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Post-den
emergence behav.

8 adults.
14 cubs

1.75 cub/den

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Post-Den Emergence Behavior of Polar Bears (*Ursus maritimus*) in Northern Alaska

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ABSTRACT. We observed polar bear (*Ursus maritimus*) maternity den sites on Alaska's North Slope in March 2002 and 2003 in an effort to describe bears' post-den emergence behavior. During 40 sessions spanning 459 h, we observed 8 adults and 14 dependent cubs outside dens for 37.5 h (8.2% of total observation time). There was no significant difference between den emergence dates in 2002 (mean = 15 Mar ± 4.1 d) and 2003 (mean = 21 Mar ± 2.1 d). Following initial den breakout, polar bears remained at their den sites for 1.5 to 14 days (mean = 8.1 ± 5.1 d). The average length of stay in dens between emergent periods was significantly shorter in 2002 (1.79 h) than in 2003 (4.82 h). While outside, adult bears were inactive 49.5% of the time, whereas cubs were inactive 13.4% of the time. We found no significant relationships between den emergence activity and weather. Adult polar bears at den sites subjected to industrial activity exhibited significantly fewer bouts of vigilance than denned bears in undisturbed areas (t = -5.5164, df = 4, p = 0.00). However, the duration of vigilance behaviors at sites near industrial activity was not significantly shorter than at the other sites studied (t = -1.8902, df = 4, p = 0.07). Results for these bears were within the range of findings in other studies of denned polar bears.

Key words: Alaska, behavior, den emergence, maternity den, North Slope, polar bear, *Ursus maritimus*

RÉSUMÉ. Nous avons observé des tanières de maternité d'ours polaires (*Ursus maritimus*) sur le versant nord de l'Alaska aux mois de mars 2002 et 2003 dans le but de décrire le comportement de sortie des ours après leur séjour dans la tanière. Dans le cadre de 40 séances d'observation ayant duré 459 heures, nous avons observé 8 ours adultes et 14 oursons à charge en dehors des tanières pendant 37,5 heures (soit 8,2 % de la durée d'observation totale). Il n'y avait pas de différence importante entre les dates de sortie des tanières en 2002 (moyenne = 15 mars ± 4,1 j) et 2003 (moyenne = 21 mars ± 2,1 j). Après la première sortie de la tanière, les ours polaires restaient à l'emplacement de leur tanière pendant 1,5 à 14 jours (moyenne = 8,1 ± 5.1 j). La longueur moyenne du séjour en tanière entre les périodes de sortie était beaucoup plus courte en 2002 (1,79 h) qu'en 2003 (4,82 h). Une fois sortis, les ours adultes étaient inactifs pendant 49,5 % du temps, tandis que les oursons étaient inactifs pendant 13,4 % du temps. Nous n'avons pas trouvé de lien important entre l'activité une fois sorti de la tanière et le temps qu'il faisait. Les ours polaires adultes à l'emplacement de tanières assujetties à des activités industrielles affichaient beaucoup moins de séquences de vigilance que les ours en tanière des régions tranquilles (t = -5,5164, dl = 4, p = 0,00). Cependant, la durée des comportements de vigilance aux emplacements situés près d'activités industrielles n'était pas beaucoup plus courte qu'aux autres emplacements étudiés (t = -1,8902, dl = 4, p = 0,07). Les résultats enregistrés pour ces ours tombaient dans l'étendue des constatations découlant d'autres études d'ours polaires en tanière.

Mots clés : Alaska, comportement, sortie de la tanière, tanière de maternité, versant nord, ours polaire, *Ursus maritimus*

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INTRODUCTION

Facultative use of dens is common in some polar bear populations during winter (Ferguson et al., 2001) and in others in summer (Ferguson et al., 1997). Denning, associated with pregnant females, is an integral part of the reproductive process and occurs in the winter months (Ramsay and Stirling, 1988; Amstrup, 2003). Activity budgets of undisturbed animals provide a basic understanding of their behavior patterns and establish a benchmark against which the effects of anthropogenic disturbance can be evaluated. Most carnivores respond to human disturbance by moving away, with minimal energetic cost (Linnell et al., 2000). Hibernating bears are an exception, however, in that displacement is energetically costly, increases exposure to predation, and may compromise reproductive efforts (Linnell et al., 2000). Belikov (1976) reported that denned polar bears are sensitive to human disturbance in the fall, when dens are being established. However, the costs of disturbance may be higher in spring if the result is premature abandonment of the den. Decreased cub survival following premature den abandonment may result from a lack of acclimation to weather (Hansson and Thomassen, 1983), an inability to traverse open leads and block ice due to poorly developed motor skills and diminutive body size (Ovsyanikov, 1998),

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hypothermia stemming from a less favorable ratio of volume to surface area (Robbins, 1993), or some combination of these factors (Linnell et al., 2000).

