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WHAT'S HAPPENING TO ARCTIC ICE?

Sea ice in Canada's Arctic and sub-Arctic regions has been melting rapidly over the past three decades, causing concerns that climate change is speeding this fragile region toward an uncertain future. If thinning continues at its current rate, by 2050 the Arctic Ocean could be completely ice-free in summer.

Polar bears in some regions are already being affected by the rapid disappearance of sea ice, which they rely on for hunting seals.

What may seem like a boon to the shipping industry would bring unprecedented social, economic, and environmental changes to the North. Aboriginal people and many species of wildlife, including polar bears and caribou, rely on sea ice for hunting, feeding, and travel. On a global scale, Arctic ice and snow play a key role in regulating the Earth's temperature by reflecting sunlight before it warms the surface. Altering this dynamic will affect the planet's climate in ways that are only now being imagined.

Numerical simulations of future climate by various global models—including Environment Canada's state-of-the-art global coupled model—support the theory that the effects of climate change will be felt first and most intensely in the Arctic. Although there is uncertainty over timing, most scientists agree that there will be less sea ice in the future, and there is concern that this thawing trend may be irreversible.

Observational evidence also supports this theory. Environmental monitoring shows that the Arctic is warming at a rate that is unprecedented over the past 400 years. The average annual temperature at Resolute Bay—a meteorological station in the Arctic archipelago—has increased by 1.3° C since 1969. Over the Canadian Arctic as a whole, the increase was more than 1°C over the last half of the 20th century.

The extent of Arctic sea ice, as observed primarily by passive microwave radiometers on satellites, has decreased at a rate of about three per cent per decade since the 1970s. Sonar records from British and American submarines indicate that Arctic ice thickness in summer has diminished by some 40 per cent since the 1950s. A recent study by the U.S. National Aeronautical and Space Agency says Arctic sea ice is vanishing at a rate of roughly nine per cent per decade—a rate that is speeding up as more ocean is exposed and greater amounts of solar energy are absorbed.

Historically, Canada's Arctic waters are covered by an essentially solid ice pack throughout winter. The ice starts to break up in July, permitting a three- to five-month shipping season before freeze-up begins in October. While some areas of the Arctic Ocean, such as Hudson Bay and the coastal zone of the Beaufort Sea, almost always become ice-free in the summer, others remain covered in ice year-round. In recent years, however, forecasters at Environment Canada's Canadian Ice Service have noticed that the ice is melting much more extensively than normally and is not forming as early in the fall.

To determine if there was any quantitative trend in this pattern, the Ice Service digitized the weekly ice charts it has produced for the Canadian Arctic since 1969. By totalling the ice coverage on these charts for each summer season (June 25 to October 15) from 1969 to 2001, meteorologists were able to study differences in total accumulated coverage from one year to the next.

Their studies confirmed that the total coverage of sea ice in summer had decreased by about 15 per cent in the Arctic (north of 60° latitude), and by about 40 per cent in the sub-Arctic area of Hudson Bay. The data were then further divided to

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A map of the Canadian Arctic, indicating areas where sea-ice studies have taken place.

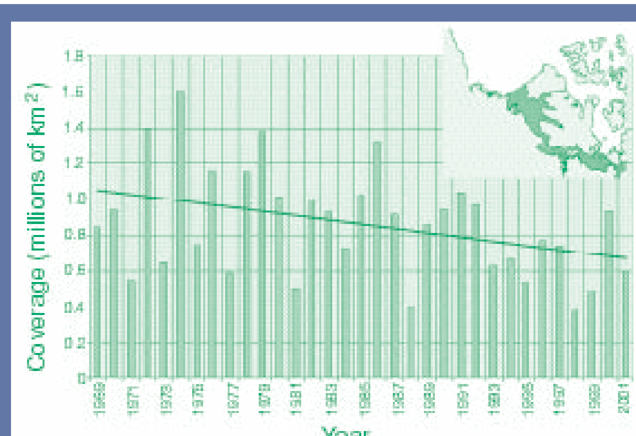
look at differences in trends between the Eastern and Western Arctic. In the Eastern Arctic, a 15-per-cent decrease in coverage was detected overall, while the three sub-regions of the Western Arctic showed declines of 10 per cent (Viscount Melville), 12 per cent (Beaufort Sea), and 36 per cent (Western Arctic Waterway). Not surprisingly, the shipping season in these regions had increased by three to nine per cent during this same period.

