George Divoky's planet
Darcy Frey
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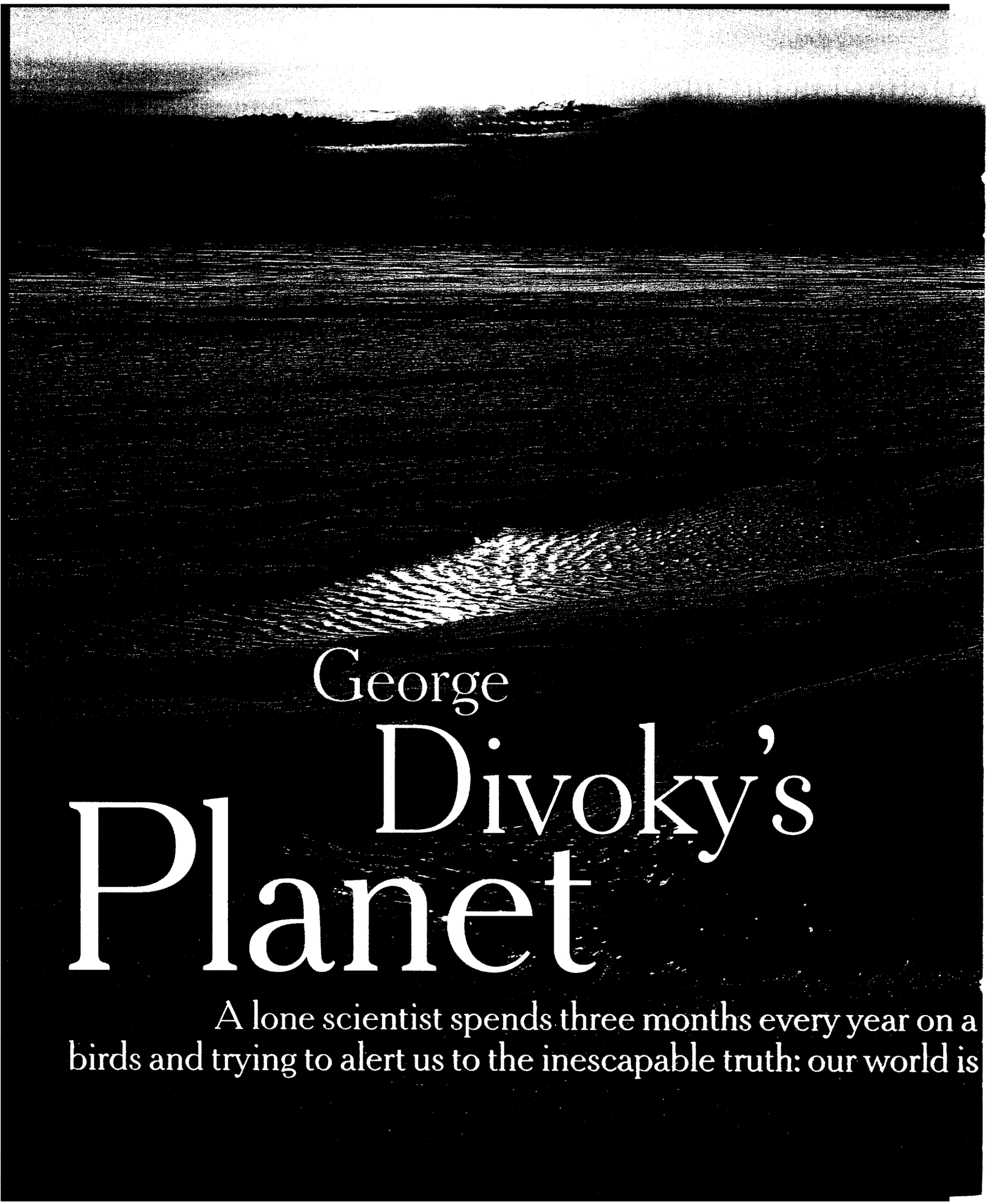

George Divoky's Planet

A lone scientist spends three months every year on a
birds and trying to alert us to the inescapable truth: our world is

wretched, freezing strip of land, fending off bears, observing his melting away. By Darcy Frey

Photographs by Joe McNally

I. IN WHICH GEORGE TRIES TO BUILD A FENCE

This is a story about global warming and a scientist named George Divoky, who studies a colony of Arctic seabirds on a remote barrier island off the northern coast of Alaska. I mention all this at the start because a reader might like to come to the point, and what could be more urgent than the very health and durability of this planet we call Earth? However, before George can pursue his inquiry into worldwide climate change; before he can puzzle out the connections between a bunch of penguinesque birds on a flat, snow-covered, icebound island and the escalating threat of droughts, floods and rising global temperatures, he must first mount a defense — his only defense in this frozen, godforsaken place — against the possibility of being consumed, down to the last toenail, by a polar bear while he sleeps. He must first build a fence.

Cooper Island, June 4, 2 o'clock in the morning. The sky is a cold slab of gray, the air temperature hovers in the upper 20's and the wind — always the wind — howls across hundreds of miles of sea ice with such unremitting force that George has disappeared beneath a hat, two hoods and a thick fleece face mask covering all but his bespectacled eyes. Standing near the three small dome tents that make up his field camp on Cooper, George raises a pair of binoculars and begins to scan for bears. Past the island's north beach, a wind-scarred plain of sea ice stretches uninterrupted to the pole. To the south, the nearest tree stands 200 miles away on the far side of the Brooks Range. Here, some 330 miles north of the Arctic Circle, with the sun making a constant parabolic journey around the sky, George surveys a view that replicates in all directions: the snow-covered island merges with the sea ice at its shores, the dazzling sheets of sea ice stretch to meet a pale gray dome of sky. Surrounded by a vast, undulating whiteness, he appears to be standing in the middle of the Arctic Ocean. He appears to be standing on the tops of cirrus clouds.

"So, . . . " he says, and the rest of his words are carried off by the wind.

"*What?*"

"I said, *so maybe we should put up the polar-bear fence before we get too fatigued*!"

Heading fast toward fatigue, I tell him that's a fine idea indeed, and exactly how many polar bears does he figure might be out there on the ice? George, who spends each summer on Cooper Island, is cheerfully indifferent to its dangers and discomforts and reassuring to those who aren't. Discussing a recent incident in which some Inupiat Eskimos had to shoot a bear that wandered into their nearby whaling camp, I consider it bad news — there are bears in the vicinity! — while George thinks of it as good: yes, but now there's one less bear.

Still scanning the faint horizon line, George insists there's nothing to get worked up about. For the most part, bears stay several miles offshore, where they can gorge on ringed and bearded seals. If a bear *were* to come to this island, he points out, its massive 800-pound frame would stand out against the sky like an approaching blimp. Even if a bear were to wander into camp, he goes on, we are sufficiently armed with a shotgun, cans of compressed pepper spray (mace) and a flarelike device known as a screamer-banger. Nonetheless, George confirms that at least one big bear shows up on Cooper each summer, usually to scavenge the beach for dead, washed-up seals; and furthermore, that an encounter can be so unpleasant that you do have to figure the odds a little differently. "I was out here once and injured the tendon in my knee," he says. "I couldn't walk, I couldn't stay warm. I kept thinking, *If it's true predators key in on the weak and the infirm. . . .* " He shrugs and gestures to the chilling evidence of predation right by our feet — a caribou skull, several seal vertebrae, a scattering of gull's feathers and the sun-bleached skeleton of a clean-picked walrus. "I guess it's safe to assume that most of our fellow Americans are south of us, sound asleep, a lot warmer than we are, and not preparing to put up a polar-bear fence."

Cooper is one of six barrier islands stretching off the coast of Point Barrow, Alaska, where the United States — along with continental North America — comes to a chilly, desolate end. Three miles tip to tip, the island is nothing more than a snow-covered strip of sand and gravel frozen into the Arctic pack ice, its only vertical relief an odd cityscape of rusted 55-gallon drums and destroyed ammunition boxes left here by the United States Navy sometime after the Korean War. In 1972, George came out to Cooper as a young ornithologist and discovered a rare colony of black guillemots — pigeon-size, stiff-legged seabirds — nesting in the abandoned drums and boxes. And for many years he pursued a rather esoteric study of them — mate selection, age of first breeding, "the kind of thing that's of interest to about 20 ornithologists," he says now. Then, almost by accident, he discovered that his birds were picking up on another kind of frequency, and that if he watched and listened with great care, they could tell him about something no less consequential than the climatic fate of the earth.

