

Dispatch #40: Brazil's Mata Atlantica: *The Critically Endangered Coastal Rainforest of Brazil, With a Postscript on the Musicality of Birdsong.* By Alex Shoumatoff
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The Atlantic Coastal Forest, or *Mata Atlântica*, is the second-largest rainforest in Brazil, after the Amazon. One of the most biologically rich and varied, and most devastated, biomes on the planet, it runs for 4600 miles, from the easternmost point of South America, in the northeastern state of Rio Grande do Norte, down to Rio Grande do Sul, which abuts Argentina and Uruguay. The *Mata Atlântica* once covered 12% of Brazil's land surface, but only 7% of it remains. Between 1985 and 1995 alone, 11% of it was obliterated. Frantic efforts to save what is left are being made by no less than 256 ngo's, domestic and international.

Beginning as a narrow strip, the *Mata Atlântica* keeps widening as it spreads south. In Bahia, at the halfway point of its extent, it is five hundred miles wide, and from Paraná, the next-to-southernmost state that it blankets, it spreads a thousand miles west, into Mato Grosso do Sul, where it comes into contact with the Pantanal do Mato Grosso, the largest wetland on earth (see Dispatch #9), and their respective floras and faunas mingle and mix. Tentacles of gallery forest, which are extensions of the *Mata Atlântica*, but with fewer species, ascend watercourses into the heart of the continent, into the torrid, desertscrub known as the *sertão* and the *cerrado*, the central savannah. During humid periods in the past, the coastal forest went all the way around the curve of northeastern Brazil and connected, in the state of Maranhão, with the easternmost extension of Amazon rainforest. Primitive lizards migrated from it into the Amazon basin and speciated there, and the new species returned and exploited new niches and continued to speciate, so in the *Mata Atlântica* there is a cornucopia of herpetodiversity-- both the original primitive species and the derived ones.

The main feature of this forest is not these floral and faunal exchanges with its neighbors, however, but its many endemic species-- ones that evolved in it and are found nowhere else, most famously the four species of lion tamarin. There are also two species of woolly spider monkey (*muriquí* in Portuguese), which are the largest primate in the Americas. The northern species, *Brachyteles hypoxanthus*, is critically endangered. Only 300 individuals are thought to be left.

Of the *Mata Atlântica*'s roughly 20,000 plant species, 8000 are endemic. But these figures, Wait Thomas, a botanist at the New York Botanical Garden who has devoted his career to the *Mata Atlântica*'s astounding flora, cautions, are only "shoot-from-the-hip guess. There are a lot of species with no names, more than one name, or the incorrect one, and others that are umbrellas for a lot of things. It's not like Europe or North America, where the taxa are established. 20% of the plants in tropical America are estimated to be still unidentified, so in an understudied area of high diversity like the *Mata Atlântica*, you would expect there to be even more."

Wait was part of a team that in the early nineties identified more than 450 tree species at least five centimeters in diameter at chest height on a single hectare, or 2.8 acres, of the

coastal forest. To put this in perspective, in all of eastern North America, from Florida up, there are only 232. This count held the world record for tree diversity for a few months, until a hectare in the Ecuadorian Amazon with even more tree species was inventoried, but in general, the coastal forest has a higher concentration of species, than the Amazon, although the latter, being many times, larger of course has more species.

Of the *Mata Atlântica*'s 1,361 species of birds, mammals, reptiles and amphibians, representing 2% of the world's vertebrate diversity, 576 are endemic. This is one of the last places on earth where new bird species are still being found. Of the 202 animal species in Brazil that threatened with extinction, 171 are in the *Mata Atlântica*. Conservation International, which is playing a major role in the effort protect what is left, has designated it one of the world's critically endangered biological "hot-spots."

