 2017
January 24, 2017
January 31, 2017
February 12, 2017
Pre-eruption
Island Area
0.288 km²
0.293 km²
0.437 km²
0.623 km²
1.02 km²
0.815 km²
Approximate vent location
Shallow seawater lake
Bering Sea
0
400 m
NORTH


August 15, 2017


Bogoslof Island NFS Pup Production
1997 – 2015 Increasing @ 10% y-1
30000
25000
20000
15000
10000
5000
0
1970
1980
1990
2000
2010

# Northern Fur Seal Pup Production in AK



# Management status

- Listed as depleted under the Marine Mammal Protection Act
  1. Eastern Stock population is ~ 586,458 seals (~ 1/3 of of its historical peak '50s)
  2. Well below OSP (optimum sustainable population)
  3. To be delisted, population needs to double to achieve 60% of historical K
  4. Eastern Stock will likely show a ~ 5% decline (preliminary results)

- Determine factors influencing demography as outlined in the Northern Fur Seal Conservation Action Narrative in the 2007 Conservation Plan
  1. Compile and evaluate available habitat-use data (ongoing research, Kuhn, Pelland, Sterling)
  2. Compile and evaluate existing physical environmental data (ongoing research, Kuhn, Pelland, Sterling)
  3. Select appropriate environmental indices (ongoing research, Pelland winter, Sterling summer)
  4. Quantify environmental effect on behavior and productivity (ongoing research, Pelland winter, Sterling summer)
  5. Ecosystem modeling (likely funded beginning 1/1/2018, 3 yr. project)
  6. Conduct oceanographic and fishery surveys based on pelagic fur seal habitat use (ongoing NOW Kuhn)

# Alaska Ecosystems Program Strategy

- Looking back to inform future study design and hypotheses (1870-2017)
  1. Data rescue and revival
     - Roger Gentry's behavioral observation archive (1973-1992, reanalyzed trip duration data – completed)
     - Peterson 1963, Loughlin et al. 1984, Goebel et al. 1991, Bartholomew & Hoel 1953 (trip duration data compiled – completed)
     - Mike Goebel's PhD thesis (1994-1996 – completed)
     - Jason Baker's Pup migration study (1996/97-1997/98 added to our tracking data set – completed)
     - Mary Donahue's PhD thesis (1995-1996 trip duration and pup growth – completed)
  2. Telemetry – Alaska Ecosystem Program has satellite tagged 863 northern fur seals (1991-2017)
     - Standardization of entire time series with over 1.5 million hours of tracking effort – ongoing
     - Adult males and females, juveniles, pups
     - At all Eastern Stock locations
     - Half in the winter, half in the summer
  3. Saildrone survey of fur seal foraging hotspots in the Bering Sea
     - Autonomous oceanographic and acoustic sampling of fur seal prey fields
     - Bottom trawl, mid-water survey, and BASIS survey
     - 2017 cameras and focal follows – study happening NOW

# Objective

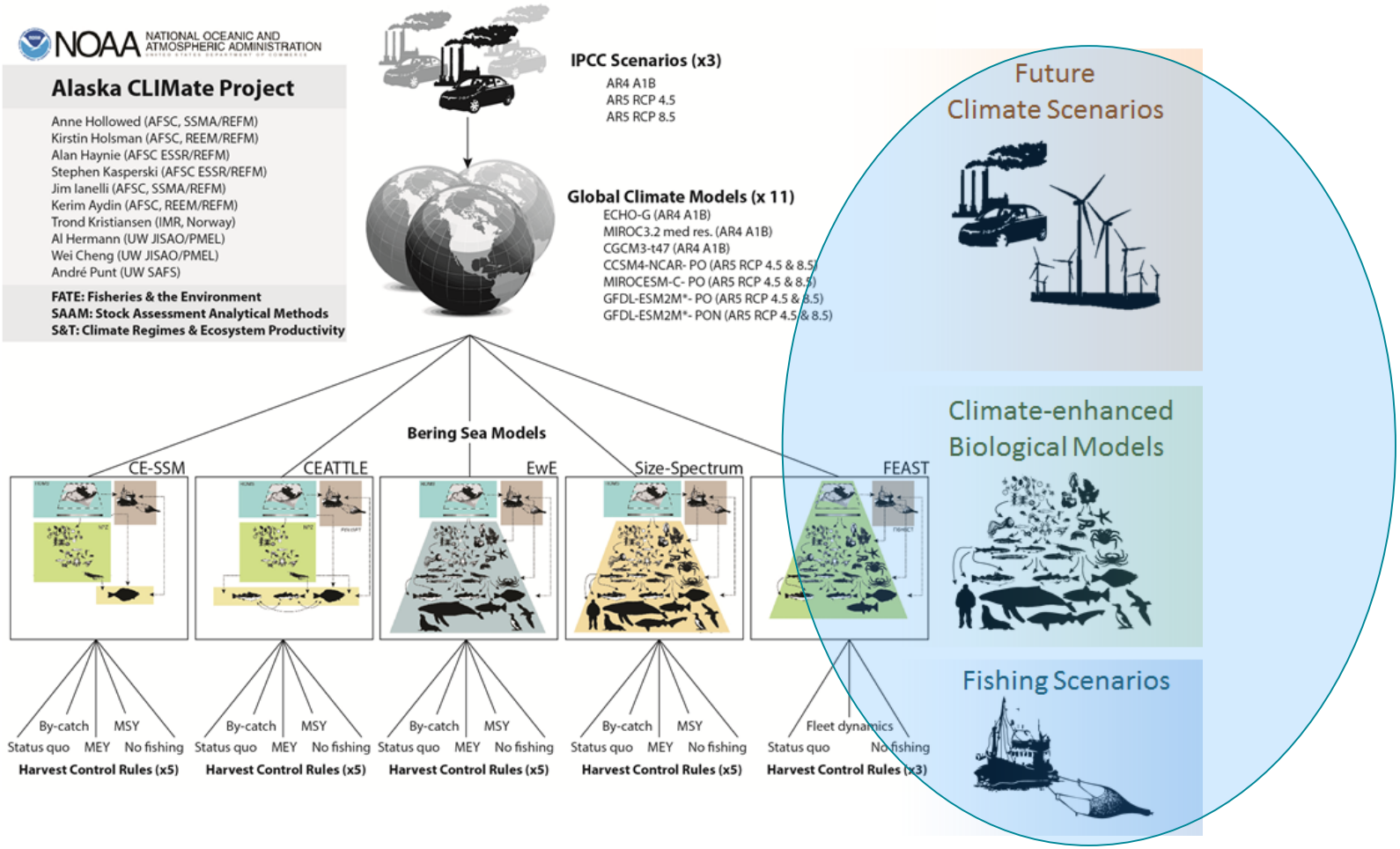
- Identify factors influencing northern fur seal demography (Eastern Stock)
  - Pup production (~1950-2016)
  - Lander's estimates of male pup survival to age 2 (1950-1980)
  - Current AEP northern fur seal demography (2010-2016)
- Our hypotheses focus on bottom up processes in both summer and winter
  - Summer foraging and pup provisioning
  - Winter migration

# Ecosystem Data

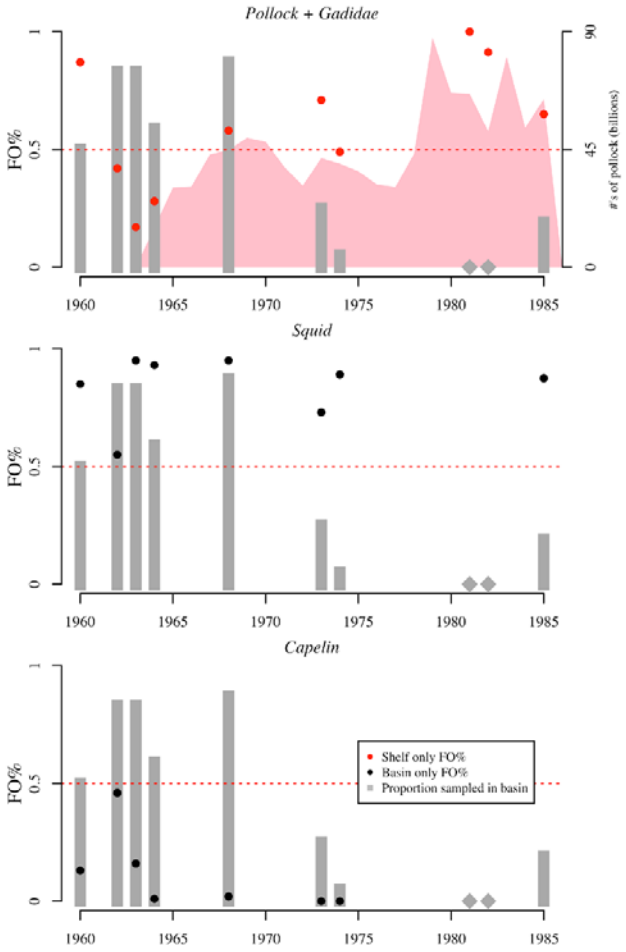

- AVISO SSH PMEL
  - eddy detection
  - edge determination
  - tracking
- MACE REFM
  - mid-water pollock
- RACE PMEL REFM
  - pollock
  - bottom temperature
  - thermocline depth
- BASIS
  - Age-0 distribution
  - Age-0 energetics
- NCEP PMEL Bond
  - wind speed
  - direction
- St. Paul Weather data
  - average summer air temperatures
- EBFM CEATTLE FEAST REFM
  - late season bottom temperatures
- Winter Seaglider
  - Washington Coast
- Movement models
  - Jonsen
  - Johnson

