

 BOSQUE COLOMBIANO	ETHNO- CONSERVATION PLAN FOR THE LIZARD Arahuac Gecko (<i>Lepidoblepharis miyatai</i>), IN COLOMBIA	CC-052-2019
		Version 3
		June 01, 2019

ETHNO-CONSERVATION PLAN 2020-2025 FOR THE LIZARD Arahuac Gecko (*Lepidoblepharis miyatai*), IN COLOMBIA.

RESUMEN

The Arahuac Gecko (*Lepidoblepharis miyatai*) is the smallest lizard in the world, it is endemic to Colombia and is Critically Endangered CR, by the IUCN, on the verge of extinction.

For the construction of this plan, it was necessary to evaluate both the Arahuac gecko (*Lepidoblepharis miyatai*) populations in the area for more than five months and the evaluation of the relationships between the local Arahuac indigenous communities and the Arahuac gecko (ethno-zoology) due to the little information existing prior to the formulation of this plan. This allowed the involvement of the community (Arahuac indigenous administration council), as well as entities interested in the process (national parks, natural foundation SIG, foundation natibo, CORPOMAGDALENA) in the consolidation of this document, in order to develop a plan of action according to needs current area.

This plan was conceived through five lines of action framed within the national policy for wildlife management: 1) research and monitoring, 2) sustainable management, 3) information and dissemination, 4) legislation, management and institutional strengthening, and 5) education, training and participation] and is designed for a period of 10 years. The



development of strategic lines includes strategies that are prioritized to be carried out in the short, medium and long term. The main actors identified for the execution of this plan are: Ministry of Environment and Sustainable Development, CORPOMAGDALENA, national parks, research institutes (INVEMAR and Humboldt), universities that carry out biological studies with influence in the area, NGOs, and the indigenous community Arahuac.

Keywords: Tropical dry forest, *Lepidoblepharis miyatai*, *Lepidoblepharis sanctaemartae*, Tayrona National Natural Park, Sierra Nevada de Santa Marta, use of substrate

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INTRODUCTION

Based on specimens deposited in collections and observations in the field, we registered four new localities with confirmed presence of *L. miyatai*. We calculated the extent of occurrence and the altitudinal distribution of the species with the locations presented, reaching an area of 40.9 km² and an altitudinal range between sea level and 400 m. The species is present in thorn scrub, dry forest and humid forest formations. Based on the microhabitat information obtained from



88 individuals registered in the Tropical Dry Forest of "Las Tinajas", northwestern sector of the SNSM, we determined that the species has differential use between three types of substrate (litter, fallen trunks and bare soil), showing preferences for litter. We consider this gecko as endemic to the northwestern sector of the SNSM, due to its reduced area of distribution and the nearby records of *Lepidoblepharis sanctaemartae*, with whom no sympatry was recorded in any of the studied locations. *L. miyatai* is a species that inhabits forest formations with extensive canopy coverage, as this generates the optimal microclimatic conditions for the establishment of this species.

1. ECOLOGY

1.1. Physical description

Very small lizard, cloaca snout length (LHC) \leq 22 mm (Meiri 2008). With J. M. Renjifo 8-11 slightly widened subdigital lamellae on the fourth toe of the hind paw. Conical dorsal scales, homogeneous and juxtaposed on the nape and scapula, flat and sub-imbricated towards the posterior region of the body; 49-78 around the body, 47-51 between the throat and the anterior border of the cloaca, 16-20 ventral at the level of the body. Flat and granular snout scales, larger than nape; 13-17 dorsal between the suture of the supralabial I and II, first large infralabial. Posterior border of the mental straight or slightly concave, without cleft or cleft, 2-4 postmentals equal to or slightly larger than gulars (Lamar 1985). Reddish to dark brown back with chocolate spots and darker back-lateral lines. Males

with cream headband on the head, and females with dark bars in the throat (Lamar 1985). Belly cream with brown spots, palms reddish.

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1.2. Geographical distribution

Countries: Colombia.

Departments: Cesar and Magdalena.

Biogeographic subregion: dry lowlands of the Caribbean.

Altitudinal distribution: up to 1,010 m a.s.l.

