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Author(s): Morisaka, Tadamichi; Sakai, Mai; Kogi, Kazunobu; Nakasuji, Akane; Sakakibara, Kasumi; Kasanuki, Yuria; Yoshioka, Motoi

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Spontaneous Ejaculation in a Wild Indo-Pacific Bottlenose Dolphin (Tursiops aduncus)

Tadamichi Morisaka1,*, Mai Sakai1,2, Kazunobu Kogi3, Akane Nakasuji1, Kasumi Sakakibara4, Yuria Kasanuki5, Motoi Yoshioka5

1 Wildlife Research Center of Kyoto University, Kyoto, Japan, 2 Japan Society for the Promotion of Science, Tokyo, Japan, 3 Mikura Island Tourist Information Center, Tokyo, Japan, 4 Graduate School of Agriculture, Tokyo University of Agriculture and Technology, Tokyo, Japan, 5 Graduate School of Bioresources, Mie University, Mie, Japan

Abstract

Spontaneous ejaculation, which is defined as the release of seminal fluids without apparent sexual stimulation, has been documented in boreoeutherian mammals. Here we report spontaneous ejaculation in a wild Indo-Pacific bottlenose dolphin (Tursiops aduncus), and present a video of this rare behavior. This is the first report of spontaneous ejaculation by an aquatic mammal, and the first video of this behavior in animals to be published in a scientific journal.

Introduction

Spontaneous ejaculation, which is defined as the release of seminal fluids in the absence of apparent sexual stimulation, has been reported in several male land mammals, including Rodentia (rats [1], hamsters [2], guinea pigs [3], mice [4]), Cetartiodactyla (mountain sheep, warthogs [reviewed in [5]], tsessebes [6]), Carnivora (domestic cats [7], spotted hyenas [reviewed in [5]]), Perissodactyla (horses [8]), and Primates (chimpanzees [9], [reviewed in [10]], humans [reviewed in [11]]). Spontaneous ejaculation could possibly be widespread in various animals, including humans, but has passed unrecognized because it is an unpredictable and rare behavior that lasts only a few seconds, making it difficult to observe.

The function of spontaneous ejaculation is unknown. Three (not mutually exclusive) possible ‘functions’ of animal spontaneous ejaculation have been discussed in previous publications: (1) a type of ‘masturbation’ as a sexual outlet and/or for the removal of surplus (or abnormal) spermatozoa [5,10,12–16]; (2) an element of sexual display [6]; (3) no clear function, or misuse of inhibitory neural control system during drowsiness and sleep [8,11,17–20].

Here, we report spontaneous ejaculation in a wild Indo-Pacific bottlenose dolphin (Tursiops aduncus), and present an accompanying video. This is the first report of spontaneous ejaculation in an aquatic mammal, and the first video of spontaneous ejaculation in animals to be published in a scientific journal.

The Indo-Pacific bottlenose dolphin is a small odontocete that reaches 2.7 m in length and 230 kg in weight, and appears in coastal waters from around South Africa, through the Indian Ocean, to southeast Asia and Australia [21]. Sexual maturity in male Indo-Pacific bottlenose dolphins occurs at approximately 7–8 years [reviewed in [22]]. Around Mikura Island, the breeding season was estimated to be between April and October with a peak in July and August [23]. The dolphins live in fission-fusion societies, which are characterized by sex-segregation and frequent changes in group membership [24]. Male bottlenose dolphins engage in much higher rates of socio-sexual behavior than wild, ‘hypersexual’ bonobos [25]. Despite many observations of socio-sexual behavior in both sexes in this species, a successful copulation or intromission has never been observed in Shark Bay, the oldest study site for this species, which was implemented in 1988 [25]. Ejaculation and actual copulation are difficult to observe even in captive dolphins [26,27] (but see [28]). Masturbation, such as rubbing genitals on tank objects or the floor, is frequently observed in several odontocetes, including the bottlenose dolphin, spinner dolphin, killer whale, baiji, and boto [26–31], but never accompanied by ejaculation. At Mikura Island, we had also frequently observed masturbation and socio-sexual behaviors, but not associated ejaculation (Morisaka, Sakai, Kogi, personal communications).