In coming to the Alaskan Arctic year after year, George is following the logic of many other scientists — that to understand Earth's mysterious and changing climate, you should go directly to its extremes. In the last two decades, scores of researchers have come to the nearby town of Barrow, hoping to learn why the Arctic is warming so significantly and how the changing polar climate may affect the planet as a whole — if the Arctic sea ice were to one day disappear, it would cause drastic changes in the climate of the Northern Hemisphere. But while many scientists gather their data from remote sensing devices — satellites, buoys, robotic airplanes — or come to this frozen, inhospitable region on brief, well-equipped trips

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George and the guillemots have been meeting like this for almost three decades, though lately, not-exactly-same-time, next year.

before returning to the comforts of the "Lower Forty-Eight," George spends three months of each year sleeping in a small yellow dome tent, warming himself over a two-burner propane stove and crawling around on his hands and knees, up to his binoculars in guillemot scat. Thousands of miles away from the debates on greenhouse-gas emissions, relatively unknown even within the scientific community, George, now 55, has come out to Cooper Island every year for more than 25 years, often with no financial or institutional support. It is not too much to say that he has staked his entire adult life on this barren gravel bar and its avian inhabitants. And now, as he continues to scan the island with his binoculars under bright, 2 a.m. skies, it is not too much to say that his life is staked on whether he can successfully erect that polar-bear fence.

The fence became an essential part of George's repertory for survival after he awoke in his tent one night to the *crunch, crunch, crunch* of approaching footsteps. When he crawled out to investigate, however, he thought he must have been dreaming: he was alone on the island. The next morning, the 16-inch tracks in the snow told him otherwise. If it's possible to see your life flash before your eyes in retrospect, that's what happened to George: a big female bear and her cub had walked within 20 yards. While the cub stayed put, the mother came up to the doorway of his tent, evidently sniffing George's placid, sleeping head before he woke, unzipped his sleeping bag and inadvertently scared both bears away.

"All right, let's see what we've got here," George says, shaking the many parts of the fence out of its canvas bag onto the snow. George's fence is made up of 30 three-foot-high garden stakes that he and I, fueled by the adrenaline of our recent arrival, now try to place in a circle around our tents. Each stake has a small pulley, through which we thread a fine piece of cord. The cord makes a perimeter around the tents and meets up at the home stake, which is connected to a spring-loaded mousetrap, an eight-volt battery and a car alarm with a large plastic horn. The fence operates on the principle that a bear wandering into camp will push the cord, the cord will trigger the mousetrap, and the closing of the mousetrap will complete an electrical circuit that turns on the alarm, thereby waking George and me to the dangers at hand.

That, at any rate, is the principle. For more than an hour, we struggle to drive the garden stakes firmly into the snow, and each time we test the fence by pushing at the cord, a stake pulls loose and the cord slackens, preventing the triggering of the mousetrap. Then, when George turns his attention to the car-alarm horn, a sharp crack echoes in the air, followed by the gentle sound of his voice: "Uh-oh. I think I broke it."

Although George has spent more summers on Cooper Island than he often cares to count, he seems, upon first meeting, an unlikely candidate for the solitary hardships of fieldwork in the high Arctic. Handsome, boyish, with disheveled hair and a face deeply creased by abundant laughter in subfreezing temperatures, George lives nine months of the year in Seattle, and there is about him the unmistakable air of the overcaffeinated urban neurotic. He wakes up talking and, rushing to get the words out, keeps up a rapid, digressive chatter — about George Bush and the Kyoto Protocols, the challenges of romantic commitment and the latest from Philip Roth — almost until the moment, 18 hours later, that he falls directly asleep. It seems a waste of his conversational gifts for him to be on Cooper Island alone. It's also somewhat alarming. When I first met George in Barrow last February, I watched in wonder at his interactions

PHOTOGRAPH BY JOE MCNALLY FOR THE NEW YORK TIMES

This year's models: George checks the breeding shelter he built; measures a guillemot egg; weighs a full-size guillemot inside a bag.

with the mechanical world — forgetting to keep his car engine running when the outside temperature dropped to 30 below; or, when he parked and did remember to plug his engine block into an electric heater, forgetting to unplug before driving off — *snap*!

But for almost three decades, he has hurled himself to the very ends of the earth and met its risks and challenges with tireless enthusiasm. When his new stove broke on the first day of one field season, he kept a series of bonfires going all summer; when he ran out of freshwater, he placed tin cups around his tent to catch the rain; when his radio broke, he tried calling for help with an old signal mirror from World War II. (He also tried spelling HELP on the beach with large pieces of driftwood, but came up one log short, inadvertently announcing to the skies a pressing need for KELP.)

Now, holding the two halves of the car alarm in his hands, he shrugs and says, "To be honest, the fence doesn't keep bears out; it just lets you know that one is about to eat you. Really, it's just a placebo." He looks around at our camp — one tent for cooking and two for sleeping that we've pitched far enough apart for privacy while also keeping, in George's words, "within screaming distance." For our campsite, he chose what seemed the safest, most sheltered location near the island's south shore — out of harm's way, and back from the thick, upended slabs of sea ice that have rammed up against the island to the north. But as far as I can see, we are nothing if not *in* harm's way: like a Bedouin camp in the desert, our three yellow tents are the only signs of life in this white-on-white landscape — the only signs of food, come to think of it, to an animal so wily that it stalks prey by sliding on its belly behind a moving block of ice and is said to raise its white paw to cover its black nose for camouflage in the snow. "Any bear that shows up on this island is probably very hungry or very deranged," George says fatalistically, "and there's not much you can do to keep Charles Manson out of the suburbs."

II: IN WHICH GEORGE RIDES ON BOATS, PLANES AND SNOWMOBILES

If this story is, truly, about a flock of seabirds in the midst of worldwide climate change, then a reader may be moved to ask: Where are the birds? What's with all the snow and ice? And why does George seem less concerned about the tangible threat of polar bears today than he does with a few intangible degrees of global warming tomorrow? To begin to answer those questions, it may help to review the scientific argument about human-driven climate change: that our endless consumption of fossil fuels is pumping vast amounts of carbon dioxide and other heat-trapping gases into the atmosphere, causing global temperatures to rise. It may also help to brush up on some geography regarding the very top of the world.

Whether the glaciers of Greenland will continue to melt and the southern oceans rise up to flood Bangladesh, whether Cape Cod will erode to a sand spit and the American prairie dry out like the Mojave, whether thunderstorms will one day reach Antarctica and sparrows the North Pole — whether all the disasters predicted by climatologists and their computer models eventually come to pass, one piece of the puzzle is already in place: the earth's climate will change first — and change most substantially — in the Arctic, that enigmatic expanse of snow and ice, of ancient peoples and unspeakably hostile temperatures that spans the top of the world.

Despite its crucial role in managing the earth's climate, however, scientists know surprisingly little about the Arctic compared with the world's other oceans. Covered by ice, nearly impassable by ship, the Arctic is still earth's least-explored frontier. On a planet that has been thoroughly mapped, ship captains in the Arctic still make up their charts as they go along; two years ago, a Navy submarine carrying a crew of scientists passed over a drowned, mile-high mountain no one knew was there. Now that Russian science has gone bankrupt, Canadian research is suffering extreme budget cuts and most U.S. money for polar research gets funneled to the McMurdo research station in Antarctica, some of the best work to fill in the blank spots of the Arctic is being done by a small but hardy group of scientists associated with the Barrow Arctic Science Consortium, which uses this thriving, mostly Inupiat whaling community as its base.

Like most bush communities in northern Alaska, Barrow is accessible only by air, and on June 1, George and I met up in the Fairbanks airport for the 90-minute flight. We had clear skies as we left the wooded foothills around Fairbanks and climbed steadily toward the Brooks Range. Watching the last of the boreal forest finger its way into protected valleys, we flew over the snow-and-glacier country of the Brooks — ridge after ridge of granite peaks and frozen valleys so remote that they still exist largely without name. Cresting the mountains and passing the imaginary Arctic Circle, we saw the peaks turn to foothills, the foothills level off to the North Slope's frozen coastal plain. In north-central Alaska, the coastal plain stretches for more than 150 miles, and our plane followed the course of wild, braided rivers over a snow-covered, wind-swept landscape desolate as the moon. On this day, the Arctic pack ice was still jammed up against shore, and from the plane it was impossible to tell exactly where land ended and sea began. But eventually a hodgepodge of dusty streets and low-slung buildings came into view, and we touched down in Barrow, perhaps the only town in the United States that would be lost in a sea of whiteness on the 1st of June.

