

Bonn zoological Bulletin	Volume 57	Issue 2	pp. 127–136	Bonn, November 2010
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## Updated checklist of the living monitor lizards of the world (Squamata: Varanidae)

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**Abstract.** We provide an update of Böhme's (2003) checklist of the living monitor lizards of the world. Since this contribution, ten new species and one new subspecies have been described. Ten of these taxa were described from the islands of the Indo-Australian Archipelago. One *Soterosaurus* taxon (*macromaculatus*) was revalidated to subspecies status, whereas the younger melanistic taxon *komaini* was synonymized with the former. In addition, five taxa (*beccarii*, *cumingi*, *marmoratus*, *nuchalis*, and *togianus*), that were formerly treated as subspecies, were re-elevated to species rank resulting in 73 extant species (including 21 subspecies). This represents a 20% increase of the world's varanid diversity since 2003. In addition, ongoing taxonomic studies on *V. spinulosus* from the Solomon Islands (formerly a member of the *V. indicus* species group) indicate that this species most likely represents a new subgenus. Therefore, this taxon is currently treated incertae sedis. In sum, taxonomic research in monitor lizards remains incomplete. Further studies must be initiated to fully understand diversity and distribution of these CITES-listed lizards next to implications for sustainable conservation measures.

**Key words:** Reptilia, *Varanus*, *Philippinosaurus*, *Soterosaurus*, *Euprepiosaurus*, *Odatia*, checklist.

## INTRODUCTION

Monitor lizards are among the largest living squamates of the world. They inhabit Africa, the Arabian Peninsula, South and Southeast Asia as well as the Indo-Australian Archipelago including Australia and several Pacific island groups. Due to their often large body size and ecological role as top predators in most environments they inhabit, monitor lizards have always been a small reptile group comparable to large placental carnivores (Sweet & Pianka 2007). Nevertheless, the diversity of monitor lizards has been underestimated for many decades.

One of the latest comprehensive listings of all extant monitor lizards was published by Böhme (2003), who listed 58 different species and 28 subspecies. This checklist was prepared at the request of the Nomenclature Committee of the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES), because of the increase in monitor lizard diversity in the early 1990s. This caused considerable confusion within trade records, which made communication about these economically important lizards in the CITES domain rather difficult.

Therefore, Böhme's (2003) checklist was adopted as the standard reference for the Varanidae by the 12<sup>th</sup> Conference of the Parties to CITES in November 2002.

The need for an updated list only seven years after the last synopsis by Böhme (2003) derives from ongoing descriptions of new species. This is partly due to the fact, that the understanding of monitor lizards, their systematics, and the underlying concepts have been refined in recent years (e.g. Koch et al. 2009). In addition, the taxonomic status of several nominal taxa has changed. This involves either subspecies elevated to species rank or the subgeneric allocation of species. Also, knowledge of distribution ranges of some rare monitor lizard species has been advanced by the examination of new voucher specimens and investigations in the field.

Next to taxonomic and phylogenetic studies on the Varanidae, those focusing on conservation particularly of the Indo-Australian realm remain scarce. A summary of threats monitor lizards are exposed to in this region, cur-

rent conservation studies and measures in place, and the conservation status of all Indo-Australian species will be outlined in detail elsewhere.

## METHODS

In the present paper, we compiled all monitor lizard taxa that were published after Böhme (2003). This includes also such names where the taxonomic status has changed. We basically follow the format of this author, which has earlier been used by Mertens (1963).

The synonymy list of each taxon starts with the original citation and is then arranged chronologically with the source of the respective name and its type locality. Chresonyms are generally not included with the exception of names with a changed taxonomic status exemplified by subspecies names, that were elevated to species level or when a new species is separated from a long recognized species. In these cases, the taxon name and the author(s) are separated by a “–”. In addition, type specimens for valid taxa are provided, if available. Collection acronyms are as follows: BMNH = British Museum of Natural History, London, UK; KU = Kansas University, Museum of Natural History, Lawrence, USA; MNHN = Muséum national d'Histoire naturelle, Paris, France; MSNG = Museo Civico di Storia Naturale di Genova Giacomo Doria, Genova, Italy; MZB = Museum Zoologicum Bogoriense, Bogor, Indonesia; NMW = Naturhistorisches Museum Wien, Vienna, Austria; PNM = Philippine National Museum, Manila, Philippines; RMNH = National Natural History Museum Naturalis, Leiden, Netherlands; SMF = Naturmuseum Senckenberg, Frankfurt, Germany; USNM = National Museum of Natural History, Washington, USA; WAM = Western Australian Museum, Perth, Australia; ZFMK = Zoologisches Forschungsmuseum Alexander Koenig, Bonn, Germany; ZMA = Zoological Museum, University of Amsterdam, Netherlands; ZMB = Museum für Naturkunde, Berlin, Germany; ZMUC = Zoological Museum, University of Copenhagen, Denmark.

