

Distribution and conservation status of *Bothrops asper* (GARMAN, 1884) in Ecuador (Squamata: Serpentes: Viperidae: Crotalinae)

Verbreitung und Schutzstatus von *Bothrops asper* (GARMAN, 1884) in Ecuador
(Squamata: Serpentes: Viperidae: Crotalinae)

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KURZFASSUNG

Bisher wurde angenommen, daß *Bothrops asper* (GARMAN, 1884) nur unterhalb von 1.500 Metern ü. M. entlang der Pazifikküste und des angrenzenden Küsten-Tieflandes von Ecuador lebt, und in gewissen Gebieten ganz selten oder gar nicht (Azuay, Loja, Imbabura, Halbinsel Santa Elena) anzutreffen ist. Eine neuerliche Auswertung von Literaturnachweisen sowie neuer Daten von Exemplaren am Laboratorio de Anfibios & Reptiles, Universität San Francisco de Quito / Fundación Herpetológica Gustavo Orcés in Quito, Ecuador sowie am National Museum of Natural History, Smithsonian Institution (Washington D.C., USA) zeigt, daß diese Art in jeder Provinz, zoogeographischen Region und den meisten Vegetations-Formationen entlang der westlichen Hänge und des pazifischen Tieflandes von Ecuador (einschließlich der Halbinsel Santa Elena) vom Meeresspiegel bis in mindestens 1.720 Meter Höhe ü. M. vorkommt. Eine Beurteilung des Schutzstatus ergibt, daß *B. asper* als eine kaum gefährdete Art (IUCN Least Concern) eingestuft werden sollte, da sie sehr verbreitet und gewöhnlich ist, und die Fähigkeit hat, sich Landschaftsveränderungen anzupassen. Wir möchten jedoch betonen, daß ganz allgemein mittel- und langfristige Überwachungsprogramme notwendig sind, um den tatsächlichen Bestand der äußerst mannigfaltigen tropischen Schlangenfauen zu erfassen.

ABSTRACT

Bothrops asper (GARMAN, 1884) was conceived as a species distributed below 1.500 m a.s.l. in the Pacific versant and adjacent coastal lowlands of Ecuador, with few or no records in certain areas (Azuay, Loja, Imbabura, Santa Elena Peninsula). However, a reassessment of literature records and new data from specimens deposited at the Laboratorio de Anfibios & Reptiles, Universidad San Francisco de Quito / Fundación Herpetológica Gustavo Orcés in Quito, Ecuador and at the National Museum of Natural History, Smithsonian Institution (Washington D.C., USA) confirms that this species has records in every province, zoogeographic zone, and most plant formations along western slopes and Pacific lowlands of Ecuador (including the Santa Elena Peninsula) at altitudes between sea level to at least 1.720 m. A conservation status assessment indicates that *B. asper* should be classified under the Least Concern IUCN category because it has a wide distribution, and it is a common species capable of adapting to altered zones. However, we emphasize the general need for mid and long-term monitoring programs in order to better understand the situation of populations of the highly diverse tropical snake faunas.

KEY WORDS

Reptilia: Squamata: Serpentes: Viperidae: Crotalinae: *Bothrops asper*, geographical distribution, altitudinal range, conservation status, IUCN category assessment, Ecuador

INTRODUCTION

Bothrops asper (GARMAN, 1884) (sensu CAMPBELL & LAMAR 2004) is responsible for most accidents by snakebites in the Pacific slopes of Ecuador and Colombia, and in general throughout its range (FREIRE & KUCH 1994; THEAKSTON et. al. 1995; WARRELL 2004). In western Ecuador, this species is responsible for about 80% of venomous snakebites (FREIRE & KUCH 1994, pers. obs.). Because of the medical impor-

tance of this species, information about its distribution is highly desirable.

