Three

TÔRNARSSUK
Ursus maritimus

THE SEASCAPE WAS almost without color beneath a low gray sky. Scattered ice floes damped any motion of large waves, and fogs and thin snow showers came and went in the still air. The surface of the water was the lacquered black of Japanese wooden boxes.

Three of us stood in the small open boat, about a hundred miles off the northwest coast of Alaska, at the southern edge of the polar pack in the Chukchi Sea. I and two marine scientists were hunting ringed seals that cold September day. In the seal stomachs we found what fish they had been eating; from bottom

trawls we learned what the fish they were eating had eaten; and from plankton samplings we learned what the creatures the fish ate were eating.*

We had been working at this study of marine food chains for several weeks, moving west in our boat across the north coast of Alaska, from the west end of the Jones Islands to Point Barrow. At Barrow we boarded a 300-foot oceanographic research vessel, the *Oceanographer,* and headed out into the Chukchi Sea. Each morning for the next two weeks our boat was lowered from the deck of this mother vessel and we worked in the sea ice until evening.

We had been hunting seals intensively for three days without success. Twice we had seen a seal, each time for only a split second. We moved slowly, steadily, through the ice floes, without conversation, occasionally raising a pair of field glasses to study a small, dark dot on the water—a piece of ice? A bird? A seal breaking the surface of the water to breathe? It is not so difficult to learn to distinguish among these things, to match a "search image" in the mind after a few days of tutoring with the shading, shape, and movement that mean *seal.* Waiting in silence, intently attentive, was harder to learn.

We were three good sets of eyes, hunting hard. Nothing. A fog would clear. A snow squall drift through. In the most promising areas of the ice we shut off the engines and drifted with the currents. The ice, despite its occasional vertical relief, only compounded a sense of emptiness in the landscape, a feeling of directionlessness. The floes were like random, silent pieces of the earth. Our compass, turning serenely in its liquid dome, promised, if called upon to do so, to render points on a horizon obliterated in slanting snow and fog.

* This project was part of a Bureau of Land Management/Outer Continental Shelf study of Alaskan coastal marine life, results of which were to lead offshore oil development in the least harmful direction.

We drifted and sipped hot liquids, and stared into the quilt-work of gray-white ice and ink-black water. If one of us tensed, the others felt it and were alert. Always we were *hunting.* This particular habitat, the number of cod in the water, the time of the year —everything said ringed seals should be here. But for us they weren't.

Late summer in the sea ice. Eventually the cold, damp air finds its way through insulated boots and wool clothing to your bones. The conscious mind, the mind that knows how long you have been out here, importunes for some measure of comfort. We made a slow, wide turn in the boat, a turn that meant the end of the day. Though we still watched intently, thoughts of the ship were now upon us. Before this, we had camped on the beach in tents; now a hot shower, an evening meal in light clothing at a table, and a way to dry clothes awaited us. In the back of your mind at the end of the day you are very glad for these things.

My friend Bob saw the bear first: an ivory-white head gliding in glassy black water 300 feet ahead, at the apex of a V-wake. We slowed the boat and drew up cautiously to within 30 feet. A male. The great seal hunter himself. About three years old, said Bob.

The bear turned in the water and regarded us with irritation, and then, wary, he veered toward a floe. In a single motion of graceful power he rose from the water to the ice, his back feet catching the ice edge at the end of the movement. Then he stepped forward and shook. Seawater whirled off in flat sheets and a halo of spray. His head lowered, he glared at us with small, dark eyes. Then he crossed the floe and, going down on his forelegs, sliding headfirst, he entered the water on the other side without a splash and swam off.

We found our way to him again through the ice. We were magnetically drawn, in a fundamental but perhaps callow way. Our presence was interference. We approached as slowly as before, and he turned to glower, treading water, opening his mouth—the gray tongue, the pale violet mouth, the white teeth—to hiss. He paddled away abruptly to a large floe and again catapulted from

the water, shook his fur out, and started across the ice to open water on the far side.

We let him go. We watched him, that undeterred walk of authority. "The farmer," the whalers had called him, for his "very agricultural appearance as he stalks leisurely over the furrowed fields of ice." John Muir, on a visit to these same waters in 1899, said bears move "as if the country had belonged to them always."

The polar bear is a creature of arctic edges: he hunts the ice margins, the surface of the water, and the continental shore. The ice bear, he is called. His world forms beneath him in the days of shortening light, and then falls away in the spring. He dives to the ocean floor for mussels and kelp, and soundlessly breaks the water's glassy surface on his return, to study a sleeping seal. Twenty miles from shore he treads water amid schooling fish. The sea bear. In winter, while the grizzly hibernates, the polar bear is out on the sea ice, hunting. In summer his tracks turn up a hundred miles inland, where he has feasted on crowberries and blueberries.

Until a few years ago this resourceful hunter was in a genus by himself: *Thalarctos.* Now he is back where he started, with the grizzly and black bear in the genus *Ursus,* where his genes, if not his behavior, say he belongs.

What was so impressive about the bear we saw that day in the Chukchi was how robust he seemed. At three years of age a bear in this part of the Arctic is likely spending its first summer alone. To feed itself, it has had to learn to hunt, and open pack ice is among the toughest of environments for bears to hunt in. This was September, when most bears are thin, waiting for the formation of sea ice, their hunting platform. In our three days of diligent searching, in this gray and almost featureless landscape of ice remnants so far off the coast, we had seen but two seals. We were transfixed by the young bear. We watched him move off across the ice, into a confusing plane of grays and whites. We were shivering a little and opened a thermos of coffee. A snow shower moved quickly through, and when it cleared we could barely make

him out in the black water with field glasses from the rocking boat. A young and successful hunter, at home in his home.

He had found the seals.

THE polar bear is only lately known to science, and not yet well. What has been learned, especially about the size and movements of its different geographic populations, has been difficult and expensive to determine, and it has come on the heels of fears that the bear was threatened with extinction.

The Russians were the first to raise an alarm. They banned polar bear hunting in 1956; in 1961 Savva Uspenskii speculated that the world population of polar bears was only about 5000. American biologists thought it was more like 17,000 to 19,000—but no one had any reliable information; nor did the technology to find out exist. At the time, Americans in Alaska and Norwegians in Svalbard were exerting a tremendous hunting pressure on polar bears, as were hunters in Canada.* In Alaska in the mid-sixties a combination of hunting by native people and airborne sportsmen was accounting for a kill of about 300 bears a year. Canadian hunters were taking more than 400 a year. Greenlanders were killing about 200 a year, and more than 400 polar bears were being killed every year in Svalbard by commercial trappers and European sport hunters. The reported kill (smaller than the actual kill), then, was about 1300 bears a year, nearly 25 percent of the population if Uspenskii was right.

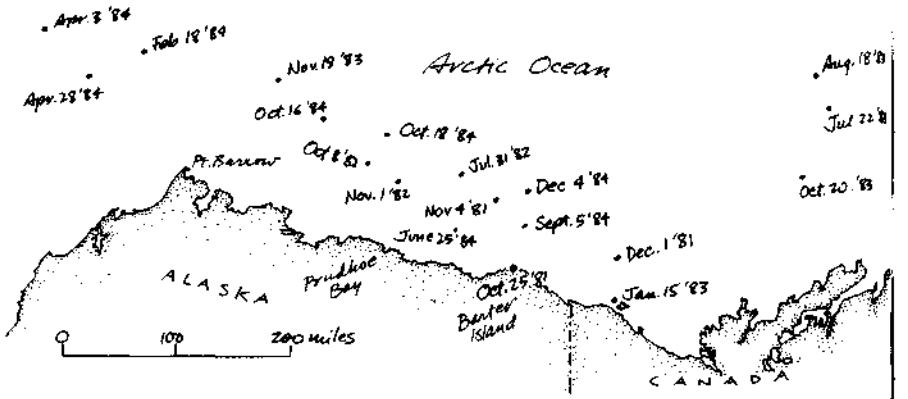
Uspenskii, fortunately, was wrong; but indications of the bear's vulnerability, and the fact that there was no scientific ground on which to base any decisions, precipitated an international meeting in Fairbanks in 1965, sponsored by the United States. This meeting produced an international agreement for polar bear management under the auspices of the International Union for the Conservation of Nature and Natural Resources (IUCN). By 1968 an IUCN Polar Bear Specialist Group had been established, to share information and coordinate management programs for an animal that drifts between countries and occupies the high seas in its wanderings.*

* Svalbard is the Norwegian name for an arctic archipelago whose largest island is Spitsbergen, a name sometimes used in English to refer to the entire archipelago.

What emerged from the research initiated by this group of polar bear biologists was both new information, some of it startling, and the end for some old theories. It had been previously thought, for example, that polar bears followed the roughly clockwise movement of ice around the Pole, bearing their young in Canada, say, with those bears then growing up in the Russian Arctic and breeding in Svalbard and in northern Greenland the next year. This notion was early laid to rest. Polar bears do wander, sometimes very far over the sea ice; but populations in the Arctic are fairly discrete. Polar bears show a high degree of fidelity to winter seal-hunting areas, summer retreats, and ancestral denning areas such as those along the Owl River in Manitoba, in Bogen Valley on Kongsoya Island in Svalbard, or in the Drem-Head Mountains on Wrangel Island.

