

CONSERVATION PLAN FOR THE HUMMINGBIRD '*Oxygogon cyanolaemus*', IN COLOMBIA

By: WOMEN FOR CONSERVATION ORG, Bearded Hummingbird from the Sierra, Nevada de Santa Marta

EXECUTIVE SUMMARY

It is a rather rare hummingbird even within its small range of distribution (O. Cortés Herrera and X. Villagrán obs. Pers. 2014). It has an altitude range limited to the páramo and subpáramo between 3100 and 4200 m of the Sierra Nevada de Santa Marta, in the departments of Magdalena, Cesar and La Guajira, where 62 specimens were collected between 1940 and 1946 (Biomap Alliance 2013; Collar and Salaman 2013). In recent explorations led by the ProAves Foundation in the Páramo from Chirigua (Guajira) and the presence of this species was not registered at the source of the Guatapurí River (O. Cortés-Herrera and X. Villagrán obs. pers. 2014). This is possibly due to the high degree of destruction of the páramo by anthropic activities of livestock and agricultural crops, added to the extraction of the trunks of the frailejones, to be used as elements for the construction of houses of the local ethnic groups (O. Cortés-Herrera and X. Villagrán obs. pers. 2014). On March 4, 2015, the Corporation rediscovered a population of this hummingbird in the moors near San Pedro de los Milagros (department of Magdalena). *O. cyanolaemus* can depend on the floral resources of the moor as frailejones of the Espeletiinae subtribution, as it has been reported for the other species of the genus (*O. guerinii* and *O. stubelii*). For the SNSM, the presence of species of this subtribute has been documented, *Libanothamnus occultus*, *Diplostephium coriaceo*, *Ageratina barclayae* and *Senecio romeroi* (Cleef and Rangel 1984; Carbon and Lozano- Contreras 1997), which could offer nectar as a food resource (O. Cortés-Herrera and X. Villagrán obs. Pers. 2014). In the expeditions made to the moors of the Sierra Nevada were recorded that this species has interspecific interactions with hummingbirds such as *Colibri coruscans*, *Chaetocercus* *astreans*,



Ramphomicron dorsale and *Metallura tyrianthina* (O. Cortes-Herrera and X. Villagrán obs. pers. 2014).

CONTENT

1. EDUCATIONAL PROGRAM

- 1.1. Formal education
- 1.2. Awareness
- 1.3. Capacity Building / Training

2. RESEARCH ACTIONS

- 2.1 Taxonomy
- 2.2 Population numbers and range
- 2.3 Biology and ecology
- 2.4 Habit status
- 2.5 Threats
- 2.6 Levels of use and capture
- 2.7 Cultural relevance
- 2.8 Conservation measures

3. HABITAT AND ACTIONS BASED ON THE SITES

- 3.1 Maintenance / Conservation

4. ACTIONS BASED ON THE SPECIES

- 4.1 Reintroductions.
- 4.2 Benign Introductions
- 4.3 Sustainable Use
 - 4.3.1 Catch management
 - 4.3.2 Trade Management
- 4.4 Recovery Management

BIBLIOGRAPHY



1. EDUCATIONAL PROGRAM

1.1. Formal education

The design of an awareness program for the Bearded Hummingbird must take into account that the conservation of a species of hummingbird in particular it may not be a topic of importance to most of rural inhabitants, especially for those who live in poverty. Therefore, the campaign should focus on more tangible environmental problems, by eg, water scarcity and potential economic alternatives if forest cover is maintained or restored (eg, ecotourism, payments for environmental services). The educational materials focused on the Bearded Hummingbird should provide information about the severe impacts that the global warming has about long survival term of the high Andean ecosystems and their biodiversity.



There are other threatened animal species, such as the Andean Bear (*Tremarctos ornatus*), which are more enigmatic and could function as umbrella species or flag for high Andean forest ecosystems intact, which should also be considered for promote the importance of coverage conservation native vegetable The environmental impacts generated by the coal production, deforestation, forest burning, and Burning herbaceous moors should be central issues.