Several studies of polar bear post-denning behavior have been conducted in areas where den concentrations exceed 12 dens/km^2, for example, on Russia's Wrangel and Herald islands (Ovsyanikov, 1998), and Norway's Kongsøya Island (Hansson and Thomassen, 1983). However, post-denning behavior in low-density denning areas such as those in northern Alaska (Amstrup and Gardner, 1994) has not been studied previously, despite concerns about the potential impact of oil exploration and development on denned bears in these areas (Amstrup, 1993). The wide dispersion of polar bear den sites in northern Alaska presents unique logistical challenges and has discouraged study. In the present study, we document the first attempts to describe behaviors of polar bears recently emerged from dens along Alaska's North Slope.

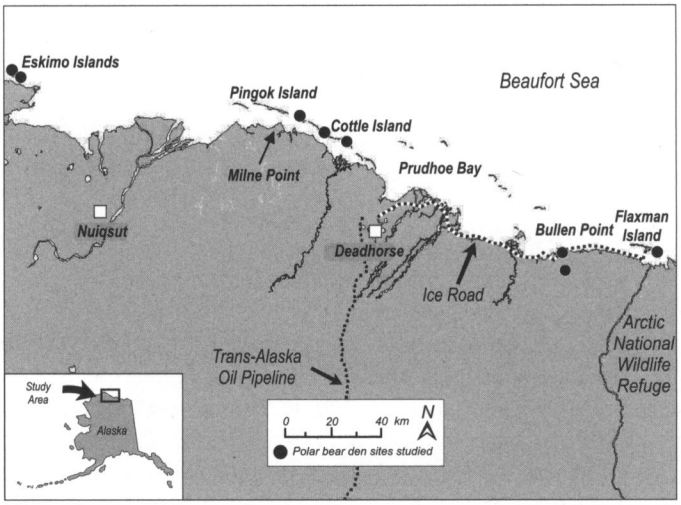

FIG. 1. Location of the study area and polar bear dens observed on the North Slope of Alaska in 2002 and 2003.

METHODS

Study Area

The study area is situated along the coastal plain of northern Alaska (North Slope), extending 133 km west and 91 km east of Prudhoe Bay, at 70°20′N, 148°24′W (Fig. 1). In the southern Beaufort Sea, terrestrial dens occur primarily on barrier islands and the nearby coastal plain, although some range as far inland as 50 km (Durner et al., 2003). This region lacks the steep topography associated with denning areas on Wrangell Island, Russia (Uspenski and Kistchinski, 1972), Herald Island, Russia (Ovsyanikov, 1998), and Svalbard, Norway (Larsen, 1985). Consequently, snow accumulation sufficient for dens exists mainly along coastal, island, and riverbank bluffs (Durner et al., 2003).

Den Site Selection and Observation

Ongoing research by the U.S. Geological Survey provided precise den locations for observation in 2002–03 through radiotelemetry (Amstrup, 2000) or the use of forward-looking infrared (FLIR) imagery (Amstrup et al., 2004) (Fig. 1). For the purposes of this study, we define "den site" as the den enclosure and the area immediately surrounding it (< 100 m). We monitored den sites with aircraft, trucks, and snowmobiles to determine the date of first den emergence, or den breakout. An ice road built by the petroleum industry to access remote areas along the coast provided vehicular access to two den sites east of Prudhoe Bay (Flaxman Island and Bullen Point, Fig. 1). We drove a truck daily to within 0.5 km of the Flaxman Island den and observed den activity from the vehicle. The Bullen Point den was not directly accessible by truck, so we used a Tucker (a four-track over-snow vehicle) to transport observers to within 0.5 km of the den. We used snowmobiles to access den sites on Cottle, Pingok, and Eskimo islands. White tents situated ~ 0.5 km from dens were used as observation blinds. Tents were anchored to the sea ice, heated with oil stoves, and fitted with observation ports that allowed variable zoom (15–60×) spotting scopes to be used from within.

Behavioral Data Recording and Analysis

One to three people were present during observation sessions. We attempted to observe from dawn to dusk, but periodically were unable to do so because inclement weather affected visibility and restricted travel. Observation sessions continued daily until the bears abandoned their dens. We used focal and instantaneous scan sampling procedures (Altmann, 1974) to document polar bear behaviors and activity patterns. Data were recorded on The Observer (Version 3.0, Noldus Information Systems, 2003). Activity states, events, and the modifiers used to describe polar bear behavior were consistent with definitions used by previous workers (Hansson and Thomassen, 1983; Larsen, 1985; Ovsyanikov, 1998). Bears that visually scanned the terrain, as evidenced by a prolonged gaze and the panning of their heads, were said to exhibit scanning behavior. A bear that suddenly stopped what it was doing and scanned the terrain was exhibiting an alert behavior. Both scanning and alert behaviors are forms of vigilance, or watchfulness. We use these terms to describe bear behavior in this report.