Within these major populations—one of them seems to wander back and forth between Svalbard, Franz Josef Land, and the east coast of Greenland; another to stay around the north and northwest coasts of Alaska; a third in the Canadian Arctic—there are smaller, somewhat less discrete populations. For example, the bears of southern Hudson Bay and of James Bay appear to be a self-contained group. (They also have a unique summer diet, denning habits different from those of other bears, and different population dynamics—they raise more cubs, who strike off on their own at an earlier age than the young of other bear populations.) Polar

* The IUCN Polar Bear Agreement, signed by Russia, Norway, Denmark, Canada, and the United States in 1973, became effective on May 26, 1976. It is the only treaty of general agreement between the five polar nations.



Locations of a radio-collared polar bear off the north coast of Alaska between October 2$, 1981 and December 4, 1984. Adapted from S. C. Amstrup, 198$, unpublished data, U.S. Fish and Wildlife Service, Anchorage, Alaska.

bears are rather retiring and unaggressive, especially in comparison with grizzly bears. Robert Brown, an English traveler writing in 1868 and reacting to the popular stories of his day, said he would far rather meet a polar bear than a grizzly. "I cannot help thinking," he wrote, ". . . the impressions which we have imbibed regarding the polar bear's ferocity are due more to old notions of what it *ought to be* rather than what it *is*. . . ."

Polar bears vary in size, and their weights can change dramatically during the year. (Very large polar bears may stand 12 feet on their hind legs and weigh 2000 pounds. The number of 12- and 13-foot bears weighing 2200 or 2400 pounds that have been reported, however, says more about unadjusted scales, stretched hides, and wishful exaggeration than about polar bears.) Bears eat prodigiously in the spring, lightly in late summer, and lightly or not at all (in the case of denning females) during the winter. An adult male might weigh between 550 and 1700 pounds and measure

75 to 100 inches from tip of nose to tip of tail. Females weigh between 350 and 750 pounds and measure from 70 to 75 inches in length.

In addition to being smaller and lighter, females have narrower skulls and lower foreheads. Young adult males are longer in the leg and are generally rangier-looking than young adult females. Some longtime observers say females have longer hair on their backs, while males have longer hair in the feathering at the back of the forelegs. The hair of older animals is often shorter, with more dark skin showing through on the snout. Eskimos make a fine distinction between male and female tracks, not merely on the basis of size—a male's paw may be 13 inches long and 9 wide—but because of faint marks left by longer hairs around a male's foot and because of the female's slightly more pigeon-toed track.

A polar bear walks in a way all its own. Coming toward you, the front legs appear to swing out to the side and the huge paws to fold toward the body like paddles, until they flick forward and are set down. The back feet appear actually to kick the front feet forward, they come so close to meeting. From the rear the walk appears bandy-legged, a trait most evident in mature males. The front legs seem long because the chest is shallow, the cleft between the legs extending into the neck. The rear legs, in fact, are longer. Viewed head-on, its hips stick out past its shoulders. From the side, from above, or from the front the bear is wedge-shaped, a form that emphasizes the sinuous movements of its long neck.

A bear walks at about 2.5 miles per hour. When it trots, it paces, moving both legs on one side of its body forward in the same motion. Over short distances—charging a resting seal—it moves in a quick bound at nearly 25 miles per hour. Over any distance, females and cubs tend to outdistance males.

Bears move with a supple agility, seeming to flow over steep, complex obstacles like sea-ice pressure ridges. They also have tremendous strength and dexterity. The same bear that pries tiny thalia from a kelp strand with a single claw can knock a

belukha whale senseless with a blow from its foreleg. Deft and quick enough to snatch a lemming from the grass, it can also flip a 400-pound bearded seal into the air.

The ivory and pearl shading we see in a polar bear's fur is caused by the refraction of sunlight (the same phenomenon that makes clouds appear white) in its guard hairs. The hair itself is optically transparent, or colorless. The brightest whites show up at the spring molt, the purest of these being those of young cubs. With exposure to sunlight, the hairs take on a subtle coloring; soft yellowish tones appear on the hips, along the flanks, and down the legs—a pale lemon wash, apricot yellows, cream buffs, straw whites. The tones deepen each year as the animal ages. In the low sunlight of a fall afternoon an older male's fur might suggest the yellow golds of ripe wheat.

A polar bear's fur is like that of no other mammal. An early mystery about it was that it seemed a relatively poor insulator compared with wolf or caribou hair; too, unlike beaver fur, which traps a layer of air between skin and water, polar bear fur loses 90 percent of its insulative value in water. Polar bears, it turned out, depend instead on a layer of blubber to keep them warm in the water (which conducts heat away from the body at about twenty times the rate of still air). On land, the bear is protected by a thick underlayer of dense wool and a relatively open layer of guard hairs about six inches long. These guard hairs are so hard and shiny they appear synthetic. They are also hollow, which means that a polar bear's fur stays erect and doesn't mat when it is wet. Also, because of the open spacing and smoothness of its guard hairs, a bear can easily shake free of water before it freezes. (He also rolls in snow, an excellent blotter, to daub off moisture—as do people who accidently fall through the ice.)

A second function of the bear's hollow hair, a key to understanding how it might stay warm on land, was discovered by accident. White bears show up poorly when photographed from the air against white snow and ice. In the late 1960s, an American scientist, reasoning that a mammal should give off more heat than

sea ice, tried infrared photography, but polar bears proved too well insulated to appear on the film. The only bit of black the film recorded was in the polar bear's tracks, which were warm for several minutes after an animal passed. (Polar bears get rid of excess body heat through their claws and footpads.) He next tried ultraviolet-sensitive film. Bears absorbed light in those wavelengths and finally appeared black on the white ice, and this led to the second discovery: polar bear guard hairs work like light pipes. They funnel short-wavelength energy from the sun to the bear's black skin, where it plays an as yet incompletely understood role in the bear's complex system of heat regulation.*

POLAR bears apparently moved into the Arctic only very recently, sometime in the middle or late Pleistocene. A population of brown bears, the prevailing theory goes, became isolated in Siberia and quickly evolved into polar bears. (The rate of evolution here is apparently astonishing. Polar bears now even show consistent variation in size within their own populations, being typically very slightly larger as one moves westward from the east coast of Greenland, reaching their largest size in the Bering/Chukchi Sea region.) The genetic distance between polar bears and brown bears, however, is not so great that they can't produce fertile young together (offspring capable themselves of reproducing).

* As commonly experienced in zoos, a polar bear's color, as well as its bulk, can be misleading—and the bear's hollow guard hairs can play a strange part in the overall distortion. Blue-green algae living in freshwater pools in zoo enclosures can migrate through a polar bear's damaged guard hairs and bloom in the hollow spaces within. Bears afflicted in this way, as they have been recently in zoos in San Diego and elsewhere, appear green to visitors. The disinfectants and cleaners used by zoos and circuses and the chemicals used to tan polar bear furs for rugs take much of the delicate shading out of the fur. The bears' true appearance is further compromised when they are kept in climates where they produce neither a substantial layer of blubber nor heavy winter coats. With so much of their dark skin showing through, they seem barbered and gaunt.

And their blood chemistries are still quite similar. But they are markedly different animals.

Brown bears, including the *grizzly* bear, are terrestrial creatures. They live largely on vegetable matter and have clear enough spatial images of their territories to defend them. The polar bear lives almost exclusively on meat. Its "territory" is something it carries with it over the ice. The difference in diets is evident in an examination of the teeth. The polar bear's are those of an ambusher and a flesh eater—long canines, smaller, shearing molars, vestigial premolars, and incisors that angle forward, enabling the bear to use them like a pair of delicate clippers. The brown bear's canines are shorter, and its molars and premolars are broader and flatter, adapted to the grinding of vegetation.

The difference evolution has made is also evident in the overall shape of their bodies. Where the brown bear is broad-shouldered and dish-faced, the polar bear is narrow-shouldered and Roman-nosed. His neck is longer, his head smaller. He stands taller than the brown bear but is less robust in the chest and generally of lighter build. The polar bear's feet are larger and thickly furred between the pads. The toes are partially webbed, the blackish-brown claws sharper and smaller than the brown bear's. It lacks the brown bear's shoulder hump and more expressive face, with its prehensile lips, well suited to stripping bushes of their berries.

The remarkable thing, again, is that they have become so different in such a short time. We call them both "bears," but when you see a polar bear surface quietly in a lead, focus its small brown eyes on a sleeping bearded seal, draw breath soundlessly, and submerge without a ripple, you wonder at the insouciance with which we name things.*

* * *

* A "lead" (pron. leed) is a passage through sea ice navigable by a surface vessel such as a kayak. Smaller fractures are called cracks.

WHEN the five polar bear nations embarked on the IUCN's program of cooperative research, each nation, by mutual agreement, went in a slightly different direction. The Americans and Norwegians pioneered techniques of marking bears and then later relocating them, establishing the broad boundaries of discrete populations. The Americans also began developing a technology for electronic tracking. The Canadians looked at general hunting behavior and at the bear's relationship with the animal it is most dependent on for food, the ringed seal. The Norwegians, with Canadian help, also began investigating the bear's physiology. The latter work, conducted at a laboratory at Churchill, Manitoba, was carried out by Nils 0ritsland with live-trapped bears from the southern Hudson Bay population.

