

... und kann Ihnen versichern, daß das Exemplar des Iltisses, das Sie mir geschickt haben tatsächlich ein *Putorius evermanni* (Lesson, 1827) ist. Dieses Exemplar ist ein wenig dunkler, aber in den Populationen unserer Steppeniltisse existieren auch solche dunkle Exemplare; sie sind typisch für die Rasse *hungaricus* Ehik, 1928.“ „Ihr Exemplar ist kein Mischling mit einem Frettchen, was wir nach unserem Belegmaterial und nach unseren Erfahrungen schließen können.“

Mit dieser Entscheidung ist die Frage, ob der Steppeniltis zur deutschen Fauna gehöre (RICHTER, 1964 a, b), im positiven Sinne beantwortet worden und es ist nun wohl in erster Linie eine Angelegenheit der Jägerschaft, in geeignet erscheinenden Landschaften auf möglicherweise auftauchende „Gelbiltisse“ zu achten und anfallende Exemplare der wissenschaftlichen Untersuchung zugänglich zu machen.

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Some Physiological Measurements of Polar Bears

By RAYMOND J. HOCK

Eingang des Ms. 25. 9. 1967

Although polar bears (*Thalarctos maritimus*) are common zoo animals, few data are available on any physiological measurements made on them. In the course of my studies in Alaska, I had occasion to collect random data on these mammals. It now seems appropriate to present them all in one place.

Weight

In 1948, while I worked at the Arctic Research Laboratory, Point Barrow, Alaska, two polar bear cubs were obtained. The den in which the bears were living had been plowed out of the snow by one of the surface supply trains, and the mother shot. The location was some miles inland from the Beaufort Sea, and southeast of Point Barrow. The cubs were located and kept by an Eskimo in Barrow village, and I secured them from him for metabolic study. On 9 to 11 April, their weights were: ♂, 8950 to 9400 g, variable daily with fasting, mean 9250 g; ♀ 8500 to 8800 g, mean 8750 g. Age of these cubs was approximately 3 months.

In 1959, while I was employed by the Arctic Aeromedical Laboratory, Fairbanks, I received a young polar bear cub from the U. S. Fish and Wildlife Service. It had been captive for some time in an Eskimo village, and was fed mainly on seal blubber.

Despite the fact that it had a pestistent diarrhea when I received it, the cub weighed 13 kg on 14 April, when its age was presumably about $3\frac{1}{2}$ months. The discrepancy between its weight and that of the Point Barrow cubs is due either to the small age difference, or to a longer time in captivity with accompanying faster growth (Hock, 1966 b, RAUSCH, 1961).

Eight days later it weighed 15 kg. The diarrhea was now cured, and food consisted of Pablum and diluted evaporated milk, of which it ate prodigiously.

At the age of about 5 months (June 5) weight was 21.4 kg. On 17 June, age about $5\frac{1}{2}$ months, weight had risen to 25.45 kg. At this time, the cub was sent to the National Zoo in Washington, D. C.

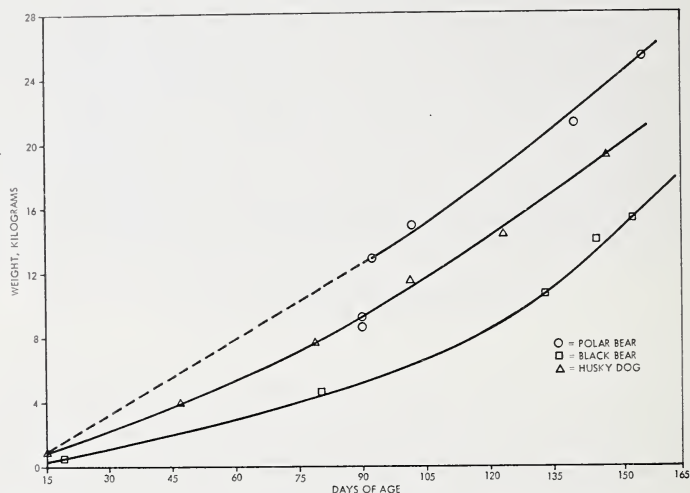


Fig. 1. Weights of young polar bear, black bear, and husky dog cub plotted against age

I have reported (HOCK, 1966 b) on the growth of black bear cubs (*Ursus americanus*) born in my cages at Fairbanks. The surviving black bear cub, the polar bear cub, and a husky dog pup (delivered by Caesarean section after the death of the mother) were brought up together, on the same food, and all lived in my laboratory annex. These animals were all born at nearly the same time (within perhaps 3 weeks), all had lost their mothers, and thus were raised on artificial foods.