While confidence was lower that the trends observed in the first two sub-regions of the Western Arctic were statistically significant, confidence in the figure for the Western Arctic Waterway was 95 per cent. This is of particular importance, because ice in the Waterway is believed to be driven mainly by local thermodynamics—in that it does not circulate into or out of the area on any large scale, but rather tends to form in winter and melt each summer in situ. This may indicate that the ice decline observed in this sub-region is more reflective of rising surface temperatures than in the Beaufort Sea sub-region, where a large flux of multi-year ice from the Arctic Ocean enters and exits.

As an adjunct to these studies, Canadian Ice Service scientists examined weekly ice charts for the northern Labrador Sea area. While global climate models predict a local cooling trend in the area even under global warning scenarios, observations made in recent years indicate that almost all of the ice in this sub-Arctic region has melted completely before June 25 and not reappeared until after October 15. The database showed strong support for these observations, indicating a decrease in summer ice coverage of 72 per cent between 1971 and 2001—with 98 per cent confidence in the trend's statistical significance.

While total accumulated coverage is considered an excellent indicator of the long-term effects of climate change, the meteorologists also looked at minimum ice cover in summer for each year in the database. While this information is not meaningful for areas such as Hudson Bay, where all of the ice frequently melts during summer, it adds to our understanding of what is happening to Arctic ice. The results of this arm of the study showed a 24-per-cent decrease between 1969 and 2001 in the area covered by sea ice at the summer minimum in both the Eastern and Western Arctic—a decline of eight per cent per decade.

There are few certainties when it comes to predicting future climate—particularly when such predictions are based on observations made over a very short period of time, relatively speaking. The probable scenario, however, is that there will always be winter ice in the Arctic Ocean; extreme inter-annual variability in coverage will persist, regardless of climate change; and there will be less sea ice in the Arctic in years ahead. Despite the uncertainties, scientific studies such as these are a critical step toward recognizing and better under-standing the impacts of climate change in time to reduce or mitigate its effects. S&E



Accumulated seasonal ice coverage in the Western Arctic Waterway during summer, from 1969 to 2001.

BLOWIN' IN THE WIND

There's a new look to Toronto's lakefront skyline, and on a clear day you can see it all the way from Burlington. It is a 30-storey windmill, and the first utility-scale turbine in North America in a downtown setting.

The $1.2-million turbine, which began operating in February, will generate about 1.4 million kilowatt hours of electricity a year—enough for some 250 households. A clean alternative to coal- and oil-fired generating stations, it will displace up to 380 000 kilograms of carbon dioxide and 8000 kilograms of nitrogen oxides and sulfur dioxide annually. These pollutants are leading contributors to climate change, smog, and acid rain.

Generating electricity is a leading source of air pollution in North America, as most energy produced over the past century has been from the burning of fossil fuels. In Ontario, about 26 per cent of all electricity is still generated by coal and oil—much of it in the heavily populated Windsor–Ottawa corridor.

Initiated to enable Torontonians to take action to improve the air quality in their city, the waterfront windmill is the result of a partnership between WindShare—a cooperative of 450 individual and corporate shareholders—and Toronto Hydro Energy Services, which will purchase the green power generated by the turbine for the next three years. Environment Canada contributed $360 000 to the project from the Government of Canada's Climate Change Action Fund, and worked closely with planners and the community to carry out an environmental assessment of its impacts.