Bothrops asper is distributed in Central and South America, from northeastern Mexico to the Pacific versant and coastal lowlands of Ecuador and extreme north-western Peru (PETERS & OREJAS-MIRANDA 1986; SOLÓRZANO & CERDAS 1989; CAMPBELL & LAMAR 1989, 2004). A map provided by CAMPBELL & LAMAR (1989) for this species

indicated a general distribution along the Pacific lowlands of Ecuador except for the Santa Elena Peninsula. PÉREZ-SANTOS & MORENO (1991) reported this species from seven (Bolívar, Carchi, Chimborazo, Esmeraldas, Guayas, Los Ríos and Pichincha) of the fourteen provinces along the Pacific slope of Ecuador. SCHÄTTI & KRAMER (1993) reported the surroundings of Vilcabamba, province of Loja, as the southernmost distribution limit of *B. asper* [as *B. atrox xanthogrammus* (COPE, 1868)]. They included in their list of examined specimens the first records of *B. asper* [as *B. atrox xanthogrammus* (COPE, 1868) or as *B. atrox atrox* (LINNAEUS, 1758)] for the provinces of Manabí, Cotopaxi, and El Oro. FREIRE & KUCH (1994) provided a dot-distribution map of *B. asper* with 36 localities in ten Ecuadorian provinces based on the collections of the Instituto Nacional de Higiene y Medicina Tropical (Guayaquil, Ecuador) and recorded additional specimens from the province of El Oro, expanding the known distribution of *B. asper* in south-western Ecuador to the area of Arenillas and Hua-

quillas, near the Ecuador-Peru border. Recently *B. asper* has been recorded from the Tumbes region, Peru, being the southernmost locality for the species (TELLO-V. 1998; PESANTES-SEGURA 2000).

Bothrops asper has been reported from around 2,500 m a.s.l. in Venezuela and 2,640 m a.s.l. in Colombia (PÉREZ-SANTOS & MORENO 1986; CAMPBELL & LAMAR 1989). ORCÉS (1948) reported the altitudinal range in Ecuador to extend to at least 1,500 m a.s.l. (as *B. atrox*). This observation was supported by FREIRE & KUCH (1994) who suggested that *B. asper* could conceivably ascend to higher altitudes wherever suitable habitat exists (highest record mentioned by these authors: type locality of *B. xanthogrammus* = *B. asper* at Pallatanga, province of Chimborazo, 1,522 m a.s.l., fide PETERS 1955). The highest records in Ecuador (reported by SCHÄTTI & KRAMER 1993) include several localities in the provinces of Cotopaxi (Gutzualo [also called Cutzhualó], Galápagos, and Las Pampas (see "Altitudinal Range" section).

MATERIALS AND METHODS

Twenty-seven specimens deposited at the Laboratorio de Anfibios y Reptiles, University San Francisco de Quito / Fundación Herpetológica Gustavo Orcés, Quito, Ecuador (FHGO) and two at the National Museum of Natural History, Smithsonian Institution, Washington D. C., USA (USNM), were examined and found to represent extensions in the known geographical range of the species in Ecuador. Localities and their geographic coordinates and elevations were determined from researcher's field notes and museum records and revised according with the Ecuador gazetteer of the IGM (2000) and NIMA (2003).

To assess the conservation status of the population of *B. asper* in Ecuador, we esti-

mated the extent of occurrence (sensu IUCN SSC 2001) of the species in the country from a polygon enclosing the set of localities herein reported, namely; data of 169 additional specimens from FHGO; data from some specimens deposited at USNM, and data from the literature (CAMPBELL & LAMAR 1989; PÉREZ-SANTOS & MORENO 1991; ALMENDÁRIZ & CARR 1992; CAMPBELL & LAMAR 1992; SCHÄTTI & KRAMER 1993; FREIRE & KUCH 1994). To optimize the estimation of the extent of occurrence of *B. asper*, the form of the polygon mostly follows IUCN SSC (2001) suggestion of a minimum convex polygon with internal angles less than 180°, except for some areas excluded because the species does not occur there (e.g., Pacific Ocean).

