Biology

Julie Ann Miller reports from Washington, D.C., at the National Zoological Park's Symposium on Animal Intelligence

Dolphin voices: Hard-nosed analysis

Reports of dolphin communication via a complex language have been based more in fancy than in fact, according to a recent study. Since the 1960s researchers have undertaken such complicated projects as trying to teach dolphins human words and decoding dolphin whistles. Sheri Lynn Gish, who is now at the National Zoological Park in Washington, D.C., criticizes such work. "It took sound out of the realm in which it is used by animals ... and it was so qualitative there was no way for researchers to compare results."

To "tease out" a better understanding of dolphin acoustic communication, Gish used two tanks electronically linked to convey sounds. In her work at the University of California at Santa Cruz, she was able to measure the patterns and types of acoustic signals emitted by captive dolphins. She recorded for more than 100 hours exchanges between a single dolphin in one tank and one or more dolphins in the other tank. She explains that her experiments involved no training — the animals "behaved spontaneously within the constraints of captivity," and the project did not assume vocalizations were for communication.

Although dolphins seem to prefer tactile and visual contact when they are put together in captivity, in the open, turbid ocean, dolphins in large schools may be out of sight of one another. So Gish says the tanks only connected acoustically may make a reasonable analogy with such a natural situation.

Some patterns of exchange were revealed by the data. Vocalizations by two animals in acoustic contact rarely overlapped. There was a tendency to match vocalizations, that is to answer a clear-tone whistle with a whistle and a burst-pulse "squawk" with another burst pulse. Gish also found a rhythm to the interchanges — short vocalizations were exchanged rapidly, while longer sounds were followed by longer silences.

Gish grouped the interchanges observed in three categories. The first she calls "aggressive." It is characterized by mostly burst-pulse vocalizations, while the dolphin claps its jaw, arches its back and blows air explosively. The second type she has named "calling." About half the vocalizations during this behavior are loud whistles, which might be specific to the individual dolphin. During these "calls" the animals appear to search the tank. Gish calls the most common vocalization pattern "transition." Composed mostly of whistles, it is used between the other two types as the dolphin rests in the center of its tank.

Dolphin vocalizations are not random sounds, but do indeed add up to an interaction having specific patterns, Gish concludes. But whether or not it's a language remains to be seen.

Do bees plan ahead intelligently?

With the realization that very complex behaviors can be the result of genetically determined programs, scientists have difficulty finding a working definition of animal intelligence. James Gould of Princeton University suggests intelligence involves "cognitive trial and error" or the thinking through of possible solutions to a problem before trying any. He illustrates this idea from his experience observing honeybees. In an experiment, he daily moved a supply of sugar water 25 percent further away from the hive compared with its position on the previous day. The bees came to anticipate the position of the feeder and flew to the correct spot. Given the natural behavior of flowers, he says, it is unlikely bees are genetically programmed to take advantage of such a movable food source. In another experiment, Gould found that bees who received information from a scout that there was food in a location on a lake would not fly to that position, although they would go across the lake to get food when directed to do so. This suggests bees have "a cognitive map" and somehow consider information to see if it makes sense before they act on it. In insects, Gould speculates, "thinking is a time-consuming and error-prone strategy of the last resort."

Earth Sciences

Weather satellites to the rescue

The presence of a new instrument aboard the recently launched weather satellite NOAA-E may not console people who fear plane crashes or shipwrecks, but it may increase their chances of surviving either of these events. The satellite can detect emergency signals transmitted by aircraft and ships and can locate the vehicles within a 13-mile range. NOAA-E (to be called NOAA-8 as soon as it is operating fully) and its Soviet counterpart COSPAS are equipped with experimental detectors designed to enhance search and rescue efforts. The experiment follows a 1979 agreement between the United States, Canada, France and the Soviet Union that supports the concept of a search and rescue satellite system.

More than 200,000 aircraft and 6,000 ships under American operation carry emergency transmitters, but until COSPAS was launched in June 1982, their signals were heard only if a plane monitoring frequencies relegated to distress signals flew nearby. Now, the emergency signals can be beamed automatically to a satellite, which then relays the signals to the ground station nearest the distressed ship or plane. It is hoped that the satellites will save lives by speeding rescue efforts. RCA Astro-Electronics, which designed and built NOAA-E, says, for instance, that 50 percent of people who live through the initial impact of a plane crash survive if rescued within eight hours. If rescue takes two days or longer, chances for survival plunge to 10 percent.

When whales abandoned the land

Those delectable fishes thriving in the shallow, salty basins formed by the closing of the eastern Tethys Sea were too tempting for at least one land mammal to resist. In a case of fateful opportunism, scientists say, 50 million years ago the earliest known whale took a dip for dinner. The skull of *Pakicetus,* found in 1978 in a sedimentary formation in Pakistan, shows that the animal was ill-equipped for aquatic life. It had the ear structure of an ordinary land mammal; the sophisticated sonar apparatus of modern whales was to evolve over millions of years as the mammals forsook their amphibious ways and spent more and more time in the water. Philip D. Gingerich and Neil A. Wells of the University of Michigan in Ann Arbor and colleagues from France and Pakistan describe *Pakicetus* in the April 22 SCIENCE. The authors say that the skull remains suggest the primitive whale may have been between six feet and eight feet long, and weighed about 300 pounds.

Pakicetus is the "perfect missing link" between whales and their terrestrial forebears, Gingerich says. The fossil was found in freshwater deposits, rather than in the saltwater deposits where later (younger) whale bones have been discovered. The other animals preserved in the formation also were land dwellers. The authors view these conditions as evidence that *Pakicetus* spent much of its time on land. It is unlikely that the early whales invaded the seas, they write, "without going through a nearshore, shallow water stage."

Far-reaching song of the dip/slip fault?

This summer transmitters positioned in Anchorage, Alaska, by researchers from Los Alamos National Laboratory will try to discern whether the ionosphere, the upper part of the earth's atmosphere, is disturbed by earthquakes. The low, rumbling sounds that accompany some earthquakes theoretically could perturb the ionosphere. The low-frequency acoustic waves are generated when rapid vertical movement in areas prone to dip/slip, or vertical, faulting causes a change in atmospheric pressure. The findings are of interest because the ionosphere is critical to satellite communications and transmission of some radar signals. The Alaska site was chosen because nearly 100 percent of earthquakes there produce dip/slip motion.