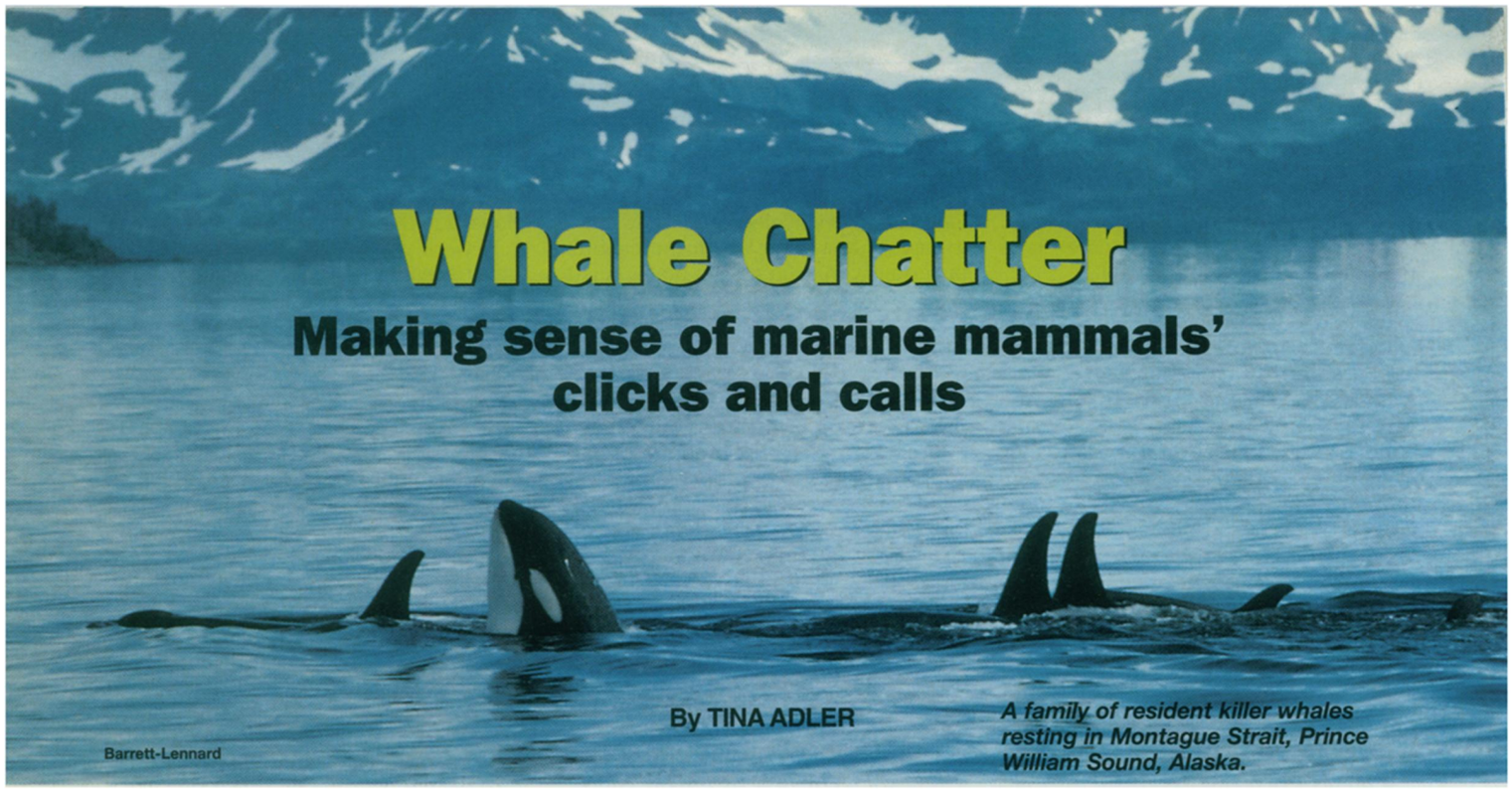

# Whale Chatter

## Making sense of marine mammals' clicks and calls

By TINA ADLER

Barrett-Lennard

*A family of resident killer whales resting in Montague Strait, Prince William Sound, Alaska.*

The first time Eva Saulitis heard the unusual wail of killer whales looking for their group, or pod, she and her colleagues were in an inflatable boat in Prince William Sound, Alaska. The scientists had been watching two whales hunting, when suddenly from below the boat the animals let out a sirenlike cry.