1.3. Bioecological aspects

Based on information from Lugo-Rugeles (1981) and Lamar (1985). Diurnal activity, forages in litter and is generally found in proximity to roots of large trees. There appears to be a difference in the type of habitat in which *L. miyatai* and *L. sanctaemartae* are distributed, as *L. miyatai* prefers thorny scrub litter, while *L. sanctaemartae* has been observed in tropical dry forest litter. Although there are no published studies on the diet in this species, it is known that in *L. sanctaemartae*, a species similar in morphology to *L. miyatai*, individuals prefer mites, lepidoptera (larvae) and ants in a higher proportion (Medina-Rangel 2013, Saboyá -Acosta et al. 2014, Medina-Rangel and Cárdenas-Arévalo 2015). According to Lugo-Rugeles (1981), by August, gravid females and positions are observed among the litter and fissures at the base of the trees. In captivity the females laid a single egg per position, and ovipositions occurred between August and October. The reduced clutch size is a typical feature in the genre.



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Apparently in this species the individuals have a reduced foraging area (Calderón-Espinosa and Medina-Rangel obs. Pers.), Although there are no studies on the range of the species and it is common find pairs of individuals (male and female), occupying the same area of activity (Calderon-Espinosa and Medina-Rangel obs. pers.).

1.4. Population information

Does not exist. However, although it is uncommon to record the species in several sites within the same life zone, when a population is found, it tends to present relatively high densities (Rueda-Solano and Castellanos 2014).

1.5. Threats

Deforestation and loss of habitat (livestock, burning, etc.) that result in the disappearance of the vegetation cover and therefore the litter, habitat of the species.

1.6. Existing conservation measures

None.



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1.7. Conservation opportunities

There are no conservation projects or management plans that involve the species. The only possibility to maintain viable populations of the species would be to stimulate the conservation of dry scrub in the areas adjacent to the Tayrona National Natural Park and Sierra Nevada de Santa Marta, Civil Society Reserves, departmental conservation areas such as the Wildlife Sanctuary Los Besotes and other types of municipal conservation figures in the region.

1.8. Proposed Research and Conservation Measures

It is necessary to carry out population ecology studies that allow knowing the population dynamics and specific requirements

habitat and resource use. In addition, it would be essential to carry out phylogenetic studies to clarify the relationship of the populations of this species with others of the genus, particularly with *L. sanctaemartae*, with whom it shares morphological similarities.

2. OBJECTIVES


2.1. General purpose

Develop a regional strategy for the conservation of the Arahuac Gecko (*Lepidoblepharis miyatai*) populations and the different associated aquatic ecosystems, according to the main threats identified in the northeastern sector of the Magdalena department.



2.2. Specific objectives

- Develop research and monitoring projects of the Arahuac Gecko populations in the different aquatic ecosystems where it is distributed in the northeastern sector of the Magdalena department.
- Develop participatory strategies that link communities, tour operators, hotels and territorial entities (CORPAMAG, National Parks and the District of Santa Marta) in order to mitigate the main threats to the conservation of the Arahuac Gecko and its essential habitats, taking into account the cultural, social and economic particularities of the region.
- Design and implement activities for environmental awareness and education that promote knowledge and appropriation of the Arahuac Gecko and the aquatic ecosystems where they are distributed, as well as the duties and rights that the community has in relation to national biodiversity.
- Build participatory scenarios for inter-institutional articulation between government authorities, private companies, academic and research institutions and associations and local communities,

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for the construction of an agenda that allows the conservation of the forests where the Arahuac Gecko lives.

3. LINES OF ACTION

3.1. Conservation

COMPONENT	OBJECTIVE	ACTIVITIES
Population management and protection	Design and establish interdisciplinary management actions that ensure the conservation of Gecko populations, considering surveillance, monitoring, research and responsible use strategies.	<ol style="list-style-type: none"> 1. Promote the implementation of programs that reduce the impact of forestry and agricultural activities, through the application of regulatory strategies and their constant monitoring. 2. Promote sustainable trade that is regulated and traceable to encourage the creation of fair markets and reduce the impacts on populations due to the illegal trade of species. 3. Prepare the protocol of actions for the effective management of the species in each locality, with standardized parameters and supervision and surveillance agreements.
Integrated habitat management	Avoid activities in areas important to the biology of the species that are incompatible, directly or indirectly, with the long-term survival of the Gecko.	<ol style="list-style-type: none"> 1. Promote the restoration of degraded areas of the Mesophilic Mountain Forest and habitats of distribution of the Gecko most likely to be recovered and establish a monitoring program for restoration projects. 2. Evaluate the Anp Management Plans to involve conservation actions for the species in the execution of the Annual Operational Programs (AOP). Incorporate actions of this PACE in the POAs of the Anp with a Gecko presence. 3. Promote actions for the conservation and restoration of the Gecko habitat, so that the distribution islands of each species are as close as possible. 4. Promote the creation of collaborative networks to coordinate monitoring and protection efforts along the migratory corridors of the species. 5. Ensure connectivity in the canopy in the Gecko distribution sites, to favor the passage of individuals


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		between trees, which increases a genetic exchange of populations and reduces the vulnerability of Gecko.
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3.2. Capacity building, environmental education and social integration

It includes actions focused on strengthening the processes of awareness and environmental education with the community in general, through school environmental projects (PRAE), articulated with citizen and community environmental education projects (PROCEDA), to form values, disseminate and generate ownership of information on the Arahuac lizards, their ecosystems and their management.