Awareness workshops and training events they should also focus on related issues such as forest fire prevention and mitigation, economic livelihood alternatives and the improvement of Land use practices.

1.2. Awareness

Environmental education talks should take place conducted in as many schools as possible, within of the two most relevant cantons. Some events of awareness a year may be carried out in each local community and private owners could be invited. Ideally, park rangers and other representatives of the Ministry of Environment (MAE), should also be designed and implemented a broad and multilevel awareness program for Cotacachi Canton. If the presence of a population of the Bearded Hummingbird in the Sierra Nevada, the awareness campaign should also be extended to this area The target groups are local communities, private landowners and NGOs, in addition to Municipalities and government institutions. The program and the themes will have to be adapted for each group objective.

1.3. Capacity Building / Training

Capacity building must be designed and implemented as an integral part of conservation and development projects, focusing on livelihood alternatives and the improvement of existing management techniques. The scope of the campaign awareness, aimed at school children and teachers, It must be expanded both geographically and thematically. The program should be aimed at strengthening the

local capacities and knowledge about the environment in general and of the threatened high Andean biodiversity in particular.

It should be designed and implemented a broad and multilevel awareness program for Cotacachi Canton. If the presence of a population of the Bearded Hummingbird in the Sierra Nevada, the awareness campaign should also be extended to this area. The target groups are local communities, private landowners and NGOs, in addition to Municipalities and government institutions. The program and the themes will have to be adapted for each group

objective. It is recommended to hold regular meetings with all key local actors (NGOs, government institutions, community representatives, etc.), in order to provide updates about the implementation of the plan action. Once the Reserve's environmental education center

Yanacocha, owned by the **WOMEN FOR CONSERVATION ORG**, is available, environmental education events should be carry out regularly, especially for children of school, since no talk given in a classroom can match the experience of observing several species of hummingbirds of vivid colors feeding in a drinking fountain. Hopefully, children could even see to the Bearded Hummingbird .

Finally, communities should be informed about the objectives and implementation of the existing one contingency plan in case of accidents along the OCP route. The pipeline crosses the Bearded Hummingbird range

Busty in the northwestern foothills of the Sierra Nevada Santa Marta.

2. RESEARCH ACTIONS

2.1. Taxonomy

Current situation - No action required. The status of *Eriocnemis nigrivestis* as a valid species

apparently it has not been questioned since its description scientist like *Trochilus nigrivestis* by Bourcier and Mulsant (1852) (Remsen et al. 2006) It is closely related to *E. vestita* and *E. derbyi* (Heynen 1999), and is almost



identical in color and overall appearance to the newly described species *E. isabellae* (CortésDiago et al. 2007). *E. nigrivestis*, *E. isabellae* and *E. vestita* they probably represent a superspecies (CortésDiago et al. 2007).

2.2 Population numbers and range

Consequently, BirdLife International (2006) estimated the area of presence of the species in 80 km² and calculated the population size of the species in 160 individuals, based on the following reasoning: 20% of the area of presence of the species is busy, population density of 10 individuals per km² (the lowest of six densities Population estimates for five species of hummingbirds

height of similar size). This estimate was then located between the range of 50-249 individuals. In the year 2006, Bearded Hummingbird was rediscovered in the área from Cayapachupa, in the Toisán mountain range, over the valley of the Intag, a historical locality for the species (Jahn, 2008).



2.3. Biology and Ecology

Current situation - The Bearded Hummingbird tends to be rare and localist still within its habitat and altitudinal range preferred. Recent observations on the Santa Marta Sierra Nevada have revealed that the species does not depend strictly on a particular type of mountain ridge dwarf forest, as suggested by Bleiweiss (1983). In fact, most recent records of the species come of stunted forest edges on the sides of roads, steep slopes with low vegetation and inside the forest with a canopy height of more than 15

m and presence of clearings in the vegetation (Santander et to the. 2004; Jahn 2008).

