ELA UPDATE

Newsletter of the Experimental Lakes Area

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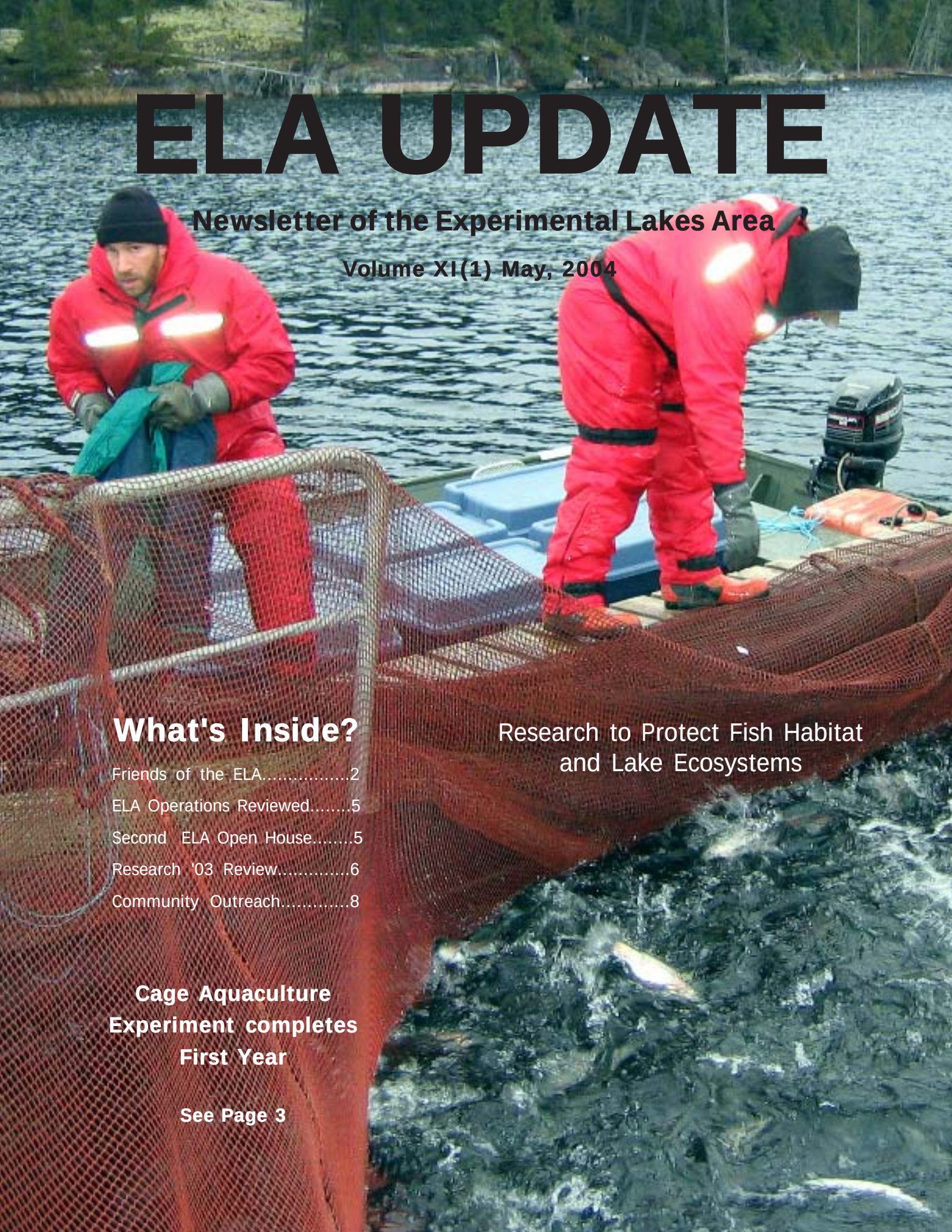

What's Inside?

Research to Protect Fish Habitat and Lake Ecosystems

Cage Aquaculture Experiment completes First Year

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ELA Update

May 2004

As part of our ongoing efforts to keep the interested public informed about our research projects and related activities at the Experimental Lakes Area, we present this newsletter. Also available electronically, this is the eleventh year in which one or more such newsletters has been produced and distributed.

The **cover photo,** by Andreas Blouw of DFO, shows ELA scientist, Paul Blanchfield, and aquaculture operator, Mike Meeker, preparing to harvest farmed fish from a cage in ELA Lake 375 in November, 2003 (see article, page 3). Once removed, the fish were placed on ice and shipped to market in southern Ontario.

