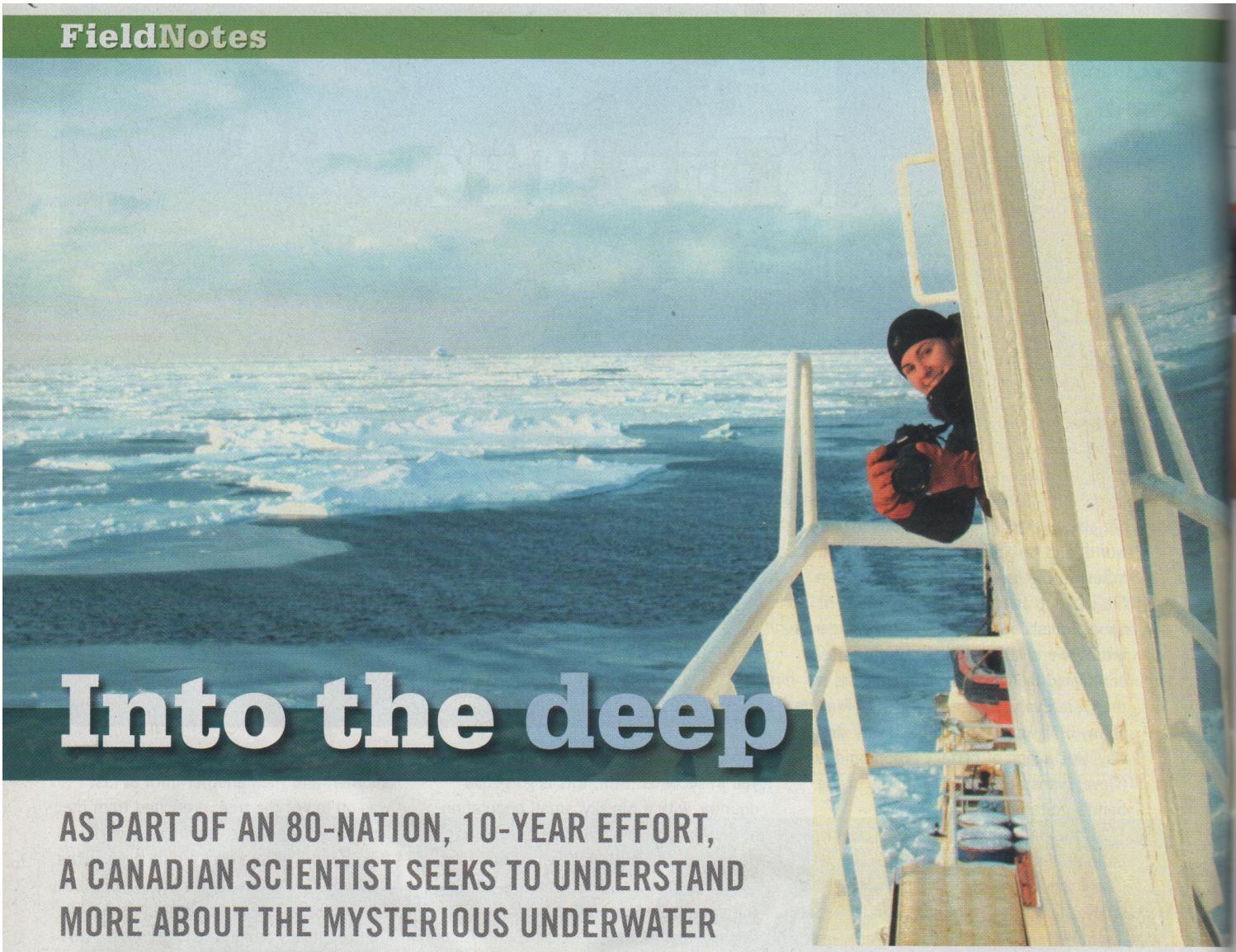


Into the deep

AS PART OF AN 80-NATION, 10-YEAR EFFORT, A CANADIAN SCIENTIST SEEKS TO UNDERSTAND MORE ABOUT THE MYSTERIOUS UNDERWATER WORLD OF THE ARCTIC

A CRUNCHY NOISE JUST WOKE ME UP. The crackling is so loud it seems like sea ice is entering my cabin. It's 9 a.m. and the sun is rising slowly, very slowly over the frozen world surrounding the icebreaker. Everything is pink, from the sky to the sea ice in the horizon. I realize now that I'm finally in the Arctic. It has been a long journey to get here: from Vancouver to Whitehorse, then to Inuvik. Trees got smaller and smaller.