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OBJECTIVE	ACTIONS	PROJECT	PRIORITY	INDICATORS MANAGEMENT
Strengthening of the PRAE, PROCEDA and PRAU in educational centers for the conservation of the Arahuac Gecko and its habitats	Develop training for the educational community on issues related to Arahuac lizards	Environmental education program with educational facilities in the area of influence of the conservation plan	Medium term	Number of policies, agreements, strategies developed
Strengthen the CIDEAs and the plan to strengthen teachers in the area of influence of the conservation plan	Develop environmental education strategies aimed at reinforcing the duties and rights that as citizens they have with biodiversity and aquatic ecosystems	Generation of regional policies focused on the conservation and sustainable use of the Arahuac Gecko populations	Medium term	Number of policies, agreements, strategies developed
Generate work and research groups on conservation, management and use	Strengthen education ecosystems biodiversity	Environmental education program with educational facilities in the area of influence of the conservation plan	Medium term	Number of policies, agreements, strategies developed
	Generate inter-institutional working groups focused on the planning and management of Arahuac lizards	Cooperation for the conservation and management of threatened fauna potentially dangerous for local communities	Medium term	Number of policies, agreements, strategies developed
	Strengthen research groups focused on hydrobiological resources within educational institutions at the basic and higher level	Knowing the biodiversity of Magdalena	Medium term	Number of policies, agreements, strategies developed
Promote community participation in education and training processes	Strengthen participatory research processes with local communities, with an emphasis on generating ecological information on Arahuac lizards	Scientific citizens in Magdalena: conserving our biodiversity	Medium term	Number of policies, agreements, strategies developed
Train communities in the administration of goods and services	Generate agreements with SENA to train local people in sustainable tourism and production methods in order to	Training the community in sustainable tourism and production processes	Medium term	Number of policies, agreements, strategies developed


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	provide alternatives for increasing income			
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3.3. Monitoring line

It includes actions to broaden knowledge about the Arahuac Gecko populations in the northeastern sector of the Magdalena department through the monitoring of populations, the conservation status of their habitats, population genetics, and ethno-zoological relationships with non-native and local communities.

OBJECTIVE	ACTIONS	PROJECT	PRIORITY	INDICATORS MANAGEMENT
Evaluate the population, trophic, spatial and reproductive ecology of the Arahuac Gecko populations in the study area on a temporal and spatial scale.	Establish an annual monitoring plan for the populations under a standardized protocol.	Monitoring of Arahuac Gecko populations in the Río Piedras-Río Don Diego sector.	Medium term	Number of monitoring carried out / number of sectors monitored / number of Arahuac lizards registered
	Generate a centralized database for the collection of Information that allows to be feedback from researchers working in the area with alligators.	Ranges and Habitat Use Assessment	Medium term	Number of monitoring carried out / number of sectors monitored / number of Arahuac lizards registered
	Develop spatial models of species distribution and threats to implement management and conservation actions in areas specific	Development of an environmental database for the monitoring of Arahuac lizards in the department of Magdalena.	Medium term	Number of monitoring carried out / number of sectors monitored / number of Arahuac lizards registered

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	Evaluate the trophic and reproductive ecology of Arahuac Gecko populations	Niche modeling and habitat analysis for the Arahuac Gecko in the department of Magdalena	Medium term	Number of monitoring carried out / number of sectors monitored / number of Arahuac lizards registered
	Employ satellite and / or UHF telemetry techniques to define the spatial ecology of the species	Evaluation of the trophic and reproductive ecology of the Arahuac Gecko populations Home	Medium term	Number of monitoring carried out / number of sectors monitored / number of Arahuac lizards registered
	Assess Arahuac Gecko populations in the area on a genetic scale	Population genetics of the Arahuac Gecko in the study area.	Medium term	Number of monitoring carried out / number of sectors monitored / number of Arahuac lizards registered

3.4. INFORMATION LINE

It includes actions that allow the dissemination of the information generated on the management, conservation and sustainable use of the Arahuac Gecko populations in the area. This process will allow the design and implementation of a communication strategy at different scales, with the purpose of positioning the Arahuac Gecko as an emblematic species for the region, as well as a focal point for the preservation of continental and marine aquatic ecosystems. The target audience will be both decision makers, as well as educational institutions and local communities that live with this species.