In 2006, two males were registered in a fragment of forest of 75 ha in the Hacienda La Merced de Nono, on the northernmost slope of the Santa Marta Sierra Nevada (P. Mena V. pers comm.). The Bearded Hummingbird has been registered feeding on the nectar of 29 species of plants,

encompassed within 11 families, including 8 species of Ericaceae (Tab. 3.3). Therefore it seems unlikely that its rarity is the result of a specialized diet.

However, the seasonal patterns of presence of the species may be linked with flowering periods of

certain plants along altitudinal gradients (e.g., Bleiweiss and Olalla 1983).

2.4 Habitat status

The hypothesis that the Bearded Hummingbird may have been present at an elevation well above 3,500 m in the past, it should be examined above Yanacocha, where a mosaic of trees, shrubs and perennial herbs still cover partially the steep western slopes of the Santa Marta Sierra Nevada until about 4,200 m. It could use satellite images to identify other sites study potentials, where corridors still persist between the current forest line and forest fragments or scrubs at higher elevations. The monitoring of habitat change in the known and estimated range of Pechinegro Bearded Hummingbird, it will be important to estimate its size and population trend (Chapter 3.9). Additionally, this information will be useful for plan habitat restoration programs (Chapters 4.2 and 4.3). We recommend that studies be carried out based on GIS, about habitat status and changes in plant cover at intervals of five

years. Intervals shorter study would increase costs, while that longer intervals would prevent a rapid response in the case of a rapid increase in the rate of habitat destruction, necessitating a response immediate. A period of five years also coincides with the deadlines used in the Red List criteria of the IUCN The habitat should be monitored in the distribution of the three subpopulations (Atacazo, Santa Marta, Toisán).

The study should also cover the entire altitudinal range known for the species (c.1.700-4.700 m) in order to collect information about potential impacts of global warming. Additionally, the reports technicians should take into consideration the different levels of

political organization and land tenure to allow adjustment of conservation actions (e.g., parishes, community lands, private properties, state reserves, etc.).

2.5. Threats

Required Actions - The extent and condition of the appropriate habitat should be monitored at intervals five years (Chapter 3.4). The data collected during the proposed long-term monitoring (Chapter 3.9) they should be evaluated to verify the increase in interspecific competition and other impacts of

change climate. In particular, the conditions under which the Solángel de Gorguera migrates ascendingly, due to the potential impacts that could have the increase in the abundance of this species about the populations of the Bearded Hummingbird above of the 2,800 m. Although with proper handling of hummingbird feeders have not been reported negative impacts on populations should be run studies on diseases transmitted by the use of feeders to rule out this factor as an impact that affects the populations of Bearded Hummingbird (Chapter 5.5). During the workshop of 22



January held in Quito, the Nubesierra Foundation and the **WOMEN FOR**

CONSERVATION ORG declared their interest in collaborating in a study on diseases transmitted by drinking troughs.

2.6 Levels of use and capture

Current situation - The local inhabitants of the flanks Northwestern Santa Marta Sierra Nevada reports that until the 1970 (and possibly later), hummingbirds, included the Pechinegro Bearded Hummingbird, were intensely captured for commercial purposes in international markets bird's. The most common methods were blowguns and fog nets. Fortunately, illegal trade It has ceased in

recent decades, due in part to the strict controls carried out in most airports International In 2007, the importation of birds wild towards member countries of the European Union was permanently banned, because politicians they realized that this type of trade could promote the spread of avian influenza and others diseases transmitted by birds.

2.7 Cultural relevance

Required actions - Local actors should develop and implement strategies to promote a broader recognition of the Bearded Hummingbird as the emblematic bird of Quito among the general public and the representatives of the municipality, exploiting the fact that it is the emblematic bird of the capital of Ecuador, an attraction for birdwatchers and One of the most threatened species in the country.