Wind power is the fastest-growing form of energy in the world—increasing at a rate of 25 per cent per year since 1990. Although it is used widely in the United States and Europe (California boasts over 15 000 windmills, and 18 per cent of Denmark's power is wind-produced), it is not yet common in Canada. Quebec and Alberta lead the way in this country, with over 100 large-scale turbines apiece, but the Toronto turbine is one of only 10 of its kind in Ontario.

Attaching the blades to the waterfront wind-turbine at Toronto's Exhibition Place. Photo: Toronto Renewable Energy Co-operative.

It takes a wind speed of at least three metres per second (about 11 kilometres per hour) to turn the 27-metre-long blades on the turbine. As the hub at the centre of the blades rotates, it turns the main shaft of the turbine, which is connected to a generator. The electricity produced by the generator feeds into the main power grid, where it is combined with power from other sources.

The lakeshore location at Toronto's Exhibition Place was chosen not only for its high visibility, but also because wind off a lake has far more energy-producing potential. When wind interacts with land, it becomes more turbulent, and loses some of its power—hence the reason that most windmills are located on lakeshores, in valleys, and on ridges.

With Toronto averaging an annual wind speed of six metres per second, the turbine will generate about 25 per cent of its maximum output. The highest number of kilowatt hours of power will be produced from November to April, when average wind speed is at its peak, while the least will be produced in August, when total estimated output drops by about half.

Contrary to what some people might expect, the turbine is relatively quiet and hardly noticeable compared to the sound of city traffic. It is far less hazardous to birds than an office building—with fatalities estimated at two birds a year. This situation will be monitored this summer as one of the requirements under the environmental assessment.

Wind power and other forms of green energy are integral to reducing Canada's dependence on fossil fuels, and to helping us meet our Kyoto targets and clean-air objectives. With investors already keen to buy shares in a second turbine—tentatively planned for the Ashbridges Bay Treatment Plant east of Exhibition Place—it may not be long before there are two Toronto waterfront turbines blowing in the breeze off Lake Ontario. S&E

NATURAL DISASTERS ON THE RISE

In 2002, natural disasters caused approximately $85 billion in economic losses worldwide—up 36 per cent over the previous year. Last summer, parts of Europe experienced the worst floods in centuries, while Western Canada struggled through the most devastating drought in its recorded history.

Flooding along the Mars River in Quebec's Saguenay region in July 1996. Photo: G. Brooks. Reproduced courtesy of Natural Resources Canada, Geological Survey of Canada.

Last year, the world experienced approximately 700 natural disasters—50 more than the annual average during the 1990s. The magnitude of the events that occurred and recent trends lend weight to the fact that such incidents are growing not only in number, but also in size.

Over the past decade, Canada has experienced many of its largest natural disasters, and experts believe that even bigger and more devastating ones are inevitable. While geophysical disasters, such as earthquakes, have remained relatively constant in this country over the past 50 years, weather-related disasters have skyrocketed. Climate change is projected to exacerbate this situation in future, as it is expected to increase the frequency and severity of some extreme weather events.

CANADA'S MOST EXPENSIVE NATURAL DISASTERS

1. 2001–02 Drought (British Columbia, Prairies, Ontario, Quebec, Nova Scotia): preliminary estimate, $5 billion
2. 1998 Ice storm (Ontario and Quebec): $4.2 billion
3. 1979–80 Drought (Prairies): $2.5 billion
4. 1988 Drought (Prairies): $1.8 billion
5. 1984 Drought (Prairies): $1 billion
6. 1996 Flood (Saguenay, Quebec): $1 billion

To examine this trend and help determine ways to mitigate its risks, a team of public- and private-sector partners, led by Environment Canada's Meteorological Service of Canada, formed the Canadian Natural Hazards Assessment Project. Key players include the Office of Critical Infrastructure Protection and Emergency Preparedness, the Institute for Catastrophic Loss Reduction, private insurance companies, emergency responders, academics, sociologists, and engineers.