Materials and Methods

Study sites and subjects

The video was taken underwater at about 10 m depth off Mikura Island, Japan, on July 2, 2012. Indo-Pacific bottlenose dolphins around Mikura Island have almost all been identified using natural marks on the body by underwater video-identification research since 1994 (see detail in [23,32]). Four researchers and a few other sightseers were involved in a dolphin-swimming program observed dolphins underwater, and one researcher observed dolphin behavior on the boat at the time. It was a cloudy day without rain, and the water temperature was approximately 25°C.
Data recording

Video recording was made with an HDR-XR550V (Sony, Japan) with an attached wide conversion lens in an underwater housing system (NTF Corp., Japan). Video codec was AVCHD of 1920 pixels in width and 1080 pixels in height with 30 frames/s. When we spotted dolphins from the boat (about 7 m length), we slowly approached the group with the boat and placed the video system underwater. We did not use scuba diving equipment, but only fins, snorkels, and masks. We did not aggressively follow dolphins and finished our observations when they went away. We recorded the time, estimated number of dolphins in the group, and both were swimming by inertia. The left eye of 266 nor #557 was moving their peduncle flukes gently downward 1 s before spontaneous ejaculation. The eye opened at 3.2 s (96 frames at (1/30 s)/frame) before spontaneous ejaculation. Spontaneous ejaculation lasted 0.43 s (13 frames at (1/30 s)/frame) with the contraction of the peduncle muscle downward and dense seminal fluid being ejaculated from the tip of the penis (Figure 1A and Video S1). The dolphin stretched his peduncle muscle upward and a few seconds later the remaining seminal fluid was ejaculated, lasting 0.73 s (22 frames at (1/30 s)/frame) (Figure 1B and Video S1). After ejaculation, the dolphin gently swam away.

Behavioral and group states

We counted 37 dolphins in this group (including #266) both from the boat and underwater during the 7-min observation. Twenty-nine out of the 37 dolphins were identified and consisted of 7 mother and calf pairs (including 3 neonates), 6 males, and 9 females without a calf. The group state was “resting”, as dolphins swam slowly and quietly in the same direction with few breaths, but with a relatively widespread “carpet formation”. Sexual behavior, and sociosexual behavior were not observed. No male dolphin except #266 showed his penis. There were no audible “pop” sounds, which are directed by male dolphins toward females during consortship [35], heard during the observation period. Most females and calves were in the front, with several males following, and #266 and #557 were at the rear of the group.

Discussion

This is the first report of spontaneous ejaculation in an aquatic mammal. Spontaneous ejaculation has previously been reported in

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**Figure 1. Spontaneous ejaculation by a wild Indo-Pacific bottlenose dolphin off Mikura Island, Japan.** (A) Dense seminal fluid was ejaculated from the tip of the penis with initial contraction of the peduncle muscle downward. (B) A few seconds after the first ejaculation of seminal fluid, the remaining seminal fluid was ejaculated for 0.86 s (26 frames at (1/30 s)/frame).

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**Ethics statement**

This fieldwork did not involve capture or handling of animals, therefore did not require approval of animal care and use procedures. The study did not involve endangered or protected species. This study was carried out in accordance with the recommendations of the Guidelines to Study Wild Animals of the Wildlife Research Center of Kyoto University and with the voluntary regulatory rule for sustainable dolphin-swimming program made by the dolphin-swimming program operator association in Mikura Island. Mikura Island belongs to Fuji-Hakone-Izu National Park. Permission for entering protected sea area in Mikura Island was given by Mikurajima village under permit #01093. This was a collaborative work with Mikura Island Tourist Information Center.
boreoeutherian mammals. As Beach [10] suggested, spontaneous ejaculation, including in human males, may have an ubiquitous physiological function considering the phylogenetically widespread nature of this phenomenon.

Spontaneous ejaculation in dolphins seems to be a very rare event, similar to other mammals except Rodentia; none of the researchers involved in dolphin research in Mikura Island had previously observed this behavior during our vast number of observational experiences, either in the wild or in various aquariums, and there are no published reports of this phenomenon. No spontaneous ejaculation was found in the previous 13,062 min of video data collected from 1994 to 2012 for the ID studies at Mikura Island.

Group behavioral state was resting, and we observed the closed left eye of #266, an indication of unihemispheric (or bilateral) sleep (reviewed in [36]), just before spontaneous ejaculation. On the basis of these observations, we assume that #266 was in a "drowsy state" when he spontaneously ejaculated. The spontaneous ejaculation in dolphins reported here thus could have "no clear function or misuse of inhibitory neural control system during drowsiness and sleep," which is categorized as (3) in Introduction. Spontaneous ejaculations in various animals, including rats, guinea pigs, domestic cats, warthogs, horses, chimpanzees, and humans occur when drowsy or asleep [3,5,7–9,11,18,37]. Although Kinsey et al. [38] explained nocturnal emission in human males as "psychic stimulation during sleep," some equally ubiquitous physiological function should exist given the phylogenetically widespread nature of nocturnal emission or spontaneous ejaculation [10]. During such states, the central nervous system (especially the inhibitory control region for the ejaculation) may be partially relaxed [11,17,18,20].