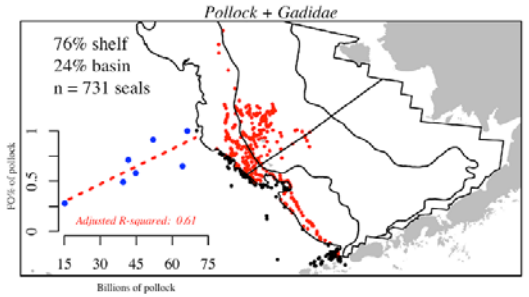
# Objective – Align with Ecosystem Models

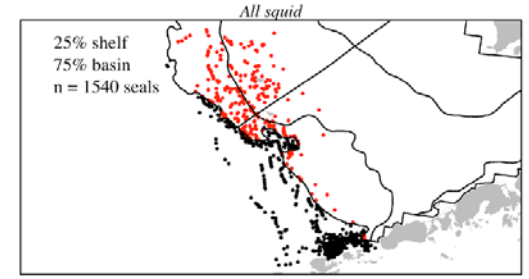
3 year project likely funded for 1/1/2018 start

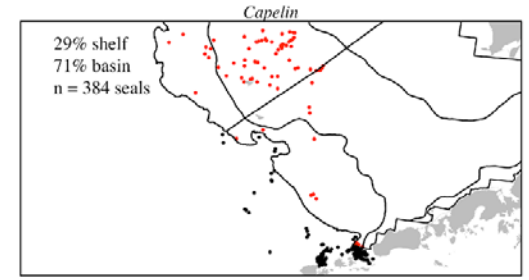


# Diet – spatial

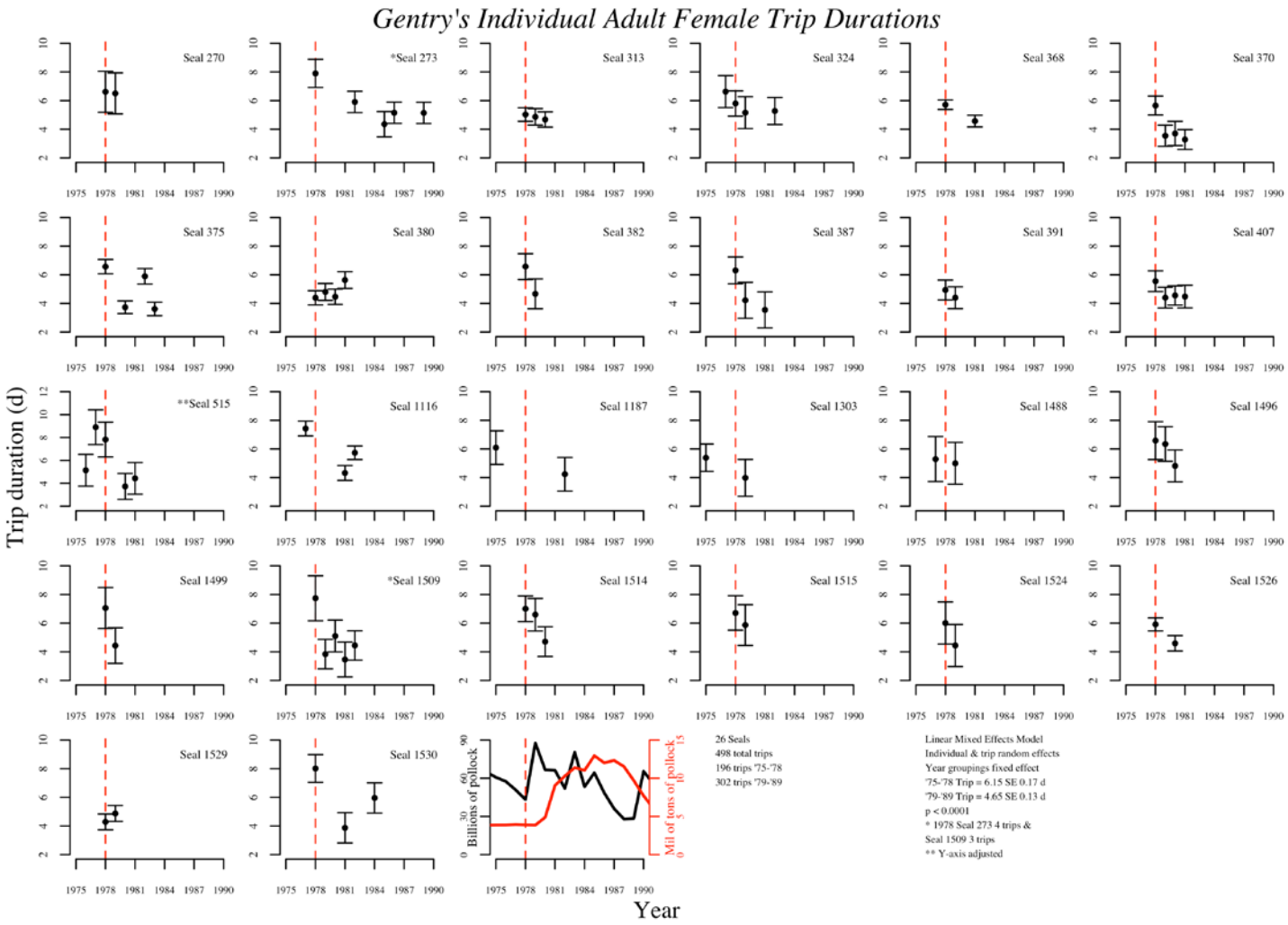


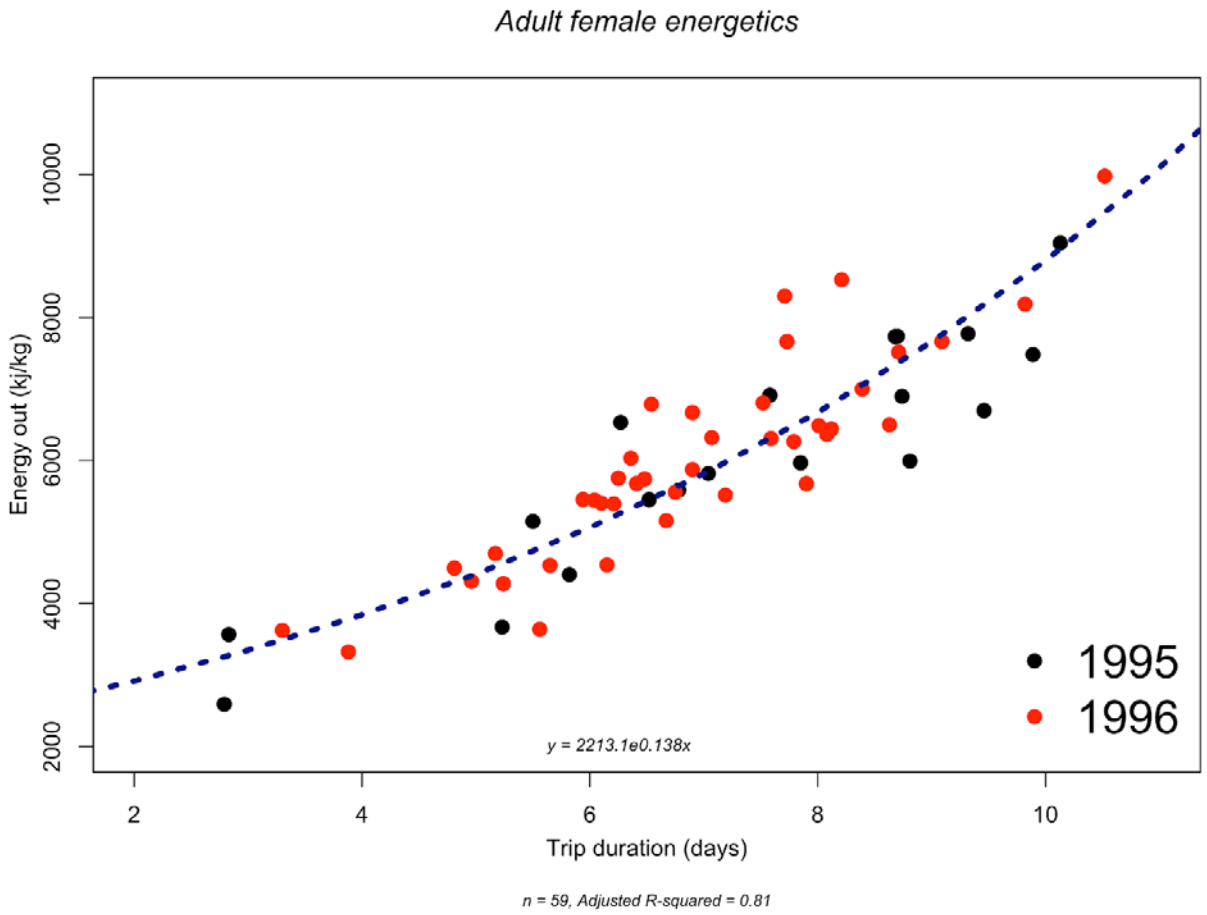



# Trip Durations



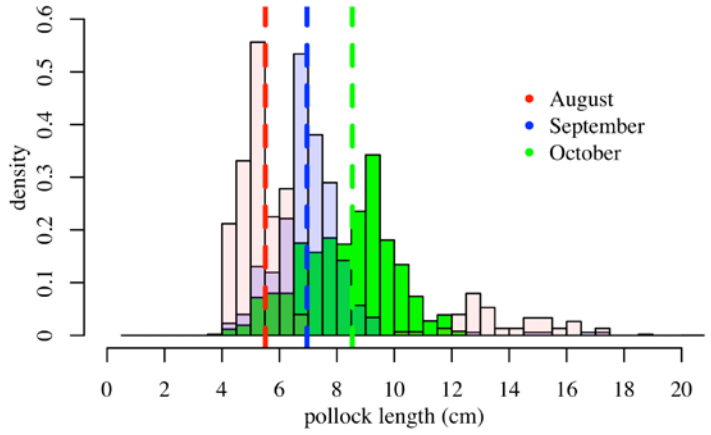

*Seal selection: With pup, multiple years, > 4 trips per year, before/equal to 1978 and after 1978*

