



CRYING TO BE HEARD

In an increasingly noisy ocean the complex communication of beluga whales could be their downfall, finds Isabelle Groc

IN HER office at the Vancouver Aquarium, Valeria Vergara is immersed in a world of sound – complex chirps, whistles, clicks, squeaks, grunts, screeches and foghorns. “It’s deafening. It’s like stepping into a jungle,” she says. But Vergara isn’t listening to the songs of tropical birds. Instead, the calls come from beluga whales, nicknamed the canaries of the sea for their singing. These Arctic inhabitants live in darkness for half the year so rely on sound to communicate, navigate, socialise and hunt. “Sound to them is like vision to us,” Vergara says. “It’s the fabric of their social world.”

On the other side of Canada, Robert Michaud relies on vision to gain insights into belugas in Quebec’s St Lawrence estuary. Over 30 years he has compiled a family album in which each animal is pictured and named. Every spring, he looks forward to the return of Yogi, Miss Frontenac, Griffon and the others from their winter feeding grounds. “I start wondering who we will see this year, who is going to be there, who is going to be missing, who is going to have a baby,” he says.

This year, Michaud’s feeling of excitement is mixed with deep anxiety. For the past six years, an alarming number of dead newborn belugas have washed up on beaches. The puzzling deaths have forced him to question everything he thought he knew about the whales. But there’s a glimmer of hope. This summer, Vergara and Michaud will combine sound and vision, eavesdropping on the underwater dialogue between mothers and calves in an attempt to solve the mystery.

When Michaud began his work in the mid-1980s, the St Lawrence belugas were struggling with a different problem. Located at the southernmost limit of the species’ distribution (see map, page 40), they are genetically distinct and geographically isolated from other beluga populations. Once numbering some 10,000, after years of whaling they were down to just 1000. Hunting had been banned in 1979, and scientists had hoped the belugas would bounce back. They didn’t. “There was something going on, because a healthy population should have doubled in 30 years,” says Michaud, who is scientific director of the non-profit Group of Research and Education on Marine Mammals, based in Tadoussac.

It took years of painstaking investigation, but eventually Michaud and other researchers identified a key culprit: toxic pollution. The St Lawrence belugas live downstream of the densely populated and highly industrialised Great Lakes region, along a major shipping corridor. The pollution released had made

them among the world’s most contaminated marine mammals. Their blubber contained levels of polychlorinated biphenyls (PCBs) 25 times higher than in other beluga populations. Exposure to PCBs weakens the immune system, reducing a whale’s ability to fight infectious diseases, a primary cause of mortality for these belugas. The St Lawrence whales also had the highest rate of cancer ever reported in cetaceans, probably caused by exposure to carcinogens such as polycyclic aromatic hydrocarbons (PAHs) concentrated in sediments.

The findings led to action. “We used the beluga as a poster child to speed up the cleaning of the St Lawrence,” says Michaud. It worked. Efforts to limit PAHs and PCBs, which had begun in the 1970s, were redoubled. With

“A brutal wake-up call came in 2012 when 16 newborns were found dead”

fewer toxins accumulating in their bodies, no beluga born after 1971 has died of cancer, as far as we know. Michaud’s team also championed the creation of protected areas for the whales’ habitat. In 1998, the Saguenay-St Lawrence Marine Park was established.

Michaud thought the worst was over. The population seemed stable, and although he continued to monitor the animals, his research programme entered a slower, sleepier phase.

Then, in the summer of 2008, eight dead newborn belugas washed up on the shore. Usually one to three calves die every year, but alarm bells didn’t ring because there seemed to be a rational explanation – a toxic algal bloom had killed numerous marine mammals that year. In 2010, another eight beluga calves died. Michaud still didn’t see the warning signal. But two years later, he had a brutal wake-up call: 16 newborns were reported dead.