The problem is that the fertile, well-watered, lushly forested coast is also prime human habitat, and is where 70% of Brazil's population lives, 20 million of them alone in the sprawling urban jungle of São Paulo. And its hardwoods are extremely desirable, starting with the rock-hard *pau Brasil*, the first natural resource that was exploited by the Portuguese, for which they named their colony. (It's also called pernambucowood.) It yields a bright red dye and (see pau-brazil.com) is used to make high- end violin bows, but it has been almost completely wiped out of the coastal forest.

In September 2005, I drove down the coast from Salvador, the capital of Bahia. The road was full of potholes. I passed some kids who were filling potholes with dirt in the hope of a *muedinho*, that passing motorists would flip them a coin. I had seen this in Uganda, but this was a first for me in South America, which is, generally speaking, better off than Africa. The poverty in Bahia, the most African part of the continent, has deepened since the collapse of its chocolate industry ten years ago.

Theobroma cacao, the tree from whose fruit chocolate is made, was introduced from the Amazon in the late 19th century, and from 1930 to 1980 Bahia was the world's largest chocolate producer. Most of the shade-loving trees were not grown in monoculture plantations, but in the cleared under story of the forest, a relatively undestructive method of cultivation known as *cabruca*. But around 1980 a fungus called *vasoura de bruxa*, or witch's broom (*Crinipella perniciosa*), was probably introduced by new cuttings from the Amazon, and gradually wiped out three quarters of the *cabrucas*. At the same time, there was overproduction of chocolate in the Ivory Coast (with the help of child labor) and in Asia, so the market was flooded and its price fell by three-quarters. The collapse of the chocolate industry was an environmental and a social disaster for Bahia. With the incentive to keep the forest intact gone, the owners of *cabrucas* logged it or cleared it for pasture. It was during this period that 11% of the *Mata Atlântica* was cut. Much of the local population was working in the *cabrucas* and chocolate factories, and cities like Ilheus and Itabuna, 200 miles or so down the coast from Salvador, were flooded with jobless people, and there was a rise in violent crime.

But in the last few years, blight-resistant strains of cacao have been developed, and the *cabruças* are coming back. Green *cabruça* production is the best hope for the forest in Bahia. One of the coastal rainforest's newly-discovered bird species, the pink-legged *gravateiro* (*Acrobatornis fonsecai*, misspelled *graveteiro* in much of the literature by non-Brazilian scientists with imperfect Portuguese; the word means someone who wears a tie), seems to rely on *cabruça* habitat, so this puts the consumer in the unusually guilt-free position of being able to eat all the chocolate he wants -- as long as it comes from Bahia, which is where the best-quality cacao is grown.

But also in the last few years, the spectacular Bahian coastline down to Trancoso, 400 miles below Salvador, has been bought up by resort-hotel developers and real estate speculators, and the local people have been driven off land they had been living on for generations but never secured title to. 20,000 desperately poor displaced natives are living in the tourist boom town of Itacaré, an hour north of Ilheus, where 300 *pousadas*, boutique beach hotels, have sprouted since a paved road connected it with the rest of the world in 1999, but there is no municipal plumbing or garbage disposal. In Itacaré I looked up with a small grassroots ngo called Yonic (see yonic.org), which was doing a lot of good things for the opportunistic, out-of-control community, among them separating the plastic and other non-biodegradable trash in its dump and baking it in a special, high-pressure oven of Yonic's own design, into rock-hard, indestructible light-weight bricks you could drive a truck over and nothing would happen. The oven compresses 16 tons of garbage into 790 bricks that can be used for construction and could be a great contribution for the humongous global petrochemical trash problem. It could make a huge dent in India, for instance. The name of this inspirational project is called Lixomonía. Yonic's core are an old Brazilian leftie who knew Chico Mendes (see my story on his murder in Past Dispatches) and a young Swiss woman named Geraldine (geraldine@yonic.org). Yonic is also providing culinary classes and ingredient and a kitchen to the *mariscadores*, the women who used to catch crabs and shrimps in the local river mouths and mangrove swamps on the coast, which have been killed by pollution, so the women can prepare snacks for the kids, and is organizing martial arts, soccer, and beach volleyball for the kids to get them off the streets. It's a spunky, hip, holistic environmental-social outfit that I highly recommend to anyone who wants to make a difference in a paradisaical part of the world that is rapidly going down the tubes.

