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Important Bird Areas AMERICAS

JAMAICA

Catherine Levy & Susan Koenig





Country facts at a glance

Area:	10,829 km ²
Population:	2,780,132
Capital:	Kingston
Altitude:	0–2258 m
Number of IBAs:	15
Total IBA area:	311,284 ha
IBA coverage of land area:	21%
Total number of birds:	300
Globally threatened birds:	9
Globally threatened birds in IBAs:	9
Country endemics:	30

General introduction

Jamaica is the third largest island in the Greater Antilles lying 145 km south of eastern Cuba and 161 km west of Haiti. It is 235 km long (east to west) and 35–82 km wide (north to south). Administratively, Jamaica is divided into 14 parishes, and the territory includes the Morant Cays (off the eastern end of the island) and Pedro Cays (off the south-west coast). The island is rugged with mountains and plateaus: much of the land is above 300 m. The highest point is Blue Mountain Peak in the Blue Mountains, a dramatically uplifted ridge-block of Cretaceous metamorphic rock which rises sharply from the coast. The eastern end of this block is capped in limestone, which forms the steep and extremely rugged John Crow Mountains. The Rio Grande, Jamaica's largest river (by surface-water runoff), separates the Blue and John Crow Mountains. The center and center-west of the island is composed of a massive limestone block with well-defined features of a karst landscape, including doline, polygonal (cockpit), and tower karst, large alluvial poljes (valleys), and many sinkholes and caves. The best-developed polygonal karst is found in Cockpit Country (the "type area" for cockpit karst). A portion of the Cockpit Country aquifer drains to the southwest, forming the Black River and Great Morass, the largest swampland ecosystem on Jamaica. In extreme western Jamaica, alluvial plains and rolling karst limestone are punctuated by a Cretaceous igneous outcrop capped in limestone, known as Dolphin Head. Due to the island's geologic history of volcanic extrusion, subsidence, and tectonic uplift, the Blue and John Crow Mountains, Cockpit Country, and Dolphin Head are recognized as three "hotspots" of adaptive radiation and endemism. The island's forested mountains and hilly interior are incised by steep valleys, particularly in the east where erosion is now prevalent due to the removal of forest cover. In the center and west, the limestone formations provide little surface water, and removal of vegetation exposes a thin red soil.

Jamaica has a tropical maritime climate. In the lowlands, the mean annual temperature is 26°C, but just 13°C at Blue Mountain Peak. Rainfall varies across the island with average annual precipitation greater than 5000 mm in John Crow Mountains, 2500 mm in the highest parts of Cockpit Country, and less than 750 mm in the Hellshire Hills –the driest part of the country. Although it rains in every month, the heaviest rains are from September to November, and again (but less heavily) in May and June. The driest months are January through March. Natural vegetation corresponds to geology, elevation and precipitation, and ranges from very wet and wet tropical forest, particularly on the north side of the Blue Mountains (where a remnant of elfin forest remains), and on limestone (especially the John Crow Mountains and Cockpit Country), to dry scrub forest, and dry woodland along coastal areas. The Forestry Department's land-use figures (up to 1998) broadly classify Jamaica as: c.30% forest (only 8% of which is minimally disturbed or "closed broadleaf" forest); 30% mixed land-use (including plantations and fields); and 39% non-forest land-use (buildings/infrastructure, wetlands, and bauxite and limestone-aggregates mining). Between 1989 and 1998, the greatest loss of forest land was in "disturbed broadleaf", and the greatest gain (44%) in "mixed land-use/ cover" (including "partly forested and partly bauxite lands"). The expansion of bauxite mining accounts for much of this latter change in land-use.