RESULTS AND DISCUSSION

Geographical distribution

Two adult males (FHGO 1167 and 1263) collected in Tamarindo, province of

Azuay (02°47'S, 79°33'W, 400 m a.s.l., 22 April 1995) constitute the first reported locality from this province. Records from Huigra-Río Chiguacay, province of Azuay,

reported by SCHÄTTI & KRAMER (1993) are in error, as this locality lies in the province of Chimborazo. They confused the much better known town of Huigra in the province of Chimborazo with the small town of Huigra in the province of Azuay. "Río Chiguauca" can not be located on present maps but it is in the Chanchan river valley, the altitude according with ANSP (Academy of Natural Sciences, Philadelphia) records is around 930 m. FREIRE & KUCH (1994) also plot localities in the Azuay-Cañar and Azuay-Guayas provincial limits but they did not cite specific localities.

One adult female (FHGO 223) from Vilcabamba, (04°15'S, 79°14'W, 1,622 m a.s.l., 1 May 1993); and one adult male (FHGO 2262) from Puliche, near Vilcabamba, (1,600 m a.s.l., 11 March 1997) constitute the second and third specimens of *B. asper* from the province of Loja. These records extend the distribution of the species 20 km to the south. *Bothrops asper* seems to be restricted to the Catamayo river valley in the province of Loja, where all the record localities for the province are located. Some local people from this province include pitvipers under the general common name of "macanchi" (TOUZET 1983). In the Vilcabamba area, *B. asper* is recognized as an uncommon species and called "macanchi mariposa", meaning "butterfly pitviper", presumably in allusion to the X-marks on the back. Another species from the Andean region of Loja is the endemic *Bothrops lojanus* PARKER, 1930. Local people distinguish the two species, and *B. lojanus* does not receive the modifier "mariposa" after "macanchi" (TOUZET 1983, pers. obs.). The two species may have vertically overlapping ranges, but until now *B. lojanus* has been recorded from higher elevations (> 2,000 m a.s.l.) (CAMPBELL & LAMAR 1989, 2004; pers. obs.). In other parts of western Ecuador, *B. asper* received other common names such as "equis", "equis de la costa", "curuncha", "llucti", "equis rabo amarillo", and "equis rabo de hueso" (ORCÉS 1948; TOUZET 1983; FREIRE & KUCH 1994; pers. obs.).

Two specimens (USNM 165210 and 165338) from Lita, province of Imbabura (00°50'N, 78°28'W, 600 m a.s.l.) constitute the first records from this province. The species seems to be fairly common in the

area of Lita, as several specimens have been seen and collected between Lita and Alto Tambo (FHGO 082, 182, 251, 346, 418, pers. obs.). Although PÉREZ-SANTOS & MORENO (1991) listed *B. asper* in the province of Carchi, there are no published records of specimens from this province; however as the area of Lita locates just on the border of the provinces of Imbabura, Esmeraldas, and Carchi, the species must occur there.

