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The Snakes of Sulawesi

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Abstract. From the existing literature, museum specimens and field data an overview was produced of all currently known Sulawesi land snakes. The checklist of In den Bosch (1985) contained fifty-five species of Sulawesi land snakes. We consider forty-four of these to inhabit Sulawesi with certainty, and added eight species, bringing the total number of certain species to 52. Eleven species of In den Bosch's list and four added by us are of doubtful occurrence for Sulawesi, giving a total of 15 doubtful species. The taxonomy of species in several genera needs to be reviewed (e.g. *Enhydris, Rhabdophis, Cylindrophis*). In order to determine which populations are threatened and in need of conservation, surveys should be carried out. This should be done with priority for the following species, since it is our impression that they are relatively rare or (potential) victim of human activities: *Candoia carinata carinata, Candoia paulsoni tasmai, Boiga tanahjampeana, Elaphe flavolineata, Gonyosoma jansenii, Ophiophagus hannah, Python molurus bivittatus, Python reticulatus, Trimeresurus fasciatus* and the red and green colour morph of *Tropidolaemus wagleri.*

Introduction

Indonesia is a country in the tropics with over 200 million inhabitants. It consists of about 17,000 islands scattered around the equator between West-Malaysia and Australia. Indonesia is one of the two countries in the world, with ecosystems possessing the highest degree of biodiversity (Mittermeier et al., 1999). Its habitats and species are threatened by increasing demands from a growing population, resulting in habitat destruction and species overexploitation by hunting and collecting. In order to put into effect any form of nature conservation, we need to know which species are present and what their conservation requirements are.

Sulawesi (formerly Celebes) is one of the five largest Indonesian islands. It has a strangely contorted form with four peninsulas. This is the result of a number of collisions between parts of the ancient continent Gondwana, fifteen to three million years ago (Audley-Charles, 1987). Most of Sulawesi's entire surface is mountainous. Several volcanos, eleven of which are still active, rise on the northern peninsula up to the Sangihe Islands. The landscape is covered with lowland forests, montane forests, forests on soils of ultrabasic rocks and of limestone, beach vegetation, swamp forests, and mangrove forests. In areas with a shortage of rain there are monsoon forests. Sulawesi is located in the wet tropical climatic zone. The temperature is relatively constant, 26 – 30 °C along the coast and about 5 °C lower in the mountains.

In the past several investigators observed a remarkable east-west differentiation in the fauna of the Indo-Australian archipelago. Three biogeographical lines were defined: Wallace's Line, Weber's Line and Lydekker's Line (fig. 1). The Malay Peninsula and the Greater Sunda Islands Sumatra, Borneo, Java and Bali belonged to the former Sunda shelf, which is presently inundated in part. New Guinea and Australia were parts of the former Sahul shelf. Wallace's Line delimits the eastern boundary of the Asian fauna. Lydekker's Line delimits the western boundary of the Australian fauna. Both these lines effectively follow the 180-200 m depth contours of the Sunda and Sahul shelves. The area between the two lines, including Sulawesi, has been nominated as a separate region, called Wallacea. This area has always been isolated on a biogeographical basis. As a result a unique fauna developed, which is not a transition between the fauna of the two shelves, although a number of Papuan species reach their western limit in Sulawesi and a number of Asian species reach their eastern limit here (Whitten et al., 1987). How and Kitchener (1997) calculated the geographic similarities of all land snakes present on 36 Indonesian islands. They found that the major boundary in the snake fauna of Indonesia is not Wallace's Line, but Weber's Line.

Approximately 217 of the 2900 snake species worldwide (EMBL reptile database, January 2004, see www.embl-heidelberg.de/~uetz/LivingReptiles.html) occur on the Indonesian islands Sumatra, Borneo, Java and Sulawesi (Inger and Voris, 2001). In the last ten years several checklists and illustrated publications became available, describing the snakes of parts of Indonesia. The checklist of In den Bosch (1985) was a first attempt to provide an inventory of the snakes of Sulawesi. An illustrated field guide of the land snakes of Sulawesi did not exist however, and we therefore produced one (De Lang and Vogel, 2005).

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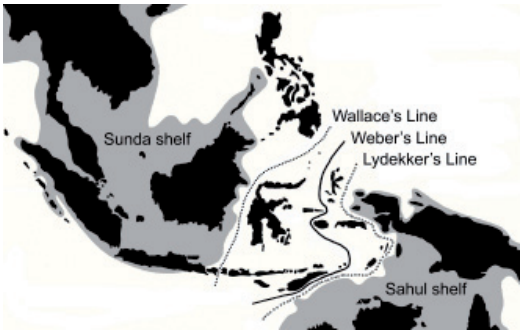

Figure 1. Biogeographical lines in the Indo-Australian archipelago.

Materials and methods

All records of Sulawesi land snake species in the scientific literature from 1837 up to and including 2003 and personal records of the authors and others were stored in a database and reviewed. A checklist of the snakes certainly inhabiting Sulawesi and a list of doubtful Sulawesi records were prepared. Distribution records of species on the checklist had to come from at least one, preferably two independent reliable sources. Sea snakes were not included. Species on the checklist were described in detail, using data from the existing literature, museum specimens and the field. Species on the doubtful list have in common that their records are old, that most of them have not been confirmed by other field workers in a period of over hundred years after publication and that their occurrence outside of Sulawesi is not rare.