Figure 1 shows the relative weights of the three animals. It may be seen that the black bear growth is slowest, and the polar bear fastest. The two Point Barrow cubs are near the dog's weight at comparable age. I have shown in Figure 1 that the polar bear's weight at birth approximates 800 g. PEDERSEN (1945) gives weight at birth of „ $\frac{3}{4}$ kilogramm“. The black bear cub weight is much lighter at birth (HOCK, 1966 b), but the husky pup weighed nearly the same.

Two larger bears were shot by Dr. ROBERT RAUSCH, Arctic Health Research Center, Anchorage, Alaska. The results have already been reported by IRVING and KROG (1954). Weights were 212 kg for a young bear (sex undetermined), and 265 kg for a 3 to 4 year-old female. Total length of the latter was 193 cm. Both were reasonably fat, although depot fat was absent. Date was 10 August, 1953, at Skull Cliff, southwest of Point Barrow, Alaska.

PEDERSEN (1945) cites weights up to 800 kg, but this appears either dubious or so remarkable it may be disregarded. Sizes up to 250 cm and maximum weights of 500 kg may more nearly reflect the maximum size to be expected in modern times.

Heart Rate

I have reported on the heart rates of black bears (HOCK, 1966 a). The polar bear cub, Oliktok, was measured at the same time and in the same manner as the black bear cubs. She was hand-held, without undue struggling. Still, the rates are: $\bar{x}$ 205, range 200 to 220 at 5 months (struggling), and $\bar{x}$ 166, range 140–180 at near six months of age. Comparable black bear rate at the latter age is $\bar{x}$ 148, range 140–160 (HOCK, 1966 a). Thus, the heart rate of the polar bear appears to be higher than that of the black bear at the same age, even though the size is much larger (polar bear 25.5 kg vs black bear 14.0 kg), as seen in Figure 2. No heart rates for older polar bears are available.

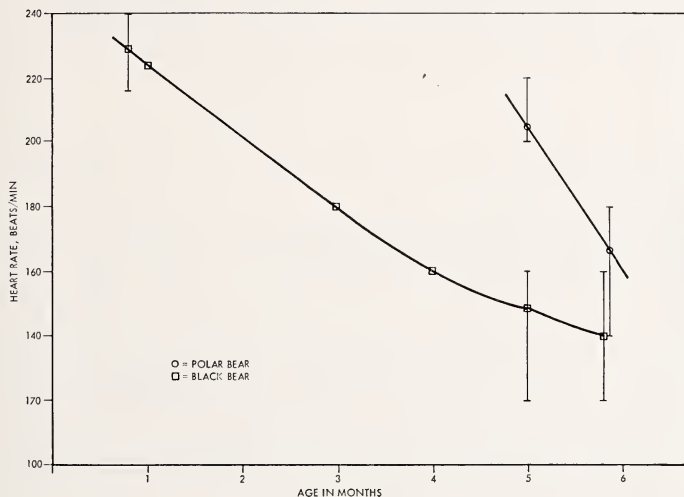


Fig. 2. Heart rate of young polar bear and black bear versus age

Body Temperature

The black bear has been shown to have a stable colonic temperature during the active phase at any time of year (HOCK, 1960). The temperature is maintained at near 38.0° C, but falls as low as 31° during lethargy.

Interest in the deep body temperature of the polar bear is great due to its Arctic pack ice habitat and the long periods it spends in water colder than 0° C. Temperatures of 37.8°, 37.2° and 37.5° have been reported (ANON., 1827), in air temperatures of –11.6° and –11.3°. Figure 3 shows colonic temperature plotted against ambient temperature.

One of the bears shot by RAUSCH in 1953 had colonic temperature of 37.35° in air of 4.5° C. It was in the water, and had been pursued a short distance. It was killed and towed to an ice floe. Water temperature was not taken, but it was probably about –1° C. The second bear was shot on a floe, but fell into a melt water pool. Fifteen minutes after death, its colonic temperature was 37.1° C in air cooler than 4.5° C.

The cub Oliktok gave colonic temperature readings between 37.0° C and 38.0° C in air of 20° C. Age was about 5 and 5½ months.

Thus, it appears that polar bears have core temperatures nearly equivalent to black bears, despite their Arctic environment and, perhaps, lengthy water immersion. Information on the latter aspect of their thermoregulation is not satisfactory, and there

is a complete lack of information on temperatures during the lethargy exhibited by the pregnant female. The papers of SCHOLANDER et al (1950a, b, c) should be referred to for more complete data on insulation of fur and fat.