Bout duration data were used to calculate the total time that adult female polar bears spent in each behavior state. Weighted means were used when activity data from individual bears were pooled. Polar bear activity budgets were derived by dividing the time in any one activity by the total observation time. Bout frequency was analyzed separately for adult females and cubs. Each analysis used combined behaviour bout data from all individuals in the cohort. A percentage occurrence per behavior category was calculated by dividing the total number of bouts of any given behavior by the total number of bouts for all behaviors observed.

TABLE 1. Locations, dates, and observational data for eight polar bear maternal den sites on the North Slope of Alaska observed in March 2002 and 2003.

Year	Den ID[1]	Location	Dates Observed[2]	Total Time Observed (h)[3]	Total Time Out of Den (h/%)[4]	Number of Adult Female Observation Sessions	Number of Cub Observation Sessions	Number of Days at Den Post-Emergence[5]
2002	821	Flaxman Island	March 19–20	18.3	1.3/7.1	2	1	2.1–3.0
2002	810	Bullen Point	March 3–12	35.3	16.9/47.9	4	0	8.7–9.0
2002	805	Cottle Island II	March 19–28	64.2	11.0/17.1	8	6	13.5
2002	818	Cottle Island I	March 20	6.6	2.4/36.4	1	0	5.0
2003	889	Eskimo Island	March16–29	180.8	2.5/1.4	12	0	14.0
2003	884	Eskimo Island	March 25–30	92.0	1.3/1.4	6	1	13.3
2003	890	Cottle Island III	March 24–25	17.8	1.2/6.7	2	2	1.2–1.7
2003	888	Bullen Point	March 20–25	43.8	0.9/2.1	5	1	5.4–6.0
Total				458.8	37.5	40	11	mean = 8.1 ± 5.1

[1] Den site identification number.
[2] The range of dates between den emergence (breakout) and den departure.
[3] Total number of hours observers watched den sites.
[4] Total number of hours bears were out of dens and visible to observers/percentage of entire observation period that bears were out of dens.
[5] When precise dates were unknown, the most probable range of days is provided. Mean number of days ± 1 SD reported at bottom.

Weather Monitoring and Recording

The U.S. Minerals Management Service (MMS) maintains five meteorological monitoring sites in the vicinity (< 50 km) of dens we observed. Wind speed (m/s), temperature (°C), and solar radiation (watts/m^2) were recorded as hourly averages. Barometric pressure (hPa) was recorded by an instantaneous reading at the end of each hour.

Statistical Analyses

We used the Student's t-test to compare den emergence dates, length of stay at dens, and weather variables for significance; linear regression and the Pearson correlation coefficient to measure the degree of association between various measures of bear activity and weather variables; and one-way analysis of variance to explore activity patterns within and between polar bear cohorts (Zar, 1984). Statistical significance was set at $\alpha = 0.05$.

RESULTS

We spent 459 hours observing eight den sites in March of 2002 and 2003 (Table 1). We observed eight adult female polar bears outside their dens for a total of 37.5 hours (8.2% of total observation time), during 40 focal observation sessions. We also recorded the activity of five cubs during 11 focal observation sessions for a total of 6.5 hours (1.4% of total observation time). There was no significant difference (t = -1.3106, df = 6, p = 0.12) between the dates of den emergence in 2002 (mean = 15 March ± 4.1 d, n = 4) and in 2003 (mean = 21 March ± 2.1 d, n = 4). Polar bear families remained at den sites for 1.5 to 14 days (mean = 8.1 ± 5.1 d, n = 8; Table 1) after their initial emergence, or breakout, from their dens.

Temporal Activity Patterns

Mothers and cubs remained mostly in the den during observation periods (mean = 91.8% of the observation time, Table 2), although inter-year differences were significant (n = 8, t = -2.124, p = 0.04). The time that family groups spent in dens averaged 71% of total observation time in 2002, compared to 97% in 2003. In 2002, the average length of stay in dens between emergent, active periods was 1.79 h (n = 21), and was significantly longer than the average period spent outside dens, 0.49 h (n = 21, t = -0.014, p = 0.00). In 2003, the average length of stay in the den between active periods was 4.82 h (n = 25), and was significantly longer than the average period spent outside dens, 0.18 h (n = 41, t = 6.475, p = 0.000). The amount of time spent in and out of dens differed significantly between years (n = 46, t = -2.848, p = 0.00; n = 62, t = 2.3038, p = 0.01).

While outside the den, adult female polar bears were inactive (e.g., exhibited sitting, standing, and resting behaviors) 49.5% of the time, whereas cubs were inactive only 13.4% of the time (Table 2). The diurnal emergence patterns of individual bears varied considerably (Fig. 2). Nightfall terminated observation sessions, but by carefully observing bear tracks and snow disturbance patterns surrounding the den with spotting scopes at dusk, we were able to compare dusk and dawn patterns to verify that bears had been out of their dens during the dark hours. Before the day of den site abandonment, maternal groups did not range more than 100 m from den entrances. Upon abandoning den sites, family groups headed north onto the Beaufort Sea.