Cooper Island is just 25 miles beyond Barrow, with the ice of the Arctic Ocean against its north shore and the ice of Elson Lagoon to the south, but the fact that those 25 miles include — at various times throughout the summer — solid ice, junked-up ice, choppy 33-degree water, driving snow, sleet, dense fog and 40-mile-an-hour gusts makes travel to and from the island about as predictable as the behavior of Cooper's occasional bears.

To start his field season, George usually snowmobiles to Cooper over the frozen lagoon, as we planned to do two days after our arrival in Barrow. By mid-June, however, the lagoon ice starts to break up and Cooper begins to resemble an island with water lapping at its shores. For the remainder of the summer George is dependent on some kind of air transport for travel and resupply. The phrase "air transport," with its connotations of scheduled departures and uniformed pilots, is misleading. George has built what he proudly refers to as a landing strip on Cooper, intended for small propeller planes equipped with tundra tires. In point of fact, it's a clearing in the gravel with two automobile tires to indicate the start and two crossed,

PHOTOGRAPHS BY JOE McNALLY FOR THE NEW YORK TIMES

wooden boards marking the end. And unless the plane is a "tail dragger," the soft gravel will make it land nose first into the ground. "Every time I walk back to camp, I drag my boots over my landing strip," George says. "Do that for 20 years, and you have a nice place to land a plane."

The first time George flew by small plane to Alaska, in 1972, he was traveling with three other biologists; within four years all had died in separate plane accidents. Of the 25 bush pilots who have flown him to and from Cooper over the years, five are no longer alive. Nonetheless, George remains sanguine about the perils of flying, often with some odd pilots at the controls. He has flown with the foolish (a pilot who took off with a chipped propeller after trying to fix it with a nail file), and he has flown with the idiotic (a pilot who refused to turn back when propane started leaking into the cabin). And once he planned to fly back to Barrow with a pilot who couldn't find the island beneath a 50-foot cloud bank and zoomed back and forth while George, on the ground, used his radio to guide him. ("You're to the north. . . . Now you're too far south. . . . *O.K., now you're right above me*!") The only way George refuses to travel is by boat, ever since he was coming back from Cooper on a windy day and his 12-foot Boston whaler took in volumes of spray over the bow. While George bailed furiously, he and the captain watched the outboard motor slip right off the stern and sink to the bottom of the lagoon. Eventually they were towed to shore by Barrow Search and Rescue. "I'm ready to have X number of minutes of terror if a plane goes down," George says, "but just the thought of going in that water — it's 33 degrees. It's a toxic substance. It might as well be an acid bath."

My appreciation for George's fortitude only grew as I tried, while still in Barrow, to arrange a return flight from Cooper in two weeks' time. I called the local air-charter service that used to perform beach landings with a Cessna 185, but a pilot there told me they had suspended off-runway landings "after we rolled that plane up into an itty-bitty ball." When I reached another pilot with his own light, fixed-wing aircraft, he asked in a challenging tone where on the island I expected him to land. I explained about the landing strip, the tires, the X marking the spot. "Sure, sure," he replied and turned down the job as well. With so many recent small-plane crashes on the North Slope keeping pilots quivering on the ground, I eventually found myself with one last option: a search-and-rescue pilot named Gary Quarles, who owned a small vintage helicopter with a rebuilt engine, though he seemed as reluctant as all the rest to take on the potential complications of the job.

At this point, George stepped in on my behalf, and I saw for myself how he has managed to conduct a 27-year, poorly financed study in remote Alaska largely by sheer force of personality alone. Quarles has the pilot's requisite drop-dead sobriety, but George invited him over for coffee and a chat. He told Quarles about his birds. ("They're sort of like pigeons, but their black feathers have a subtle green iridescence — it's very impressive.") And he described all the methods he has devised over the years to survive on Cooper. ("It's like we're inventing a whole new culture out there.") And with a nifty bit of anthropomorphism, he explained what brings the birds back to Cooper Island each year. ("Frankly, I know what they're going through. I once drove from East Lansing, Mich., to Sunapee, N. H., to visit my girlfriend, and I actually blew out the engine of my car thinking, I've got to get there! *I've got to get there*!") By the time Quarles reached the bottom of his coffee cup, he was laughing and on board, promising not only to pick me up, but also to run resupply for George throughout the summer.

"Well, I guess it's optimistic to think Gary will actually come through for us," George said after Quarles left. "But then evolution selected humans for optimism, didn't it? If Gary can't do the job," he went on, "I bet the folks at Search and Rescue will come get you. To be honest, this is how it always goes. Every year I fly to Barrow never knowing how I'm going to get out to the island and back. But I've learned it's just a matter of putting yourself in the next situation, putting yourself in a position where a favorable outcome is not only likely, but absolutely necessary." He stopped and smiled. "See, unless you're stuck out on Cooper on June 15, no one's going to think of coming out to rescue you on the 15th."

On the morning of our departure, after a fitful night of sleep, I met up with George at the Barrow Arctic Science Consortium for a final check of equipment, then to load three long wooden sleds with our gear: food, tents, stoves, pots, pans, water jugs, shotgun, radio, Global Positioning System, sleeping bags and mounds of fleece and down. Dave Ramey, who runs operations for BASC and moonlights as George's Jewish mother, alternately worried and scolded him for leaving everything to the last minute, for not upgrading his field camp after all these years. "Really, George, why don't you just build a cabin out there?" he said. "It's crazy to be crawling in and out of tents all the time. And you really ought to use an Arctic oven — that would warm you right up."

By day, without guillemots, the island looks like a gravel beach. At night, with the birds teeming at their nests, the place is transformed by a hundred scenes of carnal bliss: Cooper Island, 90210.

Ramey and two of his colleagues had agreed to take us out, so we hitched the three loaded sleds to the backs of three snowmobiles and, after pushing hard from behind, ran and jumped on back. Within minutes of leaving Barrow, we hit thick fog and white-out conditions, and as we plowed across the ice-covered lagoon, we often lost sight of each other, hearing only the drone of engines in the mist before a wraithlike, hooded figure and a headlamp came back into view, as if through a desert sandstorm. For the next hour and a half, we roared across the smooth lagoon ice, tunneling through dense sheets of fog, and riding shotgun on the back of a sled, gazing out upon the absolute, featureless whiteness, I was hard pressed to say whether we were moving at 5 or 50 miles an hour; or whether the black, elongated bodies of ringed seals resting by their breathing holes were a stone's throw or a full mile away; or whether we weren't, after all, floating through a cloud bank at 30,000 feet. One summer, George came out to Cooper Island and, lacking landmarks of any kind, mistakenly set up his camp on the snow-covered lagoon — and spent five days waiting for land to appear beneath him before he realized his *terra* was no more *firma* than a slowly melting sheet of ice. He beat a quick path to shore. On this day we had Dave Ramey and a G.P.S. to guide us, and after crossing 25 miles of lagoon ice, we reached a slight rise in elevation, no higher than the back of a breaching whale, and some bare strips of gravel, which confirmed we had reached the shores of Cooper Island.

After helping to unload the sleds, Ramey and his colleagues started up their snowmobiles for the return trip to Barrow. And after waving them goodbye, George and I watched the red taillights disappear into the white fog, then stood and listened to the whine of engines diminish, then die completely in the wind. Alone with George, I looked around at the snow-covered island with its scattering of bones and feathers, the fog hemming in our sightlines to within 100 feet. Unable to tell where land ended and sea began, peering through the mist for bears and up at the sky for birds, I groped for the comforts of the familiar, or at least the analogous. Go to the Alps and you'll recognize the Himalayas. Spend time in Malibu and you'll know what's up on Montauk. But this bleak, bewildering place, in which wind rippling a pool of melt water shows up as a sign of life — what did

Cooper Island echo if you'd not yet been to Mars? George saw me shivering and said, "Eat and drink everything in sight, and you'll start to thermo-regulate." So I cinched my hood a little tighter, adjusted my face mask and, beginning to comprehend what it meant to be a creature of Earth's temperate zones, shoveled trail mix into my mouth. But in truth I'd had the shivers ever since Barrow, when Dave Ramey took me aside to deliver some forceful words. "We'll get you out to Cooper Island today," he said. "But the rest is up to you. I don't know what George may have promised you," he went on, his tone suggesting a dozen messy situations George had dragged him into. "But unless you've got reliable air transport lined up, you should expect to be out there till the ice melts out. I'm serious. Don't expect Search and Rescue, or me, or anyone else to come get you." He looked at me hard. "If you go out to Cooper Island today, you're on your own."