## Update of the checklist of extant monitor lizards by Böhme (2003)

### Subgenus *Philippiusaurus* Mertens, 1959

#### *Varanus bitatawa* Welton, Siler, Bennett, Diesmos, Duya, Dugay, Rico, van Weerd & Brown, 2010

2010 *Varanus bitatawa* Welton, Siler, Bennett, Diesmos, Duya, Dugay, Rico, van Weerd & Brown, Biol. Lett., 6: 654. – Type locality: Base of the San Ildefonso Peninsula,

la, Sitio Casapsipan, Barangay Casiguran, Municipality of Casiguran, Aurora Province, Luzon Island, Philippines.

2008 *Varanus olivaceus* – Eidenmüller & Philippen (in part), Terralog, 6: 103.

Type specimens: Holotype PNM 9719 (formerly KU 320000), paratypes KU 322188 and PNM 9008.

Distribution: Northern Luzon, Philippines.

Remark: This species was recently separated from *V. olivaceus* based on minor genetic variation, morphological differences and biogeographic evidence (Welton et al. 2010).

### Subgenus *Soterosaurus* Ziegler & Böhme, 1997

#### *Varanus s. salvator* (Laurenti, 1768)

1768 *Stellio salvator* Laurenti, Synops. Rept.: 56. – Type locality: Sri Lanka.

1758 *Lacerta monitor* part. Linnaeus, Syst. nat., 10 (1): 201. – Type locality: In Indiis (*nomen rejectum* according to ICZN 1959, Opinion 540).

1947 *Varanus salvator kabaragoya* Deraniyagala, Proc. 3rd ann. Sess. Ceylon Assoc. Sci., 2 (Abstr.): 12. – Type locality: Ceylon (= Sri Lanka).

Type specimen: Neotype ZFMK 22092, designated by Koch et al. (2007).

Distribution: Sri Lanka.

Remark: Until recently the nominotypic subspecies had the widest distribution range within the widespread *V. salvator* complex. Due to the revalidation of the subspecies *V. s. macromaculatus* from continental Southeast Asia, the nominotypic subspecies is now restricted to Sri Lanka.

#### *Varanus salvator macromaculatus* Deraniyagala, 1944

1944 *Varanus salvator macromaculatus* Deraniyagala, Spol. Zeyl. 24: 60. – Type locality: Siam (= Thailand).

1802 *Tupinambis elegans* Daudin (in part), Hist. nat. Rept., 3: 36. – Type locality: Surinam.

1831 *Tupinambis exilis* Gray in Griffith, Anim. Kingd., 9: 25. – Type locality: India (*nomen dubium*, fide Koch et al. 2007).



1834 *Varanus vittatus* Lesson in Bélanger, Voyage Ind. Orient. Zool.: 307. – Type locality: Indian subcontinent and islands at the mouth of the Ganges River (*nomen dubium* fide Koch et al. 2007).

1842 *Varanus binotatus* Blyth, J. asiat. Soc. Bengal, 11: 867 (Lapsus fide Mertens 1942).

1942 *Lacertus tupinambis* Mertens (in part, non Lacépède, 1788) Abh. Senckb. Naturf. Ges., 466: 245. – Type locality: unknown (Lapsus fide Brygoo 1987).

1947 *Varanus salvator nicobariensis* Deraniyagala, Proc. 3rd ann. Sess. Ceylon Assoc. Sci., 2, Abstr.: 12. – Type locality: Tillanchong, Nicobar Islands.

1987 *Varanus salvator komaini* Nutphand, J. Thai. Zool. Center, 2 (15): 51. – Type locality: Sea shore areas and small islands in south western Thailand.

2007 *Varanus salvator macromaculatus* – Koch, Auliya, Schmitz, Kuch & Böhme, Mertensiella, 16: 136.

Type specimens: Lectotype MNHN 871, paralectotype MNHN 1884.77, designated by Koch et al. (2007).

Distribution: Thailand, Peninsula Malaysia, Vietnam, southern China, Hainan, Sumatra, and Borneo and smaller off-shore islands.