After more than three years of collecting and analyzing data, the project team has written 20 technical papers on the subject, most of which will be published early this year in a special edition of the *Journal of Natural Hazards*. Also scheduled for release by this spring is a summary document for decision makers and members of the public.

The team's findings indicate that a combination of factors are behind this upward trend, not only in Canada, but also around the world. Chief among these is the fact that human beings have greatly increased their vulnerability to suffering some degree of loss from a hazardous event. This has occurred due to the many economic, socio-demographic, and technological changes that have taken place over the past 50 years.

For example, by exploiting our natural resources, humans have degraded the environment and destroyed natural buffers that help to reduce the impacts of certain hazards. Greenhouse-gas emissions from the burning of fossil fuels are changing our climate. The cutting of timber on hillsides is magnifying the impact of landslides. The draining of wetlands has amplified the effects of flooding.

Population growth and urbanization are also major contributors to our increase in vulnerability. Higher concentrations of people living in urban areas means that if disasters do hit, they affect a larger number of individuals. Urban sprawl has led to more development in high-risk areas, such as flood plains. Over-reliance on technologies, such as structures that divert floodwaters, has also encouraged development that might otherwise not have taken place—making the potential impact of a disaster even greater. Other factors include our aging population and our aging infrastructure, both of which are more susceptible to harm.

Data show that just over half of all Canadian disasters—whether natural or not—have been weather related, and that this percentage has increased drastically in recent years. Virtually all of the most expensive natural disasters this country has experienced fall into this weather-related category.

As in the rest of the world, floods are the main cause of the increase in the number of natural disasters in Canada, despite the fact that their impacts are largely avoidable. Snowmelt accounts for about 40 per cent of all floods in Canada, although they can also be

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FACTORS THAT MAKE US **LESS** VULNERABLE:

- better warning and emergency-response systems;
- greater economic capacity;
- well-established government disaster-assistance programs and private insurance companies;
- better government policies;
- community initiatives;
- advances in science and engineering; and
- major risk-reduction programs, such as the Red River Floodway.

caused or compounded by heavy rainfall, ice jams, glacier outbursts, coastal storms, tsunamis, cyclones, and hurricanes.

While some research suggests that a greater percentage of Canada's rainfall is occurring in heavy downpours, much responsibility for the upward trend in flood disasters is our own. Flooding in urban areas has been greatly exacerbated by extensive paving (which reduces the penetration of water into the ground), aging sewer systems that are less able to cope with larger loads, and the construction of roads, homes, and other structures on flood plains.

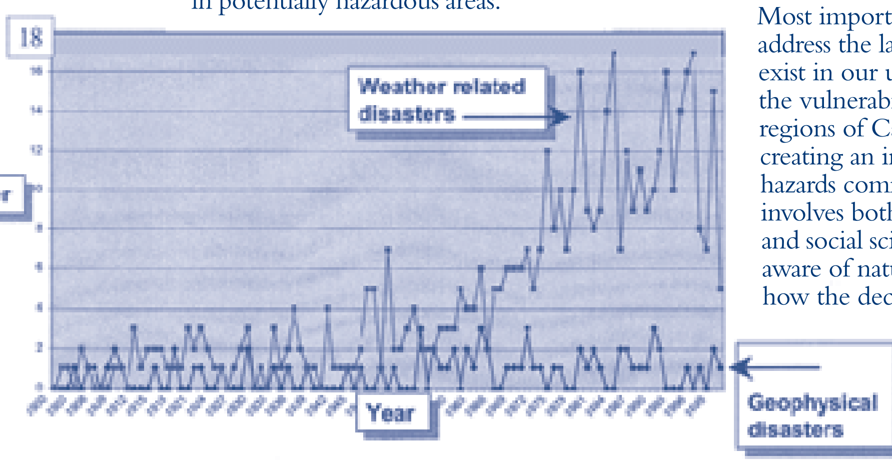
Forecasts can be useful in lessening the impact of flood events, but improved flood-plain mapping, land-use planning, and the use of structural defenses are even more effective. For example, the Red River Floodway, which was constructed in the 1960s to protect Winnipeg from flooding, has been used more than 20 times since—and saved an estimated $6 billion during the Red River Flood of 1997.

