

Mark Auliya and André Koch

Visual Identification Guide to the Monitor Lizard Species of the World (Genus *Varanus*)

Guidance for the Identification of Monitor Lizards with current
Distribution Data as well as short Explanations on
Reproductive Characteristics and Captive Breeding to support
CITES Authorities



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**Mark Auliya
André Koch**

Cover picture: Emerald monitor lizard (*Varanus prasinus*) for sale on a reptile market in Hamm, Germany
(M. Auliya)

Authors' addresses:

Dr. Mark Auliya
Dr. André Koch
Zoologisches Forschungsmuseum Alexander Koenig
Adenauerallee 160, 53113 Bonn
E-Mail: wildlife@cosiar.org
andrepscalkoch@web.de

Scientific Supervision:

Dr. Mona van Schingen
Dipl. Geogr. Ulrich Schepp
Division II 1.1 „Wildlife Conservation“

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Preface

Germany and the member states of the European Union (EU) are among the most important importers of living reptiles and their parts and products (e.g. leather) worldwide. In addition, Germany is a central transit country in the EU reptile trade and thus bears a great responsibility for the conservation of the traded species in their countries of distribution.

Among reptiles, monitor lizards (Varanidae) are particularly relevant for international trade, which is regulated by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). To date, 82 species of monitor lizards are scientifically described, which vary much in relevance for trade and differ in conservation and protection status (CITES Appendix I or II). Many of these taxa have been described only recently as distinct species based on genetic divergences. The increasing numbers of newly described cryptic (morphologically similar to identic) monitor lizard species in different species complexes pose an increasing challenge to management authorities regarding proper species identification. However, the accurate identification of species is crucial for the proper implementation of the CITES convention and the conservation of monitors lizards.

In April 2016, the German Federal Agency for Nature Conservation (BfN) conducted a workshop entitled "Trade in exotic reptiles in Germany on the example of monitor lizards (family Varanidae)" and published the results in the "NaBiV-Schriftenreihe" (issue 159). A main result of the workshop was the call for an identification guide for monitor lizards to assist the respective authorities in charge in identifying monitor lizards based on morphological characteristics.

This edition of the "BfN Scripts" now fulfills this requirement and provides a morphological identification guide for all currently described monitor lizard species, both for the authorities and for interested experts. In addition to relevant information on species identification, this guide also contains data on the reproductive characteristics of individual species. This information is relevant for making plausibility findings on the "breeding ability" of traded species.

Prof. Dr. Beate Jessel

President of the Federal Agency for Nature Conservation

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Without the help and support of numerous friends, colleagues from the IUCN SSC Monitor Lizard Specialist Group (MLSG), and professional photographers, it would not have been possible to complete this comprehensive identification guide to the monitor lizards of the world. To take up the precious time of so many was often challenging, but this effort was worth it, also because many recognized the importance of this contribution in the sense of species protection and therefore gladly supported us actively.

First of all, we would like to thank Ulrich Schepp from the German Federal Agency for Nature Conservation (BfN), who contributed significantly to the initiative for the production of this guide. He and Mona van Schingen (BfN) accompanied the development of this work with a lot of patience and advice; they were always willing to help develop the layout, conscientiously proofread the German and English versions and often provided helpful comments. Timm Reinhardt and Christian Stotzem (both also from BfN) supported the proofreading of the species fact sheets.

Supplementary literature sources were provided by Ulrich Schepp, Robert Mendyk as well as Ulla Bott and Wolfgang Böhme from the Zoological Research Museum Alexander Koenig (Bonn). Specifically, Mark Auliya would also like to thank "World Animal Protection" (WAP) for providing funds on herpetological field research in western Africa.

By far the greatest challenge was to compile good and meaningful images for all 81 monitor species. Many people and colleagues supported us in this task, some even by providing photos of third parties. Therefore, we would like to thank all supporters including those whose photos we were unfortunately not able to consider in the final selection mainly due to space restrictions (for some monitor lizard species we were in the fortunate position of being able to choose between several good photos, while for other species there are hardly any or apparently no photos at all existent of live specimens) in alphabetical order:

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Monitor Lizards: A short Overview

Monitor lizards of the family Varanidae represent a relatively ancient group of reptiles. Next to crocodiles and the large constricting boas and pythons, they belong to the largest living cold-blooded predators on our planet. Currently, all 81 recognized monitor lizard species are placed in the single genus *Varanus* Merrem, 1820 which is subdivided into 11 subgenera based on morphology and molecular evidence. The closest extant relatives of monitor lizards are the rare Bornean earless monitor (*Lanthanotus borneensis*) and the East Asian crocodile lizard (*Shinisaurus crocodilurus*). Monitor lizards inhabit Africa, the Arabian Peninsula, the Middle East, South and South-east Asia as well as the Indo-Australian Archipelago including Australia and several remote Pacific island groups such as the Solomons, Admiralties, and Marianas. Many monitor lizard species have a restricted distribution range, some are only found on single islands.

Although being morphologically rather similar, the various monitor lizard species show remarkable differences in body size ranging from the small *Varanus sparnus* measuring merely 23 cm and less than 17 g to the famous Komodo dragon (*V. komodoensis*) with a total length of about 3 meters weighing possibly up to 100 kg. Ecologically, monitor lizards show a wide variety of adaptations. While most species are terrestrial, the New Guinean tree monitor lizards of the subgenus *Hapturosaurus* have a long and prehensile tail. They are highly arboreal probably rarely visiting the forest floor. Other species, such as the Southeast Asian water monitors of the subgenus *Sotosaurus* or Mertens' water monitor (*V. mertens*) of the subgenus *Varanus*, display semi-aquatic to terrestrial life habits (nostrils are directed more upward so that these monitors can remain submerged only with the nostrils protruding out of the water, or nostrils are even sealed while underwater) and are always associated with aquatic environments such as lakes, marshlands, coasts, and rivers. In Australia many monitor lizard species are found in rocky habitats (note that monitor lizards are called "goannas" in Australia). For instance, the Black-palmed rock monitor (*V. glebopalma*) of the subgenus *Odatria* exhibits "rubbery" scales on the soles of its fore and hind feet, which, in addition to its sharp claws, probably provide some kind of adhesion to rocky surfaces.

Most monitor lizard species are carnivorous, mainly preying on insects and spiders next to vertebrates; some species are even scavengers. However, a small radiation of endemic species in the Philippines has resulted in the evolution of the mostly frugivorous Gray's monitor lizard (*V. olivaceus*), the Panay monitor lizard (*V. mabitang*), and the recently described Sierra Madre forest monitor lizard (*V. bitatawa*). The spread of seeds from fruit-bearing trees is one of many ecological functions that these monitor species perform in tropical forests. But it is also clear that the role of many monitor lizard species in their ecosystems is virtually unexplored and our knowledge about their biology is still very limited, particularly for those species inhabiting New Guinea and the remote Pacific island groups.

Why do we need this Identification Guide for Monitor Lizards?

Of all the animal species listed in the Appendices to the CITES, monitor lizards (*Varanus* spp.) are among the most traded internationally. Between 2005 and 2014 alone, more than 6.8 million skins of Asian water monitors (*Varanus salvator*) were exported commercially from Malaysia and Indonesia for the international fashion industry. While only a few monitor species are used for the reptile leather industry, most species are exported for the live animal trade. Of these, the African Savannah monitor (*Varanus exanthematicus*), with proven exports of 224,000 live specimens between 2010 and 2017, is clearly the most commonly-traded monitor lizard species. In addition, more than 42,000 skins of this species were exported from Africa during the same period.

While some monitor species are geographically widespread and regionally relatively common, other species are very rare and exhibit a rather restricted distribution range. For such species, even the harvest of only few specimens from the wild can have a negative impact on wild populations and thus jeopardize the long-term survival of this species. For example, the Blue-spotted Tree Monitor (*Varanus macraei*) from Indonesia is found only on the island of Batanta with a size of 453 km². This area is smaller than the size of Lake Constance in southern Germany.

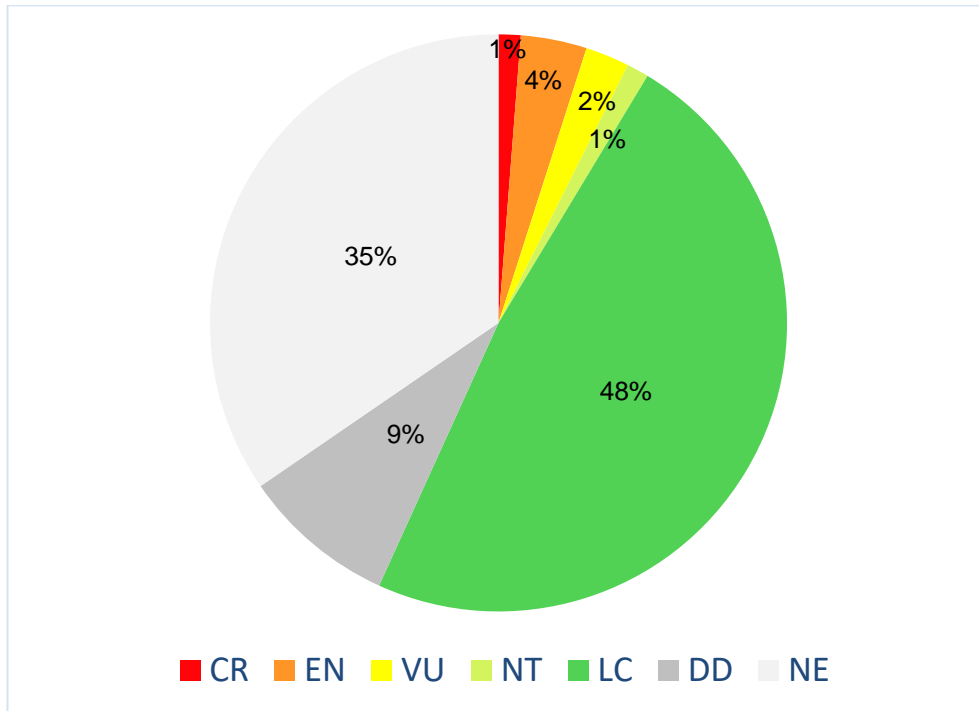
Especially in the last two decades, the discovery of new monitors has experienced a great boom. Thus, about 20 novel species of monitor lizards were described during this period. Among these are some of the most conspicuous species, such as the above-mentioned *Varanus macraei*, as well as many morphologically identical looking species such as *Varanus dalubhasa* and *Varanus semotus*, which at first sight show no differences to other, mostly closely related monitor species. In addition, in recent years, many taxa (↔), which were formerly treated as subspecies, have been raised to full species status, e.g. *Varanus beccarii*, *Varanus nuchalis* and *Varanus togianus*, further increasing diversity.

This species diversity within the genus *Varanus* and the morphological similarity of many monitor species are increasingly confronting law enforcement authorities worldwide with the problem of clearly identifying traded specimens. In order to be able to more effectively control a sustainable trade in monitor lizards, this identification guide shall serve as a tool for law enforcement authorities. This illustrated identification guide shall help to differentiate between the various monitor species and to clearly determine them, or at least to limit them to one species group or subgenus. In the case of monitor species which are particularly difficult to distinguish, reference is made to this accordingly.

The conservation status of 65% of all monitor lizard species has already been assessed by the IUCN. Among them, only 7 species are considered threatened so far. Although 39 species (48%) are currently classified as non-threatened, a large proportion of species (35%) have so far not been assessed at all or they are data deficient (9% representing 7 species) (see Annex 1 about the IUCN Red List). All monitor species are also listed in Appendices I and II of CITES, so there are different trading restrictions. For these reasons, it is all the more important to correctly identify monitor lizards in the international trade at the species level, to avoid that, for instance, threatened species are traded under a false name. The correct identification of the species in high demand is the crucial prerequisite for effectively enforcing the relevant regulations and laws in nature conservation.

In addition to the problem of species identification, CITES has the obligation to mandatorily verify the origin of each individual, whether it is born in the wild or in captivity. In order to check the plausibility of the origin of traded specimens that are not labelled as "wild caught" (W), data about reproduction are essential. Therefore, the present identification guide also contains – if available – important data on the reproduction and biology of each species, since the false declaration of juveniles as "F" or "C" – i.e., born or bred in captivity – can disguise illegal wild catches. Cases of this illicit practice known as "wildlife laundering" have been documented again and again.

We believe that this identification guide will be a first, but long-overdue initiative as a capacity building measure to better monitor and warrant legal trade in monitor lizards. Besides, we hope that also other stakeholders such as biologists, conservationists, herpetologists and nature lovers in general will find enrichment in this treatise on the world's monitor lizards.



Conservation status of Varanidae (in %) according to the IUCN Red List assessments carried out between 1996 and 2017. Among the 81 currently recognized species of monitor lizards, 53 species have been assessed to date. Of these, one species has been assessed Critically Endangered, three species Endangered, two Vulnerable, one Near Threatened, 39 Least Concern, 7 Data Deficient, and 28 species have not yet been evaluated to date.



Left: An adult Crocodile or Papuan monitor (*Varanus salvadorii*) seized at Munich airport, Germany, © Mark Auliya; right: An adult Blue-spotted Tree Monitor (*Varanus macraei*) at a facility of an Indonesian trader. In 2014, this species was assessed Endangered in the IUCN Red List, © Mark Auliya

How to use this Identification Guide

This guide aims to minimise the use of scientific language in the species fact sheets so that it will be more user-friendly. Where necessary, technical terms are linked by an arrow (↔) indicating that these terms are explained in the glossary. Due to space restrictions the species fact sheets are predominantly written in a shorthand manner.