No dolphin, including #266, showed any masturbation activity such as genital rubbing on objects which has been reported in various dolphin species [26–31]. Furthermore, no sexual or socio-sexual behavior was observed, and no dolphin showed his penis during the observation period in spite of it being the high breeding season. Therefore, the spontaneous ejaculation reported here did not directly relate to masturbation or sexual or socio-sexual activity. As no females were within eyesight around #266, and #577 was in front of #266 when the spontaneous ejaculation occurred, the spontaneous ejaculation reported here also could not have functioned as a sexual display.

No research has been conducted to reveal the mechanism of ejaculation in dolphins. If the mechanism is similar to other animals such as rats, the neural control of ejaculation in dolphins might be located at the spinal level and controlled by the androgen- and gastrin-releasing peptide system [39–41]. During drowsiness, this neural control system would be partially relaxed, and spontaneous ejaculation could occasionally occur in dolphins. Although we did not verify that the fluid we observed was actually an ejaculate, there is little possibility that the fluid was other substance such as urine or purulent matter when taking into account the white color, thickness, and pulsive emission of the fluid with a fully erect penis.

Reports of spontaneous ejaculation from various animals are needed to understand this phenomenon, including in human males, and to reveal its evolutionary function. It is difficult to observe spontaneous ejaculation, which only lasts a few seconds in animals; however, collecting such information is important for an understanding the animal basis of spontaneous ejaculation, or "wet dreams" in human males.

Supporting Information

Video S1 Spontaneous ejaculation by a wild Indo-Pacific bottlenose dolphin (Tursiops aduncus) off Mikura Island. (MP4)

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Author Contributions

Conceived and designed the experiments: TM. Performed the experiments: TM MS KK AN KS YK. Analyzed the data: TM. Contributed reagents/materials/analysis tools: TM MS KK YK. Wrote the paper: TM.

References

1. Orbach J [1961] Spontaneous ejaculation in rat. Science 134: 1072–1073.
2. Beach FA, Eaton G (1969) Androgenic control of spontaneous seminal emission in hamsters. Physiology & Behavior 4: 155–156.
3. Martan J [1968] Factors affecting spontaneous ejaculation of male guinea-pigs. J Reprod Fertil 17: 161–163.
4. Huber MHR, Bronson FH (1980) Social modulation of spontaneous ejaculation in the mouse. Behavioral and Neural Biology 29: 390–393.
5. Bagemihl B (1999) Biological Exuberance: Animal Homosexuality and Natural Diversity. New York: St. Martin's Press. 749 p.
6. Joubert SC [1975] The mating behaviour of the tsessebe (Damaliscus lunatus lunatus) in the Kruger National Park. Z Tierpsychol 37: 182–191.
7. Aronson LR (1949) Behavior resembling spontaneous emissions in the domestic cat. Journal of comparative and physiological psychology 42: 226.
8. Mcdonald SM (1990) Spontaneous erection and masturbation in equids. Proceedings of the Thirty-Fifth Annual Convention of the American Association of Equine Practitioners: 567–580.
9. Risce A [1971] Nissen's observations on the development of sexual behavior in captive-born, nursery-reared chimpanzees. The chimpanzee 4: 1–18.
10. Beach FA [1975] Variables affecting "spontaneous" seminal emission in rats. Physiology & Behavior 15: 91–95.
11. Beach FA, Westbrook WH, Clements LG [1966] Comparisons of the ejaculatory response in man and animals. Psychosomatic Medicine 28: 749–763.
12. Levin RJ [1975] Masturbation and nocturnal emissions—possible mechanisms for minimizing teratozoospermia and hyperpermia in man. Med Hypotheses 1: 130–131.
13. Agno A [1976] The number of spermatozoa in spontaneous ejaculates of rats. J Reprod Fertil 48: 405–407.
14. Kihlstro¨m JE [1966] Diurnal variation in the spontaneous ejaculations of the male albino rat. Nature 209: 513–514.
15. van Du H, Larson K [1970] Spontaneous seminal discharge and preceding sexual activity. Physiol Behav 5: 1161–1163.
16. Martan J [1966] Occurrence of the intact spermatozoa in spontaneous ejaculations of isolated male guinea pigs. Transactions of the Illinois State Academy of Science 59: 78–80.
17. Beach FA [1967] Cerebral and hormonal control of reflexive mechanisms involved in copulatory behavior. Physiol Rev 47: 289–316.
18. Stefanick ML [1983] The circadian patterns of spontaneous seminal emission, sexual activity and penile reflexes in the rat. Physiol Behav 31: 737–743.
19. Carro-Juárez M, Rodríguez-Manzo G [2008] The spiral pattern generator for ejaculation. Brain Res Rev 58: 106–120.
20. Kuhr CS, Heiman J, Cardenas D, Bradley W, Berger RE [1995] Premature emission after spinal cord injury. J Urol 153: 429–431.
21. Jefferson TA, Webster MA, Pitman RL [2008] Marine Mammals of the World. A Comprehensive Guide to their Identification. London: Academic Press. 573 p.

