Letter from the Desk of David Challinor
June 2002

In mid-March of this year, the night herons returned to the National Zoo as they have for more than 50 years. The staff counted over 300 of their flimsy stick nests last winter in the tall, bare trees surrounding the bird house and duck ponds. Not all nests fledged young, but the count gave us a good idea of what to expect come next breeding season. Today, three months after their parents' arrival, the earliest nestlings are fledging and awkwardly perching on the top of the low chain-link fence that separates the ponds. As I write this letter, it is blowing hard outside, portending a predicted violent thunderstorm later this afternoon. By fledging early this spring, however, the birds will have time to lay a second clutch should many of the colony's nests be blown out of the trees by the storm. This month's letter is about colonial nesters—birds, reptiles and mammals that live in colonies, herds and pods—and will review the advantages and disadvantages of breeding in dense, seemingly overcrowded conditions.

Heron nests are often packed together but not nearly so as some ground nesting seabirds, such as sooty terns, where the nests—shallow depressions in the sand—are only about a bird's body length (plus or minus one foot) apart. The vulnerability of such breeding tactics seems initially clear: A crowded heron colony could be consumed by a forest fire or flattened by a hurricane, either of which could destroy or fell the nesting trees. The risks are small, however, because forest fires generally occur in mid-to-late summer, well after young birds have dispersed. Hurricanes similarly do not strike until fall. The Zoo's night herons are, nonetheless, vulnerable to very windy May days of which we had many in 2002. Crowded nesting, furthermore, could enable disease to spread rapidly, but evidently avian colonial nesters have evolved the necessary defenses and one seldom hears of a nesting colony being wiped out by a pathogen.

Sooty terns and other densely nesting seabirds favor remote, low-lying islands such as tropical atolls that have few terrestrial predators. However, an atoll that is commonly only a couple of meters above sea level is often swept clean by storm surges. Whole nesting colonies can be eliminated with no young surviving. Atoll nesting seabirds, however, have evolved an elegant defense against such wholesale catastrophes. Every sooty tern that fledges and flies out to sea from a given colony is genetically assigned a "class." Thus, a third of those fledging will stay at sea for two years and return to nest when three years old; another third will stay away an extra year and return when four; and the last class will remain away until they are five. For the colony to disappear, there would have to be a catastrophic storm annually over a decade during the breeding season before there would no longer be a class returning to nest. The Navy faced this problem at Midway Island. Laysan albatrosses kept returning to nest on this island despite the Navy's best efforts, such as bulldozing the dunes flat to make it harder for the birds to get the necessary updraft to get aloft. The birds were a hazard to the planes using the airstrip, but the Navy never succeeded in getting rid of this nesting colony. Albatross live for three or four decades and also have nesting classes, so the birds returning to nest each year could clearly outlast the Navy's efforts to remove them.

Smithsonian scientists learned about the breeding class system in a long-term banding project sponsored by the Pentagon in the 1960's. Thousands of sooty tern fledglings were banded with easily visible color-coded leg bands according to year fledged. It then became a matter of checking the atoll colonies each breeding season until the first set of color-coded birds returned. By netting the adults and recording band numbers annually, the pattern of class breeding years was determined. This research was labor intensive and required enormous ship time to transport and maintain the banding crews on the remote scattered atolls of the Pacific. Only the military could have afforded it, but it answered an important question about seabird breeding strategy that was published in the scientific literature of the time.

Questions still abound about colonial nesters, and particularly hard to determine is the minimum number of birds needed to maintain a colony. Perhaps the most extreme example of this quandary was the Passenger pigeon. Once estimated to have a population between three and five billion, it was probably the most abundant bird that ever lived. They were ruthlessly slaughtered for food, and the oak/beech forests that provided mast as food and nesting sites were cleared for farming. By the end of the nineteenth century, they were virtually extinct; the last bird died in a zoo in 1914. These birds needed dense flocks to stimulate breeding and died out when they became too few. The concept that undercrowding can lead to extinction seemed contradictory, but an American biologist, Warder Allee, advanced this idea in the early 1950's.

One reason for a population collapse might be the simple problem of finding mates when individuals or single sex groups are widely scattered, as is the case among the great whales. Despite the long whaling ban, blue whales, sperm and North Atlantic right whales have not rebounded nearly as quickly as hoped. The only big cetacean whose population recovered successfully is the eastern Pacific grey whale. The ocean is so large that widely wandering species, when reduced below a critical number, may fail to make sufficient contact for successful reproduction. For example, northern hemisphere right whales and humpbacks never make contact, as far as we know, with their southern hemisphere conspecifics. This is understandable when we consider their respective migration patterns. During summer, northern humpbacks travel from their breeding grounds off Hawaii to Alaska to feed, but their southern hemisphere counterparts move in a reverse direction to feed near the Antarctic during their seasonal summer, which is winter in Hawaii.

Species such as flamingoes and penguins nest in large colonies generally for self-protection. Although many young are lost to predators, the percentage is relatively insignificant to the number successfully fledged. Flamingoes, in fact, seem to have a fairly precise minimum number for maintaining a breeding colony. When the National Zoo had only about a dozen of these birds 15 years or so ago, we tried to induce breeding by attaching mylar mirrors to the walls of their enclosure to fool the birds into believing there were more of them. We also played taped calls of a wild flamingo colony. The birds did not cooperate, however, and it was not until 1992 that they began to build nests—a whole year after the Zoo had bought eight new birds from the aquarium in Bermuda. Since then, the colony has grown past the critical number of about 20 and the flock has been producing chicks regularly each spring.

Among reptiles, the green iguana of Central and South America has evolved an effective way of ensuring the survival of its young by digging nest holes cheek and jowl in open patches of forest. The holes are almost a meter long and slant down at a shallow angle. The female lays about 30 eggs, which hatch in approximately two months. All the young in a colony hatch almost synchronously, and the young congregate at their hole entrances for a day or two. Meanwhile, predators, mostly vultures, perch in the trees surrounding the clearing. Suddenly, as if a starting gun had sounded, all the young explode from their nest holes and race into the surrounding forest. The relatively few taken by vultures are more than offset by the numbers that successfully escape, thereby providing a graphic example of the benefits of colonial nesting and synchronous dispersal of vulnerable young. From an evolutionary perspective, it is clear that individuals within a colony that do not synchronize their breeding put their young at such risk that they are soon selected out.

Minimal numbers have been determined for other animals to breed successfully. To ensure survival of the pack, African hunting dogs must have one pair of breeders, plus three or four non-breeding adult helpers. One is necessary to watch the pups while the others help the parents to hunt.

The Allee effect (that there is a minimum size for some populations to propagate) is now being recognized as a significant factor in determining the replenishment of severely depleted stocks of all kinds, including tree species and especially fish. North Atlantic herring stocks have still not recovered after a 25-year ban on their harvesting, nor have the once bountiful sardines of Monterey Bay, made famous by Steinbeck's "Cannery Row." The Peruvian anchovy fishery peaked in the late 1960's with an annual harvest of more than ten million tons. Today, they are barely worth fishing for, with only one-hundredth of the former catch being landed.

The determination of the minimum size needed for a population to sustain itself is a moving target as the animals themselves can change their behavior to adapt to differing conditions. White-tail deer, Canada geese, coyotes and, increasingly, wild turkeys here in the east seem to have found ways to exploit their human-dominated habitat. Will the Atlantic salmon and cod be able to do so too? Scientists have only begun to look for the answers, but the Allee effect of minimal breeding populations is a good base from which to start.

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