Most monitor lizard species are described on a double page comprising a text page and a facing page illustrating the respective species in several photographs. Three species (i.e. *V. niloticus*, *V. ornatus*, and *V. salvator*) that are distributed over an extensive geographic range are treated on three or four pages. The photographs indicate major diagnostic characters using red arrows marked with numbers that are cross-referenced in the describing text. The photographs selected are those available to us during the compilation of this identification guide. However, for several monitor species high-quality photographs of live specimens were unavailable.

The text of the species fact sheets is divided into four main segments. The first paragraph provides the species' scientific, English, German and local names as well as synonyms. It further summarizes information on subspecies, taxonomy, protection status, and distribution. The second segment addresses diagnostic morphological characters, colour pattern and exemplifies monitor species that appear similar with regard to morphology and colour pattern. Information on the species' reproduction biology, including size and age at sexual maturity, clutch size, incubation period and temperature, size and weight of hatchlings, growth rate, and its potential to breed in captivity, are given in the third section. Despite an extensive literature search, we were not able to find comprehensive information about specific reproductive traits in several monitor species. This may also be due to the fact that some rare sources were unavailable to us in due time. The species-specific fact sheets are supplemented with general information on ecology and final remarks about commercial exploitation and threats.

Overall, information content of each subtopic is different for each species. Thus, for some species information on colour pattern may be more comprehensive because the species treated includes morphologically different subspecies, or the subtopic on similar species is more extensive as is the case if the species treated includes melanistic (i.e., blackish coloured) populations. Thus, for the aforementioned subtopics often more lines were allocated which are then missing for other subtopics. This weighting was applied differently from species to species.



Juvenile Savannah monitors (*Varanus exanthematicus*) hatched at a local trader in Togo, © Mark Auliya/World Animal Protection

Guidance for the Species Fact Sheets

For each subtopic detailed explanations are provided below.

Scientific species name:

Each species fact sheet starts with the scientific species name which is followed by the name(s) of the describer(s). In case more than two authors contributed to a species description only the first author name is provided and the remaining are abbreviated with the Latin expression “et al.” meaning “and others”. For a full list of all names of describers of the single species see the Index.

Subgenus:

The subgenus to which each monitor lizard species belongs to is given in the upper right corner. It is a more precise classification than the genus level (*Varanus*). All 81 monitor lizard species are allocated to 11 currently recognized subgenera based on distinctive morphological characteristics and molecular genetic evidence. Species accounts are treated alphabetically within their respective subgenus. All subgenera show differently coloured headers to support orientation. The colour codes are as follows:

- 1) *Empagusia*
- 2) *Euprepiosaurus*
- 3) *Hapturosaurus*
- 4) *Odatria*
- 5) *Papusaurus*
- 6) *Philippinosaurus*
- 7) *Polydaedalus*
- 8) *Psammosaurus*
- 9) *Solomonsaurus*
- 10) *Soterosaurus*
- 11) *Varanus*

Common names:

For **English** and **German names** we provide most common names traced, also those considered for subspecies (see below). In addition, for some species **local names** from the respective distribution range are listed. However, when numerous local names were found, particularly for species with an extensive distribution range, such as *Varanus niloticus*, *V. exanthematicus*, *V. salvator*, and *V. bengalensis*, only few were selected. Note that “Biawak”, the general name for monitor lizards in Bahasa Indonesia and Bahasa Melayu (languages of Indonesia and Malaysia), and “Soa-soa” (Bahasa Indonesia) for the sailfin lizards of the agamid genus *Hydrosaurus* are often used interchangeably.

Synonyms:

Synonyms are different scientific names under which the treated species was once known and/or described. But these were replaced by the currently used valid name, which is usually the oldest available name for a given species. We decided to include more recent synonyms, which have been used in the literature after about 1940.

Subspecies:

Subspecies are usually geographically isolated populations that are genetically and/or morphologically distinct from conspecific populations belonging to the same species. When a species does not include subspecies, but species status is ambiguous or doubtful, such as in *V. nebulosus*, reference is made to that fact herein. In other cases, where a newly described species was once recognized as part of a formerly known species this is noted accordingly. For instance, prior to their scientific description as a new species, those monitor lizards now known as *Varanus hamersleyensis* were formerly recognized as *V. pilbarensis*. Finally, if a species was originally described or treated as a subspecies of a widespread species, such as was the case in some Philippine water monitor lizard species (i.e., *Varanus cumingi*, *V. marmoratus*, and *V. nuchalis* were treated as subspecies of *V. salvator* in the past), this is also noted under this section.

International conservation status:

The international conservation status of a given species refers to CITES, the Convention on International Trade in Endangered Species of wild Fauna and Flora (www.cites.org), and the EU legislation (see Acronyms) and indicates the Appendix/Annex in which each monitor lizard species is currently listed. Among the 81 species described in this guide, 76 are listed in Appendix II and Annex B (among these only *Varanus olivaceus* is listed in Annex A), while five species (i.e., *V. bengalensis*, *V. flavescens*, *V. griseus*, *V. komodoensis*, and *V. nebulosus*) are listed in Appendix I and Annex A, respectively. The listing in Appendix I/Annex A prohibits commercial trade in these species. To check the recent conservation status, go to www.cites.org.

IUCN Red List Status:

The Red List of the IUCN, the International Union for Conservation of Nature and Natural Resources (www.iucn.org), evaluates the conservation status of animals, plants and fungi. Among the 81 species of the family Varanidae, currently 53 species have been allocated a threat category. Species fact sheets mention either the category or, if not yet assessed, the term “Not Evaluated (NE)” (see Annex 1 for definitions of the Red List categories). Further information on the population trend is provided, if available, together with the year when the last assessment was undertaken. To check the recent IUCN Red List status, go to www.iucnredlist.org.

Distribution:

Notes included in this section either summarize major regions for species with extensive distributions, such as *Varanus niloticus* and *V. indicus*, or specify the occurrence of species that are only native to single/few countries, e.g., *Varanus nesterovi* in Iraq and Iran. In some species that are endemic to one country, but only inhabit a small range or island within that country, the region or island is mentioned, such as for *Varanus macraei* on Batanta Island, Indonesia. For Australian monitor species the names of the inhabited provinces are indicated.

Size:

Size measurements include information on the **Total length (TL)** from the tip of the snout to the tip of the tail and **Snout-vent length (SVL)** from the tip of the snout to the cloaca (↔), after which the tail begins (Fig. 1). Measurements provided represent hitherto recorded maximum sizes. Therefore, new findings may prove an increase of both measurements in the future. However, in some monitor species the maximum size is not known, thus the age class is supplemented, e.g., subadult (↔).

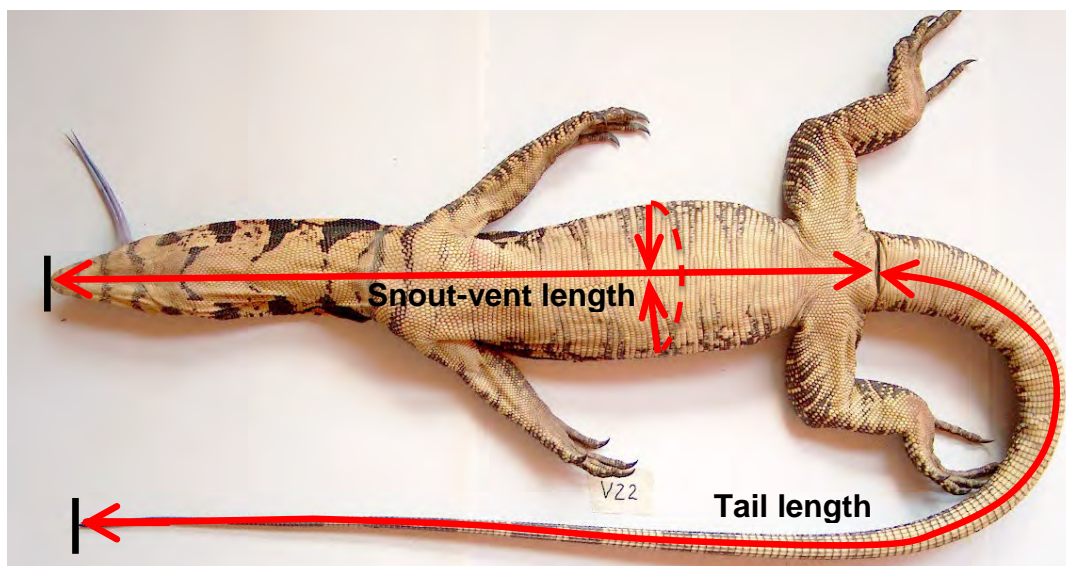


Fig. 1: The Total length (TL) is given by the Snout-vent length (SVL) and the tail length. Also shown is the position to determine the number of scale rows around midbody, © André Koch

Morphological traits:

This section refers to the major diagnostic characters that describe a species. These characters relate to the morphology of specific body features, such as shape and position of the nostrils (Fig. 2), the shape of the tail (Fig. 3), and the presence or absence of distinctive scales such as enlarged supraoculars (↔) above the eyes (Fig. 4). Also, in several monitor species the number of midbody scale rows (↔) is provided (Fig. 1). This information alone may not be species-specific, but it can be used in combination with other morphological characters to correctly identify a certain species.



Fig. 2: Differences in position and shape of the nostrils in monitor lizards exemplified by *V. salvator* (left: oval to roundish and located closer to the tip of the snout) and *V. griseus* (right: slit-shaped and located closer to the eye), © Mark O'Shea & Mark Pestov



Fig. 3: Differences in the shape of the tail in monitor lizards exemplified by *V. jobiensis* (left: laterally flattened with a dorsal (double) keel consisting of two scale rows, rather triangular in cross section, and lateral tail scales smaller than lower ones) and *V. glauerti* (right: roundish in cross section lacking a dorsal keel, scales above and below equal in size forming continuous rings around tail), © Frank Jünemann & Jordan Vos



Fig. 4: Differences in the shape of the head scales above the eyes (supraoculars) in monitor lizards exemplified by *V. bengalensis* (left: not enlarged) and *V. prasinus* (right: distinctly enlarged, in the subgenus *Hapturosaurus* also the head scales in-between are enlarged), © André Koch

Colour pattern:

The colour pattern adds to describe a species, its background colour and patterning on head, body, limbs, tail and underside. Specific colour morphs or distinct subspecies of a given species are also described in detail. Since the colour pattern of some monitor lizard species differs between young and full-grown specimens (see e.g., *V. melinus*), these differences are described where appropriate.

Similar species:

To aid identification of single monitor species, look-alike species with a similar colouration and pattern are listed in this section together with diagnostic characters to distinguish between similar species. These superficially similar species may either occur in the same distribution range, as is the case with *V. pilbarensis* and *V. hamersleyensis* in Western Australia, or even on different continents (e.g., *Varanus salvator* in Southeast Asia and *V. niloticus* in sub-Saharan Africa).

Size and age at sexual maturity:

If available, information about body size (total length and/or snout-vent-length) and age at first reproduction is provided.

Clutch size:

All monitor lizards lay eggs for reproduction. If available, information about minimum and maximum as well as average number of eggs laid by a female is provided. In addition, the number of clutches per year and the minimal interval between two successive clutches is given where known. In general, larger females are able to lay more eggs than younger ones.

Incubation period and temperature:

Reported number of days and temperature ranges during incubation are mostly based on published captive breeding records, because data from the wild are usually lacking for most monitor lizard species. Since microclimate conditions, such as temperature, humidity etc., in the wild are dynamic and rarely constant over a longer period, as can be accomplished for clutches under controlled conditions in captivity, incubation periods of both wild-born and captive-bred individuals are usually incomparable. Nevertheless, observations from captive breeding provide valuable information about reproduction. Compared to other lizards, monitor lizard eggs exhibit a relatively long incubation period of up to more than 300 days.

Size and weight of hatchlings:

If available, information about body size (total length and/or snout-vent-length) and weight of juveniles after hatching is provided.

Growth rate:

Mostly based on experiences with captive-bred specimens, the body size (total length and/or snout-vent-length) and weight of young monitor lizards at various life stages is provided, if available.

Captive breeding:

Based on published and available information a general statement about the frequency and likelihood that a given monitor lizard species has been successfully bred in captivity is made. Requirements and stimuli that may positively affect the successful reproduction, such as simulation of the rainy season and separation of both sexes for a certain period, are provided on a case-by-case basis, if known.

Specifics:

Specific phenomena in reproduction biology of monitor lizards, such as parthenogenesis, i.e. the unisexual reproduction without males, or the delayed reproduction due to sperm storage in females after copulation (so-called Amphigonia retardata) are mentioned, where information about single species is available. Note that parthenogenesis has been documented in several captive-bred monitor lizard species belonging to various subgenera. Therefore, it is very likely that all varanid

species are able to produce offspring unisexually, which, for instance, may facilitate the successful colonisation of new islands or territories.

Ecology:

Here, some major life history traits, such as time of main activity, main food source(s) and preferred habitat (arboreal, terrestrial or aquatic), are briefly indicated. In addition, it is stated if the species is an island endemic, i.e. when the distribution is restricted to one or only few (small) islands. Such endemic species are especially vulnerable to over-exploitation and other threats.