Relationship of Polar Bear Activity and Weather

We explored relationships between polar bear activity and weather. Regression analysis was used to model the

TABLE 2. Activity budgets of adult female polar bears (n = 8) and dependent cubs (n = 14) observed at their den sites in northern Alaska in March 2002 and March 2003.

Activity	Total Observation Hours		Percent of Total Observation Time		Percent of Time Outside[1]	
	Females	Cubs[2]	Females	Cubs	Females	Cubs
In den	421.4	81.7	91.8	91.8	–	–
Generally Inactive[3]	18.5	1.0	4.0	1.1	49.5	13.4
Nursing	1.3	0	0.3	0	3.6	0
Foraging	4.8	0.2	1.1	0.2	12.9	2.0
Walking	4.6	1.3	1.0	1.4	12.3	17.5
Digging	2.9	0.3	0.6	0.3	7.8	3.7
Play	0.1	3.9	< 0.1	4.4	0.3	53.8
Generally Active[4]	5.0	0.7	1.1	0.8	13.4	9.6
Excretion	0.1	0	< 0.1	0	0.3	0
Total	458.7	89.1	100.0	100.0	100.0	100.0

[1] Time when bears were outside the den and visible to observers.
[2] Total time of cub observation is less, as females were the focus of the study. Observers could not simultaneously observe both cohorts and record data.
[3] Includes sitting, standing, and resting behaviors.
[4] Includes rolling in snow, running, and social interaction.

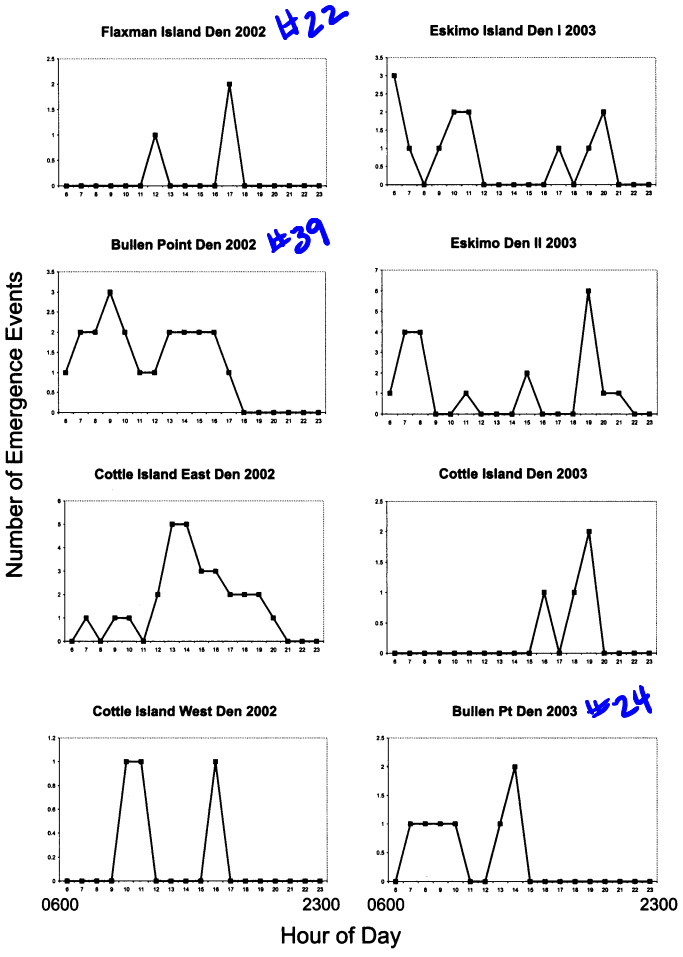

FIG. 2. The diurnal activity pattern of polar bears (n = 8) at den sites, North Slope, Alaska, 2002–03.

relationship of duration of den-emergent periods with several weather variables, including temperature, wind, humidity, barometric pressure, and solar radiation. However, regression did not reveal statistically significant relationships between bear activity and weather variables, as all had r^2 values of less than 0.07, which indicates that climate was only a minor factor influencing activity.

The amount of time spent in and out of dens was significantly different between years, possibly because weather was significantly colder in 2003 than in 2002 (-25.2°C vs. -20.6°C; n = 732, t =12.31, p = 0.000), although it was not significantly windier (-4.5 m/s vs. -4.6 m/s; n = 732, t = 0.863, p < 0.19).

There was no measurable precipitation in March of either year. The mean temperature for den breakout days (-27.8°C) was not significantly different from the mean temperature for March (mean = -21.0°C, t = -1.587, p = 0.06). Mean wind speed for days of den breakout (3.5 m/s) also did not differ significantly from the mean wind speed for March (4.6 m/s, t = -1.00, p = 0.16), and mean solar radiation on breakout days (85.9 w/m^2) was not significantly higher (t = 0.4386, p = 0.33) than the monthly mean (68.0 w/m^2, t = 0.4386, p = 0.33). Neither relative humidity on days of breakout (mean = 75.9%) nor barometric pressure (mean = 1024 hPa) varied significantly from monthly means (humidity: mean = 80.2%, t = -1.32, p = 0.09; pressure: mean = 1028 hPa, t = -0.72, p = 0.236).

