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# As the Canadian Coast Guard ship Nahidik grates against a ragged sheet of ice in the Beaufort Sea, Capt. Adriaan Kooiman spins the wheel and mutters: "I'm not supposed to be in here. This is big ice."

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The others on the bridge say nothing. They know he's right, but no one wants to turn back. All are veteran Arctic researchers, who have come north for three weeks as part of a government research team to study the potential effects of the coming oil and gas boom on the local marine environment. So far, unseasonably thick ice cover, fog and gales have scuppered much of their work. With just a day or two of valuable ship time left, they're anxious to reach their destination -- an abandoned underwater drill island called Issungnak, 85 kilometres northwest of Tuktoyaktuk.

For three hours, they hover on the bridge, watching Kooiman ease the Nahidik through the ice as if she were swimming through broken glass. The old ship is not an icebreaker -- if she hits a floe at speed, it'll slice her thin hull wide open.

When the engines finally slow, signalling their arrival, scientists and deckhands scramble to launch workboats and deploy sampling gear. The clock is ticking -- they don't know how long they'll be able to work here before the ice chases them back to Tuk harbour.

Although the industry drilled almost 100 exploratory offshore wells in the Beaufort during the 1970s and '80s, no one monitored the impact of that activity on the aquatic environment. In fact, few scientists have studied the sensitive ecosystem here in any detail. With the region bracing for another surge in exploration, thanks in part to the promise of a new natural gas pipeline running south, the federal government launched the Nahidik program as part of its sustainable development mandate.

During the two-year research project, biologists from the Department of Fisheries and Oceans hope to create a food chain model of the ecosystem to red-flag species or habitats that may be vulnerable to disturbance from drilling.

Scientists describe the structure of the Arctic food chain as simple and fragile. There are only a few steps between the base levels of phyto and zooplankton -- tiny floating plants and animals -- and top-level predators such as seals and polar bears. A single species -- Arctic cod -- is the master link in the chain; most marine mammals and larger fish depend on it as their main food source. If something were to happen to the cod, nothing else could replace it -- the whole ecosystem would collapse.

Dr. Mike Papst manages the Nahidik's ecological study. Understanding what species live here and where they get their food energy from is essential, he says, not only to enable industry to plan for potential problems, such as an oil spill under the ice, but also to help policy-makers develop management plans for food sources critical to the local Inuvialuit people, such as beluga and cod.

For almost three weeks, his team has been cruising the offshore waters of the Beaufort, trying to collect samples of aquatic species from each part of the food chain. At Issungnak, one of the first pieces of gear they lower over the side is a pair of cone-shaped nets called a bongo, which traps the tiny animals that form the base of the food structure. In its fine mesh, they catch rich communities of minuscule jellyfish, shrimp-like shellfish called copepods and newly hatched Arctic cod.

Photos, Denise Withers, for CanWest News Service
This bottom-dwelling scavenger eats everything in its path, dead or alive.

Photos, Denise Withers, for CanWest News Service
Beaufort: Poised for action, the crew waits for a mushrooming iceberg to clear before lowering the giant "claw" to the bottom to grab a sediment sample.

Photos, Denise Withers, for CanWest News Service
DFO's Robert Fudge checks out the haul from his plankton nets. The tiny animals trapped by the finely meshed cylinder make up the bulk of the food mass in the Beaufort Sea.

Randy Baker, CanWest News Service
Despite predictions of clear sailing by sophisticated ice modelling programs, unusually thick ice blocks the C.C.G.S. Nahidik from reaching several key study sites this summer.

Denise Withers, for CanWest News Service
Out in the acoustics launch, Eric Gyselman weaves through the ice, while trying to "see" fish beneath him. Not running into ice is only half the risk out here -- if the ice closes in around him, he'll be cut off from the Nahidik.

Finding healthy populations of larval cod here is significant, says Robert Fudge, lead biologist on the study.

"We're seeing enormous populations of zooplankton out there and lots of larval fish. The young cod are eating in amongst the zooplankton and doing very well here. So it's an important nursery area for them -- obviously very valuable -- and we want to be careful to protect it."

To study the upper levels of the food chain, the team has spent days fishing offshore for adult cod and other mature species but, so far, has caught nothing. Fudge throws every net he has in the water at Issungnak -- all come up empty.

"I would have thought we'd have caught fish", he sighs. "It's a little bit surprising."

Frustrated, he even tries setting his gill net among the ice floes -- but, after just two hours, an SUV-sized berg runs over its buoys, collapsing the whole thing.

He can't say yet what his empty nets mean -- whether the fish aren't here or if they're just out of reach, under the ice. "It's a hostile environment" he shrugs. "Next year, we'll just have to be more inventive at how we fish out here."

Knowing exactly where to set his nets is Fudge's biggest challenge. From the surface, it is impossible to tell where the fish might be. For guidance, he relies on acoustics biologist Eric Gyselman.

"When you work in the ocean, it's like working in a big black box," explains Gyselman. "If you want to fish, or do anything, you're basically reaching into that black box and rummaging around with your eyes closed until you find something. The really interesting thing about acoustics is that it actually lets you visualize what's there."

Sound travels much better under water than light does. That's why toothed whales such as belugas use acoustics to navigate and locate prey. Fishermen use acoustics, too.

"You can go down to Canadian Tire and buy a little fish-finder and it's exactly the same principle -- you put sound in the water and get it back," says Gyselman.