Drought is Canada's most expensive natural disaster in a cumulative sense. Over 40 severe events have occurred over the past 200 years in Western Canada alone, and a number have taken place in other parts of the country as well. Four of the six most expensive natural disasters in Canada's history were droughts—and all four took place within the last 25 years.

Droughts can be related to reduced streamflow, water levels, runoff, or soil moisture, but most are caused by disruptions in normal weather patterns that result in below-normal precipitation. They can be self-perpetuating, since areas experiencing drought add little water vapour to the local atmosphere. Droughts can't be predicted, but their impacts can be lessened through such efforts as water and soil conservation, grassland management, and forest-fire watches.

Although the only significant earthquake in Canada occurred off the East Coast in 1929, triggering a tsunami that killed 28 people, scientists predict that an earthquake in the Vancouver area is the most likely major disaster on our horizon. Since quakes occur where tectonic plates converge, only certain regions of the country are at risk: the West Coast, the St. Lawrence and Ottawa valleys, off the coast of Nova Scotia and Newfoundland, and certain parts of the Arctic.

Quakes are also unpredictable, but maps of their probability can be created using databases of past locations and magnitudes, and geotechnical models. These maps allow for the design of appropriate building codes, as well as the avoidance of development in potentially hazardous areas.



Comparison of weather-related and geophysical disasters in Canada between 1900 and 2000, from the Office of Critical Infrastructure Protection and Environmental Preparedness database. Source: Mohammed Dore.

FACTORS THAT MAKE US **MORE** VULNERABLE:

- population growth (+24 per cent between 1980 and 1998);
- urbanization;
- environmental degradation;
- urban sprawl in hazard-prone areas;
- loss of community memory about hazardous events due to increased mobility;
- an aging population (the number of Canadians over age 65 will increase to 1 in 5 by 2026, up from 1 in 20 in 1921);
- an aging infrastructure, unable to cope with environmental loads;
- greater reliance on power, water, transportation, and communication systems; and
- historical over-reliance on technological solutions.

The findings of the Canadian Natural Hazards Assessment Project clearly indicate that mitigating the risks of natural disasters in Canada requires more than advancements in science and technology. It requires us to create a culture that is aware of disasters and their risks, and that considers them at all levels of decision making. It requires the implementation of non-structural steps, such as the preservation of the natural environment, public education, and the relocation of communities to areas that are not hazard-prone.

Most importantly, we must address the large gaps that exist in our understanding of the vulnerability of different regions of Canada by creating an interdisciplinary hazards community that involves both the physical and social sciences. By being aware of natural hazards and how the decisions we make affect our vulnerability, the human and economic toll they impose upon us can be greatly reduced. S&E

PROTECTING WATER FROM MINE WASTE

Mining ore produces large quantities of waste rock, tailings and other refinery by-products that are usually stored on site. With exposure to the atmosphere, the sulfide-rich waste oxidizes, releasing acid and metals into the environment and putting nearby water bodies at risk.

Although the Sherridon Mine has been closed for more than half a century, tailings and other waste continue to release elevated concentrations of metals and other elements into groundwater and surface water.

Scientists from Environment Canada's National Water Research Institute (NWRI) are leading studies on the mechanisms that control the release and transport of these contaminants—information needed to develop effective management and restoration strategies.

The NWRI researchers and their partners are carrying out their investigations at several Canadian sites, including the Sherridon Mine near Flin Flon, Manitoba. Closed since 1951, the copper, zinc, gold, and silver mine generated some 7.4 million tonnes of high-sulfide tailings during its 24-year life span, covering an area of more than 50 hectares.