Remark: This subspecies of *V. salvator* was recently resurrected from the synonymy of the nominotypic subspecies which, due to differences in morphological characters and colour pattern, had to be restricted to Sri Lanka (Koch et al. 2007). At the same time, the melanistic taxon *komaini* from Thailand was identified as a junior synonym of *V. s. macromaculatus* in the absence of morphological differences except for the lack of a light colour pattern. Therefore, the remaining subspecies of *V. salvator* are: *V. s. salvator*, *V. s. macromaculatus*, *V. s. andamanensis*, and *V. s. bivittatus* (Koch et al. 2007).

### ***Varanus cumingi* Martin, 1838**

1838 *Varanus cumingi* Martin, Proc. Zool. Soc. London 1838: 69. – Type locality: Mindanao, Philippines.

1942 *Varanus (Varanus) salvator cumingi* – Mertens, Abh. Senckb. Naturf. Ges., 466: 256.

2007 *Varanus (Soterosaurus) cumingi* – Koch, Auliya, Schmitz, Kuch & Böhme, Mertensiella, 16: 168.

Distribution: Islands of the Greater Mindanao region (i.e., Mindanao, Samar, Leyte, and Bohol), Philippines.

Remark: Recently, *V. cumingi* was demonstrated to be specifically distinct from *V. salvator* (Koch et al. 2007). The species was also shown to be polytypic and a new subspecies was described from the northern islands within the species range (Koch et al. 2010).

### ***Varanus c. cumingi* Martin, 1838**

1838 *Varanus cumingi* Martin, Proc. Zool. Soc. London 1838: 69. – Type locality: Mindanao, Philippines.

1991 *Varanus salvator cumingi* – Gaulke (in part), Mertensiella, 2: 154.

Type specimen: Lectotype BMNH 1946.8.31.5, designated by Koch et al. (2007).

Distribution: Restricted to Mindanao and off-shore islands, Philippines.

### ***Varanus cumingi samarensis* Koch, Gaulke & Böhme, 2010 (Fig. 1D)**

2010 *Varanus cumingi samarensis* Koch, Gaulke & Böhme, Zootaxa, 2440: 19 – Type locality: San Augustin near Gandara, Samar Island, Philippines.

1991 *Varanus salvator cumingi* – Gaulke (in part), Mertensiella, 2: 161.

Type specimens: Holotype ZFMK 64713, paratype ZFMK 64712.

Distribution: Samar, Bohol, and Leyte, Philippines.

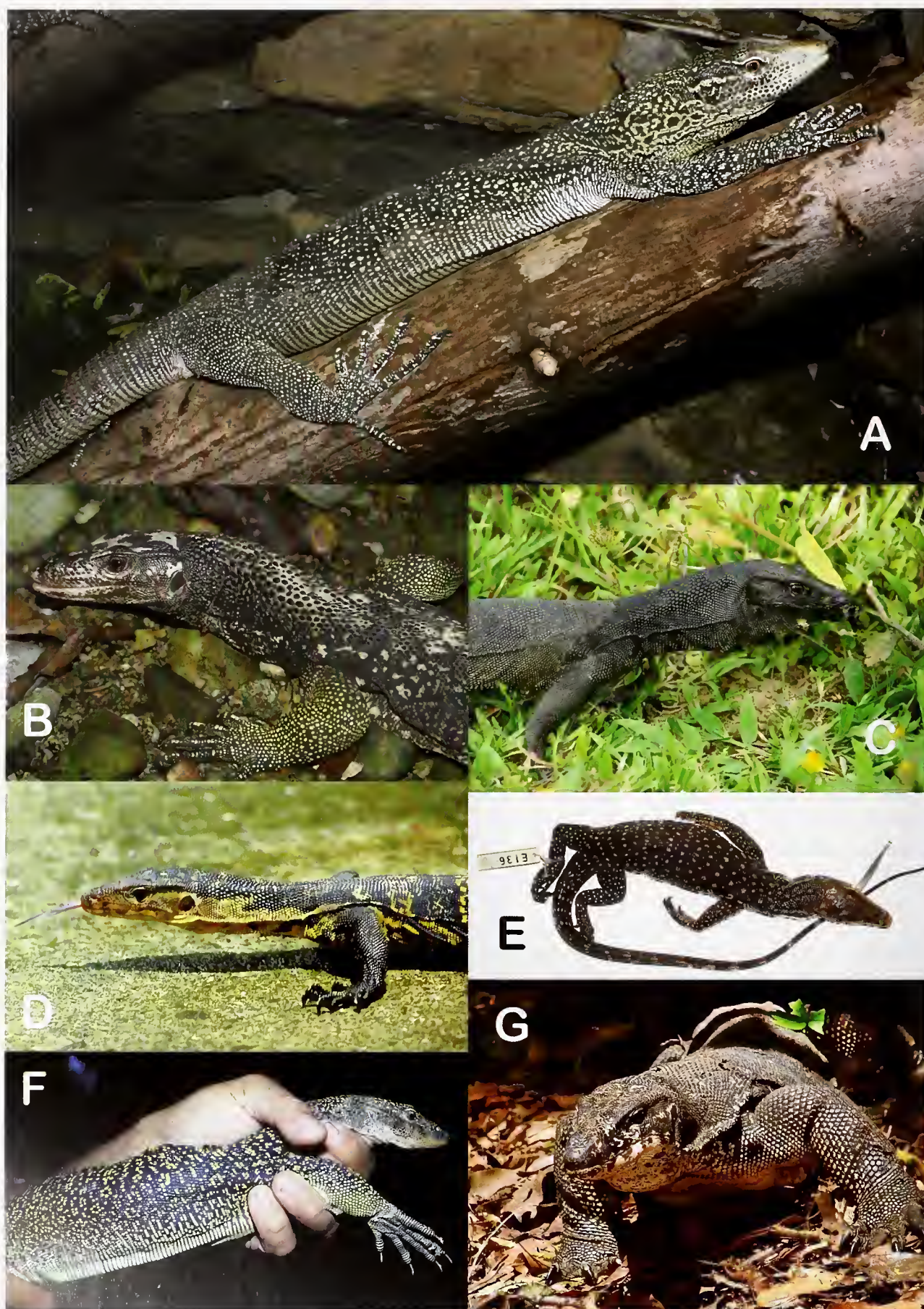
### ***Varanus marmoratus* (Wiegmann, 1834)**