A transducer that is mounted in the bottom of a 10-metre launch sends a sound signal like a flashlight beam through the murky water, straight down to the bottom. The signal bounces back and is recorded by a powerful on-board computer. Each of these digital signals, or "pings," carries detailed information about the size, density and shape of whatever it hits underwater. Gyselman's system processes that signal in real time, to enable him to "see" life in the water column beneath his hull.

Unlike commercial fish finders, this technology is so sensitive it can locate a fish as small as a paperclip up to 200 metres away. The acoustic system can also identify the composition of the seabed -- whether it is rock, sand or mud -- even going so far as to distinguish between plain mud and mud with worms.

Although this technology is considered state-of-the-art, it can't yet tell Gyselman and Fudge what kind of fish they are seeing. However, the scientists hope that, in a few years, they will be able to match different species of fish to different acoustic signals -- almost like fishing by sound.

Getting such sensitive electronics to work reliably in a harsh environment such as the Beaufort is never easy. To collect the acoustics data, Gyselman has to drive his small launch in a grid pattern over each study site. However, at Issungnak, where ice covers almost half the open water, that proves nearly impossible. After zigzagging around the frozen patches, Gyselman's recorded grid pattern looks like a berserk Etch A Sketch drawing. He tries not to let it discourage him. "You learn quickly that those are just limitations to doing this type of work," he says.

The area of the Beaufort Sea under development by the petroleum industry is unusually shallow -- often less than 10 metres deep, as far as 30 kilometres offshore. Mud, clay and occasional sand bars blanket this seabed, courtesy of Canada's longest river, the Mackenzie.

The surface layers of this mud shelter an astonishingly vibrant population of marine life -- invertebrates such as minute crustaceans, worms and clams that feed fish and mammals, including grey whales. These bottom-dwelling or benthic species are perhaps the most at risk from drilling, yet they are also the least understood part of the food chain.

Dr. Kathy Conlan, an invertebrate specialist from the Canadian Museum of Nature, joined the Nahidik science crew to categorize these benthic creatures.

She has been focusing her research on life in the sediment at the abandoned drill islands. These underwater platforms all share similar features: They're built from compacted sand; the top of each island rests a few metres below the surface of the water; and most have a "borrow" pit nearby, from which the island's sand or building material has been "borrowed."

At Issungnak, the fourth island in her study, she collects more than a dozen buckets of goopy sediment, using a giant claw-like box-grab. Then she and her assistant sieve through the buckets, picking out all the tiny animals.

Conlan admits this can be tedious work, but what she has seen so far surprises her. "The tops of the islands are basically sterile, likely because they're just a few metres below the surface and are scoured regularly by waves, so nothing can settle in there. But, by contrast, the borrow pits are very rich (with invertebrates)."

If her data support this observation, it could mean both good and bad news for the petroleum industry. Many companies want to reuse the sand from these old drill islands to build new ones; if they can do it without a negative impact to the existing bottom-dwelling community, they could save both time and money.

However, the fact the islands are still standing and as sterile as when they were built 30 years ago means they are not returning to their natural state. As habitat, they remain useless to the local aquatic animals. This is one of the most significant findings of the trip, says Papst.

"The ability of these sand platforms to withstand the forces of this highly dynamic environment tells us their impact here is much longer term than anyone ever predicted. This discovery could have a real influence on how the local Inuvialuit and government bodies manage applications to build new underwater islands."

Despite the environmental, economic and physical challenges of working offshore in the Arctic, it seems almost certain oil and gas production here will move forward soon. The petroleum deposits in the Beaufort-Mackenzie Basin represent almost 25 per cent of Canada's total frontier resources. With energy prices soaring, industry cannot afford to ignore such riches much longer.

Devon Canada, one of the most active companies in the region, expects to drill new wells offshore as early as 2005. In the American Beaufort, off the coast of Alaska, one commercial oil well is already in production; more will likely follow, spurred on by financial incentives from the Bush administration.

The U.S. government recently reopened Arctic offshore exploration as part of its campaign to achieve energy self-sufficiency. Recently, three companies offered a total of $8.9 million US in high bids for the rights to explore oil and gas prospects in U.S.-managed portions the Alaskan Beaufort. The lease-sale included offshore tracts under jurisdictional dispute with Canada.

With things moving quickly in the Beaufort, the need to understand this sensitive environment has never been more critical. Yet, the Nahidik science study has funding to run for just one more season, at a total cost of $3 million. Local stakeholders, such as the Fisheries Joint Management Committee in Inuvik, which represents the local Inuvialuit, believe such a program is long overdue; they would like to see it expand into a more comprehensive investigation.

Martin Bergmann, director of Arctic science program development at Fisheries and Oceans, agrees the science is needed, but admits securing the funds for such a project will be a struggle. "Arctic science is a big-ticket item and those are often the first to go when budgets are cut."

As it wraps up its first season on the Nahidik, the research team turns its day at Issungnak into one of the most productive of the entire voyage. It gets a break from the weather and is able to explore the site for nine hours before a murky fog forces its retreat. As the ship creeps back through the ice toward the harbour, those still working on deck pause to watch a ghostly blue berg wander past. Perilous yet fragile, it reflects a world few Canadians see, a wilderness these scientists believe deserves our attention.

Illustration:
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