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PLOS ONE | www.plosone.org 3 August 2013 | Volume 8 | Issue 8 | e72879
22. Yuen QW, Brook FM, Kiioshita RE, Ying MT (2009) Semen collection and ejaculate characteristics in the Indo-Pacific bottlenose dolphin (Tursiops aduncus). J Androl 30: 432–439.

23. Kogi K, Hishii T, Imamura A, Iwatani T, Dudzinski KM (2004) Demographic parameters of Indo-Pacific bottlenose dolphins (Tursiops aduncus) around Mikura island, Japan. Marine Mammal Science 20: 510–526.

24. Connor RC, Wells RS, Mann J, Read AJ (2000) The bottlenose dolphin: social relationships in a fission-fusion society. In: Mann J, Connor RC, Tyack PL, Whitehead H, editors. Cetacean societies: Field studies of dolphins and whales. Chicago: The University of Chicago Press. pp. 91–126.

25. Mann J (2006) Establishing trust: socio-sexual behaviour and the development of male-male bonds among Indian Ocean bottlenose dolphins. In: Sommer V, Vasey PL, editors. Homosexual Behaviour in Animals: An Evolutionary Perspective. Cambridge: Cambridge University Press. pp. 107–130.

26. Mcbride AF, Hebb DO (1948) Behavior of the captive bottle-nose dolphin, Tursiops truncatus. Journal of Comparative and Physiological Psychology 41: 111–123.

27. Mcbride AF, Krizler H (1951) Observations on pregnancy, parturition, and postnatal behavior in the bottlenose dolphin. Journal of Mammalogy 32: 251–266.

28. Harrison RJ, Ridgway SH (1971) Gonadal activity in some bottlenose dolphins (Tursiops truncatus). Journal of Zoology 165: 355–38.

29. Defran RH, Pryor K (1980) The behavior and training of cetaceans in captivity. In: Herman LM, editor. Cetacean behavior: mechanisms and functions. New York: Wiley. pp. 319–362.

30. Chen D, Wang K, Gong W, Wang D, Liu R (2001) Cycles of sexual masturbation behavior of a male baiji, "Qi Qi", in captivity. Acta Hydrobiologica Sinica 25: 467–473.

31. Chen D, Zhao Q, Wang K, Zhang X, Wei Z, et al. (2002) Relationships between sexual masturbation behavior and serum testosterone levels of a captive male baiji. Acta Zoologica Sinica 48: 611–617.

32. Sakai M, Morisaka T, Kogi K, Hishii T, Kohshima S (2010) Fine-scale analysis of synchronous breathing in wild Indo-Pacific bottlenose dolphins (Tursiops aduncus). Behavioural Processes 83: 48–53.

33. Kogi K (2001) Effects of dolphin watching program on the behavior of bottlenose dolphins at Mikura island (Master). Tse Mie University. 79 p.

34. Norris KS, Wursig B, Wells RS, Wursig M, Brownlee SM (1994) The Hawaiian Spinner Dolphin: University of California Press.

35. Connor RC, Smolker RA (1996) ‘Pop’ goes the dolphin: A vocalization male bottlenose dolphins produce during consortships. Behaviour 133: 643–662.

36. Lyamin OI, Manger PR, Ridgway SH, Mukhametov LM, Siegel JM (2008) Cetacean sleep: an unusual form of mammalian sleep. Neurosci Biobehav Rev 32: 1451–1458.

37. Orbach J, Miller M, Billimoria A, Sohalka N (1967) Spontaneous seminal ejaculation and genital grooming in rats. Brain Res 5: 520–523.

38. Kimsey AC, Pomeroy WR, Martin CE (1948) Sexual Behavior in the Human Male. Philadelphia: W. B. Saunders. 804 p.

39. Sakamoto H, Takanami K, Zuloaga DG, Matsuda K, Jordan CL, et al. (2009) Androgen regulates the sexually dimorphic gastrin-releasing peptide system in the lumbar spinal cord that mediates male sexual function. Endocrinology 150: 3672–3679.

40. Sakamoto H, Matsuda K, Zuloaga DG, Nishiura N, Takanami K, et al. (2009) Stress affects a gastrin-releasing peptide system in the spinal cord that mediates sexual function: implications for psychogenic erectile dysfunction. PLoS One 4: e4276.

41. Sakamoto H, Matsuda K, Zuloaga DG, Honga H, Wada E, et al. (2008) Sexually dimorphic gastrin releasing peptide system in the spinal cord controls male reproductive functions. Nat Neurosci 11: 634–636.