1834 *Hydrosaurus marmoratus* Wiegmann, in Meyen, Reise um die Erde, 3: 446. – Type locality: San Mat(h)eo village or Talim Island, Laguna Bay, near Manila, Luzon, Philippines.

1829 *M[onitor] marmoratus* Cuvier, Règne animal 2(2): 26. (*nomen nudum* fide Mertens 1942; Good et al. 1993).

1844 *Monitor bivittatus philippensis* Schlegel, Abb. Amphib.: x. – Type locality: Manila, Luzon.





**Fig. 1.** Fig. 1: Some monitor lizards described after Böhme's (2003) checklist and species where the taxonomic status has changed since. A: *Varanus boehmei* Jacobs, 2003 (photo T. Ziegler); B: *V. nuchalis*, revalidated species status (photo M. Gaulke); C: *V. to-gianus*, revalidated species status (photo A. Koch); D: *V. cumingi samarensis* Koch, Gaulke & Böhme, 2010 (photo M. Gaulke); E: *V. rasmusseni* Koch, Gaulke & Böhme, 2010, juvenile paratype ZFMK 89391 (photo A. Koch); F: *V. liringensis* Koch, Arida, Schmitz, Böhme & Ziegler, 2009 (photo M. Auliya); G: *V. palawanensis* Koch, Gaulke & Böhme, 2010 (photo I. Langlotz).



1876 *Varanns manilensis* von Martens, Preuß. Exped. Ostas. Zool., 1: 196. (Lapsus fide Mertens 1942).

1942 *Varanus (Varanus) salvator marmoratus* – Mertens, Abh. Senckb. Naturf. Ges., 466: 254.

1944 *Varanns salvator philippinensis* Deraniyagala, Spol. Zeylan., 24: 61. – Type locality: Luzon.

1997 *Varanns (Soterosaurus) salvator marmoratus* – Ziegler & Böhme, Mertensiella, 8: 177.

2007 *Varanus (Soterosaurus) marmoratus* – Koch, Auliya, Schmitz, Kuch & Böhme, Mertensiella, 16: 161.

Type specimen: Lectotype ZMB 470, designated by Mertens (1942).

Distribution: Restricted to Luzon and some off-shore islands, Philippines.

Remark: Originally, Wiegmann (1834) based his description on two voucher specimens (Koch et al. 2007). The second larger syntype, however, which should have paratype status, is missing (Good et al. 1993). Recently, *V. marmoratus* was shown to represent a collective species (Koch et al. 2010). The disjunct island populations of the Greater Palawan region and the Sulu Archipelago were allocated to two new species (see below).

### ***Varanus nuchalis* (Günther, 1872) (Fig. 1B)**

1872 *Hydrosaurus nuchalis* Günther, Proc. Zool. Soc. London, 1872: 145. – Type locality: Philippines.