Then a group of three or four other whales a few miles away let out a similar wail, and the two hunters swam at full speed to join the pod. Once united, the group raised quite a hullabaloo, letting out a variety of calls, says Saulitis of the North Gulf Oceanic Society in Homer, Alaska.

Since that summer in 1988, Saulitis and her colleagues have moved to a 26-foot fishing boat and gone out every year to listen to the killer whales of Prince William Sound. They've recorded two other incidents of males and their groups calling for each other. The wails consist of an extremely rapid series of different, loud sounds, which each animal produces in its own unique tone, she believes.

Few species of whales engage in this sort of plaintive, long-distance communication, Saulitis says.

Although people have studied whales for centuries, the clicks and calls that whales sing to themselves and to each other as they cruise the oceans remain, in many ways, mysterious. The whales clearly chatter to communicate and to keep track of each other, but researchers can only guess at the meaning of many of those sounds.

Generally, different populations of even the same species of whales have their own distinct repertoire of calls, which makes studying whale communication complicated, researchers note.

Some whales also engage in echolocation—the art of bouncing click sounds off prey or objects in order to locate and identify them. Reams of data exist on the acoustic properties of the echolocation signals of captive whales and dolphins, says Lance G. Barrett-Lennard of the University of British Columbia in Vancouver.

Until recently, however, the questions of when and why whales use echolocation in the wild had not been directly addressed, he asserts. Moreover, the possibility that they find objects or prey simply by listening, instead of relying on echolocation or vision, had not been investigated.

Barrett-Lennard and K. A. Heise

*A resident killer whale, probably a female, breaching in Prince William Sound, Alaska.*

The importance of decoding the whales' secret languages and understanding their use of sounds in the wild is becoming more urgent. A growing number of underwater noises, such as boat engines, military sonar, and oceanographic experiments, may threaten whales' ability to communicate and navigate the oceans.

The population of killer whales that Saulitis studies, called transients, form small pods of four to five animals. They eat other marine mammals, such as seals and porpoises. Like most whale species, they spend the majority of their time below the surface of vast bodies of murky water, where eyesight serves little purpose. Whales, however, hear well when they are underwater, so they can take advantage of the ease with which sound travels through water.

Saulitis has discovered that transient killer whales make a variety of different calls while socializing or sharing a meal. When killing an animal, such as a harbor seal, the whales make odd, loud bursts of the same clicks that they normally reserve for echolocation, she says.

So although transients make fewer clicks and calls overall than many whales, "when they are vocal, they are really vocal," Saulitis concludes from her unpublished findings.

The population of Prince William transients that Saulitis studies has dropped from 22 to 11 during the last 8 years. The number of harbor seals, which the transients eat, has also decreased. Both populations declined after the *Exxon Valdez* spill in 1989 (SN: 2/20/93, p. 126).

Transient killer whales often disguise their echolocation sounds, Barrett-Lennard and his coworkers report in the March ANIMAL BEHAVIOR. Between 1990 and 1992, they tracked killer whales in Prince William Sound and along the coast of British Columbia for a total of 14 months. They recorded and observed 6 pods of transients and 11 of residents, which form more stable and larger social groups than transients do. The residents also eat fish rather than seals and porpoises. Although they are members of the same species, transients and residents don't mate with each other.

Whales that employ echolocation can send clicks in specific directions. The

echo of these clicks bouncing off an object reveals to the animals not only the location but also the nature of that object. The echoes from a large or small fish, a seal, another whale, or a boat sound different.

Killer whales use both single clicks and click trains during echolocation, Barrett-Lennard and his colleagues report. A rapid series of three or more pulsed noises, each of which resembles a single-frequency chirp, or "tsk, tsk, tsk," makes up a click train. When the animals swim near the boat, the scientists can hear the noise without amplifying it.

Resident killer whales change the speed of their clicking gradually. Transients, however, often change the clicking speed very abruptly, probably to make it difficult for their prey to recognize the sound, the team reports. Submarine crews employ the same camouflage technique when they vary the timing and frequency of their sonar's sonic waves, Barrett-Lennard points out.

It's more important for transients than for residents to disguise their clicks, as the transients' prey hear the sounds easily, he says. Fish, the residents' dish, hear the telltale clicks poorly.

The Vancouver team produced "the best data [I've seen] on changes in click patterns, in this case to avoid detection by prey," says Peter Tyack of the Woods Hole (Mass.) Oceanographic Institution. "I think it's a very exciting study."

