

## SANTA FE IN AN EL NINO YEAR

by

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*Dr. Laurie is engaged on a three-year study of the population dynamics of the marine iguana as a basis for future conservation policy. (Noticias 35 and 36). He uses Santa Fe Island, where there are no introduced animals, as a control for comparison with other islands where the species is under threat from alien predators such as cats and dogs. He tells how in 1982-83 the normally deserts conditions of Santa Fe were rudely upset.*

Holding an umbrella in one hand and a torch in the other I waded back, up to my knees, through the fast-running river and checked the water level once more before hurrying inside to the relative dryness of our tent. It was lucky that we had dug drainage channels so deep around the tent, for they were full and discharging a lot of rainwater which would otherwise have flowed straight through. I set my alarm again and sank back into a state of semi-wakefulness in which the sounds of the wind and the rain on the tent merged with the roar of the river and the waterfall just 20 metres away and the pounding of the waves on the rocks below. Two hours later I was out again, but by then the river level had dropped and the danger of being swept off the cliff in our sleep had passed for the moment. By 0900 the next morning, 17 December 1982, when the rain finally ceased; 10 inches (254mm) had fallen within 20 hours.

Never had I imagined that we would see such rain on arid Santa Fé (Barrington Island). I had always wondered and marvelled at the stream beds and ravines which we saw filled with well worn rocks and giant boulders swept into position by ancient rivers. But when the sun beats down relentlessly day after day, month after month, on this low-lying island of grey rocks and scattered cacti it is hard to imagine floods on such a scale. I don't need to imagine them any more. Between 15 November 1982 and 23 January 1983, 24 inches (600mm) of rain fell at Miedo on the south-eastern coast of the island. Flash floods had covered the whole island in sheets of water, and several times we had watched, hardly believing our eyes, deafened by the roar, as raging torrents of muddy water swept down nearby ravines to form waterfalls off the cliffs, colouring the ocean red and brown in vast concentric and overlapping rings which spread far out to sea. One could not possibly cross the main river near the sea, but my wife, Haruko, and I walked up it on the day after the biggest storm, climbing an inland waterfall, skirting torrents of water by inches, still we reached the upper plateau, a cactus plain where all was green and criss-crossed by braided water channels. The cacti looked distinctly out of place among all that water and lush green vegetation. Most plants were still putting their resources into vegetation growth but a few, such as the *Cordia*, sported bright yellow flowers, as did some of the tiny annuals. The ground, normally baked as hard as brick, was so soft that we frequently sank to our knees or higher in mud. Stepping stones, even enormous safe-looking boulders, were little help for they also sank rapidly into the mire under our weight.

Adrian Matson at the Research Station had mentioned in October that the sea temperatures were above normal and we might expect an 'El Niño' year. This results from the southward flowing El Niño current displacing the cooler, northward flowing Humboldt current, and is characterized by anomalously high sea surface temperatures off the coasts of Ecuador and Peru, heavy rainfall, 'red tide', and sometimes the mass mortality of various marine organisms. According to W.H. Quinn and his colleagues<sup>1</sup>, the average interval between 'strong' "El Niño type events", with sea-surface temperatures more than 3.0°C above the mean, is 12.3 years, the last one having taken place in 1972-73. This year's, however, appears to have been exceptionally 'strong'.

October and early November were dry on Santa Fé but there was a noticeable lack of the persistent sea mist or 'garua' which generally occurs in the mornings at that time of year, sometimes not clearing until 0900 or later. The sea was noticeably warmer and by mid November we were experiencing windy

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<sup>1</sup>Quinn, W.H. Zopf, D.O., Short, K.S. and Kuo Yang, R.T.W. (1978) Historical trends and statistics of the Southern Oscillation El Niño, and Indonesian droughts. *Fishery Bulletin* 7(3) 663-678.

rainshowers which swept in rapidly from the sea. Some of them were quite heavy. The plants responded rapidly, with the *Bursera* and *Cordia* bursting into leaf and a few of the *Cordia* flowering. There were high winds then and the rain beat horizontally at us or at our tents. Such showers became heavier and more frequent towards the end of November and the sky was often overcast for much of the day.

