

# Foraging ecology of Steller sea lions and northern fur seals in far eastern Russia

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Alaska SeaLife Center  
windows to the sea



# Program participants:

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Nature preserve "Komandorsky"



RUSSIA

ALASKA

Asian

Western genetic population

Steller sea lion range



# Why Russia??

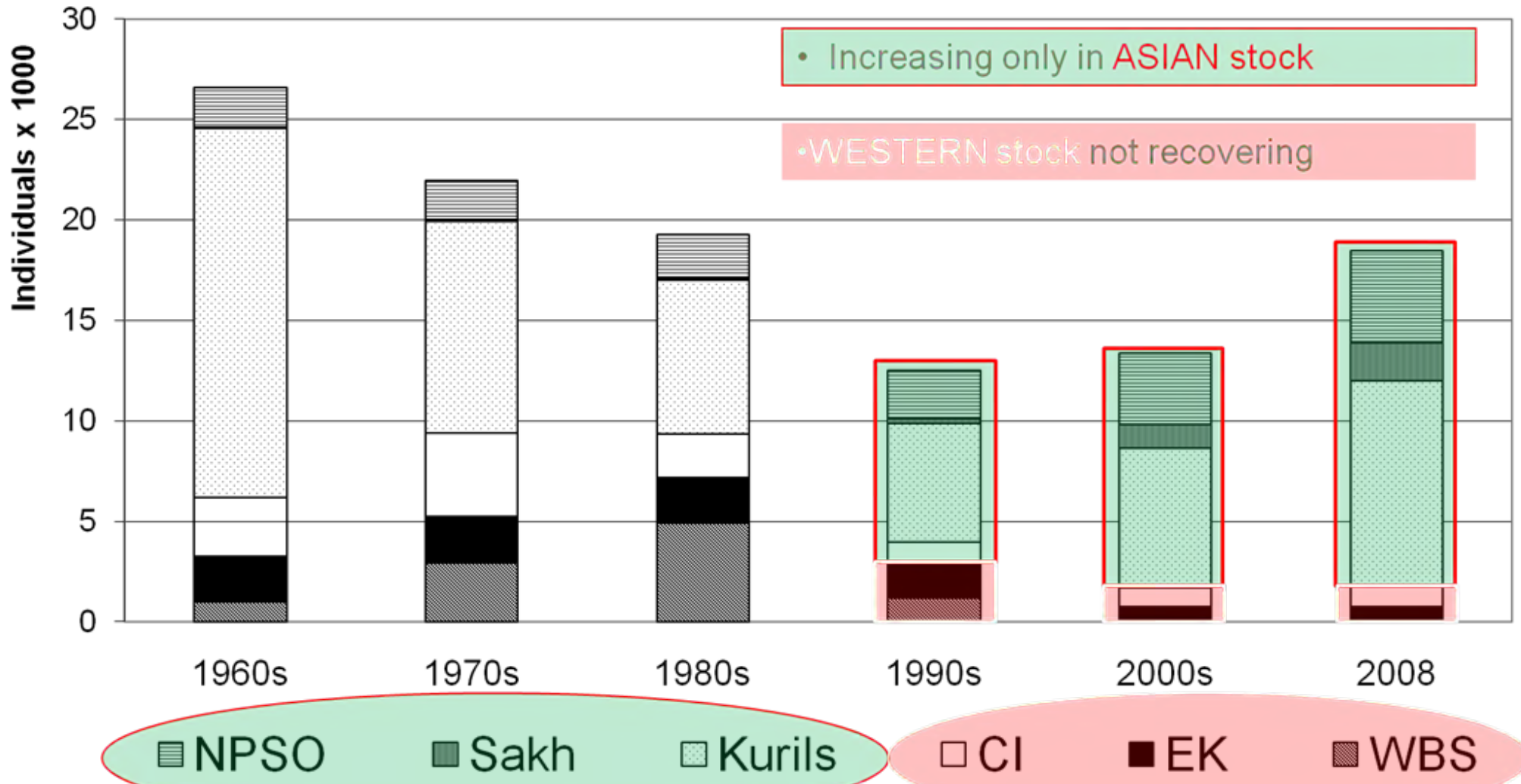
## From “The Recovery Plan for the Steller Sea Lion, March 2008

### RECOVERY CRITERIA:

The western DPS of Steller sea lions will be considered for reclassification to “threatened” when all of the following conditions are met:

1. The population for the U.S. region has increased (statistically significant) for 15 years on average, based on counts of non-pups (i.e., juveniles and adults). Based on an estimated population size of roughly 42,500 animals in 2000 and assuming a consistent but slow (e.g. 1.5%) increasing trend, this would represent approximately 53,100 animals in 2015.
2. The trends in non-pups in at least 5 of the 7 sub-regions are consistent with the trend observed under criterion #1. The population trend in any two adjacent sub-regions cannot be declining significantly. The 7 sub-regions are:
  - a. Eastern Gulf of Alaska (US)
  - b. Central Gulf of Alaska (US)
  - c. Western Gulf of Alaska (US)
  - d. Eastern Aleutian Islands (including the eastern Bering Sea) (US)
  - e. Central Aleutian Islands (US)
  - f. Western Aleutian Islands (US)
  - g. Russia/Asia
3. The ESA listing factor criteria are met.

# Total SSL Abundance in Russia:



# Why Russia??

From “The Recovery Plan for the Steller Sea Lion, March 2008

## **Recovery Action Outline**

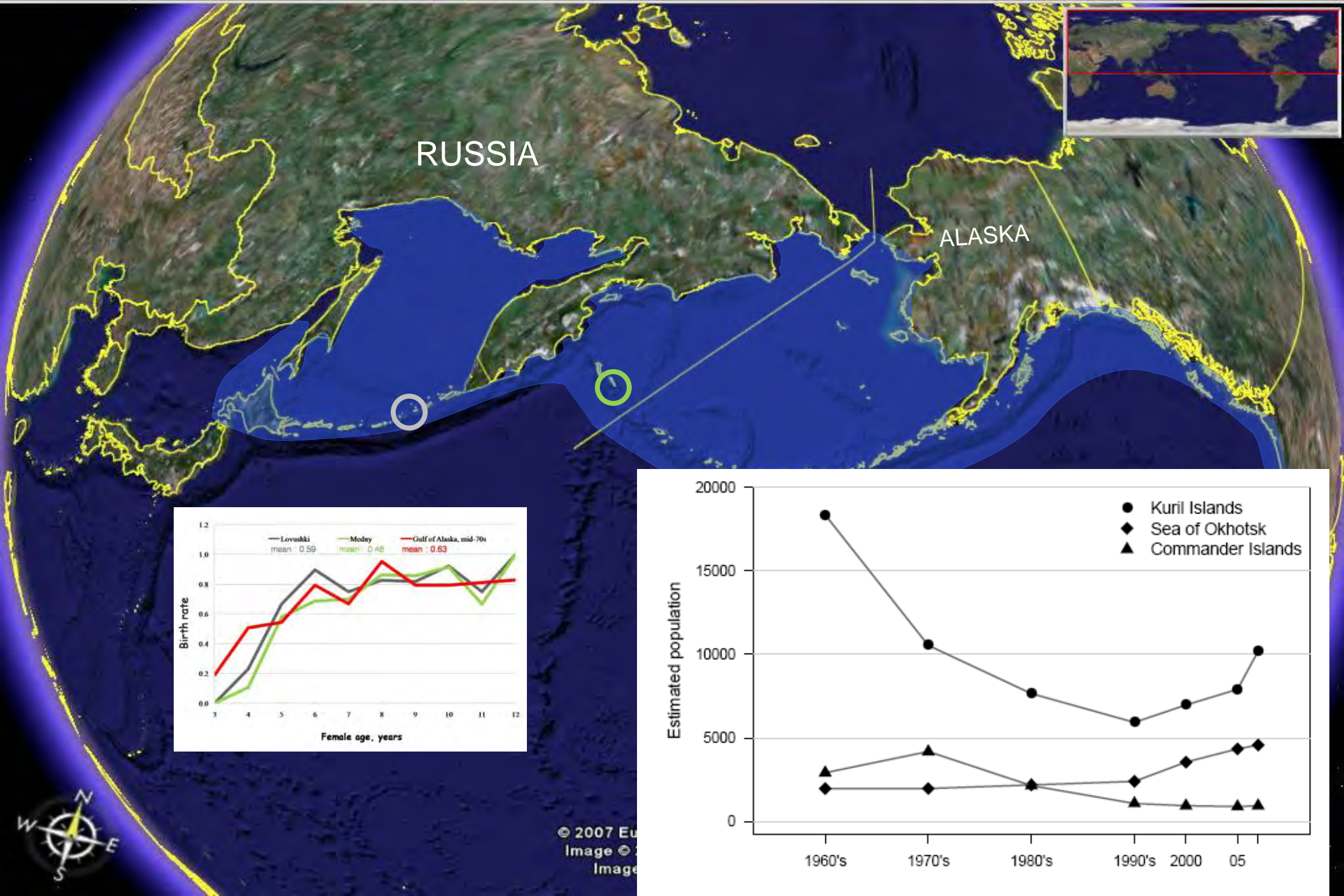
1.2.2 Promote cooperative pup branding/resight programs in Russia

Priority 2a (actions that should be taken first)