# FEAST – unpublished fur seal energetics data

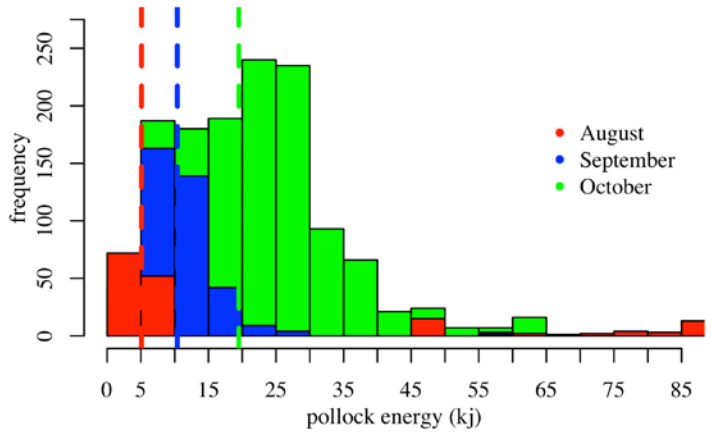


# Fur Seal Diet – Energetics

*August, September, October pollock length frequencies*



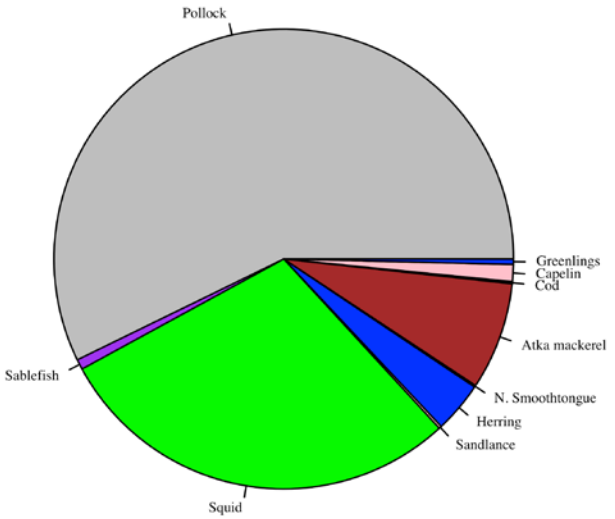

*August, September, October pollock energy in kilojoules*



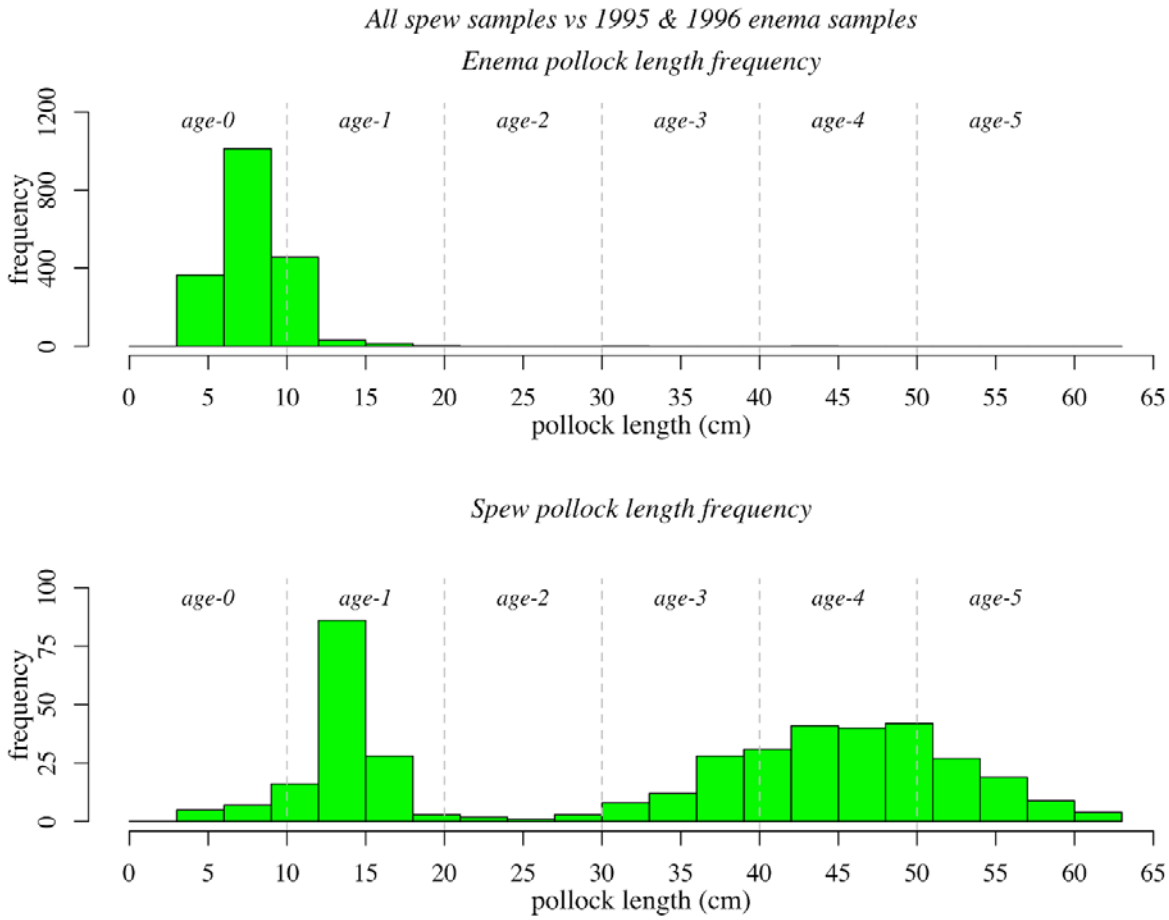

*1996 Enema Results*

*n = 65 seals and 1,986 fish & 313 squid*

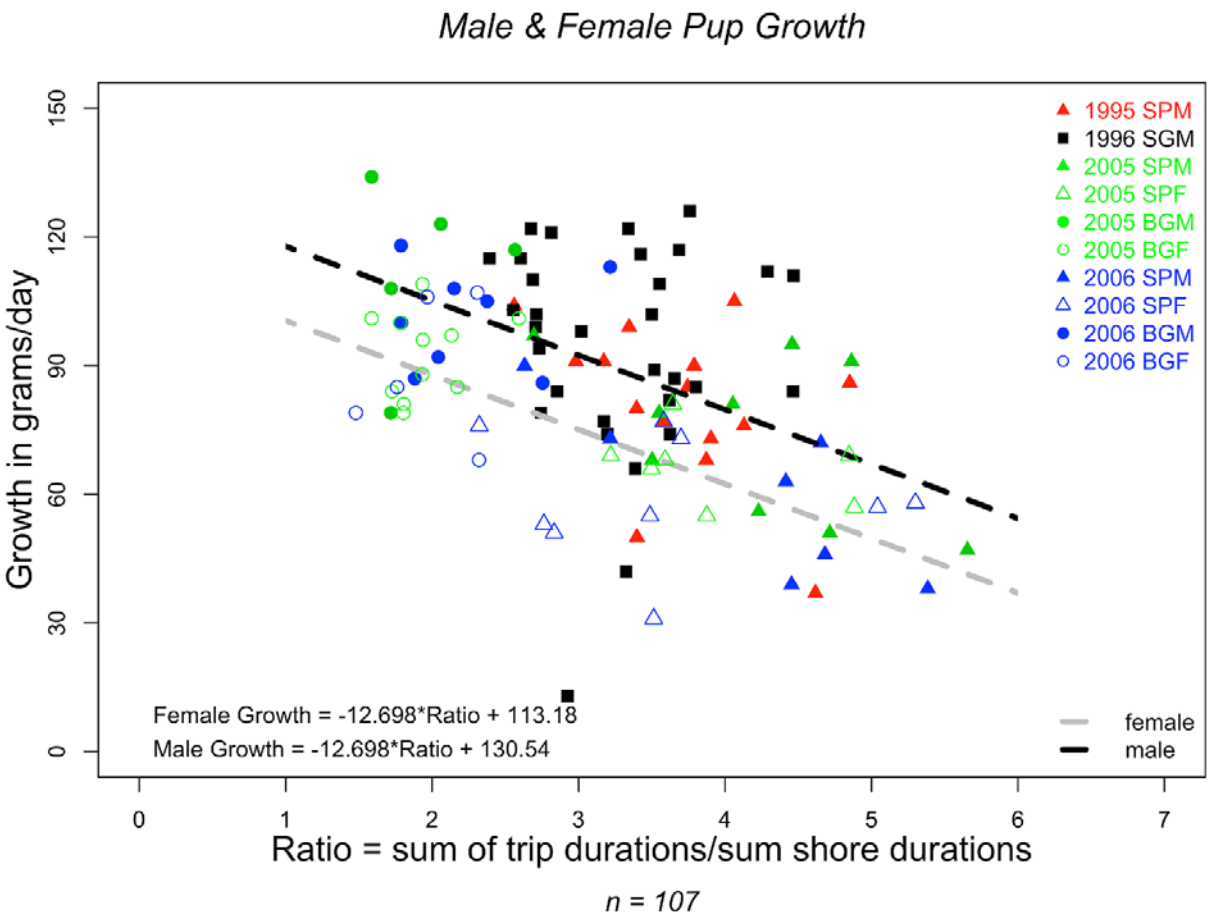
*Enema prey energy content - Total = 70,689 kj*