In Bahia only 3% of the *Mata Atlântica* is left. For several hours, as I drove south from Salvador, the highway wended through a spacious, rolling landscape. Most of it had been cleared for pasture. I passed several flocks of peach-fronted parakeets coasting into shade trees. Here and there were still large patches of intact *mata fechada*, or close-canopied forest, with the flat-topped crowns of emergents rising over a hundred feet. Night had fallen by the time I reached Itacaré. I could see the waves crashing in the moonlight in sandy scalloped coves that the frothy rainforest came right down to.

In the morning I went into the forest with Marco Antônio de Freitas, a 34-year-old biogeographer from Salvador who has written seven books on the fauna of Bahia and is especially knowledgeable about its reptiles and amphibians. Yonic had brought him down to

give me a taste of the marvels of the *Mata Atlântica*. We drove 20 miles inland to the Fazenda Caititú, a private 550 preserve of undisturbed rainforest that is owned by a wealthy German named Michael von Eckis, who comes for a few months of total seclusion each year.

On the way Antônio stopped to collect a six-foot-long *surucucú* or bush master that had been run over during the night and was being picked apart by two caracaras. *Surucucús* (*Lachesis muta*) are very common around here, he told me. (The local subspecies is *rhombeata*.) They are the largest venomous snake in South America and one of the most aggressive and poisonous. He pried back its upper jaw with a pen knife to show me its huge fangs. Its skin was orangey brown with jagged black diamonds. There are four species of pit viper in the immediate vicinity. The fer-de-lance, *Bothrops jararaca* is most frequently encountered. It blends with the leaf litter on the forest floor and is easy to not see. *B. bilineata* is green with yellow spots. And two species of coral snake. Most of the 125 kinds of snake that have been found in Bahia are harmless colubrids, and there are many waiting to be found and many amphibian species as well. Like many tropical field biologists, Antônio is in a race against time, development and deforestation, the ever-growing human footprint and our atavistic, indiscriminate fear of snakes. Bushmasters are killed on sight. “And the birds are *um espetáculo*—,” Antônio said—“600 species in Bahia.”

Caititú happened to be the very forest where Wait Thomas and his team identified more 450 species of tree. Most of the trees were only 30 or forty feet tall and not very thick, because the soil was thin and lateric, but there were a few gigantic, buttressed *maçarandúba* and *citão* trees. Their straight boles were strung with a seething chaos of vines and encrusted with epiphytes. I had never seen such a diversity of leaf shapes and plant types in any rainforest, so many forms of life, many of them reduced that were new to me, so many microhabitats and microniches, miniature vines with intricately filigreed leaves, and Frogs no bigger than your fingernail. A strikingly striped slug-like *Geoplanario* in a pool of water in a bristling ground bromeliad. The *Mata Atlântica*, Antônio said, is the world center of bromeliad diversity. There are over a thousand species. This is where the pineapple family originated. We crept toward something big thrashing in the understory, hoping it would be a monkey, but it was adjust-fledged *filhote de urubú*, a juvenile black vulture, getting its wings, tangled in vines.

This forest was clearly not for beginners, as the bossa nova composer Antonio Carlos Jobim once said of Brazil. Thomas recalled that “We needed to number every tree and collect it. We had a *mateiro*, a local woodsman, with us, but the *mateiros*’ terms are very broad. What they call a *goiaba* could encapsulate 20 species of eucalyptus. We came up with ten new species that have been described, and others that are in the works. Every tenth tree was something that didn’t have a name.”