In Inuvik, a small town in the Mackenzie Delta, I met with a group of 40 scientists, mainly graduate students from the province of Quebec. We took small 32-seater airplanes 400 kilometres east to Paulatuk, in the Northwest Territories. Here, there are no trees. A helicopter carried us, four people at a time, from the small airport in Paulatuk to the helicopter deck of the Amundsen, a beautiful icebreaker from the Canadian Coast Guard.

I'm on the ship to document marine biodiversity as part of the Census of Marine Life—a 10-year effort in 25 key ocean areas that includes literally thousands of the world's top marine scientists from 80 nations. As a graduate student in marine ecology, I have the opportunity to work on the ship for six weeks—sampling marine species on the sea floor and filming various research activities. Like me, the other scientists on the ship are studying all parts of the unknown arctic marine ecosystems: from the bacteria to the phytoplankton (algae) diversity, and from the krill (shrimp-like critters), to fish and other fauna found at the bottom. All this life is mainly supported or driven by the presence of sea ice. Some researchers are looking at the extent, thickness and changes in the sea ice, too. I feel like we are all small pieces of a larger puzzle, a great marine biodiversity project happening around the world.

Up to now, my studies have centred on deep-sea species in the Pacific Ocean, off Canada's West Coast. But similar methods are used here, in the Far North, to sample species that lie at the bottom of the sea floor. We use a box corer—which looks a bit like a large metal jaw—to bring what is basically a "mud square" containing small species like worm to the deck of the boat; the Agassiz trawl net is dragged for five minutes on the seabed and brings up larger species like sea stars, brittle stars, fish, and anemones; the remotely operated vehicle (ROV) allows us to visually explore the bottom of the ocean without getting wet, comfortably installed

PHOTO: JOANNIE FERLAND

PHOTOS: (RIGHT) ARCTICNET; (TOP) JOANNIE FERLAND

Arrival of the plane with all the scientific equipment. I'm filming.

in a control room full of screens.

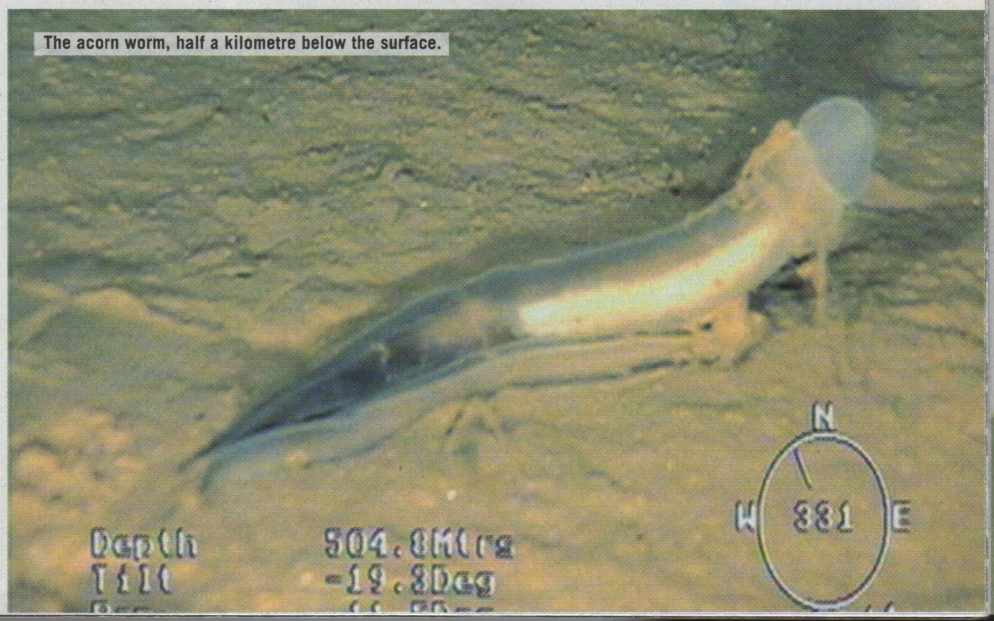
I experienced the other pole, Antarctica, during a university field course last year. On that trip, I witnessed the effects of climate change first-hand and witnessed how everything on our planet is connected by oceanic currents. Climate change is one of the most serious environmental problems facing our world and the poles will be the most strongly affected.