2.3.3 Deploy instruments to obtain fine scale data on sea lion foraging habitat. Priority 2a

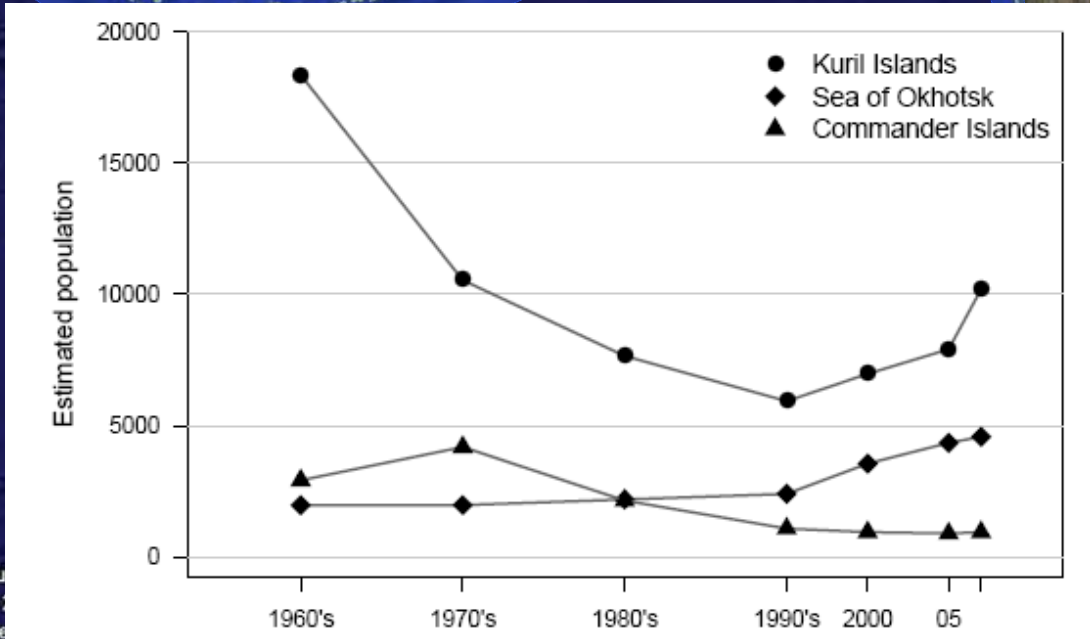
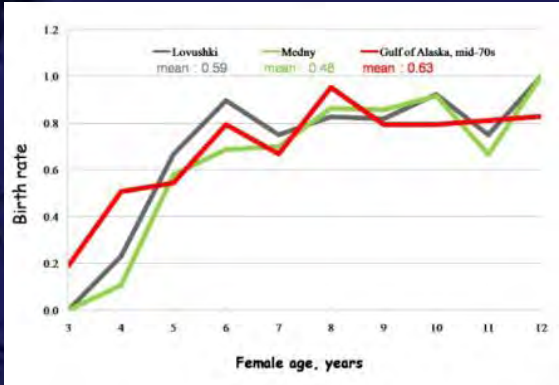
2.5.2 Determine the energetic costs to foraging sea lions. Priority 2a

2.6.5 Assess the response of sea lions to changes in prey distribution and availability. Priority 2a

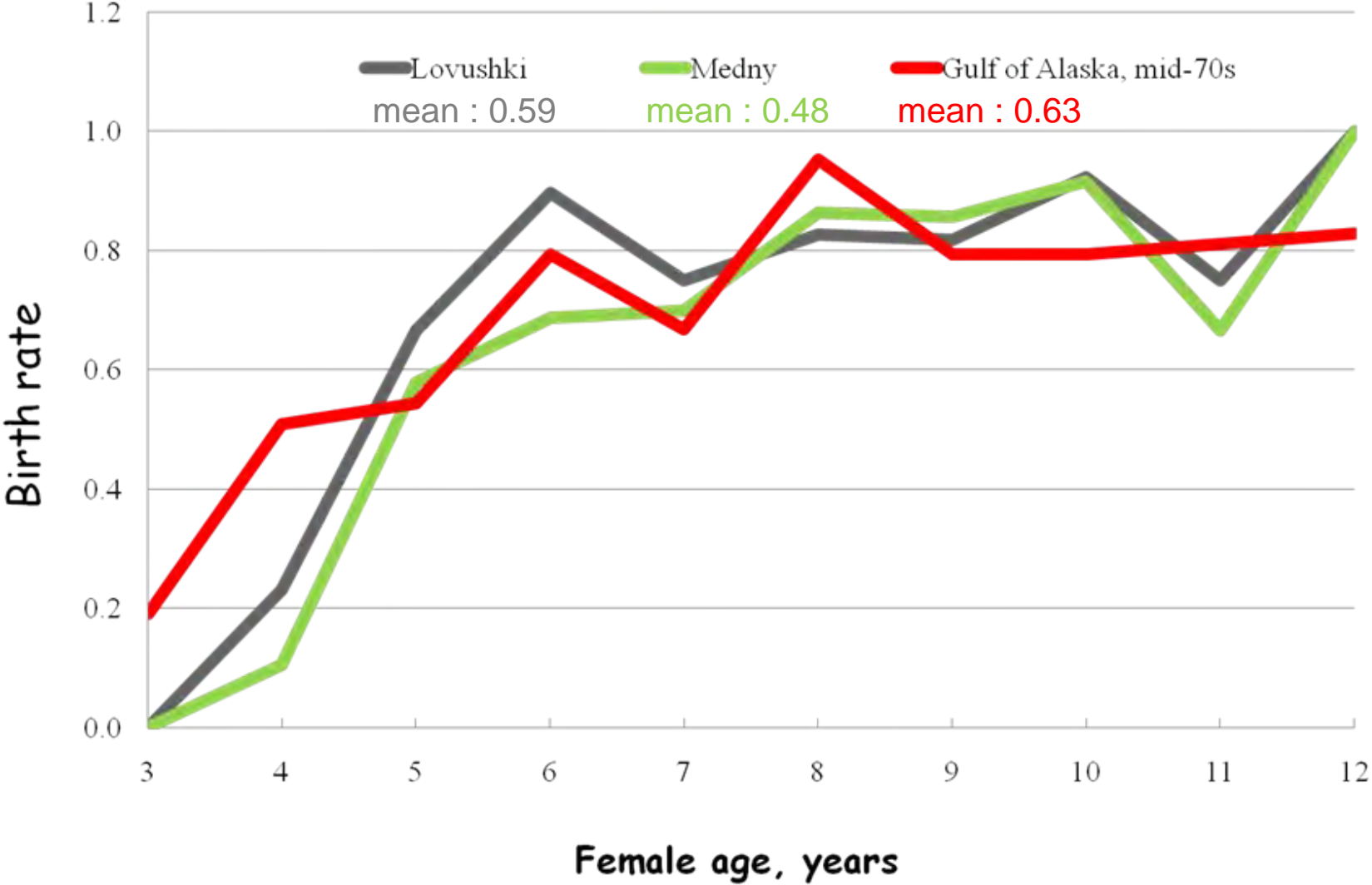


RUSSIA

ALASKA

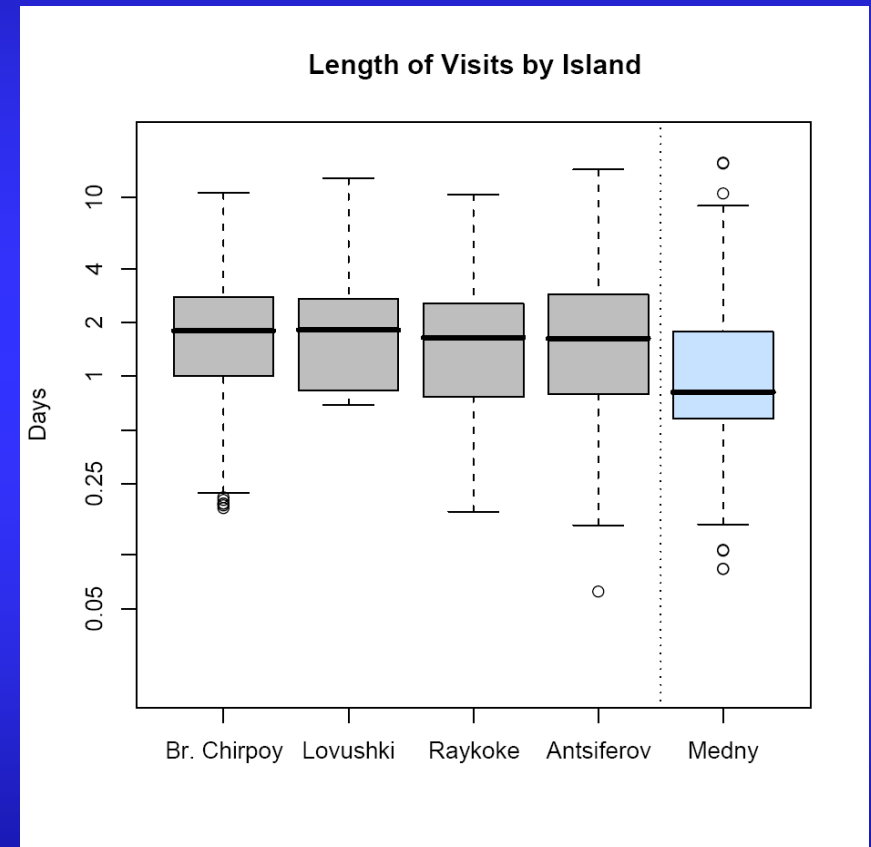
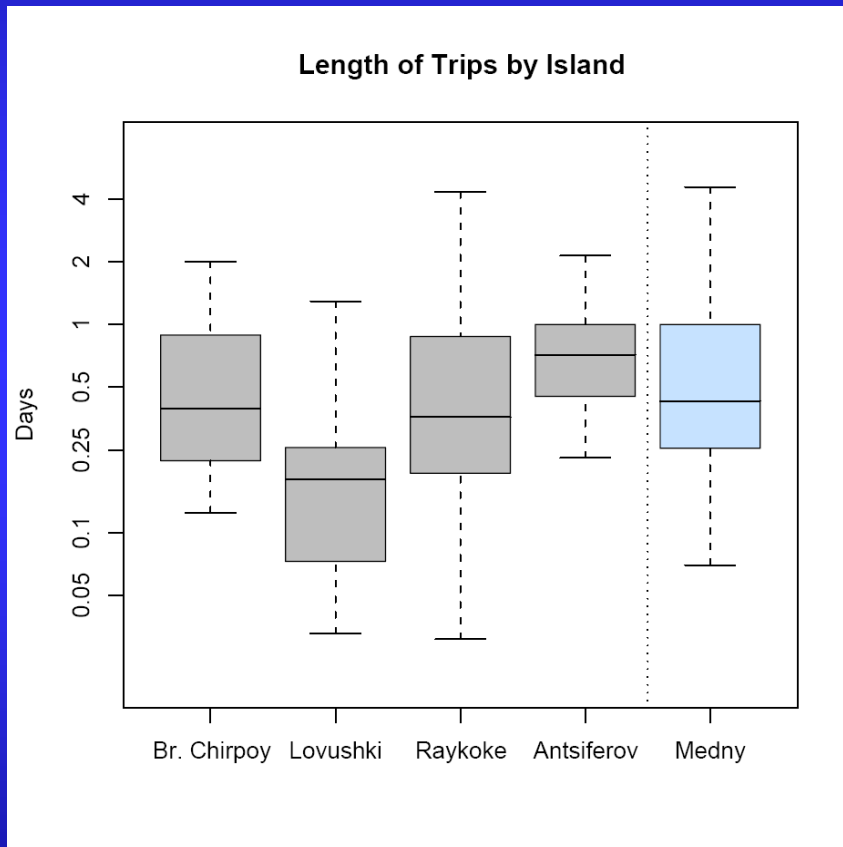


