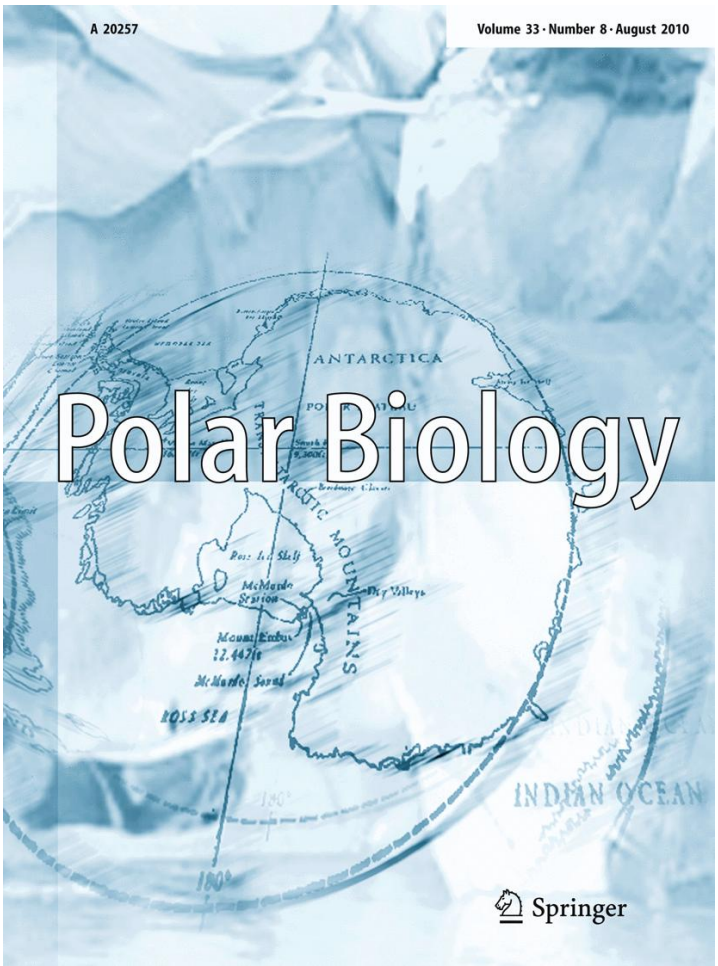
ISSN 0722-4060, Volume 33, Number 8



Polar Biol (2010) 33:1145–1147
DOI 10.1007/s00300-010-0790-3

SHORT NOTE

Social–sexual behavior seasonality in captive beluga whales (*Delphinapterus leucas*)

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Received: 19 October 2009 / Revised: 21 February 2010 / Accepted: 22 February 2010 / Published online: 13 March 2010

Abstract Observation of wild beluga whales (*Delphinapterus leucas*) indicates that this species breeds seasonally, and hormonal assays of captive animals show corresponding fluctuations in reproductive hormones. The question remains, however, whether copulatory behavior itself occurs seasonally. As an index of copulatory behavior, data are reported here on the frequency with which pelvic thrusting occurs over the calendar year. Male-on-female thrusting did vary significantly across months, with a clear peak in activity in March. On the other hand, male-on-male pelvic thrusting did not differ significantly across months. Possible functional roles are suggested for this latter enigmatic behavior.

Keywords Social–sexual behavior · Cetacean · Seasonal breeding

Introduction

In the wild, beluga whales characteristically inhabit shallow waters along the Arctic ice edge. They are characteristically migratory in nature, moving northward in spring and summer months as the polar ice retreats and southward in fall and winter as it expands (Kleinenberg et al. 1969). During much of the year, observers report seeing socially segregated groups, with pods of adult females and associated juveniles separate from pods primarily consisting of adult males (Kleinenberg et al. 1969). It is primarily only in the spring time that adult males have been observed intermixing with the female groups and this has been widely presumed to be the mating period (Sergeant 1973; Brodie 1971; Kleinenberg et al. 1969), although actual copulation is rarely if ever directly observed in the wild.

Robeck et al. (2005) reported evidence of a similar seasonality in the fluctuations of reproductive hormones in captive Beluga Whales held at a number of North American seaquariums. Both testosterone in males and progesterone peaks (consequent to presumed luteal phases) in females were elevated in late winter/early spring, peaking in March.