III: IN WHICH GEORGE FIRST ENCOUNTERS THE MYSTERY OF THE LITTLE BLACK BIRD

Cooper Island, June 6, 12:30 in the morning. The sky is full of slanting rain and freezing fog, the air temperature can't seem to reach 30 and the wind continues to blow out of the northeast with such numbing regularity that we've begun using it for support; if it stopped in an instant, we'd both pitch face-forward into the snow. Standing at the edge of the frozen Arctic Ocean, George lifts a high-powered telephoto scope up to his right eye and begins to scan the skies, wondering when his birds will leave their winter habitat on the sea ice and make their annual trip to Cooper Island to breed. George's scope is black and cylindrical and strapped with silver duct tape to the butt of an old wooden rifle. To brace the rifle stock against his shoulder and peer through the chunky, mortarlike scope, he must squint and lean back, bending slightly at the knees. Beneath his hat, his hoods and his thick fleece face mask, he looks like a nearsighted bugler, blowing reveille into a gale.

> 'I've lost the ability to assess what's uncomfortable. I'm working in gloves, and I'm eating Wheat Chex melted in chicken bouillon, but at 32 degrees it tastes like mother's milk!'

With no sign of the birds just yet and weather conditions such as they are, we appear to have two choices: walk or freeze. We choose to walk, while George begins to tell the story of how a heap of Navy trash — some of it stamped with the words PLEASE DO NOT DESTROY, THESE BOXES ARE REUSABLE — came to be used by several hundred black guillemots and one lone scientist whose narrow, ornithological study eventually led him onto the trail of worldwide climate change.

Except for the fact that the dead walrus by our campsite had not yet decomposed, Cooper looked much the same when George first came upon it in the summer of 1972. Back then, five years after oil was discovered at Prudhoe Bay, environmentalists were on alert for the possibility of tanker spills, and George, 26 and already an ardent ornithologist, was hired by the Smithsonian Institution to go up and down the northern Alaskan coast to identify any vulnerable seabird habitats. Traveling the coastline on a Coast Guard icebreaker, he was dropped off one day on Cooper. Remarkably, the sun was out, catching the surface of all the Navy debris, and as he walked along, marveling at this strangely picturesque collection of scattered wood and rusted metal, two black guillemots, startled by the crunch of gravel, suddenly flew out from beneath an ammo box. Since guillemots don't normally breed in this part of the Arctic — they are cavity nesters whose natural habitats, rocky cliffs and headlands, do not exist for more than 500 miles — it was, in George's words, "definitely a hit." He looked around and found eight more pairs breeding in the boxes, at which point, he says, "I almost wet my pants." Before he left that day, he flipped over a piece of wood, creating a new nest site, and when he returned to Cooper three weeks later, he looked under the planks and found eggs.

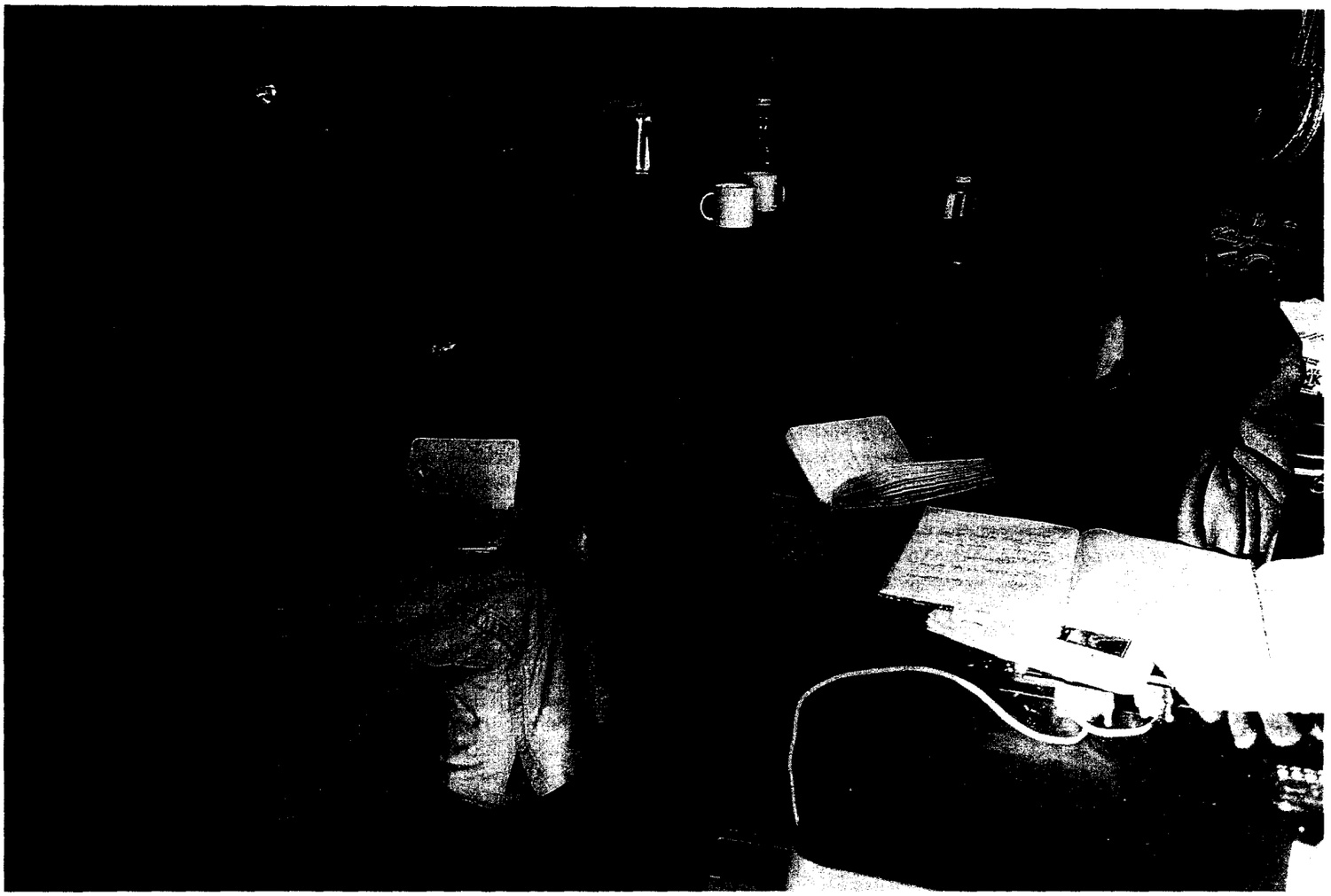
George couldn't get enough money to return to Cooper for three more years, but in 1975, when funds for another assessment project became available, he asked to be sent back. When he arrived, he found 18 pairs of guillemots breeding in the boxes, and hoping to grow the colony, George began creating — and naming — new nest sites in earnest: Freshman Housing, the Condos, Married Student Housing. ... "Not only were there these odd places," he says, "but you could *create* odd places and have them breed there." To a degree that was unusual even in the field of ornithology, George became obsessed, and over the next 10 years, he came out to Cooper each summer — creating nest sites, banding the birds and, because guillemots are a long-lived species displaying fidelity to both their mates and their nest sites, coming to know them as individuals. One bird, nicknamed WOGy because of its white-orange-gray leg band, has returned to her same nest site on Cooper for more than 20 years. "It was like a suburban street in the 1950's," George says. "I knew who lived in every house." By 1978, there were 70 guillemots on Cooper Island, and by 1981 the population was up to 220. By 1990, almost 600 birds were scrambling around the drums and ammo boxes, looking for places to breed.

Back then, George was thinking no more about global warming than any well-informed person with an interest in the natural world. Sharing the island with the birds and the bears, he had other things on his mind, and if he did pause to consider the Arctic climate, he assumed that it was static. Because he always got out to Cooper after the snow had melted and the birds had already occupied their nest sites, he also assumed that his seabirds timed their arrival on Cooper Island to the summer solstice, their reproductive schedule cued by the lengthening days.

In 1984, however, he happened to come out to Cooper earlier than usual, when the nest boxes were still covered by snow, and seeing that, he began to wonder if the birds' breeding habits were prompted not by the lengthening photo period, as he'd originally thought, but by access to their nest cavities — like clockwork, the first egg in the colony always showed up exactly 14 days after the birds occupied their nests.