Now, I find myself on the other side of the planet. We are way up North, in the Northwest Passage through the Arctic Ocean. The winter is coming soon and it is cold, about –20 degrees outside. Already, in October, the days are getting shorter and shorter. Soon, it will be polar night, when it is dark 24 hours a day for most of the winter. During that long winter, sea ice extends, slowly covering the Northwest Passage, completely blocking our exit path.

The helicopter takes off every morning on scouting missions—checking to see where the sea ice is building and where the icebreaker should go to avoid getting stuck as it makes its way through the boulder-like ice, crushing it with its weight and speed. The Amundsen is so powerful it can break ice up to three metres deep.

Making our way through the Prince of Wales Strait, which forms part of the Northwest Passage route, is getting harder and harder. The multi-year ice is thick—it didn't melt during the previous Arctic summer and, so, keeps getting thicker and thicker every winter. Sea ice is almost like a living creature. It grows, pushes, creating shapes and ridges. First, it forms like a slush, followed by a thin layer, which shapes like waves with the movement of the ocean. The ice then becomes thicker and thicker, this is known as multi-year ice. There is normally no multi-year ice this far south, but researchers on board say that the lack of sea ice in October this year opened the channel for multi-year ice to be pushed south by the wind. While the multi-year ice didn't melt, it is a sign that it is breaking down. Soon, our captain realizes that we are barely moving forward; it takes so much time to break the ice—if we can break it at all. We need to get out of this strait as soon as possible; the Northwest Passage is closing down on us for the winter. A decision is made: we need to call the CCGS Louis S. St-Laurent, a heavy Arctic icebreaker, to help us get through the Northwest Passage. It arrives 48 hours later. Its arrival is welcomed by most of the staff and scientists of the Amundsen who gather on deck to watch it "fly" over the sea ice in a beautiful Arctic sunset. At last, we will move at a normal, arctic pace, about 14 knots or 1.9 kilometres an hour when there is no sea ice.

So much of the marine world is unknown, unmapped. As a scientist, that is what is so compelling. New species could mean new answers



The acorn worm, half a kilometre below the surface.

PHOTOS: (RIGHT) ARCTICNET; (TOP) JOANNIE FERLAND

ON A TYPICAL DAY, I WAKE UP AND HAVE a look at the main communication board. What has been changed in the schedule? Is there too much ice to sample? Is it too windy? Are we running late for the next sampling station? Lots of flexibility is necessary when you work in an environment like this. Each laboratory knows at which time it needs to be ready on deck to sample water, krill, fish or species on the seabed. It's now my turn: I go to my cabin, put on multiple layers of clothing, slip into my Mustang (a warm, bright orange floating suit), an orange hard hat, a pair of steel-toe gum boots, and multi-layered gloves. Off I go, barely able to move.

