

Ridgway's Hawk (*Buteo ridgwayi*)

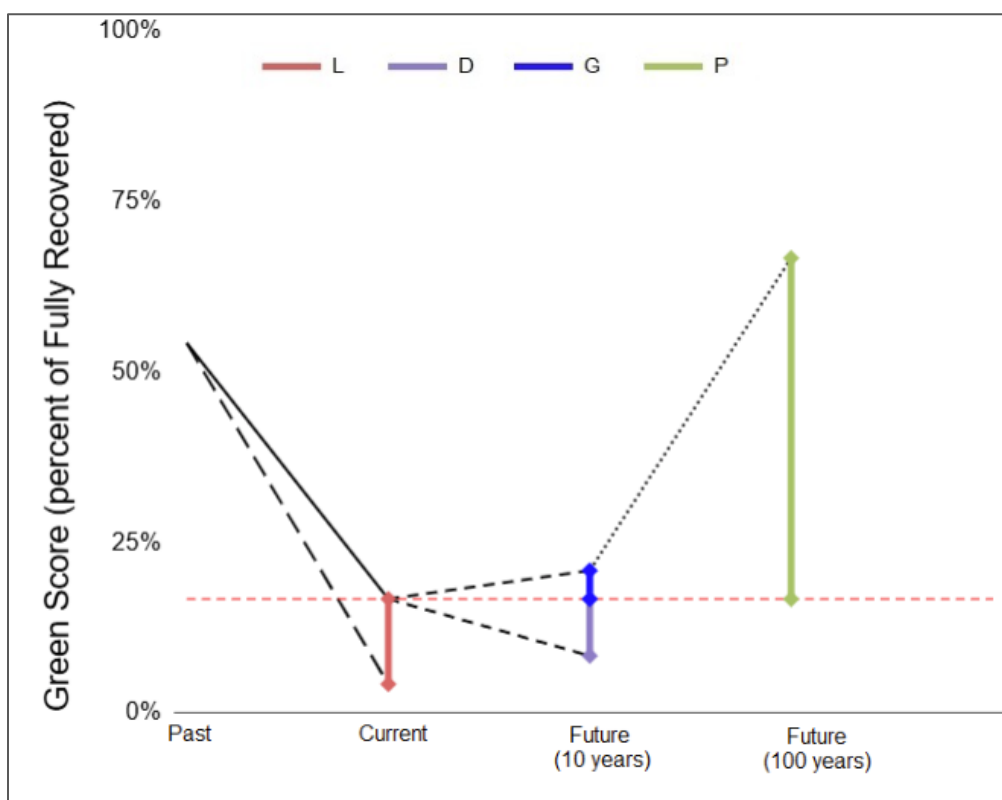


Figure S1. Graphical representation of the conservation metrics based on the Green Scores. Key: Vertical arrows represent the four conservation metrics: L – Conservation Legacy (may not appear if current and counterfactual states are the same); D – Conservation Dependence (may not appear if current and future-without-conservation states are the same); G – Conservation Gain (may not appear if current and future-with-conservation states are the same); P – Recovery Potential (may not appear if current and potential states are the same). Horizontal red dashed line represents the Current Green Score. Solid black line: observed change in the Green Score of the species (ignore it if "Former" state is not specified). Long-dashed black line: (counterfactual) past change expected in the absence of past conservation efforts. Dashed black lines: future scenarios of change expected with and without current and future conservation efforts. Dotted black line: long-term potential change expected with future conservation innovation and efforts.