0ritsland quickly uncovered a number of fascinating things. Because bears climb in and out of the water regularly, they have special heating and cooling problems. Eventually, 0ritsland discovered that the bear's basal metabolism was adequate to keep it warm in all seasons under a variety of conditions. He also determined that their winter pelage provided adequate protection in temperatures as low as —4O°F with a 15-mile-per-hour wind. (Laboratory results are always somewhat problematic because they oversimplify. In the field bears tend to lie down in the leeward protection of drifts and pressure ridges or to dig temporary dens in —i5°F to —2O°F weather with 15-mile-per-hour winds.)

The bears' only "problem," 0ritsland found out, was getting rid of the heat produced by working muscles. They do so, 0ritsland learned, by increasing blood flow to their footpads and claws, to their snouts and legs (the least insulated parts of their bodies), and, most remarkably, to two unique sheets of thin muscle that lie across the bear's back behind its shoulder blades, between the skin and a layer of blubber. Blood shunted to all these areas either radiates heat off into space or comes into contact with previously cooled blood, which it warms in countercurrent or heat-exchange systems. When the core temperatures of bears in 0ritsland's

experiments began to climb above 101.6°F, their heartbeat increased from a resting pulse of about 45 per minute to as high as 148 per minute, and they switched from a pattern of regular breathing to rapid, shallow breathing (panting) to bring cool air to the lungs.

Bears do not overheat when they are swimming, so they will also jump in the water to cool off. And eat snow.

It is its layer of blubber that causes a polar bear to overheat so easily. The blubber is heaviest on the outside of the back legs and over the buttocks and lower back, where it may be as much as 4.3 inches thick. Lesser amounts are on the upper body, front legs, and neck. Polar bears depend on their blubber for warmth, especially in the water, and for nourishment. During the five months a female is hibernating, giving birth, and nursing her cubs, she lives entirely on her fat reserves. Bears waiting out storms in temporary dens and bears ashore waiting for sea ice to form in the fall do the same. This regimen is such that in southern Hudson Bay denning females may come ashore weighing 750 pounds in early August and emerge from their dens in April weighing only 350 pounds. Similarly, males coming ashore in late summer may lose 30 percent or more of their body weight in the three months that pass before ice forms and they are able to hunt on the sea ice again.

During the summer, especially on the tundra of the Hudson Bay coast, bears dig summer sleeping pits to get out of direct sunlight, sometimes digging down to the layer of permafrost to cool off. When trying to sleep in warm weather, they often roll on their backs in order to expose their bellies and feet. In cold weather they hug their back legs to their stomachs with their forelegs, curling tight to bury their heads in their chests, where they breathe warm air with their backs against the wind.

0ritsland's experimental findings have a certain attractiveness because they simplify and provide numbers. To watch polar bears in the wild, however, is to marvel at the intricacy of their physiology and behavior. The animals alternately seek shelter or exposure, sleep and travel, hunt down certain foods, and mate and hibernate. The interplay here among rest, exertion, and nutrition that carries them comfortably through life is something that cannot be broken down into pieces. Like the skater's long, graceful arc, it is a statement about life, the full exercise of which is beautiful.

THE bears that are successful, that respond with insight to new circumstances, that do the right thing at the right time, season after season, may live to be thirty. Beyond learning how to secure food, the most intriguing aspects of their behavior are the steps female bears take to ensure that there will be more bears.

Before she dens, usually in late October or early November, a female bear must put on a heavy layer of fat to sustain herself (and her cubs) until she emerges to hunt again in the spring. If the weather doesn't turn stormy and food is abundant, a female might den late. If little food is available, she may decide not to den at all that year. In the face of early storms that keep her from feeding, she may make a temporary den, wait out the weather, and then decide what to do. Polar bears conceive during the female's three-week estrus in April and May, but the fertilized eggs do not implant in the uterine wall until much later—some speculate at the moment the female commits herself to a long denning period, which only females carrying fertilized eggs do.

Bears are as particular about the type of snow they select for a maternity den as Eskimos are in constructing an iglu, and the two structures have many features in common. The female usually chooses a site where snowdrifts develop in early autumn, often close to the top of the leeward side of a ridge. Midwinter storms are not likely to expose a den built there, nor is the den likely to be buried in an avalanche. The variety of structures denning females build is great, but they share a certain architecture: an entrance tunnel 5 to 10 feet long and 24 to 28 inches wide and high; a small room at the end of the upward-sloping tunnel, just big enough for the bear to turn around in; and a ventilation hole.

By designing for the flow of air and controlling the thickness of snow, an excellent insulator, a female can keep fresh air moving through her den all winter and maintain the temperature at about 32°F, no matter how cold it gets outside. She does this by radiating a small amount of heat, about as much as a 200-watt bulb, and by trapping that heat in the den chamber with a sloping entrance tunnel and an air dike, or sill, where the tunnel enters the den. She also adjusts the thickness of the roof. (Eskimos put the same techniques to use.)

The female is not actually hibernating during the winter. Her heartbeat and rate of respiration are greatly reduced, but her temperature falls only very slightly. She can awaken and become alert in moments. If her den gets too warm, ice will form on the walls, cooling the chamber and inhibiting the exchange of carbon dioxide and oxygen through the snow walls. The bear may then scrape off the ice and adjust the ventilation, or dig a new chamber adjacent to the old one. J0rn Thomassen, who has watched denning bears in Svalbard for several years, speculates that some females are more successful than others at designing and maintaining these structures, and that older bears, learning from their own mistakes, subsequently build dens where the exchange of gases, the conservation of heat, and, later, the expansion of the den to allow the cubs to exercise before they emerge, are accomplished with more economy.

Dens are very clean. By metabolizing fat instead of protein, the female produces very little body waste. Except for a mouthful of snow now and again, she also draws all the water she needs from her fat reserves.

Cubs, usually two but sometimes one or three, and very rarely four, are born sometime in December or early January. They are blind, deaf, poorly insulated, and unable to walk or smell. In their first weeks they are dependent on three things for survival: the protection of the den, the warm crevices of their mother's body, and her rich milk. (Polar bear milk has the consistency of cream. Those who have tasted it say it tastes like cod liver oil and

smells of seals or fish. It is richer than whale milk and higher in protein than seal milk.) Again, it is only with the protection of a well-made den that a female can conserve and direct her metabolism to produce the heat and milk that her cubs need.

The cubs are so small at birth, barely a pound, that the female can hide one in the rolled toes of her front paw. At about twenty-four days they can hear, and a week later they are able to see. It is several more weeks before they can walk and smell. By late March or early April the cubs weigh about 25 pounds, and the female, depending on the weather and the cubs' condition, breaks out of her den. For the first days she might just sit drowsily in the sun at the den entrance. Or roll in the snow to revive her coat. Or nose about in a desultory way, looking for grasses and lichens to nibble.

A well-placed den entrance will be protected from the wind and directed in some measure to the south and west to take advantage of the sun's afternoon warmth. Cubs venture forth onto this sheltered sun porch a few days after their mother and for the next few weeks do not travel far at all. Their mother often nurses them here in a sitting position in the sunshine, with her back against a snowbank. The cubs lie on her belly. While they nurse she may put her head back and stare at the sky, or roll her head slowly from side to side, or rock her cubs gently in the cradle of her forelegs.

These first few weeks are a critical time for all three animals. The female balances her desire to leave in order to hunt to feed herself against an investment in the cubs' learning, exercise, and preparation for travel. For most bears the sea is no more than a day away. For others, like those denning on the southern coast of Hudson Bay, the journey is much longer and requires making temporary dens along the way.

Rasmus Hansson and J0rn Thomassen, who have watched more bears emerge from their dens than probably anyone else, studied bears for several years at a traditional denning area called Bogen Valley, in Svalbard. Most of the bears there den in a long

line just below the ridge of Retzius Mountain. (In spite of this density it is very rare to see two families outside their dens at the same time. How the females manage periods of exercise so as not to interfere with each other is not known.)

Since portions of the southwest face of Retzius Mountain slope at an angle of 70^0, the first problem cubs face there is getting down to the floor of Bogen Valley. They learn to imitate their mothers, who slide down rump first, looking over their shoulders and braking with their claws; or on their sides, leading with all four feet; or headfirst on their bellies. Mothers at the bottom catch cubs veering out of control.

In those first few days outside together, say Hansson and Thomassen, the females tend to rest while the cubs exercise vigorously. The cubs pick up blocks of ice or snow, which they then throw and chase or wrestle with violently, biting and chewing like cats. Cubs also stand up to swat at each other and roll over thrashing and neck-biting in the snow. In analyzing the cubs' behavior, the two Norwegian scientists concluded that the cubs were developing in three areas: strength and coordination; social habits and communication skills, which would permit the female and her cubs to live and hunt together efficiently during the next two years; and fighting techniques. In the future the latter would serve males in their battles with each other during the breeding season, and females in the defense of their own cubs. (Male bears, according to some researchers, will try to kill any cub they encounter, especially if the female offers a weak defense.)