Scientific paradigms don't shift overnight, however, and more than 10 years of grinding, repetitive fieldwork would pass before George came to understand exactly what that meant. In 1995, in response to Vice President Al Gore's task force on climate change, a call went out for data sets: did anyone have information that would shed light on regional climate change? George acquired National Weather Service data on when the snow melted at Barrow and plotted the dates on a graph. Then he looked at his own data on when the first egg showed up on Cooper Island and plotted those dates as well. The correlation leapt off the page: from 1975 to 1995, snow was melting in northern Alaska, on average, five days earlier each decade. Over those same 20 years, the date his guillemots laid their eggs was occurring, on average, five days earlier each decade. In fact, since guillemots require at least an 80-day snow-free summer in which to copulate, ovulate, hatch and fledge their chicks — and there were rarely 80 snow-free days in northern Alaska until the 1960's — they wouldn't even be this far north were it not for warmer temperatures. Expanding their range, playing with the edge of a changing climate, his guillemots, he realized, were tracking the region's snow melt on an annual basis. And an earlier date of snow melt was, in effect, an indication that the seasons

PHOTOGRAPH BY JOE McNALLY FOR THE NEW YORK TIMES



When George's field assistant, Tamara Enz (shown in the weatherport), joins him, the human population on Cooper Island increases 100 percent.

were in flux; that in a mere 20 years, the brief Arctic summer was now arriving 10 days earlier; and perhaps most important, that climate change was having a biological effect, leaving a fingerprint on a species living in a seemingly remote, pristine environment thousands of miles away from the industrial hand of man.

And over the past few years, George has come to believe that the warmer Arctic climate is changing not only his birds' breeding habits but also the species in a far more profound way. Traditionally, the birds come back to Cooper Island over three successive nights, trying to gauge the degree of snow melt from the air, and there are dangers at every turn. If George's birds arrive on the island when it is still covered by snow, they can't take refuge in their dark, protected nest cavities and, with black feathers set off against the white snow, they run a high risk of predation; one summer a snowy owl showed up during the birds' mass arrival and swiped a guillemot out of the flock, eating it offshore and nicely demonstrating why getting to the island too early poses such a danger. If, on the other hand, the guillemots arrive too late, they risk losing their longtime mates, which is what happened one summer when one of George's favorite birds, Black-White-Black, returned to Cooper two days late only to find its mate, White-Red-White, otherwise engaged. Major battles ensued as Black-White-Black tried to fight his way back into his longtime nest. "It was something to watch," George recalls. "There was blood on top of the nest site and guillemot footprints in the blood!" Caught between the perils of early and late arrival, knowing that their survival and reproductive success depends on perfect timing, the guillemots of Cooper Island have had to develop a highly sophisticated method for gauging snow melt. Those that can do it have persisted; those that can't have not. In effect, the warming of the North American Arctic has already precipitated natural selection for birds that can assess climate change in a highly sensitive way.

Just what a hormonally crazed, falcon-fearing guillemot actually looks like became visible to me on our very first night on the island, when George suddenly looked up at the sky at 2 a.m. and said with considerable excitement, "I think I hear guillemots!" I heard or saw not a thing. Again, George looked and listened: "Yup, they're definitely up there somewhere." And a moment later, I had my first sighting: 12 black birds in a tight flock, flying skittishly over the island at 500 feet, their rapid wing beats making a faint, wobbly Doppler sound like the hum of a dozen tiny windmills. Keeping in tight, antipredator formation, determined not to descend into owl or falcon range, they swooped over the snow-covered island, assessing the degree of snow melt on their nest sites and, evidently displeased with what they saw, disappeared as quickly as they'd arrived, dispersing like dust motes into the flat gray sky.

On the following night, with low fog engulfing the island, just one bird showed up, checked out the dismal conditions and flew back out to sea. But tonight, as we walk back to camp after touring the island in the steady rain, eight of them are back, flying lower and less nervously than they were two nights before. Directly above their nest sites, they set their wings and come dive-bombing toward the ground, but pull out of the dive at a hundred feet, caught between their hormonal urge to breed and their terror of landing so conspicuously on the white snow. Then, out of nowhere comes a second flock, merging with the first, flying with agitation, a few individual birds dropping from the flock with a stronger urge to land, but joining the safety of the group once again. Suddenly, their numbers have grown to 20, flying in tight concentric circles at 50 feet — around and around, dip-

ping, rising, surveying the ground still half-covered in snow. I take my eyes away to write some notes, and when I look up again there are 40, groups merging and breaking apart, darting like schools of minnows, keeling from black wing to white underwing, visible to invisible against the slate gray sky. For half an hour, we watch the complex choreography. And at 12:52 a.m., one bird breaks from the group and heads toward ground. "This guy's going to land!" George cries out. "This guy's going to land!" Feet splayed, wings pulled back, the first guillemot of the season arrives on Cooper with a great fluttering fanfare of wings. George looks through his scope and, recognizing the bird, lets out a hoot. "That's a chick that fledged here — a Cooper product, back in the 'hood!"

After three nights alone on the island, George is delighted that his birds are back. But he's also mindful of the grim chronology: when he began his study almost 30 years ago, snow persisted on Cooper, preventing his birds from gaining access to their nests until the last week of June. Over those same 30 years, despite natural year-to-year variability, the birds have arrived, on average, five days earlier each decade. "The great thing about guillemots is that they're birds, they're nonpolitical, they have no choice but to react," he says. "Every weather station in the Arctic should have a bunch of guillemots nearby so that if skeptics doubt the weather data, you can point to the date the first egg gets laid in the colony." Tonight, it is June 6. The birds are back three days earlier than they were the year before.

IV: IN WHICH GEORGE IMPERSONATES A GUILLEMOT

Unlike Antarctica, a continent surrounded by ocean, the Arctic is mostly ocean ringed by land — the frozen, inhospitable fringes of Alaska, Canada, Greenland, Iceland, Scandinavia and Russia. And therein lies the simple reason for its crucial climatic role. For as long as human memory can recall, the majority of the Arctic Ocean has been covered, year-round, with a nine-foot-thick mosaic of sea ice as vast as the continental United States. Constantly moving, buckling, melting and refreezing, this blindingly white pack ice is remarkably efficient in reflecting solar radiation back into space before the sun's rays can overheat the region. The Arctic Ocean also serves as a kind of heat vent for the entire planet, taking the solar radiation that gets absorbed by the tropics and the temperate zones and, once it has moved poleward, releasing it to the atmosphere. But every year, as the 24-hour polar night shifts to 24-hour summer sunlight, more than half the pack ice melts, and when that white ice changes to dark, open water, the exposed ocean, instead of reflecting the sunlight, absorbs it and begins to warm the overlying air. And if, as a result of ever-increasing fossil-fuel emissions, the Arctic climate became too warm, it would create a "positive feedback loop": as the ice receded, the ocean would absorb more heat, potentially melting more ice until a cycle of heating and melting eliminated the permanent pack ice. Some computer models show that if atmospheric carbon dioxide were to double, the planet would heat up enough to melt the Arctic's summer sea ice by 2050. And if that forecast were to come true, extreme changes in the temperature and salinity of the Arctic and Nordic Seas would follow. In fact, the Arctic sea ice plays a crucial role in the circulation of ocean water for the entire planet; according to one theory, if the pack ice were to melt away completely, the fresh, frigid water cascading out of the Arctic and into the North Atlantic would stop the transport of warm water from the tropics to the high latitudes, shutting down the Gulf Stream and changing climate patterns throughout the Northern Hemisphere.

With those facts, figures and drop-dead predictions in the forefront of their minds, the scientists associated with the Barrow Arctic Science Consortium work with a special sense of mission. Walt Oechel, from San Diego State University, heads a team that flies a one-man airplane over much of Alaska's North Slope in order to measure how much carbon dioxide is produced and absorbed by the thousands of square miles of tundra — he was the first to discover that the tundra, once thought to be an absorbing sink for atmospheric carbon dioxide, had, at some point in the 1980's, become a source, in effect pumping vast new amounts of the gas into the atmosphere. Bernie Zak, from the Sandia National Laboratories in Albuquerque, N.M., runs the Barrow site of a Department of Energy project that, along with sites in the Great Plains and the tropical western Pacific, seeks to measure the role that clouds play in Earth's heat-exchange processes. Dan Endres, living year-round in Barrow, runs the Climate Monitoring and Diagnostics Laboratory station here, the government agency that, along with stations in Hawaii, American Samoa and Antarctica, produced perhaps the most famous and persuasive piece of global-warming data: the graph showing 20th-century global temperatures running — and jumping — in tandem with worldwide emissions of carbon dioxide. And 25 miles away, there's George in his hat and gloves, huddled over his Coleman stove, with a week's growth of beard, breath pluming from his nostrils and lips starting to crack from the cold.