# Steller sea lion fecundity

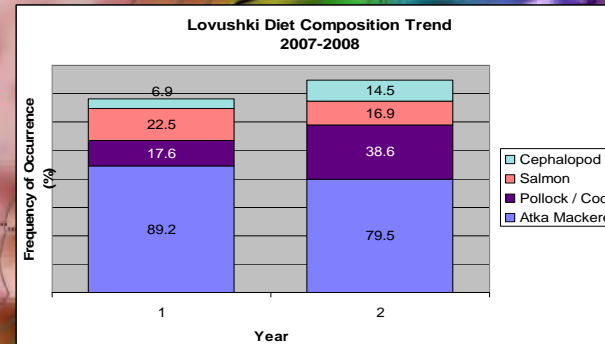
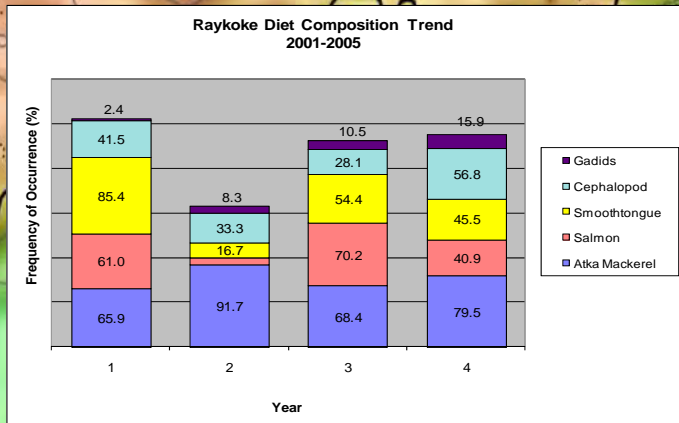




# Maternal attendance patterns for Steller sea lion rookeries in Russia



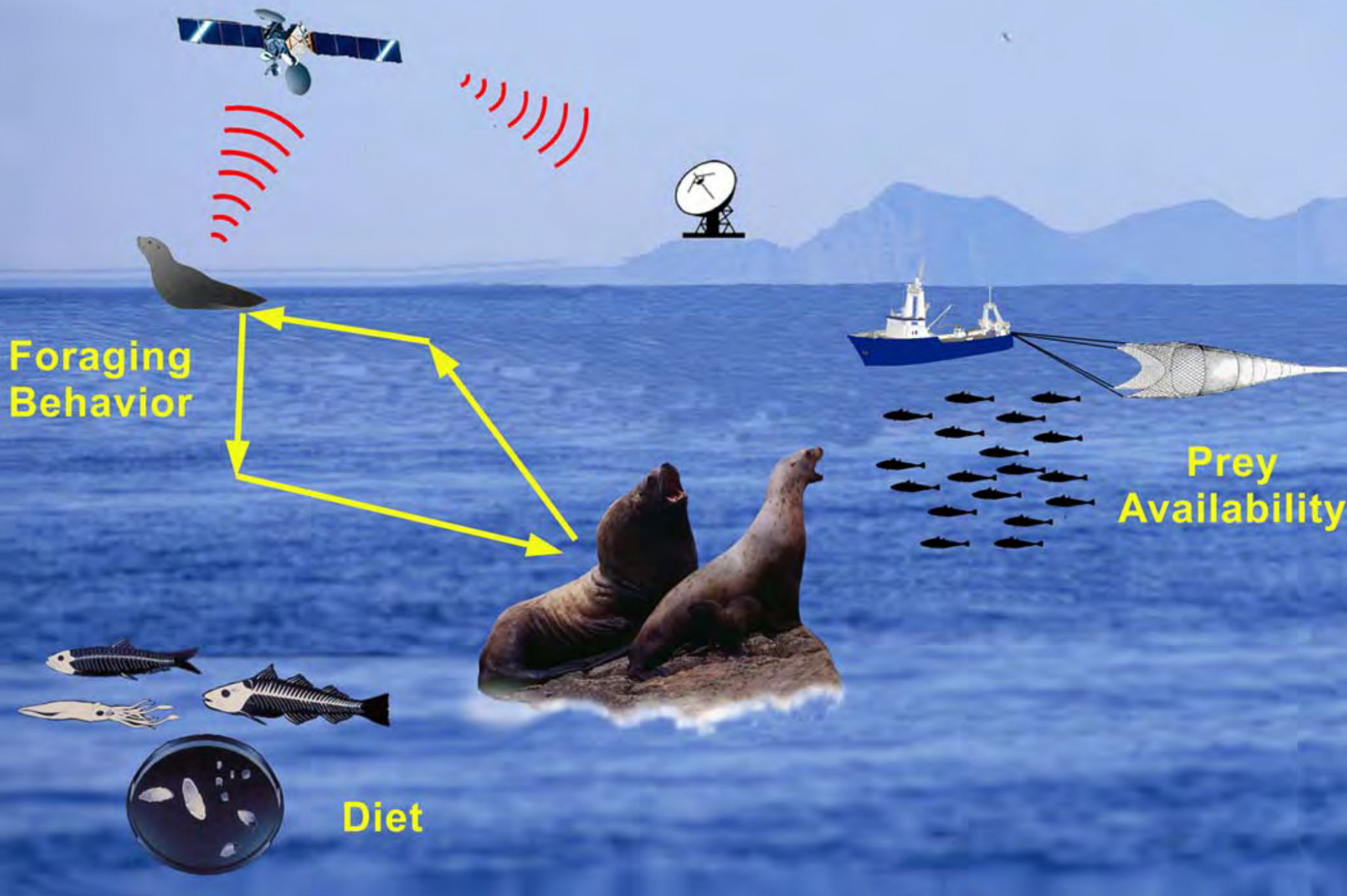
Trip and Visit durations by Island (30 days after 1<sup>st</sup> trip)



**Foraging Behavior**

**Prey Availability**

**Diet**





# Lovushki Island Summer 2007



- 5 SSL tagged w/ GPS & stomach temp. tags
- 4 recaptured



- 7 NFS tagged w/ GPS & stomach temp. tags
- 7 recaptured



- 6 NFS tagged with small TDR/VHF
- 6 recaptured

# Lovushki Island Summer 2008



- 9 SSL tagged w/ satellite-linked GPS & stomach temp. tags (no need for recapture)
- 3 SSL tagged w/ VDAP video recorders
  - All 3 recaptured

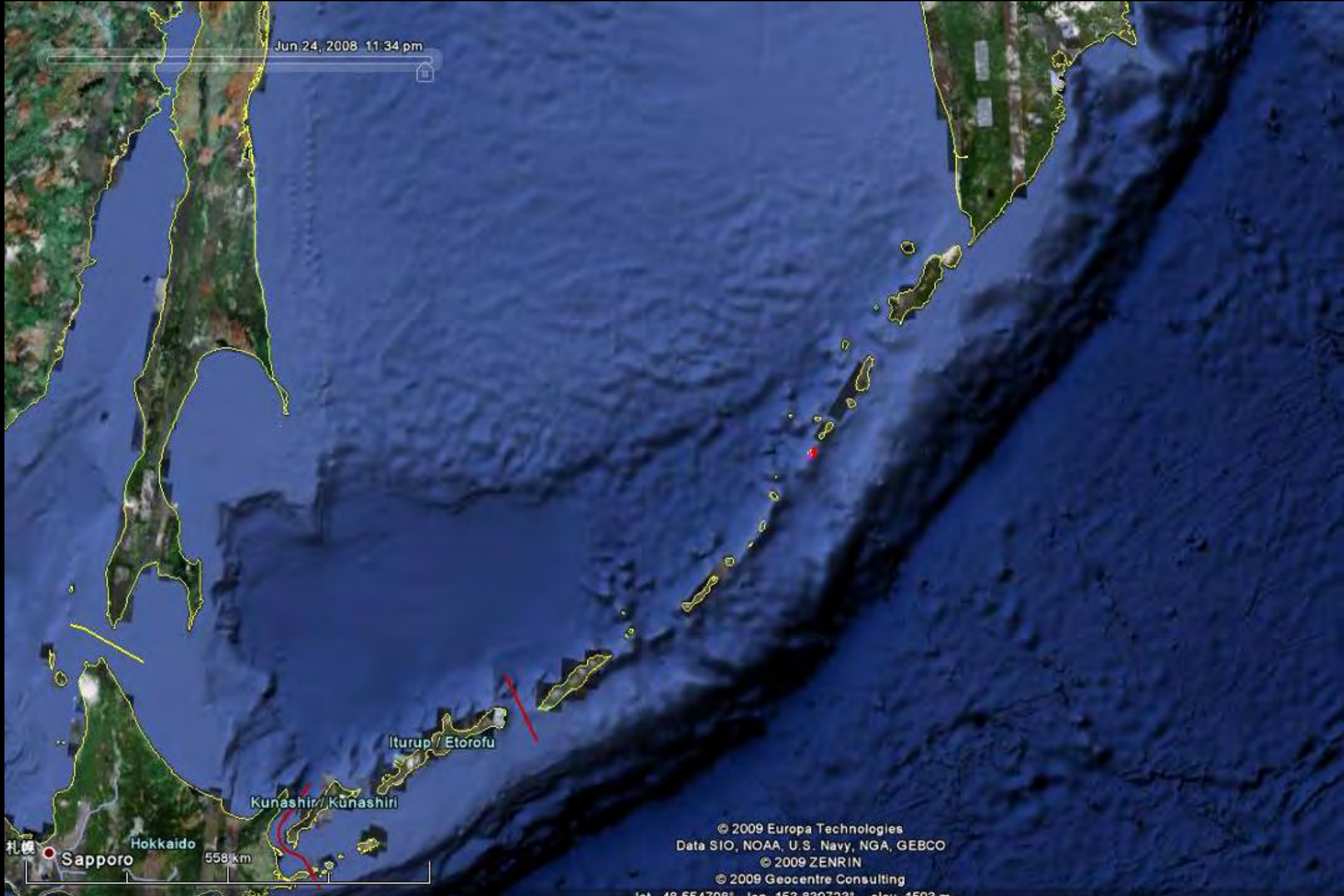


- 6 NFS tagged w/ GPS & stomach temp. tags
- 6 recaptured



- 6 NFS tagged with small TDR/VHF
- 6 recaptured

Jun 24, 2008 11:34 pm



札幌

Sapporo

Hokkaido

558 km

Kunashir / Kūnashiri

Iturup / Etorofu

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lat: 48.5547081 lon: 152.8207221 elev: 1502 m