Karst limestone "cockpits" in Cockpit Country (JM005).
Photo: Geoeye/Jamaica Forestry Department, from Ikonos Images

Conservation and protected area system



National laws for biodiversity conservation in Jamaica have lagged behind other legislation, but are now under scrutiny as part of the process to update the Protected Areas Systems Master Plan. The Wildlife Protection Act, originally passed in 1945 to regulate sports-hunting and fishing, has been enhanced by many regulations that attempt to address gaps, particularly in relation to protection of animals. However, this act does not address habitat protection or the conservation of flora. Habitat protection comes under the Natural Resources Conservation Authority Act (1991) which provides the legislative framework for a system of protected areas and paved the way for the establishment of marine parks and the Blue and John Crow Mountains National Park. The island also has over 150 forest reserves designated under the Forest Act (1996, and subsequent regulations) which provides for the preservation of forests, watershed protection, and ecotourism. Private lands declared as forest reserves can be entitled to property tax exemptions. Jamaica's protected areas portfolio is biased towards the forested mountains of the interior, leaving lowland and coastal ecosystems under-represented. Most of the remaining forested coastal areas are privately owned.

“Jamaica’s protected areas are biased towards forested interior mountains, leaving lowland and coastal ecosystems under-represented.”

Recognition of Jamaica’s unique biodiversity has come about slowly over the past 30 years despite an encouraging start when, after the first United Nations Conference on the Environment (Stockholm 1972), it was decided to amalgamate the various national environmental commissions into one agency –the Natural Resources Conservation Department. This agency was felt to have only advisory capabilities, so it was expanded in 1991 to become the Natural Resources Conservation Authority (NRCA). NRCA is responsible for declaring and managing national parks, and enforces the requirement for project-related environmental impact assessments. The Forestry Department manages the island’s forest estate. In 1988, Hurricane Gilbert’s devastating effects revealed problems in natural forest management; this prompted the

preparation of a National Forestry Action Plan (1990), followed by a new Forest Act (1996). The latter explicitly includes “conservation and sustainable management of forest”, thus covering activities such as the protection of forest resources for ecosystem services and biodiversity. Conservation remains a challenge due to limited financial resources. Partly because of insufficient capacity within Forestry Department and NRCA and partly because of policy changes in the governance of natural resources, management of Jamaica’s first national park (declared in 1990) was delegated to the NGO Jamaica Conservation and Development Trust. Other NGOs to be mandated with protected area management are: the Caribbean Coastal Area Management Foundation with responsibility for the Portland Bight Protected Area; and the Montego Bay Marine Park Trust which has been given the mandate to manage the Montego Bay Marine Park. Elsewhere, the Jamaican iguana (*Cyclura collei*) project, lead by Dr Byron Wilson (University of the West Indies), provides a focus for research and conservation activities within the dry forest habitat (including a small forest reserve) of Hellshire. In Cockpit Country, the Forestry Department and Windsor Research Centre (Trelawny) are working together to facilitate the work of three Local Forest Management Committees –encouraging local community engagement in sustainable forest resource use and management.

Even though an attempt was made to set up one agency to “provide for the management, conservation, and protection of the natural resources of Jamaica”, there are at least 34 pieces of legislation that refer to the environment, e.g. Land Acquisition Act (1947), Urban Development Act (1968), Maritime Areas Act (1996) –not all of which are administered by NRCA, but by other government agencies as well. Problems associated with conservation in Jamaica include poor coordination between the plethora of government institutions responsible for the various laws and regulations, insufficient recognition of the value of biological diversity, insufficient funding, poor enforcement, incomplete or improper environmental impact assessments, and incomplete island-wide evaluation of landscape and biodiversity values. While these issues are inhibiting effective conservation action, there are a number of significant threats that are directly impacting Jamaica’s unique biodiversity. Habitat loss and fragmentation are the greatest threats. With primary forest reduced to just 8% of the land area, multiple factors (e.g. increased predation, increased competition from invasive species, reduction of genetic vari-



Black River lower morass (JM007).
Photo: Vaughan Turland

ability etc.) impinge on the long-term survival prospects of the species populations that remain. Driving this habitat loss, degradation and fragmentation, is the expansion of bauxite mining and limestone quarrying; residential, hotel and resort developments (particularly along the coasts); highways and roads; and, to a lesser extent, agriculture. Annual dry season (or drought period) fires (started intentionally) have a significant impact on woodlands and forests. Climate change models are predicting significantly drier summers in the Caribbean suggesting that fire risk will be of increasing concern. Another consequence of increasing habitat loss, degradation and fragmentation is the reduced resilience of the remaining forests to stochastic events such as hurricanes (or indeed the forecasted effects of global climate change). The last serious hurricane to hit almost the entire island was Hurricane Gilbert in 1988. More recently the trajectories of hurricanes Allan and Charley (2004), Emily (2005) and Dean (2007) carried them near or over Jamaica's south coast. It would be prudent for future protected area planning to consider coastal vulnerability to hurricanes.