# Diet – pollock age structure by sample type

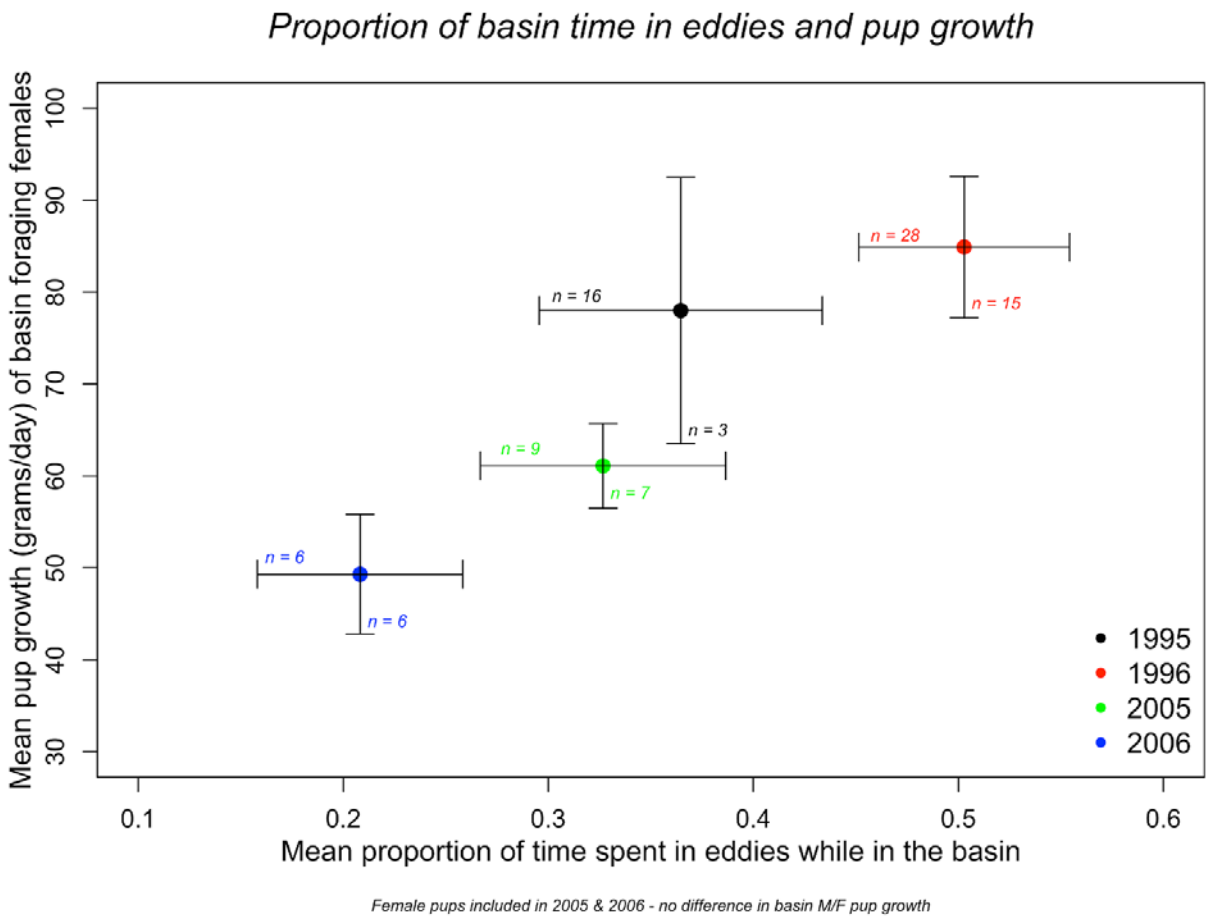


# Mom behavior and pup growth*

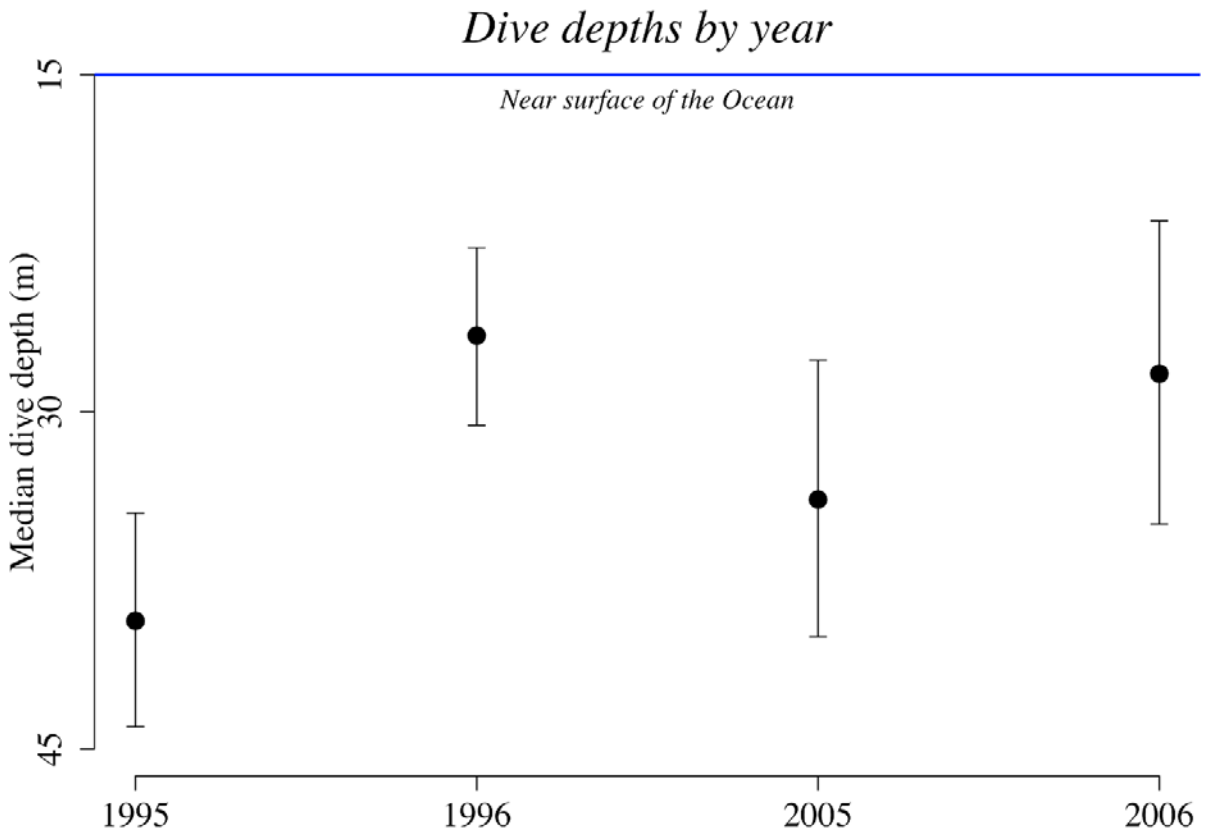



* other significant factors include moms mass and moms time on shore or at sea relative to when the pup mass measurement was taken (i.e. pup mass residuals positive if pup mass was taken when mom was on shore suckling or pup mass residuals negative if pup mass was taken when mom was gone for several days at sea. Overall, we can explain ~ 50% of the pup growth variability.