Jun 24, 2008 11:34 pm



101 km

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©200

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lat 48.554798° lon 153.839723° elev 0 m



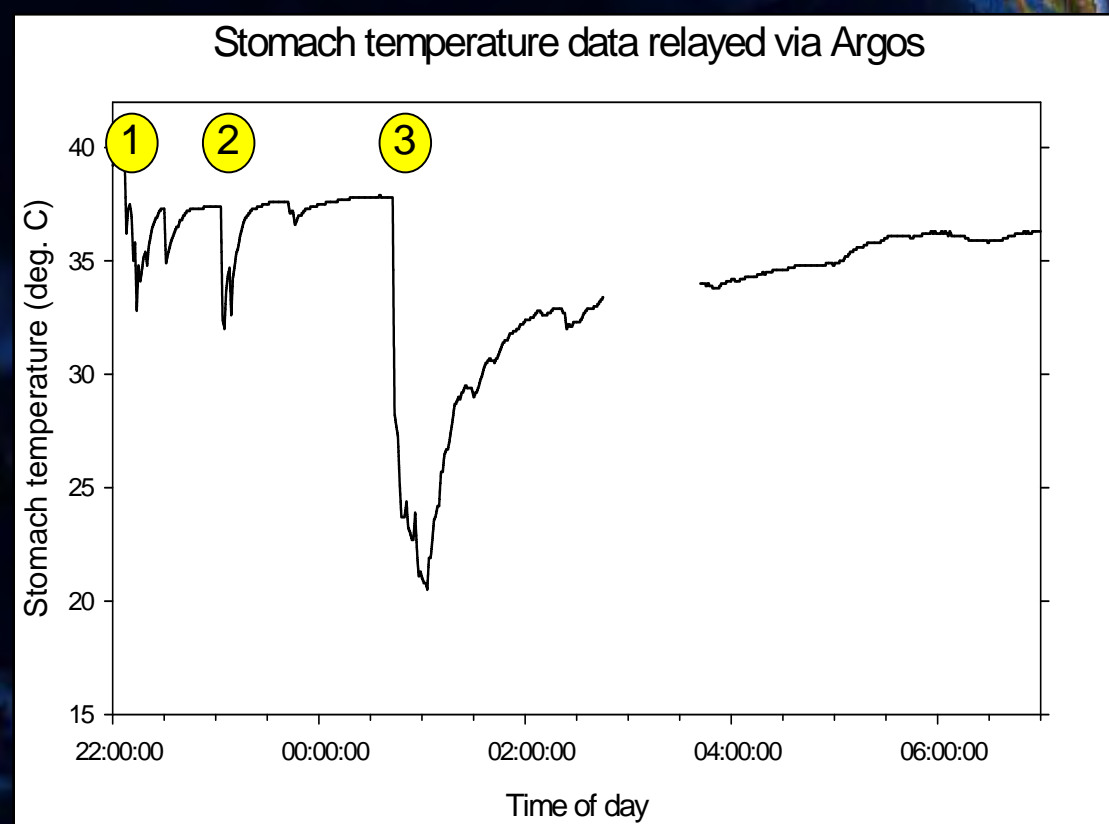
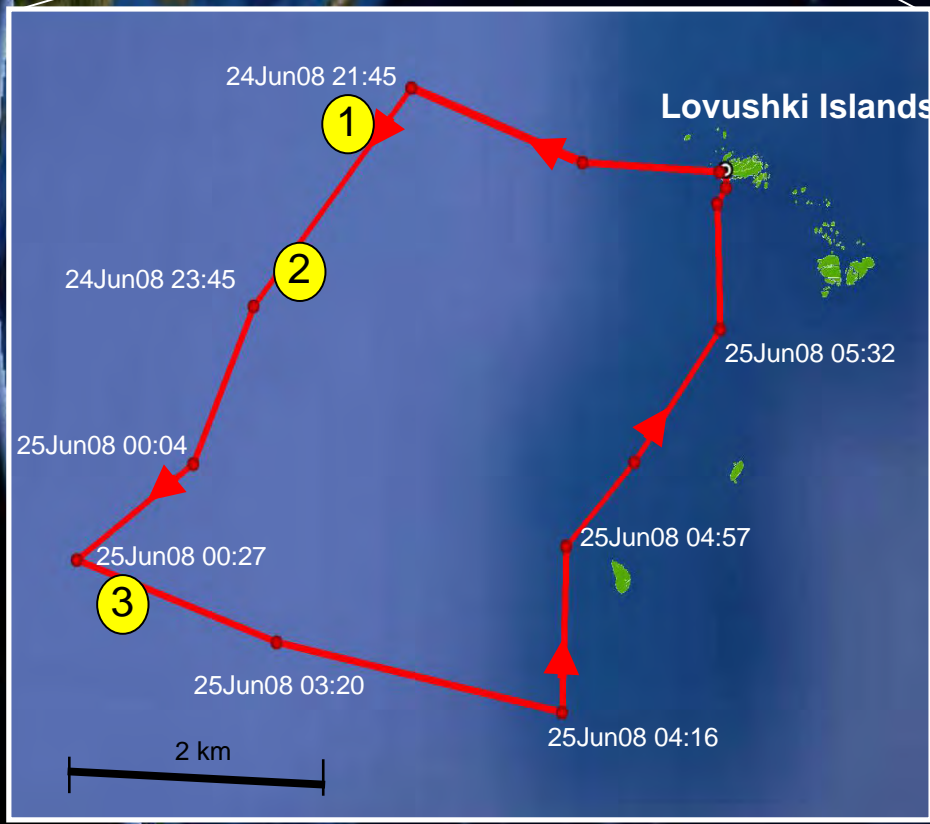
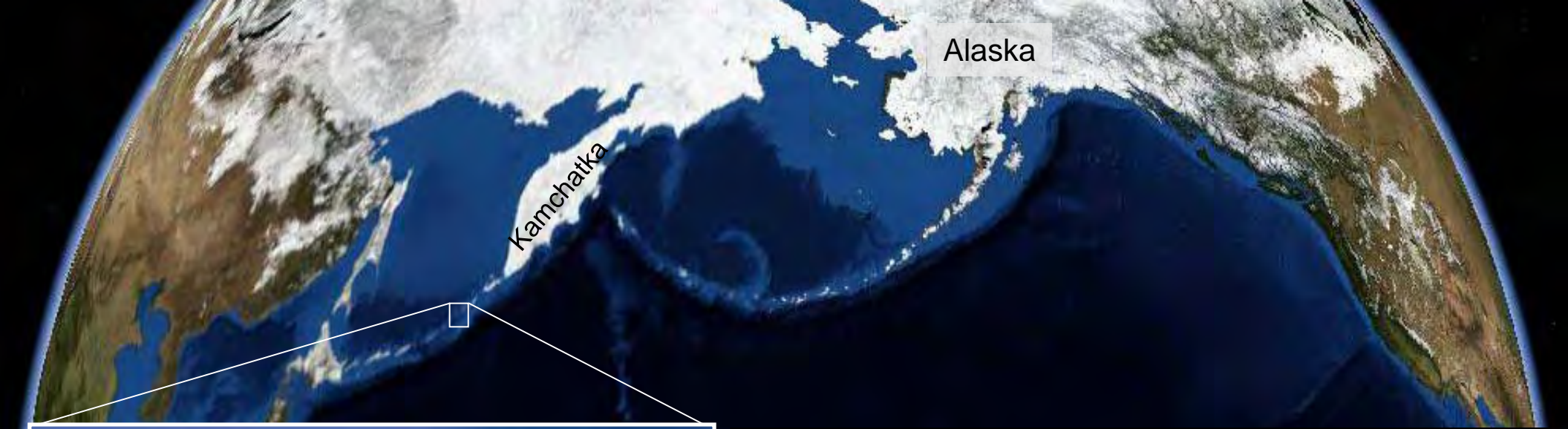
Jun 24, 2008 11:34 pm



7.24 km

Data SIO, NOAA, U.S. Navy, NGA, GEBCO

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# Video & Data Acquisition Platform

- Equipment in deployed VDRs
  - Head Mount
    - B&W CCD camera with near-infrared LEDs
    - GPS
  - Backpack
    - Digital video recorder (hard drive); flash memory for data
    - Pressure sensor (depth)



- Other sensors
  - Thermistor
  - Conductivity sensor
  - Illuminance sensor
  - Water (swim) speed
  - 3-axis accelerometer (pitch, roll, yaw)
  - 3-axis magnetometer

