RESPONSES OF POLAR BEARS TO HUMAN MENSTRUAL ODORS

BRUCE S. CUSHING,[1] Wildlife Biology Program, University of Montana, Missoula, MT 59812

Abstract: Laboratory and field tests were conducted at Churchill, Manitoba, in 1978 and 1979 to determine whether human menstrual odors attract polar bears (*Ursus maritimus*). The polar bear was chosen because the odor of its primary prey, seals, could be used as a standard attractant against which the relative attractiveness of other scents could be measured. When 4 captive bears were presented with a series of different odors, a strong behavioral response was elicited only by seal scents and menstrual odors (used tampons). When these materials were arrayed in a location frequented by free-ranging bears, the bears detected and consumed, the food scent samples and used tampons, but ignored the non-food scents and human blood. The primary method of detection was by scent with a minority of the samples being detected visually or by other means. The lack of response to the other scents, combined with the fact that in the laboratory and field the bears' responses to seal scents demonstrated that menstrual odors attract polar bears. Comparing bear responses to human blood and menstrual blood indicates that it is not the blood that is acting as the attractant, but some property peculiar to the menstrual products.

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The possibility that human menstrual odors might attract bears has been debated for years. This issue came dramatically to light in 1967 when 2 women campers were killed by grizzly bears (*Ursus arctos*) in Glacier National Park, and menstruation was suggested as the cause of the attacks (Glacier National Park, unpubl. rep., U.S. Dep. Inter., Natl. Park Serv., 1967). Credibility has been leant to this theory by the National Park Service and U.S. Forest Service, which jointly distribute a brochure entitled *Grizzly, Grizzly, Grizzly* advising women to stay out of bear country when menstruating. Craighead (1976:206) cites several individuals who firmly believe that menstrual odors could in no way lead to conflicts. Despite the debates on this subject, there is no empirical evidence to support either contention. With the increasing use of bear habitat by humans it has become imperative to determine whether or not menstrual odors attract bears.

Conflicts with ursids have been attributed mainly to black (*U. americanus*) and grizzly bears. However, certain groups of Inuit prohibit their women from gathering berries when menstruating, in the belief that the women are in danger of attack from polar bears (*U. maritimus*) (I. Mysterud and I. Silis, pers. commun.). Despite the fact that much of the concern centers on bears other than polar bears, these arctic bears offer a unique opportunity for investigation because they feed almost exclusively on seals. Polar bears utilize sight, scent, and possibly sound to locate seals or their lairs (Stirling 1973, 1974; Smith and Stirling 1975; Stirling and Latour 1978). Seals can be considered as a true source of attraction for polar bears. The other bears do not have such a single prey or source of attraction. The responses of the polar bears to the odors from their major circumpolar prey, the ringed seal (*Phoca hispida*) (Stirling and McEwan 1975), can be established and used as a standard for comparing the relative attractiveness of other stimuli.

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METHODS AND MATERIALS

This study consisted of a laboratory and field study, and was conducted during 1978 and 1979. Free-ranging bears were captured from the Cape Churchill vicinity and brought to the Churchill

[1] Present address: Department of Zoology, Michigan State University, East Lansing, Michigan 48824.

Bear Laboratory, located in Churchill, Manitoba. Four bears were studied at the laboratory. Bear 1, a 5.5-year-old female weighing 204 kg; Bear 2, a 12.5-year-old female weighing 272 kg; Bear 3, a 5.5-year-old male weighing 236 kg; and Bear 4, a 2.5-year-old female weighing 152 kg. Bears 1 and 2 were used in 1978, while 3 and 4 were studied in 1979. The bears were housed, separately and at different times, in a 3.7 × 3.7 × 1.4 m cage inside a room equipped with an observation booth. Two fan boxes opened into the room, approximately 1.2 m from the cage.

Six days after capture, baseline behavioral observations of the bear were taken for a 5-day period. These observations totalled 40 hr and were taken in 4–10 hr blocks. The bear's behaviors were recorded for a 1-minute period every 10 min. The baseline observations provided a comparison with test data. On test days, baseline observations were recorded for 0.5 hr before and after the test. Just prior to the test, an olfactory stimulus was placed in 1 of the fan boxes. When the baseline observations were completed the fan was turned on for a period of 20 min, allowing permeation of the odor. During the test period, the bear's behavior was recorded for 10 s at the start of each minute. Several tests were conducted using women instead of olfactory stimulus (scents) in these cases the procedure was the same, except the woman entered the room and sat passively facing the cage for the 20 min test.

Controls and test materials (complete list Table 1) were selected at random and presented to the bears at various times. Any one stimulus was presented only once to a bear, excepted when two different used tampons were tested or different women, and there was only one test per day. Blood samples were obtained from the same women that contributed used tampons. The bears' response to seal scent was considered to be the strongest and their responses to other stimuli were compared to the responses to seal.