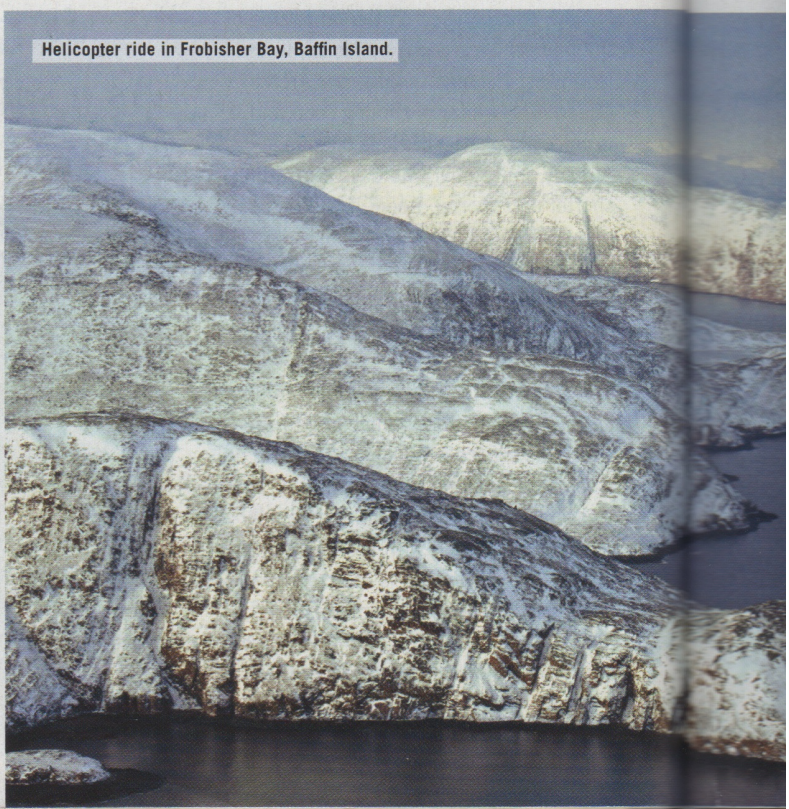
The box corer is going down to 800 metres today. When it is back on deck, Heike Link, a PhD student from Quebec's University of Rimouski, takes some sediment cores and brings them back to the lab for measurements and experiments. Then, the Coast Guard staff brings the Agassiz trawl net. We slow down the icebreaker to one knot, make sure there is no sea ice around to break our precious net, bring it down to the seabed to collect some species and bring it up five minutes later. In the net, there is a weird mix of mud and movement. Trapped in the muck are hundreds of interesting critters to rinse and look at. We fill two buckets and bring them back to the lab. We will identify and classify them later.

After hours working in the cold, it is now time for hot chocolate and snacks. We gather at the cafeteria, take some layers off, chat and discuss what's next. When do we need to go back to the lab: tonight or tomorrow morning? We decide there's no point in waiting. As I head to the on-board lab, I hear some noise from the living room. Some grad students are really concentrating as they play Rock Band with fake drums and guitar. It's so funny to watch them and even more fun to try. Being contained on the ship, we need our entertainment.

In the lab, I put some music on and start classifying species. I put them in containers labelled with information on where and when they were sampled. These samples will be sent to university labs in Ontario and Quebec for genetic analysis, using a method called Barcode of Life to determine what species were found in the Arctic and what changes are happening in their distribution from one year to another.

OUR FIRST ROV DIVE IS VISCOUNT MELVILLE Sound, an arm of the Arctic Ocean in the Northwest Passage where there is a high concentration of belugas in the summer. But why are the belugas gathering here? This dive might help us find the answer. The seabed is fairly flat and muddy; we can't see much sea life. But, wait. What is that critter at 500 metres? It looks like a fish with a jellyfish head. It's actually a 25-centimetre long worm and we have no idea what it is. In fact, so much of the marine world is unknown, unmapped. As a scientist, that is what is so compelling. New species could mean new answers—they could, potentially, help us find cures to diseases or at the very least better

The mystery worm we uncovered in the deep is a new species—one of many that the Census of Marine Life project will unearth


Helicopter ride in Frobisher Bay, Baffin Island.

PHOTOS: (TOP) JOANNIE FERLAND; (BOTTOM) MAEVA GAUTHIER

understand the complex relationships in our marine ecosystems.