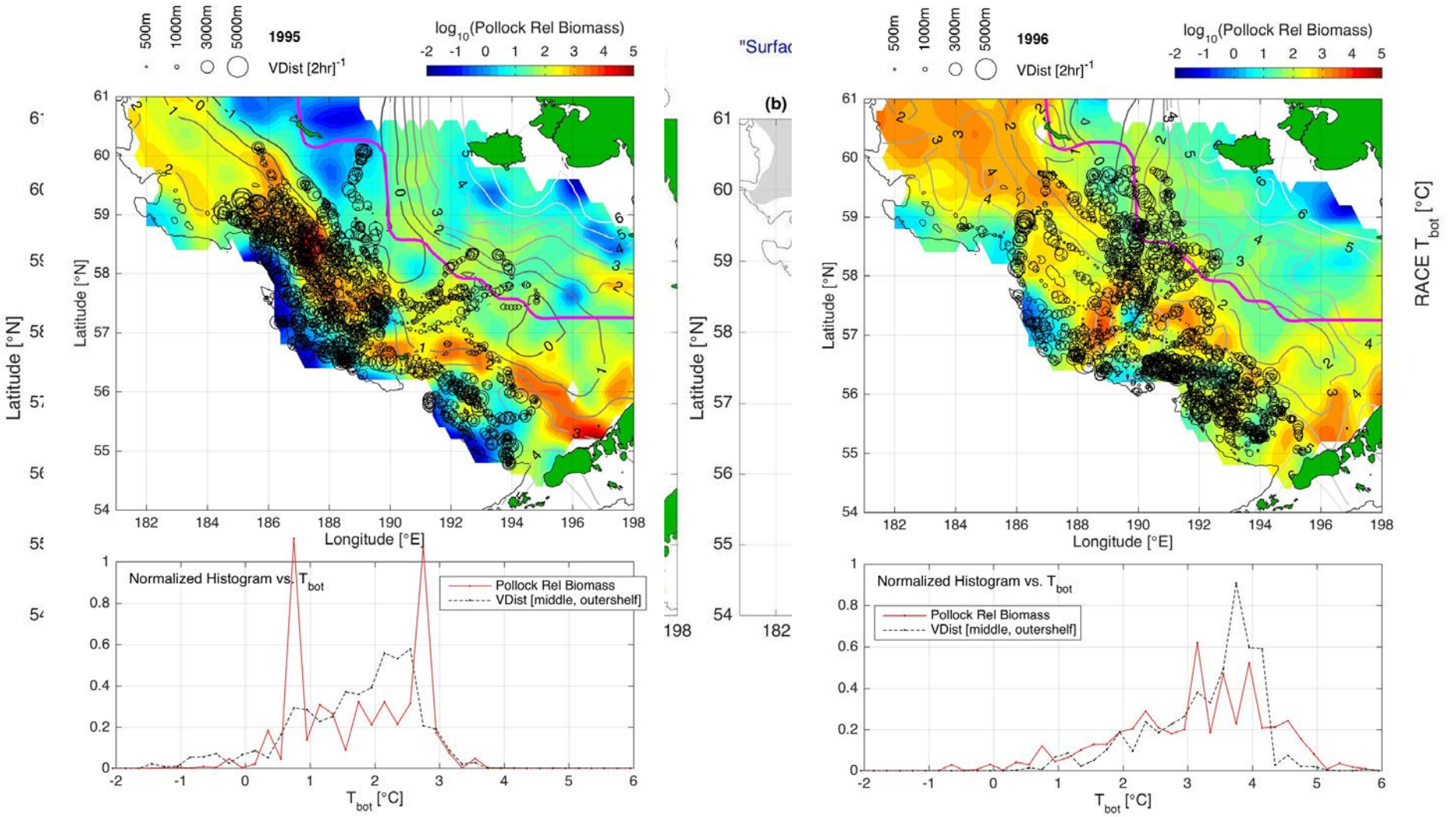
# Pup growth and time in eddies



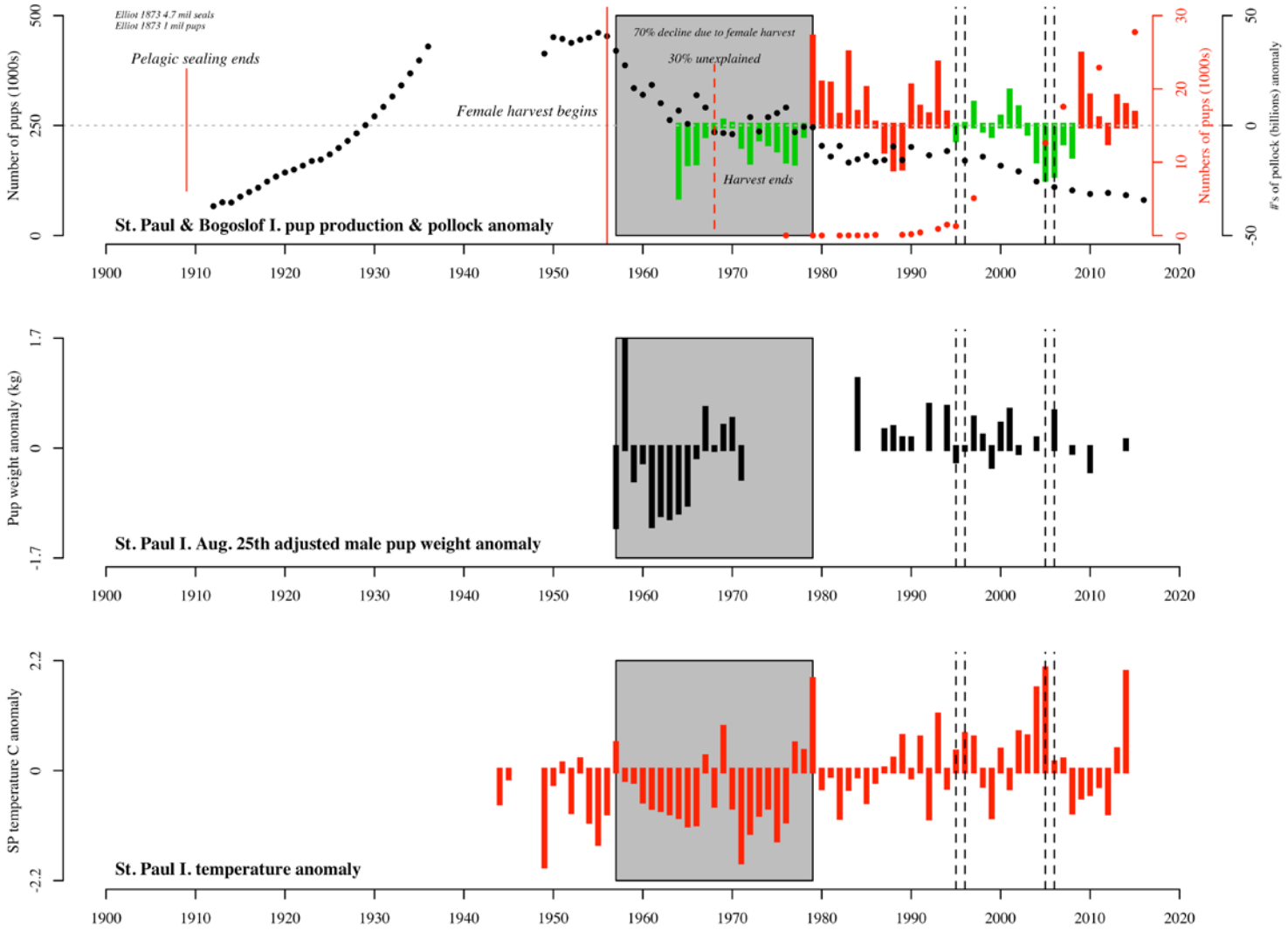
# Shelf foraging – diving



# Shelf foraging – cold vs. warm



# Potential links to productivity



# The influence of prey abundance and distribution on northern fur seal foraging behavior

## Saildrone Missions

## 2016 and 2017

ITAE

Innovative Technology for Arctic Exploration

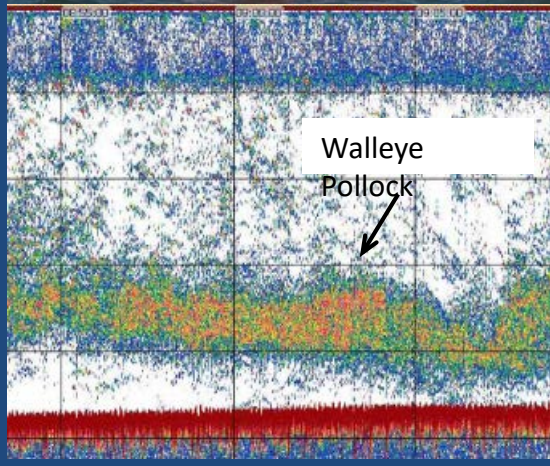
NOAA RESEARCH
Pacific Marine Environmental Laboratory