It would appear that a polar bear swimming for long periods in cold water would show a high heat loss, due to the great heat capacity of the cold water sink, movement through the water, the elongated shape of the bear, and the low insulation of its fur and fat in water. This must be balanced by either high heat production, or reduction of the body to water gradient by lowering peripheral temperature through vasoconstriction, or both. Reduction of the central body temperature would also serve to decrease the body to cold water gradient. Perhaps all avenues available are used,

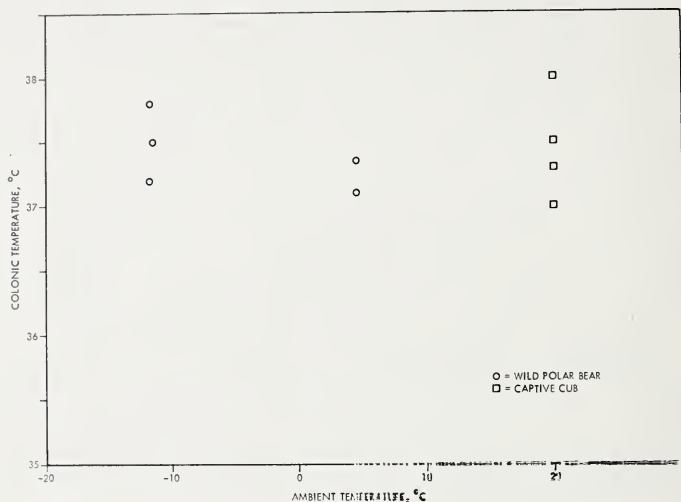


Fig. 3. Colonic temperature of wild adult polar bears and the captive cub in relation to ambient temperature

although it is obvious that too great reduction of the temperature of the core would lead to hypothermia and loss of coordinated function. Perhaps this does not occur until a much reduced central temperature is reached, as the black bear is capable of sudden and coordinated movement at a core temperature only slightly above 31° C. Any information on this general subject would be very desirable.

Metabolic Rate

Studies of metabolic rate (MR) were made at Point Barrow, and have been reported by SCHOLANDER et al (1950b). They are re-plotted here, as shown in Figure 4. Thermoneutrality is seen to extend to about 10° in these cubs, with a rather steep rise at lower temperatures. I have compared the MR of these cubs and husky pups of about the same age (HOCK, 1965).

The MR is high for animals of this size (SCHOLANDER et al, 1950c), but this may be due to their young age. The cub Oliktok, age 5½ months, weight 25 kg, had consecutive metabolic determinations made at Fairbanks. Mean MR was 0.49 ml O₂/gm/hr at 24.5° C, substantially lower than the MR of the 3 months-old cubs. No MR data exist for larger, older polar bears.

HOCK (1958) has compared MR of a young black bear in winter and spring. As

figure 4 shows, the MR is much lower for the black bear at all ambient temperatures. However, the age of this bear was 9 to 10 months, weight 31 to 35 kg, so that it was older and heavier than the polar bears. Difference in MR may be due to these differences of age and weight of the two subject species, or conversely may reflect a valid higher MR of the polar bear.

Discussion

Polar bears are seen to be quite "normal" mammals, despite their habits and habitat. They grow more quickly than black bears, and appear to have a higher heart rate, especially for their size. Their colonic temperature appears to be slightly lower and more variable than their black bear relatives. The MR on the other hand, is much higher than that found for black bears, at least in young animals. This may be merely a function of differences in size and age. Alternatively, the MR and heart rate may really be higher than in the black bear. The higher MR and the lower central body temperature would give a partial answer to the vexing question concerning the problem of maintenance of core temperature during long immersion in cold water. More observations on this matter are clearly needed.

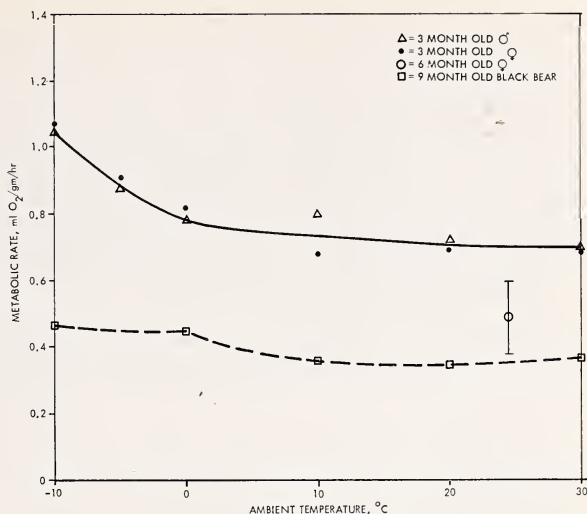


Fig. 4. Metabolic rate of polar bear cubs (SCHOLANDER et al, 1950 b), and the female cub „Oliktok“ compared to MR of the black bear at various ambient temperatures