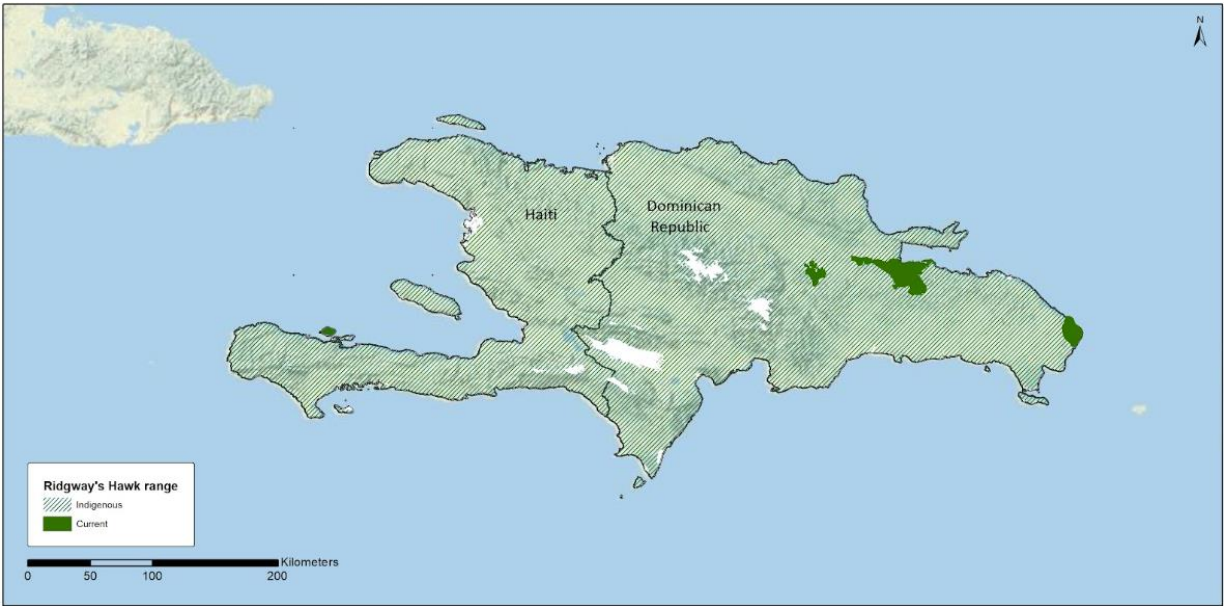


Figure S2. Current (dark green) and indigenous (diagonal hatched) range of Ridgway's Hawk in Hispaniola. The species has been observed in a variety of habitat types ranging in elevation from 0 to 2,000 m above sea level. White areas (with the exception of those along the coast) indicate elevations $\geq 2,000$ m asl.



Figure S3. Current (dark green) and indigenous (diagonal hatched) range of Ridgway's Hawk and the delimitation of eight spatial units (SUs) used for this assessment. SU1 is Les Cayemites islands, SU2 is Gonâve Island, SU3 is Central and north Haiti, SU4 is Sierra de Neiba and Sierra de Baoruco, SU5 is Cordillera Central, SU6 is Cordillera Septentrional, SU7 is Los Haitises and surrounding area, and SU8 is Punta Cana. The current range includes both remnant subpopulations (located in SU7, Los Haitises National Park, and SU1, Les Cayemites islands) and reintroduced subpopulations (located in SU5, Aniana Vargas National Park and SU8, Punta Cana). The species' indigenous range includes the entirety of Hispaniola and several satellite islands between 0–2,000 m asl. White areas (except for along the coast) represent elevations $\geq 2,000$ m asl.

Table S1. Conservation actions relevant to the species in past, present, or future scenarios.

Classification	Full Description	Relevant to species?
1.1.	1.1. Land/water protection: Site/area protection	
1.2.	1.2. Land/water protection: Resource & habitat protection	
2.1.	2.1. Land/water management: Site/area management	x
2.2.	2.2. Land/water management: Invasive/problematic species control	
2.3.	2.3. Land/water management: Habitat & natural process restoration	
3.1.1.	3.1.1. Harvest management	
3.1.2.	3.1.2. Trade management	
3.1.3.	3.1.3. Limiting population growth	
3.2	3.2 Species recovery	x
3.3.1.	3.3.1. Species re-introduction: Reintroduction	x
3.3.2.	3.3.2. Species re-introduction: Benign introduction	
3.4.1.	3.4.1. Ex-situ conservation: Captive breeding/artificial propagation	
3.4.2.	3.4.2. Ex-situ conservation: Genome resource bank	
4.1.	4.1. Education and Awareness: Formal education	
4.2.	4.2. Education and Awareness: Training	
4.3.	4.3. Education and Awareness: Awareness & communications	x
5.1.1.	5.1.1. Legislation, International level	
5.1.2.	5.1.2. Legislation, National level	
5.1.3.	5.1.3. Legislation, Sub-national level	
5.1.4.	5.1.4. Legislation, scale unspecified	
5.2.	5.2. Policies and regulations	
5.3.	5.3. Private sector standards & codes	
5.4.1.	5.4.1. Compliance and enforcement- International level	
5.4.2.	5.4.2. Compliance and enforcement- National level	
5.4.3.	5.4.3. Compliance and enforcement- Sub-national level	
5.4.4.	5.4.4. Compliance and enforcement- Scale unspecified	
6.1.	6.1. Livelihood, economic & other incentives: Linked enterprises & livelihood alternatives	
6.2.	6.2. Livelihood, economic & other incentives: Substitution	
6.3.	6.3. Livelihood, economic & other incentives: Market forces	
6.4.	6.4. Livelihood, economic & other incentives: Conservation payments	
6.5.	6.5. Livelihood, economic & other incentives: Non-monetary values	

Table S2. Threats relevant to the species in past, present, or future scenarios.