In just over five months, the ten thousand hatchery-reared rainbow trout increased in weight approximately 10 times, while feeding on commercially prepared food pellets. At the same time, they produced a lot of waste material, most of which dropped to the bottom of the lake beneath the cage. What impacts do such aquaculture operations have on lake ecosystems and on the wild fish populations and other creatures living such lakes?

ELA Update is produced by John Shearer, with support from other ELA researchers in the Environmental Science Division of Fisheries and Oceans Canada, Winnipeg. Its production is mandated under the terms of the Canada-Ontario agreement for the ELA.

"Friends of the ELA"

Foundation is Up and Running

In its 36 years of existence, the ELA has gained many "friends". Several thousand researchers and support staff, ranging from eager students to world-renowned scientists, have worked on site. Today, they can be found, literally, all over the world, and most look back with fondness on their ELA experiences.

However, not all of the ELA "friends" have worked at the facility. Many more have visited the ELA on various tours. Others have simply read about the place and the many accomplishments of ELA researchers. Often, these people ask how they can assist the ELA, but the opportunities for most have been limited. Now, a new initiative has opened the doors for more people to get involved in supporting the ELA. A non-profit foundation, called the **Friends of the ELA** Inc., has been created and granted charitable status.

The Friends of the ELA will benefit freshwater research at the Experimental Lakes Area by raising money to supplement and complement the research conducted at the Experimental Lakes Area, especially high-quality long-term research and monitoring on environmental problems in Canada's freshwaters. It is managed by a volunteer Board and research projects are approved by a Scientific Advisory Committee and by DFO. The Friends of the ELA will benefit DFO by raising the profile of the Department and one of its research groups. Your participation, in whatever form you may choose, is most welcome.

Want to become a member of Friends of the ELA?

Membership in the Friends of the ELA is open to all individuals, groups and corporations who support the overall goals of the conservation and protection of freshwater ecosystems. There are four classes of membership; namely, Regular, Bronze, Silver and Gold.

Membership dues are as follows: Regular: $20 per year; Bronze: $100 per year; Silver: $500 per year; Gold $1000 per year.

Need more information or want to join?

For more information about this new and exciting organization, feel free to e-mail either Drew Bodaly **(*bodalyd@dfo-mpo.gc.ca*) or** Mike Paterson **(*patersonm@dfo-mpo.gc.ca*).**

Drew or Mike can also be reached by regular mail at the

Freshwater Institute
501 University Crescent
Winnipeg MB R3T 2N6

Want to make a tax-deductible donation?

Donations can be sent to the

Friends of the ELA Inc.
c/o Louise Nebbs
1504 – 201 Portage Avenue
Winnipeg, MB R3B 3K6

Aquaculture Experiment Completes Successful First Year

Do you love to eat fish? If so, do you know where the fish that you eat comes from?

The Issues

As our human population continues to increase, our demands for fish protein as a food source also grow. This, in turn, has resulted in excessive harvesting pressures on many wild fish populations, both in the oceans and in freshwater. Increasingly, with these wild stocks in decline, we are turning to fish farming, or aquaculture, as a means of meeting these demands.

In recent years, fish farming has become a significant industry in parts of Lake Huron. This industry is expected to grow in the Great Lakes, and may spread to smaller inland waters as well. In these operations, as in many marine locations, hatchery-reared fish are placed in large cages suspended in natural waters and fed commercially prepared food pellets. This process is called "cage aquaculture".

Experience has shown that there are potential problems associated with cage aquaculture. Huge amounts of food are provided to these caged fish as a means of promoting rapid growth. Some of this food, uneaten, will fall through the bottom mesh of the cages and collect on the lake sediments below. Faecal material from the concentrated fish populations will also collect on the bottom under the cages. As this material collects, bacteria will begin to decompose it, removing dissolved oxygen from the surrounding waters and releasing nutrients that can spur algal growth.

This mass of fish droppings and uneaten food can attract bottom dwelling animals and fish, perhaps altering the natural foodweb interactions in the lake.

Inevitably, some of the caged fish escape, resulting in direct interactions, and perhaps competition, with wild species in the lake. Also, such high concentrations of caged fish can increase the possibility of an infectious disease spreading through the caged population, and possibly being transferred to wild populations.

While all of these potential impacts are known, little controlled research has been conducted in an effort to quantify the risks and to assess what numbers of caged fish are practical in a given situation, if the health and well being of the natural ecosystem are to be protected.