Remarks:

In case the national protection status is known this is mentioned together with information on international and domestic trade activities in recent years. This information is based on the CITES trade database available at <https://trade.cites.org>. Also, for some species particular threats such as habitat destruction, invasive species, or exploitation are mentioned.

Glossary

Adult	A sexually mature organism
Amphigonia retardata	Delayed reproduction due to sperm storage
Anterior	Directed towards the front of an organ or body
Arboreal	Living in trees, tree-dwelling
Bifurcation	Area where the forked tongue splits into two distinct tines/tips
Clade (genetic)	A species group (taxon) consisting of one species and its descendants
Cloaca, cloacal region	Terminal part of the gut into which the urinary, digestive and reproductive systems open into one exterior opening through the vent (between snout-vent length and tail)
Concave	Curved to the inside
Congener	Belonging to the same genus
Conspecific	Belonging to the same species
Crest, double-crested	A distinct ridge on the upper surface of the tail composed of two rows of scales
Digit	Finger or toe
Disjunct distribution	A non-continuous geographic distribution, e.g., two populations that are separated by a mountain chain or a strait
Distal(ly)	Directed away from the base, e.g., from the tail base toward the tip
Diurnal	Active during the day
Dorsolateral(ly)	Indicating the region between the back/top and the sides of the body
Dorsoventral(ly)	Transition from dorsal to ventral surface of a body
Dorsum, dorsal	Back, upper surface
Endemic	The restricted distribution of a taxon (see below) to islands or a certain continental region
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 of Australia; http://www.environment.gov.au/cgi-bin/sprat/public/public_threatenedlist.pl
Euryoecious	Living in a wide range of habitats
Frontal region	Area on mid-top of the head (fore-head) between the supraoculars
Generalist	An unspecialised species with a wide adaptability to different environmental conditions and habitats
Granules, granular	Tiny roundish scales (resembling a pebbled surface) that typically encircle dorsal non-overlapping scales in monitor lizards
Gular region	Throat region
Hatchling	An animal that just emerged from an egg
Holotype	A particular specimen upon which a species or subspecies was scientifically described
Home range	Area, where an individual animal roams and carries on all its activities such as foraging, reproducing etc.
Interorbital area	Upper head surface between the eyes
Invertebrates	Animals without bones, such as insects, crabs and spiders
Juvenile	A young organism
Keel, keeled	A ridge on a scale or the dorsal crest of the tail
Laterally compressed	On both sides flattened, referring to the tail
Melanistic	Predominance of black pigments (melanin) in colour pattern
Midbody scales	Scale rows around the midbody at widest part or in the middle between fore and hind limbs
Nasal region	Area on snout between nostrils
Nocturnal	Active during the night
Nuchals	Scales in the nape/neck region
Occipital scales	Scales at the dorsal surface/top of the head posterior of scales in the parietal region (see below)

Ocelli	Round, two-coloured eyespots
Palms	Inner surface of fore limbs between base of digits and wrist
Paratopotype	A specimen collected at the same locality as specimens of the type series (not necessarily at the same time)
Paratype	Specimen next to the name-bearing holotype based on which a (sub)species was described; together they form the original type series
Parietal region	Area on top of the head between frontal and occipital region
Parietal/pineal eye	A round, light sensitive organ (epiphysis) in the middle of the parietal region (see above)
Parthenogenesis, parthenogenetic	Unisexual reproduction of females without males, the egg cell develops without previous fertilization
Posterior	Directed towards the back of an organ or body
Prehensile	Related to the tail that can grasp and wrap around a branch, an adaptation to an arboreal (see above) mode of life
Riparian (ecosystem)	Bank of a natural watercourse such as a river, lake or tidewater
Rostrum	Region at the tip of the snout
Saxicolous	Living in rocky habitat
Semiaquatic	Living partially in water
Semi-arboreal	Living partially on trees
Sexual dimorphism	When both sexes differ in certain morphological traits (e.g., size, colour pattern)
Subadult	Stage between a juvenile and adult (i.e. sexually mature) organism
Supraoculars	Head scales above the eyes (in some varanids distinctly enlarged compared to surrounding head scales)
Supratemporal region	Area above/posterior to temporal region (see below) commonly indicating larger scales
Taxon (plural: taxa)	Any defined unit in the biological hierarchy; e.g., at family, genus, species or subspecies level
Temporal region	Lateral areas on side of head between eye and ear opening
Terrestrial	Living on land, ground-dwelling
Tympanum	Eardrum
Type locality	Location from where the name-bearing holotype (see above) of a (sub)species originated from
Ventrum, ventral	Belly, lower surface of the body
Vertebrates	Animals with bones, such as fish, amphibians, reptiles, birds and mammals

Acronyms and Symbols

♂	Male
♀	Female
∅	Average
BMNH	The Natural History Museum (formerly British Museum of Natural History), London, Great Britain
BPBM	Bernice Pauahi Bishop Museum, Honolulu, Hawai'i, USA
C	A "captive-bred" specimen, born/hatched in a controlled environment and fulfilling the criteria according to CITES Res. Conf. 10.16
cf.	Confer (Latin) = compare, here: similar to a certain (sub)species
CITES	Convention on International Trade in Endangered Species of wild Fauna and Flora; www.cites.org
Commission Reg. (EU) No 2017/160	"...amending Council Regulation (EC) No 338/97 on the protection of species of wild fauna and flora that regulates trade in animal and plant species listed in the Annex to the Regulation" that implements CITES in the European Union. Thus, "the species listed in the Annex include the species set out in the Appendices to CITES as well as species whose conservation status requires that trade from, into and within the Union be regulated or monitored". https://www.mise.gov.it/images/stories/commercio_internazionale/cites/en/Reg_2017_160_en.pdf
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 of Australia; http://www.environment.gov.au/cgi-bin/sprat/public/publicthreatenedlist.pl
F	A "captive-born" specimen, born/hatched in a controlled environment without fulfilling the criteria for source code C according to CITES Res. Conf. 10.16
IUCN	International Union for Conservation of Nature; https://www.iucn.org
IUCN Red List	The IUCN Red List of Threatened Species; https://www.iucnredlist.org
KU	University of Kansas Biodiversity Institute, Lawrence, USA
MNH	Muséum National d'Histoire Naturelle, Paris, France
MZB	Museum Zoologicum Bogoriense, Cibinong, Indonesia
n	Total number of samples, here the number of specimens examined
NMB	Natural History Museum, Basle, Switzerland
PNM	National Museum of the Philippines, Manila, Philippines
QM	Queensland Museum, Brisbane, Australia
RMNH	Naturalis National Museum of Natural History, Leiden, The Netherlands
SMF	Senckenberg Forschungsinstitut und Naturmuseum, Frankfurt, Germany
ssp.	Subspecies
USNM	US National Museum of Natural History, Smithsonian Institution, Washington D.C., USA
ZFMK	Zoologisches Forschungsmuseum Alexander Koenig, Bonn, Germany
ZMH	Zoologisches Museum, University of Hamburg, Germany
ZMUC	Zoological Museum, University of Copenhagen, Denmark
ZSM	Zoologische Staatssammlung München, Munich, Germany

Main Characteristics of the 11 Subgenera of Monitor Lizards

Subgenus (No species)	Diagnosis	Range
<i>Empagusia</i> (5)	<ul style="list-style-type: none"> • Medium-sized to large species (ca. 1.2-2 m TL) • Slit-shaped nostrils closer to eye than to tip of snout • Laterally compressed tail with a dorsal (←) keel (←) • Supraoculars (←) sometimes enlarged 	<ul style="list-style-type: none"> • South Asia • Southeast Asia
<i>Euprepiosaurus</i> (15)	<ul style="list-style-type: none"> • Medium-sized to large species (>1.7 m TL) • Roundish nostrils closer to tip of snout than to eye • Supraoculars enlarged • Laterally compressed tail with dorsal keel (except for <i>V. juxtindicus</i>) • Lateral tail scales smaller than lower ones 	<ul style="list-style-type: none"> • Moluccas (Indonesia) • New Guinea • Australia • Pacific Islands
<i>Hapturosaurus</i> (9)	<ul style="list-style-type: none"> • Medium-sized species (ca. 1 m TL) • Long and slender body, neck, limbs, and toes with sharp claws • Tail very long, round in cross-section, prehensile (←) • Tail scales form continuous rings around tail • Roundish nostrils closer to tip of snout than to eye • Supraoculars enlarged, also head scales in-between 	<ul style="list-style-type: none"> • New Guinea • Australia
<i>Odatria</i> (22)	<ul style="list-style-type: none"> • Small to medium-sized species (usually <1 m TL) • Roundish nostrils closer to tip of snout than to eye • Tail roundish in cross-section lacking a dorsal keel (except for <i>V. semiremex</i>) • Tail scales on top and below equal in size forming continuous rings around tail 	<ul style="list-style-type: none"> • Lesser Sunda Islands (Indonesia, East Timor) • New Guinea • Australia
<i>Papusaurus</i> (1)	<ul style="list-style-type: none"> • Very large species (>2.5 m TL) • Very long tail, prehensile • Lateral tail scales distinctly smaller than lower ones • Adults with high head and distinctly bulged snout 	<ul style="list-style-type: none"> • New Guinea
<i>Philippinosaurus</i> (3)	<ul style="list-style-type: none"> • Large species (up to 2 m TL) • Nostrils slit-shaped, closer to tip of snout than to eye • Tail laterally compressed, more oval in cross-section • Supraoculars less enlarged 	<ul style="list-style-type: none"> • Philippines
<i>Polydaedalus</i> (5)	<ul style="list-style-type: none"> • Large species (usually >1.5 m TL) • Adults with high head • Tail laterally compressed with a dorsal keel • Supraoculars not enlarged 	<ul style="list-style-type: none"> • Africa • Arabian Peninsula (Saudi Arabia, Yemen)
<i>Psammosaurus</i> (2)	<ul style="list-style-type: none"> • Medium-sized species (<1.3 m TL) • Relatively short tail • Nostrils slit-shaped, closer to eye than to tip of snout • Supraoculars not enlarged 	<ul style="list-style-type: none"> • Northern Africa • Arabian Peninsula • Central Asia • South Asia
<i>Solomonsaurus</i> (1)	<ul style="list-style-type: none"> • Medium-sized species (ca. 1 m TL) • Nostrils closer to tip of snout than to eye • Relatively large eyes • Body scales distinctly keeled, conical-shaped 	<ul style="list-style-type: none"> • Solomon Islands
<i>Soterosaurus</i> (10)	<ul style="list-style-type: none"> • Relatively large eyes • Nostrils distinctly closer to tip of snout than to eye • Supraoculars enlarged • Tail laterally compressed with a dorsal keel • Lateral tail scales smaller than lower ones 	<ul style="list-style-type: none"> • Philippines • Southeast Asia (only <i>Varanus salvator</i>)
<i>Varanus</i> (8)	<ul style="list-style-type: none"> • Large to very large species (<3 m TL) • Roundish nostrils closer to tip of snout than to eye • Laterally compressed tail 	<ul style="list-style-type: none"> • Lesser Sunda Islands (Indonesia) • New Guinea • Australia

Varanus bengalensis (Daudin, 1802)

Subgenus: *Empagusia*

English names: Bengal monitor, Indian monitor

German name: Bengalwaran

Local names: Samserah (Afghanistan), Gosom, Goh-saap, (India), Phuut migyuang (Myanmar), Gopar (Nepal), Samserah, Gho (Pakistan), Tala-goya, Udumbu (Sri Lanka), Da-kuat, Lan (Thailand)

Synonyms: *Varanus irrawadicus* Yang & Li, 1987

Subspecies: None; some authors, however, regard *V. nebulosus* a subspecies of *V. bengalensis*.

International conservation status (CITES / Commission Regulation (EU) No 2017/160): Appendix I/A

IUCN Red List status: Least Concern (LC), population trend decreasing (last assessed 2009)

Distribution: Iran, Afghanistan, Pakistan, India, Sri Lanka, Bangladesh, Nepal, Bhutan, China, Myanmar

Total length (TL): 175 (♂ 150) cm (♂), ♂ 120 cm (♀); **Snout-vent length (SVL):** 61 (♂ 58) cm (♂), ♂ 46 cm (♀)

Morphological traits (adults): Large species; head, legs and tail strong; tail about 1.5 times SVL, laterally compressed, above with a keel (←); lateral tail scales much smaller than those below; nostrils slit-shaped (oval in juveniles), located in the middle between eye and tip of snout (1); head scales above the eyes small, not enlarged; snout bulgy, particularly in large specimens (2); 88-110 (♂ 96) scale rows along the belly from neck wrinkle to anterior margin of hind legs

Colour pattern: Over the large distribution area the colour pattern shows differences from very dark (3) to light (4); upper body side brown to black usually patterned with more or less many small light or dark scales/spots; body underside light and dark speckled; tongue pink/flesh-coloured, partly dark (5); pattern in **juveniles** clearer, light spots on back larger, sometimes with dark V-shaped pattern in neck; tail light and dark banded, bands broader towards the end (6); throat and belly light with dark transverse bands (7).

Similar species: *V. nebulosus* has enlarged scales above the eyes, 70-90 (♂ 78) scale rows along the belly, a lighter colouration, and a less bulgy snout. However, these characteristics do not always seem to be constant throughout the distribution range, so that identification is often difficult without knowledge of the locality. In *V. komodoensis* the nostrils are located close to the tip of the snout, >200 cm TL.