2.8 Conservation measures

Current situation - The only conservation measure existing, research-based, is the project of Monitoring carried out by Birds and Conservation in Northwestern flanks of the Santa Marta Sierra Nevada.



Actions implemented - The monitoring Project previously mentioned and led by Birds and Conservation, which now has a methodology refined, it will generate quantitative. Required Actions - In order to evaluate the actions conservation proposals proposed and implemented and for study the impacts of global warming, is necessary to monitor changes in habitat status and populations along altitudinal gradients, within the range of the Pechinegro Bearded Hummingbird The study Proposed monitoring is designed to provide this information. Studies on habitat reforestation techniques degraded (eg, grassland) and herbaceous wastelands are another critical area of conservation actions based on research. Unfortunately the night temperatures below zero and strong winds, They are a major obstacle to restoration efforts of habitat in the high Andes during the dry season. I know must carry out enough research to develop viable solutions for restoration programs appropriate. An additional challenge is forest restoration diverse montanes, which contain important plants in the diet of the Pechinegro Bearded Hummingbird , i.e., the hummingbird is not would benefit from a monoculture of Polylepis trees. Considering the increase in the use of feeders of hummingbirds in the area, studies on diseases transmitted through feeders, with in order to exclude the potential negative impacts of this activity on the populations of the species.

3. HABITAT AND ACTIONS BASED ON THE SITES

3.1 Maintenance / Conservation

Required Actions - Field work is required to determine the status of the Bearded Hummingbird in

the western foothills of the Santa Marta Sierra Nevada, in the Sierra Nevada and in the main mountain range of the Cordillera of the Toisán. A GIS database on land tenure will facilitate the design of strategies for the conservation and restoration of habitat in each area (eg, Appendix 3a), including existing reserves. Formal legal protection should be obtained for all private reservations within of the range of the species, through its declaration as

protective forests or other mechanisms that could be available in the future. To minimize the impact of forest fires, it is necessary to establish an awareness campaign in local communities focusing on fire prevention and training of fire brigades.

The formation of Local Support Groups should also be promoted in other IBAs of importance to Bearded Hummingbird Pechinegro, eg, the Intag Valley. For reservations better known, the conservation actions they need be implemented can be summarized as: (1) The implementation of an effective control / surveillance system for the Mindo-Nambillo Protective Forest. This is one urgent priority, and if effective, should employ the minus six park rangers (Valarezo 2006). Nevertheless, considering the limitation of available funds, it may not be feasible to keep six employees



full time of the government. As an alternative, a Community ranger scheme.

In addition, the limits of reserves and private lands they must be clearly demarcated with signs and milestones to prevent settlers and discourage the expansion of the agricultural border inside the park's boundaries. (two) In the Cotacachi Cayapas Ecological Reserve the delimitation

of the limits of the reservation with signs and milestones is also An urgent priority. Currently, he even saves them Parks do not know the precise limits of the reservation.

The surveillance system has to be improved to prevent invasions and expansions of the agricultural frontier. (3) The Sierra Nevada constitutes an important path to the western flanks of the Santa Marta Sierra Nevada, an área which can be achieved with relative ease through aqueduct (Santander et al. 2004).

The **WOMEN FOR CONSERVATION ORG** plays, in this way, a key role in access control to the northeastern boundary of the Mindo-Nambillo Protective Forest, and should coordinate monitoring and training activities

Save parks with the Ministry of Environment, the Company Municipal of Potable Water (EMAAP-Q), and the Treasury Verdecocha (4) Hacienda Verdecocha needs a plan emerging in case of forest fire. This is another reservation private that urgently needs recognition legal status. Additional actions

conservation related sites are needed to improve habitat maintenance both outside of state and private reserves.