“The introduced mongoose is a causal factor in the possible extinction of the Critically Endangered ground-nesting Jamaica Petrel and Jamaican Pauraque.”

Alien invasive species impacting Jamaica's native biodiversity include small Indian mongoose (*Herpestes auropunctatus*), black and brown rat (*Rattus* spp.), dogs, cats, and feral pigs. The impact of these species has not been quantified although the mongoose has been identified as a causal factor in the possible extinction of the (Critically Endangered) ground-nesting Jamaica Petrel (*Pterodroma caribbaea*) and Jamaican Pauraque (*Siphonorhis americana*). It was also thought to have contributed to the extinction of the endemic Jamaican iguana (*Cyclura collei*) until a small population was rediscovered in Hellshire Hills in 1990. Between 1996 and 2008, the Jamaican Iguana Recovery Group removed c.1000 mongoose from the core iguana conservation zone and operates a trapping grid every day. Snares are used to trap and remove pigs from the core iguana area and from the adjacent coastal fringe. Recent research has indicated that pigs may be responsible for the loss of nearly all sea-turtle nests in a given season. Non-native psittacines imported for the pet trade pose a high threat to the endemic *Amazona* parrots and the native *Aratinga* parakeet through the introduction of disease, the potential for hybridization, and competitive exclusion of nesting cavities. A temporary ban on their importation, grounded in concerns for the introduction of highly pathogenic strains of avian influenza, remains in effect as of 2008, and efforts are being directed to support the Veterinary Services Division in making the ban permanent. Invasive plants are also a threat. Where natural vegetation has been cleared, exotic species frequently outcompete native species, and forest fragmentation facilitates their colonization of new areas. Aggressively invasive species which create biologically sterile monocultures in Jamaica include *Bambusa vulgaris*, Asian ferns (*Nephrolepis* spp., *Pittosporum undulatum*), and *Alpinia allughas* (contributing to loss of native species in the swamp forest of the Black River Great Morass).

Red-billed Streamertail (*Trochilus polytmus*), one of two species belonging to an endemic genus, is restricted to the Jamaica Endemic Bird Area and present in 12 IBAs.

Photo: Howard Nelson

Ornithological importance

Of Jamaica's c.300 recorded bird species, 124 breed (including 12 that are introduced) and over 170 species occur as wintering Neotropical migrants, transients or vagrants. The Jamaican avifauna exhibits exceptional levels of endemism, with 36 restricted-range species defining the Jamaica Endemic Bird Area (EBA 027), and 30 breeding species confined to the island (and primarily to natural forest and woodlands). A number of the restricted-range species are shared with neighboring islands, e.g. Vervain Hummingbird (*Mellisuga minima*), Stolid Flycatcher (*Myiarchus stolidus*), Greater Antillean Elaenia (*Elaenia fallax*) and Golden Swallow (*Tachycineta euchrysea*) are all shared with Hispaniola (EBA 028). Five of the species endemic to Jamaica represent four endemic genera: two *Trochilus* spp. (streamertails), Orangequit (*Euneornis campestris*), Yellow-shouldered Grassquit (*Loxipasser anoxanthus*) and Jamaican Blackbird (*Nesopsar nigerrimus*). In fact, 48 species are endemic to the island at the genus, species or subspecies level. Black-billed Streamertail (*Trochilus scitulus*) has the narrowest range of all the island endemics, being confined (but abundant) in the John Crow Mountains IBA (JM014).