The geographical area covered is Sulawesi's five administrative provinces: North-Sulawesi, including the Talaud and Sangihe Islands in the north; Gorontalo, in the central region of the northern peninsula; Central-Sulawesi, including the Togian Islands south of the northern peninsula and the Banggai and Bowokan Islands in the east; Southeast-Sulawesi, including the islands Wowoni, Buton, Muna, Kabaena, and the Tukangbesi Islands in the southeast; and South-Sulawesi, including the islands of Selayar and Tanahjampea, and the Bonerate Islands and Kalaotoa in the south.

Results

The checklist, containing fifty-two species, is presented in the Appendix.

In addition to the checklist, the following snakes have been discovered recently, but not yet formally described: *Enhydris* n. sp., a crescent-spotted snake from Mount Lompobatang, Southwest-Sulawesi, caught at an altitude of over 1200 m (D.T. Iskandar, pers. comm.); a paddle-tailed water snake from Lake Towuti (near Lake Matanna), Central-Sulawesi, which looks like an *Enhydris* species, but is probably a new homalopsine genus (D.T. Iskandar, pers. comm.); and two *Calamaria* n. sp. from Buton Island, Southeast-Sulawesi (G. R. Gillespie, pers. comm.).

The list of doubtful records, contains fifteen species of which the presence in Sulawesi is unlikely but cannot be excluded: *Boiga multomaculata* (Boie, 1827); *Bungarus candidus* (Linnaeus, 1758); *Calliophis intestinalis* (Laurenti, 1768); *Enhydris enhydris* (Schneider, 1799); *Gonyosoma oxycephalum* (Boie, 1827); *Homalopsis buccata* (Linnaeus, 1758); *Naja sputatrix* Boie, 1827; *Oligodon octolineatus* (Schneider, 1801); *Pseudorabdion longiceps* (Cantor, 1847); *Rhabdophis chrysargos* (Schlegel, 1837); *Rhabdophis subminiatus subminiatus* (Schlegel, 1837); *Trimeresurus albolabris* (Gray,1842) or *Trimeresurus insularis* Kramer, 1977; *Typhlops ruficaudus* (Gray, 1845); *Xenochrophis melanzostus* (Gravenhorst, 1807); *Xenochrophis vittatus* (Linnaeus, 1758).

Discussion

In his checklist, In den Bosch (1985) included fifty-five species of land snakes. We consider forty-four of them to be definitely present on Sulawesi. We added eight species, for the following reason: four species saw their geographic range expanded; one species was added because of a taxonomic change; one species which was discovered after 1985; one species because of a difference in opinion and one species which was overlooked. Therefore our checklist contains 52 certain species definitely occurring on Sulawesi. We found four species doubtful for Sulawesi in addition to the eleven species on In den Bosch's checklist, regarded by us as doubtful in retrospect. This brings the total number of doubtful records at 15.

The taxonomy of species in several genera is weak and needs to be reviewed. The differences between *Enhydris matannensis*, *E.plumbea* and *E. enhydris* for instance are small. One of the reasons is that the description of *Enhydris matannensis* is based on two specimens only. In the genus *Rhabdophis* it is not certain whether it is justified to distinguish *R. callistus* from *R. chrysargoides* only on the basis of a difference in colouration of the juveniles. The differences between the species *Cylindrophis isolepis, C. melanotus* and *C. ruffus ruffus* are also small and for *C. isolepis* data is taken from only three specimens.

That the island of Sulawesi has always been isolated can be seen from the low species richness and the high level of endemism in its fauna, relative to the Greater Sunda Islands (Whitten et al., 1987). This is the case for several taxa, including frogs and land snakes. In

Sumatra there are 127 species of land snakes, of which 16 % are endemic (David and Vogel, 1996). In Borneo there are 133 species (23 % is endemic) (Stuebing and Inger, 1999). For the land snakes of Sulawesi our data shows that 22 of the 52 species are endemic, which equals 42 %.

In order to determine which snake populations are threatened and in need of conservation, surveys should be carried out urgently. Thus far herpetofaunal inventories taken in Sulawesi have only been on a very limited scale. We believe that surveys should be made, with priority given to the following species, since it is our impression that they are relatively rare or (potential) victim of human activities: *Candoia carinata carinata*, *Candoia paulsoni tasmai*, *Boiga tanahjampeana*, *Elaphe flavolineata, Gonyosoma jansenii*, *Ophiophagus hannah*, *Python molurus bivittatus*, *Python reticulatus*, *Trimeresurus fasciatus* and the red and green colour morph of *Tropidolaemus wagleri*.

During the production of the field guide "The Snakes of Sulawesi" we encountered some remarkable facts. It is generally known that Wagler's Palm Viper (*Tropidolaemus wagleri*), a common snake in Sulawesi, is coloured green (fig. 2). We however point to the existence of a rare "red form". Fig. 3 is the first colour photo of the "red form" ever published. This form is only found in North- and Central-Sulawesi. Boulenger (1897) gave the first description and a drawing of the "red form". Heinrich (1932) showed a B/W photo of probably a "red form" specimen. Ahl (1933) was the last researcher mentioning the "red form". So this form has been overlooked for a period of over 70 years.

