Background

For northern fur seals, understanding the impacts of changes in prey availability is critical because the U.S. population has been declining since the mid-1950s (Towell et al. 2012).

The largest colony of northern fur seals in the U.S. breed on the Pribilof Islands (Alaska) (Fig. 1). Between June and November, female seals are dependent on local prey, primarily walleye pollock, to raise offspring.

In this system, as with many far-ranging marine predators, temporal or spatial mismatches exist between prey surveys and predator tracking periods. This discrepancy makes it difficult to assess relationships between seal behavior and prey distribution and abundance.

Objective:

Investigate how relationships between northern fur seal behavior and prey abundance change with increasing temporal disparity between predator tracking periods and prey surveys.

Methods

- Pollock distribution and abundance were measured during the NOAA Fisheries annual groundfish assessment survey from May to July 2006 (Fig. 3).
- Trawl surveys were conducted in the center of 20 x 20 nm grids, with higher density surveying occurring around the Pribilof Islands (Fig. 1).
- Pollock biomass (weight catch per unit effort [WTCUE, kg/grid]) and density (number catch per unit effort [NCUE, fish/grid]) were determined for each trawl survey grid.
- Analysis of pollock abundance distributions did not vary significantly between July and Oct, which is consistent with assumptions used for pollock stock assessment analyses.

Fur Seals

- Adult female fur seals (N = 18) were equipped with a satellite tracking transmitter and dive recorder to measure foraging behavior from July to October 2006 (23).
- Using dive and movement variables previously suggested as metrics for foraging success, we examined relationships between fur seal behavior and prey abundance using linear mixed models.
- Summary dive and movement metrics (Table 1) were determined for each survey grid at 3 temporal scales: within 2 weeks of the prey survey (1 mo), and within 2 weeks of the survey (2 wk).

Results

Pollock Distribution and Abundance:

- Pollock were captured at 98% of the stations with WTCUE ranging from 0.01 to 106.1 kg/grid and NCUE ranging from 0 to 1396.6 fish/grid (Lauth and Acuna, 2007).
- The highest densities were measured south of St. Paul Island and in the northwest region near the shelf break.

Fur Seal Behavior:

- Fur seals foraged throughout the Bering Sea shelf and basin during 152 recorded foraging trips (Fig. 2).
- During the full reproductive season, 23,576 hours were spent in 160 unique survey grids where 139,444 dives occurred.

Relationships Between Fur Seal Behavior and Prey (Table 1):

- For seal behavior was related to pollock abundance at all temporal scales.
- Time in grid measures (hours and hours/area) were only significant at the longest temporal scale, however, it was a negative relationship with respect to pollock abundance.
- Multiple dive behaviors were positively related to abundance at the shorter temporal scales (2 wk and 1 mo).
- Even when significant, relationships changed with variation in temporal disparity (Fig. 3).

Conclusions

- Multiple significant relationships were found between northern fur seal behavior and prey abundance, even with the limited sample size at the shortest temporal resolution (2 weeks).
- The dive behavior associated with areas of abundant pollock (e.g. increased vertical distance traveled and longer duration dives) is consistent with previously reported metrics of foraging success (e.g., Austin et al. 2006, Skinner et al. 2014).
- Our results suggest that a prey survey conducted within one month of tracking may still provide the information necessary to identify key foraging areas.
- Investigating northern fur seal behaviors associated with prey encounter and potential foraging success is particularly valuable for developing management and conservation strategies as the population continues to decline.

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References