Although 18 globally threatened and Near Threatened species occur on Jamaica, two of these, Golden-winged Warbler (*Vermivora chrysop-tera*) and Cerulean Warbler (*Dendroica cerulea*), are only known as vagrants and are not represented in IBAs. Also, the Near Threatened

“Jamaican avifauna exhibits exceptional levels of endemism, with 36 restricted-range species, including four endemic genera.”

Piping Plover (*Charadrius melodus*) and Black Rail (*Laterallus jamaicensis*) are not present in sufficient numbers to trigger IBA criteria. The Jamaica Petrel (*Pterodroma caribbaea*) and Jamaican Pauraque (*Siphonorhis americana*) are classified as Critically Endangered, and neither has been seen with certainty for 130 years although there are possibilities that the pauraque persists in Hellshire Hills IBA (JM011) and the petrel could survive in John Crow Mountains IBA (JM014). The Jamaican Blackbird is considered Endangered as it occurs in small numbers and only inhabits moist forest with numerous bromeliads such as is found in the Blue and John Crow Mountains, Mount Diablo, and the larger IBAs of the Cockpit Country Conservation Area.

Thirteen seabird species nest on Jamaica and its offshore cays, and the island is regionally important for four of these, namely Masked Booby (*Sula dactylatra*; over 50% of the Caribbean's nesting birds), Sooty Tern (*Sterna fuscata*; c.30%) Brown Noddy (*Anous stolidus*; c.30%) and Brown Booby (*Sula leucogaster*; c.20%).

IBA overview



All but one of Jamaica's 15 IBAs (Table 1, Figure 1) have some form of protection and many of the terrestrial IBAs overlap with forest reserves or crown lands to some extent. However, only 44% of the area covered by the IBAs is under formal protection, and active management is minimal in many areas.

The IBAs have been identified on the basis of 49 key bird species, including 14 (of the 18) globally threatened and Near Threatened birds, all 36 restricted-range species, and nine congregatory water-

birds/seabirds. It was not possible to identify IBAs for significant (qualifying) populations of two of Jamaica's globally threatened birds, namely Piping Plover (*Charadrius melodus*) and Black Rail (*Laterallus jamaicensis*). However, Piping Plover is known to occur (although not in significant numbers) in Black River Great Morass IBA (JM007), Portland Ridge and Bight IBA (JM010) and Yallahs IBA (JM012), and Black Rail has been recorded in Black River Great Morass IBA.

Significant populations of the majority of Jamaica's key bird species are found in two or more IBAs. However, for many of the congregatory species, significant (i.e. >1% of the global population of the species) populations are only found in one IBA. The Black River Great Morass IBA (JM007) and Pedro Cays and Bank IBA (JM009) support most of these populations, emphasizing how critically important they are for the maintenance of Jamaica's waterbird and sea-bird populations.

“Although unrecorded for 130 years, Jamaican Pauraque may persist in Hellshire Hills IBA and Jamaican Petrel could survive in John Crow Mountains IBA.”

Table 1. Important Bird Areas in Jamaica

IBA code	IBA name	Adm unit	Area (ha)	A1				A2	A3	A4				
				CR	EN	VU	NT			A4i	A4ii	A4iii	A4iv	
JM001	Negril	Parishes of Hanover, Westmoreland	27,740		1	1		X				X		
JM002	Dolphin Head	Parishes of Hanover, Westmoreland	5,370		1	1		X						
JM003	Bluefields	Westmoreland Parish	4,660		1	1		X						
JM004	Catadupa	Parishes of Saint Elizabeth, James, Trelawny	15,735		3	4		X						
JM005	Cockpit Country	Trelawny Parish	63,935	1	4	4		X						
JM006	Litchfield Mountain - Matheson's Run	Parishes of Saint Ann, Trelawny	15,745	1	3	4		X						
JM007	Black River Great Morass	Saint Elizabeth Parish	17,770		1	2		X				X		
JM008	Mount Diablo	Parishes of Saint Ann, Saint Catherine	7,150	1	2	2		X						
JM009	Pedro Cays and Bank	Kingston Parish	23,345									X	X	
JM010	Portland Ridge and Bight	Clarendon Parish	42,829			1	2	X				X		
JM011	Hellshire Hills	Saint Catherine Parish	9,400	1		1	1	X						
JM012	Yallahs	Saint Thomas Parish	8,080			1	2	X						
JM013	Blue Mountains	Parishes of Portland, Saint Andrew, Saint Mary, Saint Thomas	40,065	1	4	2		X						
JM014	John Crow Mountains	Parishes of Portland, Saint Thomas	14,235	1	1	3	3	X					X	
JM015	Morant Cays and Bank	Kingston Parish	15,225									X	X	

