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Ripple Marks

The Story Behind the Story

BY CHERYL LYN DYBAS

Siberia on the Chesapeake: Winter Storms Foretell Changes in Chesapeake Waterfowl Populations

A preternatural quiet has fallen over the land. Our breathing is the only sound. On this cold snap of a February day, even exhaled air is quickly stilled, flash-frozen into ice crystals. Wind-whipped snows rest in six-foot-high banks that stretch for miles. We might be in Siberia.

Suddenly, not in Russia but in Maryland along the Chesapeake Bay, a hushed world springs to life. Hundreds of lesser snow geese, their wings white-on-white against the deep snows, take flight from a nearby field, startled, perhaps, by our presence. Lesser snow geese breed in summer in Siberia and other High Arctic locales. The geese leave the Far North before the first blizzard, to drift down and settle for the winter along the normally snow-free mid- and South Atlantic coast.

"But they, and we, were in for a big surprise this season," says Suzanne Baird, manager of Maryland's Blackwater National Wildlife Refuge on the Chesapeake. The 26,000-acre refuge serves as wintering grounds for vast numbers of waterfowl—in most years. In February 2010, snowfall shattered all records in the mid-Atlantic region. "Over the past two weeks alone, we've been buried under more than 50 inches," says Baird, climbing atop a snow pile to look at refuge conditions. "Many of the geese and ducks have flown, but some are still here, riding out the storm."

To one-third of the Atlantic coast's migratory waterfowl, the Chesapeake Bay has been the avian equivalent of Florida. "They're as much a part of the bay in winter as the water and the sky," says Matt Whitbeck, wildlife biologist at Blackwater.

How long will Chesapeake inlets, marshes, and fields be filled with ducks of every description?

Blackwater's snow-changed waterfowl population may be a harbinger of things to come. In spite of the cold weather in the eastern United States last January and February, the winter was the fifth warmest on record worldwide. A manifestation of global warming, regionally severe winter weather may be linked to a planet whose temperature is going up, not down. A warmer atmosphere holds more moisture and, as large land masses like North America cool over winter months, increased snowfall results.

"If these changes become the norm," says Chris Haney, chief scientist at Defenders of Wildlife, "they will alter all kinds of migratory pathways."

The Chesapeake's wintering duck populations are already decimated by loss of the underwater grasses and oyster beds on which many waterfowl feed. In the 1930s, for example, an estimated 500,000 canvasbacks congregated from December through March in just one place in the upper Chesapeake. Today, only 50,000 canvasbacks winter on the entire bay.

Long-term trends in wintering waterfowl populations are tracked throughout the United States in an annual waterfowl survey, conducted in January or February each year. In 2010, "extensive ice on the Chesapeake led to less open water and lower numbers of several duck species," says Larry Hindman, waterfowl project leader at the Maryland Department of Natural Resources. Survey teams counted 787,100 waterfowl on Maryland's Chesapeake Bay and Atlantic coast, down from 836,900 the previous year.

The fields that line the Chesapeake usually aren't winter white, but the gold of wheat, a favorite food of snow geese and other waterfowl. Marshes often remain ice-free, attracting ducks like northern shovelers. "With snow and cold, though," says Baird, "geese become concentrated in the few fields where they can reach corn and soybean stubble to eat. Ducks huddle tightly together, paddling around small open-water patches in ponds."

We skid along Blackwater's icy Wildlife Drive in Baird's SUV, approaching pool Number One. There, a pair of northern shovelers shivers at the edge, sliding every so often into the flinty water. In several loops around Wildlife Drive, we would count only a smattering of ducks. "Everything has taken cover," says Baird, bundled in a dark green US Fish and Wildlife Service parka.

Not far from Blackwater along the Choptank River, the situation is much the same. At the end of a deserted, snowy road, a wide-angle view of the Choptank awaits. It's a look at nothing but water. "In years past," says Braedan Quigley, director of sales at the nearby Hyatt Regency Chesapeake Bay, "waterfowl blanketed the river. The wingbeats of thousands upon thousands of ducks filled the air."