1942 *Varanus (Varanus) salvator nuchalis* – Mertens, Abh. Senckb. Naturf. Ges., 466: 258.

1997 *Varanus (Soterosaurus) salvator nuchalis* – Ziegler & Böhme, Mertensiella, 8: 177.

2007 *Varanus (Soterosaurus) nuchalis* – Koch, Auliya, Schmitz, Kuch & Böhme, Mertensiella, 16: 165.

Type specimen: Holotype BMNH 1946.9.1.17.

Distribution: Islands of Negros, Panay, Masbate, Ticao, and Cebu, Philippines.

Remark: Despite a high variation in colour pattern, a recent study could not document a correlation between colour pattern and distribution (Koch et al. 2010).

### ***Varanus palawanensis* Koch, Gaulke & Böhme, 2010 (Fig. 1G)**

2010 *Varanus palawanensis* Koch, Gaulke & Böhme, Zootaxa, 2446: 33. – Type locality: Tabon, Palawan Island, Philippines.

1942 *Varanus (Varanus) salvator marmoratus* – Mertens (in part), Abh. Senckb. Naturf. Ges., 466: 254.

1991 *Varanns salvator marmoratus* – Gaulke (in part), Mertensiella, 2: 154.

2007 *Varanus (Soterosaurus) marmoratus* – Koch, Auliya, Schmitz, Kuch & Böhme (in part), Mertensiella, 16: 161.

Type specimens: Holotype SMF 73912, paratypes SMF 73914–15, BMNH 94.6.30.19, BMNH 94.6.30.20, MNHN 1884-187, ZMUC E78, and ZFMK 89691 (formerly SMF 73913).

Distribution: Islands of Greater Palawan (Palawan, Balabac and the Calamian Island group) and Sibutu Island within the Sulu Archipelago, Philippines.

Remark: Traditionally, the populations of Palawan and adjacent islands were allocated to *V. marmoratus*, but recent investigations confirmed their morphological distinctness (Koch et al. 2010).

### ***Varanus rasmusseni* Koch, Gaulke & Böhme, 2010 (Fig. 1E)**

2010 *Varanns rasmusseni* Koch, Gaulke & Böhme, Zootaxa, 2446: 28. – Type locality: Tarawakan, north of Batu-Batu, Tawi-Tawi Island, Sulu Archipelago, Philippines.

1992 *Varanns salvator marmoratus* – Gaulke (in part), Hamadryad, 17: 21.

2007 *Varanns (Soterosaurus) cf. marmoratus* – Koch, Auliya, Schmitz, Kuch & Böhme, Mertensiella, 16: 163.

Type specimens: Holotype ZMUC R42151, paratype ZFMK 89391 (formerly ZMUC R42153).

Distribution: Only known from the type locality, but probably also on other islands of the Tawi-Tawi island group, Philippines.

Remark: Recent morphological investigations demonstrated the specific distinctness of the Tawi-Tawi population which was formerly assigned to *V. marmoratus* (Koch et al. 2010).

***Varanus togianus* (Peters, 1872) (Fig. 1C)**

1872 *Monitor (Hydrosaurus) togianus* Peters, Monatb. Kön. Preuss. Akad. Wiss., 1872: 582. – Type locality: Timotto, Togian (= Togeian) Islands, Central Sulawesi, Indonesia.

1942 *Varanus (Varanus) salvator togianus* – Mertens, Abh. Senckb. Naturf. Ges., 466: 253.

1997 *Varanus (Soterosaurus) salvator togianus* – Ziegler & Böhme, Mertensiella, 8: 177.

2007 *Varanus (Soterosaurus) togianus* – Koch, Auliya, Schmitz, Kuch & Böhme, Mertensiella, 16: 156.

Type specimens: Lectotype ZMB 7388, paralectotype ZMB 7389, by designation of Mertens (1942).

Distribution: Sulawesi, except the northern peninsula.

Remark: Recent investigations revealed this endemic Sulawesi taxon to be specifically distinct from *V. salvator* (Koch et al. 2007) and polytypic (Koch et al. unpubl. data).

**Subgenus *Euprepiosaurus* Fitzinger, 1843*****Varanus indicus* species group*****Varanus liruensis* Koch, Arida, Schmitz, Böhme & Ziegler, 2009 (Fig. 1F)**

2009 *Varanus liruensis* Koch, Arida, Schmitz, Böhme & Ziegler, Austr. J. Zool., 57: 33. – Type locality: near Lirung, Salibabu Island, Talaud Islands, Indonesia.