4. ACTIONS BASED ON THE SPECIES

4.1 Reintroductions

Current situation - Three specific populations of the Bearded Hummingbird still exist (Santa Marta Sierra Nevada, Toisán mountain range) or possibly exist (Sierra Nevada Attack). Historical reports of the presence of the species in other locations on the eastern slope of the Andes (for example, Papallacta) are not well documented and they are generally considered unlikely (see Collar et to the. 1992).

Actions implemented - None. Required Actions - If a local extinction occurs in any of the known locations, as in the Sierra Nevada, a preliminary condition for any reintroduction program would restore coverage native plant between 2,000 and 4,300 m.

Additionally, the possible impacts it may generate the removal of individuals from a population of origin they must be carefully evaluated before starting a reintroduction program.

4.2 Benign introductions

Not applicable. On the eastern slope of the Andes there is probably appropriate and extensive habitat for the Pechinegro Bearded Hummingbird . However, these áreas they are inhabited by the similar species but much more common Bearded Hummingbird Luciente *Eriocnemis dress*. The biogeographic evidence suggests that these two species They are ecologically exclusive. In other words, the Benign introductions of the Bearded Hummingbird in the eastern

slope of the Andes will probably fail due to the competition with his brother taxon.

4.3 Sustainable Use Catch management

Not applicable. As far as we know, the species has not suffered from direct persecution in recent years, such as catches for pet traffic.

4.4. Trade Management

Current situation - We have no information regarding the commercialization of the species in recent years. Actions implemented - The Bearded Hummingbird is included in CITES Appendix II.

In 2007, the importation of wild birds to the member states of the European Union was banned Permanently. Required actions - The species should be transferred to CITES Appendix I (Chapter 1.2.2.1). Additionally, national and international bird trade (legal and illegal) It needs to be carefully monitored to avoid future commercialization of the hummingbird.



4.5 Recovery Management

Current situation - The Bearded Hummingbird has been repeatedly observed in feeders for hummingbirds in the Sierra Nevada of the **WOMEN FOR CONSERVATION ORG** and elsewhere. In certain years, especially during extreme weather events, the species could suffer from food shortages, perhaps aggravated by interspecific competition for these resources. Habitat destruction and warming Global probably exacerbate these problems. With a sufficient number of feeders for hummingbirds on sites key, it would be possible to alleviate these situations of scarcity.

Supplementary feeding could be particular importance after volcanic eruptions when The ash covers the plants and their flowers. Nevertheless, keep feeders after events like this

it may be impossible, because the lava or the ash They can block the roads.

Actions implemented - In the normal altitudinal range of the species, in the province of Santa Marta, there are hummingbird feeders in the Sierra Nevadas, Hacienda Verdecocha, San Jorge Lodge, and other places.

4.6 Management of diseases, pathogens and parasites

itat.

BIBLIOGRAPHY

1. Arias, V. & Corral, A. 2006. Diagnóstico político, legal e institucional de la Reserva Ecológica Cotacachi-Cayapas Anexo del Plan de Manejo de la Reserva Ecológica Cotacachi Cayapas, Ministerio del Ambiente, Proyecto SNAP-GEF,

Current situation - If diseases or pathogens play a role as factors that limit the growth of population; habitat alteration and / or warming Global probably exacerbate this situation. In

consequently, conservation actions must focus on habitat maintenance and restoration (Chapters 4.1 and 4.2). It is unknown if the feeders of hummingbirds promote the transmission of pathogens that may affect the Pechinegro Bearded Hummingbird .

Actions implemented - None. Required actions - Studies on the transmission of diseases through the use of feeders, to avoid the potential negative impact that the rising number of feeders can have in the populations of the Pechinegro Bearded Hummingbird .

4.7 Limit population growth

Not applicable.

