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Review of: Henry Walter Bates 1864 *The Naturalist on the River Amazons*.
2nd ed. London: John Murray 394 pp. Reprint by Dover, New York (1975).

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[Thirtieth in a series on "naturalist-in" books.]

As a young man Henry Walter Bates (1825-1892) and another working-class English naturalist, Alfred Russel Wallace, had the idea of financing an expedition to the Amazon through the sale of plant and animal specimens. They went in 1848, remained together for about a year and then worked independently. Over 11 years Bates collected almost 15,000 specimens, mostly insects, of which more than half represented undescribed species. Most of that time was spent in the Upper Amazon, isolated from other scientists except through the very slow exchange of letters. The lack of intellectual society was the one thing that he most missed, and Bates never left Britain again after his return (Crawforth 2009).

This book is a classic, perhaps the most engaging of Victorian natural history. It first appeared in 1863 in two volumes. The next year Bates condensed it to the one-volume edition reviewed here. The 12 chapters have nine full-page and 30 smaller illustrations. The former include an interior view of primary forest so rich and wild that one could miss its human element: two Indians with their blowguns.

The two friends had large ambitions. Enthusiastic about the growing idea that species evolve, they saw the study of tropical life as the best path to understanding this process. Charles Darwin had already formulated his theory of evolution by natural selection, but did not publish it until near the end of Bates's time in Brazil. They landed at the coastal city of Pará (now Belém) in a state of exaltation. Bates remarked that "The impressions received during our first walk, on the evening of the day of our arrival, can never wholly fade from my mind." Belém then had a population of just 15,000 and was well forested on all sides, where the teeming tropical diversity that they sought was very much in evidence. There were, for example, about 700 species of butterflies within an hour's walk of Belém, more than twice as many as in all of Europe.

The Amazon river system drains an area of 7 million km², about 40% of South America. Bates first went up the Amazon in 1849 and traveled widely in the interior after that. He wandered in a world framed by rivers and streams, whose sheer immensity is the central feature of the landscape. Toward its mouth, the Amazon is so wide that one cannot see both shores at once. Some of its tributaries are more than 1000 km long, hundreds of meters wide even far upstream, and navigable for hundreds of kilometers. Of one waterway far up the Amazon, Bates remarks that this "stream is not more than forty or fifty yards broad." Note that this insignificant "stream" is wider than any of the "rivers" of Trinidad.

The Rio Negro and its tributaries flow south from the Guiana Highlands, whose soils tend to be dark and nutrient-poor. At Manaus, 1600 km from Belém, it joins the Amazon, whose headwaters are in the Andes. Above this confluence the Amazon is commonly called the Solimões in Brazil. The dark waters of the Rio Negro and the light waters of the Solimões run side by side for several kilometers before mixing. Bates remarked that "In crossing we passed the line a little more than half way over, where the waters of the two rivers meet and are sharply demarcated from each other." Unlike Wallace, Bates made no substantial exploration of the Rio Negro system.

Amazon travel was then a laborious business. The tides reach far upriver, the river's rise and fall are a major seasonal factor. There was danger of wind and squalls on large rivers, of getting grounded on the small ones. An 1851 descent of about 2200 km from Ega (now Tefé) to Belém took 29 days, even with a strong current. In the Upper Amazon, boatmen to manage the boat and mass of cargo were often hard to obtain.

Then there were the biotic difficulties, such as ticks, which attacked in large numbers and could leave a festering wound. In some places Bates was much tormented by mosquitoes in the night and other biting flies in the daytime. Sporadic epidemics could descend on an area. In 1850 yellow fever affected about 3/4 and killed about 5% of Belém. Later a smallpox outbreak took away a further 5%. Bates names some personal friends who perished in this way.

