

How Unusual Are Unusual Events?

Short-term studies in behavior and ecology seem plagued by so-called unusual environmental occurrences that distort normality, or so it seems to field biologists

ONCE a biologist steps out of the relatively controlled experimental environment of the laboratory he faces the vagaries of the real world, which often seem to conspire to upset even the most carefully laid research plans. "Periods of drought or cold, or even a severe storm, can dramatically affect a population of animals or plants you are studying," says Patrick Weatherhead of Carleton University, Ottawa. "You then explain what you perceive as unusual results in light of the unusual event, whatever it was." Anyone with just a passing acquaintance with the ecological literature will instantly recognize this line of reasoning.

Weatherhead, himself a field biologist, began to wonder a couple of years ago whether such unusual events were unusual at all, or were instead an artifact of an observational approach. With the help of his student D. Hoysak, he combed through 380 papers in four journals in the area of ecology, evolution, and behavior and looked for those studies in which unusual events had been adduced as an explanation of observations.

The question goes beyond a simple curiosity about the frequency of truly unusual events, says Weatherhead, because in several major areas of ecological research the impact of significant deviations from the normal has important conceptual implications. For instance, the structure of ecological communities might be influenced by the nature and frequency of what one researcher has called "ecological crunches." And it may be that the proximity to which a species approaches an optimum in its foraging strategy is limited by unpredictable events in the environment.

"I didn't have any strong predictions about what I might find," says Weatherhead, "except perhaps that unusual events might be less common in aquatic environments, which are relatively more buffered than terrestrial ones." In fact, this single prediction was not borne out. But several clear patterns did emerge, the overall implication of which is that a field observer's perceptions of his world are at least as

important as the true nature of supposedly unusual events that occur within it.

The kinds of unusual events mentioned in the papers surveyed were both biotic, such as predation and disease, and abiotic, including drought, flood, and storm. Over the long haul, such events might be expected to occur more or less randomly—but not according to field biologists' reports.

"Given a 5% probability of an unusual event in a 1-year study," notes Weatherhead,



Social relations in danger. Food shortages can have dramatic short-term effects on small populations.

"one should expect a 35% probability of such an event in a 7-year study." Not so. "Studies lasting 7 years or longer had less than a 10% likelihood of including an unusual event." Weatherhead interprets these results to imply that "we cannot treat these events as only statistical phenomena."

Underlying this apparent paradox, it seems, is the issue of perspective. Suppose, for example, you are studying mother-infant relations in a group of vervet monkeys, and a brief but severe drought results in mass infant mortality. Such an event would loom larger in a 1-year study that includes the drought period than it would in a 7-year project during which period the population recovers. Similarly for plant communities, which might appear to have been devastated by prolonged drought, only to bounce back when the rains return. Such has been the pattern in East Africa in recent years, for instance.

So, concludes Weatherhead, "unusual events may be encountered at the same rate in long and short investigations, but researchers in long investigations may less often consider them important."

John Wiens, a biologist at Colorado State University, has argued that in trying to understand the structure of ecological communities, short-term studies risk missing infrequent but important perturbations in the biotic and abiotic environments. This caveat must be correct, but, to judge from Weatherhead's survey, short-term studies "experience too many unusual events," not too few. The reason for this, says Weatherhead, is that "we tend to overestimate the importance of some unusual events when we lack the perspective provided by a longer study." In other words, some putatively unusual events are not unusual at all.

One curious pattern, for which Weatherhead can offer no explanation at present, concerns a comparison between disciplines. It turned out that of the 135 behavioral

studies surveyed only 3% cited unusual events as an explanation of results presented. This compares with 11% for ecological studies and 16% for evolutionary studies. The differences are not a result of short-versus long-term studies, because the average duration for all three groups was 2.5 years. Exactly what the explanation is, however, remains a mystery.

At the very least, Weatherhead's survey confirms what many field biologists often argue, that long-term studies are most valuable. The 3-year study, which coincides with funding cycles and graduate research projects, is at the point where the usual is most often interpreted as the unusual. ■

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ADDITIONAL READING

P. J. Weatherhead, "How unusual are unusual events?" *Am. Nat.* 128, 150 (1986).