Thomas told me that 95% of the trees at Caititú, as in any rainforest, are sterile; the competition for space and light is so intense that they won’t reproduce. Not that they aren’t capable of it, but they never get the chance. Only 5% of the trees make it up to the canopy, to have crowns and to flower and be pollinated. Most of the lines in human

family trees are also sterile, as I would discover that summer, when my son Nick and I met our 22nd cousin, Alex Grigorov, in Russia. Grigorov (see Dispatch #tk) had done a monumental study of the Avinoff clan, to which we both belong, through the centuries. Most of our common ancestors had failed to reproduce, because they were picked off by war disease, or were unable to find a mate, or not interested, or for any number of other reasons. The Darwinian imperative to perpetuate oneself simply does not apply, or does not get to apply, in many cases across the spectrum of life. There's a lot of other stuff going on that is not on the radar of doctrinaire sociobiologists.

On the road back Marco Antônio collected another run-over snake, a green colubrid in the genus *Opistroglyphis*. We stopped at the controversial serpentarium of a local doctor, who was breeding captive bush masters to keep the species from going under and re-releasing them into the wild. His efforts were not appreciated by the ophidophobic locals.

From Itacaré I drove down to Ilheus, where Brazil's best-known novelist, Jorge Amado, grew up and spent the rest of his life writing about. The road threaded circuitously through the *mar dos moros*, the Sea of Hills, which rises almost immediately out of the sea and is where the cacao is grown. It skirted the last tracts of intact forest because by the time it was put in, the 1992 inventory of the remaining *Mata Atlântica* had been completed, and they had been given national heritage protection, although illegal deforestation, logging and firewood collection, continues ubiquitously and not much is being done about it. Occasionally between two hills there would be a glimpse of miles of sandy beach with white breakers slathering them and the blue infinity of the Atlantic hundreds of feet below. Humpback whales are a common sight, making their way up and down the Bahia coast. 1361 sightings were logged in 2004. From a hundred-foot cliff in Trancoso, a few days later, I watched twenty leatherback turtles, the largest turtles on earth, tossing in the surf, their immense yellow-brown carapaces submerging and resurfacing, feeding or mating, I imagine, or perhaps a bit of both.

In Ilheus, I rendezvoused with a 31-year-old long-haired ornithologist and musician named Cassiano Gatto at the offices of IESB, the Institute for Socio-Environmental Studies in Southern Bahia. Cassiano was one of eight biologists who were doing field work in southern Bahia under the auspices of IESB and with the support of entities like Birdlife International and Conservation International. He was studying two very rare and restricted endemic birds in the 11,000-hectare Una Biological Reserve, 30 miles south of Ilheus. One was a *mutúm* or curassow, *Craz blumenbachii*, and the other was a tapaculo. The tapaculos belong to the Rhinocryptidae, the most inconspicuous and cryptic bird family in the South America. Many of the last species that are being discovered on the Bird continent are tapaculos. A new one was just found in the Amazon, and there are twenty or so species in the Andes. This one was described in 1989 as a new endemic, *Scytalopus psychopompus*. But in fact, Cassiano explained, it is probably *Scytalopus indigotus*, a species that had already been collected in Bahia and named by the nationality and first name tk ornithologist Weid in 1825, so it will have to be renamed. All the tapaculos have to be revised.

The bird is four inches high and grey with brick-red wings, unlike the barred brown ones of most of the tapaculos. Its local name is *macucinho*, or little monkey (the *macaco* is a big bird, the tinamou, which is solitary and very rare, because it is a much-hunted game bird). It is a bird that hates the sun and lives in permanently crepuscular streambeds in the *mata fechada*, or closed-canopied forest. One bird will spend its entire life in a dark little swamp no more than 100 yards long. Cassiano had been going out to Una for the day three to five times a week for the last three months, and he had only seen the tapaculo twice, so furtive and elusive is this passerine. Its song is a shrill, slowly rising fluting, like a little frog's. He had no idea what it eats or what its sex life is like.