For information on trigger species at each IBA, see individual site accounts at BirdLife's Data Zone: www.birdlife.org/datazone/sites/



A significant percentage of the Caribbean's Brown Boobies (*Sula leucogaster*) nest in Jamaica. Photo: Brandon Hay

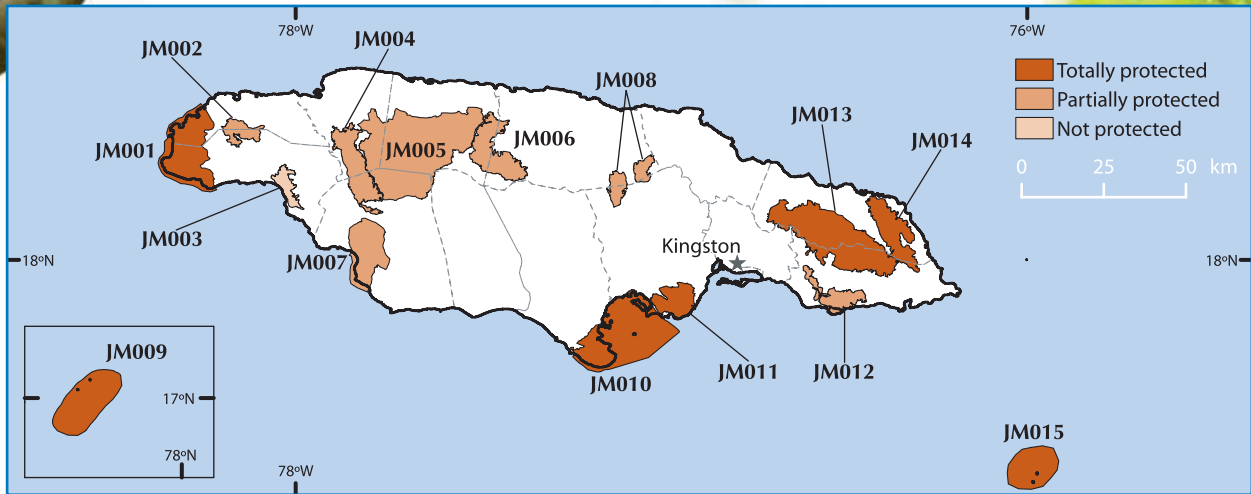


Middle Cay, Pedro Cays and Bank IBA (JM009) hold at least 25,000 breeding birds and are also used by Neotropical migrants as a stopover site.
Photo: Brandon Hay

The Endangered Jamaican Blackbird (*Nesopsar nigerrimus*) or "Wildpine Sergeant", one of Jamaica's four endemic genera.
Photo: Hugh Vaughan



Figure 1. Location of Important Bird Areas in Jamaica¹



¹ Totally protected refers to the site's legal protection status and does not imply effective protection in all cases.

Box 1

Community-based conservation project raises awareness and reduces threat of bauxite mining



Tree nursery in Cockpit Country, used by the Local Forest Management Committee (Site Support Group).
Photo: Susan Koenig/ Windsor Research Centre

Communications components of a community-based conservation project in Cockpit Country Conservation Area played an important part in raising awareness of local biodiversity and suspending licenses for bauxite prospecting. The project, aimed at promoting research, developing local capacity and creating awareness of local biodiversity, among other objectives was funded by UNEP-GEF over a six-year period. As a result of communications materials, including a calendar highlighting native and endemic flora and fauna, school children and community members are now aware of their importance in the area. The problems of introduced species were also highlighted in these materials.