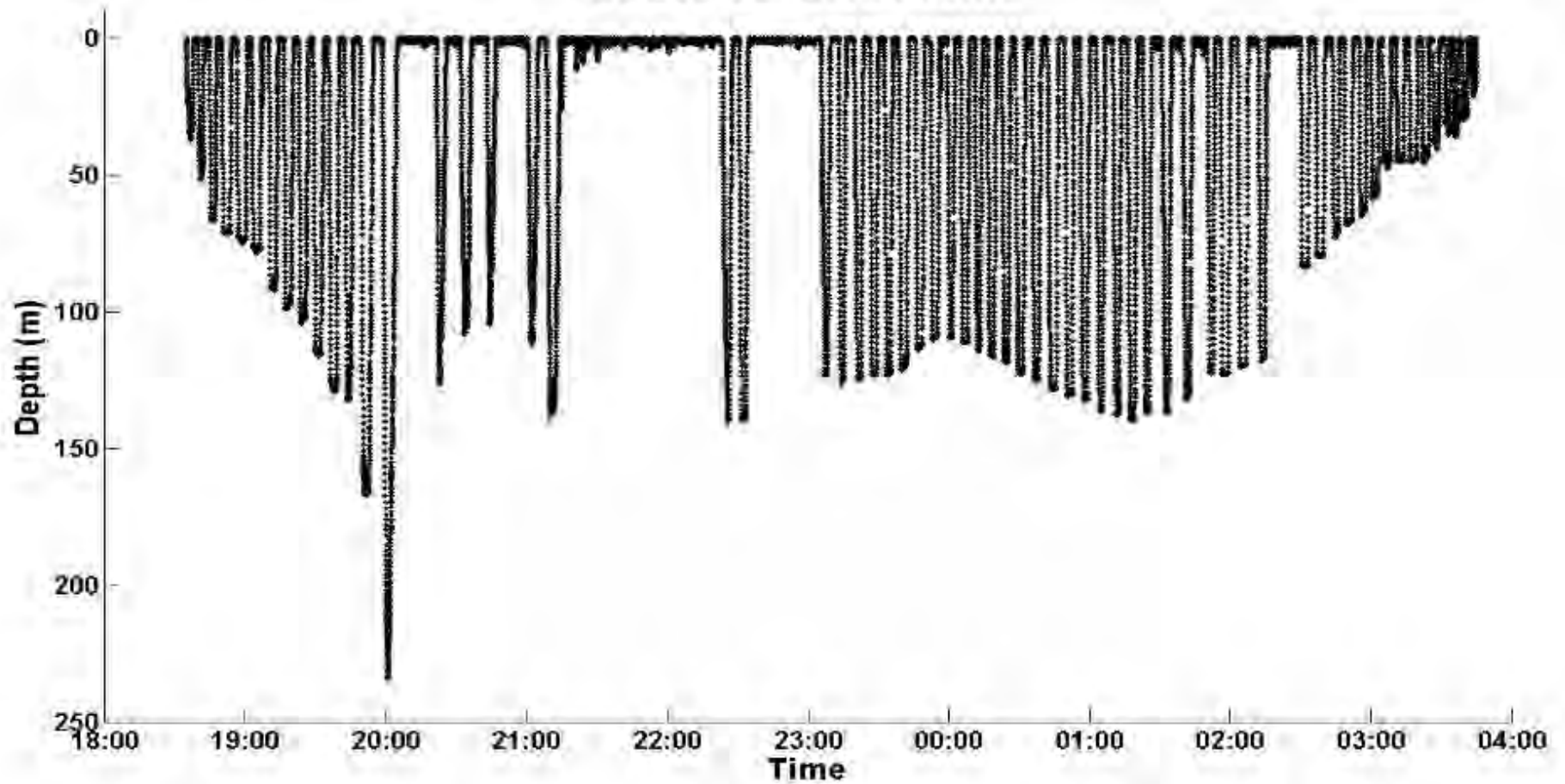






# Example of Time-Depth Record

SSL08-05: Dive Profile



# Clip 1: Bottom Foraging (Depth: 60-70m, Time: 18:45)

## Clip 2: Bottom Foraging (Depth: 130m, Time: 19:37)



## Clip 3: Bottom Foraging (Depth: 120m, Time: 01:00)

## Clip 4: Backlight Feeding (Depth: 125m, Time: 19:45)



# Atka Mackerel

*Pleurogrammus monopterygius*

- Display diurnal vertical migration<sup>1</sup>
  - Active vertical movement away from “settling depth” (near 100 m) during daylight hours
  - Returned to “settling depth” in late afternoon
- Vertical migration may increase susceptibility to SSL predation during daylight hours<sup>1</sup>



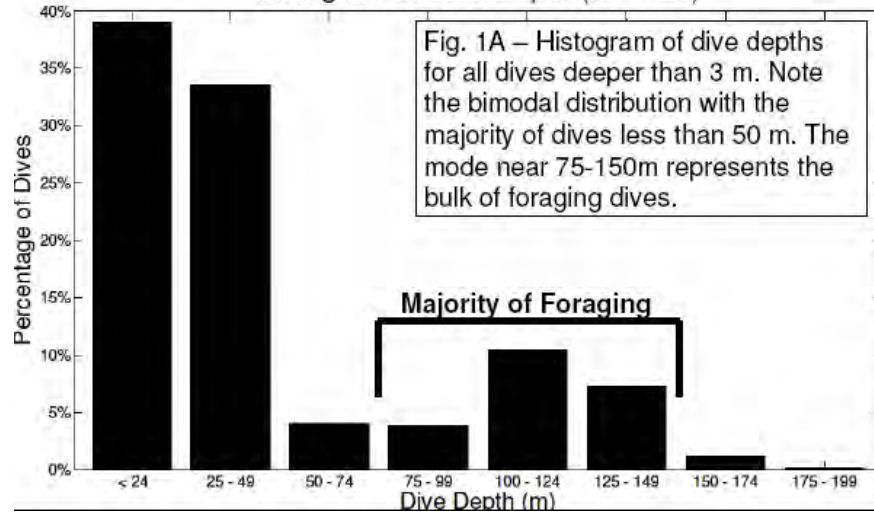
<sup>1</sup>Nichol and Somerton, 2002;  
Mar Ecol Prog Ser 239: 193–207

- SSL exploit Atka mackerel behavior
- Prey detection primarily by vision
- Vibrissae critical in low light

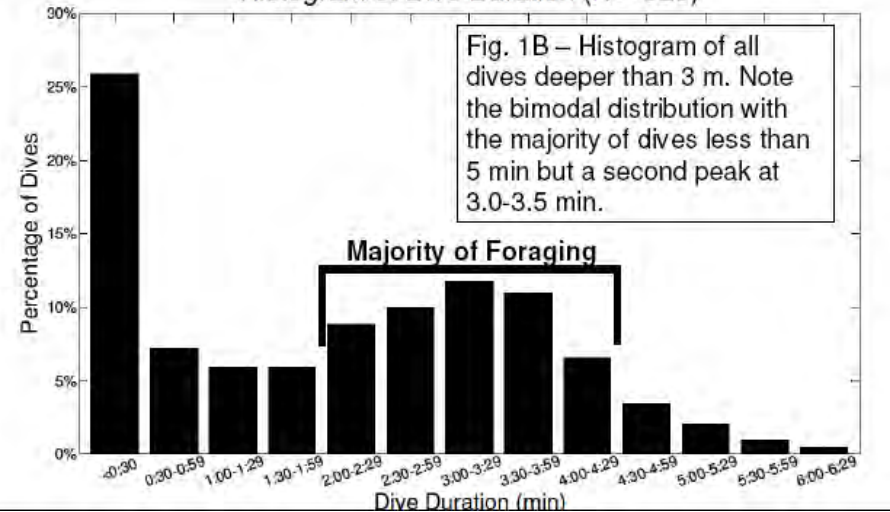


# Results – Dive Characteristics

Histogram of Dive Depth (N = 928)



Histogram of Dive Duration (N = 928)

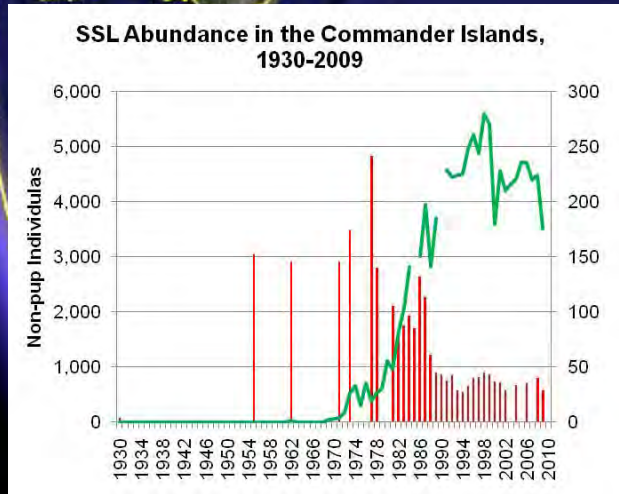
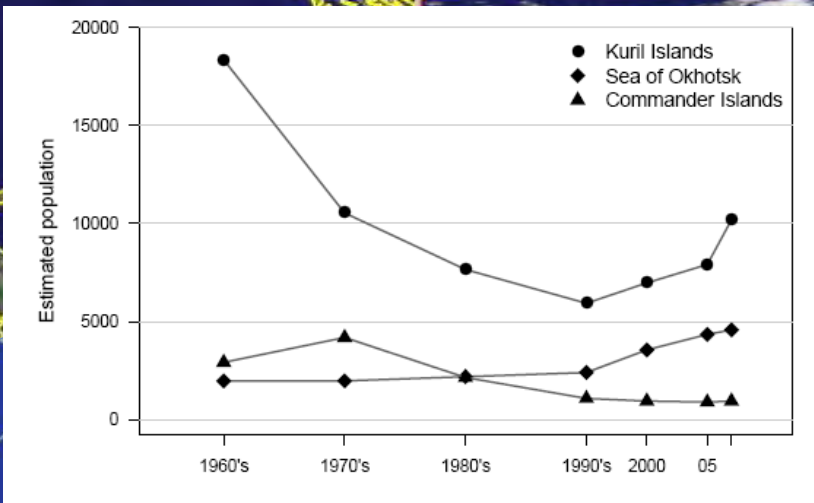
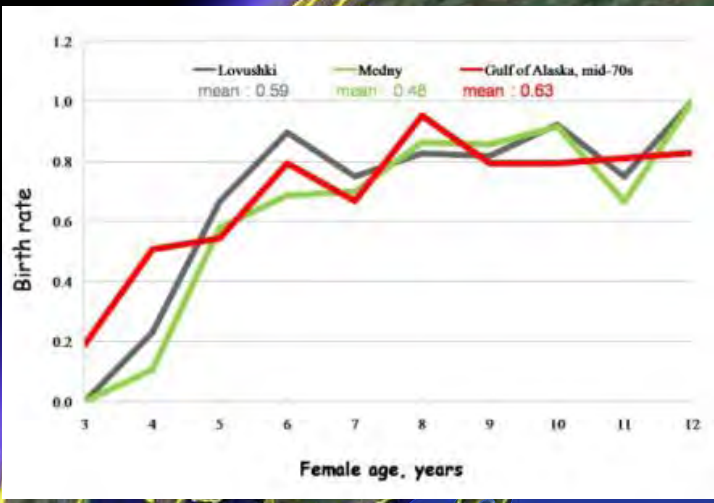