Duration of Activity

We assessed bout duration of each activity type for all adult females combined and calculated the percentage of total observation time that these bears spent in each activity.

Adult females were inactive the majority (mean = 49.5%) of the time we observed them outside their dens. Standing was their most prevalent activity, at 28.3% of total observation time (mean bout duration = 18 seconds, range 1–429 seconds), followed by resting (21.8%, 44 s, 1–703 s), sitting (12.1%, 27.4 s, 1–311 s), walking (9.3%, 14.4 s, 1–300 s), digging in the snow (7.9%, 13.4 s, 2–177 s), foraging (7.4%, 13.1 s, 2–442 s), rolling in the snow

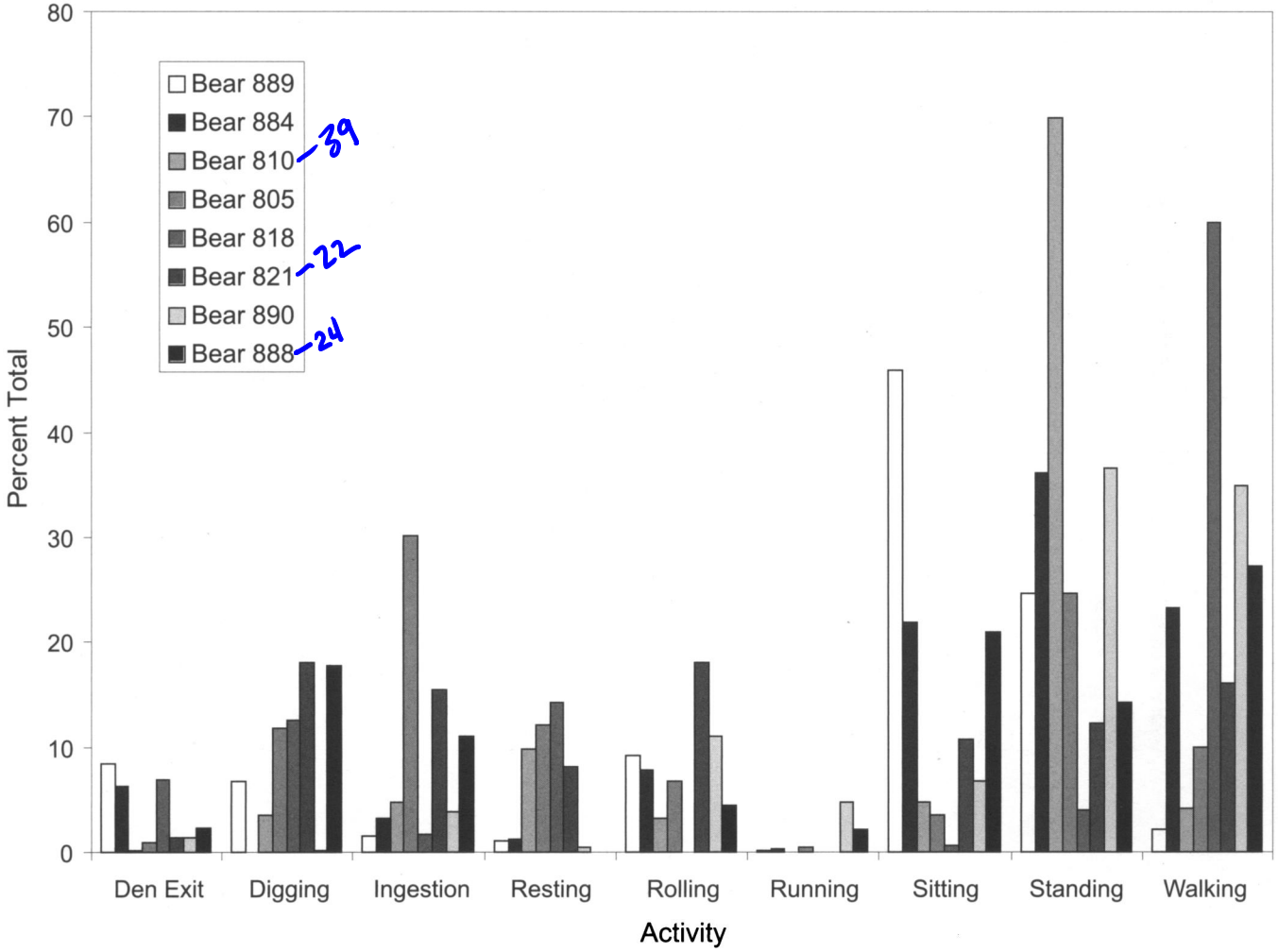

FIG. 3. Activity budgets of adult female polar bears (n = 8) compared by percentage of time spent in each principal activity type (based on 37.5 h of direct observation).