The field work was conducted at Klein Tower, near Gordon Point, located 18 km east of the laboratory. Tests were conducted during October and November 1979. Four days of preliminary study were conducted in 1978 to determine proper methodology for the following year. In 1979, 42 stakes, 35.5–45.5 cm high, were placed around the tower. They were located form 50 to over 402 m away form the tower, and were arranged such that no 2 stakes were closer than 70.7 m. This allowed for placement of test stimuli on the stakes so that no single bear could be directly downwind of more than 1 odor. Plain paper toweling was used to hold the liquid materials, which were placed in quantities of 5 ml. One sample of each material was placed upon several stakes and replaced after 1 or 2 days, depending on the material, or after consumption.

The data collected included: number of bears visiting a stimulus, how many visits an individual bear made, their behavioral response, duration of this response, method of stimulus detection, and the distance at which the stimulus were detected. Anytime a bear passed within 30 m of a stimulus data were recorded. If the bear was downwind of the material and did not respond, this was recorded as "ignored." However, if the bear was not downwind, the response was recorded as "no response, upwind." This allowed for determination of lack of response based upon visual cues only as opposed to olfactory cues.

RESULTS

The baseline results revealed that the bears spent the majority of their time inactive, 92–95% for all bears. The test responses were similar, for most tests, with the bears remaining inactive, i.e. no major body movements, during the 20 min. test period. The seal scents elicited a stereotypic response form all the bears. Within two minutes of turning the fan on the animal began to sniff the air with its head raised. The bear continued to sniff the air and then got up and tracked the scent to its source, inserted its muzzle between the bars directly in front of the fan, and took several deep breaths. During this time the bear was salivating heavily. Next the bear's activity increased as it paced the cage, groaned and chuffed (Wemmer et al. 1976), pawed, and chewed on the cage bars. These behavior patterns, especially sniffing, were rarely observed during baseline periods. This response, defined as a maximal behavioral response, was also elicited from used tampons (Table 1). Only Bear 3 responded maximally to any scent other than seal or menstrual odor (Table 1). In the laboratory, menstrual odors were acting as an attractant.

In all but one instance there was a behavioral response by the bears to the presence of a human female, whether they were menstruating or not

Table 1. Responses of caged polar bears to human, animal, and food odors and to passive human subjects.

Test stimulus	Response[a] Bear 1	Bear 2	Bear 3	Bear 4
Baseline odors				
Control (fan only)	None	None	None	None
Seal oil	Max	Max	Max	Max
Seal blubber	Max	Max	Max	
Human blood	None	None	None	None
Unused tampon	None	None	None	None
Used tampon, non-menstrual			None	
Menstrual odors				
Sanitary napkin		None	None	
Used tampon 1	Max	Min+	Max	Max
Used tampon 2	asl	Max		
Animal and food odors				
Castoreum	Mod	Min	None	
Chicken	None	None	Max	
Horse manure	None	Min	Max	
Musk	Min	Min	None	
Sardine mash		None		
Seafood	None	None	Min+	
Nonmenstruating human, subjects				
1st female	Min	Mod	Min	
2nd female	None		Min+	
3rd female	Min			
Menstruating human, subjects				
1st female	Mod	Mod	Mod	
2nd female	Mod	Min	Mod	
3rd female	Mod			

[a] asl = asleep; Min = sniffs air 3–7 times but no movement towards scent; Min+ = no movement, sniffs air 10–20 times; Mod = sniffs several times, and shows increased activity for 2 minutes or less; Max = sniffs for most of the test, tracks scent to source, and shows from 5–10 minutes of increased activity.

Table 2. The number and type of field responses by polar bears to test stimuli.

Stimulus	Responses none, upwind	ignore	sniff	lick	chew	consume
Blood	3	7	1	1		3
Castoreum		3	3		1	
Chicken						6
Horse manure	2	6	4	2	1	
Musk						
Seafood	4			1		8
Seal oil	2					24
Tampon		4	2			1
Used tampon	9	2	3	5	9	33
Total	20	22	13	9	11	75

(Table 1). The responses were not as strong as for seal scents or used tampons, with no response exceeding a moderate response (Table 1). A moderate response consisted of limited sniffing with the bear displaying increased activity, but for a shorter duration. The activities of the bear were usually confined to the opposite end of the cage from where the subject was sitting. However, Bear 2 did turn and pounce at a menstruating female. Bear 4 was received too late in the season to test with human subjects.

The field season ran from 14 October through 8 November; during this period 45 bears made 150 approaches (Table 2). The bears ranged from 1st-year cubs to males estimated at over 25 years of age; 48.5% were subadult, 12.1% subadult or adult, 18.2% single adults, and 21.2% adult females with cubs. There was no detectable pattern of response based upon age or sex.

In the 150 approaches test materials were detected 54.1% of the time by scent, 13.8% visually (approached from other than downwind), 7.3% by tracking our footprints from stake to stake, and 4.6% by simply moving from stake to stake; the remaining 20.2% were "ignored." Bears detected significantly more of the materials olfactorally than visually ($x^2 = 11.03$, df = 1, $P \leqslant 0.001$). Seafood scents were detected by scent 100% of the time; chicken scent, 80%; seal oil, 73.7%; used tampons, 65.4%; (34 of 52); horse manure scent, 30.7%; castoreum, 28.6%; human blood, 16.7% (2 of 12); and unused tampons, 0.0%.