1915 *Varanus indicus* – de Rooij (in part), Rept. Indo-Austr. Arch., 1: 149.

1942 *Varanus (Varanus) indicus indicus* – Mertens (in part), Abh. Senckb. Naturf. Ges., 466: 263.

Type specimens: Holotype MZB Lac. 5178, paratypes MZB Lac. 5176-77, 5179-80, ZFMK 87587 (formerly ZMA 15411a), ZMA 15411b.

Distribution: Only known from the type locality.

Remark: *V. liruensis* represents the most north-western member of the *V. indicus* species group (Koch et al. 2009).

***Varanus obor* Weijola & Sweet, 2010**

2010 *Varanus obor* Weijola & Sweet, Zootaxa, 2434: 18. – Type locality: Soela-Bési (= Sanana Island), Sula Islands, Moluccas, Indonesia.

Type specimen: Holotype RMNH 7225.

Distribution: Only known from the type locality.

Remark: *V. obor* represents the latest discovery of a member of the *V. indicus* species group. Nothing is known about its conservation status (Weijola & Sweet 2010).

***Varanus rainierguentheri* Ziegler, Böhme & Schmitz, 2007**

2007 *Varanus rainierguentheri* Ziegler, Böhme & Schmitz, Mitt. Mus. Nat.kd. Berlin, Suppl. 83: 110. – Type locality: Jailolo, Halmahera Island, Moluccas, Indonesia.

2005 *Varanus* cf. *indicus* – Böhme & Ziegler, Salamandra, 41: 57.

Type specimens: Holotype ZFMK 85404, paratype USNM 237438.

Distribution: Northern Moluccan islands of Halmahera, Ternate, Tidore, Morotai, Bacan, Gebe and Obi.

Remark: Originally, *V. rainierguentheri* was only known from its type locality (Ziegler et al. 2007a), but recent field studies showed that this species occurs over a wider range in the Moluccas (Weijola 2010).

***Varanus zugorum* Böhme & Ziegler, 2005**

2005 *Varanus zugorum* Böhme & Ziegler, Salamandra, 41(1/2): 52. – Type locality: Kampung Pasir Putih, Jailolo district, Halmahera Island, Moluccas, Indonesia.

Type specimen: Holotype USNM 237439.

Distribution: Only known from the type locality.

Remark: *V. zugorum* appears to be the rarest or at least known monitor lizard of all species described, known only from the holotype specimen. Recent field work on Halmahera Island failed to record this secretive species (Setiadi & Hamidy 2006; Weijola 2010; Awal Riyanto, Bogor, pers. comm. viii.2010). Only one putative photograph of a live specimen exists (see Böhme & Ziegler 2005).



***Varanus prasinus* species group*****Varanus beccarii* (Doria, 1874)**

1874 *Monitor Beccarii* Doria, Ann. Mus. Civ. Stor. Nat. Genova, 6: 331. – Type locality: Wokam, Aru Islands, Indonesia.

1942 *Varanus (Odatia) prasinus beccarii* – Mertens, Abh. Senckb. Naturf. Ges., 466: 296.

2003 *Varanus (Euprepisaurus) prasinus beccarii* – Böhme, Zool. Verh., 341: 25.

2007 *Varanus (Euprepisaurus) beccarii* – Ziegler, Schmitz, Koch & Böhme, Zootaxa, 1472: 15.

Type specimens: Syntypes ZMB 7993, MSNG 28723.

Distribution: Restricted to the Aru Islands.

Remark: In the past, the taxon *beccarii* was considered a subspecies of *V. prasinus* (e.g. Mertens 1942; Ziegler & Böhme 1997). Recently, Ziegler et al. (2007b) demonstrated that *V. beccarii* is distinct from the latter species. The species is potentially threatened by the international trade in live specimens.

***Varanus boehmei* Jacobs, 2003 (Fig. 1A)**

2003 *Varanus boehmei* Jacobs, Salamandra, 39(2): 66. – Type locality: Waigeo Island, West Papua, Indonesia.

Type specimens: Holotype ZFMK 77837, paratypes ZFMK 82826, ZFMK 84000, ZMA 21702 (formerly ZFMK 79122) and three further specimens which were still alive and will be deposited in ZFMK after their demise.

Distribution: Only known from the type locality.

Remark: Due to its restricted distribution range and its exploitation for the international pet trade, *V. boehmei* must be considered threatened.

***Varanus reisingeri* Eidenmüller & Wicker, 2005**

2005 *Varanus reisingeri* Eidenmüller & Wicker, Sauria, 27(1): 4. – Type locality: Insel Misol (= Misool Island) off the west coast of West Papua, New Guinea, Indonesia.