Within a week of our arrival, Cooper Island has lost much of its snow cover, the shoreline is beginning to emerge from its nine-month encasement in the sea ice and the mass of birds is back — some 235 black guillemots set to breed in the dark cavities of the rusted 55-gallon drums and destroyed ammunition boxes littered across the flank of Cooper Island. To lower the risk of predation, and to save the brightest daylight hours for fishing out on the sea ice, the birds show up on Cooper only at night, usually sometime after 12, and roost on the north side of the island's main pond, calling to each other with a high-pitched, melancholy whistle. Then, once they've achieved the safety of numbers, they disperse to their nest sites and commence their breeding activities: courting and head-bobbing, strutting and exploring their nest cavities and, of course, copulating wildly. By day, without the guillemots in attendance, the island looks like what it is — a gravel beach with trash on it. At night, however, with the birds teeming at their nest sites, the place is transformed by a hundred scenes of carnal bliss: Cooper Island, 90210.

> About climate change, George says: 'You still get these people who say, "Do you really think it's happening?" and I'm like, "What is it you don't understand?" '

Now that the birds are back, George picks up his pace, walking all night in the wind and rain, taking detailed notes of which birds have returned, which nest sites are occupied, who is mating with whom — all written into one of his yellow field journals with a pen taped to a footlong tent stake, the better to manipulate it while wearing two pairs of gloves. Because the birds are gone by day and here by night, George reverses his sleeping habits so that he can observe the birds from midnight until noon, then rest in the afternoon. And so that I can observe George, I do, too. But whereas the 24-hour light, the day-for-night sleep schedule and the ceaseless wind and cold all leave me disoriented — a victim of what scientists here call Arctic brain fuzz, in which higher brain functions seem to shut down as the body works to stay warm — George slips easily out of the diurnal rhythms of civilization and into the surreal, Cooper-driven universe, waking up cheerful and energetic after six hours of afternoon sleep. Since the sun never sets —

and won't for more than a month — long, undifferentiated stretches of time pass on Cooper, marked only by golden, low-angle light as the sun approaches the ocean at midnight and then, some five hours later, by a gradual brightening of the sky, followed by the snow buntings' chimelike music — a dawn chorus in a place with no dawn.

We do what we can to domesticate and structure the endlessly unspooling days. Waking at 10 p.m. to a breakfast of oatmeal or pancakes, we tune the shortwave radio to NPR's "All Things Considered." Then, after working through the night, we sit down to a dinner of Dinty Moore beef stew at 8 a.m., accompanied by "Morning Edition." At 12, not quite certain whether it's noon or midnight, we call it a day, wish each other good night and head off to our wind-blasted tents. There, we crawl inside two sleeping bags apiece and, truly warm for the first time in 18 hours, fall instantly to sleep. Many animals that live in or migrate to the Arctic each summer have special adaptive features. Polar bears have their eight inches of blubber, ankle-high willows possess scores of extra leaves to soak up the constant light, certain birds shut down their adrenal glands for the season so that their stress response does not become the death of them. Meanwhile, George, living like a large, flightless guillemot in his own low-lying cavity, seems to manage just fine without those adaptations.

Guillemots in the coalmine: In the mid-90's, George started seeing fewer birds.

After three days alone on the island, we are joined by George's field assistant, Tamara Enz. Extravagantly competent, no less hardy than George, Tamara immediately sets out to fix all of his half-baked projects — remounting the radio antenna to improve our communication with Barrow, shoveling snow into trash bags to avoid a late-summer drought of drinking water. Refusing to work all summer crawling in and out of a three-foot-high cook tent, she also builds a structure called a weatherport — essentially a piece of canvas stretched over an arched metal frame. The weatherport affords us a place to retreat from the wind and permits the luxury of cooking in a standing position. But because it's larger than the old cook tent, we can't seem to heat it with the propane stove; when the outside temperature is 28 degrees, the weatherport's temperature rarely reaches above 32 — it's like entering a walk-in meat freezer with the uncomfortable sensation that we are its meat. Sitting beneath the flickering light of the propane lantern while the weatherport creaks in the wind like a ship on high seas, we huddle around the radio, listening eagerly for the weather report, and the report is always the same: highs in the upper 20's, chance of rain, flurries and fog, wind out of the northeast at 15 to 20 miles per hour. Tamara, who at 35 has spent most of her working life in field camps from Maine to Alaska, tries to put the Cooper experience in perspective for me. "Here there's no camp cook, there's no place to go and you're on call all the time," she says. "You spend all day in the rain, the wind and the cold. And to warm up, you walk around in the rain, the wind and the cold." George smiles at the description and says: "I've been doing this for so long, I've lost the ability to assess what's uncomfortable. I mean, it's 32 degrees in here, and I'm working in gloves, but basically I feel good. Sure, my feet feel a little funny, and I'm losing sensation in my lower lip, and for dinner I'm drinking hot Jell-O and eating Wheat Chex melted in chicken bouillon" — he toasts the air with his cup — "but at 32 degrees, it tastes like mother's milk!"

Over the many years George has studied his guillemots, he has developed what he refers to as the Cooper culture — the practice of surviving on the fewest resources possible. For the most part, poverty has been the mother of invention. Though George now gets financing from the National Oceanic and Atmospheric Administration and has income from his off-season work as a seabird consultant for the council investigating the Valdez oil spill, for many years he had to cobble together his field-season budget from a half-dozen sources or, when his funds dried up completely, raise the money himself. During much of the 1980's, he had no funds, no assistant, no radio, and he lived on a diet of oatmeal and rice. To minimize his resupply costs, he'd cache his unused cans of food and fuel in the permafrost, then draw himself a map so that he could dig them up the following year. And he has taught himself time-honored survival techniques used by the Inupiats, like supplying himself with drinking water by melting multiyear sea ice, or waiting for freshwater to float to the top of the lagoon during breakup.

But even now, when he has the money to prosecute his research with less day-to-day hardship, and at a time in life when many of his friends are complaining of their aches and pains, George chooses the ascetic path. "People are always saying to me, 'Why don't you build a shack?' But I need to have a personal relationship with the birds. I need to be in their environment, to experience what the guillemots do, to know what it feels like to leave your cavity in the wind and the rain." Among Arctic scientists, many of whom have their data relayed to them by computer, George is an anomaly, and when he attends conferences on polar science, he sometimes gets miffed. "I once heard someone give a paper on trace metals in Arctic water," he says, "and it was clear the guy had never even been to the Arctic. I thought, *I've passed more Arctic water through my bladder than you'll see in a lifetime*!"

George looks out the weatherport door into a swirl of fog and freezing rain. "Do you think it's strange that I've left a series of beautiful women in April and May — one of whom wanted me to spend the summer at *her mother's Long Island summer house* — to come up here?" He shakes his head. "Basically it all comes down to the yellow field books at the end of the year. I mean, I actually *broke up* with someone here in 1980, but I look at the field books and think: *1980, now that was a good year*!"

In the field of ornithology, you can find other examples of scientists who have kept long-term studies going, year after year. In Great Britain, starting in the 1930's, the naturalist Ronald Lockley studied shearwaters and puffins for 20 years. In New Brunswick, Charles Huntington, a professor from Bowdoin College, has kept a study of Leach's storm petrels going since the 1950's. But in the nascent field of climatology, rare is the scientist with anything longer than a 5- or 10-year data set. That the guillemots come back year after year is, on the whole, less surprising than the fact that George does, too. In the 27 years that have elapsed since he first be- *Continued on Page 47*

PHOTOGRAPH BY JOE McNALLY FOR THE NEW YORK TIMES

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gan his study, the dead walrus by our campsite has lost all its skin, fat and muscle; the young boy who once brought out supplies to Cooper grew up to become the mayor of the North Slope Borough; and Cooper Island itself has eroded a quarter of a mile to the northwest — George's old campsite and airstrip on the east end are now completely underwater. When George wanders the beach, strange, ancient-seeming objects catch his eye, and he picks them up, marveling at how they could have reached Cooper Island — before he remembers bringing them out himself more than two decades before. All of which has put him in a unique position to track changes in the Arctic climate and to make sense of large, seemingly random events that take years to figure out, like the one that began 10 years ago when the population of his guillemot colony gradually and mysteriously began to drop.

Throughout the 1980's, almost 650 birds were coming to Cooper Island each summer, and with 85 percent over-winter survival, competition for the 200 or so nest sites was fierce — one bird came back 11 years in a row before it could breed. "It was like rent control in New York," George says. "They were all waiting for someone to die." Then in 1995, he passed by two nest sites and saw the same male going back and forth, pairing with two females. "I didn't believe my eyes," he recalls. "I'd never seen a female without a male, I'd never seen bigamy, and as all males know, you can't keep one female happy. . . . " Looking around his colony that year, he saw 10 more females who owned a nest site, but couldn't attract a mate. Something, apparently, was decreasing adult survival.