We drove down to Una in Cassiano's vintage Bandeirante Land Cruiser with a tire on the roof and spent the day walking the research trails that criss-cross the reserve. The trees here were much bigger than the ones at Caititú, of more Amazonian girth, growing along long, narrow ridges and shooting up 150 feet from deep, dark gullies. There were lots of places where tapaculos could have been lurking, but we didn't see any. We did see lots of other birds and heard even more. Cassiano said I would have no trouble exceeding the 123 species in 24 hours, which I saw in the Pantanal de Mato Grosso a few years ago.

Occasionally as we walked along a ridge we caught a glimpse of the mountains further inland, where most of the new species are being found. Like the slender antbird, *Rhopornis ardesiacaca*, which is associated with large ground bromeliads in the *mata seca*, or dry forest. It was discovered in 1996. The Afore-mentioned pink-legged gravateiro, a new species and genus in the Furnariidae, or neo tropical ovenbird family, inhabits the montane forest, 300 to 1000 meters above sea level, in the Serra das Lontras, where there are also possibly new species of *Heliobletus*, or tree hunter. Lontras also has a globally threatened species, the white-necked hawk, *Leucopternis lacemulata*. In another locale, Boa Nova, another, lovely new species of ovenbird, *Synallaxis whitneyi*, was found in 1995. It has a rufous crown, wings, and tail and a grey belly, face, and throat. Boa Nova is also home to the Bahia spine tail, *Synallaxis cinerea* (initially thought to be a new species but renamed *cinerea* in 2001, after a skin in the American Museum of Natural History revealed that it had already been collected by Weid in 1831); the band-tailed ant wren, *Myrmotherula urosticta*; the black headed berry eater, *Acrpornis melanocephalus*; the white winged cotinga, *Xipholena atropurpurea*; the cinnamon-vented pita, *Lipaugis lanidioides*; the Bahia tyrannulet or *borboletinho* (little butterfly), *Phylloscartes beckeri*; the near-threatened solitary tinamou, mantled hawk, harpy eagle, and spot-breasted anti-vireo; the ochre-rumped antbird, Outstale's tyrannulet; the bay-ringed tyrannulet, the bare-throated bellbird, and possibly tapaculos and tree hunters. As well as Stresemann's bristle front merulaxis, *M. stresemani*; the hook billed hermit, *Glaucis dohrnii*; the white-winged cotinga, *Xipholena atropurpurea*; and the brown-backed parrotlet, *Touit melanotus*. The mountains in the interior of Bahia are a mecca for hard-core birders, although the new discoveries are partly a function of the fact that ornithologists are working there. Uninvestigated parts of the Amazon are still yielding new species, like two recently discovered species of *Psitticidae*. IESB and Birdlife International's Brazil program have identified 161

important areas along the coastal states, with 104 threatened birds species comprising 91% of the total of globally threatened bird species in Brazil. 16 are classified highest priority and are getting two million dollars from the European Union for their protection, including an 8,000-hectare preserve in the Serra das Lontras and a 35-mile corridor linking the Serra with Una. The inland montane forest once extended all the way down to Boa Nova, where only less than 2.6 % of the original forest remains. Boa Vista, Cassiano said, “is one of the poorest municipalities in Bahia. Starvation is common. The people rely on forest products, and they are the main impact: illegal firewood gathering, logging, the pet trade, and subsistence hunting. There has to be more environmental education, land acquisition, and implementation of alternative economies. There is great touristic potential. The people are highly artistic. They perform street theatre and have lively bands and dancing.”

Cassiano raised his glasses to follow a mixed flock of 20 dazzling tanagers moving through the foliage. He rattled off the scientific names of eight species, ranging from the flame-blue, red-legged *Psioniopsis* to the *supercolorido* red-rumped tanager, which has a coat of seven colors. 30 to 40 species of birds travel together in large flocks in this forest: flycatchers, woodcreepers, bromeliad searchers, soil scratchers, in “guilds,” divided into various trades. Many follow the common ant bird, *Thamnomanes caesius*.