OBJECTIVE	ACTIONS	PROJECT	PRIORITY	INDICATORS MANAGEMENT
Generate information and dissemination mechanisms of both technical and general interest	Develop a bibliographic platform on Arahuac lizards in the region that allows decision makers, the scientific community and local people to stay informed about this species in the region	Arahuac Gecko virtual platform in the department of Magdalena	Medium term	Program developed and implemented

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information on Arahuac lizards in the department of Magdalena	Develop an awareness program on Arahuac lizards for regional radio and television that facilitates the dissemination of information to the local community	The Arahuac Gecko in the Magdalena. Culture and biodiversity. The Arahuac Gecko in the Magdalena.	Medium term	Program developed and implemented
	Implement massive outreach campaigns (primers, brochures, billboards, radio spots, etc.) on the rights and duties of citizens for the protection and conservation of the Arahuac Gecko	Rights and duties of citizens towards these species.	Medium term	Program developed and implemented
Generate citizen participation mechanisms for the conservation and sustainable use of populations of Arahuac Gecko in the department of Magdalena	Generate spaces for the exchange of knowledge and learning between the actors involved on the management, conservation and sustainable use of local aquatic resources	Conservation of aquatic ecosystems through local initiatives	Medium term	Program developed and implemented
	Socialize the "Plan for the conservation, management and sustainable use of the Arahuac lizards in the northeastern sector of the department of Magdalena" with the local communities through participatory tools	Socialization of the "Plan for the conservation, management and sustainable use of the Arahuac lizards in the northeastern sector of the department of Magdalena"	Medium term	Program developed and implemented

BIBLIOGRAPHY

- Bille, T. (2001). Ein zweites exemplar von *Abronia bogerti* (Tihen, 1954) aus Oaxaca, Mexiko, mit Bemerkungen zur Variation der Art (Sauria: Anguidae). *Salamandra*, 37 (4), 205-210.
- Bogert, C., & Porter, A. (1968). A new species of *Abronia* (Sauria: Anguidae) from the Sierra Madre del Sur of Oaxaca, Mexico. *American Museum Novitates*, 2279, 38.

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- CAMP. (2000). Informe sobre la Conservación, Asesoramiento y Manejo Planificado para lagartijas Abronia. Tuxtla Gutierrez,
- Chiapas. Campbell, J. (1994). A New Species of Elongate Abronia (Squamata: Anguidae) from Chiapas, Mexico. *Herpetologica* , 50 (1), 1-7.
- Campbell, J. (1994). A New Species of Elongate Abronia (Squamata: Anguidae) from Chiapas, Mexico. *Herpetologica* , 50 (1), 1-7.
- Campbell, J. A. (1982). A new species of Abronia (Sauria: Anguidae) from the Sierra Juárez, Oaxaca, México. *Herpetologica* , 38 (3), 355-361.
- Campbell, J., & Brodie, E. (1999). A New Species of Abronia (Squamata: Anguidae) from the Southeastern Highlands of Guatemala. *Herpetologica* , 55 (2), 161-174.
- Campbell, J., & Frost, D. (1993). Anguid lizards of the genus Abronia: revisionary notes, descriptions of four new species, a phylogenetic analysis, and key. *Bull Am Mus Nat Hist* , 216, 121.
- Campbell, J., Sasa, M., Acevedo, M., & Mendelson, J. (1998). A new species of Abronia (Squamata: Anguidae) from the high Cuchumatanes of Guatemala. *Herpetologica*, 45 (2), 221-234. }PROGRAMA DE ACCIÓN PARA LA CONSERVACIÓN DE LAS ESPECIES
- Campbell, J., Solano-Zavaleta, I., Flores-Villela, O., Caviedes-Solis, I., & Frost, D. (2016). A New Species of Abronia (Squamata: Anguidae) from the Sierra Madre del Sur of Oaxaca, Mexico. *Journal of Herpetology* , 50 (1), 149-156.
- CITES. (2015). Estado de conservación, uso, gestión y comercio de las especies del género Abronia. Tel Aviv, Israel: CITES.
- CITES. (2014). Estado de conservación, uso, gestión y comercio de las especies del género Abronia. 28 Comité de Fauna. Documento 22.4.
- CITES. (2015). Examen de las propuestas de enmienda a los apéndices I y II. Johannesburgo, Sudáfrica: CITES.
- CITES. (2016). Examen de las propuestas de enmienda a los apéndices I y II. Johannesburgo, Sudáfrica: CITES. Cruz-Ruiz, G., Mondragón,
- D., & Santos-Moreno, A. (2012). The presence of Abronia oaxacae (Squamata: Anguidae) in tank Bromeliads in temperate forests of Oaxaca, Mexico. *Brazilian Journal of Biology* , 72 (2), 337-341.
- Díaz-Velasco, B. (2005). Estudio ecológico preliminar de la población escorpión verde Abronia graminea (Sauria: Anguidae) en Puerto del Aire, Veracruz. Tesis de Licenciatura. México, D. F.: Facultad de Ciencias. UNAM. 78 pp.
- Flores-Villela, O., & Sánchez-H, O. (2003). A new species of Abronia (Squamata: Anguidae) from the Sierra Madre del Sur of Guerrero, México, with comments on Abronia deppei. *Herpetologica* , 59 (4), 524-531.
- Good, D. (1988). Phylogenetic relationships among gerrhonotinae lizards, and analysis of external morphology. University of California Press , 121, 1-139.