The ELA Approach

To assist in developing appropriate guidelines for cage aquaculture in freshwater lakes, ELA scientists have partnered with the Northern Ontario Aquaculture Association and Meeker Aquaculture of Manitoulin Island to conduct a multi-year pilot study using commercial aquaculture techniques in an ELA lake. Funded under DFO's Aquaculture Collaborative Research and Development Program, the project is strongly supported by DFO's Habitat managers in Ontario and by the Ontario Ministry of Environment. By doing a realistic simulation in a real lake, we hope to provide many of the answers

Workers unload some of the more than 10,000 live rainbow trout fingerlings from the large tank truck that brought them from the hatchery in June, 2003. The fish were placed in small containers and transported by ATV, then boat, from the road to the fish pen in Lake 375.

that regulators are seeking. After two years of intensive background studies in the lake, the experimental phase began in the spring of 2003 and has completed a successful first year.

The 2003 Experience

On June 5 of last year, a large and sophisticated tanker truck from southern Ontario slowly wound its way down the ELA access road as the driver growled expletives and wondered why he was there. By the end of the day, his cargo of more than 10,000 live rainbow trout, weighing less than 100 grams each, had been transferred to a 1 million litre mesh cage suspended in ELA Lake 375. Over the next $5^1/_2$ months, Patrick Buat, the "keeper of the fish", lovingly fed several tonnes of commercial food pellets to these fish as they grew to an average weight approaching a kilogram. In late November, just before winter covered the lake with sheet of ice, more than 30 volunteers removed the grown fish from the cage, packed them on ice, and sent them off to market on another large truck.

While Patrick was growing the fish, a team of researchers was carefully monitoring conditions in the lake, including the behaviour of wild fish. The data collected were compared to similar data from previous years, when no caged fish were present, and to similar data in nearby lakes with no caged fish. While the caged fish were gone, the monitoring continued through the winter season.

One of the most interesting monitoring activities involves the electronic tracking of selected fish within the study lake and in a nearby reference lake. To accomplish this, ELA biologists have surgically implanted small battery-powered transmitters beneath the skin of some wild lake trout and white suckers. These transmitters continually send out signals that are picked up by solar powered receivers and transmitted to solar-powered computers that analyse the signals and plot the location and depth of each fish within the lake. Over time, these data provide a detailed history of the movements of these fish, day and night, summer and winter. When some of the caged rainbow trout reached a suitable size, the researchers also implanted them with transmitters released them to the open lake. Unfortunately, few of these "escapee" fish survived for long, and the data obtained showing their movements in the lake are very limited.

Technician Paul Mutch broadcasts food pellets to the waiting rainbow trout in the aquaculture cage, while Biologist Patrick Buat prepares camera equipment that is used for underwater observations of the fish. Where possible, researchers emulate the procedures used in commercial cage aquaculture operations, but on a smaller scale.

All results to date have not been fully analyzed The movements of the wild lake trout and minnows did seem to be affected. There was a noticeable build up of fish-related sediment under the cage, but impacts to the lake during this first year of farming seem to be minimal. This spring, another "crop" of rainbow trout will be placed in the cage and the farming cycle repeated. Ideally, we would like to continue this process for several additional years to determine whether adverse impacts appear or magnify over time as sediments accumulate and other interactions continue. Unfortunately, we do not have assured funding for this study beyond the present year. Without this, we may not be able to definitively state whether longer term impacts will appear with the current numbers of fish.

Did you Know?

More than 100 graduate students from more than 20 universities have completed doctoral and masters theses based on research conducted at the Experimental Lakes Area .

Annual Open House a Great Success Again

After organizing the first-ever ELA open house event for residents of the Kenora area in 2002, a second event was offered to residents of the Dryden and Vermilion Bay areas last September.

As the sun rose on Saturday morning, September 20, 2003, about 65 persons gathered in Dryden, and along Highway 17 to the west, waiting for the buses that would transport them to the ELA. Eight hours later, somewhat shaken from their bus ride along the Pine Road, but more aware of what the ELA is and what happens there, most agreed that the day had been very worthwhile.

Participants in the annual open house event watch closely as Sandy Chalanchuk and Patricia Ramlal demonstrate how live fish are weighed, measured and tagged, before being returned to the lake. This enables researchers to accurately estimate the size of fish populations in the small ELA lakes, without adversely affecting the fish populations.

Over the course of the day, the visitors had received an illustrated history and introduction to the ELA, seen the aquaculture study (see page 3), viewed a live fishing demonstration, viewed demonstrations in the laboratory, toured the workshop and the weather station, and visited one of the flooded upland reservoirs. All this without having to walk more than a few hundred meters from the buses.

ELA staff and students involved in the event also were unanimously positive in their evaluations. We always enjoy sharing our findings with the interested public and appreciate the words of encouragement that we receive. If there is sufficient interest, we hope to offer another such event this fall. Check the ELA web site for updated information.