1942 *Varanus (Odatia) prasinus prasinus* – Mertens (in part), Abh. Senckb. Naturf. Ges., 466: 292.

Type specimens: Holotype SMF 83679, the two paratypes are still alive and will be deposited in SMF after their demise (Bernd Eidenmüller, Frankfurt, pers. comm. xii.2010).

Distribution: Only known from the type locality.

Remark: The taxonomic validity of this species remains uncertain because diagnostic morphological characters largely overlap with *V. prasinus* from New Guinea. As the former species, *V. reisingeri* is also potentially threatened by exploitation for the pet trade.

**Subgenus *Odatia* Gray, 1838*****Varanus bushi* Aplin, Fitch & King, 2006**

2006 *Varanus bushi* Aplin, Fitch & King, Zootaxa, 1313: 24. – Type locality: Marandoo, Western Australia (22° 37'S 118° 08' E).

1980 *Varanus caudolineatus* – Storr (in part), Rec. West. Austr. Mus., 8: 250.

Type specimens: Holotype WAM R108999, paratypes WAM R54230, WAM R56834, and WAM R62171.

Distribution: Endemic to the Pilbara region of Western Australia.

Remark: *V. bushi* was described as morphologically and genetically distinct from its closest relatives *V. caudolineatus* and *V. gilleui*. All three Australian dwarf monitor lizards display complex patterns of sexual dimorphism (Aplin et al. 2006).

**Subgenus: *Incertae sedis******Varanus spinulosus* Mertens, 1941**

1941 *Varanus indicus spinulosus* Mertens, Senckenbergiana, 23: 269. – Type locality: Georgs-Insel (= St. George Island or San Jorge Island), near Santa Isabel (= Ysabel) Island, Solomon Islands.

1942 *Varanus (Varanus) indicus spinulosus* – Mertens, Abh. Senckb. Naturf. Ges., 466: 271.

1994 *Varanus spinulosus* – Sprackland, Herpetofauna, 24 (2): 34.

1997 *Varanus (Euprepiosaurus) spinulosus* – Ziegler & Böhm, Mertensiella, 8: 14.

2007 *Varanus* (subgen. inc. sed.) *spinulosus* – Böhm & Ziegler, Mertensiella, 16: 105.

Type specimen: Holotype NMW 23387 (formerly NMW 3709).

Distribution: San Jorge and Santa Isabel Islands, Solomon Islands, and Bougainville Island, Papua New Guinea.

Remark: For almost 50 years, this rare monitor lizard species was only known from the holotype (Sprackland 1993). The former collection number of the type was originally assigned by Mertens (1941, 1942) and still applied by de Lisle (2009). Tiedemann et al. (1994) and Böhm & Koch (2010) provided the current number. Sprackland (1994) elevated *spinulosus* to full species status. Recently, the distribution range of *V. spinulosus* was extended, when the species was newly recorded from Bougainville Island and its occurrence was confirmed on the island of Santa Isabel (Böhm & Ziegler 2007; Dwyer 2008).

*V. spinulosus* was formerly allocated to the *V. indicus* species group of the subgenus *Euprepiosaurus* (see Ziegler & Böhm 1997), but a new monotypic subgenus is discussed based on new genital morphological findings (Böhm & Ziegler 2007).

## DISCUSSION

In total, ten new species and one new subspecies were introduced to science since Böhm's (2003) checklist. Nine of the species (i.e., 90%) and the subspecies were described from islands of the Indo-Australian Archipelago. Only one new species, *V. bushi*, was recently identified from Western Australia (Aplin et al. 2006). In addition, five taxa (*beccarii*, *cumingi*, *marmoratus*, *nuchalis*, and *togianus*) were re-elevated to full species status due to morphological (e.g., scale counts, morphometrics, colour pattern) and/or genetical idiosyncrasies, thus bringing the global diversity to 73 (including 21 subspecies). This represents an increase in species diversity of 20% since 2003. Particularly 2010 has been a very productive year for the increase of monitor lizard diversity. Four new species and one new subspecies were described from Indonesia and the Philippines within the first half of 2010 (Koch et al. 2010; Weijola & Sweet 2010; Welton et al. 2010).