Zusammenfassung

Eisbären erweisen sich trotz ihrer Lebensweise und ihres Lebensraums als ganz „normale“ Säugetiere. Sie wachsen schneller als Schwarzbären und scheinen eine höhere Herzfrequenz zu haben, insbesondere im Hinblick auf ihre Größe. Ihre Darmtemperatur scheint etwas niedriger und variabler als die ihrer Schwarzbären-Verwandschaft. Andererseits ist der Stoffwechsel weit höher als man ihn bei Schwarzbären findet, wenigstens bei Jungtieren. Dieser Eindruck entstand aber möglicherweise nur durch Größen- und Altersunterschiede. Stoffwechsel und Herzfrequenz könnten tatsächlich höher sein als bei Schwarzbären. Der höhere Stoffwechsel und die niedrigere Rektaltemperatur könnten eine Teilantwort geben auf die noch ungelösten Fragen nach dem Problem der Beständigkeit der Innentemperatur während langen Aufenthalts in kaltem Wasser. Weitere Untersuchungen sind nötig.

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Entgegnung auf die Bemerkungen von Jiří Volf bezüglich: "New Sighting of Przewalski Horses?"

Im 32. Band dieser Zeitschrift (Heft 4, 1967, S. 245—246) werden von J. VOLF (Prag), Bemerkungen hinsichtlich meiner Freilandbeobachtungen in bezug auf das Przewalski-Pferd geäußert und zwar behauptet J. VOLF, ich hätte das Wildpferd mit dem Wildesel verwechselt. Ich fühle mich gezwungen, auf diese Bemerkungen zu reagieren, da seine Einwände, wie aus der nachstehenden Begründung hervorgeht, nicht stichhaltig sind.

J. VOLF behauptet, daß das Wildpferd vom Wildesel auf große Entfernung selbst mit dem Fernglas nicht unterschieden werden kann, insbesondere in der Steppe, wo die Luft stark vibriert. Jedermann, der im Hochland von Inner-Asien gewesen ist, kann dies Argument sofort widerlegen. Die Luft dieses Gebietes ist außerordentlich klar, eine gute Sicht ist auf große Entfernung möglich, insbesondere an solchen Tagen, wie auch in meinem Falle, wo ein kalter Wind weht, so daß selbst in Bodennähe kein Vibrieren herrschte. Außerdem wird von J. VOLF der Umstand nicht berücksichtigt, daß die Mongolen äußerst scharfsichtig, ausgezeichnete Kenner und Beobachter der mongolischen Tierwelt sind. Mit dem Fernglas konnte ich mich selbst überzeugen, da ich nahezu 20 Minuten die kleine Herde verfolgte, daß es sich zweifellos um Wildpferde handelte.

Auf beiden Aufnahmen hält J. VOLF die Tiere für viel zu hell um sie als Wildpferde ansprechen zu können. Diesbezüglich sei erwähnt, daß die auf Umkehrfilm verfertigten Aufnahmen einerseits überbelichtet sind, andererseits die Farbenwirkung auf dem Steppenhochland sehr von der Belichtung und von der Farbe des Bodens abhängt. Der Boden selbst ist dunkelgrauer Granit, mit einer spärlichen halbwüstenartigen Vegetation, wo die Tiere heller erscheinen als in Wirklichkeit, was durch den überbelichteten Film nur noch stärker hervorgehoben wird.

Mit scheinbar beachtenswerter Sorgfalt analysiert J. VOLF den mit einem normalen Objektiv verfertigten Film und kommt auf Grund der 50fachen Vergrößerung zu der Folgerung, daß die photographierten Tiere nicht Wildpferde, sondern Wildesel sind. Ich verfertigte ebenfalls mit den verschiedensten Verfahren Vergrößerungen und konnte feststellen, daß die Bilder wegen der dicken Emulsion eine Vergrößerung nicht vertragen, die Tiere erscheinen vollkommen verschwommen, die Körpermasse und die Geflecktheit ist äußerst unsicher zu erkennen. Wenn man jedoch vorweg an das Vor-

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