CAMPBELL & LAMAR (1989, 2004) and FREIRE & KUCH (1994) pointed out the apparent absence of *B. asper* in the lowlands of the Santa Elena Peninsula, province of Guayas, and implied that this might be due to xeric conditions prevailing in this part of the province. However, a female (FHGO 1715) from the surroundings of Colonche (02° 01'S, 80°40'W, 8 m a.s.l., 01 May 1995) and two additional observations at Monte Verde (02°03'S, 80°44'W, 4 m a.s.l., August 1997) and in the surroundings of Santa Elena (02°06'S, 80°53'W, 26 m a.s.l., August 1997) confirm the presence of *B. asper* on the Santa Elena Peninsula. The discontinuous distribution of this snake in that area could be related to the level of humidity and food supply. Anecdotal observations suggest that *B. asper* (juveniles and adults) are relatively more abundant near the base of the Chongon-Colonche Cordillera, a small coastal mountain range, than in the nearby dry lowlands, due to the higher level of humidity on the mountain range. All records from the dry lowlands of the Santa Elena Peninsula refer to adults; so we hypothesize that some adult snakes that tolerate the hard environmental conditions of that extremely dry peninsula and feed on medium to large food items (e.g., rodents) can disperse into the nearby desert lowland region (although normally occurring along water courses that serve as corridors); while juveniles that are at a higher risk of dehydration and depend on small prey items (e.g., anurans, arthropods, fide CAMPBELL & LAMAR 2004) are restricted to more moist areas. As few records are available from the area of Santa Elena Peninsula to support further conclusions regarding ontogenetic shifts in spatial movements, it would merit further study on the ecology of *B. asper* in the area, especially because it might have a potential medical perspective.

Altitudinal range

The highest point of altitudinal distribution of *B. asper* in Ecuador according to SCHÄTTI & KRAMER (1993) is about 1,800 m a.s.l. at Las Pampas (province of Cotopaxi), but the exact altitude of specimens collected at this locality is questionable. Hundreds of specimens of amphibians and reptiles have been reported from "Las Pampas" (= San Francisco de Las Pampas) based on collections assembled by G. ONORE. Several of those specimens have been used in descriptions of new species, however elevations attributed to this locality vary considerably. FLORES (1985) cited the elevation as 1,500 m, TIRIRA (1999) as 1,700 m, HOOGMOED (1989), LYNCH & DUELLMAN (1997), and SCHÄTTI & KRAMER (1993) as 1,800 m, SCHÄTTI & KRAMER (1991) as about 2,000 m. COLOMA (1995) cited several species of *Colostethus* as sympatric at "vicinity of San Francisco de Las Pampas, between 600-1800 m". It seems that specimens collected at different localities in the surroundings of San Francisco de Las Pampas were coded under the same name, "Las Pampas" (A. M. VELASCO pers. comm.). Thus, the locality registered as "Las Pampas" and "San Francisco de Las Pampas" in several museums around the world should be better conceived as a wide area instead of a single locality, with an elevational range between 600-1,800/2,000 m as COLOMA (1995) did. Therefore, the highest confirmed locality for *B. asper* in Ecuador is Galápagos at 1,720 m a.s.l. in the province of Cotopaxi (specimens reported by SCHÄTTI & KRAMER 1991, locality not to be confused with the Galápagos Archipelago). The lowest point for *B. asper* is sea level at various points on the coast (e.g., FHGO 731, 1237, 1294 from Salango 01°35'S, 80°51'W, 0 m a.s.l.).

In conclusion, *B. asper* (sensu CAMPBELL & LAMAR 2004) is a species distributed along the western slopes and lowlands of Ecuador (including the Santa Elena Peninsula) at altitudes between sea level to at least 1,720 m (but probably higher), with records in the provinces of Esmeraldas, Manabí, Guayas, Los Ríos, El Oro, Carchi, Imbabura, Pichincha, Cotopaxi, Bolívar, Chimborazo, Azuay, and Loja (fig. 1). This

species occupies four zoogeographic zones in Ecuador: Northwestern Tropical, Southwestern Tropical, Western Subtropical and Temperate (sensu ALBUJA et al. 1980), and 14 Ecuadorian plant formations (sensu SIERRA 1999): Foothills Cloud forest, Foothills Evergreen forest, Foothills Semi-deciduous forest, Littoral Dry scrubs, Littoral Spiny scrubs, Lowland Evergreen forest, Lowland Flooded Evergreen forest, Lowland Semi-deciduous forest, Lowland Xerophytic scrubs, Mountain Cloud forest, Mountain Dry scrubs, Mountain Dry Spiny scrubs, Mountain Humid scrubs, and Savanna.