Nevertheless, copulatory behavior itself has yet to be investigated in a systematic fashion in this species. The question remains whether copulatory behavior in this species is similarly seasonal and whether it is tightly bound to the mid-March hormonal peaks. In order to address this question, we report here on the frequency of occurrence of pelvic thrusting in a socially mixed captive population of belugas held at Marineland of Canada.

Methods

The subjects in this investigation were fifteen Beluga Whales (*Delphinapterus leucas*) held in a 5.2 M liter pool at Marineland of Canada (Niagara Falls, Ontario). The population consisted of five adult males and seven adult females that had been wild caught in the Chukchi Sea 3–6 years earlier as well as two male and one female juveniles that had been born in captivity at Marineland. All of the whales could be readily identified based upon patterns of scars and/or body shape. The water temperature in the pool was held at 10°C throughout the year.

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The social interactions among the whales were observed on two mornings per week (45 min per morning) over an 11-month period (January–November). For the purpose of the present study, every instance of pelvic thrusting was logged ad libitum, with the identity of both the thruster and the thrustee noted whenever possible. A pelvic thrust was defined as any instance in which one whale approached another, rolled ventrally toward the other, and pushed its genital region in such a way as to make contact with the other whale, regardless of whether an erection was present. In order to assess inter-rater reliability, two observers independently logged data from the same pool on 29% of the observation days.

On occasion, individual animals were temporarily shifted out of the study pool for husbandry reasons. Because of this and to allow for comparability across days, a Thrust Index was calculated for each gender combination on each day as the adult sex ratio times the number of thrusts divided by the number of adults of that sex, divided by the time of observation on that day. For example, when considering male-on-female pelvic thrusting, the formula for each day was (the number of adult males present/the number of adult females present) X (number of male-on-female pelvic thrusts/number of adult males present)/number of observation minutes.

Table 1 The presence or absence of erection during male-on-male pelvic thrusts in the beluga whale

	Male thrustee erection present (%)	Male thrustee erection absent (%)
Male thruster erection present	6.0	58.1
Male thruster erection absent	1.9	33.9

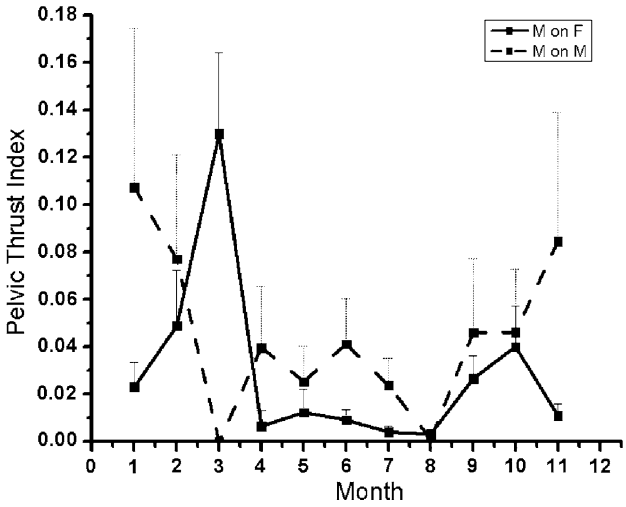

Fig. 1 Male pelvic thrusting in captive beluga whales as a function of month and sex of recipient (see text for explanation of Pelvic Thrust Index)

Results and discussion

Over the total 46.4 h of observation, 1,458 discrete pelvic thrust events were recorded, 910 (62.4%) of which involved an adult male thrusting on another identifiable adult. Most of the other 37.6% involved juveniles, or instances in which the whale identities were indeterminate. Only 20 instances involved adult female-on-female, and only three instances involved adult female-on-male. Of the 910 known adult male thrusts, 59.7% were confirmed to be male-on-male, 40.3% were confirmed to be male-on-female. For the 13.5 h that two observers overlapped, the concordance in recording thrusts by identifiable whales was $r = 0.87$, $P < .001$.