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- Good, D., & Schwenk, K. (1985). A new species of *Abronia* (Lacertilia: Anguidae) from Oaxaca, Mexico. *Copeia* , 1985, 135-141.
- Hartweg, N., & Tihen, J. (1946). Lizards of the genus *Gerrhonotus* from Chiapas, Mexico. *Occasional papers of the Museum of Zoology of the University of Michigan* , 497, 1-16.
- Koludarov, I., Sunagar, E., Undheim, B., Jackson, T., Ruder, T., Whitehead, D., et al. (2012). Structural and Molecular Diversification of the Anguimorpha Lizard Mandibular Venom Gland System in the Arboreal Species *Abronia graminea*. *Journal of Molecular Evolution* , 75, 168-183.
- Liner, E. (1994). Nombres científicos y comunes en inglés y español de los anfibios y los reptiles de México. *Natural History Museum-Dyche Hall. University of Kansas. Herpetological Circular* , 23, 116.
- Phillips, S., & Dudík, M. (2008). Modeling of species distributions with Maxent: new extensions and a comprehensive evaluation. *Ecography: Pattern and process in ecology* , 31 (2), 161–175.
- Ramírez-Velázquez, A. (2008). Enigmático lagarto del mundo maya. *Especies* , ene/ feb, 16/22.
- ABRONIA 77 Smith, H., & Smith, R. (1981). Another epiphytic alligator lizard (*Abronia*) from Mexico. *Bulletin of Maryland Herpetological Society* , 17, 51-60.
- Solano-Zavaleta, I., Mendoza-Hernández, A., & García-Vazquez, U. (2007). Reporte del tamaño de la camada en *Abronia taeniata* (Wiegmann, 1828). *Boletín de la Sociedad Herpetológica Mexicana* , 15 (1), 18-19.
- The reptile data base. (2016). The reptile data base. Retrieved 20 de Noviembre de 2016 from <http://www.reptile-database.org/>
- Tihen, J. (1954). *Gerrhonotine lizards recently added to the American Museum collection, with further revisions of the genus Abronia*. *American Museum Novitates* , 1687, 1-26.
- Torres, M., Urbina, A., Vásquez-Almazán, C., Pierson, T., & Ariano-Sánchez, D. (2013). Geographic distribution: *Abronia lythrochila* (Red lipped arboreal alligator lizard): Guatemala: Huehuetenango. *Herpetological Review* , 44 (4), 624.
- Urbina-Cardona, J., & Flores-Villela, O. (2010). Ecological-niche modeling and prioritization of conservation-area networks for Mexican herpetofauna. *Conservation Biology* , 24 (4), 1031-1041.
- Werler, J., & Shannon, F. (1961). Two new lizards (Genera *Abronia* and *Xenosaurus*) from the Los Tuxtlas range of Veracruz, Mexico. *Transactions of the Kansas Academy of Science* , 64 (2), 123-132. Zaldívar-Riverón, A., Schmidt,
- W., & Heimes, P. (2002). Revisión de las categorías en el proyecto de norma oficial mexicana (PROY-NOM-059-2000) para las especies de lagartijas de la familia Anguidae (Reptilia). México, D. F.: Museo de Zoología «Alfonso L. Herrera, Departamento de Biología, Facultad de Ciencias, Universidad Nacional Autónoma de México. Bases de datos SNIB-Conabio. Proyecto W 026.