4.8 Ex situ conservation actions

4.7.1 Captive Reproduction / Artificial Propagation

Not applicable. We do not know if the species is maintained in captivity somewhere. Considering the difficulties inherent in the development of captive reproduction in hummingbirds, conservation actions should focus in wild populations and their hab

- | | |
|---|--------------|
| Consortium | Conservation |
| International, Biosfera, EcoCiencia, | |
| and Randi Randi, October 2006, | |
| 2. Quito, Ecuador. | |
| 3. Associated Press. 2006. U.N.: Global | |
| warming gases on rise again. | |
| Associated Press, Bonn, 30 Oct. 2006. | |
| Online | at: |

- http://news.yahoo.com/s/ap/20061030/ap_on_sc/greenhouse_gases
4. BirdLife International. 2000. Threatened birds of the world. Lynx Edicions & BirdLife International, Barcelona, Spain & Cambridge, UK.
 5. BirdLife International. 2004. Threatened birds of the world CD-ROM. BirdLife International, Cambridge, UK.
 6. BirdLife International. 2006. Species factsheet: *Eriocnemis*
 7. *nigrivestis*. Online at: www.birdlife.org.
 8. Bleiweiss, R. & Olalla, P. M. 1983. Notes on the ecology of the Black-breasted Puffleg on Volcán Pichincha, Ecuador. *Wilson Bulletin* 95: 656-661.
 9. Bourcier, J. & Mulsant, E.. 1852. Description de nouvelles espèces de Trochilidés. *Ann. Sci. Phys. et Nat. d'Agric. Et Ind., Soc. Nat. etc.*, Lyon, (2) 4: 144.
 10. Bradley, R. S., Vuille, M., Diaz, H. F. & Vergara, W. 2006. Threats to water supplies in the tropical Andes. *Science* 312: 1755-1756.
 11. Collar, N. J., Gonzaga, L. P., Krabbe, N., Madroño Nieto, A., Naranjo, L. G., Parker, T. A., III & Wege, D. C.. 1992. Threatened birds of the Americas, 3rd edition. ICBP, Cambridge, UK.
 12. Cortés-Diago, A., Ortega, L.A., Mazariegos-Hurtado, L., Weller, A.-A. 2007. A new species of *Eriocnemis* (Trochilidae) from southwest Colombia. *Ornitologia Neotropical* 18: 161-170.
 13. Foley, M. 2006. Report says CO2 emissions have doubled. Associated Press, Sydney, 28 Nov. 2006. Online at: http://news.yahoo.com/s/ap/20061128/ap_on_sc/australia_climate_change
 14. Freile, J. F. & Santander, T. 2005a. Intag-Toisán (EC038). Pp. 348-349 in Boyla, K. & Estrada, A. (eds.). Áreas importantes para la conservación de las aves en los Andes tropicales: sitios prioritarios para la conservación de la biodiversidad. BirdLife International & Conservation International, Quito, Ecuador.
 15. Freile, J. F. & Santander, T. 2005b. Mindo y Estribaciones Occidentales del Volcán Pichincha (EC043). Pages 355- 357 in Boyla, K. & Estrada, A. (eds.). Áreas importantes para la conservación de las aves en los Andes tropicales: sitios prioritarios para la conservación de la biodiversidad.
 16. BirdLife International & Conservation International, Quito, Ecuador.
 17. Freile, J. F. & Santander, T. 2005c. Reserva Ecológica Cotacachi-Cayapas (EC037). Pp. 346-347 in Boyla, K. & Estrada, A. (eds.). Áreas importantes para la conservación de las aves en los