Visitors view bottom dwelling "critters" through microscopes in the Benthic Lab.

ELA Operations being Reviewed

The Experimental Lakes Area is operated by Fisheries and Oceans Canada, often referred to as DFO. The ELA relies heavily on Ontario to provide access to, and protection of, the land and water bodies used for the ELA research. Many partner agencies assist with the various research studies. However, DFO must provide the core ELA funding, including the salaries of key ELA researchers and operations staff based at DFO's Freshwater Institute in Winnipeg.

At a time when all federal departments are being asked to review priorities and reallocate funds, DFO is reviewing the costs and procedures of running the ELA and looking for ways to more effectively ensure that adequate core funding is available. The Audit and Evaluation Directorate of DFO is currently carrying out such an evaluation of ELA operations and will be reporting on their findings to senior management. The evaluation scheduled for completion this spring, is expected to have major implications for future ELA operations.

Research '03 Review

2003 was another busy year for research at the ELA. Scientists from across North America conducted more than 30 studies, covering a range of water quality and fish habitat issues. Here, we briefly review a few of the larger studies. A more comprehensive summary of ELA research in the past year can be found on the worldwide web at http://www.umanitoba.ca/institutes/fisheries/resact.html.

FLUDEX

Following 5 consecutive years of experimental flooding, the Flooded Upland Dynamics experiment, or FLUDEX, was terminated last fall. The dramatic wooden walls that helped contain these reservoirs have now been removed from the landscape, and the small areas of dead forest rehabilitated.

Until last fall, the flooded upland sites contained dead trees (upper) enclosed by wooden walls up to 2 metres high. Now, with this experimental study completed, the walls and dead trees have been removed and the sites rehabilitated (lower).

During those years, this project clearly demonstrated that forested upland areas, when flooded by creation of large reservoirs, can produce significant amounts of toxic methyl mercury. The decomposition of flooded upland vegetation and soils can produce significant quantities of carbon dioxide and methane, which are released to the atmosphere as greenhouse gases. Because of the smaller amounts of stored carbon in these upland sites, the production of greenhouse gases does not persist for as many years as it would in flooded wetlands where more carbon is stored as peat.

Estrogen Study

The experimental addition of minute concentrations of a synthetic estrogen to ELA Lake 260 has attracted much interest over the past three years. During the open water periods of 2001, 2002, and 2003, a concentration of 5 to 6 parts estrogen per trillion parts lake water has been maintained in the surface waters of the lake.

This estrogen is used in most birth control pills and for hormone replacement therapy. Women's bodies do not break it down effectively, nor do most current sewage treatment plants. Low concentrations have been found in waters downstream of many urban areas, and there is evidence that fish and other aquatic species in these waters are suffering reproductive impairment. The ELA study approximates the concentrations found in these sites.

At the ELA, researchers have been closely monitoring fish, frogs, and some invertebrate animals in Lake 260 to determine whether effects of the hormone are evident. In many of the species under study, males are undergoing various forms of feminization. Some male fish are actually producing rudimentary eggs. Now we have strong evidence that this reproductive impairment is resulting in population decreases, and possible extirpation of at least one fish species. The short-lived fathead minnow has almost disappeared from the lake over the past two years. We believe that the estrogen has prevented male fatheads from successfully fertilizing the eggs.

Additions of estrogen to the lake have now ceased, and the concentration in water is no longer measurable. We will continue to monitor fish populations and other critical components of the ecosystem to further document and verify the effects of the estrogen. In particular, we want to see whether populations of longer lived fish species will show significant decreases during the time

of estrogen additions. Given the results to date, this experiment provides strong evidence to convince legislators and regulators that improved sewage treatment is needed to break down these substances before they are released into natural waters.

METAALICUS

This study, the Mercury Experiment To Assess Atmospheric Loading In Canada and the United States, is the largest and most costly single experiment ever undertaken at the ELA. After several years of background and pilot studies, the main experiment got underway in the Lake 658 basin in 2001. Now, we are starting to see results that could have significant implications for mercury releases to the atmosphere by human activities.

When we humans burn fossil fuels, particularly coal, mercury in the fuel is vapourized and released to the air. Large coal-burning power plants release large quantities of mercury to the atmosphere. This mercury then drifts down wind before eventually falling back to earth. Mercury falling from the sky can be detected virtually anywhere on Earth, but it is particularly measurable downwind from major industrial areas.

We also know that mercury is the most widespread contaminant in fish. Even in remote lakes, older predatory fish, such as pike and lake trout, almost always contain levels of toxic methyl mercury that are unacceptably high for regular consumption by humans.