Thrown into a sudden crisis, researchers spent the whole of 2013 reviewing everything they had learned about the St Lawrence belugas. They discovered that whale numbers weren’t stable after all; they had been declining at a rate of 1 per cent per year since the early 2000s. The death of newborns wasn’t the only puzzle, either. For a decade female belugas had been dying while giving birth, a rare phenomenon in cetaceans. With fewer than 900 animals remaining, in December 2014 the Committee on the Status of Endangered Wildlife in Canada deemed the population endangered. ➤

Belugas are among the most vocal of cetaceans

DAVID DOUBILET/NATIONAL GEOGRAPHIC CREATIVE

CAROLINE MÉTHOT



Could the ever-noisier marine environment be behind the deaths of baby belugas? Monitoring the whales' behaviour and communication could tell us (below)

The situation seemed more hopeless than ever. Thirty years ago, the belugas struggled with what Michaud calls "ghosts from the past", but at least the problems of intense commercial hunting and toxic contaminants were relatively easy to act on. "Right now we have a population in decline but we don't know where the problem is," says Veronique Lesage of the Department of Fisheries and Oceans Canada, who led the 2013 review.

In an attempt to find out, researchers have been scrutinising all the possible culprits, from factors associated with climate change to new pollutants (see "The perfect storm for belugas", below right). Michaud compares the work to a huge and complex detective enquiry.

GRETCHEN FREUND



Recreational hazard

While sifting the evidence one association jumped out at him: between 2003 and 2013, recreational boating had increased, particularly in areas important to mothers and calves. What's more, the high calf mortalities in 2010 and 2012 coincided with warm and dry conditions that led to more boats in whale habitat during July and August, when belugas are born. "Could there be a mechanism to explain the calf mortality?" he wondered.

This is where Vergara comes in. While studying the interactions of a captive female beluga and her newborn at Vancouver Aquarium, she discovered that they use specific broadband, pulsed calls to maintain contact. "The contact calls are a predominant function for mothers and calves but also used for herd cohesion," she says. Her research also revealed that newborn calves babble like human babies. During the early months their calls sound like a finger running along a comb. It takes them between one and two years to fully reproduce the contact calls of their mothers. This sophisticated approach to communication could be their downfall.

Vergara thinks the increase in boat traffic in the St Lawrence could have affected the babies' ability to communicate with their mothers. "During the first two weeks, the calves' calls don't reach the frequency that adults' calls reach. It means that they could be more susceptible to masking by boat noise," she says. As a result, when there is a lot of boat traffic, calves are more likely to become separated from their mothers, leaving them without care or food. Tellingly, the dead newborns showed no signs of disease, just starvation. "When Valeria brought this idea with the data and the mechanism to explain it, I thought wow, this is a very important hypothesis to investigate," says Michaud.

Creatures of sound

Living in the Arctic and sub-Arctic means beluga whales spend half the year in darkness, so they rely on sound to communicate, navigate, find food and survive.



Noise pollution may also help explain why females are dying in labour. “If a pregnant female is stressed or disturbed when she is ready to give birth, that could be associated with an increase in the birthing duration,” says Stephane Lair at the University of Montreal, who conducts beluga necropsies.

Vergara’s findings are also a warning for other beluga populations and other cetaceans. “Global warming is causing the Arctic to lose ice at an unprecedented rate, and this means that there are a lot more areas opening up for navigation and human activities that bring about noise,” she says.

Noise is thought to play a critical role in the decline of the Cook Inlet beluga population in Alaska, which has dropped by nearly 75 per cent since 1979, with only 340 animals remaining. Cook Inlet serves as a harbour for Anchorage, Alaska’s largest city, so lots of noisy activities take place there, including port expansion, construction projects, shipping and airport traffic, seismic surveys for oil and gas, and military activities. “The belugas chose the wrong inlet to live in,” says Manuel Castellote, a marine mammal acoustics expert with the US National Oceanic and Atmospheric Administration (NOAA).

Tackling the noise pollution problem from the other end, Castellote and others are attempting to discover what the whales really hear. They are conducting hearing tests on belugas living in the quieter area of Bristol Bay, in south-west Alaska, by measuring their brain

THE PERFECT STORM FOR BELUGAS

Isn’t it ironic? The sound of whale-watching boats may be contributing to the death of baby belugas in Canada (see main story). But noise probably isn’t the only reason behind the decline of the St Lawrence estuary population. “We are looking for one factor, but maybe there is more than one,” says Stephane Lair at the University of Montreal.