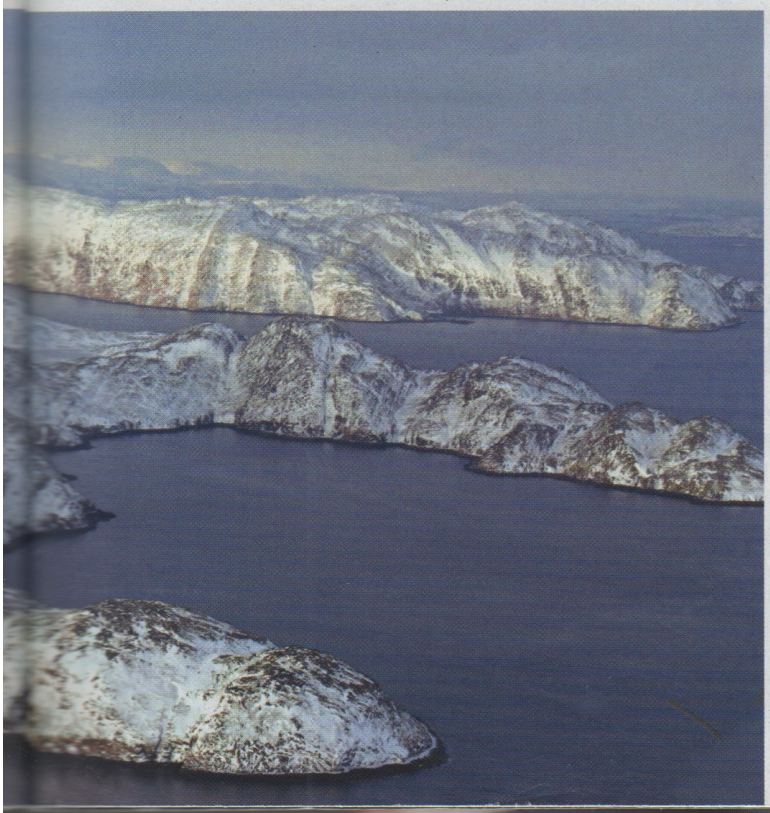
Two weeks later, we arrive at our second dive site. At Scott Inlet, off the east coast of Baffin Island, the sunrise is gorgeous with the full moon in the sky at the same time. Our two photographers, Philippe Bourseiller and Jean-Jacques Pangrazi, are on the top deck, immortalizing this magnificent landscape with their cameras. I have to escape too soon as we have an ROV meeting before this special dive. The geologists detected some oil seepage in the area with their multi-beam sonar. There are kilometres in question and we only have a few hours at the bottom in which to search a few hundred metres. It's like trying to find a needle in a haystack. We decide on specific transects to explore. The ROV goes under water and examines the rocky ecosystem at 200 metres. While oil seepage causes some alternative planning, as marine scientists, we are happy to see these signs because the ecosystems surrounding seeps are really different and have adapted to that energy source; we call them chemosynthetic ecosystems. The foundation of these ecosystems, microbes, don't use energy from the sun (they're too deep) but rather energy from the oxidation of chemicals like sulfates, methane or hydrogen. These seepage signs include bacterial mats covering rocks and gas bubbles coming out of the sea floor. Surprisingly, a brittle star seems to have chosen this specific spot as a perfect bubble bath.

Taking mud samples. Heike Link, PhD candidate from University of Rimouski.

As the trip winds to a close, we make our way to Quebec City by sea, going down the East Coast, passing foggy Newfoundland shores and entering the St. Lawrence Gulf. People wave as we approach the Coast Guard dock and we are greeted with the news that the mystery worm we uncovered in the deep is an acorn (enteropneust) worm. Researchers believe it may be a new species—one of many that the Census of Marine Life project will unearth. These discoveries will help us establish a baseline for measuring anthropogenic and natural changes. It will guide future decisions on what is declining, what requires further exploration.

As I write, scientists on the Amundsen head out to sea again. What will they find this time? The biodiversity documentation continues.

PHOTOS: (TOP) JOANNIE FERLAND; (BOTTOM) MAEVA GAUTHIER



Maeva Gauthier has been a member of The Explorers Club since 2008. Maeva is finishing a master's degree in marine ecology at the University of Victoria. Recently, she developed a passion for scientific filmmaking as a tool to bring information and awareness to the general public. For more information on The Explorers Club, visit its website, **explorersclub.ca**

ArcticNet brings together scientists and managers in the natural, human health and social sciences with their partners from Inuit organizations, northern communities, federal and provincial agencies and the private sector to study the impacts of climate change in the coastal Canadian Arctic.

The findings from this Arctic expedition, as well as Maeva's short Arctic film, were presented at the Census of Marine Life conference last October in London, U.K., to wrap up this 10-year marine biodiversity project. For more information about the new species discovered and this large-scale project, please go to Census of Marine Life website, coml.org