Conservation status

Based on these distributional data, the area of the polygon drawn to estimate the extent of occurrence is approximately 110,000 km² (fig. 1). This area includes several zones affected by urbanization, deforestation, contamination, and uncontrolled extension of the agricultural frontier, therefore some sub-populations of *B. asper* have experienced reduction, fragmentation, or even complete extirpation. However, *B. asper* seems to be well adapted to altered areas, and can even live in open and suburban zones at considerable densities (pers. obs). Based on the wide distribution and adaptive capacity of this relatively common species, we suggest to place the Ecuadorian population of *Bothrops asper* under the IUCN category of Least Concern (LC) on a national level, although surely this category can be applied to a global status. Nevertheless, we point out that the current evaluations of the conservation status for most species of the tropical herpetofauna (e.g. CI-IUCN Global Amphibian Assessment, this publication) are based on inferences or estimations from indirect evidence such as the estimation of the distribution range (criterion B sensu IUCN SSC 2001) or a declination in the area of occupancy, extent of occurrence and habitat quality (criterion A sensu IUCN SSC 2001). It is necessary to establish mid and long-term monitoring programs in order to know more about the ecology of the species and to assess the real situation of the populations of snake taxa from the Tropics through adequate quantitative indices and verified population size.

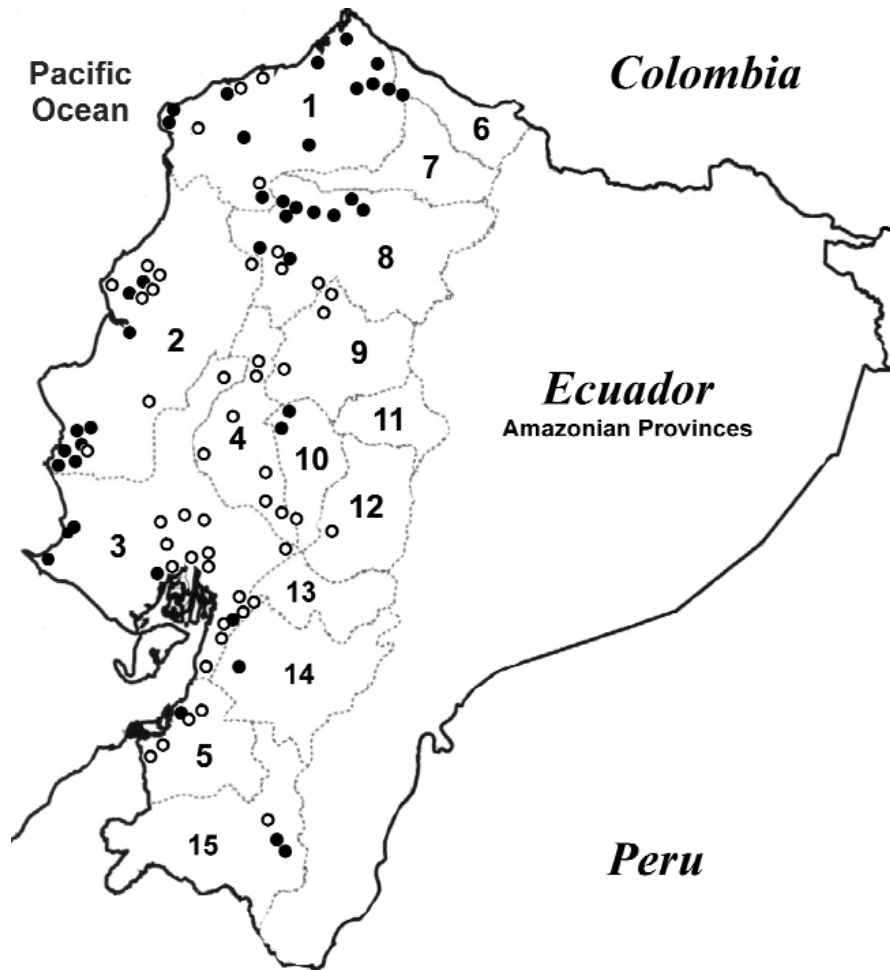


Fig. 1: Distribution of *Bothrops asper* (GARMAN, 1884) in Ecuador.

