



## **Flying High with the Jaco and Sisserou: Real-time Parrot Conservation on Dominica, Nature Island of the Caribbean**

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### **Introduction**

Dominica's endemic Amazon parrots, the Sisserou and Jaco (*Amazona imperialis* and *A. arausiaca*, respectively), are cultural as well as functional flagships for Dominica's unique oceanic rainforest ecosystem and its vast biological inventory. Long-standing parrot conservation and public education efforts surrounding the Sisserou, Dominica's national bird and emblem, have achieved a broad base of public support and awareness, and significant protection of Sisserou habitat, which includes the oldest forest stands on the island. The parrots' secretive natures and Dominica's difficult terrain have impeded systematic research into the parrots' ecologies, from which a strategic conservation plan might be implemented. The current program addresses key, scientific elements in the evolution of a comprehensive conservation plan, including habitat and parrot population surveys, direct monitoring and documentation of reproduction and parental care in the Sisserou, and establishing a fully



functional, self-contained parrot research laboratory. The ultimate objectives of the Dominica initiative are to better understand the distribution, abundance, demographics, and reproduction of both parrot species, and to integrate these findings, along with reproductive enhancement techniques, into a long-term, *in situ* conservation commitment.



## Acronyms

AS = Amazona Society, U.K.  
CFR = Central Forest Reserve  
CWPT = Canadian World Parrot Trust  
FWD = Dominica's Forestry, Wildlife, and Parks Division  
LPF = Loro Parque Fundación  
MDNP = Morne Diablotin National Park  
MTPNP = Morne Trois Pitons National Park  
NFR = Northern Forest Reserve  
PCRC = Parrot Conservation and Research Centre at the Botanical Gardens, Roseau  
RSCF = Rare Species Conservatory Foundation

## Discussion

In terms of biodiversity per unit area, degree of species endemism and degree of threat, Dominica's oceanic rainforest ecosystem is among the Lesser Antilles' highest conservation priorities. As the "Nature Island of the Caribbean," Dominica is the largest and most pristine of the Windward Islands. Mountains consume roughly 75% of this independent nation, with most slopes carpeted in virgin forest; some 52,000 acres (21,060 ha) are State owned (28% of the total land area). Dominica's mountainous rainforests boast high species diversity (>60 woody plant species/hectare; over 1600 flowering plants) and Gommier trees (*Dacryodes excelsa*) exceeding five feet in diameter. Animal biodiversity is similarly impressive, represented by 166 bird species, 20 species of freshwater and land crabs, 12 native terrestrial mammals, a myriad of amphibians and reptiles (including the Lesser Antillean iguana, *Iguana delicatissima*), and a suite of spectacular invertebrates highlighted by 55 species of butterflies and the Hercules Beetle (*Dynastes hercules hercules*). Dominica is the only island in the Eastern Caribbean to have two, endemic Amazon parrots, the Jaco and the Sisserou. The Sisserou, Dominica's national bird and the largest and one of the rarest of Amazon parrots, is only found in and adjacent to the Morne Diablotin and Morne Trois Pitons National Parks. Ever since Hurricane David in 1979—the most devastating hurricane in Dominica's recorded history—conservationists have feared for the Sisserou's extinction, as the species was reduced to a small remnant population on the slopes of Morne Diablotin. The Sisserou's recovery has been the subject of intense field research over the past 20 years championed by Dominica's FWD, but such work is daunting: the Sisserou is very sparsely distributed across vast, mature, montane rainforest, is exceedingly shy and reclusive, and exhibits a low reproductive rate. Meanwhile, with the ever-present hurricane threat, the Sisserou's recovery has become a race against time.



Since 1997, RSCF and the Dominican government have partnered to research Dominica's parrots and conserve the Sisserou—the flagship species for the Eastern Caribbean's largest, intact oceanic rainforest ecosystem. The program is multifaceted, and includes:

- extending formal, legal protection to the forests surrounding Morne Diablotin, stronghold for the Sisserou
- developing management and conservation strategies for the Jaco and Sisserou with Dominica's FWD
- coordinating support for ongoing research, staff capacity building and education programs with public zoological facilities, other non-profit organizations, and NGO's.

The program has produced a number of significant results, including first-ever, intra-cavity documentation of reproduction in the Jaco, using a specialized video probe, and quantitative analyses of bi-parental care and recruitment in the Jaco and Sisserou, using direct observations and time-lapse video surveillance. Most significantly, on January 21, 2000, culminating a two-year, \$1.086 million campaign spearheaded by RSCF and the Dominican government, Dominica formally declared the new Morne Diablotin National Park, encompassing ~8500 acres (3443 ha) of pristine rainforest and the principal nesting area for the Sisserou. This conservation milestone will likely produce the second Natural World Heritage Site for the Caribbean, and the second for Dominica—after MTPNP, declared a NWHS in 1998.