When cubs reach some threshold level of strength and coordination, when they are able to walk well and are responsive to their mother's instructions to "stay" and "come," the bears depart from the den. The time of all three having to live solely on the stored fat of the female is nearly over.

THE Polar Eskimos of northwest Greenland call the polar bear *pisugtooq,* the great wanderer. On the basis of mark-and-recapture studies and radio-tracking information, scientists have determined

that individual bears wander largely within a local area; but some, indeed, are long-distance travelers. A polar bear tagged in Svalbard, for example, showed up a year later near Nanortalik, Greenland, 2000 miles to the southwest. Another bear, a female, traveled a straight-line distance of 205 miles in two days. Polar bears have also been found far afield in unlikely places, at the crest of Mount Newton in Svalbard, for example, 6600 feet above sea level, or 30 miles inland on the Greenland ice cap. An American crew on the ice island Alpha saw a female and her cub at 84°N in December 1957. (She had become entangled in runway lighting, which she tore out moments before a plane attempted a landing.) A Russian ice-island crew spotted a female and her cubs a little more than a hundred miles from the Pole in the summer of 1937.

Because we think of polar bears as northern animals, and of "the North" as an area that doesn't extend very far south, it is somewhat surprising to discover that bears den at only 53°N, on Akimiski Island at the southern end of Hudson Bay. Or that bears still turn up occasionally on the east coast of Newfoundland as far south as Saint John's. Some stories of their wandering have an esoteric perseverance and loneliness about them. In 1938, for example, an aging female was shot far inland in the province of Quebec, near Peribonka on Lac Saint-Jean. She had apparently ascended the Saguenay River from the Gulf of Saint Lawrence and was headed for James Bay, some 360 miles farther north.

Once, looking up from the sea ice at the coastal cliffs of Devon Island, Ray Schweinsburg, a Canadian polar bear biologist, said to me, "I used to think the land would stop them. But I think they can cross nearly any terrain. The only thing that stops them is a place where there is no food."

The bear is a great wanderer not solely because it travels far, but because it travels with curiosity, and tirelessly. The Eskimo hunters in Greenland mean that it covers the ground successfully and intelligently when they pronounce the word *pisugtooq.*

Eskimos, long-time, keen observers of the polar bear, have advanced other thoughts about polar bears that science has treated

with skepticism, and in some quarters with cynical disdain. Eskimos widely assert, for example, that most polar bears are left-pawed, that if one must leap in desperation from a charging bear it should always be to the bear's right.* Eskimos have also asserted that polar bears push blocks of ice ahead of them as shields when they are stalking seals; that a wounded bear will staunch the flow of its blood with snow; that they will hurl ice and rocks at walrus to wound and distract them, hoping to snatch an unprotected calf; and that females use anal plugs when they den.

Refuting any of these things is a complicated business. It becomes not only a denial of the integrity of the person telling the story, but a denial of the resourcefulness of the polar bear. Too, because of poor translations, you might end up refuting something that was never meant. The best field biologists, with a fundamental grasp of the animal's behavior, take the attitude that these things could happen, though they themselves have not seen them. The anthropologist Richard Nelson has offered succinct advice on this issue. "Eskimos," he writes, "are highly reliable observers of animal behavior, and many of their least believable statements have been proved to me by personal observation." Some scientists strongly resisted the notion that bears might use tools until a Canadian biologist found evidence in 1972, on the north coast of Devon Island, that a female with two cubs had smashed in the roof of a ringed-seal lair with a 45-pound piece of ice. Scientists have also found that bears intentionally stalk small prey like lemmings, which Eskimos have long claimed they do. And that a polar bear will hunt sea ducks by coming up underneath a flock of them in the water like a killer whale.

One of the most persistent of bear legends—that they cover their dark noses with a paw or a piece of snow when they are stalking a seal—may have originated with Eskimos, but the thought

* On the basis of this, Greenland Eskimos object to the depiction of a polar bear extending its right paw on the official seal of the Royal Greenland Trading Company as inaccurate.

has the flavor of invention about it. At a distance of 1000 yards, the argument goes, you can barely distinguish a polar bear on the sea ice, but you can clearly see its black nose. How could a seal not notice it? It's possible that it does—and that that is exactly what the bear intends. To a seal, a polar bear approaching in a straight line over flat ice, its lowered forequarters sliding along ahead of its hindquarters, would show very little body movement—the pushing motion of the rear legs does not break the outline of the hips. If the seal focuses on the dark nose, the bear's shape falls into vague relief against the surrounding ice. And at that distance the nose looks like another seal resting on the ice. Because of an optical phenomenon, the size of the bear's nose does not begin to fill more of the seal's image of that part of the sea ice until the bear is almost on top of the seal. And at that point the bear rises and bounds toward it.

It is possible the bear goes down on its forequarters only to keep the horizon from showing up between its legs; but it is also possible it wants its dark nose down there on the ice where it looks like a seal. Without direct evidence, without setting up an experiment, one can only speculate.

The desire to verify conjecture, to witness spontaneous, unstructured events in the wild, is of course very sharp among field biologists. Nothing—no laboratory result or field-camp speculation—can replace the rich, complex texture, the credibility, of something that takes place "out there." And scientists working in the field know that what they see in the field always has the potential to contradict what they have read or been told.* One-time events, like seeing a polar bear stalk and kill a seal in open

* In a recent laboratory experiment, polar bears were declared "inefficient walkers" because they overheated on a treadmill. An experienced polar bear biologist smiled when I asked him about this. "The bear can't walk properly on a treadmill. . . . Walking into the wind, making that great pendulum swing of his legs, opening and closing his body to the cool air, you don't see that on a treadmill. Out on the sea ice you see he can walk a long way without overheating."

water (some biologists doubted this ever occurred, until one of them, Donald Furnell, and an Eskimo companion, David Oolooyuk, saw a bear do so in 1978), may be of no *statistical* importance. It may not be possible, in other words, to generalize about all bears from these incidents. But such events emphasize the resourcefulness of the individual bear and the range of capability in the species; or they may reveal an unusual technique widespread only in a certain population. These events underscore something critical in the biology of large predators: the range of capability in the species. No matter how long you watch, you will not see all it can do.

Once, in a helicopter flying along Barrow Strait, Ray Schweinsburg and I saw a lone bear headed south across the ice. "I'd like to follow him," Schweinsburg shouted over the engine noise. "I'd like to go down there and just follow him." And he rolled his eyes and smiled at the impossibility of it.

I looked out the window, at the hundreds of square miles of ice that lay ahead of the bear. Even if it were possible to follow, I thought, how well could we put together what we saw? What would we miss out there? I remembered again the desert writing of Wilfred Thesiger, wandering in the Empty Quarter with his Bedouin companions. The Arctic reminds one of the desert not only because of the lack of moisture and the barren topography, but because it puts a like strain on human life. It favors tough and practical people, people aware of the vaguest flutter of life in an environment that seems featureless and interminable to the untrained eye. People with a predator's alertness for minutiae, for revealing detail. The loss of "a native eye" among civilized cultures has been commented on by people as diverse as Vladimir Arseniev, writing about the Manchurian native Dersu Uzala, and Laurens van der Post, writing about Kalahari Desert people.

It not only takes a long time of watching the animal before you can say what it is doing; it takes a long time to learn how to watch. This point is raised, deferentially but repeatedly, in encounters with Eskimos. They are uneasy, they manage to say, about

the irrevocability of decisions made by people who are not sensually perceptive, not discriminating in these northern landscapes, not enthusiastic about long-term observations. When I hear these points made, my instinct is to nod yes; but it always causes me to reflect on something else—how dependent we are on Western field biologists to tell us fully and accurately what the animals did while they were there. How we hope they regain some approximation of "the native eye" in their studies.

The bear I was watching disappeared, cut off by the door frame of the helicopter.

To follow a bear, or simply follow in its tracks, is to *"reeeally* learn something," as the Eskimos say, smiling. Not only about where a bear went, but how it dealt with what happened along the way. A set of tracks might show where a bear had leaped into the air and come down headed in another direction—and you would look around for evidence of what surprised it. The trail of a cub alongside its mother disappears where it has crawled up onto its mother's back for a ride on a cold day. Bear tracks on the sea ice might follow the line of a pressure ridge (where seal lairs are likely to be) at a distance of 100 feet or so on the downwind side. Fresh tracks turning into a fiord might make no sense until you saw a bird rookery, beneath which the bear had scavenged dead birds. A male's tracks might cross a female's and turn to follow. Another set of tracks might turn suddenly and continue in an unerring line, and an aglu, a seal's breathing hole, would be there at the end, with signs of the bear's patient waiting. Tracks below a high bluff would show where a bear had hunted on a July morning, out of the sun.

The wide walk of a fat bear in June, you would see, differs from the walk of a thin bear in October. Bear tracks would show a consistent avoidance of deep snow; in spring they would not cross melt pools, where needle ice can puncture a bear's foot. On a sheet of sea ice so thin it would not support a human step, you would see traces where a bear had crossed with skating steps like a water strider, sprawled nearly on its chest.

These signs reveal that the polar bear lives in an olfactory

and a visual landscape, and that it is attentive, especially in summer, to a thermal landscape. It looks for cool places.