NOAA FISHERIES
Alaska Fisheries Science Center

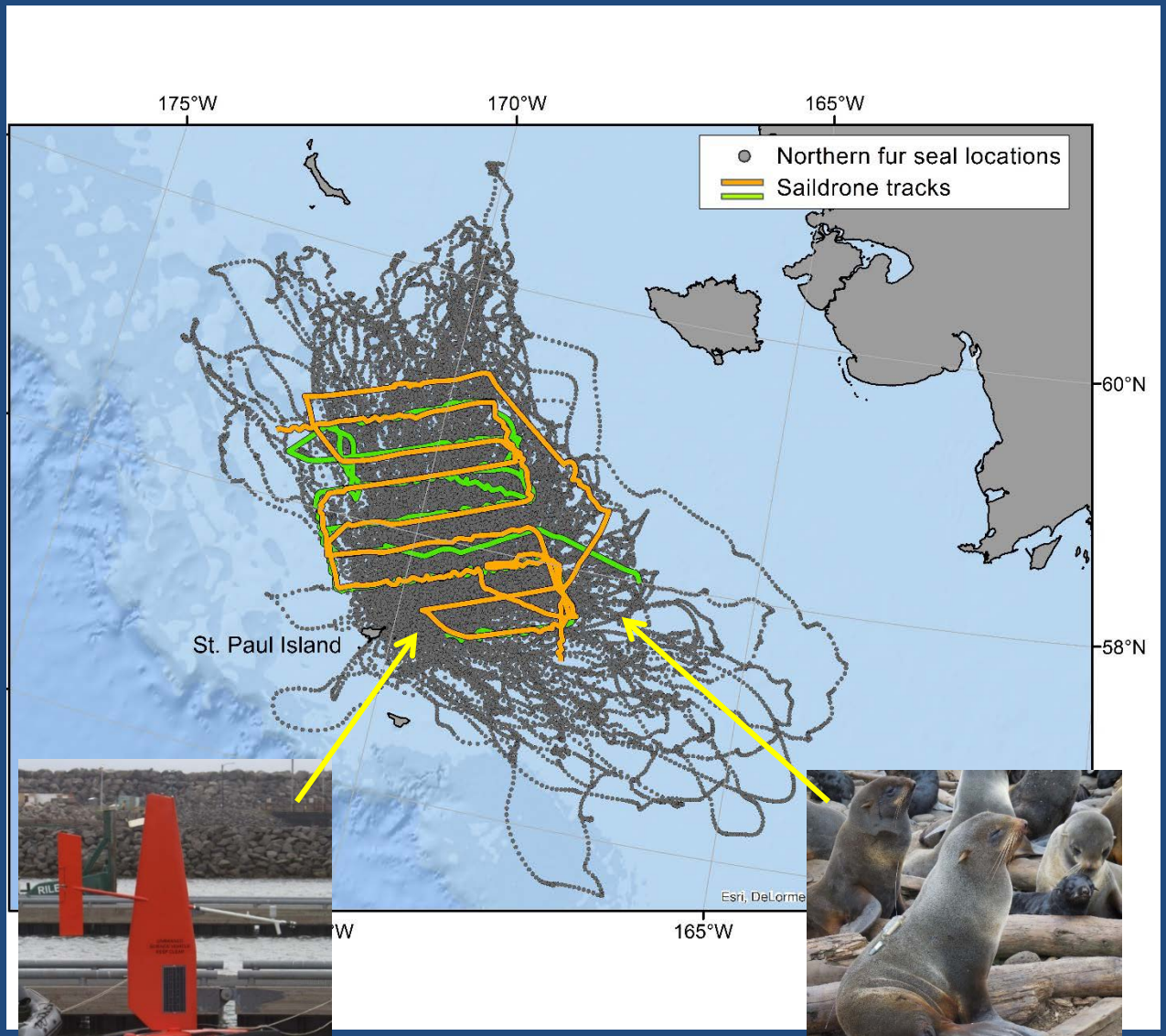
# Project goals

- Quantify fish distribution and abundance within the northern fur seal summer foraging range
- Simultaneously track fur seal dive and movement patterns to examine foraging behavior in relation to variation in prey availability
- Determine specific prey characteristics (e.g., density, depth, fish size) that are associated with increased fur seal foraging success

Fills significant data gaps for understanding northern fur seal-pollock interactions and directly addresses needs identified in the northern fur seal conservation plan

# 2016 Mission summary



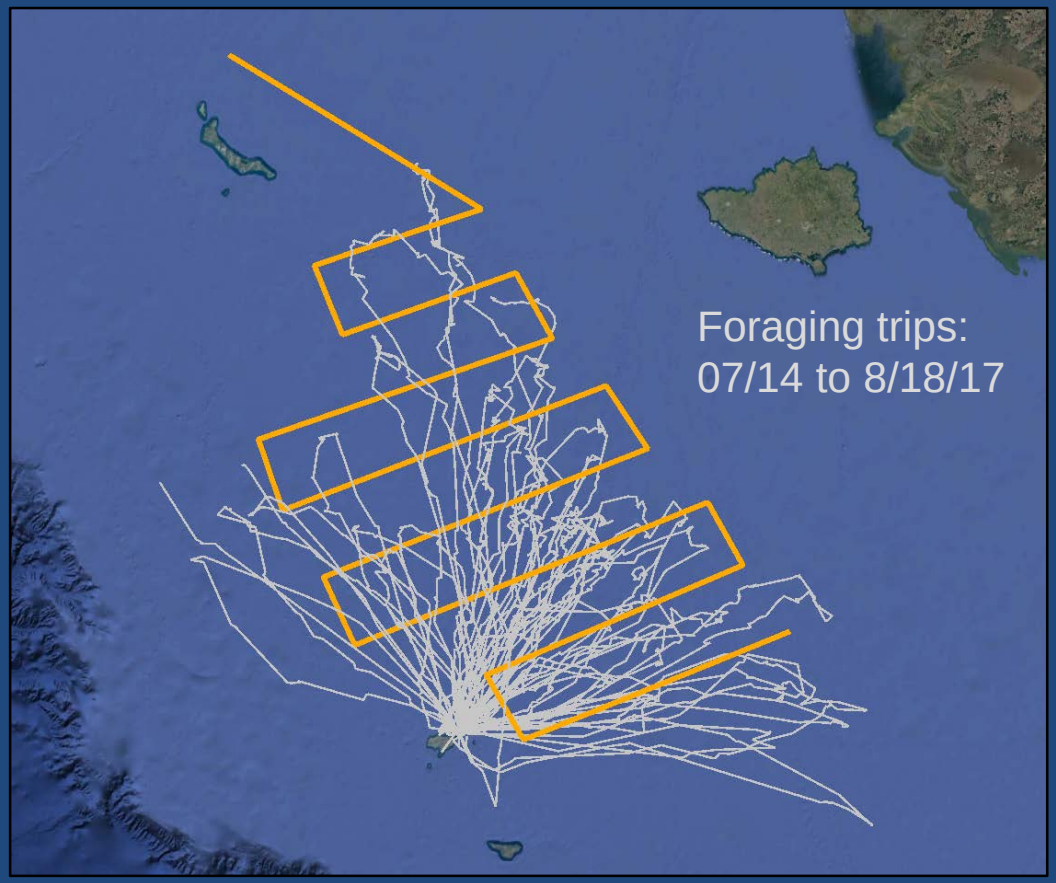




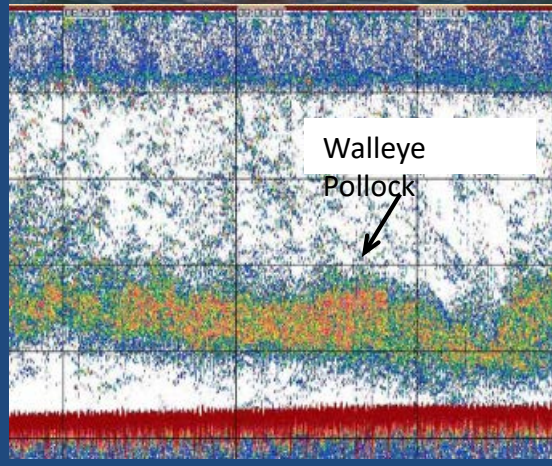

- Recorded fur seal behavior for ~70 days (n= 29 fur seals)
- 34,000+ hours at sea
- 284,000+ dives
- 65 Saildrone sampling days within the fur seals core use area (July-Aug)
- Additional echosounder data outside of core sampling area