Today this land's end holds little but a closed oyster-packing plant, its doors jammed shut by snowbanks. Tattered window screens knock against empty buildings in a place suspended in time, awaiting a sea change in the Chesapeake's weather—and ultimately in its fortunes.

Adapted from an article by C.L. Dybas in the winter issue of Defenders *magazine.*

Photos courtesy of Ilya Raskin.

Early Spring Disrupts Life on Northern Rivers

The winter-old river ice creaks and groans, shifting position. Spring has come early to the frozen upper Hudson River, and ice-out is just around the corner.

Lilliputian wildflowers will soon line the Hudson's banks. In what are known as riverside ice meadows, an ancient cycle of ice formation and melting gives rise to swamp candles, ladies'-tresses, wood lilies, and other rare, diminutive flowers.

In New York's Adirondack Mountains, ice that forms on the river in winter is pushed onto its banks in spring. There, it scours the sloping cobble shores, keeping them free of shrubs and small trees and leaving space for wildflowers to sprout in fragile, Arctic-like ice meadows.

But the future for these floral pixies, which depend on late-melting river ice, is bleak. The number of ice-covered days on northeastern rivers has declined significantly in recent winters, says hydrologist Glenn Hodgkins of the US Geological Survey (USGS) Maine Water Science Center in Augusta.

The trend could spell disaster for the ice meadows. It also signals trouble ahead for endangered Atlantic salmon and other fish, for wetlands plants and animals, and for northern economies, all of which are sustained by winters with icy rivers.

"Northeastern rivers have 20 fewer days of ice cover each winter now than they did in 1936," says Hodgkins. The total now averages 92 days. "A lot of that decrease has occurred since the 1960s," he says.

Hodgkins studied 16 rivers in Maine, New Hampshire, and Vermont. In recent years, the data show that 12 of the 16 rivers had much earlier ice-out dates. "On average, ice-out dates were 11 days earlier in 2000 than in 1936," Hodgkins said. "These changes are linked to warmer temperatures in late winter and early spring."

Winter, it appears, is melting around the edges.

Research by Hodgkins and USGS scientist Robert Dudley also shows changes in early spring stream flow across eastern North America from Minnesota to Newfoundland. Rivers are gushing with snow and ice melt as much as 10 to 15 days sooner than they did 50 to 90 years ago, based on USGS records.

Along with riverside plants, we and other animals may be the poorer for it.

"The next thing we have to figure out," says Hodgkins, "is whether groundwater, an important source of our drinking water, is being affected. The timing of spring ice-out and snowmelt is especially important to groundwater resources in the northeastern United States, where aquifers consist of thin sediments overlying bedrock. They have little storage capacity."

After what hydrologists call spring recharge, groundwater slowly flows into streams throughout the summer. This groundwater flow is a source of cool water during summer and accounts for a large percentage of streamflow during low-flow periods, says Hodgkins. He and other USGS scientists are analyzing groundwater levels in dozens of wells throughout northern New England that have at least 10, and often more than 50, years of data.

The answer may lie just outside Hodgkins' door. The Maine Water Science Center, where he works, is two miles from the Kennebec River.

"In more than 20 years here," says Andrew Cloutier, another researcher at the center, "I've never seen the river as ice-free as it's been in recent winters." Scientists usually retrieve samples of river water in winter by drilling through ice that's several feet thick. "But not so anymore," says Cloutier. "We're just as likely to be out there in open water in hip waders."

Hydrologists haven't been the only ones in hip waders, says Jim Worthing of Randolph, Maine, who rents huts to ice fishers through his Jim Worthing Smelt Camp. In most years, the fishers set huts on the surfaces of frozen rivers to catch smelt. "Several seasons now I've had to put the huts on floaters [floating platforms] and pull them into the river so people could still fish," he says.