Size/age at sexual maturity: ♂: >23.3 cm SVL; ♀: in captivity >22.5 (♂ 28.9) cm SVL, in nature >29.5 cm SVL; at the age of 2.5-3 years in captivity, possibly later in nature

Clutch size: 8-32 (♂ 21) eggs per clutch depending on the size of the female; 1-2 clutches per year, minimal interval of 59 days between two clutches.

Incubation period/temperature: 189-216 (♂ 192) days, in extreme cases 162-300 days at 27-34 °C

Size/weight of hatchlings: 17.2-22.2 (♂ 19.7) cm TL and 7.9-11.4 (♂ 9.4) cm SVL; 8.3-28 (♂ 13.6) g; according to Auffenberg (1994:15): 71-84 (♂ 78) g

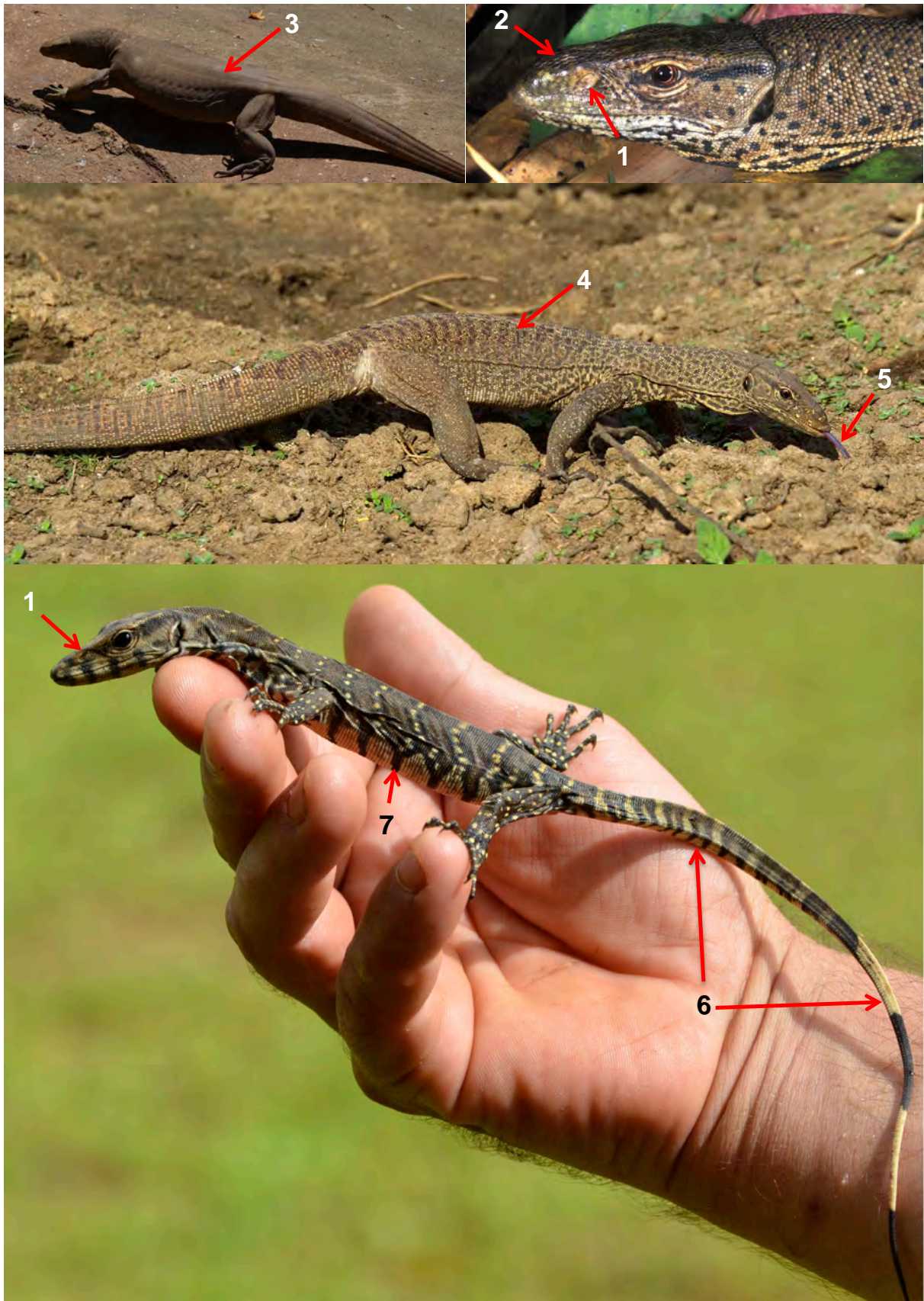
Growth rate: In captivity after 12 months: 19.5-26.3 (♂ 23.1) cm SVL; after 24 months: 25.0-30.3 (♂ 28.3) cm SVL; in nature after 3 months: ♂ 16.4 cm SVL, after approximately 12 months: ♂ 19.2 cm SVL

Captive breeding: So far only rarely bred, under right conditions breeding seems simple; in nature day length and monsoon influence reproduction; egg deposition box required.

Specifics: Delayed reproduction (*Amphigonia retardata* ←) due to sperm storage by >1 month has been documented.

Ecology: Diurnal (←); mainly ground-dwelling; mainly eats invertebrates such as insects and arachnids.

Remarks: Today, international trade no longer plays a role due to the high protection status. Nevertheless, *V. bengalensis* is hunted locally for various purposes (skins, consumption, folk medicine, talisman, superstition). The genitalia, for instance, are illegally traded in India as alleged plant roots known as Hatha Jodi in Ayurveda medicine.



Varanus bengalensis. Above left: adult, Sri Lanka, © Sameera Gunawardena; above right: adult, Tambuttegama, Sri Lanka, © Mark O'Shea; centre: subadult, Bundala, Sri Lanka, © Henrik Bringsøe; below: juvenile, Western Ghats, India, © Silke Schweiger

Varanus dumerilii (Schlegel, 1840)

Subgenus: *Empagusia*

English name: Dumeril's monitor

German name: Dumerils Waran

Local names: Biawak dumerili, Phut (Indonesia), Biawak Kudong (Malaysia), Tut-too, Hao Chang Kao (Thailand)

Synonyms: *Varanus macrolepis* Blanford, 1881; *Varanus heteropholis* Boulenger, 1892

Subspecies: None; the taxon (↔) *heteropholis* was temporarily recognized as subspecies of *V. dumerilii*.

International conservation status (CITES / Commission Regulation (EU) No 2017/160): Appendix II/B

IUCN Red List status: Not Evaluated (NE)

Distribution: Southern Myanmar (Burma), Thailand, Malaysia as well as Borneo, Sumatra, and some off-shore islands (Bangka, Billiton), Indonesia

Total length (TL): 130 cm (♂), 100 cm (♀); **Snout-vent length (SVL):** 50 cm (♂)

Morphological traits (adults): Medium-sized species; head, legs and tail strong; tail about 1.3-1.6 times as long as SVL, laterally flattened with a keel (↔) above; lateral tail scales much smaller than those below; nostrils slit-shaped to oval, closable, located closer to eye than to tip of snout (1); scales of upper body side relatively large, especially on neck distinctly enlarged, round and flat (2); head scales above eyes slightly enlarged

Colour pattern: Upper body brown with 4-5 lighter transverse bands on the back, continuing on tail; a dark band runs from the eye over the ear opening along the side of the neck to the upper back (3); 3 dark stripes run across the mouth; dark spots or stripes on the side of the neck; body underside light brown to cream-coloured, belly with lateral dark pointed markings or transverse stripes, throat with dark cross stripes and spots (4); tongue pink/flesh-coloured (5); iris medium to dark brown; **juveniles** with more contrasting colour pattern of 10-12 pale yellow to orange-yellow transverse stripes over black back and tail; legs with bright spots; head and neck bright orange (6); after a few weeks this juvenile colouration fades.

Similar species: Juveniles of *V. rudicollis* and very dark *V. nuchalis* lack the intensive orange-yellow head colouration and bright bands on the back; *V. rudicollis* has a longer and more domed snout, a darker background colour, and smaller scales around midbody (139-169 vs. 66-102); *V. nuchalis* has a dark blue-grey tongue in the front half above, nostrils roundish/oval, located closer to the tip of the snout than to the eye.

Size/age at sexual maturity: Ca. 100 cm TL; maybe with 4 years (♀)

Clutch size: Up to 3 clutches per year each with 4-23 eggs

Incubation period/temperature: 163-234 days at 24-30 °C

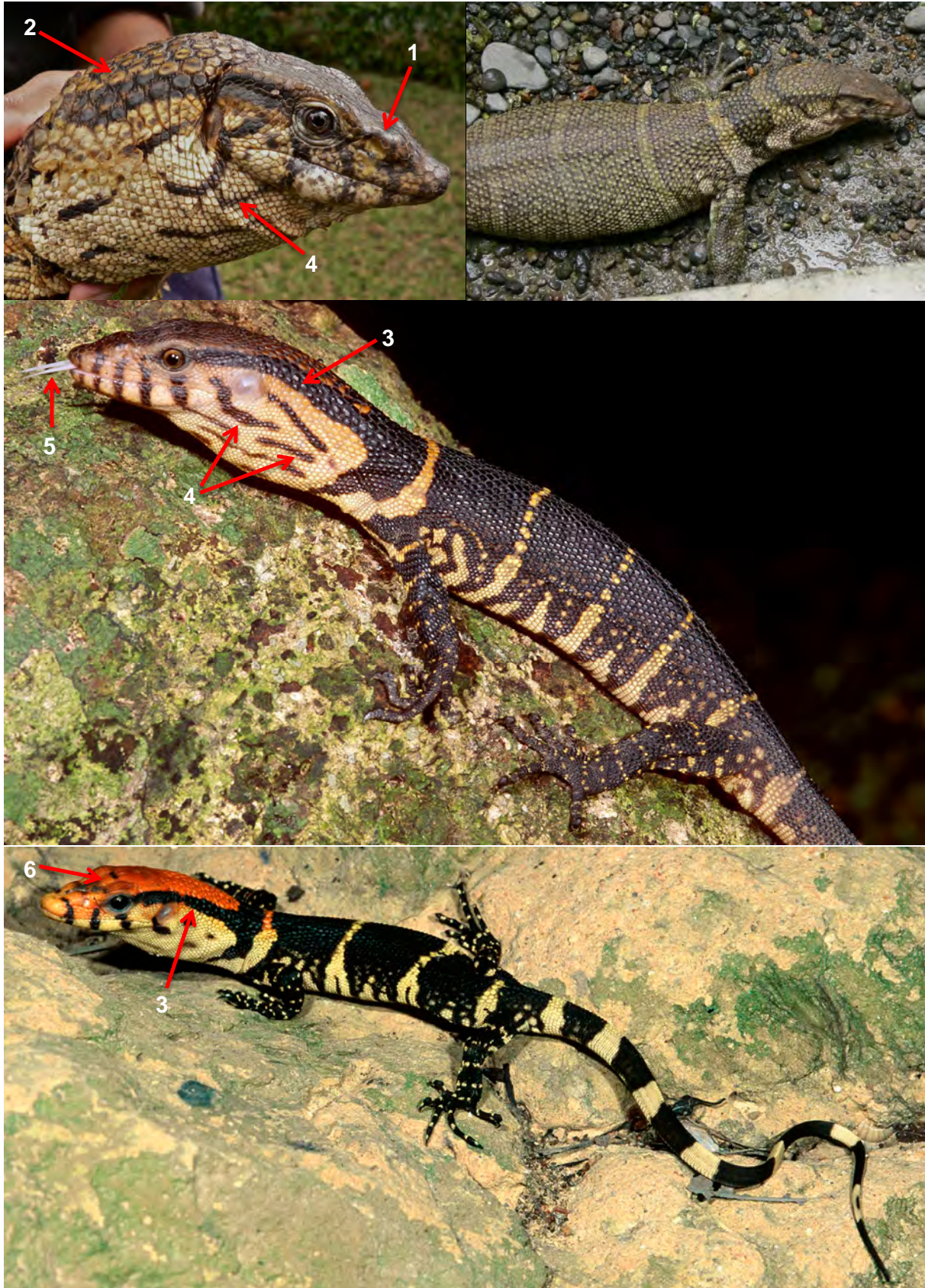
Size/weight of hatchlings: 8.1-8.5 cm SVL; 17.8-24 cm TL; 10-20 g

Growth rate: After 1 month: 24-26 cm TL, 16-17 g; after ca. 2 months: 25-28 cm TL, 19-22 g; after 5 months: 13 cm SVL; after 12 months: 99 cm TL (♀)

Captive breeding: Breeding has often been successful in zoos and in private collections; temporary separation of both sexes may be beneficial for reproduction; nesting box for egg deposition required

Ecology: Diurnal (↔); ground-dwelling; feeds mainly on crabs next to arthropods (spiders, scorpions, insects), frogs, and fish.

Remarks: *V. dumerilii* is in demand by the pet trade due to its attractive juvenile colouration. Between 2010 and 2018 Indonesia exported up to 1,060 live specimens each year according to the CITES trade database. *V. dumerilii* is not nationally protected in Indonesia. Since 1997, imports of wild-caught specimens into the EU are suspended.