# 2017 Mission

- Collected fish distribution and abundance data while simultaneously tracking fur seals (July – Sept)
- Test animal-borne cameras to record video of fur seals feeding and to record the prey species/size consumed
- Test accelerometers to determine if fur seal behavior (lunges/strikes) can be used to measure feeding rates when cameras aren't used

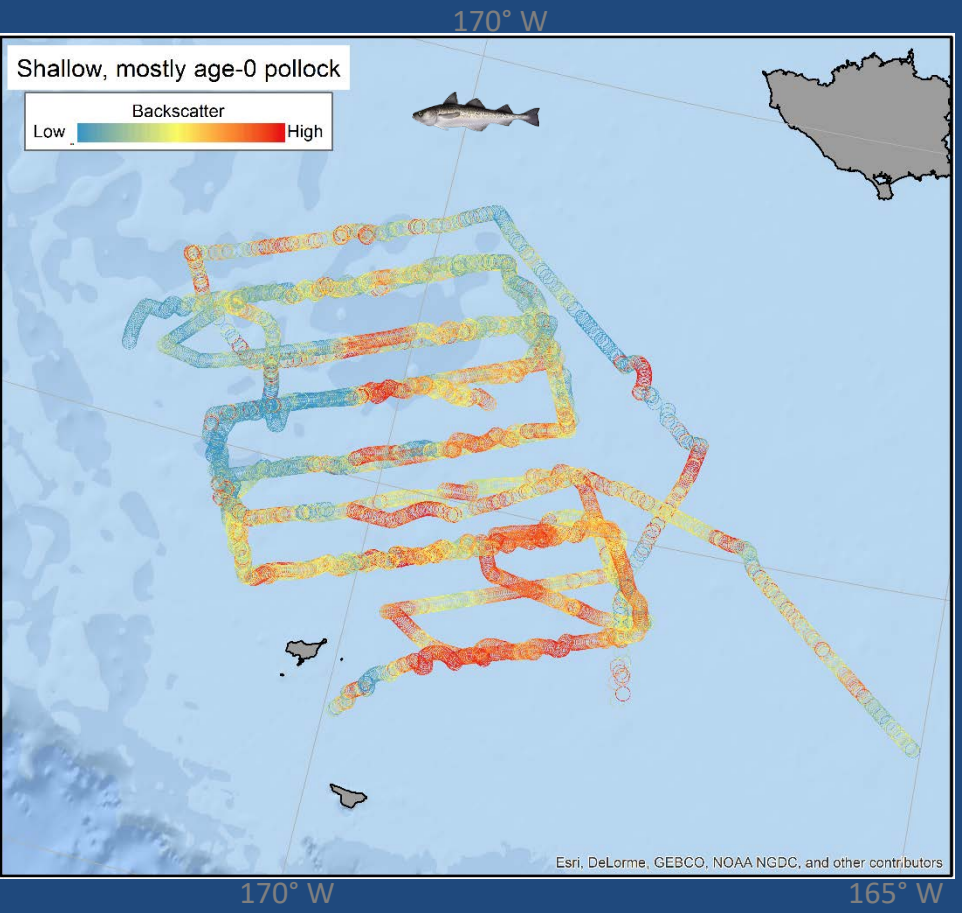


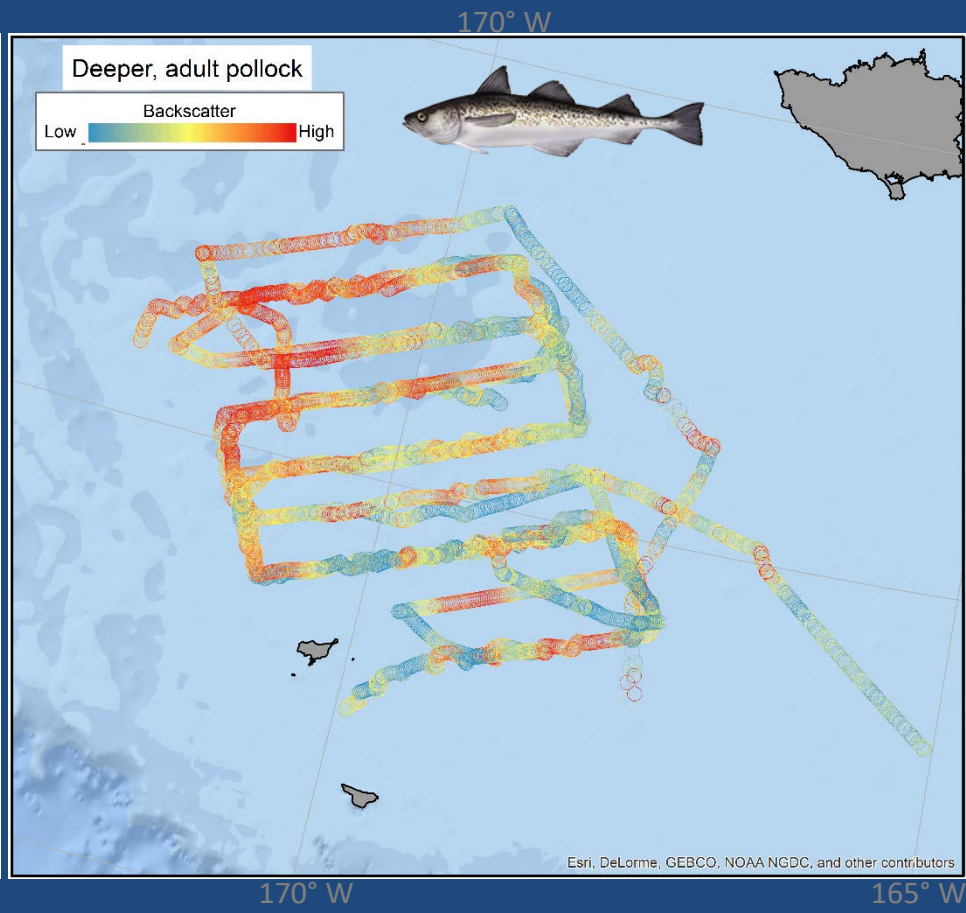




# Pollock segregation by age class

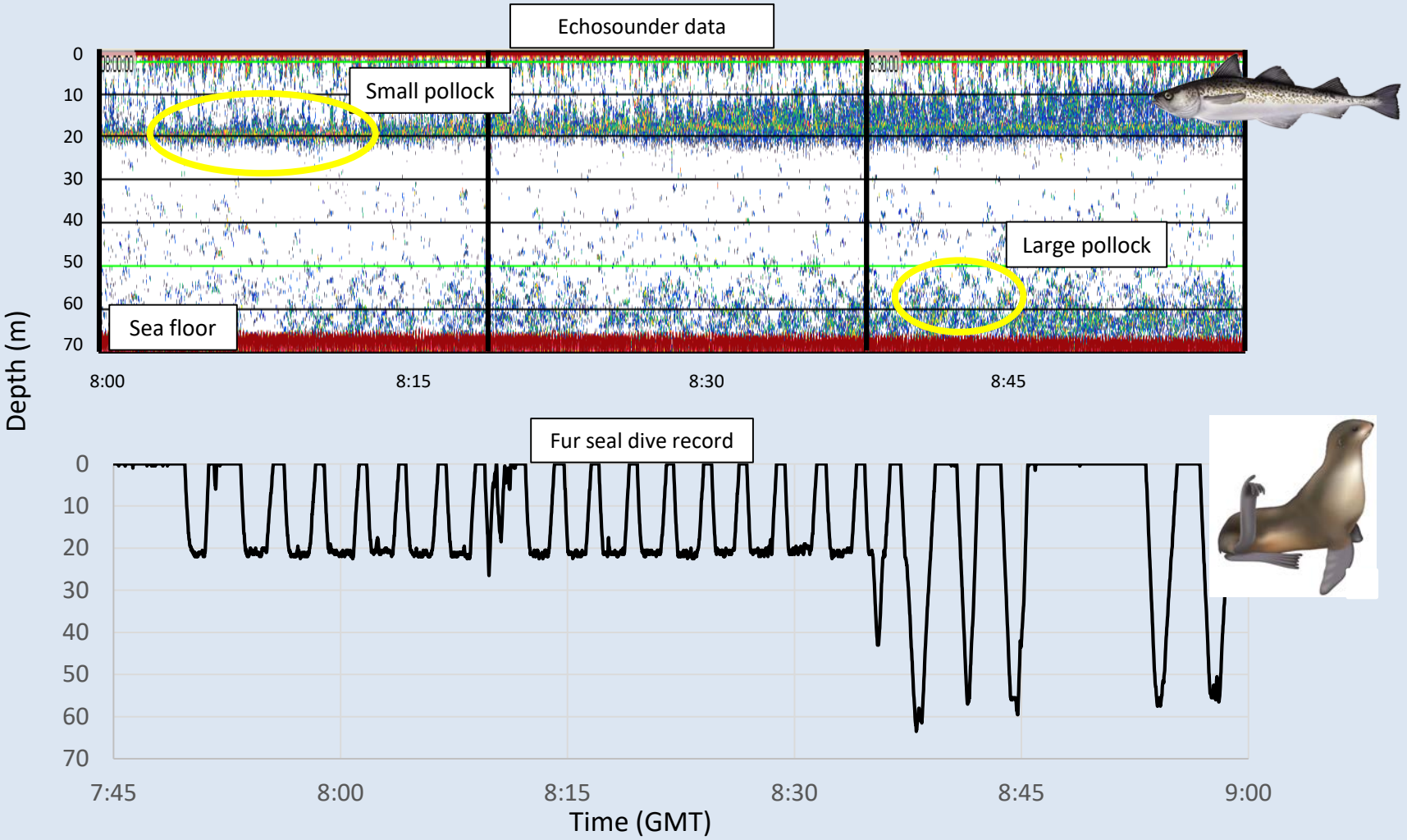
Echosounder data showed spatial separation between small and large pollock