The distance at which a scent was detected was dependent on the position of the bear relative to the wind direction and test sample, on wind velocity, and possibly on the test material itself. The mean distance for a detection by scent accompanied by a response by the bear was 39.9 ± 60.1 m (SD), with a detection range of 30 cm to 370 m. Test materials were "ignored" from 30 cm to the maximum possible distance of 30 m. The mean distance of detection suggests that 30 m was an acceptable limit for the ignore response.

Once a bear had contacted the test material the duration of a response varied according to the type of response and which material was present. Sniffing and licking responses averaged 35.5 ± 22.8 s (SD), all types of test material, while the mean response time when chewing or consuming the test material was 162.2 ± 135 s (SD). The longest mean responses were consume seal oil (226.9 s), consume used tampons (211.5 s), consume seafood (120.5 s), and chew used tampons (98.5 s).

The comparison of primary interest is the responses of the bears to seal scents and used tampons. Seal samples were consumed every time they were detected, while used tampons were consumed or vigorously chewed 42 of 52 contacts (Table 2), and the difference in consumption rate is significant ($x^2 = 5.32$, df = 1, $P \leqslant 0.05$). While the bears did consume a greater proportion of the seal samples the amount of time they spent consuming seal oil and used tampons did not differ ($t = 0.438$, df = 36, $P \geqslant 0.5$), and the bears spent more time at the used tampon stakes than at the other, non-seal, scents. Also, the other food scents, chicken and seafood, were not consumed more often than the used tampons ($x^2 = 1.39$ df = 1, $P \geqslant 0.1$, and $x^2 = 0.34$, df = 1, $P \geqslant 0.5$, respectively). These results support the contention that menstrual odors are an attractant to polar bears, but what aspect of the used tampon is responsible for this attraction. The tampon, itself, did not attract the bears as unused tampons were never detected by scent and it is obvious by inspection that there is a significant difference between the number of tampons vs used tampons consumed. Human blood, as opposed to menstrual blood, was not functioning as an attractant as the blood was responded to only a small percentage of the time and there was a significant difference between the portion of used tampons and blood samples consumed (Fisher's Exact Probability $P \leqslant 0.001$).

DISCUSSION

This study was based upon the assumption that seal scents would reliably elicit a well defined, strong behavioral response from the bears, and the results support this contention. In the laboratory, seal oil and blubber produced the maximum response, and this response was the very similar for all bears. In the field, these scents had the longest response durations and were tracked from the longest distance, up to 370 m. Since the results demonstrated that the seal scent elicited the strongest responses, I concluded that these responses were valid to use as a standard to measure the relative attractiveness of other scents.

The various scents in this study were chosen for specific purposes. The inclusion of the 3 animal scents, castoreum, musk, and horse manure, and the 2 food scents, seafood and chicken, allowed testing of whether the polar bears were simply responding to any unique odor or were selectively responding to "attractants," as it could be argued that menstrual odors simply represented a unique odor. The captive bears ignored or only displayed a minimal response to these scents, which indicates that the bears were selectively responding to attractants, seal scents and menstrual odors. The field results lend added support to this conclusion as the wild bears displayed little or no interest in the 3 animal scents (Table 2). However, this was not the case for the 2 food scents. The bears in the field consumed the majority of food scent samples and always responded to these scents when detected via olfaction. This may be due to the behavior of the Churchill population of polar bears. These bears normally wait for Hudson Bay to freeze and just prior to freeze up they are mobile and restless (Stirling et al. 1977), so that these bears may have been more interested in food than the bears captured several months earlier, and the captive bears were fed regularly. However, the captive bears always showed a strong response to seal scents, even when recently fed. Again suggesting the strength of the response to seal scents. From all this it can be concluded that a strong response in the laboratory predicts a strong field response, but that weak laboratory response does not accurately assess the field response of the animals.

Polar bears are attracted to menstrual odors and it has been shown that human vaginal secretions and the odors emitted change with the onset of the menstrual flow (Doty et al. 1975). This study reveals that it is these changed properties associated with menstrual blood that attracts the bears and not the blood itself, as indicated by the lack of response to human blood, nonmenstrual, by the bears in the laboratory and the field. This study supports the theory that menstrual odors act as an attractant to bears, at least polar bears. However, this should not be taken to extremes as that is not the same thing as saying menstrual odors lead to attacks, as is exemplified by the captive bears altered response when women were present in the room as opposed to receiving the scent only. Such an attraction, by drawing the bears into proximity of people, could

still lead to an incident or attack, simply because the more often bears and people come in contact the higher the chance that an incident will eventually occur. In conclusion, menstrual odors attract polar bears, and for now it might be wise until other studies have been conducted to consider this a strong possibility with other ursids.

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