

Hemoglobin, Packed Cell Volume, and Dive Characteristics from Ribbon and Spotted Seals

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Introduction

Hemoglobin (Hb) and packed cell volume (PCV) are indicators of oxygen storage and transport capacity in the blood. They are higher in marine mammals than in terrestrial mammals, allowing marine mammals to make deep dives and stay submerged while foraging.

Body oxygen stores are an important physiological parameter that influence the diving abilities of marine mammals; species that dive deepest or longest generally have the largest oxygen stores (Burns 1999). Oxygen storage capacity of blood can be estimated using Hb concentration and PCV.

Existing data on these hematology values are scarce for ribbon and spotted seals, and detailed dive behavior of these seals is also limited.

Additional knowledge about blood oxygen capacity and how it relates to diving ability in ribbon and spotted seals can provide information about their accessibility to foraging areas and prey species; information which could be valuable in assessing how ice-associated seals may be affected by a changing environment.

Methods

In the spring of 2009 and 2010, we captured ribbon and spotted seals in the marginal sea-ice of the Bering Sea.

We collected blood samples from 51 ribbon and 45 spotted seals and attached satellite-linked dive recorder tags (SDRs) to animals that had molted enough to glue the tag securely to the head or back. We tagged 24 ribbon and 14 spotted seals.

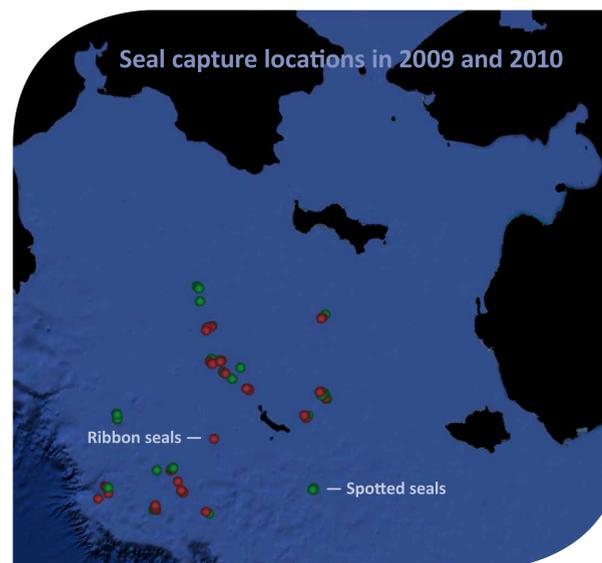
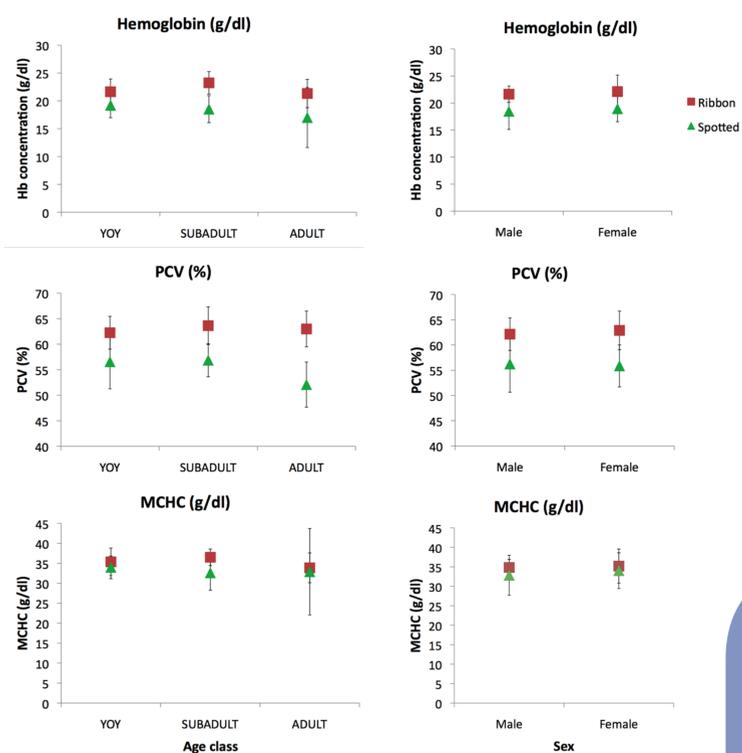
We measured hemoglobin using the cyanmethemoglobin method (Pointe Scientific, Inc.) and determined PCV by centrifugation.