Varanus dumerilii. Above left: adult, © Mark Auliya; above right: adult, © Andrea & Dietmar Trobisch; centre: subadult, Ketambe, Aceh, Sumatra, Indonesia, © Ulrich Manthey; below: juvenile, Lake Pedu, Kedah, West Malaysia, © Ulrich Manthey

Varanus flavescens (Hardwicke & Gray, 1827)

Subgenus: *Empagusia*

English name: Yellow monitor

German name: Gelbwaran

Local names: Sun Gohoro (Nepal); juveniles are known as “bib-cobras” in the Terai region (Nepal and India)

Synonyms: *Varanus picquotii* Duméril & Bibron, 1836

Subspecies: None

International conservation status (CITES / Commission Regulation (EU) No 2017/160): Appendix I/A

IUCN Red List status: Least Concern (LC), population trend unspecified (last assessed 1996)

Distribution: Pakistan, India, Nepal, Bangladesh

Total length (TL): 95.2 cm; **Snout-vent length (SVL):** 44.8 cm; σ 34.2 cm (σ), ϕ 33.2 cm (ϕ)

Morphological traits (adults): Medium-sized species; head, body, legs and tail strong; toes and tail relatively short; claws slightly curved; tail about 1.2-1.3 times as long as SVL, laterally flattened with a low keel (\blackleftarrow) above (**1**); lateral tail scales only little smaller than lower ones, partly forming continuous rings around tail; body scales big; head relatively short and tall, snout bulgy (**2**); nostrils oval to slit-shaped, closer to tip of snout than to eye (**3**); head scales above eyes slightly broad-ened

Colour pattern: Upper side of body orange to reddish brown with yellow rows of spots or horizontal stripes, sometimes unicoloured light brown to ochre; tail with narrow yellow-brown banding; dark stripe from eye to ear fades increasingly with age; dark stripes over mouth; body underside yellowish with (red) brown pointed markings on belly (**4**) and cross stripes on throat (**5**); tongue dark blue-grey; iris dark brown; colour patterns more intense during reproductive time (**6**); **juv-niles** dark brown to black with high-contrast pattern of transverse rows of white to yellow spots or cross stripes on back (**7**); underside whitish; tail with narrow yellow banding (**8**); legs with small dots; head laterally (\blackleftarrow) yellowish with black stripes over mouth

Similar species: *V. exanthematicus* with slit-shaped nostrils, closer to eye than tip of snout (vs. oval and closer to tip in *V. flavescens*), shorter tail (0.9-1.25 times SVL vs. 1.2-1.3 times SVL), blunt, conical teeth (vs. pointed and laterally compressed) and without yellow to reddish-brown colouration; *V. bengalensis* has slit-shaped nostrils, midway between eye and tip of snout (vs. oval and closer to tip); juveniles of *V. salvator* with longer head and flatter snout, distinct (vs. less) widened scales above eyes, tail at least 1.5 times as long as SVL, with higher keel above (vs. a maximum of 1.3 times SVL with low keel).

Size/age at sexual maturity: >25 cm SVL; with 2.5-4 years

Clutch size: One clutch per year with 4-30 (ϕ 16) eggs ca. 4 weeks after mating between early August and early October

Incubation period/temperature: 235-254 days at 29-30 °C, or ca. 155-173 days at 30-34 °C **Size/weight of hatchlings:** 6.6-8.0 (ϕ 7.8) cm SVL; 14.3-18.8 (ϕ 16.3) cm TL

Growth rate: Juveniles grow rapidly doubling their length in less than 2 years; increase in SVL by ca. 6 cm per year

Captive breeding: Breeding so far only very rarely succeeded in zoos. In nature, monsoon determines the reproductive activities of *V. flavescens*.

Ecology: Diurnal (\blackleftarrow); ground-dwelling; feeds mainly on frogs and their eggs and the eggs of lizards, turtles and birds, as well as mammals and insects.

Remarks: Today there is no international trade in *V. flavescens* due to its high protection status; in the past, however, these monitors were hunted heavily for their skins. Nevertheless, there is a local use for medicine, leather, meat and superstition.



Varanus flavescens. Above: adult, probably during the mating season, Jalpaiguri, India, © Sourav Mandal; second and third row: adult, western lowland of Nepal, © Hemant Raj Ghimire; below left: juvenile, western lowland of Nepal, © Hemant Raj Ghimire; below right: adult, Shuklaphanta Nationalpark, Nepal, © Kul Bahadur Thapa

Varanus nebulosus (Gray, 1831)

Subgenus: *Empagusia*

English name: Clouded monitor

German name: Nebelwaran

Local names: Biawak (Malaysia), Da-kuat, Lan (Thailand), biawak abu-abu (Indonesia)

Synonyms: *Varanus vietnamensis* Yang & Liu, 1994; *V. bengalensis nebulosus*

Subspecies: None; however, some authors regard *V. nebulosus* a subspecies of *V. bengalensis*.

International conservation status (CITES / Commission Regulation (EU) No 2017/160): Appendix I/A

IUCN Red List status: Not Evaluated (NE)

Distribution: Myanmar, Thailand, Laos, Cambodia, Vietnam, Malaysia, Indonesia (Sumatra, Java)

Total length (TL): 175 (♂ 150) cm (♂), ♂ 120 cm (♀) according to *V. bengalensis*; **Snout-vent length (SVL):** 61 (♂ 58) cm (♂), ♂ 46 cm (♀) according to *V. bengalensis*

Morphological traits (adults): Large species; head, legs and tail strong; tail about 1.5 times as long as SVL, laterally flattened with a keel (←) above; lateral tail scales much smaller than those below; head scales above eyes enlarged; nostrils slit-shaped (rounded in young specimens), located between eye and tip of snout (1); snout often bulgy, especially in large specimens (2), 70-90 (♂ 78) scale rows along the belly from neck wrinkle to anterior margin of hind legs

Colour pattern: Dorsal background colour variable, light brown, yellowish-brown (3) to dark brown (in southern Thailand [4]) with many light scales/spots; body underside light and dark speckled; tongue pink/flesh-coloured, partly dark; pattern in **juveniles** specimens clearer, light spots on back larger, with dark V-shaped pattern at the neck (5); tail light and dark banded, bands wider towards the end (6); throat and belly light, usually with dark transverse bands.

Similar species: *V. bengalensis* has no enlarged head scales above the eyes, 88-110 scale rows along the belly, mostly a darker ground colouration, and the snout is more bulgy. However, these characteristics do not always seem to be constant, so that identification is difficult without knowledge of the locality.

Size/age at sexual maturity: ♂: >23.3 cm SVL; ♀: in captivity >22.5 (♂ 28.9) cm SVL, in nature >29.5 cm SVL; at the age of 2.5-3 years in captivity, possibly longer in nature according to *V. bengalensis*.

Clutch size: 9-27 eggs per clutch depending on the size of the female; 1-2 clutches per year according to *V. bengalensis*; minimum time span of 49 days between two clutches

Incubation period/temperature: 234-282 days at 27-30.0 °C

Size/weight of hatchlings: ♂ 21.6-24.8 cm TL; ♂ 17.5-19.5 g

Growth rate: In captivity after 12 months: 19.5-26.3 (♂ 23.1) cm SVL; after 24 months: 25.0-30.3 (♂ 28.3) cm SVL; in nature after 3 months: ♂ 16.4 cm, after approximately 12 months: ♂ 19.2 cm according to *V. bengalensis*.

Captive breeding: So far only rarely bred, but under right conditions breeding seems simple; in nature, day length and monsoon influence reproduction; egg deposition box required.

Specifics: Delayed reproduction (*Amphigonia retardata* ←) due to sperm storage by >1 month possible according to *V. bengalensis*.

Ecology: Diurnal (←); mainly ground-dwelling; eats mainly invertebrates such as insects, spider and scorpions

Remarks: Due to the high conservation status no international trade in *V. nebulosus* takes place according to the CITES trade database. Nevertheless, these monitors are hunted locally for various purposes (skins, consumption, folk medicine, talisman, superstition). The species is nationally protected in Indonesia.



Varanus nebulosus. Above: adult, South Vietnam, © Peter Geisler; second row: adult, West Malaysia, © Mark Auliya; third row left: juvenile, Tioman Island, Malaysia, © Pauli Hien; third row right: adult, Tioman Island, Malaysia, © Mark Auliya; below: adult, Meru Betiri National Park, Java Island, Indonesia, © Simon Arming & Patrick Müller

Varanus rudicollis (Gray, 1845)

Subgenus: *Empagusia*

English names: Rough-necked monitor, Harlequin monitor

German name: Rauh Nackenwaran

Local names: Ngu-hao Chang, Kor Lung, Hao Dong, Hao Chang, Thao Ra-toei (South Thailand), Biawak Serunai (Malaysia), Biawak Punggur (Borneo)

Synonyms: *Varanus scutigeralus* Barbour, 1932; *Varanus swarti* Mangili, 1962

Subspecies: None

International conservation status (CITES / Commission Regulation (EU) No 2017/160): Appendix II/B

IUCN Red List status: Not Evaluated (NE)

Distribution: South Thailand, south Myanmar (Burma), Malaysia and Bangka, Riau, Borneo, and Sumatra islands, Indonesia

Total length (TL): 146 cm, 124.4 cm (♀); **Snout-vent length (SVL):** 59 (♂ 33.6) cm, 40.6 cm (♀)

Morphological traits (adults): Large species; head, body and legs slender; tail 1.3-1.6 (in juveniles 1.1-1.3) times as long as SVL, laterally flattened with a keel (←) above (1); lateral tail scales smaller than lower ones; snout arched and long (2); nostrils oval (juveniles) to slit-shaped (adult), closer to eye than to tip of snout (in the middle in juveniles) (3); scales in the neck significantly enlarged, in adults conical to pointed (4); head scales above eyes slightly enlarged

Colour pattern: Upper body side dark grey to black grey with more or less pronounced pattern of 5-6 transverse rows of grey, light brown or yellowish spots becoming larger towards the ventral (←) side, on anterior (←) back as transverse bands (5); spotted transverse rows continue on tail, second half with broad bands; body occasionally plain black, unpatterned (6); sometimes three dark stripes run across the mouth; body underside dirty yellow, belly with grey transverse bands, throat grey; tongue pink/flesh-coloured; iris reddish brown to dark brown; **juveniles** brighter and with more contrasting colouration; legs and toes dotted with bright scales (7); head laterally brown, dark spots over mouth; a dark band runs from behind the eye over the ear opening along the side of the neck to the upper back (8), another black band runs along the middle of the neck; throat with dark cross stripes; underside of tail bright and dark banded

Similar species: *V. dumerilii* has a shorter, less bulgy snout, flat (vs. conical to pointed) neck scales, and larger scales around the middle of the body (66-102 vs. 139-169); juveniles with intense orange-yellow head colour and yellow horizontal stripes on back; *V. nuchalis* has a dark blue-grey tongue in the anterior half, nostrils roundish/oval, closer to tip of snout than to eye; unicoloured black (melanistic) *V. salvator* have no enlarged neck scales, a shorter, not bulgy snout, and a dark blue-grey tongue.

Size/age at sexual maturity: ♂: ca. 60 cm TL; age unknown

Clutch size: Up to 3 clutches per year (resp. every 4-6 months) with up to 16 (♂ 8-10) eggs approximately 4 weeks after mating

Incubation period/temperature: 152-190 days at 28-30 °C

Size/weight of hatchlings: 20-26 cm TL; 14-21.6 g

Growth rate: After ca. 9 weeks: 11.7-13.2 cm SVL, 25.3-29.3 (♂ 27.9) TL, 20.6-29 (♂ 25.2) g; after ca. 18 weeks: 13.2-14.7 SVL, 28.5-34.2 (♂ 31.7) cm TL, 29.2-50.1 g

Captive breeding: Breeding so far very rarely succeeded in zoos and private collections. Simulation of the rainy season can trigger reproductive behaviour.

Specifics: A probable case of parthenogenesis (←) has been published.

Ecology: Diurnal (←); ground and tree-dwelling; little is known about the biology of *V. rudicollis* in the wild. The species feeds mainly on invertebrates (insects, scorpions, spiders, and molluscs).

Remarks: According to the CITES trade database, Indonesia exported annually more than 1000 live specimens of *V. rudicollis* between 2010 and 2017. The species is not protected in Indonesia.



Varanus rudicollis. Above left: juvenile, © Mark Auliya; above right: juvenile, Hayup, Borneo, ZSM 68-1914 © André Koch; centre left: adult, Maliau Basin, Borneo, © Simon Arming; centre right: adult, Batang Toru Forst, Sumatra, Indonesia, © Gabriella Fredriksson; below left: adult, © Andrea & Dietmar Trobisch; below right: adult, © Dmitry Telnov, Entomological Society of Latvia

Varanus caerulivirens Ziegler et al., 1999

Subgenus: *Euprepiosaurus*

English name: Turquoise monitor

German name: Türkiswaran

Local names: Biawak halmahera (Indonesia), biru (Halmahera Island)

Synonyms: None; prior to their scientific description, these monitors were allocated to *V. indicus*.