Classification	Full Description	Relevant to species?
1.1	1.1 Residential & commercial development: Housing & urban areas	
1.2	1.2 Residential & commercial development: Commercial & industrial areas	
1.3	1.3 Residential & commercial development: Tourism & recreation areas	
2.1.1	2.1.1 Agriculture & aquaculture: Annual & perennial non-timber crops: Shifting agriculture	x
2.1.2	2.1.2 Agriculture & aquaculture: Annual & perennial non-timber crops: Small-holder farming	x
2.1.3	2.1.3 Agriculture & aquaculture: Annual & perennial non-timber crops: Agro-industry farming	
2.1.4	2.1.4 Agriculture & aquaculture: Annual & perennial non-timber crops: Scale Unknown/Unrecorded	
2.2.1	2.2.1 Agriculture & aquaculture: Wood & pulp plantations: Small-holder plantations	
2.2.2	2.2.2 Agriculture & aquaculture: Wood & pulp plantations: Agro-industry plantations	
2.2.3	2.2.3 Agriculture & aquaculture: Wood & pulp plantations: Scale Unknown/Unrecorded	
2.3.1	2.3.1 Agriculture & aquaculture: Livestock farming & ranching: Nomadic grazing	
2.3.2	2.3.2 Agriculture & aquaculture: Livestock farming & ranching: Small-holder grazing, ranching or farming	x
2.3.3	2.3.3 Agriculture & aquaculture: Livestock farming & ranching: Agro-industry grazing, ranching or farming	
2.3.4	2.3.4 Agriculture & aquaculture: Livestock farming & ranching: Scale Unknown/Unrecorded	
2.4.1	2.4.1 Agriculture & aquaculture: Marine & freshwater aquaculture: Subsistence/artisanal aquaculture	
2.4.2	2.4.2 Agriculture & aquaculture: Marine & freshwater aquaculture: Industrial aquaculture	
2.4.3	2.4.3 Agriculture & aquaculture: Scale Unknown/Unrecorded	
3.1	3.1 Energy production & mining: Oil & gas drilling	
3.2	3.2 Energy production & mining: Mining & quarrying	
3.3	3.3 Energy production & mining: Renewable energy	
4.1	4.1 Transportation & service corridors: Roads & railroads	
4.2	4.2 Transportation & service corridors: Utility & service lines	x

Classification	Full Description	Relevant to species?
4.3	4.3 Transportation & service corridors: Shipping lanes	
4.4	4.4 Transportation & service corridors: Flight paths	
5.1.1	5.1.1 Biological resource use: Hunting & collecting terrestrial animals: Intentional use (species being assessed is the target)	
5.1.2	5.1.2 Biological resource use: Hunting & collecting terrestrial animals: Unintentional effects (species being assessed is not the target)	
5.1.3	5.1.3 Biological resource use: Hunting & collecting terrestrial animals: Persecution/control	x
5.1.4	5.1.4 Biological resource use: Hunting & collecting terrestrial animals: Motivation Unknown/Unrecorded	
5.2.1	5.2.1 Biological resource use: Gathering terrestrial plants: Intentional use (species being assessed is the target)	
5.2.2	5.2.2 Biological resource use: Gathering terrestrial plants: Unintentional effects (species being assessed is not the target)	
5.2.3	5.2.3 Biological resource use: Gathering terrestrial plants: Persecution/control	
5.2.4	5.2.4 Biological resource use: Gathering terrestrial plants: Motivation Unknown/Unrecorded	
5.3.1	5.3.1 Biological resource use: Logging & wood harvesting: Intentional use: subsistence/small scale (species being assessed is the target [harvest])	
5.3.2	5.3.2 Biological resource use: Logging & wood harvesting: Intentional use: large scale (species being assessed is the target)[harvest]	
5.3.3	5.3.3 Biological resource use: Logging & wood harvesting: Unintentional effects: subsistence/small scale (species being assessed is not the target)[harvest]	x
5.3.4	5.3.4 Biological resource use: Logging & wood harvesting: Unintentional effects: large scale (species being assessed is not the target)[harvest]	
5.3.5	5.3.5 Biological resource use: Logging & wood harvesting: Motivation Unknown/Unrecorded	
5.4.1	5.4.1 Biological resource use: Fishing & harvesting aquatic resources: Intentional use: subsistence/small scale (species being assessed is the target)[harvest]	
5.4.2	5.4.2 Biological resource use: Fishing & harvesting aquatic resources: Intentional use: large scale (species being assessed is the target)[harvest]	
5.4.3	5.4.3 Biological resource use: Fishing & harvesting aquatic resources: Unintentional effects: subsistence/small scale (species being assessed is not the target)[harvest]	