## Preliminary analysis of foraging success

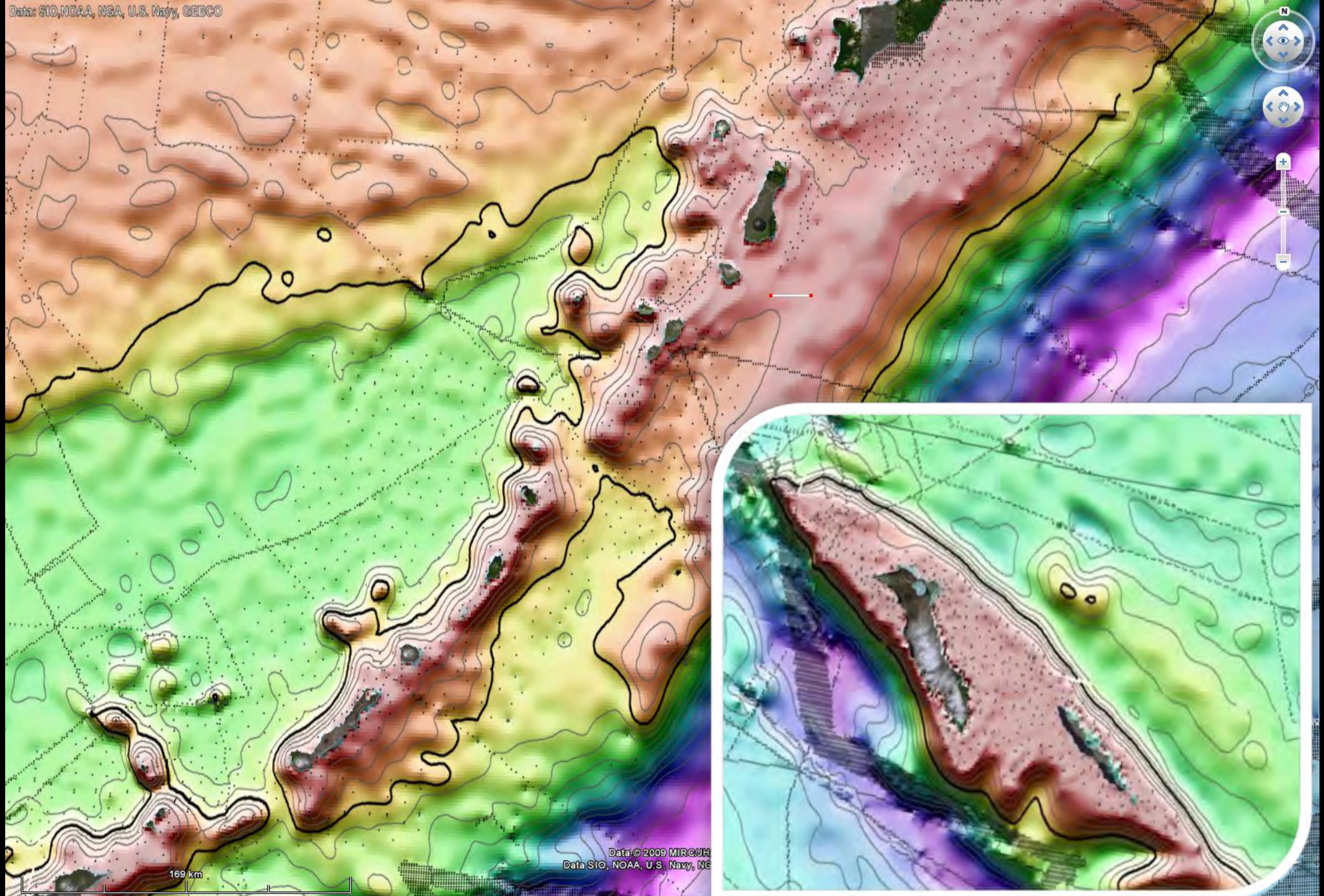
Animal ID	Hr of Video	Ingestions	Ingestions per min. of video
SSL08-1	1.75	7	.07
SSL08-2	4.1	49	.2
SSL08-5	1.4	10	.12
SSL09-1	10.76	69	.11
SSL09-3	9.12	121	.22



Google





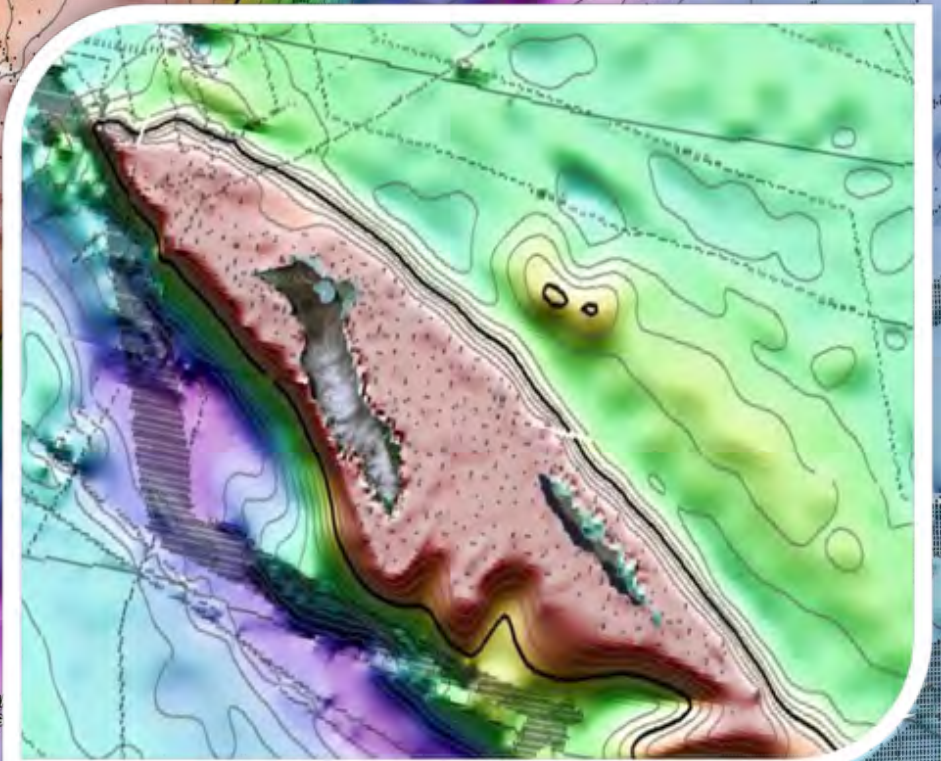


169 km

Data © 2009 MIRC/JH  
Data SIO, NOAA, U.S. Navy, NGS

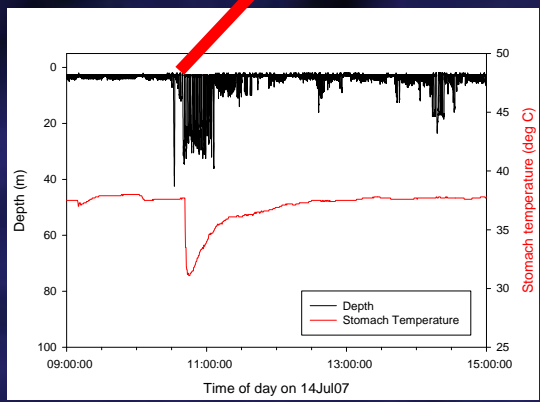
lat 48.291279° lon 154.108679° elev -1552 m

Eye at 570.35 km

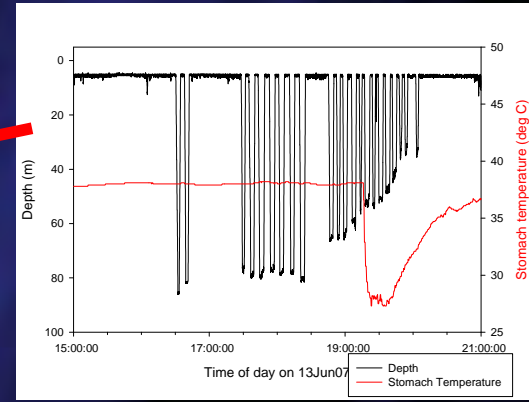




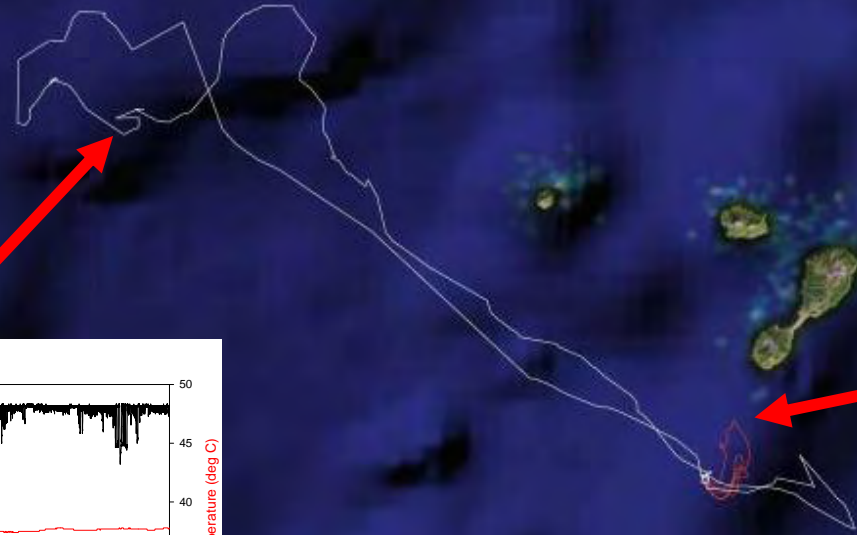
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lat: 48.5547081, lon: 152.8207221, elev: 1502 m