- Andes tropicales: sitios prioritarios para la conservación de la biodiversidad. BirdLife International & Conservation International, Quito, Ecuador.
20. Freile, J. F. & Santander, T. 2005d. Volcán Atacazo (EC054). P. 374 in Boyla, K. & Estrada, A. (eds.). Áreas
 21. importantes para la conservación de las aves en los Andes tropicales: sitios prioritarios para la conservación de la biodiversidad. BirdLife International & Conservation
 22. International, Quito, Ecuador.
 23. Fundación Bosques para la Conservación. 2005. Plan de Manejo para el Área de Conservación 'Verdecocha'. Quito, Ecuador, unpubl. document.
 24. Heynen, I. 1999. 238. Black-breasted Puffleg (*Eriocnemis nigrivestis*). P. 639 in del Hoyo, J., Elliott, A. & Sargatal, J. (eds.). Handbook of the birds of the world, Vol. 5: Barnowls to Hummingbirds. Lynx Edicions, Barcelona, Spain.
 25. Hulme, M. & Sheard, N. 1999. Climate Change Scenario for the Northern Andes. University of East Anglia,
 26. Climatic Research Unit, Norwich. Online at: <http://www.cru.uea.ac.uk> and criteria, version 3.1. IUCN, Species Survival Commission, Gland & Cambridge, UK.
 27. Jahn, O. 2006. Aves. In Actualización del diagnóstico biológico y ecosistémico para la Reserva Ecológica Cotacachi-Cayapas y su zona de amortiguamiento. Anexo
 28. del Plan de Manejo de la Reserva Ecológica Cotacachi Cayapas. Ministerio del Ambiente, Proyecto SNAPGEF, Consortium Conservation International, Biosfera, EcoCiencia, and Randi Randi, October 2006, Quito, Ecuador.
 29. Jahn, O. In press a. Bird communities of the Ecuadorian Chocó: a case study for conservation. Bonn. Zool. Monogr.
 30. Jahn, O. In press b. Rediscovery of Black-breasted Puffleg *Eriocnemis nigrivestis* in the Cordillera de Toisán, northwest Ecuador, and reassessment of its conservation status. Bull. B.O.C.
 31. Krabbe, N., Braun, M. J., Jácome, M., Robbins, M. B., Schjørring, S. & Sornoza M., F. 1994. Black-breasted Puffleg found: extant but seriously threatened. *Cotinga* 1:
 32. 1-8. Lægaard, S. 1992. Influence of fire in the grass páramo vegetation of Ecuador. Pp. 151-170 in Balslev, H. &
 33. Luteyn, J. L. (eds.). Páramo: an Andean ecosystem under human influence. Academic Press, London, UK.

