A WHALE OF A SONG

In flipper-to-flipper encounters, scuba diving investigators observe and eavesdrop on humpback whales

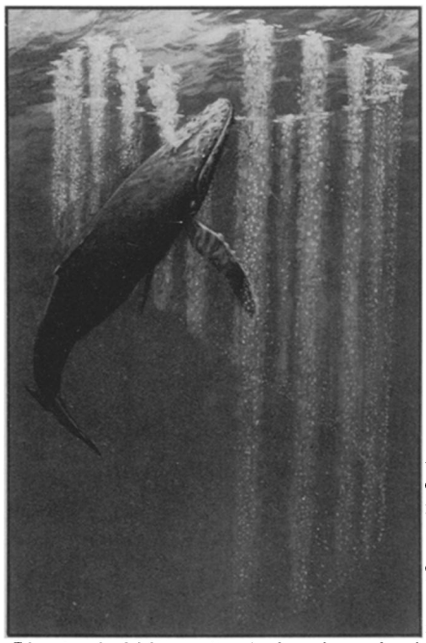
BY JULIE ANN MILLER

The song of the humpback whale, nature's loudest, longest and slowest song, is an evolving art form. In addition to being performers, humpback whales seem to be composers, constantly incorporating new elements into their old tune. Roger Payne of the New York Zoological Society and Sylvia A. Earle of the California Academy of Sciences told a press conference of discoveries about the whale's song, and also about its feeding, that indicate an intriguing intelligence.

Rumbling bass passages and squeaky treble phrases, arranged in complex sequences, make up the song of the humpback whale. If the song is sped up fourteen times, it sounds surprisingly like a bird's song. (A recording of whale song at natural tempo and at high speed is included in the January NATIONAL GEOGRAPHIC, along with articles by Payne and Earle.) At its natural speed, the whale song evokes a variety of human reactions. Writer and biologist Richard Ellis describes its "ethereal beauty" and others liken it to an enticing siren's song (see box). But in 1856 Charles Nordhoff reported a whale under the boat uttering "the most doleful groans, interspersed with a gurgling sound such as a drowning man might make."

Occasionally Earle and other researchers have dived near singing, 40-ton whales. "Under water the song was so intense that we could feel the sound as the air spaces in our heads and our bodies resonated," Earle says. Underwater cinematographer Al Giddings described the experience as feeling like "drums on my chest."

When the researchers transcribed numerous whale songs from underwater recordings, they found that all the humpback whales in an area sing the same song, although the whales are well out of synchrony in duets or choruses. By analyzing songs collected over twenty years Katy Payne, Roger Payne's colleague and wife, discovered that the songs change progressively from year to year. "The songs of two consecutive years are more alike than two that are separated by several years," Roger Payne says. "For example, the songs we taped in 1964 and 1969 are as different as Beethoven from the Beatles." He points out, "We are aware of no other animal besides man in which this strange and complicated behavior occurs, and we have no idea of the reason behind it." Paralleling some critics of human music, Roger Payne says that the songs of the 60s were more beautiful than those of the 70s.



National Geographic Society

Blowing bubbles as it spirals, a humpback whale concentrates food in a gulp-size area. Painting by Richard Schlect.

Because whales only sing in winter, Roger Payne says the researchers' first hypothesis was that the changes reflect flawed memory; the humpbacks simply forget part of the song over the summer and have to improvise in parts each fall. When the Paynes and Earle organized a six-month study to record a full season of songs, they learned that the whales return to their winter grounds faultlessly singing the song of the last season. The variations arise only as the winter progresses; an old phrase gradually decreases in frequency and a new phrase takes its place. Roger Payne observes that the introduction of new material and the phasing out of old in many ways are similar to the evolution of language.

Like human compositions, whale songs have a defined structure. In a given year, the humpback whales that winter in Hawaii sing a different song than the whales wintering in Bermuda. But the structure of the song and the rules for change are the same. Each song, for example, contains about six themes that follow in the same order. Each phrase contains 2 to 5 sounds. If a theme is deleted, the others stay in order. The researchers have deduced about fourteen simple, predictive laws for the song modification.

Because the laws of composition are the same between two, probably isolated, herds of whales, Roger Payne suggests that the whales inherit, genetically or through learning, a set of song rules. "It must be a function of the huge brain to keep track of the changes," he says. In addition, the whales must memorize all the complicated sounds and their orders and store the information at least six months. "To me, this suggests an impressive mental ability and a possible route in the future to assess the intelligence of whales," Roger Payne says.

