

U.S. Geological Survey - Earthquake Hazards Program

Animals & Earthquake Prediction

The earliest reference we have to unusual animal behavior prior to a significant earthquake is from Greece in 373 BC. Rats, weasels, snakes, and centipedes reportedly left their homes and headed for safety several days before a destructive earthquake. Anecdotal evidence abounds of animals, fish, birds, reptiles, and insects exhibiting strange behavior anywhere from weeks to seconds before an earthquake. However, consistent and reliable behavior prior to seismic events, and a mechanism explaining how it could work, still eludes us. Most, but not all, scientists pursuing this mystery are in China or Japan.

We can easily explain the cause of unusual animal behavior seconds before humans feel an earthquake. Very few humans notice the smaller P wave that travels the fastest from the earthquake source and arrives before the larger S wave. But many animals with more keen senses are able to feel the P wave seconds before the S wave arrives. As for sensing an impending earthquake days or weeks before it occurs, that's a different story.

A once popular theory purported that there was a correlation between Lost Pet ads in the San Jose Mercury News and the dates of earthquakes in the San Francisco Bay area. A thorough statistical analysis of this theory, published in California Geology in 1988, concluded that there was no such correlation, however.

Another paper published in a scientific journal in the U.S. on this subject by a respected scientist in 2000 is summarized here...

The paper poses this question: Is it reasonable for a seismic-escape behavior pattern to evolve, and can such a genetic system be maintained in the face of selection pressures operating on the time scales of damaging seismic events? All animals instinctively respond to escape from predators and to preserve their lives. A wide variety of vertebrates already express "early warning" behaviors that we understand for other types of events, so it's possible that a seismic-escape response could have evolved from this already-existing genetic predisposal. An instinctive response following a P-wave seconds before a larger S wave is not a "huge leap", so to speak, but what about other precursors that may occur days or weeks before an earthquake that we don't yet know about? If in fact there are precursors to a significant earthquake that we have yet to learn about (such as ground tilting, groundwater changes, electrical or magnetic field variations), indeed it's possible that some animals could sense these signals and connect the perception with an impending earthquake.

However, much research still needs to be done on this subject. The author suggests establishing a baseline behavior pattern that can be compared with reactions of various environmental stimuli, and then testing various potential stimuli in the laboratory. Of course, the presence of these stimuli still needs to be researched with regard to precursory phenomena preceding an earthquake, for if these signals aren't present in the environment before an earthquake, a connection is irrelevant.

References

- Kirschvink, Joseph L. (2000). Earthquake Prediction by Animals: Evolution and Sensory Perception, *Bull. Seism. Soc. Am.*, 90, pp. 312-323.
- Quammen, D. (1985). Animals and earthquakes: This World, *San Francisco Chronicle*, April 21, p. 15-16.
- Schaal, Rand B. (1988). An Evaluation of the Animal Behavior Theory for Earthquake Prediction, *California Geology*, v41, n2.