(6.2%, 16.3 s, 2–686 s), entering or exiting the den (3.7%, 15.9 s, 1–195 s), interacting with cubs (2.9%, 20.0 sec, range = 3–287 sec), and running (0.3%, mean = 22.5 sec, range 2–96 sec) (Fig. 3).

Cubs, unlike their mothers, were primarily in motion while out of the den (mean active time = 85%). They engaged in play longer than any other activity (45.6%, mean = 32 seconds, range = 2–526 seconds), followed by walking (18.6%, 30.4 s, 3–206 s), and to a lesser extent, standing (7.6%, 21.1 s, 3–163 s), sitting (6.2%, 46.4 s, 6–240 s), entering or exiting the den (5.7%, 8.5 s, 1–120 s), interaction with mothers (5.5%, 37.7 s, 3–199 s), digging in snow (4.2%, 34.4 s, 3–181 s), foraging (2.6%, 20.4 s, 5–157), rolling in snow (2.4%, 32.3 s, 5–234 s), resting (0.9%, 21.3 s, 4–64 s), and running (0.7%, 17.1 s, 5–38 s) (Fig. 4).

Frequency of Activity

For adult females outside the den, the most frequently occurring activity that we observed was standing (30.5% of total bouts, n = 1599 bouts). While standing, adults scanned the terrain frequently (89.8% of standing bouts). The second most frequent activity state was walking (12.7% of total bouts, n = 668 bouts), during which time adult females mostly scanned the area (72.0% of standing bouts). The third most common activity was digging in the snow (11.7% of total bouts. n = 615 bouts), which was nearly always done with a single paw (99.4% of digging bouts), as was also true for cubs (88.5% of cub digging bouts). Foraging, the fourth most common activity state (11.2% of total bouts, n = 586 bouts), was also modified by scanning. The least frequent behaviors observed included play (< 0.1% of total bouts, n = 1 bout), running (< 0.1% of total bouts, n = 12 bouts), and nursing (< 0.1% of total bouts, n = 19 bouts).

For cubs, playing was the most frequent activity in our observations (37.7% of total bouts, n = 327 bouts), and was most often modified with search behavior (50.4% of play bouts), as cubs scanned the ground while exploring the den site. Den entry and exit (18% of total bouts, n = 156 bouts) was the second most frequent activity: cubs darted in and out of the den while their mothers rested nearby. The third most common activity we observed was walking (16.4% of total bouts, n = 142 bouts), as cubs followed the mothers about the den site. The least frequent cub behaviors included

