Spatio-temporal distribution of male bearded seals in the Chukchi Sea using underwater vocalizations

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ABSTRACT
The Chukchi Sea Environmental Studies Program (CSESP; www.chukchiscience.com), sponsored by Statoil, ConocoPhillips, and Shell, includes passive acoustic monitoring that has operated almost continuously since summer 2006. Bearded seal (Erignathus barbatus) is a highly vocal ice seal that is widely distributed in the high north. Due to the implementation of the CSESP, and monitoring during seismic acquisition in 2007, scientists developed strategies to study these seals. In this study, underwater vocalizations of male bearded seals were analyzed from July 2007 to October 2011. Bearded seals were identified by their trills, ascents, and moans. To determine the seasonal variation in the occurrence of male bearded seal vocalizations in a one-year cycle, call counts were determined by analyzing 20-min recordings between 2:00 and 6:00 a.m., every third day. Bearded seal vocalizations increased progressively from August to March, peaked between April and June, and were essentially absent in July.

INTRODUCTION
Bearded seals (Erignathus barbatus), the largest of the northern phocids, are distributed throughout the Arctic. Females give birth in mid-April to mid-May (Burns, 1981). Mating takes place throughout the end of lactation and males are in breeding condition from April to early July (Burns, 1981; Cleator, 1996; Van Parijs et al., 2001). Male bearded seals either hold small aquatic territories or roam over larger areas while displaying (Van Parijs et al., 2003). Males advertise their breeding condition by producing long underwater trills (e.g. Cleator et al., 1989) and use vocal and dive displays throughout the breeding season (Van Parijs et al., 2001).

MATERIAL AND METHODS

Data collection
Deployment in the northeastern Chukchi Sea each year from 2007 to 2012

Figure 1. Maps showing the summer (a) and winter (b) deployments

- 2007 summer deployment – 10 AURALs
- 2009 to 2011 summer deployments – up to 44 AMARs
- Winter deployments - 5-8 AURALs
- 20% duty cycle in 2007–2008
- 17% duty cycle in the other years
- Data were recorded continuously

Data analysis
Bearded seal vocalizations were detected and classified manually by one trained analyst following two methods:

- 20-min recordings between 2:00 am and 6:00 am every 3 days (to examine call counts vs ice; 3% of all data)
- 10-min recordings on a 17-20% duty cycle every 10 days (to examine daily cycle, duration of vocalizations and the proportion of each vocal type; 2.5% of all data)

RESULTS

- Bearded seal detections increased progressively from December to March, peaked between April and June (matting period) and were essentially absent in July.
- Decreased ice cover in May–June resulted in higher males displaying.

DISCUSSION

Bearded seals were present at all sampled stations. Peak in calling occurred in the spring, coinciding with mating period. Fewest vocalizations were detected in summer and vocalizations increased with the formation of pack ice in the winter. A similar seasonal pattern was observed for both years, but call counts were lower in 2008-2009. Frequency of occurrence of vocalizations varied following a daily cycle (diurnal pattern continued throughout winter even though there was no real night-day cycle). Males advertise their breeding condition by producing longer underwater trills (notably [AL2(T)] and trills with ascent/plume [AL1(T)])

REFERENCES