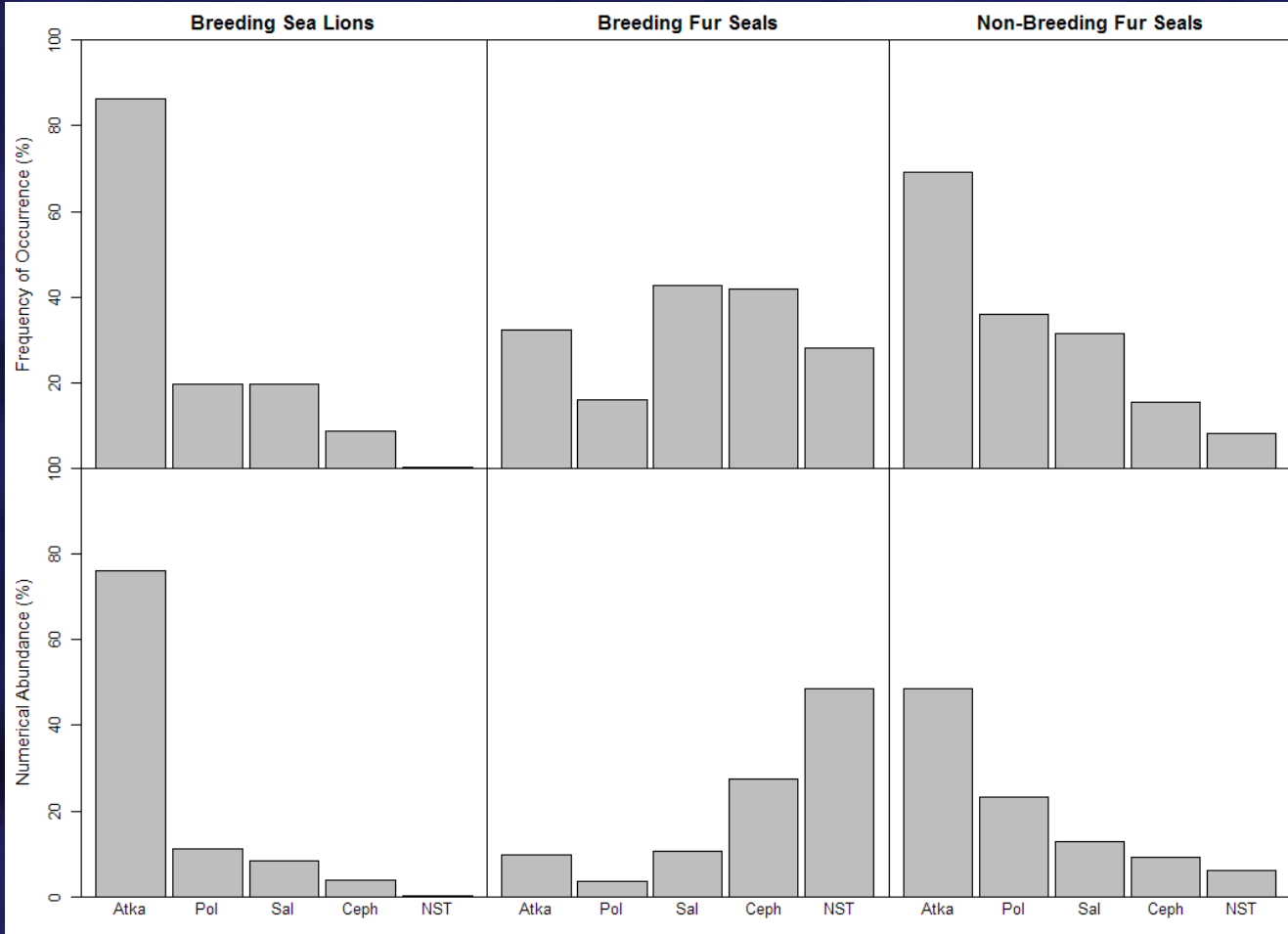


Northern fur seal



Steller sea lion





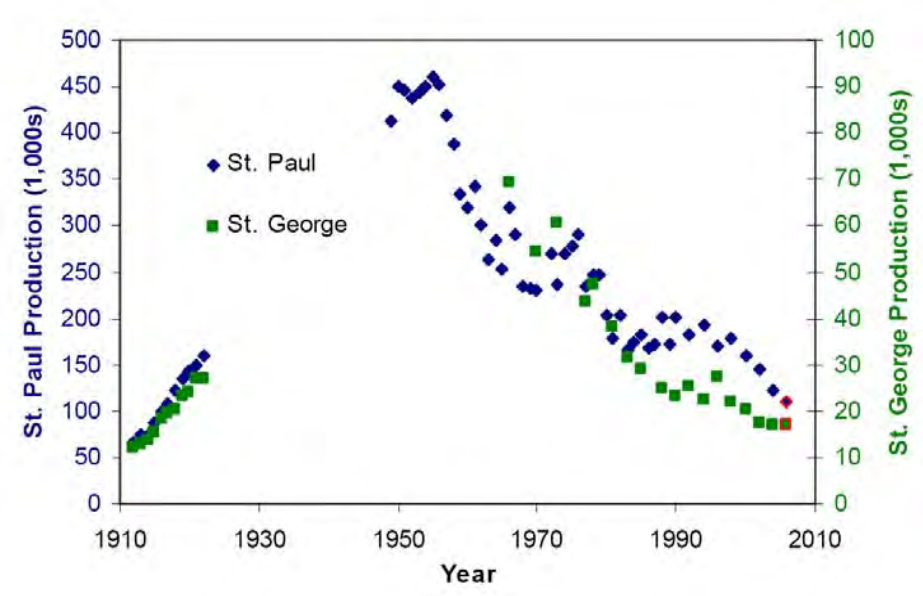
Squid - *Berryteuthis magister*



Northern smooth tongue







## Pribilof Islands: St. Paul & St. George

Towell, R. T., R.R. Ream, & A.E. York. 2006.  
*Marine Mammal Science* 22:486  
 National Marine Mammal Lab data

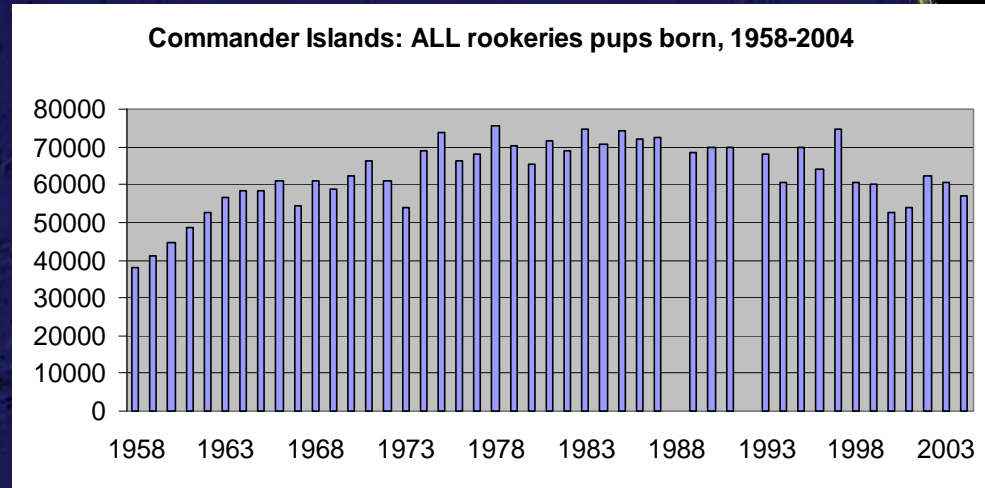
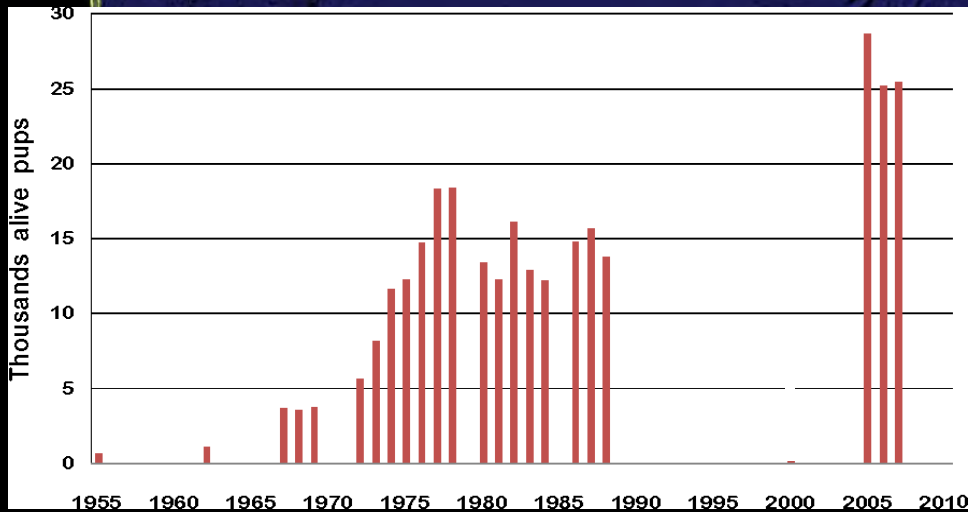


Image NASA  
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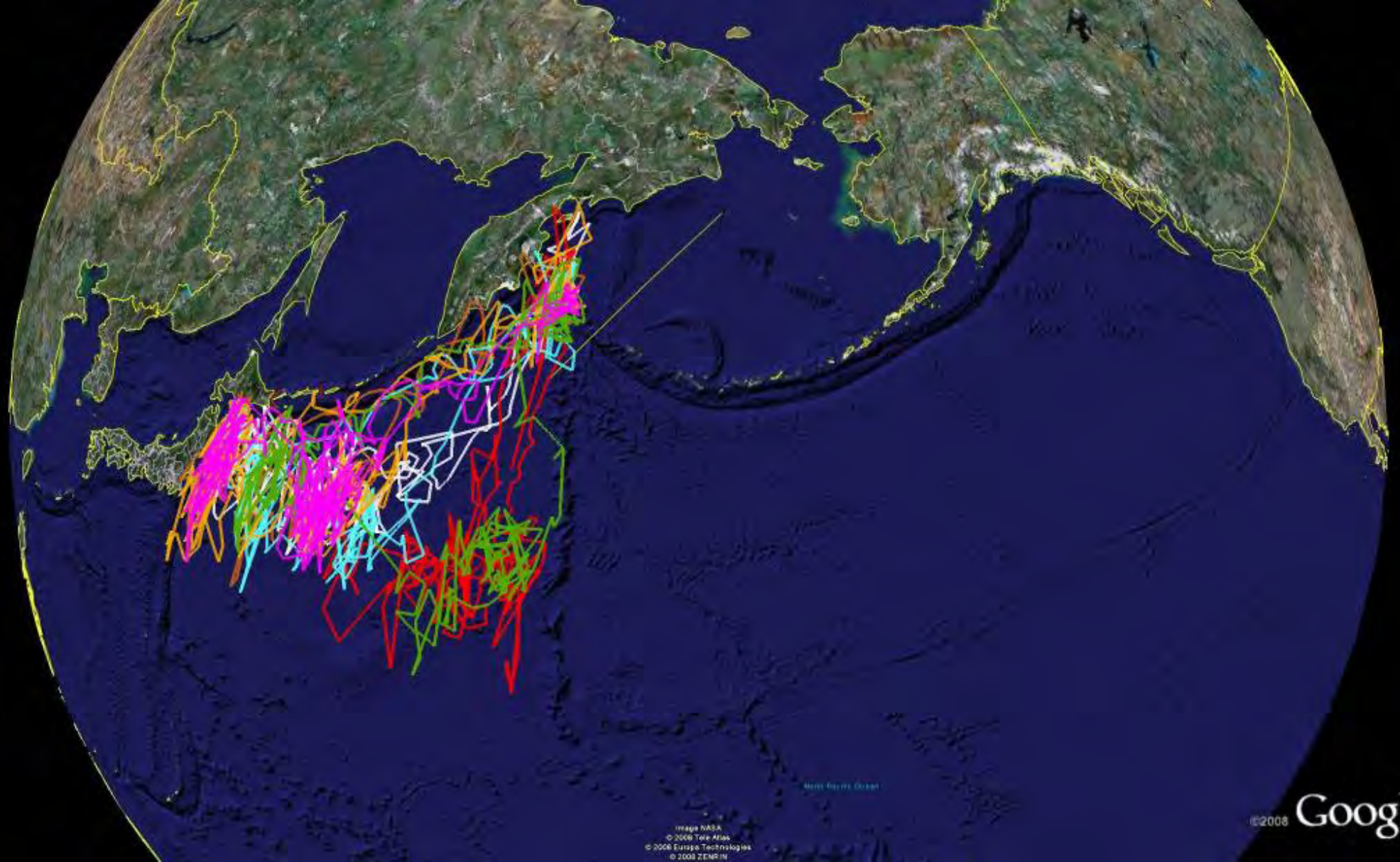
Blokhin & Burkanov (2007)

Burkanov, Andrews, Altukhov, Calkins, Gurarie, Permykov, Waite (2007)









Belonovich, Burkanov, Staniland, Davis & Andrews. 2009.