One of Cassiano’s colleagues was studying the sloths. She used ropes and climbing gear to get up to where they were and radio-collared them and tracked their movements. “Most of the time they hardly move at all, except when they go down their tree to defecate,” he explained. “That is the challenge: how to study them without going crazy Move you son of a bitch. Sloths are very solitary. Camilla has been radio tracking five of them for a year and a half and has never once found two of them together. Reproduction must be a very rare event.”

Another colleague, a naturalized daughter of Swiss cacao growers, Cassiano continued, was studying bromeliad pollination by the 20 or 30 species of *beija flor*, or hummingbird. A red-bellied hummingbird, either *Ilocaris saicuis ck* or *safirina*, hovered for a second overhead, and buzzed off. There weren’t many plants in flower at this time of year, so the hummingbird was probably looking for insects in spider nests. Insects are a bigger part of their diet during nectar shortage. They need protein in their fat glands for their young.

Another colleague was piecing together the sequential flowering of the trees, and another was focusing on 15 species of wild rat, especially the beautiful black and white flanked *rato do cacão*, or *suruê*, which had adapted to the *cabruças* but was disappearing. The Una reserve has been set aside to protect the endemic gold-faced lion tamarin, *Leon topithecus chrysomelus*. Russell Mittermeier, the executive director of Conservation International, spear-headed its creation. This subspecies is not to be confused with the golden lion tamarin, found in the *Mata Atlântica* around Rio de Janeiro and São Paulo, which is *pencilata* and can be seen at the Montreal Biodome and the Millbrook (New York) school zoo. We didn’t see it, or the endemic marmoset, *Callithrix kulli*, or the endemic yellow-breasted capuchin, a troop of twenty of which Cassiano had

encountered the day before. Some of our best birding took place on canopy platforms 130 feet up in gigantic trees connected by rope bridge in the adjacent 5000-hectare Una Ecoparque which is open to the public and offers guided tours, unlike the reserve. The trees soared out of a steep gully in which heliconius butterflies were floating on long, narrow, brown-and-yellow, sun flooded wings. Reaching the shed that led to the platforms; we flushed out one of Bahia's 60 species of bat (not one of the three of vampire bat). Most of the bird action in rainforests is in the canopy, and we finally got a good look at some of the species we had only gotten blurred, incandescent flashes of.

Overheated and sweating profusely after ascending the fortieth steep gully of the day, my head swimming and my notebook filled with the mellifluous polysyllabic Latin and Portuguese names of dozens of exquisite polychromatic songbirds, I sat down on a log and just listened to all the birds singing and calling from different directions and distances, the *pi pi pi pi pi* of a *pirireca* from 40 degrees, the *pik pik pik* of something else at 130 degrees, the loud whistles of a *capitão do mato*, the *psi psi psi psi* of the endemic *Herpsilochmus pileatus*, the rising and falling *brr* of a pileated ant wren, the *pfi pfi* of an all-yellow tanager, *Euphonia chlorotica*. It was not only music, but a hauntingly beautiful symphony, these pulsing, seemingly subtly orchestrated bursts of Mixolydian and pentatonic arpeggio from a dozen invisible instruments. The experience was heightened by being not only acoustic but spatial. After hours of running around in the forest, doing the taxonomic thing, it felt like I was finally here.

Cassiano had learned the birds in this forest first aurally, then visually, by the painstaking process of matching their vocalizations with fleeting glimpses of them. He was as aurally trained and attuned as he was visually, having studied harmony and composition for the jazz and bossa nova guitar for six years before deciding to become a biologist. "A lot of sophisticated neurocognitive studies of bird songs and calls are being done these days," he mused. "But I think the musical impulse in birds is the same as it is in humans: you sing to attract attention and a mate, and the more beautifully you sing, the more beautiful a mate you can attract. It's as simple as that." You sing to attract others of your kind. Kate McGarrigle, one of the vivacious, legendary, mellifluous McGarrigle sisters and the mother of Rufus Wainwright, (Kate is producing my CD, "Suitcase on the Loose," which is in the throes of creation as we speak) is in complete agreement, as far as her own musical impulse is concerned.