Subspecies: None

International conservation status (CITES / Commission Regulation (EU) No 2017/160): Appendix II/B

IUCN Red List status: Not Evaluated (NE)

Distribution: Northern Moluccas (Halmahera, Bacan, Morotai, and Obi islands), Indonesia

Total length (TL): 110 cm; **Snout-vent length (SVL):** ca. 40 cm

Morphological traits (adults): Medium-sized species; head, body and legs slim; tail about 1.5 times as long as SVL, laterally flattened, with a keel (←) above (1); lateral tail scales smaller than lower ones; nostrils roundish (juvenile) to oval (adult), closer to tip of snout than to eye (2); head scales above the eyes enlarged

Colour pattern: Head, body, legs and tail dark brown to black with intense pattern of many whitish to pale yellow scales/small spots, sometimes forming circles on the back; tail dark with bright blue bandings (3), which become more indistinct with age; blue hue can also spread to the legs and feet; without light stripe between eye and ear (4); body underside light grey (5), rarely bluish, throat and neck yellowish to beige; iris brown; tongue pink/flesh-coloured, tips sometimes dark (6); **juveniles** with larger yellow spots on back and legs; legs and head with more intense blue hue; underside turquoise to bluish with narrow black cross stripes

Similar species: *V. indicus*, *V. cerambonensis*, *V. lirungensis*, *V. rainerguentheri*, and *V. finchi* lack the blue coloration on tail and legs; *V. jobiensis* has relatively larger eyes and occasionally a pattern of cross stripes on the back, some animals have a pink (sometimes blue) throat colour, which can extend over the mouth to the eye; *V. doreanus* overall with darker underside of the body and narrower tail bandings (about 40 vs. about 20 blue and black sections); adult animals with dark throat, young animals also on belly and undersides of legs dark with light spots

Size/age at sexual maturity: ♀: 32 cm SVL, 81 cm TL; age unknown

Clutch size: 2 eggs per clutch with a minimum interval of 8 months have been documented.

Incubation period/temperature: No published data; probably similar to *V. indicus*.

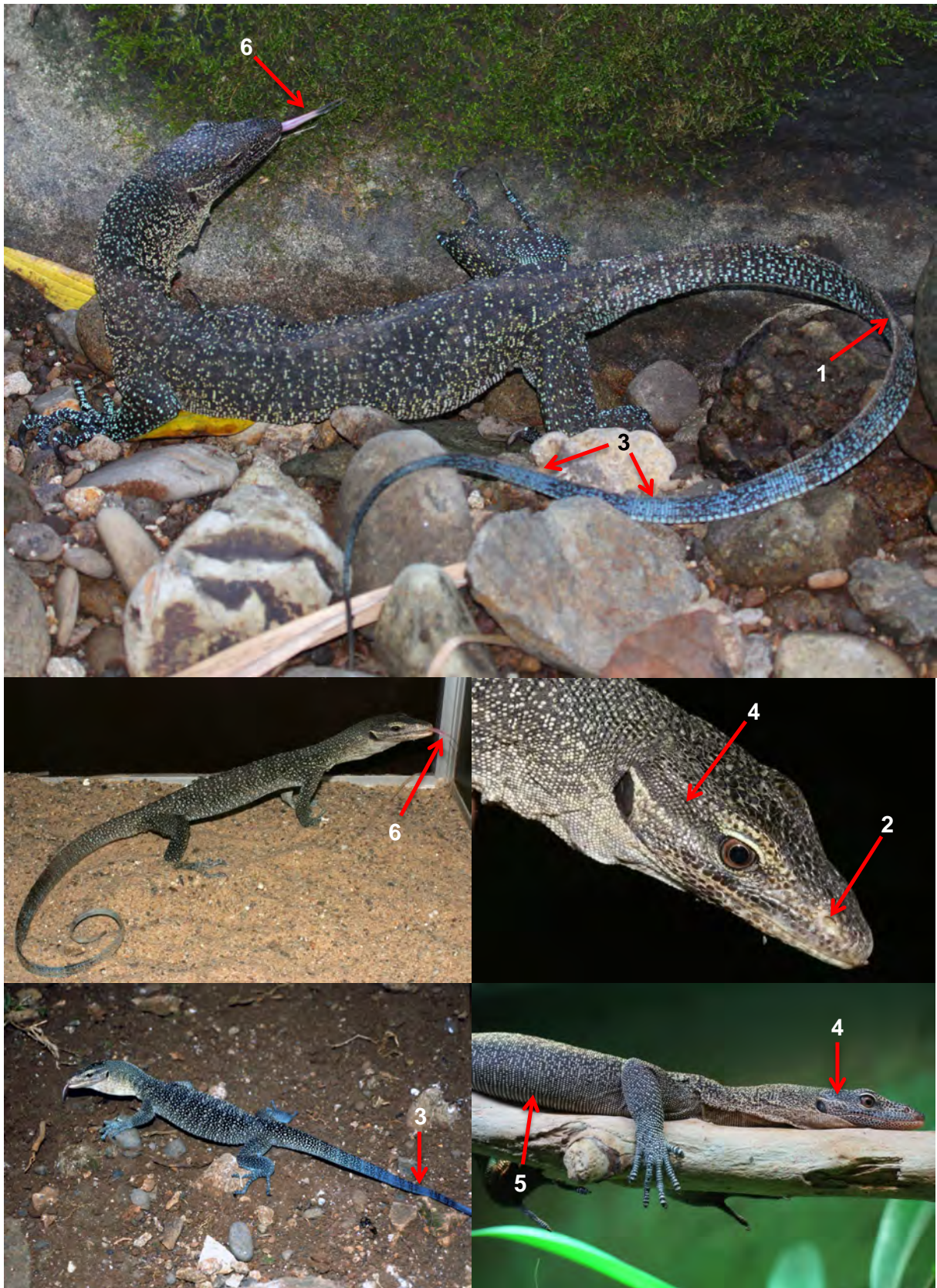
Size/weight of hatchlings: No published data; probably similar to *V. indicus*.

Growth rate: No published data; probably similar to *V. indicus*.

Captive breeding: No breeding success has been documented so far; conditions probably similar to *V. indicus*. Dissection of sexually mature specimens revealed males to have enlarged testes throughout the year, suggesting that reproduction takes place year-round.

Ecology: Diurnal (←); island endemic (←); ground and tree-dwelling; feeds mainly on invertebrates (insects, crabs, arachnids), but also frogs.

Remarks: Although *V. caerulivirens* occurs in the international pet trade, this is not documented by the CITES trade database. This species is probably traded unnoticed as *V. indicus*.



Varanus caerulivirens. Above: adult, north of Weda, Halmahera Island, Indonesia, © James L. McKay; centre left and right: juvenile, Cologne Zoo, © Thomas Ziegler; below left: adult, © Kai Philipp; below right: adult, Cologne Zoo, © Sven Mecke

Varanus cerambonensis Philipp et al., 1999

Subgenus: *Euprepiosaurus*

English names: Banded Pacific monitor, Seram monitor

German name: (Seram-Pazifikwaran)

Local names: Biawak Seram, bwo, bwo-Sipane, bwo-inai, Puo-inae, Puo-pipane (Indonesia)

Synonyms: None; prior to their scientific description, these monitors were allocated to *V. indicus*.

Subspecies: None

International conservation status (CITES / Commission Regulation (EU) No 2017/160): Appendix II/B

IUCN Red List status: Not Evaluated (NE)

Distribution: Central Moluccas (Ceram, Ambon, Saparua, Buru, and Banda islands), Indonesia

Total length (TL): 98.4 (140?) cm; **Snout-vent length (SVL):** 40.9 cm

Morphological traits (adults): Medium-sized species; head, body and legs slim; tail about 1.5 times as long as SVL, laterally flattened, with a keel (↔) above; lateral tail scales smaller than lower ones; nostrils roundish (juvenile) to oval (adult), closer to tip of snout than to eye; head scales above the eyes enlarged

Colour pattern: Head, body, legs and tail dark brown to black with intense pattern of many yellow small spots, sometimes forming rosettes and diffuse broad horizontal bands on the back (1), specimens from the island of Buru have more rosettes on the back (2); tail base with single short rows of light scales (3), indistinct light and dark banding towards the end, without blue colouration (4); body underside yellowish, sometimes with pale grey cross stripes on belly; head sideways with indistinct bright streak from eye to ear (5); iris dark brown; tongue pink/flesh-coloured with dark pigmentation above (6); **juveniles** with larger yellow spots on back and legs; underside with dark pointed markings or cross stripes; light and dark bandings on tail more distinct; tongue mostly plain pink without dark pigmentation above

Similar species: *V. jobiensis*, *V. doreanus* and *V. caerulivirens* show blue colouration on tail (and legs); *V. indicus* lacks the bright stripe between eye and ear; tongue dark blue; the pattern on the back is more uniform, not forming broad transverse bands, light points usually consist of only 1-3 yellow scales (adults); *V. lirungensis* lacks the light stripe between eye and ear, throat light pink, belly with pale grey cross stripes; *V. rainerguentheri* has a less pronounced light stripe between eye and ear; an even back pattern of eye spots, which can dissolve into a fine mottling; juveniles with dark pigmentation on the tongue; *V. finschi* lacks the bright stripes on the side of the head between eye and ear; the pattern on the back consists of evenly distributed eye spots with a bright centre, not forming broad transverse banding; tongue usually without dark pigmentation; *V. douarrha* lacks a distinct yellow stripe between eye and ear, shows a variable amount of dark marbling on throat, and exhibits dark pigmentation only on the distal parts of tongue.

Size/age at sexual maturity: No published data; probably similar to *V. indicus*.

Clutch size: No published data; probably similar to *V. indicus*.

Incubation period/temperature: No published data; probably similar to *V. indicus*.

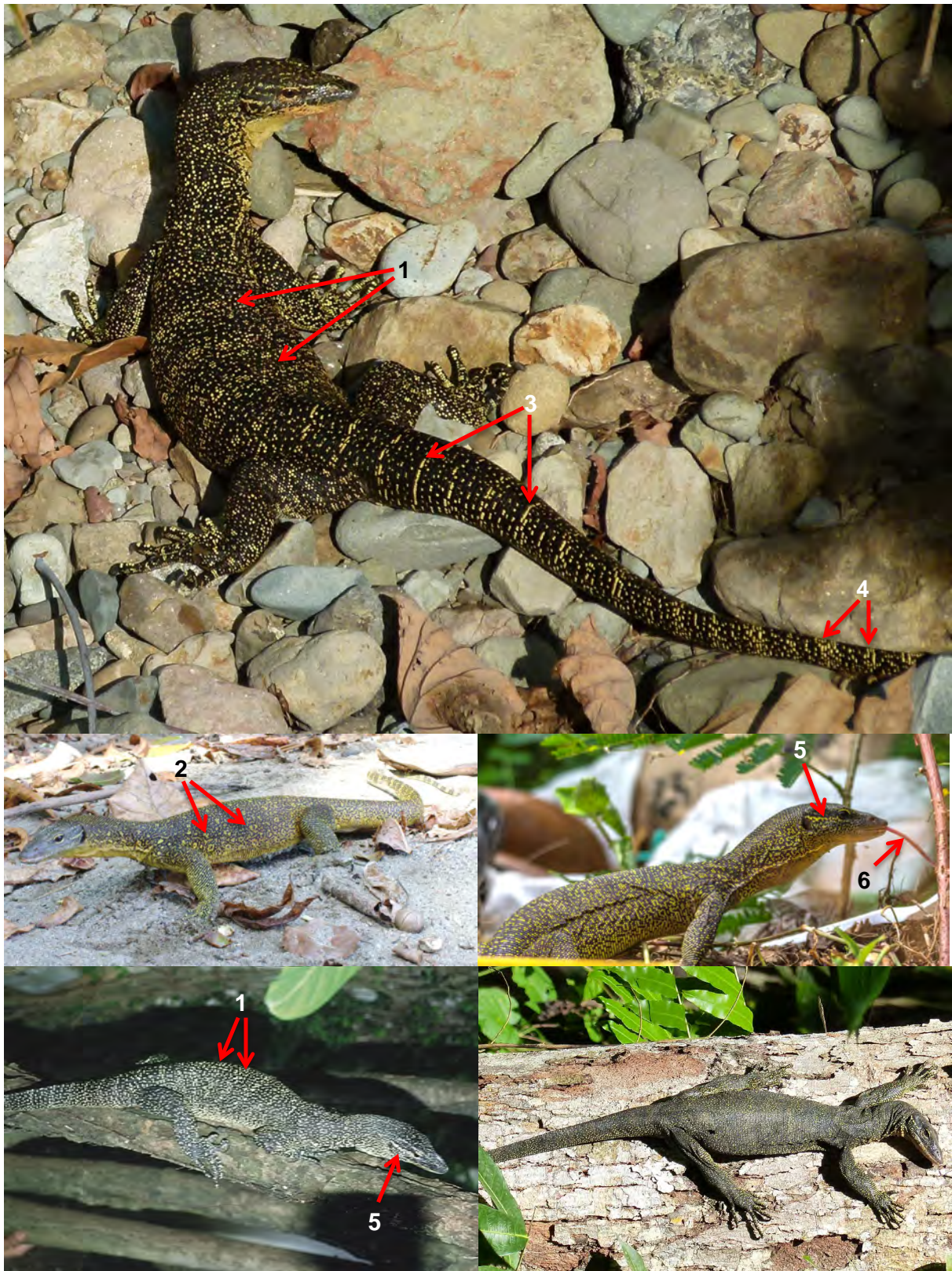
Size/weight of hatchlings: 9.8 cm SVL; 24.8 cm TL; weight unknown

Growth rate: No published data; probably similar to *V. indicus*.