The mockingbirds busied themselves after every shower collecting nesting material and the island continued to become slightly greener, but it was not until after 7 December, when it rained steadily all day and all night, that the birds started to lay and the island became generally green to the eye with a host of herbs and grasses growing up between the rocks and immediately falling prey to the land iguanas. The resident pair of Galapagos Buzzards mated and laid 2 eggs (which did not hatch) in a nest 30 metres from camp; a pair of fly-catchers nested just up the hill; and finch and mockingbird nests sprang up in cacti and bushes all about us. At night, the lanterns began to attract a myriad of beetles and moths which I had never seen before. And the rain went on and on. Hawk-moth caterpillars roamed in armies right down to the shore, devouring the green leaves almost as soon as they emerged, and the grass grew higher and higher until it is now (in late January) almost a metre high in places. The rain became harder and came with less wind. Now the days are very still, the sea is calm and the sun shines fiercely from dawn to dusk with shade temperatures of up to 34.5°C at midday. The period of heaviest rain appears to have passed, but we are still getting occasional heavy showers and the mosquitoes continue to plague us at night and in the early morning.

Already we have observed several changes among the marine iguanas compared with last year, possibly effects of 'El Niño'. First there were the mysterious deaths of several animals, mostly adult males, during October and early November. They lost weight rapidly and died, apparently from lack of food (algae), having in some cases halved their weights within a few weeks. We found flukes in all their upper digestive tracts but have since found the same flukes in mouths of apparently healthy individuals. Second, the first year mortality of 1982 hatchlings appears, on first assessment, to be higher than it was for 1981 hatchlings, although this has to be confirmed during the next few weeks. Third, both mating and nesting started 3 weeks earlier than in 1981-82 and nesting has continued over a considerably longer period than last year with a far higher number of females nesting this year. The land iguanas also nested earlier this season.

The marine iguanas started nesting on 23 December and are still nesting now, a month later. We sit up above the sandy nesting ground under a sun shelter watching and identifying females with a telescope and binoculars as they bask on the surrounding rocks and then come out on to the sand to dig or fill in their burrows. They are very timid as they can fall easy prey to the hawks when out in the open, and we mount an almost continual watch so that we can record the identities of as many females as possible. So far the results tend to confirm that most females do not nest every year: up to now we have seen only 3 out of more than 50 marked females who nested here in 1982 whereas we have seen more than 50 other marked females whom we did *not* see nesting here in 1982.

Mating on Santa Fé started on 30 November, and we watched with interest, with the rain pouring down our necks, as the prime territories (those with most females most of the time) were occupied throughout by new males this season, while the less good territories were defended by the same males as last season. It appears that the effort involved in defending a prime territory may only be sustainable for one year at a time. Perhaps there are two different ways of being territorial, both more or less equally rewarding in terms of numbers of matings: defence of a prime territory with 12-30 matings in the season (or seasons?), or the less demanding defence of an inferior territory with 2-5 matings in successive seasons. Next year's observations will clarify this further, but we still do not know what effect the El Niño phenomenon may have had on the subsequent condition of last year's territorial males.

Next we will turn our attention to an accurate assessment of 1982 hatchling survival and growth rates and compare them with those for 1981 hatchlings here and 1982 hatchlings on Caamaño. As soon as the nesting finishes we will recapture, or at least identify with binoculars, as many as we can. We shall also

make another attempt to attach enclosing cages to the rocks to observe and measure any increased growth of algae in the absence of iguana grazing. So far the heavy swell on the southern coast of Santa Fé has proved too much for us, and the cages have been torn off by the waves within a few days. In the one cage which did stay attached there was actually less algae inside than outside after a few days! We shall return to Santa Fé for the hatching season in April and the next breeding season in November, but apart from that we have work to do on Tower and Fernandina and we have to look in more detail at the predation of hatchlings by cats on northern Isabela.



A muddy torrent roars past the Lauries' camp on desertic Santa Fé Island. *Photo by Haruko Laurie*