● - material deposited at the Laboratorio de Anfibios y Reptiles, University of San Francisco de Quito / Fundación Herpetológica Gustavo Orcés, Quito, Ecuador or at the National Museum of Natural History, Smithsonian Institution, Washington D. C.; ○ - data from the literature (CAMPBELL & LAMAR 1989, 1992; PÉREZ-SANTOS & MORENO 1991; ALMENDÁRIZ & CARR 1992; SCHÄTTI & KRAMER 1993; FREIRE & KUCH 1994). A symbol can represent more than one locality. Numbers correspond to the mainland Ecuadorian provinces Esmeraldas (1), Manabí (2), Guayas (3), Los Ríos (4), El Oro (5), Carchi (6), Imbabura (7), Pichincha (8), Cotopaxi (9), Bolívar (10), Tungurahua (11), Chinborazo (12), Cañar (13), Azuay (14), Loja (15). The borders of the Amazonian provinces of Ecuador are not included for clearness of the figure. Continuous thick line: Ecuador international border; thin dotted line: borders of provinces.

Abb. 1: Verbreitung von *Bothrops asper* (GARMAN, 1884) in Ecuador.

● - Exemplare am Laboratorio de Anfibios y Reptiles, Universität San Francisco de Quito / Fundación Herpetológica Gustavo Orcés, Quito, Ecuador sowie am National Museum of Natural History, Smithsonian Institution, Washington D. C.; ○ - Literaturangabe (CAMPBELL & LAMAR 1989, 1992; PÉREZ-SANTOS & MORENO 1991; ALMENDÁRIZ & CARR 1992; SCHÄTTI & KRAMER 1993; FREIRE & KUCH 1994). Ein Symbol kann mehr als einen Fundort darstellen. Die Numerierung bezieht sich auf die Ecuadorianischen Festlandsprovinzen Esmeraldas (1), Manabí (2), Guayas (3), Los Ríos (4), El Oro (5), Carchi (6), Imbabura (7), Pichincha (8), Cotopaxi (9), Bolívar (10), Tungurahua (11), Chinborazo (12), Cañar (13), Azuay (14), Loja (15). Ununterbrochene starke Linie: Landesgrenzen von Ecuador; punktierte Linie: Provinzgrenzen.

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RESUMEN

Bothrops asper (GARMAN, 1884) fue concebida previamente como una especie distribuida bajo 1.500 m de altitud en la vertiente Pacífica y tierras bajas adyacentes de Ecuador, con pocos registros o ausente en ciertas áreas (Azuay, Loja, Imbabura, península de Santa Elena). Sin embargo, una re-evaluación de los registros en la literatura y nueva información de especímenes depositados en el Laboratorio de Anfibios & Reptiles, Universidad San Francisco de Quito / Fundación Herpetológica Gustavo Orcés y en el National Museum of Natural History, Smithsonian Institution, Washington, D. C. demostraron que esta especie se ha registrado en todas las provincias, pisos zoogeográficos, y la mayoría de las formaciones vegetales a lo largo de los flancos occidentales y tierras bajas de Ecuador (incluyendo la península de Santa Elena) desde el nivel del mar hasta por lo menos 1.720 m. Una evaluación de su estado de conservación indica que *B. asper* debería ser clasificada bajo la categoría de la UICN de Menor Preocupación debido a su amplia distribución, y a que es una especie común capaz de adaptarse a zonas alteradas. Sin embargo, se resalta la necesidad de programas de monitoreo a mediano y largo plazo que permitan conocer la situación real de las poblaciones de la altamente diversa ofidiofauna tropical.

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