While mercury does occur naturally, it seems probable that much of the mercury contaminating fish is the same mercury that is falling from the sky, and much of that mercury comes from human activities. Up until now, there has been no way to clearly demonstrate this link, however.

This small ELA lake (658) is the site of a study intended to clearly demonstrate linkages between the toxic methyl mercury found in many predatory fish and the fallout of mercury from the sky, much of which comes from the burning of fossil fuels in large power plants.

Now, the METAALICUS experiment at the ELA is beginning to provide this information. For the past three open water seasons, METAALICUS researchers from across North America have been applying tiny amounts (less than a teaspoonful in total) of new mercury to Lake 658, to a small wetland draining into the lake, and to the forested upland area draining into the lake. These three forms of new mercury are uncommon in nature and can be distinguished from each other, and from all the mercury already present in the drainage basin by their different atomic weights. By tracing the movement of these new forms of mercury within the Lake 658 ecosystem, the scientists can determine whether newly deposited mercury moves into the food web, and begins to biologically accumulate in the fish.

As there are only a few laboratories equipped with the costly mass spectrometers needed to distinguish the different forms of mercury, analysis of the many samples takes time. However, the new mercury added directly to the lake began to move into the food web and the fish fairly quickly. We are now seeing some of the mercury added to the upland moving into the lake and its food web. This is the first direct scientific evidence that newly deposited mercury can rapidly become methylated and enter the aquatic food web.

We will be adding new mercury again during the 2004 field season, and will continue to monitor its movements in the ecosystem. If the current trends continue, this study should be instrumental in convincing legislators in Canada and the United States that controls on mercury emissions from power plants would assist in helping to reduce the levels of toxic mercury in fish.

Community Outreach

Visit the ELA on the Web: http://umanitoba.ca/institutes/fisheries

ELA staff members have continued to interact with the public, particularly the local community, on a number of fronts. The September open house event (see page 5) was a big success, but certainly not the only one during the past year.

Dryden "Con" Course

In late May, John Shearer participated again in the 47th annual Dryden Conservation Course. This event is unique in Canada, and the ELA has been a long-time supporter. Each year, sixty Grade X students from Dryden High School get an excellent introduction to a range of resource use issues.

CIF Tour

About a dozen members of the Lake of the Woods Chapter, Canadian Institute of Forestry, visited the ELA for a day tour and meeting in June. Some of the tour members were particularly familiar with the area, having worked there during forestry operations in the past.

LOWDPOA Tour

In July, Gerry Wilson, Executive Director of the Lake of the Woods District Property Owners Association, arranged for two buses to transport LOWDPOA members to the ELA for a day tour. A short article about the tour appeared later in the Kenora Miner & News' *Holidayer.* This tour was such a success that Gerry is proposing to run a sequel this July.

Dryden LCAC Tour

Members of the Dryden Local Citizens Advisory Committee and Dryden District OMNR toured the ELA facility in early September. As with most day tour groups, they were given an illustrated talk on the history and current research, a tour of the field station, and a short visit to some of the more accessible field sites.

St. Thomas Aquinas students view fish tagging demonstration by Fisheries Biologist Doug Allan

School and Youth Tours

In August, a group of Stewardship Rangers from Dryden toured the ELA. September and October saw groups from Springfield Collegiate (Oakbank, MB), Dryden High School, and St. Thomas Aquinas High School (Kenora) visit. All three high schools have a long history of interactions with the ELA.

Fall Presentations

In early October, John Shearer made a luncheon presentation to the Kenora Rotary Club. In spite of a malfunction by the projector, the Rotarians seemed to appreciate getting an update on ELA activities. Later that month, Drew Bodaly made a presentation to a meeting of regional civic officials in Winnipeg Beach, MB. This presentation was organized by the Red River Basin Commission.

Earth Day 2004

John Shearer attended an Earth Day event organized by a Kenora citizens' environmental group. He presented an overview of the history and current research at the ELA to a number of local residents.

Spring Shows

In early May, ELA research was highlighted through information booths at both the LOWDPOA annual meeting in Winnipeg, and the Kenora Home and Leisure Show. While spring is a busy time for ELA staff, we always enjoy the opportunity to meet with the interested public and share what we are doing with them.

Anyone wishing to learn more about the ELA is invited to contact John Shearer, ELA Operations Manager, 501 University Crescent, Winnipeg, MB R3T 2N6. Phone: 204-983-5206. Fax: 204-984-2404 E-mail: ShearerJ@dfo-mpo.gc.ca