Classification	Full Description	Relevant to species?
5.4.4	5.4.4 Biological resource use: Fishing & harvesting aquatic resources: Unintentional effects: large scale (species being assessed is not the target)[harvest]	
5.4.5	5.4.5 Biological resource use: Fishing & harvesting aquatic resources: Persecution/control	
5.4.6	5.4.6 Biological resource use: Fishing & harvesting aquatic resources: Motivation Unknown/Unrecorded	
6.1	6.1 Human intrusions & disturbance: Recreational activities	
6.2	6.2 Human intrusions & disturbance: War, civil unrest & military exercises	x
6.3	6.3 Human intrusions & disturbance: Work & other activities	x
7.1.1	7.1.1 Natural system modifications: Fire & fire suppression: Increase in fire frequency/intensity	
7.1.2	7.1.2 Natural system modifications: Fire & fire suppression: Suppression in fire frequency/intensity	
7.1.3	7.1.3 Natural system modifications: Fire & fire suppression: Trend Unknown/Unrecorded	
7.2.1	7.2.1 Natural system modifications: Dams & water management/use: Abstraction of surface water (domestic use)	
7.2.2	7.2.2 Natural system modifications: Dams & water management/use: Abstraction of surface water (commercial use)	
7.2.3	7.2.3 Natural system modifications: Dams & water management/use: Abstraction of surface water (agricultural use)	
7.2.4	7.2.4 Natural system modifications: Dams & water management/use: Abstraction of surface water (unknown use)	
7.2.5	7.2.5 Natural system modifications: Dams & water management/use: Abstraction of ground water (domestic use)	
7.2.6	7.2.6 Natural system modifications: Dams & water management/use: Abstraction of ground water (commercial use)	
7.2.7	7.2.7 Natural system modifications: Dams & water management/use: Abstraction of ground water (agricultural use)	
7.2.8	7.2.8 Natural system modifications: Dams & water management/use: Abstraction of ground water (unknown use)	
7.2.9	7.2.9 Natural system modifications: Dams & water management/use: Small dams	
7.2.10	7.2.10 Natural system modifications: Dams & water management/use: Large dams	
7.2.11	7.2.11 Natural system modifications: Dams & water management/use: Dams (size unknown)	

Classification	Full Description	Relevant to species?
7.3	7.3 Natural system modifications: Other ecosystem modifications	
8.1.1	8.1.1 Invasive & other problematic species, genes & diseases: Invasive non-native/alien species/diseases: Unspecified species	
8.1.2	8.1.2 Invasive & other problematic species, genes & diseases: Invasive non-native/alien species/diseases: Named species	
8.2.1	8.2.1 Invasive & other problematic species, genes & diseases: Problematic native species/diseases: Unspecified species	
8.2.2	8.2.2 Invasive & other problematic species, genes & diseases: Problematic native species/diseases: Named species	x
8.3	8.3 Invasive & other problematic species, genes & diseases: Introduced genetic material	
8.4.1	8.4.1 Invasive & other problematic species, genes & diseases: Problematic species/diseases of unknown origin: Unspecified species	
8.4.2	8.4.2 Invasive & other problematic species, genes & diseases: Problematic species/diseases of unknown origin: Named species	
8.5.1	8.5.1 Invasive & other problematic species, genes & diseases: Viral/prion-induced diseases: Unspecified "species" (disease)	
8.5.2	8.5.2 Invasive & other problematic species, genes & diseases: Viral/prion-induced diseases: Named "species" (disease)	
8.6	8.6 Invasive & other problematic species, genes & diseases: Diseases of unknown cause	
9.1.1	9.1.1 Pollution: Domestic & urban waste water: Sewage	
9.1.2	9.1.2 Pollution: Domestic & urban waste water: Run-off	
9.1.3	9.1.3 Pollution: Domestic & urban waste water: Type Unknown/Unrecorded	
9.2.1	9.2.1 Pollution: Industrial & military effluents: Oil spills	
9.2.2	9.2.2 Pollution: Industrial & military effluents: Seepage from mining	
9.2.3	9.2.3 Pollution: Industrial & military effluents: Type Unknown/Unrecorded	
9.3.1	9.3.1 Pollution: Agricultural & forestry effluents: Nutrient loads	
9.3.2	9.3.2 Pollution: Agricultural & forestry effluents: Soil erosion, sedimentation	
9.3.3	9.3.3 Pollution: Agricultural & forestry effluents: Herbicides & pesticides	
9.3.4	9.3.4 Pollution: Agricultural & forestry effluents: Type Unknown/Unrecorded	
9.4	9.4 Pollution: Garbage & solid waste	
9.5.1	9.5.1 Pollution: Air-borne pollutants: Acid rain	
9.5.2	9.5.2 Pollution: Air-borne pollutants: Smog	