And food could be hard to find, as the local people did not produce a surplus. Bates tried a vegetarian diet, but with ill effects, so that the search for meat was a frequent concern. At Tefé, where he stayed two years, the standard article of food was a large freshwater turtle. "I became so sick of turtle ... that I could not bear the smell of it, although at the time nothing else was to be had, and I was suffering from actual hunger." The turtles' eggs at the nesting beaches were collected for their valuable oil. Bates estimated that 48 million eggs were harvested annually in the Upper Amazon. This does not sound sustainable, and the local people told him that the turtles were not nearly as abundant as in years past.

Amid all this, Bates happily collected and observed. During his sojourn in some localities, he "led a quiet, uneventful life ..., following my pursuit in the same peaceful, regular way as a Naturalist might do in a European village. For many weeks in succession my journal records little more than the notes made on my daily captures." The first two hours of the day were devoted to collecting birds, the middle part to collecting insects before the mid-afternoon rain. The late afternoon was for processing specimens and notes.

Toward the Indians who were his main contacts upriver, Bates's attitude was liberal and sympathetic, but with little admiration. He appreciated their openness and hospitality, but regarded them as unemotional, incurious and largely uninteresting. Even less did he admire the working-class Portuguese immigrants, sarcastically termed "these shining examples of European enlightenment". He partly attributed to the tropical environment their indolence, "a moral condition not to be wondered at in a country where perpetual summer reigns, and where the necessaries of life are so easily obtained." Bates makes virtually no comment on the African slavery that had

so incensed Darwin in Brazil 20 years earlier, perhaps because he spent almost no time in plantation areas. Enslavement of Indians as domestic servants was illegal, but tolerated by the authorities.

It bears mention that a form of the Tupí language known as *lingoa geral* was a lingua franca throughout much of Brazil at this time. It has since almost disappeared, and I have had no success in hearing it spoken in the Lower Amazon.

Bates earned his living from collecting and shipping dead specimens, yet he had a keen sense of the living organism. This is seen, for example, in descriptions of the nesting behaviour of solitary wasps. Watching sand wasps, he described and interpreted the orientation flights on leaving the nest, perhaps the first to do so. Ants were everywhere, including leafcutters (*Atta* spp.). Bates pondered the division of labour among different-sized workers. The largest could not be soldiers or supervisors, as they did not sting or seem to give directions, yet nature would have eliminated them if they were truly useless. He suggested that they served in passive defense of colony from vertebrate predators, just by being so spiny and un-succulent.

Around Tefé he collected about 550 species of butterflies. Their wings provided a wealth of heritable characters, and he "paid special attention to them, having found that this tribe was better adapted than almost any other group of animals or plants to furnish facts in illustration of the modifications which all species undergo in nature It may be said, therefore, that on the expanded membranes nature writes as on a tablet the story of the modification of species, so truly do all changes in the organisation register themselves thereon."

Bates's main contribution to science was his theory of mimicry (Bates 1862). *Heliconius* butterflies were common and slow-moving, yet all but ignored by lizards and other predators. He further noted that species from different genera or even different families might bear a strikingly exact resemblance to a given *Heliconius*. While *Heliconius* tend to be markedly distasteful, a look-alike species might be palatable, and Bates reasoned that the palatable mimic gained protection from predators through an evolved deceptive resemblance to the unpalatable model. This was one of the earliest and most striking triumphs of the new theory of evolution.

Bates was at São Paulo de Olivença, more than 3000 km upriver and planning to ascend another 1000 km into the peruvian Amazon, when he was laid low by fever, the culmination of a gradual deterioration over years. "Heat, mosquitoes, insufficient and bad food, hard work and anxiety had brought me to a very low state of health." It was time to go home. In Belém he was welcomed by old friends for whom the Brazilian interior where he had spent seven and a half years was still the unknown *sertão* (backlands).

Even in his wasted state, Bates knew that he was leaving behind the best years of his life, remarking that "To live again amidst the dull scenes [of England] I was quitting a country of perpetual summer, where my life had been spent ... on the endless streams or in the boundless forests." Even so, I doubt that he had ever seriously thought to settle in Brazil. During those years, Bates was ever an expatriate, never an immigrant.

References

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