The origin and diffusion of music, and the role that birdsong has played in its development, is a worthy subject for a future Dispatch of its own. It would help flesh out the musical component of this site. Music, in the end, is what matters most, and while being the most instantly recognizable and universally practiced art form, it is also the most elusive. The musicality of birdsong is also a subject that I have long been interested, since listening to Indians in the Amazon imitating birds on flutes and exchanging whistled riffs with birds in the forest in the seventies, and even earlier, transfixed by the limpid liquid fluting of wood thrushes in the New Hampshire woods and of hermit thrushes in the Adirondacks, or, since then, of *uirapurús*, or musician wrens, in the rainforest of Acre, Brazil, and of bulbuls in Nepal. Is birdsong music? Most definitely. Some birdsongs use the same eight-note scale that we do. The field sparrow, for instance,

sings in minor thirds: DEF, EFGF, ABD, BCD. F. Schuyler Matthews' delightful 1904 *Fieldbook of Wild Birds and Their Music*, provides transcriptions, on the treble and bass clefs, of the melodic sequences of most of the North American species. The physics of sound, the way the ear hears and organizes, appears to be the same, or similar, across species. David Bird, the Montreal Gazette's birding columnist, points out (in his June 27, 2007 column) that "what makes learning birdsong so daunting is that not only do some species have many different calls and songs, some vary from one locale to another. For example, northern cardinals in the southwestern U.S. have different dialects than those in the east." Same as us.

Bird calls are genetically inherited, but birdsong is learned, Roger Pasquier, one of America's leading authorities on our fine feathered friends, tells me. There's a white-throated sparrow in Central Park that sings 'half the time like a black throated green warbler, because during the small window in its youth when it was learning how and what to sing, it must have picked up on a warbler in the vicinity as well as on its own species. Some bird vocalizations, like chickadees', are very stereotypic, others, like mockingbirds and catbirds' are incredibly inventive. The more species there are in an area, the more stereotypic, and thus distinctive, their calls tend to be."

Moreover, there are differences in the songs of individual birds of the same species, so that their young can recognize them, Camille Parmesan told me when I was reporting the Dispatch (originally published in *Audubon* magazine) on her. She was able to discern them while doing a study of kingfishers on the Colorado River in and around Austin, Texas.

In a paper in the 1990s in the *American Scientist*, the psychologists Meredith West and Andrew King describe the motifs of starling song and their penchant for mimicking human speech, so the flow between bird and human and bird music has been a two-way street. According to Luis F. Baptista, chairman of the department of ornithology and mammalogy at the California Academy of Sciences, who has studied the convergence of themes in birdsong and music, snippets of birdsong are clearly recognizable, not only in tropical tribal music, but in the work of Mozart and Beethoven. Mozart bought a pet starling on May 27, 1784, and kept it until its death three years later, eight days after which he composed "A Musical Joke," mimicking its propensity to intertwine whistled tunes, and he borrowed the opening phrases of the rondo in his violin concerto from the European blackbird. Antonio Vivaldi wrote a flute concerto called "Il Gardellino" that was inspired by and named for the goldfinch, and Ottorino Respighi's "Fountains of Rome" incorporates the song of the European nightingale.

More typically, the composer creates passages reminiscent of bird trills but without direct resemblance to the song. "As composers, birds often use the same rhythmic variations, pitch relationships, permutations and combinations of notes as sound in music, so that some bird songs resemble musical compositions," Baptista writes in a paper co-authored with Robin Keister of the University of California at Davis. Some birds use the five-note, pentatonic scale common in Chinese music. Others use "instruments" like special feather structures that vibrate like the reed in a wind instrument

when they are diving in the air. Male palm cockatoos in northern Australia and New Guinea break off branches and bang them in their beaks on hollow logs, like drumsticks. Williamson's sapsucker drums in seven different tones and pitches. March wrens can sing duets that exchange as many as 150 different song themes. A European skylark was once heard singing a complex song that lasted 58 minutes. Lawrence's thrush of South America has been found to mimic 173 other birds' songs, as well as frogs and insects. (These facts were gleaned from a fascinating 2000 article in Newsday by Earl Lane.)