Smelt fishing, a popular rite of winter in Maine, "starts as soon as ice forms on rivers," Worthing says. Smelt are anadromous fish, hatching from eggs in rivers and then migrating to ocean shallows, where they spend their adulthood before eventually returning to freshwater. In December, the fish begin moving upriver, where the ice fishers await them.

"Or did," says Worthing. "I'm beginning to think the end is coming for ice fishing on rivers here. But never mind us—what's it doing to the smelt?"

Plenty, if the work of scientists like Joan Trial is any indication.

"Lack of ice on rivers severely affects fish, especially anadromous fish like endangered Atlantic salmon," says Trial, a biologist at the Maine Department of Marine Resources in Bangor. "Ice cover insulates rivers and streams, protecting young salmon from cold. Without that cover, the salmon are also more susceptible to predators." Bald eagles, for example, are able to snare their piscine prey only from open water.

Atlantic salmon are in peril for several reasons, but Canadian researchers Terry Prowse of the University of Victoria and Joseph Culp of the University of New Brunswick say that lack of river ice has the potential to kill large numbers of salmon eggs, as well as juvenile and adult fish.

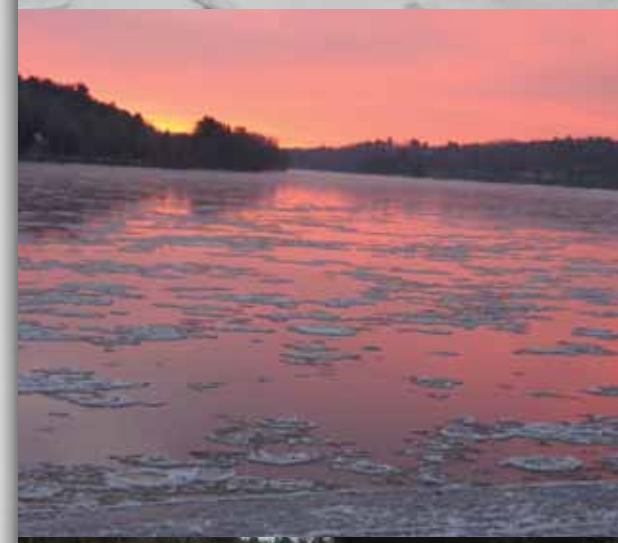
The most difficult winter situation for salmon and other fish, the biologists say, is on-again, off-again ice cover: rivers that freeze over one week and are open the next.

Fish expend critical energy responding to these unstable conditions. Ice that doesn't stay frozen may also contribute to the deaths of aquatic animals such as northern leopard frogs, which overwinter far beneath a chilled-to-freezing blanket.

A reduction in river ice between January and April has important ecological effects, says Hodgkins, including more frequent formation of "anchor ice." Anchor ice, a spongy, smothering type of ice, covers the bottom of a river instead of "floating" on top. It can't form when a river is already frozen. "Anchor ice slows down or eliminates water flow near the riverbed, which leaves fish embryos starved for oxygen," Hodgkins says.

When river ice finally breaks up in spring, the process results in what's known as ice-jam flooding: water spilling over the banks behind piled-up ice. Ice-jam flooding, say Prowse and Culp, is the main way water levels are sustained in ponds and wetlands alongside rivers. Without this flooding, habitat often disappears for migrating waterfowl and aquatic mammals such as beavers and mink. If there's not enough ice during winter, wetlands can quickly become dry lands when spring arrives.

At the ice meadows along the upper Hudson River, that's indeed the story. If the trend continues, say scientists, the wood lilies and ladies'-tresses may soon be gone in the warming winds.



Left page and background photos courtesy of Carl Heilman II/Wild Visions Inc.
Right page photos courtesy of Glenn Hodgkins, USGS.

Winter Roads Need a Diet: Low Sodium

Look at any car in the northern tier of the United States in winter, and you'll see why roads need to go on a diet—a low-sodium diet.