An erection was present on 59.2% of the occasions in which an adult male thrust on an adult female. An intromission was observed in less than 1% of such occasions. Table 1 presents the rate with which erections occurred during male-on-male pelvic thrusts as a function of thruster and thrustee erections. In general, the thruster had an erection approximately two-thirds of the time. The thrustee had an erection approximately 8% of the time.

Figure 1 plots the Thrust Index as a function of calendar month for both male-on-female and male-on-male. Overall, an ANOVA showed month to be significant for male-on-female ($F(10,53) = 3.30$, $P = .002$). There was a clear peak in this behavior in March, and a post hoc analysis (Tukey) showed (a) that month 3 was significantly different from every other month except month 2 and (b) that the rate of male-on-female thrusting did not differ significantly among any of the other months. For male-on-male thrusting, the effect of month was not significant ($F(10,53) = 0.61$, ns).

Our findings clearly indicate seasonality with regards to male-on-female pelvic thrusting in this species. At our facility, the peak of that activity clearly occurs in March. This observation coincides nicely with Heide-Jørgensen and Teilmann (1994), who reported that male–female associations in the wild also peak around March. Sergeant (1973) reported a somewhat later spring-time peak (April–May) for a different wild population. Bel'kovich (1960) speculated that the timing of breeding in this species may correlate with latitude, in that reproductive activity in more northerly populations may be delayed to coincide with the later breakup of ice.

To date, we have recorded 18 beluga births at Marineland of Canada. The dates of these births have ranged from June 23 to August 1, with the median date being July 7. If mid-March (i.e., Mar 15) is taken as the median conception date at our facility, the July 7 median birth date implies a gestation period of approximately 479 days. This conforms

nicely to the multi-institution study conducted by Robeck et al. (2005) in which gestation was estimated at 475 days for animals in which conception was inferred from progesterone levels and for which parturition dates were known. It also comes close to the 435 days estimate made for a wild population by Brodie (1971) who compared the time when males and females associate with the time that calves are first observed.

One of the most striking findings stemming from this report is the overall quantity of social–sexual activity displayed by this species. On average, pelvic thrusts occurred at a rate of 32 per hour among the 15 belugas observed in the present study. It is possible that the frequency of this behavior was influenced by the conditions of captivity. However, frequent social–sexual activity of this type has also been recorded for other cetacean species, including the bottlenose dolphin (McBride and Kritzler 1951; Connor et al. 2000).

That male-on-female thrusting frequently occurs, and that it peaks seasonally in March, may not by itself be surprising. Presumably, it simply reflects reproductive activity in this species. On the other hand, the frequent occurrence of male-on-male pelvic thrusting needs to be explained. Considering the adult males alone, male-on-male pelvic thrusts occurred 2.7 times per hour per animal.

The sheer preponderance of this behavior, in terms of the striking frequency with which it occurs, and the amount of energy and effort that appears to be devoted to it certainly implies a functional role for it in beluga society. It is possible that male-on-male thrusting serves as a form of practice sex that ultimately helps to prepare males for male-on-female contact when it becomes available. Alternatively, it is possible that this contact plays a role secondary to sex specifically. In baboons and macaques, male-on-male mounting is thought to play a role in the establishment of dominance (Hausfater 1975). On the other hand, in bonobos, social–sexual contact among non-reproducing individuals is hypothesized to promote social bonding and affiliation (Manson et al. 1997). Both possible functions have also been proposed for male-on-male social–sexual contact in the spinner dolphin (Silva et al. 2005). It is certainly possible that such functions may be served in the beluga whale as well.

It is unfortunate that observational data from the month of December was not possible in the present study. Upon visual inspection of the data in Fig. 1, it appears that the frequency of M-M pelvic thrusting increased somewhat in the months of November and January, albeit not significantly. Whether M-M thrusting similarly rises in December is a question which will have to be addressed at a later time.

In any event, it was our impression that the male-on-male pelvic thrusts were widespread and usually reciprocal. It will be important in future investigations on this topic to assess whether the amount or direction of such contacts correlates with indices of social status and/or affiliation so that possible roles for this somewhat enigmatic behavior can be appraised.

Acknowledgments Anthony Dell'Anno made valuable contributions at an early stage of this project. We are grateful for the hospitality and support of Marineland of Canada.

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