Captive breeding: No successful keeping and breeding has been documented so far; conditions probably similar to *V. indicus*.

Ecology: Diurnal (↔); island endemic (↔); mainly ground-dwelling; feeds on invertebrates (crabs, centipedes and insects), next to small lizards and their eggs.

Remarks: Although *V. cerambonensis* is found in the international pet trade, this is hardly documented in the CITES trade database. Only two specimens were officially exported to the USA in 2012. This species is probably traded unnoticed as *V. indicus*.



Varanus cerambonensis. Above: adult, Ambon Island, Indonesia, © Andrea & Dietmar Trobisch; centre left: adult, Buru Island, Indonesia, © Valter Weijola; centre right: adult, Banda Neira Island, Indonesia, © Robin Schütz; below left: adult, Liang, Ambon Island, Indonesia, © Kai Philipp; below right: adult, Sawai, Seram Island, Indonesia, © Andrea & Dietmar Trobisch

Varanus doreanus (Meyer, 1874)

Subgenus: *Euprepiosaurus*

English name: Blue-tailed monitor

German name: Blauschwanzwaran

Local names: Biawak ekor biru (Indonesia), Birumoipoko (New Guinea)

Synonyms: *Varanus kalabeck* Lesson, 1830; prior to 1994 these monitors were allocated to *V. indicus*.

Subspecies: None; some authors, however, regard *V. semotus* a subspecies of *V. doreanus*.

International conservation status (CITES / Commission Regulation (EU) No 2017/160): Appendix II/B

IUCN Red List status: Not Evaluated (NE)

Distribution: New Guinea and Salawati, Biak, Waigeo, and Aru islands as well as northern Queensland, Australia

Total length (TL): 173.5 cm (♂); **Snout-vent length (SVL):** 83.5 cm (♂)

Morphological traits (adults): Medium-sized to large species; head, body and legs slim; tail about 1.5 times as long as SVL, laterally flattened, with a keel (←) above; lateral tail scales smaller than lower ones; snout slightly bulky, nostrils roundish (juvenile) to oval (adult), located closer to tip of snout than to eye; head scales above the eyes enlarged

Colour pattern: Head, body and legs dark brown/black with finely speckled pattern of small yellow spots/scales, bluish on legs to the feet; tail brilliant blue and dark banded on the second half (1), becoming more indistinct with increasing size (2); body underside yellowish to whitish, throat with dark marbling (3); head without bright stripe from eye to ear (4); iris dark brown; tongue light pink to yellowish (5); **juveniles** with back pattern of round white/yellow dots (6), which dissolve with age to bright mottling; underside of body rich in contrast with bright spots or cross stripes on a dark background (7), but sometimes predominantly bright belly with black cross stripes/markings (8); blue and black bandings of the tail clearer

Similar species: *V. semotus* has larger dorsal scales and therefore lower scale counts on the back between the ear opening and the hind legs (149-153 vs. 153-215 in *V. doreanus*) and around midbody (152-161 vs. 158-180 in *V. doreanus*); *V. jobiensis* has larger eyes, a tapering snout, sometimes a striped back pattern and a light underside of the body (throat reddish to orange or sometimes bluish); *V. yuwonoi* has a light stripe from the eye to the ear opening, a bicoloured body (head, neck and anterior back black-grey without yellow spots, rest of the back intense yellow, transitional area with black cross stripes) and a lighter belly; *V. caerulivirens* has a darker background colour on back with a finer pattern of more and smaller spots and a lighter body underside, especially without a dark throat (adults) or without large bright spots (juveniles) and a broader banding on tail (about 20 vs. about 40 blue and black parts).

Size/age at sexual maturity: A ♀ with a SVL of 31 cm (TL 81 cm) had not yet laid eggs; age unknown

Clutch size: No published data; probably similar to *V. indicus*.

Incubation period/temperature: No published data; probably similar to *V. indicus*.

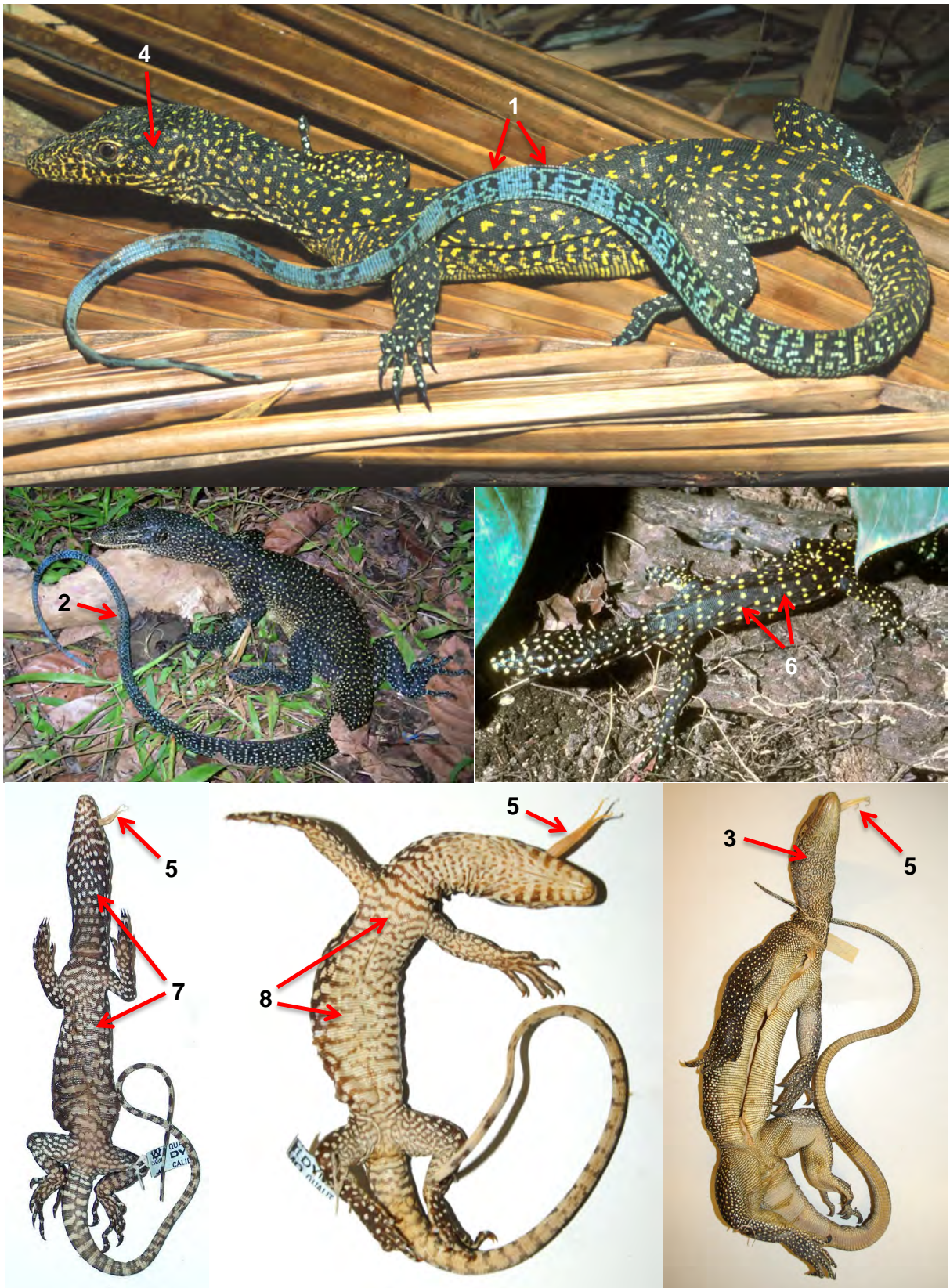
Size/weight of hatchlings: No published data; probably similar to *V. indicus*.

Growth rate: No published data; probably similar to *V. indicus*.

Captive breeding: So far, no successful breeding has been documented; conditions probably similar to *V. indicus*.

Ecology: Diurnal (←); mainly ground-dwelling; aggressive in handling; feeds next to invertebrates (especially beetles and grasshoppers) mainly on small snakes, lizards and their eggs, possibly also fledglings (nest-young birds) or bird eggs.

Remarks: *V. doreanus* is not nationally protected in Indonesia. The species is regularly exported for the live pet trade. According to the CITES trade database an annual export quota for live specimens from Indonesia is currently in place.



Varanus doreanus. Above: subadult, Bensbach river, Papua New Guinea, © Mark O'Shea; centre left: adult, Waigeo Island, Indonesia, © Amir Hamidy; centre right: juvenile, Karkar Island, Papua New Guinea, © Mark O'Shea; below left and centre: juvenile, Yongsu river, near Jayapura, Indonesia, MZB 3649; Doreh, Cenderawasih-Bucht, Indonesia, RMNH 7035, © André Koch; below right: adult, Dobo, Aru Islands, Indonesia, NMB 6214, © André Koch

Varanus douarrha (Lesson, 1830)

Subgenus: *Euprepiosaurus*

English name: New Ireland mangrove monitor

German name: -

Local names: Kailam, Rawu, Rabu (New Ireland, Papua New Guinea)

Synonyms: None; until 2017, *V. douarrha* itself was considered a synonym of *V. indicus*.

Subspecies: None; formerly, *V. douarrha* itself was considered a subspecies of *V. indicus*.

International conservation status (CITES / Commission Regulation (EU) No 2017/160): Appendix II/B

IUCN Red List status: Not Evaluated (NE)

Distribution: New Ireland, Lavongai, and Djaul islands, Bismarck Archipelago, Papua-New Guinea

Total length (TL): 133 cm (♂); **Snout-vent length (SVL):** 53 cm (♂)

Morphological traits (adults): Medium-sized species; head, body and legs slim; tail about 1.5 times as long as SVL, laterally flattened, with a keel (←) above (1); tail scales above smaller than lower ones; nostrils roundish to oval, closer to tip of snout than to eye (2); head scales above the eyes enlarged

Colour pattern: Head, body, legs and tail black, with more or less distinct cross rows of yellow ocelli (←) and spots (3); first third of tail above intensely yellow speckled, unclear banded towards the end; throat cream to yellow-orange with grey-black marbling; belly and underside of limbs and tail plain grey; head without light stripe between eye and ear opening (4); iris dark brown; tongue pink/flesh-coloured with grey pigmentation on the tines (5), sometimes also on the distal part of the trunk, in rare cases extending to midlength; **juveniles** on back with a clearer pattern of spotted cross rows (6); tail patterned with cross rows of bright spots; underside rich in contrast bright and dark patterned (7); tongue almost plain bright without dark pigmentation

Similar species: *V. indicus* has a completely dark blueish grey tongue (vs. pink with dark tips in *V. douarrha*), a uniformly cream coloured throat (vs. a variable amount of dark marbling in *V. douarrha*), evenly scattered yellow spots on the dorsum (vs. transverse rows of ocelli in *V. douarrha*); *V. finschi* has a unicoloured pink/yellow tongue (vs. pink with dark tips in *V. douarrha*), a lighter throat with only few dark spots (vs. a variable amount of dark marbling in *V. douarrha*) and smaller scales around midbody (on average 180 vs. 141 in *V. douarrha*); *V. cerambonensis* has a distinct yellow stripe between eye and ear opening (which is usually lacking in *V. douarrha*), a light, unpatterned throat (vs. variable amount of dark marbling in *V. douarrha*), and usually shows dark pigmentation half way up the tongue (vs. being restricted to the distal parts in *V. douarrha*); *V. li-rungensis* with light pink throat and pale grey cross stripes on belly and underside of legs, tongue above always darkly pigmented (vs. usually only dark tips in *V. douarrha*).

Size/age at sexual maturity: No published data; probably similar to *V. indicus*.

Clutch size: No published data; probably similar to *V. indicus*.

Incubation period/temperature: No published data; probably similar to *V. indicus*.