34. Lyons, J.A. & Santander, T. 2006. Unusual sighting and new record of Black-breasted Puffleg. Online at: http://www.mindobirds.com.ec/details_samarito.htm
35. Lovell, J. 2006. 2007 crucial in global warming battle: UK. Reuters, London, 20 Nov. 2006. Online at: http://news.yahoo.com/s/nm/20061120/sc_nm/environment_britain_kyoto_dc
36. Malcolm, J. R., Liu, C., Neilson, R. P., Hansen, L. & Hannah, L. 2006. Global warming and extinctions of endemic species from biodiversity hotspots. *Conservation Biology* 20: 538-548.
38. Mindo Cloudforest Foundation. 2006. Estrategia Nacional de Aviturismo. CORPEI. Quito, Ecuador. Online at: [http://www.vivecuador.com/Reglamento_LeyTurismo/PDF_PLANDETUR/Estrategia_Aviturismo_Jun-2006\(Ref_No_26\).pdf](http://www.vivecuador.com/Reglamento_LeyTurismo/PDF_PLANDETUR/Estrategia_Aviturismo_Jun-2006(Ref_No_26).pdf)
39. No_26).pdf
40. Parmesan, C. 2006. Ecological and evolutionary responses to recent climate change. *Ann. Rev. Ecol. Evol. Syst.* 37: 637-669.
41. 637-669.
42. Poats, S. 2006. Diagnóstico socioeconómico de la Reserva Ecológica Cotacachi-Cayapas. Anexo del Plan de Manejo de la Reserva Ecológica Cotacachi Cayapas. Ministerio del Ambiente, Proyecto SNAPGEF, Consortium Conservation International, Biosfera, EcoCiencia, and Randi Randi, September 2006, Quito, Ecuador.
43. del Ambiente, Proyecto SNAP-GEF, Consortium Conservation International, Biosfera, EcoCiencia, and Randi Randi, September 2006, Quito, Ecuador.
44. Proaño, M. 2006. Diagnóstico de los recursos hídricos de la Reserva Ecológica Cotacachi-Cayapas. Anexo del Plan de Manejo de la Reserva Ecológica Cotacachi Cayapas. Ministerio del Ambiente, Proyecto SNAPGEF, Consortium Conservation International, Biosfera, EcoCiencia, and Randi Randi, September 2006, Quito, Ecuador.
45. Ecuador.
46. Remsen, J. V., Jr., Jaramillo, A., Nores, M., Pacheco, J. F., Robbins, M. B., Schulenberg, T. S., Stiles, F. G., da Silva, J. M. C., Stotz, D. F. & K. J. Zimmer. 2006. A classification of the bird species of South America. *South American Checklist Committee (SACC) / American Ornithologists' Union (AOU)*. Online at: www.museum.lsu.edu/~Remsen/SACCBaseline04
47. Robbins, M. B., Schulenberg, T. S., Stiles, F. G., da Silva, J. M. C., Stotz, D. F. & K. J. Zimmer. 2006. A classification of the bird species of South America. *South American Checklist Committee (SACC) / American Ornithologists' Union (AOU)*. Online at: www.museum.lsu.edu/~Remsen/SACCBaseline04
48. Checklist Committee (SACC) / American Ornithologists' Union (AOU). Online at: www.museum.lsu.edu/~Remsen/SACCBaseline04
49. SACCBaseline04
50. Ridgely, R. S. & Greenfield, P. J. 2001. *The birds of Ecuador: status, distribution, and taxonomy*. Cornell University Press, Ithaca, USA.
51. Rodríguez, O. 2002. Zamarrillo Pechinegro (*Eriocnemis nigrivestis*). Pp. 90-91 in Granizo, T., Pacheco, C., Ribadeneira, M.B., Guerrero, M., & Suárez, L. (eds.). *Libro rojo de las*

- aves del Ecuador. SIMBIOE, Conservation International, EcoCiencia, Ministerio del Ambiente, UICN, Quito, Ecuador.
52. Santander, T., Tellkamp, M. P., Williams, R. & Davidson, I. J. 2004. Conserving the globally threatened Blackbreasted Puffleg *Eriocnemis nigrivestis*. CECIA & BirdLife International, Quito, Ecuador.
53. Schuchmann, K.-L., Weller, A.-A. & Heynen, I. 2001. Systematics and biogeography of the Andean genus *Eriocnemis* (Aves: Trochilidae). *Journal für Ornithologie* 142: 433-481.
54. 142: 433-481.
55. Stattersfield, A. J., Crosby, M. J., Long, A. J. & Wege, D. C. 1998. Endemic bird areas of the world: priorities for biodiversity conservation. BirdLife International, Cambridge, UK.
56. Stiles, F. G. & Wolf, L. L. 1973. Techniques for colormarking hummingbirds. *Condor* 75: 244-245.
57. Valarezo, V., Titusunta, E., Cumanicho, O., Araujo, W. & Andino, M. 2006. Plan de Manejo del “Bosque y Vegetación Protectores Montañas de Mindo y Cordillera de Nambillo”. Ministerio del Ambiente del Ecuador, Distrito Regional 5 Pichincha, Quito, Ecuador.
58. Vuille, M. & Bradley, R. S. 2000. Mean annual temperatura trends and their vertical structure in the tropical Andes. *Geophysical Research Letters* 27: 3885-3888.
59. Vuille, M., Bradley, R. S., Werner, M., Keimig, F.T. 2003. 20th century climate change in the tropical Andes: observations and model results. *Climatic Change*, 59 (1- 2), 75-99.
60. Waser, N. M. & Calder, A. 1975. Possible impairment of nest-building of hummingbirds by acetate leg tags. *Condor* 77: 361.
61. 77: 361.