Use of BAS geolocation tags to study northern fur seal *(Callorhinus ursinus)* winter migrations

Belonovich, Olga[1]; Andrews, Russel D[2]; Burkanov, Vladimir N[3, 4]; Davis, Randall W[1]; Staniland, Iain J[5]

(1) Dept. of Wildlife and Fisheries Science, Texas A&M University, College Station, TX, 77843, USA; (2) School of Fisheries and Ocean Sciences, University of Alaska Fairbanks and the Alaska SeaLife Center Seward, Alaska, 99664, USA; (3) Kamchatka Branch of the Pacific Institute of Geography, Petropavlovsk-Kamchatsky, 683000, Russia; (4) National Marine Mammal Laboratory, NMFS, NOAA, Seattle, WA, 98115, USA; (5) British Antarctic Survey, Cambridge, CB3 0ET, UK ; Corresponding author: aizberg@gmail.com

Fig. 1. Northern fur seal adult female with geolocator flipper tag

Introduction

Northern fur seal (NFS) (Fig. 1) pup production on the Pribilof Islands (USA) is declining at an annual rate of 6% whereas the Commander Islands (Russia) population remains stable (Ream and Burkanov, 2005; Blokhin et al., 2007). One hypothesized reason for the different population dynamics could be a disparity in winter feeding conditions

Objectives

- To assess the winter foraging grounds of NFS females from Bering Island BAS Geolocation tags (GLS)
- To assess the use of GLS in the study of fur seal movements

BAS Geolocation tags

Light level geolocation (mass < 4 g) is the calculation of position (2x per day) from light level readings with reference to time.
Estimate position: latitude from day/night length, and longitude from the absolute time of local midday/midnight. Error SD is typically no better than 185 115 km (Fox, 2007)

Methods

Geolocation tags (GLS) tags were attached to 12 adult females on 1 November 2007 on Severno-Zapadnoe rookery (Bering Island, Commander Islands) just before they departed on their annual winter migration.
Six of these females were also instrumented with location-only satellite tags (SPOT-5; Wildlife Computers). Seven females were recaptured during July 2008; 2 females were recaptured during July 2009. Five recaptured seals provided concurrent satellite tracking data. Satellite tag positions were filtered based on speed and turning angles using the Douglas filter. GLS light level data was converted to position estimates using BASTrak, TransEdit, and BirdTracker software, and then a speed filter was applied. Satellite tag position error was estimated to be an order of magnitude less than for the GLS tags, so daily GLS positions were compared to the best daily satellite tag position to calculate an average GLS error of 238 132 km. MATLAB programs were used to correct the GLS position data: Daily position estimates were determined from the satellite tag tracks and the GLS data loggers and GLS positions were corrected using the robust regression (Fig. 2).

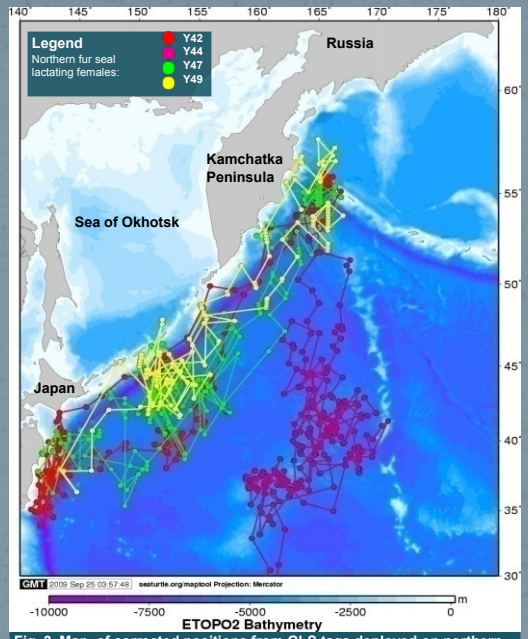
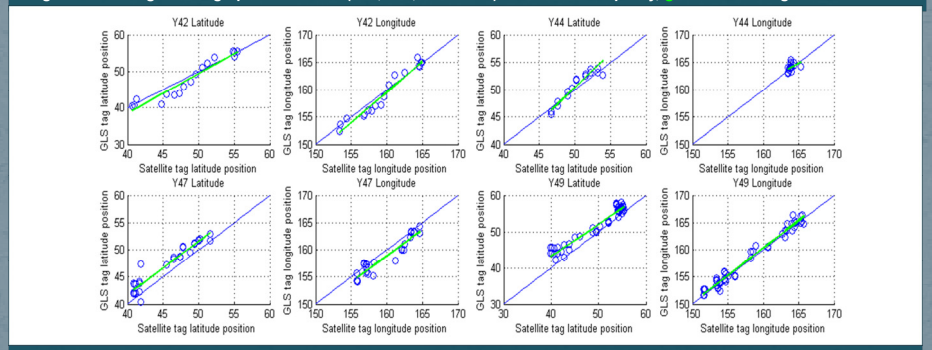


Fig. 3. Map of corrected positions from GLS tags deployed on northern fur seal s during their winter migrations (November 2007 – July 2008)

Fig. 2. Robust regression graphs for 4 seals (Y42, Y44, Y47 & Y49). Blue: line of equality, green: robust regression line

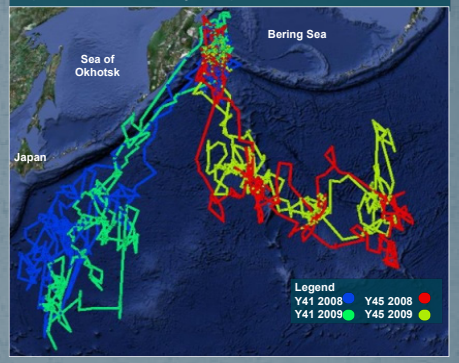


Robust regression was used to limit the effect of outliers in the derivation of correction factors for GLS tag latitude and longitude estimates.

Results and Discussion

- Robust regression smoothing technique effectively reduced the mean error for GLS positions from 238 132km to 94 77 km.
- Most of the seals migrated to the southwest of Bering Island, exploiting both shelf break and oceanic waters. The maximum straight line distance was 2,741 437 km from Severo-Zapadnoe rookery (Fig. 3).
- The two females tracked over 2 different winters followed a very similar path in each year (Fig. 4).
- GLS loggers can provide acceptable location data that is useful in the analysis of large scale pinniped migration patterns.

Fig. 4. Map of corrected positions from GLS tags from 2 northern fur seals tracked over nearly 2 years (November 2007 – July 2009)



References:
1. Ream, R. & Burkanov, V. 2005. Trends in abundance of Steller sea lions and northern fur seals across the North Pacific Ocean, PICES XIV Annual Meeting, Vladivostock, Russia
2. Blokhin, I., Burkanov, V., & Calkins, D. 2007. Overview of abundance and trends of northern fur seal (*Callorhinus ursinus*) in Commander Islands, 1958-2006, caveats and conclusions. 17th Biennial Conference on the Biology of Marine Mammals. Cape Town, South Africa.
3. Fox, J. Geolocator manual version 6, British Antarctic Survey, 2007

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