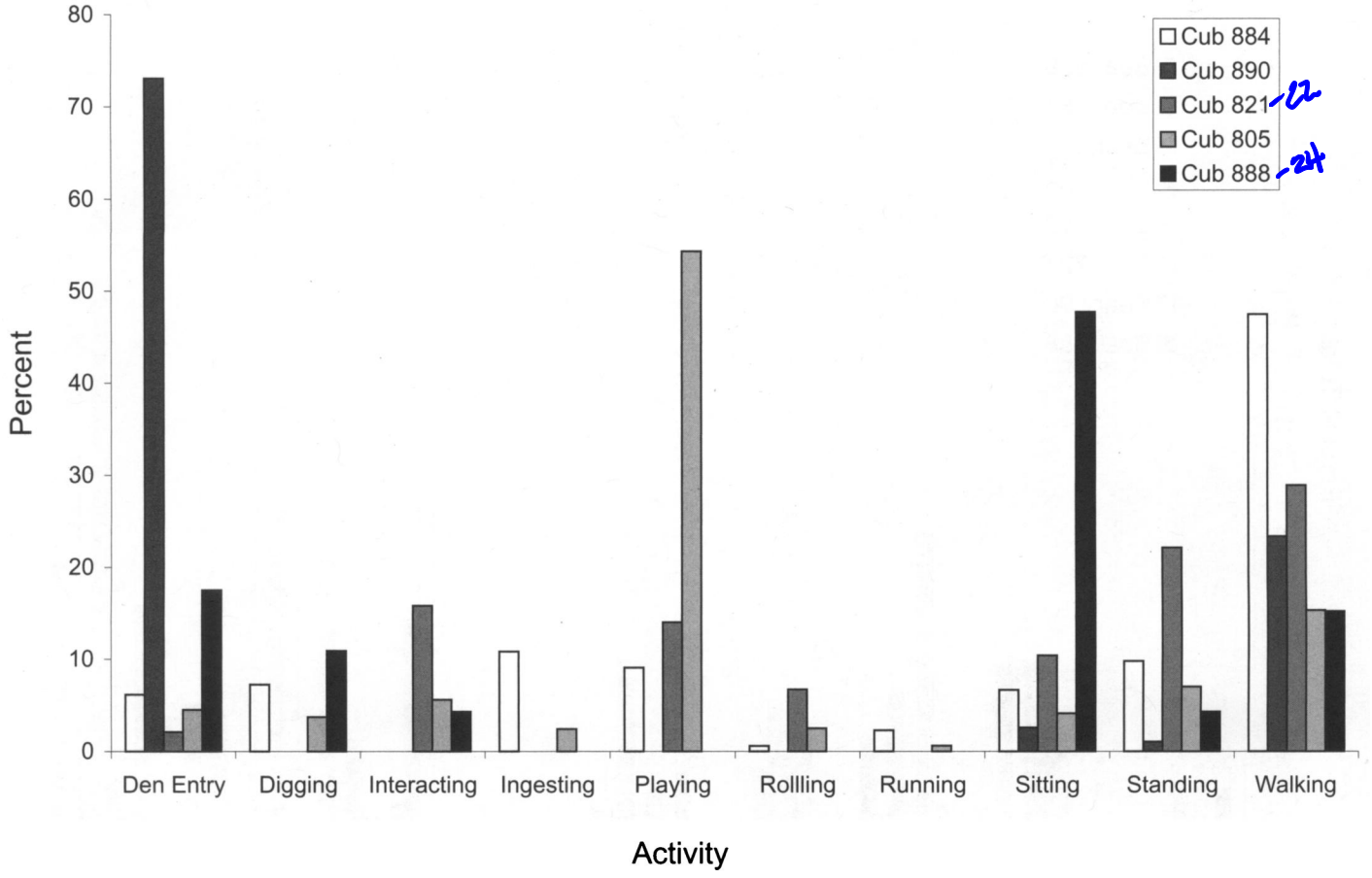

FIG. 4. Activity budgets of polar bear cubs (n = 5) compared by percentage of time spent in each principal activity type (based on 6.5 h of direct observation).

running (1.0% of total bouts, n = 9 bouts), resting (1.2% of total bouts, n = 10 bouts), and rolling (2.0% of total bouts, n = 17 bouts). We observed cubs running during bouts of play, and when their mothers reacted to disturbance by running, the cubs followed them into the den.

A comparison of mean bout length of adult females and cubs shows significant differences in the way these cohorts partitioned time (Fig. 5). Cubs spent significantly less time entering or exiting their dens, and resting than did their mothers. Additionally, cubs changed activity states more often and were more active than their mothers nearby.

Response to Industrial Activity

Two of the four den sites studied in 2002 were within 1.6 km of an ice road used by the oil industry. During the study, approximately 50 traverses of the road by fully loaded trucks occurred daily. Cued by the sound and sight of passing trucks, bears occasionally scanned in their direction. To compare the amount of time spent in vigilant (scanning and alert) behaviors by bears at these sites with bears not near the ice road, the duration and frequency of vigilant behavior for all adult bears is presented in Figure 6. Adult polar bears at den sites subjected to road traffic exhibited a significantly lower frequency of bouts of vigilant behaviors than bears elsewhere (t = -5.5164, df = 4, p = 0.00). However, the percentage time engaged in vigilant behaviors at sites near the ice road was not significantly different than for other sites (t = -1.8902, df = 4, p = 0.07).

DISCUSSION

Family groups in this study emerged from dens earlier than those observed by Ovsyanikov (1998) on Herald Island, Russia, though mean emergence dates for each location varied by only seven days (Alaska: mean = 18 Mar ± 2.4 days, n = 8; Russia: mean = 25 Mar ± 1.5 days, n = 7). Satellite radio-tagged polar bears (n = 40, from 2000–02) of the southern Beaufort Sea population had a mean emergence date of 20 Mar ± 2.0 days (S. Amstrup, unpubl. data). We determined emergence dates in this study by direct observation, whereas the dates for radio-tagged bears were inferred from sudden changes in collar temperatures, a method which is less precise. By contrast, den emergence at both northern locations (approximately 70° N), lagged nearly a month behind the mean emergence date for polar bears in the vicinity of Churchill, Manitoba (54° N; mean = 25 February, n = 9; Lunn et al., 2004).

The range of days maternal groups in this study remained at den sites following breakout (1.5 to 14 days) was similar to that of Hudson Bay family groups (4–18 d, Lunn

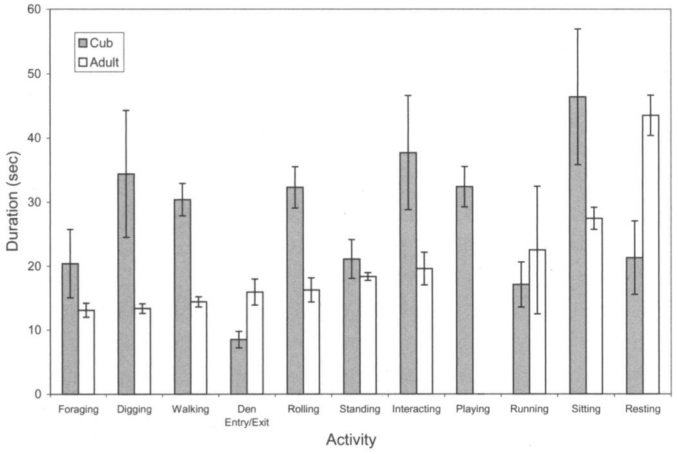

FIG. 5. A comparison of mean bout length of principal activities engaged in by polar bear cubs and their mothers, North Slope, Alaska, 2002–03. Error bars are ± one standard error.