From following hundreds of such tracks, polar bear biologists have developed certain impressions. Males keep largely to the coasts in summer, while females with cubs and subadults are more apt to travel overland from place to place. Bears make use of mountain passes, ravines, and other features of the land in such a way as to suggest that these are traditional routes across isthmuses as well as occasional one-time shortcuts around an area of bad ice or open water. (To take a shortcut, a creature must have a map in its head of where it is—memory is no help. How bears create and use such maps is one of the most intriguing of all the questions about them.)

Beyond using celestial clues and a knowledge of prevailing winds and currents, which reliably guide Eskimos across the angular topography of shifting sea ice, no one knows how bears find their way. But they consistently travel directly to aggregations of seals; they return to core denning and breeding areas every year; and they find their way unerringly to the coast from hundreds of miles offshore. This would be astonishing enough if they only did it on land, where there are perennial landmarks, but they also do it at sea, where a frozen landscape is created anew each year, where it can change from one day to the next with the sudden rise of a new pressure ridge or the opening of a lead, with a shift of pack ice in the currents. In some areas of stable ice, bears may travel for weeks without seeing a break in the continuity of the sharp blue line of the horizon, with only "the infinite expanse of the frozen plain, the infinite dome of the cold blue sky, and the cold, white sun" before them.

Gathering ground to themselves. Navigating. Wandering with purpose.

THE large black nose pulls cool air continuously across the nasal membranes, straining it for scent. The female bear climbs on top of an old piece of multiyear ice and rises on her hind legs to scan

the ice fields beyond. She shields her eyes against the brilliant JVlarch light with her paw. She goes on. Partway across a refrozen lead the bear pauses motionless, one paw off the ground. Her head tilts and the small ears pivot independently. She puts the paw down. She sniffs the air at several levels, then the head is still, the attention fixed. She has found *netsik.* And *netsik,* somewhere beneath the snow and ice of Viscount Melville Sound, knows, perhaps, that *nanuq* has come.

The relationship between the hunted animal and the hunter has only recently come to be studied with the same intensity that biologists have brought to the study of the isolated life histories of the individual species. A Canadian polar bear biologist, Ian Stirling, has added greatly to a Western understanding of the polar bear by combining his study of bears hunting seals with a study of ringed seals and ice dynamics. In the spring of 1974, Stirling, with the help of ringed-seal biologist Tom Smith, was able to explain a peculiar sudden decline of the polar bear population in Amundsen Gulf. In the winter of 1973-74, he said, little snow fell in the area —too little to permit seals to excavate their snow lairs on the ice except in a few isolated places. Also, the ice itself remained stable and unbroken in areas where there were usually leads in winter. Perhaps the solid ice also affected concentrations of the seals' food. At any rate, a number of seals moved out (one of Smith's tagged seals moved all the way to Cape Dezhnev, Siberia), very few seals made birth lairs, and many bears either starved or moved on. Because, in essence, it didn't snow enough that year.

The ringed seal that the polar bear habitually hunts is a small marine mammal completely at home in the sea ice. Its short snout and large eyes suggest a cat's face, though its sleek head is earless. Its short-necked, broad-shouldered, barrel-chested, tapered body is like that of its relatives, the harp, ribbon, and spotted seals. Like them, too, the ringed seal is awkward out of water because its hind flippers don't pivot forward like a walrus's or a sea lion's to help it walk.

Ringed seals are the most abundant large mammal in the Arctic

—the Russians estimate a minimal population of 2.5 million—but they are relatively unsocial, rarely gathering in dense numbers. The young are born in snow-covered lairs on top of the ice in early April. Eight to ten weeks later they are on their own. Adults breed in late April and early May, at about six years of age. They feed, interestingly, at two levels of arctic marine food chains, consuming both fish in the cod family and the zooplankton those fish feed on. Differences in age at weaning—if the ice breaks up early a pup is not nursed as long—partially account for the variety of size in ringed seals. An adult may range from 40 to 60 inches in length and weigh from 80 to 250 pounds. During breeding, nursing, and molting, ringed seals feed lightly and may lose as much as 30 percent of their body weight. They are also territorial at this time, sometimes so aggressively defensive around their breathing holes that young seals who have crawled out on the ice through the wrong hole are kept at bay by another seal in the water until they are frozen out.

Among many questions about the ringed seal are how it finds food beneath the ice in the darkness of winter and how it "remembers" the location of its breathing holes, particularly after a deep dive in ocean currents.

A ringed seal is most vulnerable to the polar bear when it surfaces to breathe. When it is hauled out on the ice it is unusually vigilant, looking up for six or eight seconds every twenty to thirty seconds, and napping so close to its breathing hole that it can usually escape. Seals in birth lairs and males and nonbreeding females in haul-out lairs under the snow present another set of circumstances, to be considered in a moment.*

From the polar bear's perspective, the seal is a swift, alert animal that can be taken advantage of only at that moment of vulnerability—when it breaks the surface of the water to draw

* Marine mammals that have crawled up onto the sea ice or come ashore are said to be "hauled out." A snow cave dug out by a seal above its aglu as a concealed place of rest is called a haul-out lair.

breath, or when it is hauled out. Bears stalk seals over the ice or approach by swimming quietly toward them. The patience and judgment evident in these stalks can rivet a human observer's attention.

The bear we left hunting on Viscount Melville Sound had heard a seal surfacing in its snow cave, a muffled tinkle of water at its aglu as it pulled itself out. The bear's footfalls are nearly soundless as it approaches—the hair between its footpads muffles the crunch and squeak of snow. The bear pinpoints in her mind the spot where the seal now rests. When she is 20 feet away—she pauses ten seconds at one step, fifteen seconds with another step, ears twitching to detect the seal's movement—she lunges, comes slamming through the snow roof with all four feet centered precisely over the aglu. The seal is cut off, finished.

Sometimes all it takes to break in the roof of a seal's lair is a single calculated blow of the 40-pound paw. But these are stout structures, and the bear may be forced to dig. Perhaps once in five times, overall, it is successful. It understands precisely, however, where in the chamber the aglu is, and its explosive entries into seal lairs of all kinds are almost invariably centered at that spot.

Probably no other predator employs as many hunting strategies with one animal as the polar bear does with the ringed seal. It may take a half hour to patiently approach a seal resting on the edge of an ice floe, surfacing quietly to reconnoiter, then submerging again. A bear may drift toward a seal like an innocuous piece of ice; when it reaches the floe edge it explodes from the water and smacks the seal dead all in one motion. When it stalks seals over the ice, it flattens itself on its forequarters and slides along slowly on chest and forelegs, taking advantage of every piece of cover. It will scrape away the sea ice at a breathing hole until there is just a thin layer left, and then cover the ice with its body to cut off sunlight, so it looks to the seal below as if the thick crust of ice and snow is still present. It will build a snow Wall to hide behind while it waits at an aglu. And it will rise up suddenly in a resting seal's own aglu.

Stirling, who has watched them hunting for more than 2000 hours in the field, emphasizes several points about bears. First, the bear is only occasionally successful. The overall hunting success in any particular situation, considering the variety of ice cover, the number of seals present, the time of year, the age and sex of the bear, and the age of the seal, might range from 2 to 25 percent. The highest rate of success for a technique that is persistently applied, in Stirling's view, is the patient wait at an aglu for a seal to show up. (The bear can tell from small details of ice accumulation and sometimes by catching a whiff of seal odor whether the aglu has been used recently enough to make waiting worthwhile.)

Older bears, especially, have exceptional patience. They will wait for three or four hours at an aglu, lying downwind of the hole on their chests, out of the seal's line of sight. To stretch its muscles a bear will sometimes rise to sit or stand up quietly, ready to drop again soundlessly if it hears a seal.

Just before it surfaces, the seal exhales, and the sight or sound of the bubbles alerts the bear. The seal rises headfirst up a cone-shaped tunnel to its breathing hole, which, on smooth ice, appears as a low mound. A small amount of water forced up ahead of the seal splashes out on the ice and freezes. (The seal keeps the tunnel open and the aglu from freezing over completely by scouring with its claws.) The bear must time its strike perfectly and move with exceptional speed. It usually strikes with one or both paws and follows so quickly with its snout that if the smashing blow of its paws doesn't kill the seal, the impact of its snout will. "Everything cooperates," writes Frans Van de Velde, "—paws, claws, snout, and teeth—to give a blow that is so rapid that the seal has hardly a chance of getting away."

When it charges a basking seal, the bear does not seem so much to run as to pounce. Thor Larsen, a biologist who has observed polar bears in Svalbard for more than fifteen years, when I asked him about their hunting behavior, said, "Cats. They are like big cats." Fast? "It is absolutely unbelievable how fast they

are—oh, do they come fast." Shrewd? "Yes. They are making judgments at every point about what to do. And they are patient."

Larsen, Stirling, Dennis Andriashek, Schweinsburg, and other polar bear biologists with long field experience often comment on the bear's seeming ability to analyze an unfamiliar situation and attempt a practical solution; on its ability to learn quickly when confronted with something new; and the novel approaches bears take to commonplace situations. "They are smart," says Larsen, "and precisely because they are, they sustain all the legends about them doing these extraordinary things, like using tools and moving blinds along ahead of them."