A second clue came four years later, when George noticed a lot of sibling aggression among chicks — a sign that food was scarce. And at several nest sites, he saw something else he'd never seen before: orphaned chicks, not yet able to fledge, starving and walking away from their nests toward shore in search of foster parents and food. "It was pretty disturbing. I picked up one chick, and it was more stress than he could take — he died right in my hands." Something was decreasing adult survival, and something, apparently, was killing off chicks.

If George's colony had consisted of any bird besides a black guillemot, his investigation of this gradual population drop might never have led him to look for answers in the Arctic environment. Arctic terns, for example, winter in Antarctica and fly 25,000 miles each year — through the tropics, through the temperate zones — before arriving in the Arctic to breed; anything between the earth's two poles could cause them to die off. Similarly, glaucous gulls, though not particularly migratory, feed on human sources of food like dumps and carrion, and therefore pick up anthropogenic contaminants that could confound interpretation. George's guillemots, on the other hand, spend their whole annual cycle in the Arctic — wintering from September to May in the pack ice of the Chukchi and Beaufort Seas, then coming to Cooper Island to breed. As George puts it, "They're not temperate-zone birds just slumming it in the Arctic." The guillemots feed at the ice edge all year long, where prey is most plentiful; they feed only on other Arctic organisms like cod and zooplankton; and they have a long, 80-day breeding cycle that they must wedge into the brief Arctic summer, which starts with the snow melt in June and goes right up to the first snowfall of the year in September. They are creatures, in other words, wholly dependent on snow and ice habitats sustained by them, restricted by them and adapted to them — they are captive to the Arctic environment and thus the first to reflect a change.

And George, no less captive to the snow and ice of Cooper Island, began to see a correlation: when the polar pack ice remained up against the shores of Cooper Island, as it did in the 1970's and 1980's, his guillemots — able to feed easily from the nearby ice edge with its great density of prey — had fabulous breeding success. When warmer summer temperatures caused the pack ice to pull offshore and retreat northward out of sight, as it did through the 1990's, his birds were unable to reach the ice edge and began to die off. By 1999, when a series of papers came out describing a major retreat and thinning of the Arctic pack ice due not only to gradually warmer temperatures, but also to a decadelong upper atmospheric shift called the Arctic Oscillation, George was in a position to put the pieces together. His colony was not merely tracking the advancement of snow melt and the earlier arrival of summer; it was also articulating a change in the very makeup of the Arctic itself — the shrinking of the polar ice cap — with all its potentially drastic worldwide consequences.

George, of course, is not the only scientist tracking the physical and biological affects of a warmer climate — permafrost melting, coastlines eroding, moose expanding northward, walruses losing ice habitat on which to pup and hunt. But when it comes to relating such observations to the larger, slow-moving story of climate change, those data sets are useful only in direct proportion to their longevity and depth. And whereas some scientists find the long-distance work of climatology tedious and lacking in the kinds of signal events that grab people's attention, George is undeterred, married as he is to the year-to-year process.

It's interesting to consider: if George had begun his study five years ago, he would have missed the advancement in snow melt, the advancement of summer. If he'd begun his work as far back as 1990, he could never have connected the colony's population drop with the retreat of the pack ice. Having amassed a continuous, eyewitness data set for 27 years, however, he was watching the climate change not only in year-to-year increments but also in shifts from decade to decade, which has enabled him to see through the static of natural climatic cycles like the Arctic Oscillation, which may warm the region one decade, then cool it the next.

"I sometimes forget that there's no other island in the Arctic where someone has gone back for 27 years," he says, cinching his hood and drawing up his face mask, preparing to leave the weatherport. "Now I feel totally obligated to keep the study going. People say, 'Couldn't you just take a year off?' But if I skip a year, then it's lost. I only have one chance." He opens the weatherport door, and the wind nearly snaps it off its hinges. "I don't want to sound like the Old Man of the Arctic, but I can remember the year the ice did this, the year the snow did that. I have the data set, I've got the numbers. It may be that I came back to Cooper all these years simply because I have minor attention deficit disorder, or all this summer sunlight has given me an addiction to high serotonin levels. But it meant something to me in a way that wasn't abstract. I was there. I saw it. And I saw it because I was there, living in my tent."

'I don't want to sound like the Old Man of the Arctic, but I can remember the year the ice did this, the year the snow did that. ... And I saw it because I was there, living in my tent.'

V: IN WHICH GEORGE SEES INTO THE PAST

The farther north you travel in this hemisphere, the more you hear conversations about the climate getting conducted not in the future, but in the present tense. In Whitehorse, the capital of Canada's Yukon Territory, officials now hold an annual exposition showcasing products to help residents mitigate and adapt to an already warmer climate. In Barrow, the Alaska Eskimo Whaling Commission spent a large part of its annual convention last year discussing, among other things, the perils of hunting bowhead whales from increasingly thinner ice. Some Alaskan natives, mindful that "traditional knowledge" is often considered merely anecdotal and lacking in scientific rigor, have set up a Web site (nativeknowledge.org), on which you can see two thousand people sharing much the same anecdotes: turtles appearing for the first time on Kodiak Island, birds starving on St. Lawrence Island, thunder first heard on Little Diomede Island, coastal storms undercutting houses at Shishmaref, snowmobiles falling through the ice in Nenana. . . . Already the central Arctic is warming 10 times as fast as the rest of the planet, outpacing even our attempts to describe it. In Canada's Northwest Territories, Inuit Eski-

mos saw their first robin last summer, though there's no word in Inuit for "robin."

Those who remain skeptical that the Arctic is undergoing a period of rapid climate change point out that the region has always gone through cycles of warming and cooling, sometimes in just decades or even years. Perhaps, according to this argument, natural fluctuations cause the water to warm and cool, and the ice to thin and thicken as atmospheric pressures, water currents and wind patterns change. But the latest findings coming out of the Arctic suggesting a longer-term trend are hard to dismiss, even if their ramifications may not be felt elsewhere for many years. Recently unclassified submarine data, for example, show that the ocean's covering of snow and ice has thinned in some places by up to four feet, or 40 percent, since the 1960's. And satellite data indicate that the ice's reach has receded at a rate of 3 percent per decade since the 1970's. Recently, warmer, saltier water from the North Atlantic has crept farther into the Arctic basin than ever seen before. And that water is about 2.7 degrees Fahrenheit warmer than it was only a decade ago, causing further melting. Current models predict that global temperatures will rise by between 0.9 and 3.6 degrees Fahrenheit by 2050. And the rate of increase could be three to five times higher in the Arctic.

For their part, the black guillemots of Cooper Island cannot foretell the future. But just this past year George did devise an ingenious way for his birds to narrate the past. In the feathers of any guillemot are a host of chemical compounds that reveal aspects of its physiology, and one such compound — a naturally occurring carbon isotope called delta 13C — gives, in effect, a snapshot of what that bird has eaten from the carbon-based food chain in the past six months, just as a human autopsy can reveal the deceased's last meal. Since each region of the Arctic also has a different carbon signature — the sub-Arctic Bering Sea, for example, is biologically highly productive and therefore possesses more of the isotope than the more northerly Beaufort and Chukchi Seas — a particular feather's delta 13C content can identify not just *what* that bird may have eaten, but also *where*.

Knowing that delta 13C is permanently preserved in feathers; knowing, too, that many Barrow-area guillemots going back as far as the 1880's had been shot, stuffed and housed in museum collections throughout the country, George sought permission to analyze those birds' feathers in order to compare them with feathers taken from his Cooper Island colony. Permission was granted, and guillemot feathers going back 120 years arrived at his Seattle home from collections in Philadelphia, Fairbanks and several points in between. George immediately sent them off to a lab, and when he plotted his data on a map, the results were startling. While the delta 13C content of the 19th-century birds was quite high, suggesting they'd had to fly as far south as the Bering Sea in winter to find ice cracks in order to fish, the more recent feathers possessed far less of the isotope, indicating that the birds had been able to winter some 500 miles to the north, in the Beaufort and Chukchi Seas. It suggested that over the past 120 years increasingly warmer temperatures were causing the pack ice to recede, causing cracks to open up farther and farther north. In effect, George had taken his 27-year study and back-cast it to show that guillemots were tracking more than a century of warming.

"Skeptics can always find fault with the instrumentation used to take temperatures back in the 1880's," he says. "But with the carbon isotope, it shows a huge decrease in delta 13C from 1880 to the present, which only makes sense if the birds were wintering farther and farther to the north. It's incredibly powerful. It's more than a hundred years. And it is," he says in a moment of gravity, "the only interpretation of this data."