Dating to 1981, Dominica's government-driven parrot program is a broad-based initiative designed to monitor parrot populations, collect and analyze natural and life history information, and recommend mitigative strategies for parrot and habitat protection. During 2000-2001, two key elements of the overall program were expanded (PCRC improvements, field research), thereby directly assisting work in progress. As an ongoing initiative, the parrot program has targeted specific conservation endpoints (e.g., protective legislation), as it also seeks to strengthen existing programs and provide greater scope of vigilance to detect and thwart potential threats to parrots and their habitats. The recent creation of MDNP, complementing Dominica's legacy of forest protection (dating back to the creation of the CFR in 1952, the MNTP in 1975 and the NFR in 1977), clearly illustrates how the parrot program leverages ecosystem-level conservation and biodiversity protection. This milestone represents the essence of the parrot flagship species concept.

With financial assistance from CWPT, LPF, AS, and several U.S. zoological societies, the parrot aviary at the Botanical Gardens in Roseau has been overhauled, enhanced, and renamed the Parrot Conservation and Research Centre (PCRC), becoming a self-contained parrot incubation, rearing and general research laboratory. Presently, one pair of Sisserous, three pair of Jacos, and three additional male Jacos live at the PCRC. In addition to functioning as a



stand-alone facility for incubation, rearing, veterinary care, and emergency housing (in the event of hurricanes), the PCRC has become the headquarters for field programs. GPS/GIS data from field surveys are now downloaded to a laptop computer with CD writer and printer, and all video surveillance tapes can be reviewed and scored directly on site. In addition, digital video and still imagery can be processed and archived for publication or other media presentations. The PCRC also has become an instruction center for FWD staff. Reillo and colleagues from RSCF have engaged FWD officers in the use of equipment at the PCRC, and have instructed animal care staff on proper husbandry and handling techniques. The improved facilities significantly ease food storage, preparation, and delivery to the enclosures, and the parrot laboratory enables ill, rescued or confiscated animals to be isolated, treated, and hand-fed for even extended periods. Staff training at the PCRC has included aviary management and design, handling and evacuation procedures, GPS/GIS methods, video and image processing, computer program orientation, and field equipment maintenance and deployment.

During the past two years, the parrot program has focused on field research across Dominica's mountainous terrain. Experiences over the past few years reveal the dynamic aspects of monitoring efforts, as well as the time-sensitive nature of conservation strategies. The parrot team's success in locating active Sisserou nests in 1999 and 2000 was dashed during the 2001 breeding season, as Dominica experienced one of the worst droughts on record. Many rainforest trees essential for foraging did not set fruit until May, three months after the typical egg-laying period. Gommier (*Dacryodes excelsa*), Clusia (*Clusia spp*), Chataignier (*Sloanea spp*), Penny-piece (*Pouteria multiflora*) and Mahot cochon (*Sterculia caribaea*) did not set fruits in the late-autumn and winter, thus reducing the nutrient base for breeders. *Bwa pen* (*Talauma dodecapetala*), which provides a thickly shelled, multiple fruit, appeared to follow its typical phenology, likely due to the long, on-stem development time that commenced in November 2000 prior to the drought. Congregations of Jacos and Sisserous were spotted on *Bwa pen* trees from December 2000-March 2001. Sisserous were also seen foraging on an unusual *Clusia* sp. at 3800' elevations, as lower-elevation plants did not set fruit. Successful Jaco nests were found in MDNP and NFR adjacent to agricultural plantations, suggesting that citrus subsidized and/or largely supplanted the lack of forest fruits during 2001. Jaco nests in the MDNP area were found to be 4-6 weeks behind schedule, while no Sisserou nesting attempts were detected. Timelapse video monitoring of a Sisserou nest (a targeted objective) was thus impossible in 2001. However, all surveillance equipment has been field-tested and is ready for deployment when typical breeding patterns resume.

Significantly, the parrot team commenced a comprehensive field survey of parrot populations using GPS and GIS methods. From December 2000 – November 2001 (and continuing thereafter), the parrot team surveyed over 25,000 acres (10,125 ha) of forest across MDNP, NFR, CFR, MTPNP and adjacent private and unallocated State lands. Surveys were conducted by recording sightings and calls during monitoring expeditions on foot across remote terrain in the forest interior. All expeditions were recorded with GPS and downloaded to digitized topographic, LANDSAT or SPOT map interfaces using OziExplorer software registered to RSCF. Flat-area estimates of surveyed areas were calculated on the



GIS program using line-of-sight estimates from the field and known topographical boundaries (e.g., river basins, ridge lines), providing discrete local density estimates for both parrot species.