Bears prey on an impressive range of animals, each of which requires something different of the bear. They hunt spotted and ribbon seals in the western Arctic and harp seals in the eastern Arctic. The large bearded seal and hooded seals off the coast of Greenland are much stronger quarry. In leads and at savssats, bears prey on belukha and narwhals.* Bears prey heavily on bearded seal pups and kill an occasional muskox, walrus, dozing hare, or goose caught flightless during its molt. They eat bird eggs, seaweed, varieties of tundra berries. And carrion. (A bear can live for months on a bowhead whale carcass or beach-cast walrus.) The bear also leaves carrion in its wake; and here lies an interesting aspect of its ecology. An adult bear in good health will usually eat only a ringed seal's blubber, leaving the rest behind for a retinue that never seems far off—the arctic fox, glaucous and Thayer's gulls, the shier ivory gull, and the ubiquitous raven. (In winter arctic foxes live far out on the sea ice, entirely dependent on scavenging polar bear kills for their survival.)

* Savssats occur most often in fiords, where a band of sea ice too wide for marine mammals to swim under on a single breath cuts them off from the open sea. As the fiord continues to freeze over, the animals, often hundreds of narwhals and belukha, are restricted to a smaller and smaller opening in the ice for breathing. If the ice doesn't break up or recede, the trap is fatal.

When a female with cubs makes a kill, on the other hand, the family normally consumes the whole seal carcass. But they also scavenge carcasses left behind by the adult males. While it is not clear how, it is evident that sharing these kills is critically important to a healthy polar bear population.

Polar bears are neither gregarious nor social, in the sense that, say, wolves or cheetahs are social. Their repertoire of body language and vocalizations seems limited, used largely to communicate a desire to avoid each other. When they are seen, they are usually seen alone—a single male or female, or a female with her cubs. They gather together in special circumstances, however, and some of these assemblies are memorable.

In 1874 two American observers saw between 250 and 300 polar bears together on Saint Matthew Island in Bering Sea, placidly "grazing and rooting about like hogs in a common." (A ship's captain who saw polar bears ranging together in a lush coastal valley in eastern Greenland likened them to sheep pastured in an English meadow.) At Cape Churchill, Manitoba, in September and October great numbers of bears are milling about waiting, like the Saint Matthew bears, for the formation of sea ice, so they can quit the coast and a life of sleeping and browsing in these summer retreats.

Food draws bears together in at least two ways. When a single bear finds a good seal-hunting ground, ten or fifteen other bears are likely to show up at the same place within half a day or so. Somehow they know. Savssats and beached carrion also draw bears. In 1980, scientists counted fifty-six of them at a bowhead whale carcass on the Svalbard coast. Larsen says scientists don't have an explanation for how bears get wind of these things. Odor likely plays a role, but bears come in from all directions and some from very far away. "They just get to a place where something is happening," says Larsen, "and they get there quickly."

Bears seem to pay each other very little mind under these circumstances. They feed, interact very little with each other, and go on their way. It is a different situation entirely when a female

with cubs encounters a lone male. She runs away immediately. Or when two males meet each other on the track of a female in estrus. The ensuing fights can be violent and protracted. (Fighting among males is so common that it is a rare male past the age of six that doesn't carry facial scars from these encounters.) On the other hand, a little-understood pairing apparently occasionally occurs with young male bears who become hunting and traveling companions.

The enduring social unit is a female and her cubs. They are usually together for two years, during which time the female teaches the cubs to hunt. Their social interaction is constant and intense. Older bears infrequently make sounds—they hiss loudly, growl, and champ their teeth when they are irritated; and when they are very agitated they make a soft chuffing sound. Cubs, on the other hand, have an impressive vocal repertoire. When they are around human observers they hiss, squall, and whimper, make a wet, popping sound by smacking their lips, and emit throaty rumblings. Scientists guess that their mothers communicate with them vocally—perhaps using only a few simple sounds. One could be a version of the adult's chuff, a quiet, repetitive call "easily located in space but not traveling far," used to warn her cubs away from danger—an approaching male, rotten ice, a rabid fox.

Somehow the female must control her cubs until they can feed themselves, if for no other reason than that they can so easily disrupt her own hunting, on which they all depend. (One scientist suggested to me that females solve this problem by walking the cubs until they are so tired they curl up together to sleep. While they rest, she hunts.)

Young bears apparently understand the basic skills of stalking and still-hunting, but require practice. Perhaps their mothers also provide some instruction by creating opportunities for them; and perhaps they learn a good deal by watching and imitating. Their initial attempts to catch seals are frantic and impatient. A young bear may give up its watch at an aglu after only ten minutes. Or charge wildly across an ice floe and dive headfirst into a lead in

pursuit of a seal. As with other predators, an acute sense of need plays a crucial role in the determination to succeed. For cubs-of-the-year (coys) and yearlings, mother will provide.

Polar bears have relatively few young, but they put a great deal of time and energy into raising and protecting them, which ensures that most of them will survive. When they are between twenty-four and twenty-eight months old, usually, the family breaks up and the cubs are on their own. The female often mates again. The cubs may stay together for a while, but then they, too, separate. At this point, the survival of *Ursus marithnus* hinges on learning to live alone. And among all age classes of bears, it is those in this transitional stage that suffer the greatest mortality.

Charles Jonkel, a biologist, summarizes the situation that faces a young bear in its first summer alone. First, it lacks experience, an indispensable attribute for a successful hunter. Second, it is somewhat limited in its ability to secure food because of its small size (a large bearded or hooded seal could get away); and it might not have strength enough to break through a seal lair before the seal escapes. Third, it has a pressing need for food, not only for its continued growth, but to build up a layer of blubber on which to draw during lean periods. Fourth, it has to learn to find its way, to comprehend and then remember the relationships between currents, prevailing winds, the position of certain land masses, the trend of coastlines. Last, it must face competition from and conflict with older bears, who may take its seals away.

A female's unique competence lies in figuring out something new and difficult—den construction—in the middle of her life; and in teaching her cubs to survive. What makes the males impressive is their year-round success as hunters (for they are more often abroad in the winter than the female) and their assertive curiosity. Males investigate almost anything they spot on the sea ice. In evolutionary terms this might only be simple resourcefulness. Curious bears may in the end eat more often. The darker side of this is that, today, with the spread of oil camps and the

abandonment of military installations, curious bears are sometimes killed by the things they test.

THERE is a famous object of Dorset art—the Dorset culture flourished in the Arctic between about 500 B.C. and A.D. IOOO—which archaeologists refer to as a "floating" or "flying" bear. The best-known example was found at a site called Alernerk, near the present village of Igloolik on Melville Peninsula in the eastern Canadian Arctic. It is carved from ivory, about six inches long, and dates from about A.D. 500. The bear's head and body are streamlined, the forelegs sweeping back along the sides and the rear legs trailing. The bear appears to be gliding or flying. There is something human in the shape of the rear legs, and it is incised with a stylized skeleton, a backbone and ribs, with the cervical vertebrae and limb joints clearly marked. The underside—the chest and abdomen—is longitudinally concave, suggesting the lack of a body; and there is a tiny compartment with a sliding wood cover in the neck, which apparently once held red ocher.

The Dorset culture, particularly toward its close, may have been dominated by influential shamans who made these carvings. Dorset shamans in self-induced trances "flew away," departing their human bodies for a spirit realm at the bottom of the sea or on the moon. Here they consulted, appeased, and cajoled on their own behalf or on behalf of their patients. They were frequently accompanied on these journeys by powerful helping spirits, and among these the polar bear was without peer. The bear helped the *angakoq,* or shaman, get outside his body so he could fly. (The skeleton carved on the bears is thought to emphasize this disembodied form of travel.)

One of the most interesting things about these carvings is how realistic they actually are. At first I thought they were stylized like modern Eskimo soapstone carvings. After I saw polar bears on the ice, I realized it was instead my conceptions that were stylized. Polar bears strike poses in real life that are but slightly

exaggerated in Dorset and modern carvings—a reminder of the native eye, the kernels of realism that lie within seemingly exaggerated native ideas.

I once asked Ray Schweinsburg about polar bears that went down into the sea, that swam down to the bottom of the ocean with their *angakoq* companions. "Once," replied Schweinsburg, "I saw a set of bear tracks that led up to the edge of a large hole in the ice, where they disappeared. There were no tracks coming out, and there was nowhere else the bear could have surfaced in that floe ice. You can easily understand the view that there are bears walking around on the bottom of the ocean."

And if you have ever seen a polar bear swimming 30 feet below the surface in clear water, watched it stroke and glide, turn and roll down there like a sea otter, you would not wonder that bears could fly.

The artistic and philosophical evocation of the polar bear by Eskimo and pre-Eskimo cultures leads one to believe that their insight derives from a special affinity with the bear. To an extent, the Eskimo and the polar bear are alike, the lines of their successful adaptation to the Arctic being parallel. The prey of both, though not the principal prey of some Eskimo groups, is the ringed seal. Their hunting methods—waiting patiently at the aglu, various kinds of stalking—are strikingly similar. (Polar bears arrived in the Arctic ahead of the Eskimo, and it is likely Eskimos learned, or at least refined, some of their techniques by watching bears hunt.) Some groups of Eskimos move off the land and onto the sea ice in winter, like bears. And after about two weeks at a place where seal hunting is good, the area seems to be hunted out for both sorts of hunter, and they move on. Both make their living at the edge of the sea ice and along the shore. And both live with the threat of starvation if the seals disappear.