This much we know: the dwindling numbers coincide with significant environmental changes connected with global warming. Rising water temperature, reduced ice cover and declines in fish populations may be creating an environment that is less favourable for an Arctic species like the beluga. If females can’t find enough food, they may not be able to support a calf. Without ice to protect them from wind, waves and storms in winter, they may spend more energy looking for shelter and become too weak to give birth, resulting in females dying in labour.

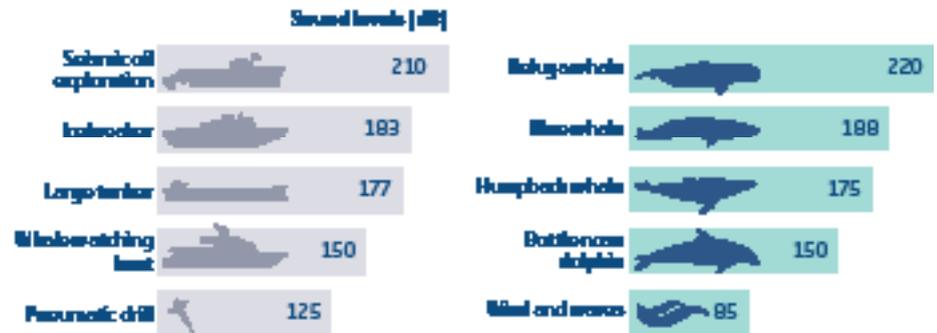
That’s not all. Since the 1990s, many

ecosystems, including the St Lawrence estuary, have seen an exponential rise in levels of polybrominated diphenyl ethers (PBDEs), which are used as flame retardants in products ranging from building materials and textiles to electronics. These and other persistent organic pollutants have been found to disrupt the endocrine system of mammals, implicating them in problems associated with reproduction, development, immunity and behaviour. So it is possible that their build-up in the bodies of belugas is compromising their ability to reproduce.

To get a handle on all the possible reasons, a team of researchers has created a new statistical model. “No one has yet attempted to integrate contaminants, noise and food limitation in the same model before,” says Rob Williams, a Pew Fellow in marine conservation, who is leading the effort. “What I am focusing on is what are the problems we can do something about.”

It’s noisy down there

Cetaceans make quite a racket but with so much human-generated noise they can have trouble hearing one another



responses to different tones and frequencies. The first results show that they can pick up frequencies between 4 and 150 kilohertz, and sounds as quiet as 30 decibels. “We are finding that these guys have very good hearing and that they are more sensitive than we previously thought,” says Aran Mooney at Woods Hole Oceanographic Institution in Massachusetts. He was particularly surprised at how little age-related hearing loss he saw.

The team hopes to carry out comparative studies in noisier environments such as Cook Inlet. “We know anthropogenic noise has been increasing in the inlet,” says Rod Hobbs, beluga project leader for NOAA. “But we haven’t been able to determine

how much of a problem it is for the whales.”

This kind of knowledge will be invaluable to anyone trying to build a case to regulate noise pollution in the oceans. So too will further investigations into the impact of sound on the survival of baby belugas in the St Lawrence estuary. To obtain this, Michaud and Vergara plan to follow beluga groups this summer as they travel from noisy environments with high boat traffic to quieter waters. The pair intend to use drones to keep track of how mothers and calves separate and reunite. At the same time, underwater hydrophones will record contact calls and help reveal how different noise levels affect communication. “It is a deeply needed source of information to monitor and devise solutions to the increase of noise in beluga habitat,” says Michaud.

Both he and Vergara hope this research will help conservationists find new ways to nurture belugas. And that’s exactly what the fragile belugas need as they face increasing human incursions into their environment. Just recently, Michaud won a battle against a proposal to construct an oil terminal in Cacouna, Quebec, near a sensitive beluga area. Similar projects that would bring more boat traffic and noise have since been proposed, and Michaud is getting ready for a new fight.

“The general environment of beluga whales is changing rapidly,” says Michaud. However, problems such as climate change cannot be easily reversed, whereas noise pollution may be. “One reason it is one of my favourite hypotheses is because we are closer to an answer,” says Michaud. What’s more, reducing noise would help the whales cope with the larger changes in the ecosystem. “We are panicked, but we are not helpless,” he says. ■

Isabelle Groc is based in Vancouver, Canada. Listen to beluga whale calls at bit.ly/NSbeluga