While preliminary, field surveys indicate that the Jaco has largely reestablished its historical, pre-hurricane distribution (1979), discounting forests that were sacrificed to agriculture during the banana boom during the mid-to-late 1980's. Within agricultural areas adjacent to primary forest, local Jaco densities may exceed 20 birds/acre (8 birds/ha), and aggregations of 30 or more birds in roost trees is common in the Syndicate, Fond Pie, Colihaut, and Woodford Hill areas. These congregations belie typical local densities across forest habitat, where Jacos are widely distributed at between 7-10 birds/1000 acres (2.8-4 birds /1000 ha) surveyed. Nest site fidelity is remarkable in this species, with some cavities being occupied by the same breeding pair for seven or more consecutive years. The Jaco appears less discriminating than the Sisserou in selecting nesting cavities, with some nests located in farmer's fields or along thoroughfares. Cavities vary in size from large, cavern-like openings of several meters depth, to narrow openings barely wide enough to permit entry. A significant body of Jaco natural and life history information is available from the FWD, and therefore need not be summarized here.

Emerging distribution and density patterns for *A. arausiaca* suggest that the species is well established across Dominica's interior, and may boast a population of ~800 individuals. Whereas agriculture in general has eliminated vast tracts of mature forest over the last 30 years, citrus plantations appear to have facilitated the Jaco's range expansion and enhanced local recruitment in some areas since 1985. With a clutch size of three and strong bi-parental care throughout the nesting and post-fledging periods, overall recruitment is high; most Jaco nests successfully fledge one or two chicks. The species' social attributes and boldness near humans, combined with its reproductive potential, increase *A. arausiaca*'s population resilience in the face of environmental perturbation, both man-made (deforestation) and natural (hurricanes). Availability of mature trees offering suitable nest cavities is likely a limiting factor for the species, especially in terms of such cavities' proximity to rich foraging areas.

As many Jaco populations now supplement their natural diet with agricultural fruits, the species' distribution, nesting behavior, and local abundance warrants careful, continuous monitoring. Jacos are perceived as pests in citrus plantations, where crop depredation is conspicuous and may be considerable (some trees are picked bare)—even though farmers rarely harvest more than 70% of the available annual crop. A new, centralized citrus processing plant, due to be operational in 2002, may increase citrus utilization and harvesting efficiency throughout Dominica, reducing perceived crop losses. The potential impacts of evolving agricultural practices upon Jaco ecology demand scrutiny, as many Jaco populations appear to have become at least partially dependent upon agriculture during periods of poor forest fruit-set. Substantially reducing the agricultural food subsidy may affect nesting behaviors in nearby forested areas, potentially increasing competition between the Jaco and Sisserou.



Patterns of distribution and abundance for *A. arausiaca* suggest that the species is not of immediate conservation concern. However, RSCF and the FWD maintain that the species must remain under special protective status, and should be considered vulnerable. The species' continuing recovery and success is wholly dependent upon aggressive forest protection campaigns, enforcement of wildlife laws, and Dominica's comprehensive land management and protection system. The parrot program will continue to monitor Jaco populations as part of its regular work plan and GPS-based population surveys for the foreseeable future. Density and population estimates will improve with replicated surveys at different times of the year.

The initial surveys suggest that the Sisserou occurs at extremely low local density wherever it is found, though the species' range has expanded nearly to pre-Hurricane-David levels. MDNP remains the species' stronghold, but densities here rarely exceed 5 birds/1000 acres (2 birds/1000 surveyed ha). Shy and secretive birds, Sisserous are difficult to detect under the best forest conditions, and are particularly challenging to observe in rough, high-elevation terrain that receives frequent precipitation. As with the Jaco observations, the preliminary Sisserou data should be considered products of a methodology under development. Unlike previous "watch-point" methods, these surveys record sightings over an expansive area, with greater encounter frequencies due to the parrot team's constant movement. The method was developed to take advantage of GPS/GIS technology, but also derives from the parrot team's many years of experience—revealing that Sisserous tend to flush from cover when humans approach, but may otherwise perch silently and remain camouflaged in thick canopy for hours at a time. The broad spatial scale afforded by the GPS-based survey method departs radically from traditional transect approaches which iteratively sample somewhat arbitrarily selected areas. For rare species exhibiting low incidence frequencies regardless of method, GPS-based surveys offer a more systematic sampling regime over broad spatial scales, are replicable, and enable local density and distribution data to be compiled simultaneously.