Man and bear are affected as well by the vicissitudes of a harsh climate, which seems to give each of them a discernable aura of successful endurance. Anthropologists and biologists turn to the same words to describe each: "tough," "practical," "tenacious,"

"inventive," "a one-time learner." And they note a difference between the two. Bears seem occasionally to lose their temper when they are hunting. "I have seen [a polar bear] watch a seal for half a day," wrote a traveler, and failing to catch it by any stratagem, "it roared hideously, tossing snow in the air, and trotted off." Other observers have seen bears smash off projections of ice or smack the water repeatedly in frustration after just missing a seal. Eskimos rarely lose their temper, and almost never when they are hunting. The usual response to failure in these circumstances is laughter.

The Eskimos' affinity for the polar bear is easy to understand from the parallels in their ecology and the similarity of their dwellings, mentioned earlier; and from knowing the esteem with which Eskimos regard a successful hunter. And from seeing a polar bear stripped of its skin, how disquietingly human its appearance is. But there is something far deeper in their involvement, for each is prey to the other.

The bear fears both the killer whale and the walrus when it is in the water, for it has no lethal leverage there. On land, it is wary of the walrus and of men, too, but it will stalk both. A hungry bear will test the resistance of either. The image of a strong, determined, cunning animal stalking them must have entered the minds of all people who felt their vulnerability out on the sea ice. Over that uneven topography the bear could draw near without ever being noticed. The fear of being hunted is vestigial in us, a dim memory from the open savannas of southern Africa. For a man waiting alone at an aglu for a seal on a winter afternoon, looking around in the half-light, alert at a subconscious and primitive level for the triggering sound of the bear's footfall, the fear must have been palpable.

Bears approached men as though they were a kind of resting seal. Some of these encounters must have ended with a pounce, a single blow, a man dead. But some of them were finished with a seal harpoon or a knife, a bear dead of a fatal miscalculation. Of the latter, some were encounters deliberately courted, by men on the verge of manhood. These were not simply terrifying moments but

moments of awe and apotheosis. These were moments that kept alive within the culture the overarching presence of a being held in fearful esteem. *Torngarssuk*, the Polar Eskimo called him, "the one who gives power."

To encounter the bear, to meet it with your whole life, was to grapple with something personal. The confrontation occurred on a serene, deadly, and elevated plain. If you were successful you found something irreducible within yourself, like a seed. To walk away was to be alive, utterly. To be assured of your own life, the life of your kind, in a harsh land where life took insight and patience and humor. It was to touch the bear. It was a gift from the bear.

Knud Rasmussen, an arctic traveler, once asked an Eskimo man about happiness, about exhilaration, and he answered, "To come across fresh bear tracks and be ahead of all the other sledges."

To men who grappled, instead, with abstractions of geography, with dreams of a mother lode of wealth in the New World, the bear was something else. In 1597, during that winter they saw the sun rise early, Barents and his men were frightened often by polar bears. Bears had killed two of the group the previous year, and now they seemed to prowl continuously around Barents' winter quarters. His men watched, unnerved, as the bears dragged huge slabs of meat (from a beached whale) past them in the dusky light. On April 15, 1597, when no bears had been seen for weeks, one of the men volunteered to crawl into a den—"but not to farre," wrote Gerrit de Veer, "for it was fearfull to behold" with hoar-frosted hairs dangling from its ceiling and its ice-covered, claw-scraped walls.

De Veer's chronicle—and a later one by Jacob van der Brugge, about a 1634 expedition to Svalbard that also suffered predation by bears—projected an image of the polar bear as a ghostly marauder. The image persisted throughout the period of arctic exploration, and was one the polar bear lent itself to. Bears loomed together suddenly in numbers on a foggy beach, like white wolves. They tore open graves and strewed the bodies about, which men found more ominous than if the bears had eaten the corpses. They entered

camps boldly on their large, silent feet and, accustomed as they were to the crack and explosion of sea ice, were not startled by gunfire. Explorers who arrived at their caches to find them torn apart by bears—sacks of flour dragged off in one direction, sleeping bags in another, equipment crates smashed to kindling, food tins surgically opened with the rake of a single claw—felt violated. Those who ate bear meat indiscriminately thought they had been tricked by their victims—poisoned—when they suffered the nauseous lethargy, the crushing headaches and loss of skin and hair that came from eating the bear's liver. Or when they developed trichinosis from eating the bear's flesh.*

Thousands of miles from familiar surroundings, genuinely frightened, and perhaps strained by the grim conditions of shipboard life, Europeans took to killing any polar bear they saw. They shot them out of pettiness and a sense of rectitude. In time, killing polar bears became the sort of amusement people expected on an arctic journey. Travelers regularly shot them from the ship's deck, for target practice. One idle summer afternoon in 1896, a whaling captain in Amundsen Gulf with nothing else to do shot thirty-five, for sport. The curious and unaggressive bear, so easily attracted to a ship, an object cruising so oddly in the ice, time and again stepped into its own death. In 1875 the crew of a whaler was playing football on a shelf of landfast ice in thick fog next to the ship. In the middle of the game a polar bear appeared and began chasing the ball in and out among the men. The whalers fled. Such stories only confirmed some in their sense of being offended, of being trifled with in this difficult place. They shot the animals with colonial indifference.

The most disturbing and deplorable aspect of nineteenth-century encounters with polar bears was a perverse manipulation of the bond between a female and her cubs, a common amusement of

* Vitamin A is found in toxic concentrations in polar bear liver. Eating it causes hypervitaminosis-A. And about 60 percent of the present polar bear population carries species of *Trichinella.*

sailors aboard whaling and sealing ships. William Scoresby tells of an incident involving walrus hunters who had set fire to a pile of blubber to attract bears. A female and two cubs drew near. The female settled her cubs at a short distance and then started trying to hook pieces of blubber out of the fire. The men watched from the safety of the deck as she fought with the flames. They threw her small bits of blubber, which she took to the cubs. As she approached them with the last piece, the men shot the two cubs dead. For the next half hour she "laid her paws first upon one, and then the other, and endeavored to raise them up." She walked off and called to them, she licked their wounds. She went off again and "stood for some time moaning" before returning to paw them "with signs of inexpressible fondness." Bored, or perhaps mortified, the men shot the female and left her on the ice with her cubs.

Sometimes a cub was taken alive, for a zoo or as a present for someone. In November 1876, a Sir Allen Young shot a female and one of her cubs from the deck of a steamship. The other cub he lassoed as a gift for the Prince of Wales.* The cub fought wildly until it was secured with chains to ringbolts in the deck. The female was butchered and the cub wrapped in her skin in the hope of appeasing him. Three or four days later the cub succeeded in tearing free of the ringbolts. He was then placed in a small cage, where he remained for the duration of the voyage. The cub roared for hours on end and pulled at the length of chain still around his neck. He was tormented by the ship's dog, which stole his food and bit his paws. The origin of the meat he was fed can be imagined. By the time the ship reached England, the cub lay prostrate in his cage, convulsing and panting. He died a week later. "Had he lived,"

* European royalty received live polar bears as gifts from explorers and adventurers from the tenth century onward. They, in turn, historically found them "an extremely valued and efficient instrument of diplomacy" in North Africa and the Middle East, where they were sent, along with gyrfalcons, in royal retinues.

wrote Frank Buckland, reflecting the attitudes of the age, "he would, no doubt, have been an honour to his country and his race."

These stories, of course, are from another era; but the craven taunting, the witless insensitivity, and the phony sense of adventure that propelled them are not from another age. They still afflict us. For these men, the bear had no intrinsic worth, no spiritual power of intercession, no ability to elevate human life. The circumstances of its death emphasized the breach with man. During these same years, by contrast, the killing of polar bears by Eskimos occurred in an atmosphere of respect, with implicit spiritual obligations. The dead bear, for example, was propitiated with gifts. Such an act of propitiation is sometimes dismissed as "superstition." "Technique of awareness" would come much closer to the mark, words that remind you of what you are dealing with.

Europeans were ill at ease in the Arctic. The polar bear was for them a symbol of the implacable indifference of an inhospitable landscape. Whatever remorse they suffered over their harsh treatment of the polar bear eventually became admiration, but for a bear that was really a curious image of themselves. De Veer's marauding ghost bear, which became an impediment to Western progress and then an amusement, a nuisance, finally became a vaguely noble creature, wandering in a desolate landscape, saddled with melancholy thoughts. A romantic, estranged, self-absorbed creature.

In the stories Eskimos tell, down to the present, the polar bear is most often cast as a helper or companion of one sort or another, like *Tornarssuk.* But he is known as *Kokogiaq,* too, the ten-legged or many-legged bear. *One time, one winter, it seemed people who went off hunting in a certain direction never came back. What happened to them was that there was a ten-legged bear down there. When people looked over there,* Kokogiaq *moved his legs around a little. It looked like people walking around on the ice. So other people went down there to see them. That's how* Kokogiaq *got people. Finally a man got the bear to come after him. He got him to chase him into a place in the ice where* Kokogiaq *couldn't turn*

around. Then that man ran around and killed him from behind ivith his spear. When people go hunting down there now, they always come back.