From November through March, autos, trains, and buses in cold climes are covered in a spray of white: road salt (sodium chloride). But scientists are finding that de-icing roads during winter storms inflicts widespread damage as road salt chemicals wash downstream.

The rise of the automobile a century ago allowed people to live farther apart—and farther from where they worked—creating new issues for management of winter roads. The first major attempts at snow removal came in the early 1860s with snowplows attached to horse-drawn carts. After the great blizzard of 1888, which paralyzed the Northeast, city officials realized they had to do more than just plow streets. As roads were cleared of snow and ice, the exposed pavement retained melted snow that refroze into ice. Enter salt and sand.

Thanks to their low cost in dollars, road salt and sand are still the most widely used substances to treat snowy and icy roads, according to the Adirondack Council report *Low Sodium Diet: Curbing New York's Appetite for Damaging Road Salt*. But the cost to the environment is high, show studies in the Adirondack Park and elsewhere. When washed downstream, road salt has significant effects on the chemistry and ecosystems of waterways near treated roads.

Continuous levels of chloride concentrations as low as 250 milligrams per liter, the equivalent of one teaspoon of salt in five gallons of water, are harmful to aquatic life and permeate drinking water enough to affect its taste. And our health.

Road salt doesn't evaporate or disappear. Eventually, it drains into nearby waters or seeps into soils. Windblown salt can be toxic to roadside vegetation. Trees and other plants along roads where salt is frequently used suffer from leaf burn, the browning of needles or leaves. Scorched by the toxicity of chloride, they often die and are replaced by nonnative species more tolerant to high chloride concentrations.

Waterways and road salt are an equally bad combination. Streams, ponds, or lakes, especially those with limited, seasonal outflow, are greatly affected by salt runoff, says Emily Debolt, a scientist at the Lake George Association in Lake George, New York. Increased levels of chloride and sodium, she says, interfere with fish spawning, degrade streams for fish and invertebrates, and create an environment conducive to invasive species.

"The high salinity increases the density of water, leading to a lack of annual mixing," says DeBolt. "Without this process, deep waters may become anoxic and cause widespread aquatic plant and animal die-offs. Essential nutrients are no longer transported to the surface, where they're needed by phytoplankton at the base of the aquatic food web."

North of the Adirondacks, road salt contamination in Frenchman's Bay near Pickering, Ontario, exceeds provincial water quality standards by as much as 250%, according to research by geologist Nick Eyles of the University of Toronto.

Scientists at the University of Minnesota studied 39 lakes, three major rivers, 10 tributaries, and numerous wells in Minnesota. They found that almost 70% of the road salt applied in the Twin Cities is retained in the watershed. "Where does road salt go when winter is over?" asked scientist Heinz Stefan of the university's St. Anthony Falls Laboratory. "Now we know."

Chloride concentrations in 39 metro area lakes increased over the past 22 years, following a similar trend in road salt purchases by the State of Minnesota. Both show a marked rise from 1984 to 2005. If the trend continues, say the researchers, the salinity in the city's lakes would double in 50 years.

In yet other studies, waters in more than half the streams in and near Milwaukee, Wisconsin, are toxic during the winter de-icing season, with lingering effects into the summer.

Farther afield, samples from 55% of streams in 13 northern US cities were potentially road-salt-toxic; 25% exceeded acute water-quality criteria. The results, from a study by scientist Steven Corsi and colleagues at the US Geological Survey's Wisconsin Water Science Center, were published last fall in the journal *Environmental Science & Technology*.

To help reduce the effects of road salt, scientists recommend more judicious use. Applying it below 15°F (-9.4°C), for example, is usually not effective in melting ice.

Water with lower salt concentrations will help roadside trees and downstream aquatic life—and rusting cars. But there's an added benefit to a low-salt diet for roads: it will go a long way for the millions of people with high blood pressure who watch their salt intake.

Photo courtesy of Carl Heilman II/Wild Visions Inc.

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