Classification	Full Description	Relevant to species?
9.5.3	9.5.3 Pollution: Air-borne pollutants: Ozone	
9.5.4	9.5.4 Pollution: Air-borne pollutants: Type Unknown/Unrecorded	
9.6.1	9.6.1 Pollution: Excess energy: Light pollution	
9.6.2	9.6.2 Pollution: Excess energy: Thermal pollution	
9.6.3	9.6.3 Pollution: Excess energy: Noise pollution	
9.6.4	9.6.4 Pollution: Excess energy: Type Unknown/Unrecorded	
10.1	10.1 Geological events: Volcanoes	
10.2	10.2 Geological events: Earthquakes/tsunamis	
10.3	10.3 Geological events: Avalanches/landslides	
11.1	11.1 Climate change & severe weather: Habitat shifting & alteration	
11.2	11.2 Climate change & severe weather: Droughts	
11.3	11.3 Climate change & severe weather: Temperature extremes	
11.4	11.4 Climate change & severe weather: Storms & flooding	x
11.5	11.5 Climate change & severe weather: Other impacts	
12.1	12.1 Other threat	

Appendix 1. Assessor Self-Review

1. Disclose any potential conflicts of interest, which could bias the assessment.

None

2. Is there any discrepancy between this assessment and the Red List assessment for the species? If so, comment on the likely reason for this discrepancy.

1) We question the indigenous distribution for Ridgway's Hawk as currently presented by BirdLife International and the species' Red List Assessment. Their maps appear to be based on the historic occurrence of forested habitat in Hispaniola. Although we do strongly agree that the species does occupy and reproduce in forested habitat between 0–2,000 m asl, the species has established breeding territories successfully in additional habitat types including lowland scrub, riparian and disturbed woods, marshlands, and human-modified landscapes such as lower montane pastures and agricultural fields (or open habitat; e.g. Wiley and Wiley 1981; Thorstrom *et al.* 2005, 2007; McClure *et al.* 2017).

We agree with Wiley and Wiley (1981) that the species appears more tolerant of a wider variety of habitat types than previously thought that were largely based on sample locations of a few museum specimens and limited information about its habitat preference. Provided that sufficient nesting structures and adequate prey are available, while also assuming their key threats are reduced (i.e. human persecution and *Philornis* nestling infestation), the species appears to thrive within areas also located outside of existing forested habitat (e.g. Punta Cana population in the Dominican Republic; McClure *et al.* 2017). In fact, almost 80% of the known Ridgway's Hawk nests (n=99) over a two-year period within and surrounding Los Haitises National Park were in trees located in areas of active (38%) or abandoned (7–30 years; 37%) agriculture and pasture (4%), with the remaining nests in primary and secondary forests (20%; Thorstrom *et al.* 2007). For these reasons, we believe that the species' indigenous range should not be limited to contiguous patches of historic forested habitat as currently displayed in the distribution maps. Instead, we argue that the species likely once occupied most of Hispaniola within a wider variety of habitat types that also included both forest edge and open areas, provided that mature trees were available for nesting purposes. Our range maps for the species therefore include a larger overall area of indigenous occupied area with spatial unit delineations along geological, specifically lower elevation mid-points located among the prominent mountain ranges within Hispaniola, and geopolitical boundaries between the two countries of Haiti and the Dominican Republic.