The “Save Cockpit Country” media campaign, supported by more than 30 national and international NGOs collected more than 5000 signatures calling on the Jamaican government to declare Cockpit Country “closed to mining”. As of April 2007, all licenses for bauxite prospecting in Cockpit Country remain suspended by Government or have been surrendered by the license holder.



Bauxite mining is driving habitat destruction across the center of the island including Mount Diablo IBA (JM008).
Photo: Susan Koenig/Windsor Research Centre

Opportunities

At least 47 terrestrial areas have been identified as “potential Important Bird Areas” and the boundaries for many of these have been used in the preparation of the Protected Areas System Master Plan. However, at present there is insufficient information concerning the occurrence of populations of key bird species at these sites for them to qualify as IBAs. This clearly presents field research objectives for the academic and conservation communities within Jamaica, namely to clarify (based on quantitative data) the international importance of Jamaica’s 47 “potential” IBAs.

Given the serious decline in Jamaican seabird numbers, their nesting sites (which include coastal areas and the offshore cays such as Morant and Pedro Cays) urgently need active conservation management, research and especially monitoring.

Although state, pressure and response variables have been collated for some of Jamaica’s IBAs, monitoring should also be implemented at all of Jamaica’s IBAs to provide an objective status assessment and highlight management interventions that might be required to maintain these internationally important biodiversity sites.

Further information

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References

- AZAN, S. & WEBBER, D. (2007) The characterization and classification of the Black River Upper Morass, Jamaica, using the three-parameter test of vegetation, soils and hydrology. *Aquatic Conservation: Marine and Freshwater Ecosystems* 17: 5–23.
- BEARD, J. S. (1955) The classification of tropical American vegetation types. *Ecology* 36: 89–100.
- BOURNE, W. R. P. (1965) The missing petrels. *Bull. Brit. Orn. Club* 85: 6.
- DOUGLAS, L. & LEVY, C. (2002) *An estimate of the number of Masked and Brown Boobies (Sula dactylatra and S. leucogaster) breeding on Southwest Cay, Pedro Cays, Jamaica.* (Unpublished report).
- DOUGLAS, L. & ZONFRILLO, B. (1997) First record of Audubon’s Shearwater and Black-capped Petrel from Jamaica. *Gosse Bird Club Broadsheet* 69: 4–6.
- DOWNER, A. & SUTTON, R. (1990) *Birds of Jamaica: a photographic field guide.* Cambridge, UK: Cambridge University Press.
- DUNKLEY, C. S. & BARRETT, S. (2001) *Case study of the Blue and John Crow Mountain National Park.* Trinidad: Caribbean Natural Resources Institute. (CANARI Technical Report 282).
- FINCHAM, A. G. (1997) *Jamaica underground: the caves, sinkholes and underground rivers of the island.* Kingston, Jamaica: University of the West Indies Press.
- GONSISKA, P. & KOENIG, S. E. (2007) *Epiphyte surveys in Barrett Hut: Litchfield–Matteson’s Run Forest Reserve.* (Unpublished report).
- HAYNES-SUTTON, A. & HAY, D. B. (2002) *Survey of migratory ducks in Jamaican wetlands. Phase one: January–April 2001.* Mandeville, Jamaica. (Unpublished report for Natural Resources Conservation Authority, National Environment and Planning Agency and Ducks Unlimited).
- GOSSE, P. H. (1848) *The birds of Jamaica.* London, UK: John van Voorst.
- GOSSE, P. H. (1851) *A naturalist’s sojourn in Jamaica.* London, UK: Longmans.