VI: IN WHICH GEORGE CONFRONTS HIS OWN MORTALITY

Cooper Island, June 18, 2 o'clock in the afternoon. In the huge amphitheater of the sky, several weather systems are playing simultaneously — rain to the south, cumulus clouds to the north — but for the moment the feature attraction is directly overhead: azure skies, not a cloud above, and the sun warming the air to an astonishing 35 degrees. With no wind for the first time in over two weeks (and no trees to rustle in a breeze), the island's birds have complete dominance of the sound stage: honk of geese, warble of snow buntings and — the soundtrack of the Arctic — the upward yodeling of long-tailed ducks as they fly in perfect V-formation above our heads. My, what a beautiful day!

The good weather is of more than passing interest to us right now. Four days ago, just minutes before he was scheduled to airlift me off the island and resupply George and Tamara with food, Gary Quarles radioed that he wouldn't be coming out after all. With the sky thick with fog, visibility was dangerously low, he said. And besides, Barrow Search and Rescue was short two pilots and had put him on 24-hour call. He'd get out to Cooper as soon as possible, he promised, weather permitting. But that was four days ago, and though we keep gazing up, looking for signs of our deliverance, there has been no indication of a chopper in the sky. For George, this is how it always goes. One year, he ran out of food on Cooper and radioed to Barrow, arranging for resupply, but the dispatcher went on vacation without forwarding George's message, and two weeks passed before someone happened to walk by the radio and heard his plaintive voice: "This is Cooper Island, *can you read me*?" Now, sitting outside the weatherport in the uncommon sunshine, he shrugs and says, "Nothing to do but hope the weather stays clear and look forward to some very positive news. I'd say you're getting the full Cooper now."

In the course of his 27-year study, George has not missed a single summer on Cooper Island, but there was a time in the mid-90's when he thought of giving it up. Back in Seattle, in what he refers to as "the dark years," his marriage was coming apart, he needed to spend more time with his school-age son, Karl, *Continued on Page 54*

DIVOKY'S PLANET

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and he began to doubt the value of all this work. "Like it or not," he says, "I've had a number of relationships go to hell because I always leave on June 1, saying, 'I'm going to the moon — goodbye.' And the financial commitment is not insignificant. And so, up to 1995, there was a feeling of — 'Wait a minute. What's going on here? Is this just another study with utility to only a subset of ornithologists? What have I done with my life?'" But when, rather suddenly, his bird study began to intersect with the larger story of climate change, George recommitted to Cooper Island and his colony of guillemots in ways he'd never imagined.

Among his colleagues in Barrow, George is a local hero for the tenacity he has shown out on Cooper Island. And his graph displaying the advancement of egg-laying among his colony of guillemots has been given a special place of honor on the wall of the Climate Monitoring and Diagnostics Laboratory in Barrow, next to the graphs of several multimillion-dollar government studies. But aside from completing his dissertation in 1998 and having an article accepted by the academic journal Arctic, he hasn't published his results or sought a wider audience. And when I ask him why that is, he looks down, he removes and cleans his glasses with his shirt, and when he looks up again, he speaks in a slow, deliberate voice. "It makes me feel really bad that I haven't gotten this out earlier," he begins. "And so it's hard for me to talk about. I think that whatever characteristics cause people to do long-term studies are somehow linked to their not wanting or needing to be published. But I don't want to make excuses. I'm 55. My father died when he was 54. I don't want to say that I outlived my dad and then fritter away the next 20 years. Or die and have someone say of me, 'He had a data set that could have really added to the debate.' Now," he goes on, "there's almost an obligation. Especially with George Bush in office, and people saying, 'Is climate change real?' You still get these people who say, 'Do you really think it's happening?' and I'm, like, '*What is it you don't understand*?!' It needs to get out, and it needs to get out soon. People say that it's happening naturally, and why should we worry? But the world may not have the stability we think it has. This," he says, gesturing around the island, "is evidence that stasis isn't operating."

George does not involve himself with the various strategies — conservation, reducing fossil-fuel emissions, reforestation programs — that may if not reverse then at least mitigate what the vast majority of scientists now believe to be a worldwide warming trend driven in part by human activity. As George sees it, his job is to question and observe until he fully understands the workings of his own particular planet — this strip of sand and gravel 25 miles off the coast of North America. But to witness all the changes that have come to Cooper Island and its birds over the past 30 years is to wonder when those changes will work their way up the food chain to us, despite civilization's capacity to buffer us from the day-to-day pressures of natural selection that formed the species as we know it. To be stranded on Cooper Island is to be reminded of the larger sphere on which we are all confined, along with all the changes we may have wrought. George shakes his head and looks off. "Aside from the nuclear threat," he says, "there hasn't been much in science that has the potential to affect a larger percentage of the population's everyday life."

And so, George is stepping up the pace. Having all but abandoned his original ornithological inquiry in favor of an all-out assault on Arctic warming, he plans to put a portable weather station on Cooper to get more precise correlations between the climate and his birds. He has talked to a scientist with a robotic airplane about flying out to Cooper to photograph the island from a bird's-eye view. He plans to begin sampling fat in chicks and adult guillemots to see if their nutrition can be related to ice conditions. And he has applied for a berth on a government icebreaker cruise next year to study the guillemots' winter habitat out on the ice.

Finally, at long last, Dave Ramey's voice comes over the radio, informing us that Quarles is on his way. And within half an hour, we can see his helicopter cruising toward us over the ice of Elson Lagoon. After two and a half weeks spent on Coo-

per Island time, my departure seems to occur in fast-forward. The helicopter touches down by the weatherport in a swirl of dust and gravel. With Quarles waving me in, I bid a hasty farewell to George and Tamara. And after I throw in my packs and jump on board, we lift off in the deafening roar of the rotar-chop.

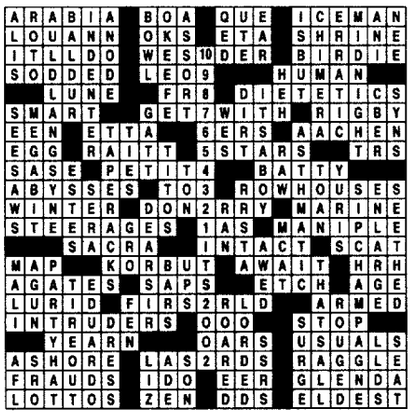
As we climb into the sky, Cooper Island begins to recede and lose detail. Out on the ocean, a line of pressure ridges — huge, colliding slabs of blue-green sea ice — rises up like the skyline of a distant city. Above them, a thin dark line of cloud — what the Inupiat call "water sky" — reveals the invisible presence of an ice crack out on the horizon. Give or take a passing icebreaker, or a native hunter looking for seals from an ice floe, the next group of human beings is probably in Svalbard, Norway, on the other side of the globe.

By the time we reach our cruising altitude of 1,000 feet, Cooper Island is just a patch of gravel in the vastness of the frozen ocean. From up here there's a temptation to employ the tropes of a hundred nature writers, to think of Cooper — of the Arctic in its entirety — as some distant, untouched environment, following only the rhythms of nature that the Alaskan poet John Haines once wrote of: "A place where the clocks are stilled and the sun still holds some of its ancient power; another kind of rhythm dominates existence: *When the ice goes out, when the fish come, when the geese and ducks begin to gather.*" But already those rhythms have been disrupted. The birds come back to the island earlier and earlier each year, the ice pulls offshore and the birds starve. And if the seas do rise, even Cooper Island, at nine feet above sea level, will go under. It may take years — it may not happen in his lifetime — but George plans to get himself a raft, just in case.

When I look below me, I can barely find the weatherport and the three yellow domes. But then I spot George out by the north beach, knees bent, telephoto scope up to his eye. Clinging to the frozen rim of the inhabited world, with his levitating tents and his wavering radio antenna, his shotgun and his limp polar-bear fence, he looks to the skies and waits. ■

ANSWERS TO PUZZLES

OF DECEMBER 30, 2001



THOMAS MANN, THE MAGIC MOUNTAIN — Time has no divisions to mark its passage, there is never a thunderstorm or blare of trumpets to announce... a new month or year. Even when a new century begins it is only we mortals who ring bells and fire off pistols.

A. Terminal
B. Herb
C. Often
D. Monotony
E. Afresh
F. Sunrise
G. Moss
H. Awake
I. Nineties
J. Noon
K. Transient
L. Hiatus
M. Erstwhile
N. Mayflower
O. Advent
P. Glass
Q. In progress
R. Cobwebs
S. Mood
T. Orrery
U. Update
V. Night shift
W. Twelve
X. Annual
Y. Improv
Z. Neoteric