Creating the Nation's first BioPark

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Letter from the Desk of David Challinor
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The well-reported storm of biblical proportions struck the National Zoo in mid-March, blanketing it with foot-deep snow and freezing temperatures. During the three days the Zoo was closed, I enjoyed touring the outside enclosures around the bird house. The duck ponds were full of visiting mallards and wood ducks; the waterfowl were inured to the cold. The large Manchurian cranes were displaying in the snow, and in an adjacent enclosure, warm in their glass-walled shelter, our two dozen Greater flamingos were calling and parading. Although they have been at the Zoo for decades, the flamingos successfully hatched their first chick only last spring. Tragically it was lost to a predator (we suspect a raccoon) when only a few weeks old. Evidently there is a minimum number needed in a flamingo flock to stimulate breeding. To create an illusion of greater numbers, the Zoo installed wall-high mirrors on three sides of the enclosure, a ploy that seemed to help initiate nest construction. The challenge to breed this species remains, but we have high hopes for the future.

Even in the wild, flamingo colonies breed erratically. On Grand Inagua, the southernmost island of the Bahamas, there is a large colony that has been protected and monitored carefully for forty years. When the flamingos feel that conditions are not right for breeding, they may fail to nest for three or four consecutive years. Scientists have yet to understand what the combination of negative factors are, and can only surmise that water level, water salinity content, invertebrate food supply, and undoubtedly a host of other variables play a role.

Despite the erratic breeding schedule and highly specialized food requirements, which I will discuss later, flamingos belong to an ancient bird order and have lived as far back as the early Oligocene (about 30 million years ago), before many other bird orders had arisen. Considerable research has been conducted into their evolution to try to determine whether they are more closely related to ducks and geese or to storks and cranes. Their webbed feet and calls are goose-like, but their skeletal structure and some organs are closer to storks and cranes. In the 1970's Charles Sibley at Yale found that the flamingo's molecular protein structure was more like storks than geese, but other research linked their behavior and their feather lice to ducks and geese. We may never unravel completely their evolutionary path, but there exist today five species in three genera.

The Greater flamingo is the largest, pinkest, and most familiar species in the New World. It is on the coat-of-arms of the Bahamas and has been on display on the infield of the Hialeah

race track in Florida since 1931; they have bred there since 1937. In the wild, the Greater flamingo has a wide distribution ranging from the Galapagos, scattered throughout the Caribbean, to southern France, Tunis, Turkey and east to India and Afghanistan. New World birds are slightly smaller, but much pinker than their conspecifics in the Old World, a characteristic evidently related to diet. The bright pink plumage in zoo birds is maintained by feeding them high levels of red carotinoids such as found in certain pink shrimp mixtures. Without this diet supplement, both the flamingos and the scarlet ibis at the National Zoo would soon fade to almost white plumage.

I mentioned the flamingos' ancient lineage, and one reason why they may have survived so long relatively unchanged is their adaptation to exploit an abundant food source with apparent negligible competition from other vertebrates. Their bills are elegantly adapted to filter small organisms that live in very salty or highly mineralized shallow lakes. Such lakes are often located in isolated mountainous areas where there is little rain. When it does rain, shallow depressions, often without outlets, quickly fill with water. As the water evaporates, it becomes increasingly mineralized. The same condition exists in shallow lagoons isolated from the ocean by barrier islands. Infrequent storm surges breech the barriers and refill the lagoons. When the breeches are resealed, the lagoons again become increasingly salty. When salinity conditions are suitable, brine shrimp (Artemia salina) populations explode, furnishing food for tens of thousands of flamingos.

Flamingos feed with the bottom half of their curved bill, upside down in the water. The edges of both the upper and lower mandibles are lined with serrated thin plates that act as a sieve. Their large tongue with two rows of small, rearward-facing, hook-like structures sucks in the food-rich, muddy water at the front end of the bill through the open sieve-like plates. When the water is expelled through the rear section of the bill, the micro-organisms that have passed through the sieve are trapped inside. On the next sucking action, not only does new muddy water enter, but at the same time the hooks on the top of the bird's tongue direct the trapped particles from the previous sip down its gullet.

Although there is clearly an evolutionary advantage to flamingos in exploiting this specialized food source, there is also considerable cost. Storm surges in coastal lagoons not only can raise water levels to flood their elevated mud nests, but can also change the salinity gradient enough to destroy the brine shrimp population, particularly if the storm was accompanied by heavy rain.

Flamingos, however, have evolved strategies to compensate for these occasional detrimental conditions. They are powerful flyers and can reach new habitats when food runs out. Enough flamingos, for example, reached the Galapagos in the distant past to establish a breeding colony there -- 600 miles from the main land. Wandering pairs or individuals are frequently seen far beyond their normal range. In the late 1970's I saw a solitary flamingo feeding in a sea grass marsh near Niantic, Connecticut. It was later reported on a reservoir shore in the Berkshire Mountains of western Massachusetts.

This past summer a flock of 31 wild Chilean flamingos (same genus but different species than the Greater flamingo) raised four chicks in a nature reserve in northwestern Germany, the northernmost wild colony known. They have returned every year since 1982 to nest there, but where they came from and where they winter is unknown. In 1987 they were joined by the first five European Greater flamingos which also made nests, but apparently the two species are not interbreeding, although hybrids have been produced in zoos.

Besides adaptability to new habitats in Germany, longevity is another characteristic contributing to the successful survival of flamingos. Breeding individuals kept in Zoo colonies are known to be over 30 years old. A long reproductive life can insure a colony's survival even when there may be frequent failures of breeding seasons.

Flamingos are thus an excellent example of specialized adaptation to exploit a narrow but often prolific food source. This can be a risky evolutionary strategy because a dependency on brine shrimp, for example, as a principal food source could be fatal if the shrimp should all die off. Flamingos' other physical and behavioral characteristics, however, have more than offset narrow food dependency, and we can thus conclude that flamingos so far seem to have beaten the survival game and should be with us to share the planet for centuries to come.

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