Use of BAS geolocation tags to study northern fur seal winter migrations

Poster presentation at 18<sup>th</sup> Biennial Conference on the Biology of Marine Mammals, Quebec, Canada

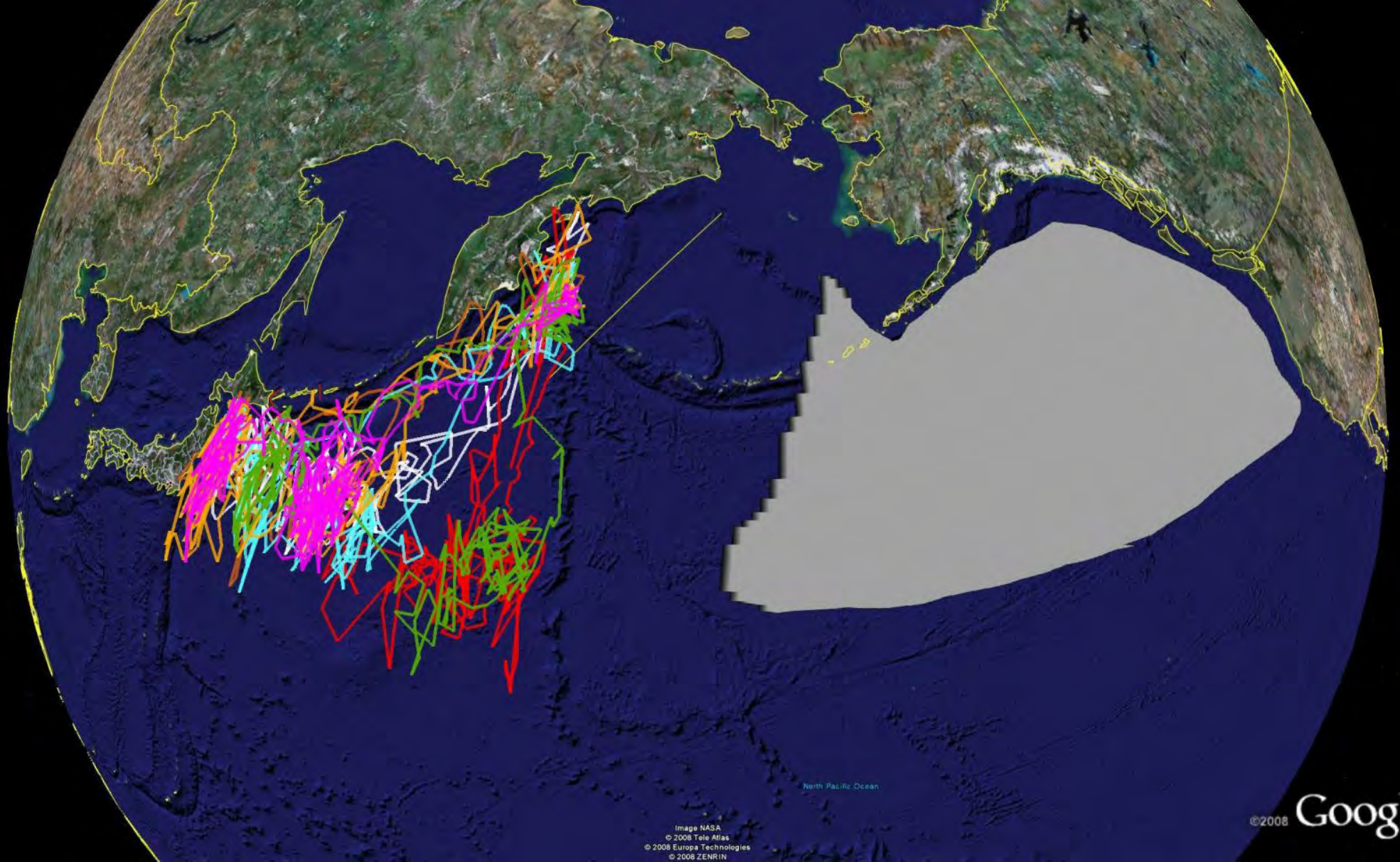


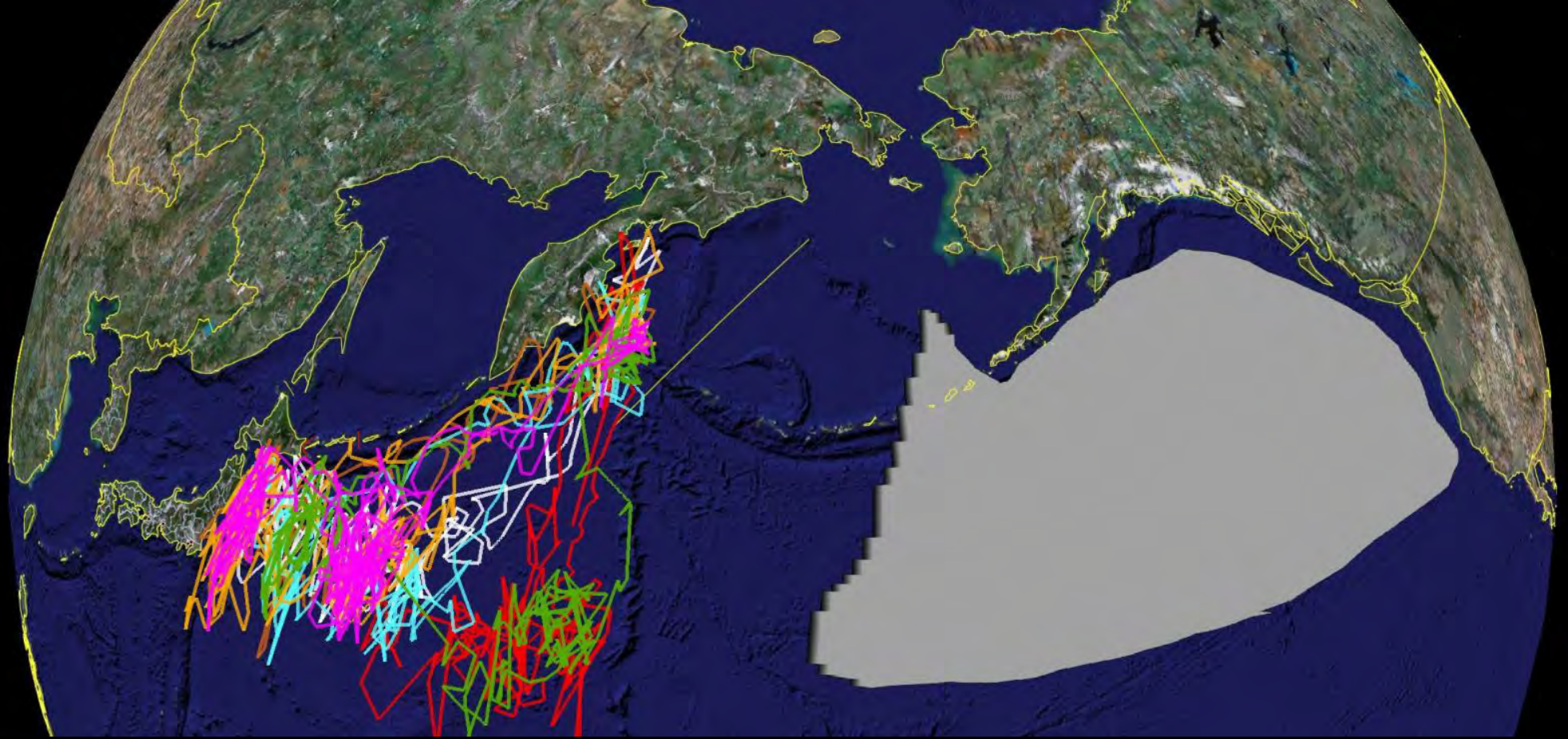
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Lee, Burkanov, Andrews & Davis. 2009.  
Oral presentation at 18<sup>th</sup> Biennial Conference on the  
Biology of Marine Mammals, Quebec, Canada

Lea, Johnson, Ream, Sterling, Melin & Gelatt. 2009.  
Extreme weather events influence dispersal of naive northern fur seals  
Biol. Lett. 5:252-257



- Habitat overlap:
  - Adult females: almost none
  - Juveniles: limited
- → Environmental factor, e.g. prey availability, may explain differences in population trends

## Collaborators on far eastern Russian SSL & NFS studies:

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Sarah Norberg, John Skinner, Shannon Atkinson - Alaska SeaLife Center

Yoko Mitani - Tokyo Institute of Technology, Tokyo, Japan

Eli Gurarie - Dept. of Quantitative Ecology and Resource Management, University of Washington

Randy Davis, Olivia Lee, Olga Belonovich and Paul Olivier - Marine Biology, Texas A & M University

Iain Staniland - British Antarctic Survey

## also thanks to:

Altukhov A.V., Belobrov R.V., Burkanova V.A., Gaidukov V.I., Kim A. S., Kutrukhin N.N., Mamaev E.G., Pasenyuk D.S., Permyakov P.A., Purtov S.Y., Ryazanov S. D., Savenko O.V., Sergeev S.N., Shulezhko T.S., Solovyev, B., Sychenko A.A., Tarasyan K.K., Tret'yakov A.V., Zhivotyagin V. N. V. Aderholt, B. Smith, D. Holley, other staff at Alaska Sealife Center and the Oleg Lyamin and Utrish Dolphinarium staff  
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