2) Number of known mature individuals is 439 (as of 2023) instead of 322 as reported in the species' Red List assessment. The discrepancy is likely due to when the assessment was last updated in 2020. Similarly, the number of mature individuals in the largest subpopulation is not 1–50 as reported in the assessment in the "Population in detail" section, but rather 340 adult hawks in the Los Haitises subpopulation. Not sure about the reason of that discrepancy because a total of 268 mature individuals was recorded in Los Haitises in 2020 when the assessment was last updated.

3) The Conservation Actions as reported in the species' Red List were mostly accurate with the exception of the following few items:

3a. We no longer think that "3.4.1. Ex-situ conservation: Captive breeding/artificial propagation" is a necessary action for the species' conservation. We believe that captive propagation and release efforts are unlikely to be of benefit to the species given the positive gains achieved in reproductive productivity from treating nests against *Philornis* parasite infestation and the importance of environmental education in reducing persecution of hawks in the local communities. The species is increasing in numbers in areas of the Dominican Republic where those conservation actions have been instituted (e.g. Los Haitises and Punta Cana).

3b. Conservation action 3.2 (Species Recovery) should be indicated on the Red List assessment to highlight the importance of treating the species' nests against *Philornis* infestation. Although *Philornis pici*, the main species that infests nestlings, is native to Hispaniola, we suspect Ridgway's Hawk should be able to persist without treatment against the parasite once the hawk's population has achieved a minimum density. Current research is underway to determine the minimum population size and density necessary to achieve that goal. Until that happens, however, nest treatment against *Philornis* infestation is a highly effective conservation action for increasing nestling survival and allowing the population to increase in abundance.

3c. Additional research will also be conducted to determine if increased infestation of *Philornis* is related to changes in habitat or other factors associated with human related habitat modification (threat 8.2.2).

3. Review the impact that you assigned to the various threats and conservation actions. Would the trajectory of the species be very different if other choices were made? If so, review your justification for these choices. If appropriate, widen the bounds on tabs 4 and 5-8 (change the lower and upper plausible values) to reflect the uncertainty introduced by the possibility of these other choices. How, if at all, did this review question cause this assessment to change? If no changes were needed, please write "no changes".

We believe that increased cattle and other livestock ranching could result in a greater amount of forest conversion to pasture (threat category 2.3.2) and could negatively impact the species. This threat is not indicated on the current Red List assessment for the species. However, we believe that the other Agriculture-based threats (2.1.1 and 2.2.2) that were indicated as threats, likely capture that concern sufficiently to not make much difference in the species' recovery trajectory given its current level of impact. If cattle ranching, for example, was intensified, it could certainly have a greater impact on forest habitat loss on the island, particularly in the Dominican Republic where intact parcels of forest still remain.

We also believe that war and civil unrest (threat 6.2) has had a significant impact on the species, particularly in Haiti, and it has prevented current and future conservation efforts within that country. Until safe, surveys for the species, for example, are unlikely to occur in areas within Haiti. We have, however, included the possibility that future conservation efforts as successfully employed in the Dominican Republic could also be used in Haiti with the goal of restoring the species in those areas once safe to do so.

References

- McClure, C.J.W., Rolek, B.W., Hayes, T.I., Hayes, C.D., Thorstrom, R., Curti, M. and Anderson, D.L. 2017. Successful enhancement of Ridgway's Hawk populations through recruitment of translocated birds. *The Condor* 119: 855–864.
- Thorstrom, R., Almonte, J., de la Rosa, S.B., Rodríguez P. and Fernández, E. 2005. Surveys and breeding biology of *Buteo ridgwayi* (Ridgway's Hawk) in Los Haitises, Dominican Republic. *Caribbean Journal of Science* 41: 864–869.
- Thorstrom, R., Almonte, J. and de la Rosa, S.B. 2007. Current status and breeding biology of the Ridgway's Hawk. In: K.L. Bildstein, D.R. Barber and A. Zimmerman (eds), *Neotropical Raptors: Proceedings of the Second Neotropical Raptor Conference*, Iguazú, Argentina, 2006, pp. 33–38. Hawk Mountain Sanctuary, Kempton, PA, US.
- Wiley, J.W. and Wiley, B.N. 1981. Breeding season ecology and behavior of Ridgway's Hawk (*Buteo ridgwayi*). *The Condor* 83: 132–151.