During the summers of 2000 and 2001, the research team conducted hydrogeological and geochemical studies on the Sherridon tailings to find out how much sulfide oxidation has occurred and to evaluate the waste's neutralizing capacity. Various minerals have the capacity to neutralize acid released through oxidization, and thereby stabilize trace metals. If insufficient neutralizing minerals are available, however, acidic waters with elevated concentrations of metals and sulfate will migrate from the waste piles to surface waters—where they could kill fish and invertebrates—and to underlying geologic formations, where their effects may appear many years later.

To find out what is happening below the surface, the researchers collected continuous cores of the tailings, coring from the surface to the bottom of the tailings piles. When they hit a cemented layer of consolidated tailings, known as hardpan, they used a backhoe to dig through it to the unconsolidated layer below. Two cores were collected at each location—one to analyze the water in the pores of the tailings, and one to analyze the solids. They also collected samples of groundwater at each location, and took water samples at one-metre intervals from the nearby lake.

The research team's results provide irrefutable evidence that abandoned mines can continue to release elevated concentrations of metals and other elements to surface and groundwater long after they are closed. After seven decades of oxidation, the pore waters in the tailings contain very high concentrations of dissolved metals, sulfate, and acid. Nearly all of the neutralizing minerals have been depleted, but less than half of the sulfide-mineral content has been consumed—suggesting that metals and acids will be released for decades or possibly centuries to come.

The highest concentrations of dissolved metals were found directly above and within the hardpan layer located about a metre below the surface of the tailings. During rainfall, pore water with a geochemical composition similar to that found above and within this layer seeps from the edges of the waste piles. Because of this, researchers suspect that the hardpan causes water to flow laterally, rather than downward, carrying with it much higher contaminant loads than they would expect to find if the discharge were coming only from the deeper water table.

The discharge from the tailings flows directly into the nearby lake, and the water samples from the lake show an abrupt increase in metal concentrations at a two-metre depth, indicating that higher-density, metal-laden water is accumulating at this depth and degrading water quality.

Results of these studies will be used to improve models for predicting the duration of the oxidation process, the rates at which metals are transported, and their long-term release into receiving waters. More accurate predictions of the degree of environmental damage likely to occur and how it can be avoided through improved disposal methods will lead to more effective tailings management programs and a more sustainable mining industry. S&E

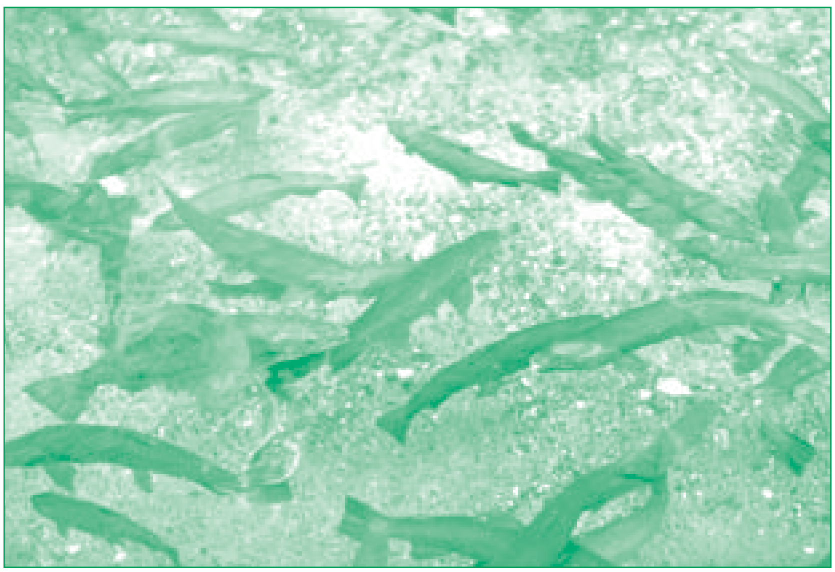
- The federal-provincial-territorial community is working through Natural Resources Canada to develop a strategy for managing abandoned mines.
- The new Metal Mining Effluent Regulations, which came into force in December 2002, impose strict limits on releases of metals and other contaminants from the approximately 100 metal mines operating in Canada.