Conclusions

1. We found fifty-two species of landsnakes certainly living in Sulawesi and fifteen species of doubtful occurrence.
2. Surveys should be carried out to determine which snake populations are threatened and in need of conservation. In our opinion priority should be given to the species *Candoia carinata carinata*, *Candoia paulsoni tasmai*, *Boiga tanahjampeana*, *Elaphe flavolineata, Gonyosoma jansenii*, *Ophiophagus hannah*, *Python molurus bivittatus*, *Python reticulatus*, *Trimeresurus fasciatus* and the red and green colour morph of *Tropidolaemus wagleri*.

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Figure 2. *Tropidolaemus wagleri,* common "green form" from Lambunu, North-Sulawesi.

Figure 3. *Tropidolaemus wagleri*, "red form" from Tangko-ko-Batuangas Nature Reserve, Northeast-Sulawesi.

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Appendix. Checklist of the snakes of Sulawesi, containing the species of land snakes, known to occur with certainty in Sulawesi on January 1st 2004. Species or subspecies endemic for Sulawesi are marked with (E).

Family Acrochordidae
Acrochordus granulatus (Schneider, 1799)

Family Boidae - Subfamily Boinae
Candoia carinata carinata (Schneider, 1801)
Candoia paulsoni tasmai Smith & Tepedelen, 2001

Family Colubridae - Subfamily Calamariinae
Calamaria acutirostris Boulenger, 1896 (E)
Calamaria apraeocularis Smith, 1927 (E)
Calamaria boesemani Inger & Marx, 1965 (E)
Calamaria brongersmai Inger & Marx, 1965 (E)
Calamaria curta Boulenger, 1896 (E)
Calamaria muelleri Boulenger, 1896 (E)
Calamaria nuchalis Boulenger, 1896 (E)
Calamaria virgulata Boie, 1827
Calamorhabdium acuticeps Ahl, 1933 (E)
Pseudorabdion sarasinorum (Müller, 1895) (E)
Rabdion forsteni Duméril, Bibron & Duméril, 1854 (E)

Family Colubridae - Subfamily Colubrinae
Ahaetulla prasina prasina (Boie, 1827)
Boiga dendrophila gemmicincta (Duméril, Bibron & Duméril, 1854) (E)
Boiga irregularis (Merrem, 1802)
Boiga tanahjampeana Orlov & Riabov, 2002 (E)
Chrysopelea paradisi celebensis Mertens, 1968 (E)
Chrysopelea rhodopleuron viridis Fischer, 1880 (E)
Dendrelaphis caudolineatus terrificus (Peters, 1872)
Dendrelaphis pictus pictus (Gmelin, 1789)
Elaphe erythrura celebensis (Jan, 1863) (E)
Elaphe flavolineata (Schlegel, 1837)
Gonyosoma jansenii Bleeker, 1858 (E)
Lycodon capucinus Boie, 1827
Lycodon stormi Boettger, 1892 (E)
Oligodon waandersi (Bleeker, 1860) (E)
Psammodynastes pulverulentus pulverulentus (Boie, 1827)
Ptyas dipsas (Schlegel, 1837) (E)

Family Colubridae – Subfamily Homalopsinae
Cerberus rynchops rynchops (Schneider, 1799)
Enhydris matannensis (Boulenger, 1897) (E)
Enhydris plumbea (Boie, 1827)

Family Colubridae – Subfamily Natricinae
Amphiesma celebicum (Peters & Doria, 1878)
Amphiesma sarasinorum (Boulenger, 1896) (E)
Rhabdophis callistus (Günther, 1873) (E)
Rhabdophis chrysargoides (Günther, 1858)
Xenochrophis trianguligerus (Boie, 1827)

Family Cylindrophiidae
Cylindrophis isolepis Boulenger, 1896 (E)
Cylindrophis melanotus Wagler, 1828
Cylindrophis ruffus ruffus (Laurenti, 1768)

Family Elapidae – Subfamily Bungarinae
Ophiophagus hannah (Cantor, 1836)

Family Pythonidae
Python molurus bivittatus Kuhl, 1820
Python reticulatus jampeanus Auliya et al., 2002 (E)
Python reticulatus reticulatus (Schneider, 1801)
Python reticulatus saputrai Auliya et al., 2002 (E)

Family Typhlopidae
Cyclotyphlops deharvengi In den Bosch & Ineich, 1994 (E)
Ramphotyphlops braminus (Daudin, 1803)
Ramphotyphlops olivaceus (Gray, 1845)
Typhlops ater Schlegel, 1839
Typhlops conradi Peters, 1874 (E)

Family Viperidae – Subfamily Crotalinae
Trimeresurus fasciatus (Boulenger, 1896) (E)
Tropidolaemus wagleri Wagler, 1830

Family Xenopeltidae
Xenopeltis unicolor Boie, 1827