Letter From the Desk of David Challinor
September 2000

The British monarch used to celebrate his/her birthday in June regardless of the ruler's actual birth date. For practical purposes it was a moveable feast, because the odds were favorable that there would be good weather in June for the Trooping of the Colors and other outdoor ceremonies that are so enjoyed in that often rainy kingdom. This birthday flexibility illustrates how easily humans can adapt the timing of a cultural event to the seasonal climate. Plants and animals, on the other hand, are much more constrained in adjusting their schedules to the vagaries of inconsistent weather. Most organisms have evolved so that their long-term survival depends on synchronizing their reproductive timing with wet or dry seasons, short or long days, hot or cold temperatures, etc. This month's letter considers some of the ways humans, along with our fellow animals and plants, adapt quickly (people) or slowly (most other organisms) to climate variation.

Much of the world's population lies between the Tropics of Cancer and Capricorn (22 degs. 30 mins. N to 22 degs. 30 mins. S), encompassing the area between Tampico, Mexico, Havana, Aswan, Egypt, Calcutta, Hong Kong and Honolulu AND in the south through Sao Paulo, Johannesburg, Brisbane and Easter Island. Within this band live most of the citizens of the struggling Third World countries, where people still must order their lives by the changing seasons. In the subtropics the rains usually start about June and continue until December, and in most years this pattern is relatively dependable. Perhaps the best known of these seasonal rains is the southeast Asian monsoon affecting India, Pakistan, Bangladesh, Burma, etc. From roughly May until September each year this large land mass heats up more than the Indian Ocean to the west. The rising hot air creates low barometric pressure over the subcontinent, which in turn brings in moisture-laden wind off the ocean. As the saturated air flows over the hilly Indian coast, it is elevated and cooled so that the moisture condenses into the heavy rain characteristic of the southwest or summer monsoon. In autumn in southern India the process is reversed with the land becoming cooler than the sea. The wind then shifts to the northeast during October, November and December. This fairly regular change in wind direction creates favorable winds in each direction for the sailing dhows trading between Arabia/India and Africa's east coast. The reversing wind supported trade for so long that it generated its own commercial language -- Swahili -- which contains many Arabic words and is still today the "lingua franca" of coastal east Africa.

Wet/dry tropical weather also determines when farmers plant their crops. The soil must be wet enough to insure seed germination and initial growth, while harvesting is generally best done in the dry season. A significant problem, however, is that the rains do not always come on schedule. Both too much or too little rain can result in crop failure, which in turn leads to famine and starvation with subsequent migration to the cities for survival. This is now happening in east Africa where the rains have failed to fall for the third year in a row. It is hard to pinpoint this

particular drought as being human-induced, but there are numerous cases where human intervention has both helped and harmed crop production. Mankind can compensate for seasonal rains with mainstream dams, for example, that alter natural river flow to the extent that traditional farming practices are forced to change. The Nile's high dam at Aswan ended the annual flooding of its narrow river plain, thereby requiring farmers to add chemical fertilizer to replace the nutrients formerly carried in the silt by the flooding river. Despite gaining the advantage of year-round water stored behind the dam, other problems have begun to emerge years after the dam's completion. Continuously filled irrigation canals sustain a population of aquatic snails that are the alternate host of schistosomes, a parasite that infects humans with devastating consequences. Prior to year-round availability of irrigation, the snail population declined precipitously during the dry season. Further, a lower but steadier year-round flow through the Nile delta has raised the water table and allowed saltwater from the sea to creep inland at shallow depths. Considerable crop land in the delta has had to be abandoned as salt accumulated at the surface.

Across the globe in Cambodia similar threats to crops arise. There the annual filling and emptying of the great Tonle Sap lake from the flooding cycle of the Mekong River made this lake one of the most productive fisheries in southeast Asia. A proposed mainstream dam would have eliminated this cycle and drastically curtailed the fishery. While the big dam is still in the talking stage, as it has been for the last 30 years, another catastrophe has struck this beleaguered nation. Years of armed conflict there have led to chaos in the management of Cambodia's natural resources. Uncontrolled cutting has eliminated much of the lake's forested watershed, which has made the lake water so silty that fish and the aquatic plants on which they feed are disappearing. More than a millenium of exploiting a magnificent large scale, sustainable system is now seriously threatened.

In the natural world, free of human interference (if any such spot still exists), immobile plants and trees are particularly vulnerable to irregular weather cycles. In Panama some trees of the semi-deciduous tropical forest on Barro Colorado Island shed their leaves in the dry season to conserve moisture, while others stay evergreen. At the end of the dry season (about March/April) many trees reach the peak of flowering, which is thought to be triggered by the first heavy rains. Trees whose seed is animal-dispersed seem to peak in August, but each tree species clearly has its own requirement for flowering and fruiting. Trees, however, have to be conservative in their reproductive strategies and cannot afford to take chances. Thus when Smithsonian scientist Joe Wright experimentally watered the forest during the regular dry season, he could not fool the trees into blossoming. They have had to evolve to survive "wet" dry seasons and vice versa; they could not afford to be misled by abnormal weather patterns.

Bird nesting, too, is often linked closely to monsoon rains, a good example being the nesting pattern of painted storks in India. When the rain-swollen clouds spill their contents in June around Delhi, rivers rise, swamps are flooded and freshwater vertebrate and invertebrate

populations explode. As the monsoon ends in August, the storks aggregate in large colonies to breed. Just as the black-crowned night herons have colonized the National Zoo, the painted

storks established their colony in the middle of the Delhi Zoo in 1960. They feed along the banks of the nearby Yamuna River, as our herons do along nearby Rock Creek and the Potomac. By January the Delhi Zoo is bursting with storks, but their normal nesting pattern can occasionally be broken when environmental conditions (at this point known only to the birds) are such that the flock will breed a second time well into the dry season as they did in May 1990. If the rains fail completely, however, they generally abandon their nests.

Calving among east African ungulates (hoofed animals) also is usually timed to coincide with the rains that rapidly green the savannas on which they live. Other mammals in southeast Asia and the llanos of Venezuela keep similar schedules. Irregular weather patterns probably began before the first mammals evolved, so that current populations of most organisms have had time to fit their reproductive cycles to the climatic norm. This generally means that for most animals annual reproductive success will vary with the seasonal climate. For example, in certain years environmental conditions will be exactly "right" for the African migratory locust to breed. These notorious swarms can darken the sky, consuming every green blade wherever they land. Much energy has been spent in trying to control this crop predator by spraying or trying to plot patterns of their spread after they achieve their flying stage. The same weather conditions can be advantageous for some insect species and deleterious for others even when both are living in the same area. Only we humans seem to have become independent of the hot/cold, wet/dry cycles inherent in our globe's weather.

I close with an illustration of how technology changed human reproductive patterns at one specific time and place. By the early 1950's window air conditioning units were becoming popular and available in Houston, Texas, where I lived at the time. The Gulf coast is notoriously hot and humid all summer -- day and night. When my eldest daughter was born there, our obstetrician told us that before air conditioning he could count on very few deliveries in his practice during March, April and May, but that by 1953 the local birthing frequency curve had leveled completely. Today air conditioning is the norm in our prosperous country as far north as New York and Chicago. Let us not forget, however, that such is not the case with most of the rest of the world where people (except for the rich) must adapt to the real world of seasonal weather changes, just as do all the other living organisms of our very finite world.

David Challinor
Phone: 202-673-4705
Fax: 202-673-4607
E-mail: ChallinorD@aol.com