Although they have a camouflage strategy, transients don't employ echolocation clicks very often, the team demonstrated. The whales usually detect and catch their prey silently, just by listening for them, despite having to swim dangerously close to shore to catch a meal.

Transient killer whales "are not swimming bats . . . they can and do spend much of their time navigating through the water without echolocating," Barrett-Lennard asserts.

Dolphins may also use echolocation less often than studies of them in captivity suggest, he contends. Attempts to prevent them from getting caught in fishing nets by equipping the nets with acoustically reflective discs or wires have failed, suggesting that in the wild, the animals rely on echolocation only infrequently. Also, unlike killer whales, dolphins have predators, so they have even more reason to remain silent.

Most other small, toothed whales use echolocation. Sperm whales may be the exception. However, they, too, communicate using sounds.

William A. Watkins of Woods Hole says there is no good evidence for sperm whale echolocation. "[My opinion is] in the minority, but I'm probably one of the few who has spent any time with the whales," he says. If sperm whales do use echolocation to find objects, they have a poor success rate. Boats run into them often, he notes.

Since 1981, Watkins and his colleagues have studied sperm whales off Dominica in the Caribbean. The researchers record the sounds of the animals with hydrophones. Also, to track their underwater whereabouts, the team shoots them with a small tag that lodges just under their skin and does not appear to disturb their behavior. The tag emits signals picked up by the hydrophones and a sonar device.

Sperm whales forage alone for hours without making a click, Watkins and his colleagues confirmed during a research expedition in May 1995. When swimming in a group, each whale repeats a series of unique clicks, probably to keep track of the others, he says. The group also has a couple of common sequences for conveying the universal messages "come here" and "go away," Watkins and his colleagues concluded from their unpublished data.

Saulitis

*A transient female killer whale going after a Dall porpoise, which she has just butted.*

The whales make either loud, slow clicks or softer, faster ones, he says. They seem to have a certain amount of "battery juice stored up in their capacitor," and it's not enough to produce clicks at full volume and full speed.

Baleen whales, a suborder of usually large whales that eat krill, or tiny animals, don't have the anatomy required to make click sounds. Researchers suspect that they do not employ echolocation. Like their toothed colleagues, however, baleens engage in interesting chatter, which sounds like a moan or groan.

Among fin whales, for example, which swim close together, one animal dominates the conversation while the others take turn answering, Mark A. McDonald and his coworkers at the Scripps Institution of Oceanography in La Jolla, Calif., report in the August 1995 JOURNAL OF THE ACOUSTICAL SOCIETY OF AMERICA. They study blue and fin whales off the coast of Oregon.

In one group of fin whales that the researchers monitored closely, the big talker zigzagged across the group, as if surveying the area, while the others swam in fairly straight lines. The whales also surfaced at the same time, as if in response to a particular call, the scientists report.

The blue whales put on yet another type of acoustic show. They call for 20 seconds, then pause for 20 seconds, then repeat the 20-second call, probably to keep in touch with far-flung colleagues while migrating, says coauthor John A. Hildebrand.

Surprisingly, a proposed global climate change project has spurred new research on the behavior of whales, including their use of sounds. To see if greenhouse gases are causing the world's oceans to heat up, the Acoustic Thermometry of Ocean Climate (ATOC) project would track water temperature by measuring how fast the underwater sound travels; it moves faster in warmer waters.

The project requires installing two loudspeakers off the coasts of California and Hawaii (SN: 6/3/95, p. 350). The speakers would produce a low-frequency rumble for 25 minutes, six times a day on every fourth day, for up to 10 years.

The public and some researchers are concerned that the low-frequency noise would disturb marine life, so the study has been delayed. The ATOC team is now examining the potential effects of its experiment on marine mammals and turtles.

A 2-month trial run off the northwest coast of Hawaii used a much quieter version of the sound. The preliminary results suggest it does not disturb the area's humpback whales in any obvious way, such as by altering their breathing rates or calls, says project leader Adam S. Frankel of Cornell University.

Scientists still worry that the sound will harm some species of marine mammals. Killer whales will be able to detect the low-frequency hum, which may impair transients' ability to find their prey quietly, Barrett-Lennard contends. He worries less about the resident killer whales, whose clicks, he suspects, will manage to "blast through the noise."

Researchers are only beginning to investigate how the many sounds that human activities produce underwater may limit the ability of whales to communicate and use echolocation—if, indeed, they do. Signs of whale distress may prove difficult to detect and show up only after many years. For now, the whales may be talking, but they aren't providing scientists with a lot of answers. □