REGULATIONS RESULTING IN CLEANER MILL EFFLUENTS

Separating the fibres in wood from the non-fibrous materials and turning pulp into paper involves a variety of chemicals—ranging from acids and alkalis to bleaches, dyes, glues, and solvents. Liquid waste produced by these processes contains a mixture of toxic substances and organic matter that can harm aquatic ecosystems if discharged directly into our lakes, rivers, and oceans.

According to a national science assessment conducted by Environment Canada's National Water Research Institute, the addition of secondary wastewater treatment systems at pulp and paper mills across Canada is significantly decreasing the toxicity of mill effluents, although effects are still being seen on fish and their habitat. The assessment is the first to detail the effects of effluent on the receiving environment, based on extensive data collected from across Canada under the Environmental Effects Monitoring (EEM) program.

Both the requirement for secondary treatment and the EEM program were introduced under the Pulp and Paper Effluent Regulations of the *Fisheries Act* in 1992. The EEM program requires Canada's regulated pulp and paper mills to conduct regular studies to monitor and assess the effects of their effluent on fish, fish habitat, and the use of fisheries resources, using protocols developed by Environment Canada. Every three or four years a cycle is completed, and the mills must provide their results to the Department for further scientific analysis. The results of these analyses are used to determine if regulations are resulting in adequate protection of the environment.



Despite the fact that the quality of effluent from pulp and paper mills is improving, effects are still being seen on fish reproduction and growth.

Since the regulations came into effect, discharges of regulated parameters have dropped to a fraction of their pre-control levels and are currently well below limits. Dioxin and furan deposits—which are covered by companion regulations under the *Canadian Environmental Protection Act*—have declined more than 99 per cent, biochemical oxygen-demand 94 per cent, and total suspended solids 70 per cent. Yet, data show a continuing effect on fish reproduction and signs of mild to moderate nutrient enrichment at most mill sites. Nutrient enrichment occurs when a body of water is overfertilized by the addition of phosphorous and nitrogen.

The EEM program uses a variety of tests to determine the impact of effluents on their receiving environment. Among these are sub-lethal toxicity tests, which measure how organism functions such as growth and reproduction are impacted at various effluent concentrations. Such tests from Cycle-1 (1996) reports indicated that mills without secondary treatment systems had much higher levels of toxicity in their effluent than mills outfitted with such systems. Tests from Cycle 2 (2000) confirmed the trend, showing that after most mills put secondary treatment systems in place, there was a significant decrease in the toxicity of pulp and paper effluent.

Studies of the abundance and diversity of bottom-dwelling invertebrates, such as worms and aquatic insects, are also used as an indicator of the quality of aquatic habitat, because they represent the condition of food available to fish. In

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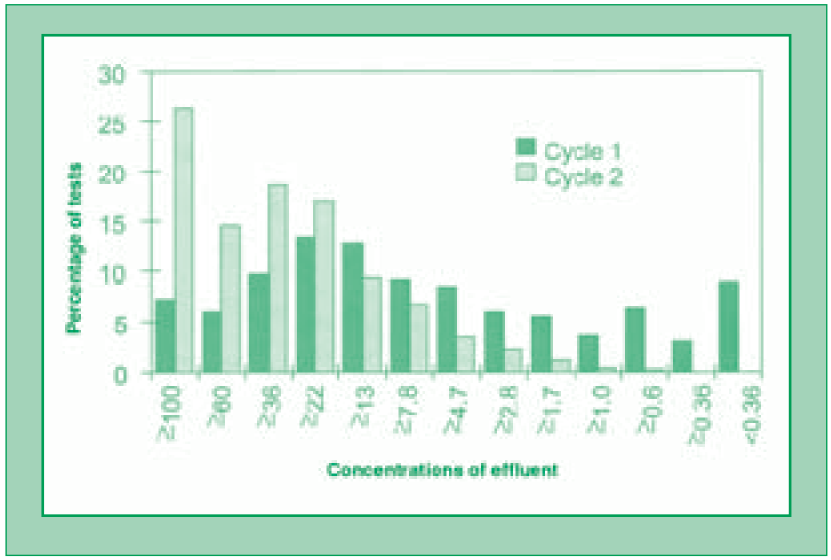
both Cycle 1 and Cycle 2, the majority of mills reported significant differences in the structure of the invertebrate community between exposure and reference areas, indicating that most sites receiving effluent had suffered habitat degradation.