Descriptions of new monitor lizard species since 2003 mainly refer to two different taxonomic groups, the South-

east Asian and Indo-Australian subgenera *Soterosaurus* and *Euprepiosaurus*, with two and six new species, respectively. In addition, the taxonomic status of several members of the subgenus *Soterosaurus* has changed. While this subgenus was hitherto considered monotypic with *V. salvator* being the only, albeit polytypic species with eight recognized subspecies (Böhm 2003), the Philippine subspecies *cumingi*, *marmoratus*, and *nuchalis*, and *togianus* from Sulawesi were re-elevated to their original species status (Koch et al. 2007), thus resulting in a species complex of closely related allies. Additionally, one subspecies (*V. salvator macromaculatus*) of the Southeast Asian water monitor lizard was revalidated, whereas the younger melanistic taxon *komaini* was synonymized with the former (Koch et al. 2007).

With currently 22 recognized species, the subgenus *Euprepiosaurus* has displaced the Australian *Odatia* as the most species-rich subgenus of varanids. Within *Euprepiosaurus*, the new species descriptions are unevenly distributed over the two species groups involved, viz. the Pacific monitors around *V. indicus* and the tree monitors around *V. prasinus*, respectively. The latter group experienced only two new species descriptions (i.e., *V. boehmei* and *V. reisingeri*) and currently comprises nine allopatric species from New Guinea and its offshore islands. On the other hand, four new species were added to the *V. indicus* species group leading to a total of 13 recognized species, at least four of which occur in sympatry on New Guinea and Halmahera in the northern Moluccas. Among these recently described Pacific monitor lizard species, next to morphologically cryptic taxa, such as *V. lirungensis* or *V. rainierguentheri*, there are also strikingly different species with idiosyncratic features in morphology and colour pattern, such as the melanistic *V. obor* and the silver-coloured *V. zugarum*. Five years after its formal description and despite repeated field trips to the northern Moluccas (Setiadi & Hamidy 2006; Weijola 2010; Awal Riyanto, Bogor, pers. comm. viii.2010), the latter species is still only known from the holotype specimen and has thus to be regarded the rarest and at least known varanid species.

Böhm (2003) already recognized a taxonomic trend towards a reduction of polytypic monitor lizard species by the elevation of nominal subspecies to species rank. Certainly, this trend still continues as seen in the *V. salvator* complex (Koch et al. 2007). The description of a new subspecies of *V. cumingi* from the Philippines (Koch et al. 2010), however, demonstrates that a distinction is still made between the degree of morphological (e.g., morphometrics and scalation features) and molecular differentiation (i.e. characteristics of the full species category) and mere geographically correlated differences in colour pattern (i.e. diagnostic features of subspecies).



## CONCLUSIONS

Because taxonomy is a dynamic discipline, further changes and additions to the list of extant monitor lizards are to be expected in the future. This will include new species descriptions – either real discoveries or by the splitting of already recognized species – as well as a change of the taxonomic status. Therefore, we are aware that this updated checklist can only represent the latest state of art and may already be outdated by the time of publication. In terms of conservation purposes, it is essential to refer to these most recent checklists, and with the increase of monitor lizard diversity especially in the Indo-Australian realm, there is definitely a need to establish user-friendly identification tools for a vertebrate group globally sought after within the international pet and reptile leather trade.

We do wish that our contribution will serve as a useful supplement to the checklist of the living monitor lizards of the world by Böhme (2003) for all those who are interested in or concerned with the diversity of monitor lizards.

**Acknowledgments.** The fact, that Wolfgang Böhme was involved in most of the recent taxonomic changes and additions to the global checklist of varanids together with the naming of one new species, viz. *V. boehmei*, after him, reflect his internationally renowned competence and eminent position in systematic monitor lizard research. On the occasion of his retirement, we hereby wish to dedicate this contribution to Professor Dr. Wolfgang Böhme, Vice Director, Head of the Vertebrate Department and Curator of Herpetology for 39 years at the Zoologisches Forschungsmuseum Alexander Koenig in Bonn, Germany. We are deeply indebted to Wolfgang Böhme, who initiated and supervised our careers related to varanid research.

Furthermore, we thank Gunter Köhler (SMF, Frankfurt), Bernd Eidenmüller (Frankfurt), and Manfred Reisinger (Landshut), for information on preserved and live type specimens in their care. Awal Riyanto (MZB, Bogor) kindly shared his observations on monitor lizards from the field. The helpful comments of two anonymous referees improved an earlier version of this contribution.

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Received: 04.VIII.2010

Accepted: 21.X.2010



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Jahr/Year: 2010

Band/Volume: [57](#)

Autor(en)/Author(s): Koch André, Auliya Mark, Ziegler Thomas

Artikel/Article: [Updated checklist of the living monitor lizards of the world \(Squamata: Varanidae\) 127-136](#)