The SDRs record dive behavior and information related to maximum dive depths and dive durations. Due to the bandwidth limitations of the ARGOS system, these data are binned and summarized into 6-hour periods.



Hematology results

Hemoglobin concentration, packed cell volume, and MCHC for ribbon and spotted seals in 2009 and 2010, compared among age classes and between sexes



Results and Discussion

Ribbon seals have higher Hb concentrations and PCVs than spotted seals for all age classes and both sexes; ribbon seals generally make longer and deeper dives than spotted seals.

The majority of spotted seal dives were less than 200 meters and most dive durations were less than eight minutes.

Ribbon seal dives were distributed over a wider range of depths than spotted seal dives, and some dives exceeded 600 meters. The majority of ribbon seal dives were 8-16 minutes in duration.

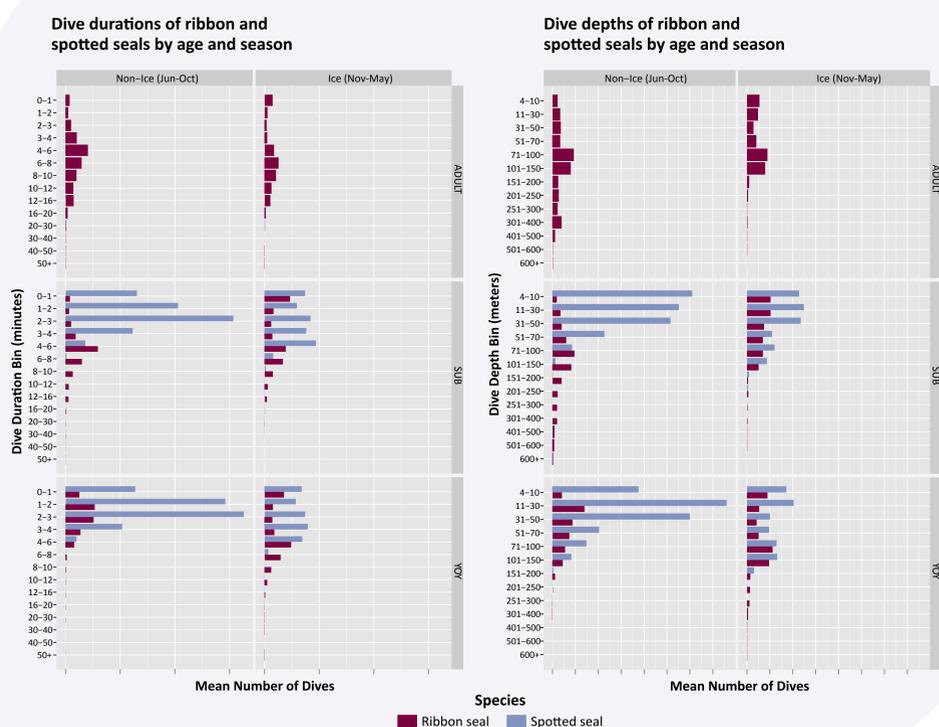
Differences in diving ability and hematology values have also been observed between hooded and harp seals. Hooded seals have higher Hb levels and PCVs and dive deeper and for a longer duration than harp seals (Boily et al. 2006, Folkow and Blix 1999, Folkow et al. 2004).

We collected blood samples from three bearded seals in 2009, and analyzed them for Hb and PCV. These data were presented in 2010 and showed much higher Hb values in the three bearded seals than in the ribbon or spotted seals sampled. This was an unexpected result given the similarity in bearded and spotted seal dive depths. Further analysis may indicate that bearded seals are capable of longer duration dives, and thus explain the higher Hb levels. We will continue efforts in 2011 to capture, collect blood samples, and deploy tags on adult bearded seals.

Our plans for future work include determining the water content of plasma and whole blood to assess whether dehydration may have affected blood values, and examining scats collected from ribbon and spotted seals to begin to relate these seals' foraging behavior and diet to their diving abilities.



Diving data results



Number of individuals captured in 2009 and 2010 for which hemoglobin concentration and packed cell volume were measured, by species, age class, and sex

AGE CLASS	Ribbon seal		Spotted seal		Total # sampled	
	HB	PCV	HB	PCV	HB	PCV
Young of the year	18	18	26	26	44	44
Subadult	12	12	13	13	25	25
Adult	21	21	6	6	27	27
SEX						
Male	25	25	22	22	47	47
Female	26	26	23	23	49	49
Total # sampled	51	51	45	45	96	96

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