Tim Gentner, a psychology researcher at the University of San Diego, reports in a 2006 article in *Nature* that starlings possess their own grammar, long thought, as Noam Chomsky argued in his theory of "recursive grammar," to be exclusively human, something that separates man from beast. After 15,000 training attempts in the course of a month, he concluded that starlings are able to recognize the equivalent of explanatory clause in their language, something that another study found tamarins incapable of. The August 28, 2007 *Montreal Gazette* has an article about Elizabeth Derryberry, an ornithologist who for her doctoral thesis at Duke studied white-crowned sparrows during mating season in a forest in California. She played the birds some songs their ancestors had sung in the same forest, recorded in 1979, which were a bit more soprano and had a faster little trill, and it left them completely cold. Then she played them some recent recordings, and the males became aggressive, as if a rival were crowding their territory, and the females became interested, arching their backs, raising their tails and beaks, and doing a flutter of wings that Derryberry calls "the copulation solicitation assay." So there are shifts in the musical tastes of birds, too, and these changes in song, Derryberry thinks, might be one of the means by which birds split into different groups with different dialect and eventually perhaps even evolve into different species.

Birds are giving all kinds of insights into the true complexity of animal awareness and intelligence, and the musicality of birds opens the door to our own animality, just as the social behavior of elephants, impalas, and meerkats reminds us that we, too, are African mammals, as I'll be getting into a forthcoming Dispatch. Stay tuned.

For more on the Mata Atlântica, and how to get involved, Google Fundação Mata Atlântica and Conservation International.

Graham Lanktree, a young freelance journalist in Montreal who has recently joined the Dispatches as Associate Editor, has the following additional bulletin on the subject of birdsong:

"As reported in the October 18, 2007 *Montreal Gazette* by the paper's bird columnist David Bird (one of the most interesting and knowledgeable ones in the business), new studies show that light and noise pollution are affecting the songs of city-dwelling birds. Mark Miller of the University of Florida measured light levels and recorded the initiation of song by American robins at several U.S. sites and found that they "initiate their morning chorus earlier in areas with high levels of artificial light and that those robins in areas with little artificial light continue to initiate song at approximately the same time, relative to civil twilight, as did robins historically." His observations were published in the February 2006 issue of the *Condor*.

Miller also found that mist and cloud cover seem to amplify the effect of the artificial light in urban areas by trapping it near the ground. This makes the light even brighter and induced the birds to sing even earlier. Traffic noise was largely to blame for decreased songbird densities near roadways, other studies conducted in the mid-'90s revealed. Some species make changes in aspects of their vocalizations to compensate for the excess noise from lawn mowers, airplanes, cars, trucks, and industry. Great tits in the Netherlands have been shown to sing at a higher pitch to compensate for urban din. Clear song transmission is critical to most birds because their reproduction may depend on it. Song is important in resolving conflicts between males, and their quality of song-learning and repertoire have both been positively correlated with female mating preferences.

William Wood and Stephen Yezerinac of Reed College in Portland, Ore., conducted the first study of urban noise impact on bird song in North America, publishing their results in the July issue of the *Auk*. They found that song sparrows singing in a noisier environment have to sing at a higher frequency. Singing loudly has a cost to the bird's health because of increased oxygen consumption and energy expenditure, as well as an increased risk of predation [by attracting more predators and the bird being so absorbed in its song that it doesn't notice them approaching. There is even a bird in Russia called the *glukhar* that becomes completely deaf while cutting loose with its hauntingly beautiful song]. Not all bird species living in noisy urban environments have the ability to adapt by changing song frequencies to maintain their populations. Those who cannot will simply depart from these habitats."

Anyone who has anything to contribute to the fascinating subjects of the musicality, semiotics, and neurocognitive dynamics of birdsong, please don't hesitate to send us your thoughts.