In their Cycle-2 reports, the majority of mills reported that the magnitude of these differences had lessened. However, data show that an increase in the number (and, in some cases, diversity) of invertebrates is still commonly observed at mill sites across Canada. These effects are a well-known sign of mild to moderate nutrient enrichment.

Fish population surveys are used to monitor fish in the receiving waters where mills discharge effluent, and to compare them to fish from a reference area not exposed to mill effluent. In both cycles, such comparisons showed statistically significant differences in at least one of three key measurements at the majority of sites, and about half the mills reported differences in all three.

The predominant national trend was a significant decrease in gonad weight and significant increases in liver weight, fish fatness, and "weight at age." The first of these effects relates directly to reproduction, and the other three to growth. The larger, fatter fish response pattern is consistent with the effects of mild to moderate nutrient enrichment on the invertebrate community, indicating an increase in food availability for the fish. The decrease in gonad size is believed to be indicative of some form of metabolic disruption—that is, a disruption in the mechanism the body uses to synthesize and break down complex substances. Such a disruption can cause serious imbalances in the maturation, sexual behaviour, and growth of an organism. Although the mechanisms of such responses and their ecological importance remains unclear, these patterns of effects on a national scale may be related to some form of disruption of endocrine functioning, which is key to growth and reproductive development.



Results of sub-lethal toxicity tests conducted on sand fleas during cycles 1 and 2 of the EEM, during which the fleas were exposed to concentrations of effluent from pulp and paper mill sites across Canada. The vertical bars indicate the percentage of tests conducted in each cycle in which the sand fleas exhibited a 25 per cent decrease in function at that threshold of concentration. A significant percentage of tests carried out during Cycle 1 showed this effect at concentrations of effluent of less than 0.36 per cent; however, during Cycle 2, approximately 26 per cent of tests did not show this effect until concentrations equal to or greater than 100 per cent effluent.

The impact of effluent from pulp and paper mills on fisheries resources is evaluated through tainting tests, which are designed to determine if the taste of the fish is affected, and through the analysis of dioxin and furan levels in edible fish-tissue, to determine if levels exceed Health Canada consumption guidelines. Dioxins and furans are analyzed only at mills that use bleaching chemicals.

Mill effluent is suspected of causing the tainting of fish at both of the mills that conducted tainting tests in Cycle 2. Since dioxin and furan levels were found to be very low at most of the more than 40 mills that reported on these levels in Cycle 1, only 10 mills were required to conduct this analysis in Cycle 2. Six of these mills showed levels of dioxins and furans in fish tissue that exceeded guidelines. However, the source of these pollutants is believed to be the historic contamination of the sediment, not the current effluent.

Further research and continued EEM studies are required to understand these phenomena and to confirm the type, spatial extent, and ecological importance of these observed effects. Environment Canada will continue to work with industry and other stakeholders to better understand their significance. The deadline for the submission of Cycle-3 reports is April 2004. S&E

S&E Bulletin

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Scientific contacts may be obtained from the *Bulletin*'s editor at Amanda.Cahoon@ec.gc.ca, or (819) 953-6846. Comments and suggestions are also welcome.