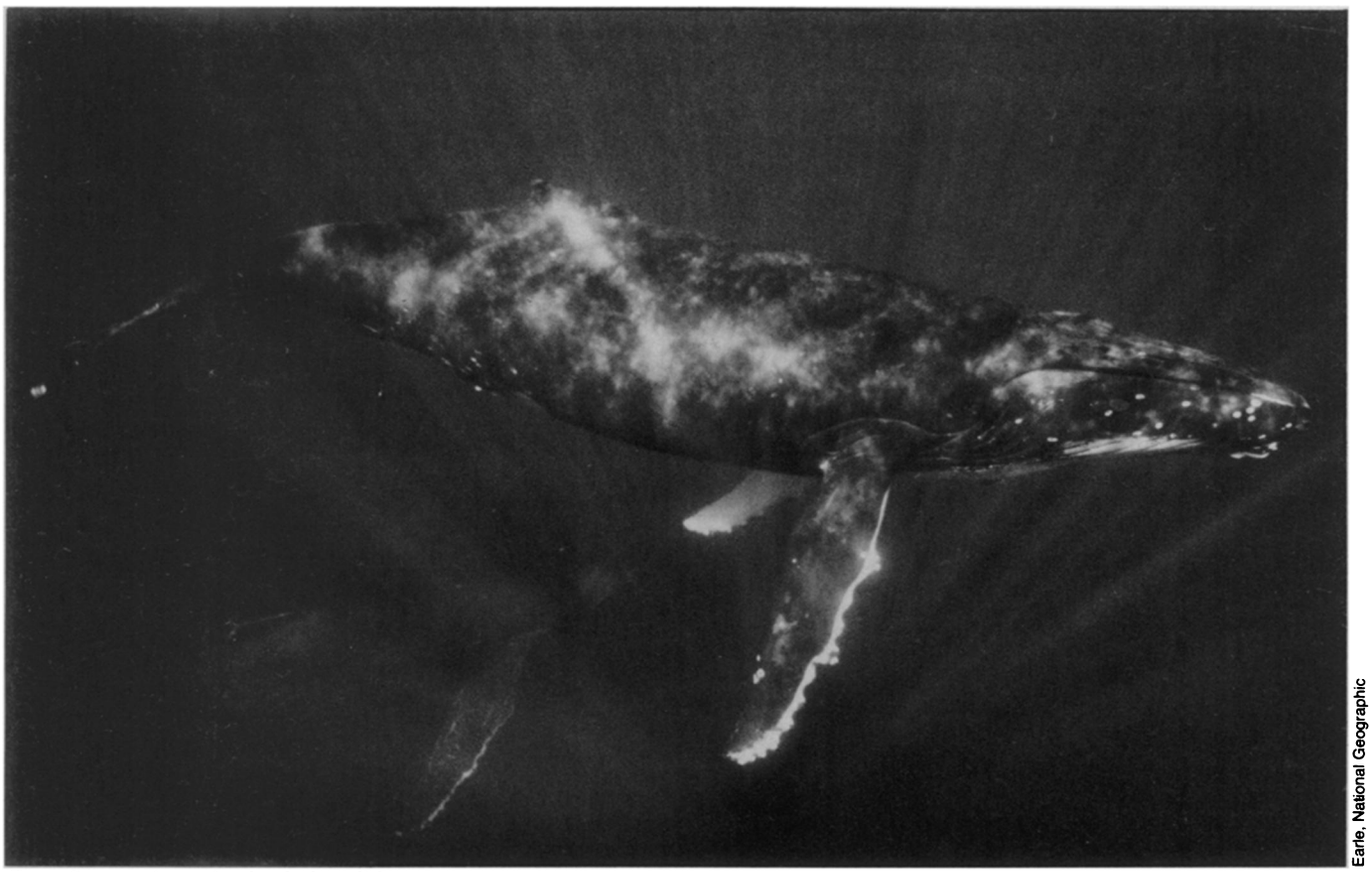
The purpose of the elaborate song so far eludes scientists. They suspect from circumstantial evidence that it is a love song. It is sung only in one season, suspected to be the breeding time, and only by adults. So far all singers that have been sexed are male, but the researchers have been unable to determine the sex of most of the whales they observe.

Linking specific behaviors with the song is an immediate goal of the research. Roger Payne says that whales are almost always alone and relatively inactive when they start to sing. When more whales appear on the scene, the first stops singing and they all go off in a tumbling melee.

Systematic investigation is a challenge, because the scientists find it difficult even to tell which whale is making the sound. Because the whales, like opera singers, breathe surreptitiously at certain points where the breath won't interrupt the song, the researchers identify the singer by listening for a characteristic breath spot while scanning the ocean surface for a spout. (The song is performed entirely by

What song the sirens sang?