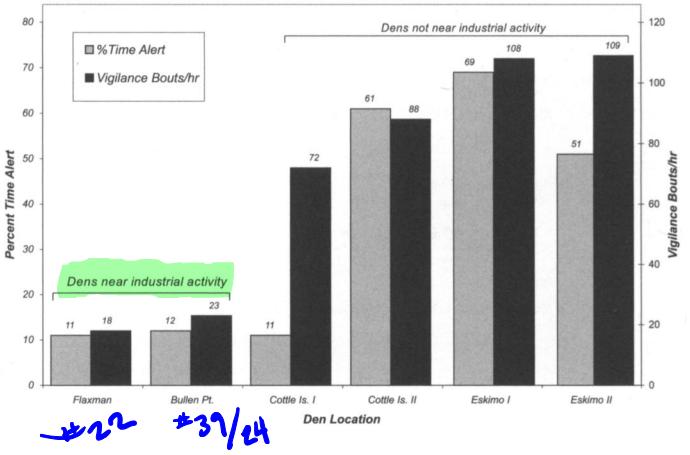

FIG. 6. Duration and frequency of vigilance behaviors at polar bear den sites, North Slope, Alaska, 2002–03.

et al., 2004). Patterns of den emergence varied greatly among maternal groups. Hansson and Thomassen (1983) observed similar patterns, noting the high variability among family groups. North slope maternal groups were not observed ranging more than 100 m from den entrances prior to den site abandonment. In contrast, post-denning bears on Wrangel Island were observed ranging up to 1 km from den entrances as they created extensive networks of trails and daybeds in a gradual, progressive movement away from den sites (Uspenski and Kistchinski, 1972).

Activity Patterns

Our bears' behaviour of spending the majority of their time in dens was similar to the behaviour of maternal groups in Svalbard, which spent 80.6% of the time in their dens one winter and 85.5% the second winter (Hansson and Thomassen, 1983). In our study, polar bear cub behaviors were less well documented than those of adult females because observers could not effectively observe and record the behaviors of more than one animal simultaneously, and adult females had priority. Consequently, while mothers were observed nursing cubs 3.6% of the time, focal observation of cubs failed to document any nursing. Lehner (1996) stated that one objective of the descriptive study of a species is to determine the frequency of rare behaviors, and that short-term studies tend to misrepresent the importance of some rare behaviors because of sampling error. For this reason one should exercise caution when interpreting polar bear cub activity data from the present study.

Hansson and Thomassen (1983) provided the only other study with comparable activity data, noting that females were inactive 66.4% of the time and cubs 41.6% of the time while outside the den. Messier et al. (1994) posited that the primary purpose for bears remaining at the den site post-emergence was for cubs to gain body weight and suggested that maternal groups left when adequate cub size was achieved. Hansson and Thomassen (1983) reported that polar bears spent increasingly more time outside dens following den breakout and suggested that this pattern reflects an increasing preparation and readiness to abandon the den site. Only four female polar bears in our study provided a sufficient number of observation days (> 4) to analyze variation over time in duration of periods outside the dens. We did not observe an incremental increase in time outside the den for North Slope polar bears; however, three of the four adult female polar bears did show an increase in time outside the den just before their departure.

We failed to identify a relationship between weather variables and polar bear activity. Similarly, Hansson and Thomasson (1983) were unable to find any significant differences in the temperature or wind for breakout days versus all other days during their study. North Slope temperatures at den breakout were similar to those reported for Wrangel Island (Belikov et al., 1977), and Kongsøya, Svalbard (Hansson and Thomassen, 1983), where bears first emerged from dens at temperatures ranging from -20° to -25°C. We did not measure percent cloud cover, a value that was significantly correlated with a number of breakout days in Svalbard (Hansson and Thomasson, 1983). Our failure to identify a linkage between weather variables and polar bear activity patterns is not surprising, considering our small sample size.

Response to Industrial Activity

Bears exposed to industrial activity on the ice road were significantly less wary than bears in other areas. Maternal groups not exposed to truck traffic on the ice road spent four times as much time engaged in vigilant behaviors as those near roads. Additionally, bears not near the road exhibited vigilant behaviors five times as often as bears near the road. Frid and Dill (2002) claim that animals become more vigilant as the perceived risk of predation increases. Our findings suggest that polar bears exposed to heavy truck traffic habituated to it (i.e., ceased responding to stimuli that lacked negative consequences). Paying less attention to the environment may have negative consequences,

but it may also be true that the higher frequency of vigilant behaviors observed at "undisturbed" sites reflects time spent out on the ice with conspecifics rather than risk associated with denning and is habitual rather than adaptive.

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