Because *A. imperialis* is encountered infrequently throughout its range, the preliminary local density estimates can only be extrapolated to estimate total population size with extreme caution. At background densities of ~3 birds/1000 flat surveyed acres (~1.2 birds/1000 ha)—that is, the average density across inhabited forest—50,000 suitable, forested acres (20,250 ha) are required to yield a total population of 150 Sisserous. All surveyed acreage is measured flat, yet there exists an obvious spatial distortion between flat-area acreage and surface-area acreage resulting from Dominica's extreme topography. While GPS-based parrot surveys enable two-dimensional area estimation using GIS maps (from which densities are calculated), the forest habitat extends in three dimensions, with surface-area-to-flat-area ratios in interior forests scaling nearly 3:1. Of note, our density estimates use flat acreage as a standard for all calculations, but in-the-field sampling bias may scale with the landscape distortion factor above, especially in light of low encounter incidences across all surveyed areas. Such sampling bias tends to consistently underestimate local densities, as well as frustrate the



certainty of absence data (i.e., confidence that birds are truly absent when no birds are seen/heard). In addition, although parrot team members are skilled at distinguishing individuals while surveying, the possibility of repeated counts cannot be eliminated entirely. Given these concerns, we tentatively conclude that the present data cannot project a total population greater than 150. This figure rests most heavily upon the correspondence between estimated and actual local densities and a ceiling of no more than 50,000 flat-area acres (20,250 ha) representing potentially suitable Sisserou habitat. Surveys will be replicated over different times of year for the foreseeable future in order to gain statistical confidence. Prudence and parsimony dictate that a conservative population estimate be adopted until field data suggest otherwise.

By all measures, the Sisserou population has exhibited a noticeable recovery from post-hurricane levels (1979-80), when the species was determined to be extinct everywhere but the upper slopes of Morne Diablotin. The small southern population in MTPNP, which over the past year exhibited stability or a modest increase, verifies that the species has benefited from government's long-term protection of Dominica's interior forests, which facilitated recolonization over a 20-year period. While encouraging, the Sisserou population's overall recovery trend illustrates the fundamental links between mature forest expanse and resilience: the species only nests within mature montane rainforest above 2000' elevation, and requires vast areas of undisturbed forest habitat in order to rebound from environmental catastrophes. Life history information for the species remains scant, but observations over the past 10 years suggest a clutch size of one, with breeding likely every other year. Essential intra-cavity information awaits deployment of timelapse and video probe equipment in 2002, which has exhibited an unusual, prolonged rainy season. Although much of the Sisserou's pre-hurricane habitat remains, expanding agriculture over the past 30 years has restricted the species to a much smaller total forest area than was potentially available prior to 1979. As none of this historical range is now reclaimable by *A. imperialis*, land protection strategies must target all remaining suitable habitat. To this end, the parrot surveys are invaluable, as field data identify new areas for potential inclusion in MDNP, including NFR lands, unallocated State lands, and private holdings. Conversion of such properties into national park emerges as a future, major conservation campaign in the northern half of the island.

The Sisserou's comeback, albeit slow, is both measurable and significant. As an endemic reliant upon the largest of Dominica's rainforest trees for survival, the Sisserou represents a compelling indicator species for rainforest rejuvenation and recovery. Moreover, as mature forest is least susceptible to hurricane damage, the species is a sentinel for evaluating the magnitude of forest perturbations. Indeed, the Sisserou's near-extinction caused by hurricane David in 1979 signaled the opening of a research window on the characteristics of Caribbean Island catastrophes and how they relate to long-term ecosystem and species recoveries, the details of which we are only now beginning to appreciate.

Clearly, Dominica's parrots have evolved with their biological and physical environments—including hurricanes—soundly proven by the species' persistence despite centuries of assaults by man and nature.



The Jaco's resilience no doubt derives from the species' relatively large clutch size, high recruitment rate, and ability to capitalize on marginal habitat. The central element in the Sisserou's survival has been an intact rainforest habitat, which affords researchers and nature lovers alike the unique opportunity to observe an oceanic rainforest ecosystem and all of its biological, physical, and temporal dynamics. Our recent Sisserou sighting in the south of Dominica confirms that the government's protected area policies and strong conservation ethic are working. Since its creation in 1975, the Morne Trois Pitons National Park has been maintained as an intact bioreserve, enabling Dominica's national bird to rebound here 20 years after the most devastating hurricane in the island's recorded history. With Dominica's terrestrial park system anchored by Morne Trois Pitons National Park in the south and the new Morne Diablotin National Park in the north, we look forward to the Sisserou's steady recovery to pre-hurricane-David levels.

While the Jaco's population seems strong, a sobering reality is that the Sisserou's future rides with the next wave of tropical storms rolling westward across the inter-tropical convergence zone. But for now, Dominicans, the parrot team, and ornithologists everywhere can cheer for *Amazona imperialis* and *A. arausiaca*, as these magnificent parrot ambassadors expand across the blanket of forest that defines Dominica, the Nature Island of the Caribbean.