- HEDGES, S. B. (1999) Distribution patterns of amphibians in the West Indies. Pp 211–254 in W. E. Duellman ed. *Regional patterns of amphibian distribution: a global perspective.* Baltimore, USA: Johns Hopkins University Press.
- JAMAICA CONSERVATION & DEVELOPMENT TRUST (2005) *Blue and John Crow Mountains National Park: management plan (2005–2010).* Kingston, Jamaica: Jamaica Conservation and Development Trust. (Unpublished report).
- KOENIG, S. E. (2008) Black-billed Parrot (*Amazona agilis*) population viability assessment (PVA): a science-based prediction for policy makers. *Orn. Neotrop.* 19 (suppl.): 135–149.
- KOENIG, S. E. (2008) *Status and threat-risks to Jamaica’s two endemic Amazon parrots.* (Unpublished manuscript).
- KOENIG, S. E., WUNDERLE, J. M. & ENKERLIN-HOEFFLICH, E. (2007) Vines and canopy contact: a route for snake predation on parrot nests. *Bird Conserv. Int.* 17: 79–91.
- LACK, D. (1976) *Island biology: illustrated by the land birds of Jamaica.* Oxford, UK: Blackwell Scientific Publications (Studies in Ecology 3).
- LAWRENCE, V. M. (2005) *Urban Development Corporation annual report 2004–2005.* Kingston, Jamaica: Urban Development Corporation. (Unpublished report).
- LEHNERT, M. S. (2008) The population biology and ecology of the homerus swallowtail *Papilio (Pterourus) homerus*, in the Cockpit Country, Jamaica. *J. Insect Conserv.* 12: 179–188.
- MCCALLA, W. (2004) *Protected Area Systems Plan: legal framework.* Kingston. (Unpublished final report).
- MCFARLANE, D. A., LUNDBERG, J. & FINCHAM, A. G. (2002) A late Quaternary paleoecological record from caves of southern Jamaica, West Indies. *J. Cave and Karst Studies* 64: 117–125.
- MINISTRY OF AGRICULTURE (2001) *National forest management and conservation plan.* Kingston: Forestry Department. (Unpublished report).
- MORRISEY, M. (1989) *Our island, Jamaica.* London, UK: Collins.
- RAFFAELE, H. WILEY J., GARRIDO, O., KEITH, A. & RAFFAELE, J. (1998) *A guide to the birds of the West Indies.* Princeton, NJ, USA: Princeton University Press.
- ROSENBERG, G. & MURATOV, I. V. (2005) Status report on the terrestrial Mollusca of Jamaica. *Proc. Acad. Nat. Sci. Philadelphia* 155: 117–161.
- SCHREIBER, E. A. & LEE, D. S. Eds. (2000) *Status and conservation of West Indian seabirds.* Ruston, USA: Society of Caribbean Ornithology (Spec. Publ. 1).
- STATISTICAL INSTITUTE OF JAMAICA (2007) Environmental statistics downloaded from: www.statinja.com/env_stats.html.
- STRONG, A. M. & JOHNSON, M. D. (2001) Exploitation of a seasonal resource by non-breeding Plain and White-crowned Pigeons: implications for conservation of tropical dry forests. *Wilson Bull.* 113: 73–77.
- SVENSSON, S. (1983) *Ornithological survey of the Negril and Black River Morasses, Jamaica.* Appendix VI to Environmental feasibility study of peat mining in Jamaica. Kingston, Jamaica. (Unpublished report).
- TUBERVILLE, T. D. & BUHLMANN, K. A. (2005) Ecology of the Jamaican slider turtle (*Trachemys terrapen*), with implications for conservation and management. *Chelonian Conserv. and Biol.* 4: 908–915.
- WILLIAMS, S. A. (2007) *Strategic management plan for the Royal Palm reserve and the Negril Great Morass.* Negril, Jamaica: Negril Area Environmental Protection Trust. (Unpublished report for BirdLife International and UNEP-GEF).
- WILSON, B. (2008) Battling invasive predators to save the Jamaican Iguana. *Aliens of Xamayca* 1(2).
- WILSON, B. S. & VOGEL, P. (2000) A survey of the herpetofauna of the Hellshire Hills, Jamaica, including the rediscovery of the Bluetailed Galliwasp (*Celestus duquesneyi* Grant). *Carib. J. Sci.* 36: 244–249.



Orangequit
(Euneornis campestris)
 Photo: Hugh Vaughan