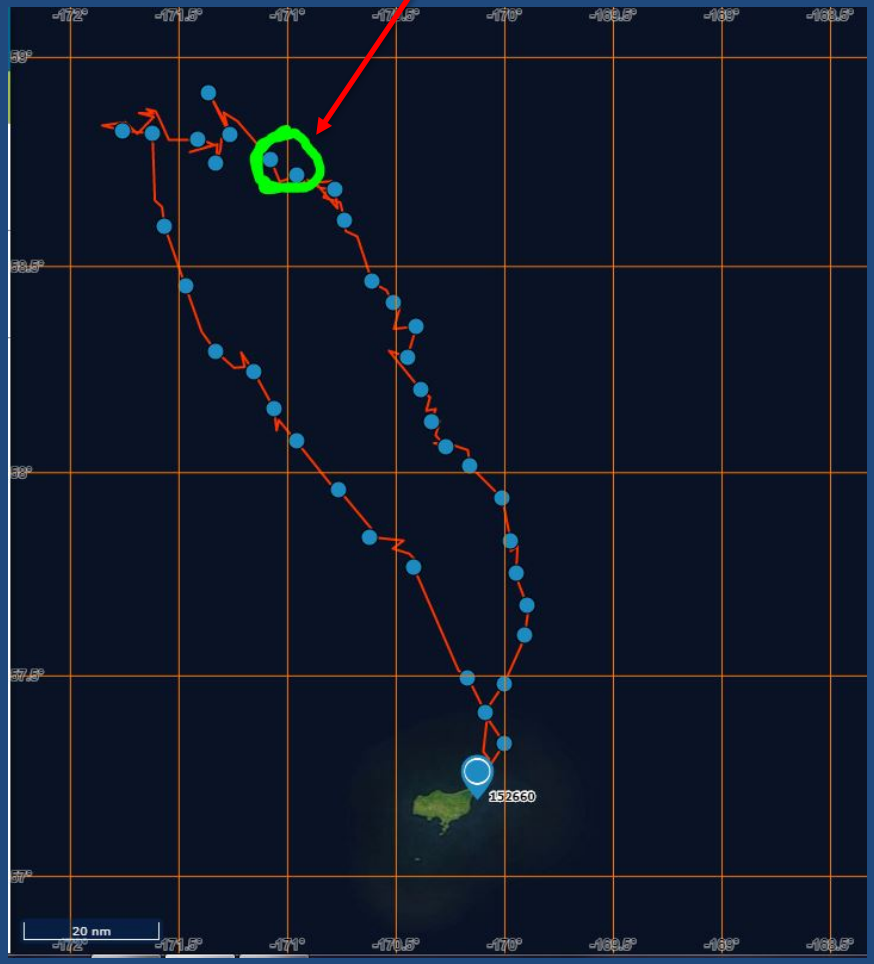



# Preliminary data exploration

Data collected when Saildrone and fur seal crossed paths (< 1 hour apart)



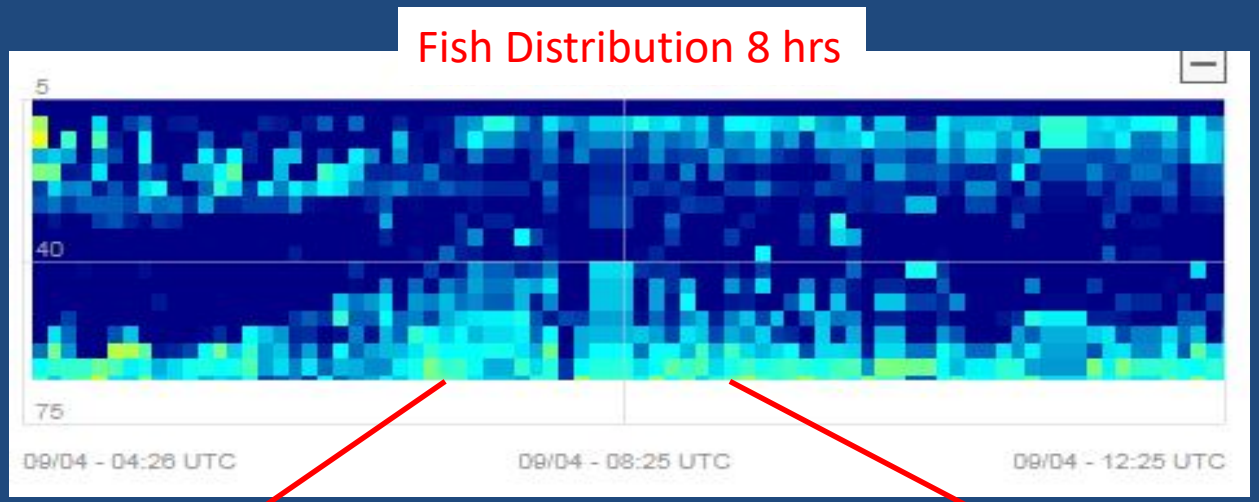
# Focal follow: 3-4 September 2017 2025-0425 local time

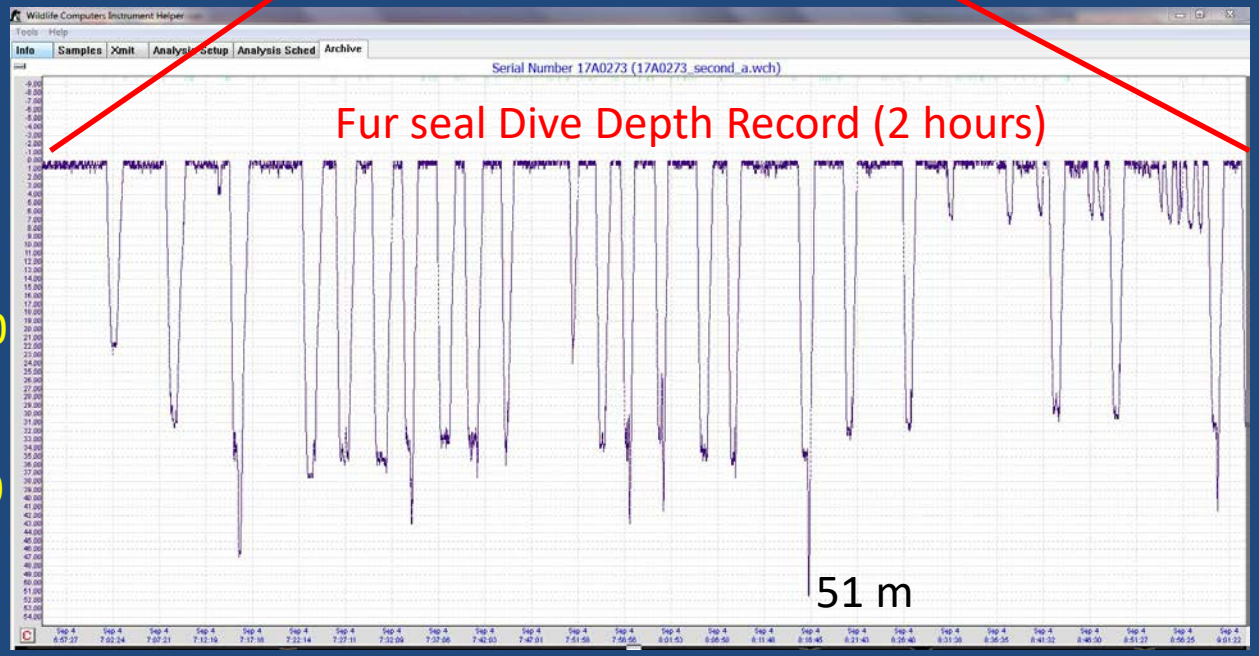



- Trip was 5.9 days long
- Other trips ranged between 6.0 and 9.4 days
- Highlighted area 175 km NNW of St Paul


Image from video (2 September) showing fur seal with captured fish

# Focal follow: 3-4 September 2017 2025-0425 local time




- Bottom depth 60-75 m
- Smaller fish near surface
- Larger fish in 10-20 m thick aggregation near bottom
- Quick-look low-resolution backscatter data; better data stored on-board

- Regular dives to top of aggregation at bottom
- Some dives 40+ m into aggregation