Eerie melodies lured mythic mariners to shipwreck on the rocks. The whale song is the fact behind that legend, Roger Payne and Sylvia Earle believe, accepting evidence that whales formerly inhabited the Mediterranean. The researchers explain that the wooden hull of a boat, as the Greeks must have used, broadcasts underwater sounds. To a person in the boat, the song can't be localized; it seems to come from all around. Even being familiar with whale songs, the researchers admit being frightened and awed by hearing them within a boat. "You actually feel the song, it is so intense," Payne says.



Earle, National Geographic

Forty-five ton humpback whales glide through the sun-streaked waters off Hawaii, unperturbed by underwater photographers.

air shuttling within the whale head, so no air is expelled to make the sound.) Once the singer is spotted, following is still a challenge. Earle says that tracking a whale feels like being an ant chasing an elephant.

A clever feeding behavior is the other observation that has brought a high regard for the whale intelligence. Chuck Juarasz of Glacier Bay in Alaska, where some of the humpbacks spend the summer, first observed whales capturing food with a net woven of bubbles. The krill and small fish that are the staples of humpback diet are scattered as in a very thin soup. However, a cylinder of bubbles rising through the depths can concentrate the creatures. Taking advantage of that phenomenon, a humpback whale will swim in a slow spiral from about fifty feet deep to the surface, emitting bursts of air through its blow hole. The whale chooses the angle for its spiral so that many bubbles reach the surface just as the whale does. Surfacing open-mouthed in the center of the bubble circle, the humpback devours its catch.

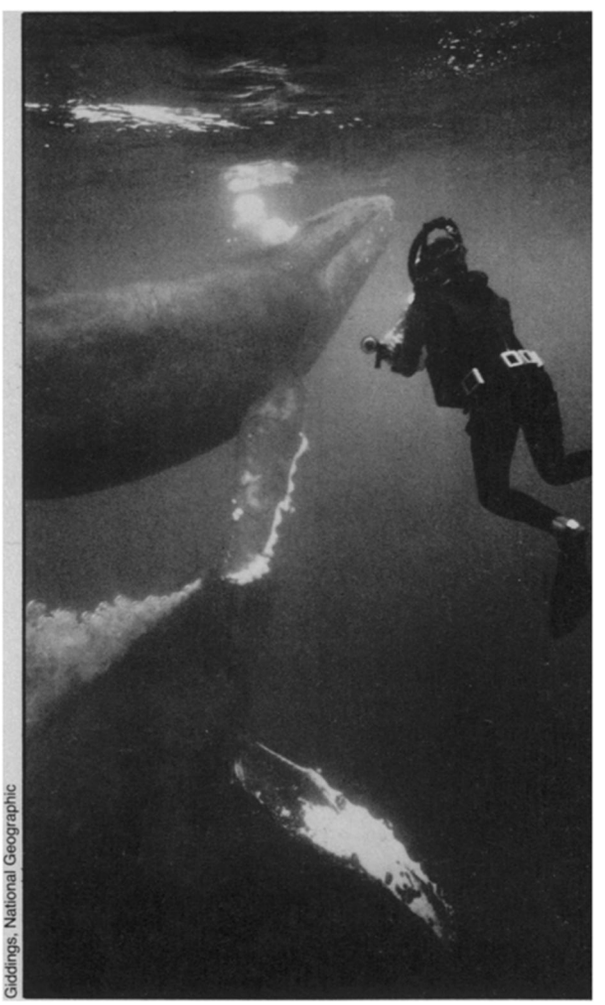
Earle reports that when she tried to scoop the fast-moving krill with a dip net, she rarely captured a single specimen. But when she scooped within a whale's bubble net, each dip yielded dozens, sometimes hundreds, of krill. To catch fish, the whales blow bigger bubbles than they do to catch krill. Occasionally two or three whales team up to make a single bubble net as large as a hundred feet across.

Payne and Earle look forward enthusiastically to learning much more about the whales. For instance, they would like to be able to identify the songs of individual animals to determine whether each herd has one leading song-changer or whether every humpback is a composer. In the only case where an identified whale was recorded singing twice, months apart, its song had changed in the same way as the song of the herd had changed.

In addition to their songs, the humpbacks produce a variety of seemingly social noises. Future investigations may relate those sounds to specific behaviors. And no whale species besides the humpback is now known to have a song, although others monotonously repeat a low, loud note that, before the underwater din of ship traffic, must have been audible for hundreds or thousands of miles.

The mission of the whale investigators appears to be more than scientific curiosity. It includes a strong concern for the preservation of the whale species. While whales are endangered, Roger Payne says, their mysteries are also endangered. "The whales are symbolic," Earle says. "They help us see ourselves more clearly. Perhaps by preserving them, we will preserve ourselves." □

The whales are mildly inquisitive about scuba diving investigators, but are careful to avoid colliding with them.



Giddings, National Geographic