The stories go like that.

Often in a story about *Kokogiaq* or *Tornrdrssuk* there is some hint not only of the bear's biology (how that wedge-shaped body could get caught in ice where a man could slip through) but of its personality. The bear's melancholy wandering, for example, is underscored in a Polar Eskimo story about a bear who falls in love with a young married woman. He cautions her never to tell her husband of their meetings because her husband will surely try to kill him. But she takes pity on her husband's failures in hunting bears and tells him where her lover lives. Far away, the bear hears her whispering to her husband in the night, and he leaves his home before the husband arrives. He goes straight to the woman's snow house. He raises his paws to smash it in—and then he lowers his paws to his side. Feeling betrayed, overcome with grief, he sets off on a long and solitary journey.

To the European mind the story is poignant. For the Eskimo it is charged with danger. For the bear to go off preoccupied with such a subject means it will not be paying attention to where it is going, that it may fall through bad ice or miss signs that will lead it to an aglu and sustenance.

A bear's long, solitary journeys across the frozen ocean, science tells us, are not precisely what the imagination once conjectured. And now, too often, wherever they go someone is in the way. Between 1978 and 1981, eighty-four polar bears were killed in the Canadian Arctic as threats to human life. The threat is real. In 1973, a bear killed a tractor operator near Kendall Island in the Beaufort Sea. In 1975, also in the Beaufort, a bear killed a construction worker on the deck of a barge. In August 1975, a polar bear severely mauled a man in a scientific camp on Somerset Island. And at Churchill, Manitoba, bears mauled people in 1966 and 1967, and killed a boy in 1968 and a man in 1983.

The former deaths are associated with industrial development in the Arctic; the attacks at Churchill derive from a more peculiar set of circumstances. For many years, polar bears at the southern end of Hudson Bay have come ashore in late July and early August with southward-drifting ice. Females commonly den for the winter in country between the Nelson and Churchill rivers, while adult males and subadults of both sexes drift northward up the coast to the vicinity of Cape Churchill, 25 miles east of the village, where coastal ice is likely to form earliest. They remain in this vicinity, "temporarily removed from their specialized predatory niche," as one scientist put it, throughout September and October.

This unusual staging was not discovered until the 1960s, when bears began turning up at the village of Churchill. Scientists theorize that when a Hudson's Bay Company post at the mouth of the Nelson River closed, an American Strategic Air Command base closed, and military maneuvers ceased at Fort Churchill, all in 1957, the hunting pressure on polar bears was relieved and the population began to increase. By the mid-sixties, polar bears were turning up in large numbers at garbage fires in Churchill, frightening people. The people, in turn, began tormenting the bears by shooting them with small-caliber weapons and chasing them with cars.

In recent years, though the bear population has continued to grow, a program of warning, local education, deterrence, and management has reduced the numbers of bears killed, and there have been few attacks. Residents of Churchill now regard the bears, somewhat fondly, as a tourist attraction. Others who have visited the area find the sight of bears ominous and peculiar—some with huge dark numerals painted on their sides, some rooting in the smoke and flames of the smoldering dump, where a bear once died from trying to eat an automobile battery.

The parade of amateur and professional photographers, filmmakers, and television personnel, baiting bears with jars of mayonnaise and importuning Churchill people to assist them in staging various scenes, is unending. More than anything, Churchill represents a moment in time when an animal in a comparatively accelerated

state of evolutionary development has encountered another creature evolving at a very much higher rate of change. Churchill, for the moment, is the answer to the question of what industrial development in the Arctic means—along with the thirty or so bears shot each year in northern Canada as "nuisances" and threats. The bears at Churchill, it should be observed, depart the day the ice will support their weight.

Recent research into the size and dynamics of polar bear populations has resulted in a hunting moratorium in Svalbard and a partial ban on hunting in the United States.* Native hunting in Greenland continues, apparently without serious effect on the population. Native hunting in Canada is under a quota system, which has worked well in the past, although quotas are subject to political manipulation and, as one scientist pointed out to me, often regarded not so much as limits but as numbers to strive for.

In 1965, polar bear biologists, meeting at the University of Alaska to pool what they knew, feared that bears might need protection from excessive hunting. The greatest danger to them now, stressed every scientist I spoke with, is not hunting but industrial development and what it brings with it, including summary demands for data on polar bear biology and ecology,t Uppermost in scientists' minds are three areas of concern. First is environmental poisoning. Bears feed at the top of a marine food chain that concentrates PCBs, heavy metals, and chlorinated hydrocarbons like

* According to the terms of the Marine Mammal Protection Act, which supersedes the stricter provisions of the IUCN Polar Bear Agreement, there are no seasonal limits and no limits on the number of bears that can be killed by native hunters. Nor are clubs, females with cubs, or denning females protected.

t In the face of such demands some polar bears have been wounded or killed in poorly designed research projects or poorly thought-through experiments. For a description of experiments that killed two bears see N. A. 0ritsland et aL, *Effect of Crude Oil on Polar Bears*, Environmental Studies No. 24 (Ottawa: Northern Affairs Program, Northern Environmental Protection Branch, 1981).

dieldrin, all of which have been found in polar bears. The waste from drilling and mining operations has also proved lethal to bears. A second concern is the disruption of female bears at their denning sites, the result of intensive overflights and other transportation corridor development and of repeated seismic surveys.* A third area of concern is what effect industrial development will have on the distribution of seals, and therefore bears.

The most pressing problem is finding a way to keep curious bears away from industrial sites. Deterrent systems that do not seriously injure bears—electric fences, rubber batons fired from riot guns—have met with some success, but polar bears are not easily stopped or fooled.

In the light of all these potential problems, IUCN polar bear biologists have asked for "no-activity zones" or what a Russian scientist has called "zones of peace," where bears will simply not be bothered by various human projects.

FAR from all these disturbing concerns, one May afternoon, I accompanied two polar bear biologists searching for breeding females on the sea ice of Lancaster Sound. I knew and trusted and liked these two men. I also sympathized with their ambivalent feelings about their work. One of them had once come upon a female nursing her cubs. Unaware of his presence, she had settled back against a bank of snow with them and was staring calmly out across the empty sea ice. "I saw that, and I said to myself, why in God's name am I bothering these animals?" They were ambivalent, too, about the drugs they were using to immobilize the bears. What they were using—-Ketamine (ketamine hydrochloride) and Rhompun (xylazine hydrochloride)—was an improvement over earlier drugs like Sernylan (phencyclidine hydrochloride, the street drug called "angel dust"), which appeared to induce psychotic reactions and

* Seismic surveys employ explosion and vibration to map the earth's crust in search of mineral and petroleum deposits. When improvements are made in seismic technology, the same areas are often surveyed again.

cause breathing difficulties. But immobilizing drugs are still problematic. One bear biologist told me, "Every time I chase an animal to put a dart in it, I am in conflict. How can I justify getting the information like this?"

That afternoon on Lancaster Sound, in the completion of the somewhat somber duties of tagging and recording data and fitting the animals with radio collars to permit satellite tracking, we saw many bears. We landed once to inspect the remains of a walrus that had been killed, perhaps, or possibly only scavenged, by a bear. We saw two-year-old cubs with their mothers striding apprehensively away from the sound of our helicopter, and we saw males and females together, mating pairs, turning beneath us to stare. And females with five-month-old cubs, scrambling over pressure ridges with a boost from their mother's nose.

One of the females we darted went down near a jumble of shattered ice. While the others made measurements, I looked at her feet. I had once been told that polar bear claws show an annual shading, faint rings, which could be used reliably to age a bear, as is the case with ringed seals. But there were none that I could detect. I looked at details of her fur and felt the thickness of her ears, as though examining a museum specimen. Uncomfortable with all this, I walked over to the pressure ridge and sat on a slab of broken sea ice. It was a beautiful day, the skies clear behind a thin layer of very high cirrus, which made the sky a paler blue. About five below zero. No wind.

As I sat there my companions rolled the unconscious bear over on her back and I saw a trace of pink in the white fur between her legs. The lips of her vulva were swollen. Her genitalia were in size and shape like a woman's. I looked away. I felt I had invaded her privacy.

For the remainder of the day I could not rid myself of this image of vulnerability.

Four

LANCASTER SOUND
Monodon monoceros

I AM STANDING at the margin of the sea ice called the floe edge at the mouth of Admiralty Inlet, northern Baffin Island, three or four miles out to sea. The firmness beneath my feet belies the ordinary sense of the phrase "out to sea." Several Eskimo camps stand here along the white and black edge of ice and water. All of us have come from another place—Nuvua, 30 miles to the south at the tip of Uluksan Peninsula. We are here to hunt narwhals. They axe out there in the open water of Lancaster Sound somewhere, waiting for this last ice barrier to break up so they can enter their summer feeding grounds in Admiralty Inlet.

As I walk along the floe edge—the light is brilliant, the ceaseless light of July; but after so many weeks I am weary of it; I stare