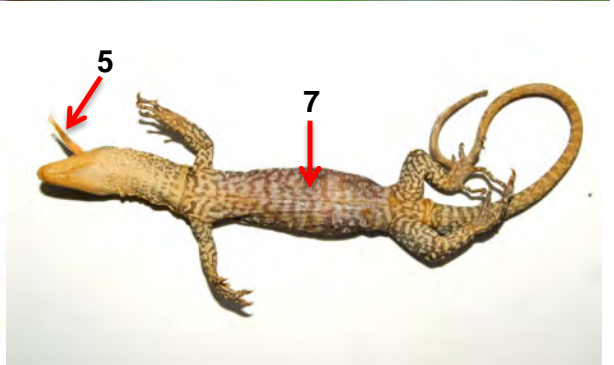
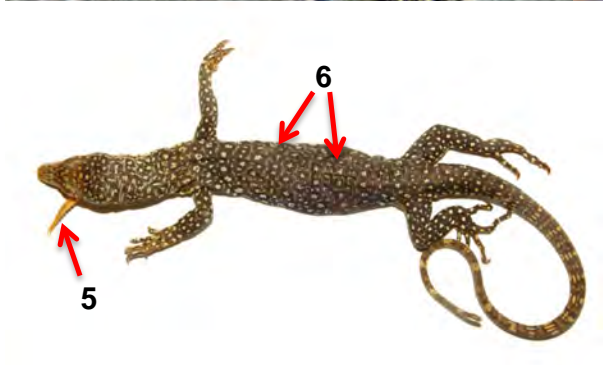
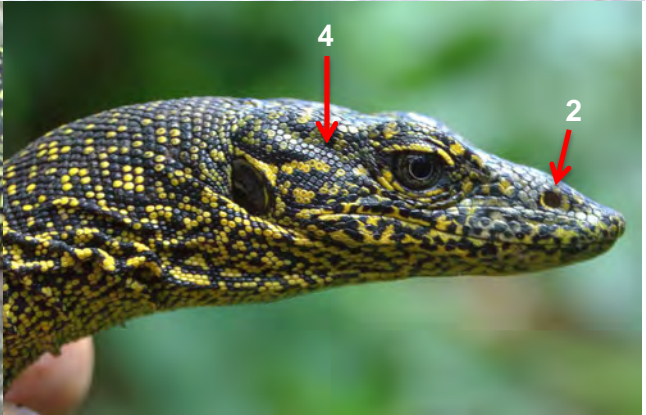
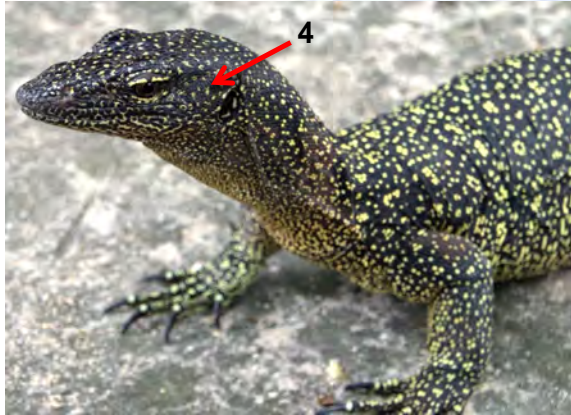
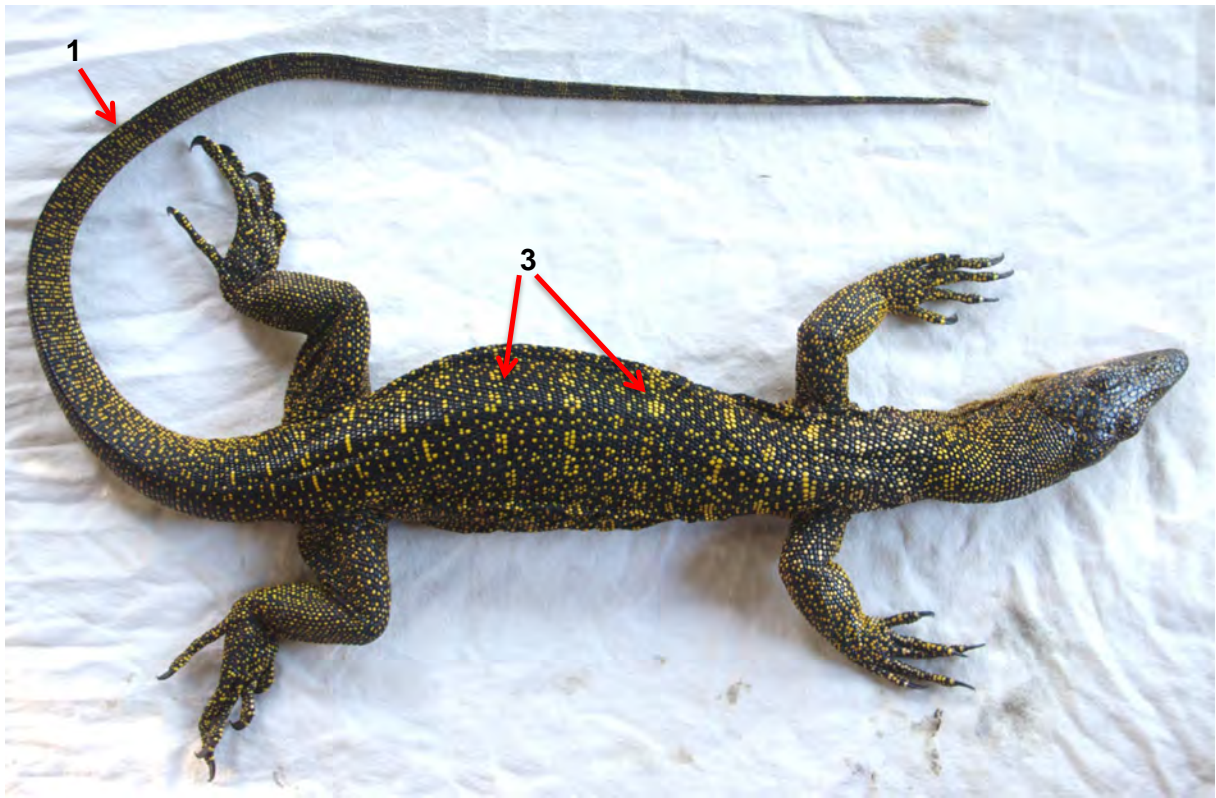
Size/weight of hatchlings: No published data; probably similar to *V. indicus*.

Growth rate: No published data; probably similar to *V. indicus*.

Captive breeding: So far, no successful keeping and breeding have been documented; conditions probably similar to *V. indicus*.

Ecology: Diurnal (←); island endemic (←); feeds on insects and crustaceans next to scorpions and lizards.

Remarks: Officially, no trade in *V. douarrha* is documented according to the CITES trade database. Due to the external similarity, however, this species could be traded unnoticed as *V. finschi* or *V. indicus*. The monitor species is locally hunted for its meat and skin.



Varanus douarrha. Above: adult, New Ireland Island, Papua New Guinea, © Valter Weijola; centre left and right: adult, New Ireland Island, Papua New Guinea, © Valter Weijola; below left and right: juvenile, New Ireland Island, Papua New Guinea, MNHN 8248, © André Koch

Varanus finschi Böhme et al., 1994

Subgenus: *Euprepiosaurus*

English name: Finsch's monitor

German name: Finschs Pazifikwaran

Local names: Balai, Andrai (New Britain Island)

Synonyms: *Varanus doreanus finschi* Böhme et al., 1994

Subspecies: None; originally, *V. finschi* was described as a subspecies of *V. doreanus*.

International conservation status (CITES / Commission Regulation (EU) No 2017/160): Appendix II/B

IUCN Red List status: Least Concern (LC), population trend unknown (last assessed 2009)

Distribution: New Britain and Duke of York islands, Bismarck Archipelago, Papua New Guinea

Total length (TL): 82 cm; **Snout-vent length (SVL):** 30.5 cm

Morphological traits (adults): Medium-sized species; head, body and legs slim; tail 1.3-1.6 times as long as SVL, laterally flattened, with a keel (↔) above (1); lateral tail scales smaller than lower ones; nostrils roundish to oval, located closer to tip of snout than to eye; head scales above the eyes enlarged

Colour pattern: Head, body, legs and tail dark grey, back with more or less pronounced transverse rows of large black encircled yellow ocelli (↔) and spots (2), in between rows many small bright dots; pattern continuing on tail base, changing in a light and dark marbling toward end of tail; legs also spotted; head with yellow dots (3); underside of body cream to pale yellow with reticulated or striped grey markings on belly, legs, and tail base (4); throat region with dark spots on the sides (5); head with ill-defined dark stripe from eye to ear (6); iris colour unknown; tongue yellowish to pink (7), sometimes central parts above and tips dark pigmented; **juveniles** with a clearer pattern of yellow eye spots in cross rows on back; tail with clear light blue and black bandings (8), fading with age; tongue (mostly) unicoloured yellowish

Similar species: *V. douarrha* has a pink tongue with grey distal parts and tines (vs. unicoloured yellowish to pink in *V. finschi*), a darker throat with variable amount of dark marbling (vs. a lighter throat with only few dark spots in *V. finschi*), and larger, thus fewer scales around midbody (↔) (on average 141 vs. 180 in *V. finschi*); *V. indicus* has a completely dark blueish grey tongue (vs. yellowish/pink in *V. finschi*), evenly scattered yellow dots/scales on the dorsum (vs. transverse rows of ocelli in *V. finschi*), and lacks a dark stripe from eye to ear (vs. stripe present in *V. finschi*); *V. cerambonensis* has a distinct yellow stripe between eye and ear opening (vs. a dark stripe in *V. finschi*), a rather banded dorsal pattern (vs. regular transverse rows of spots and ocelli), and usually shows dark pigmentation half way up the tongue (vs. unicoloured yellowish/pink in *V. finschi*); *V. doreanus* and *V. semotus* have blue tail bandings (vs. whitish/yellow in *finschi*) and a dark marbled throat (vs. nearly unpatterned in *V. finschi*).

Size/age at sexual maturity: No published data; probably similar to *V. indicus*.

Clutch size: No published data; probably similar to *V. indicus*.

Incubation period/temperature: No published data; probably similar to *V. indicus*.

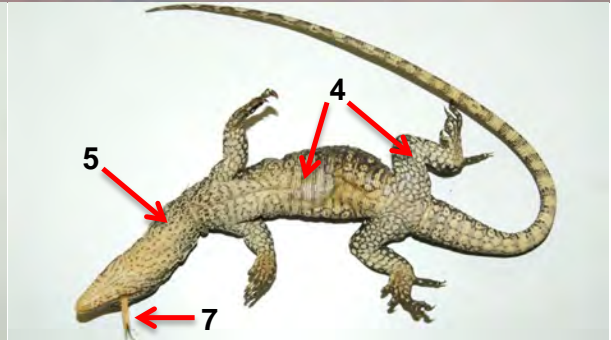
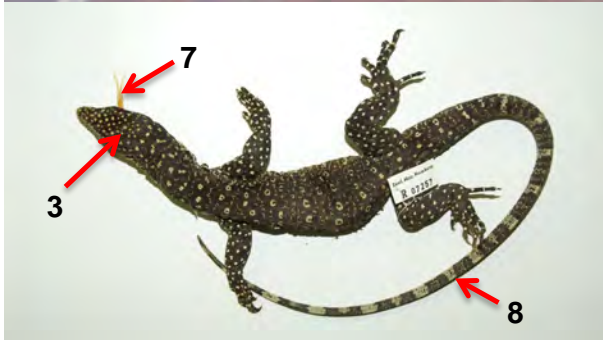
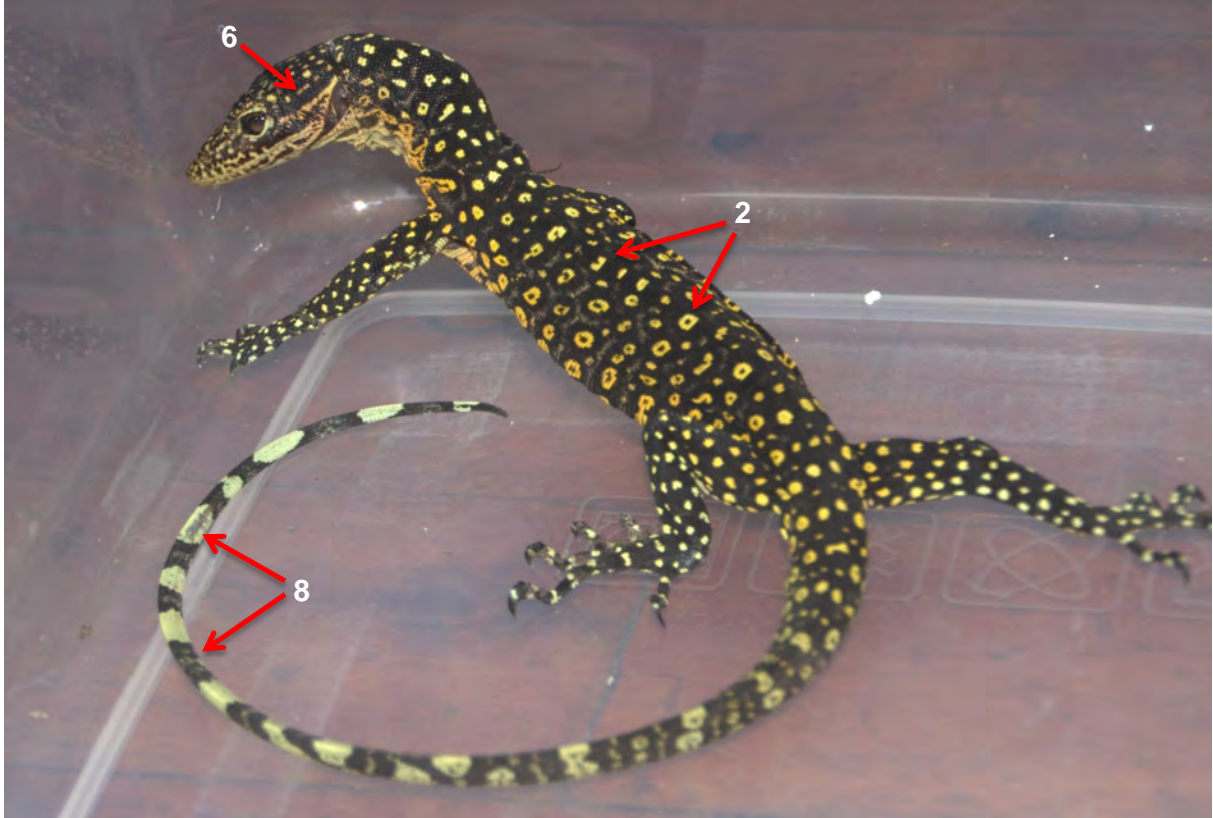
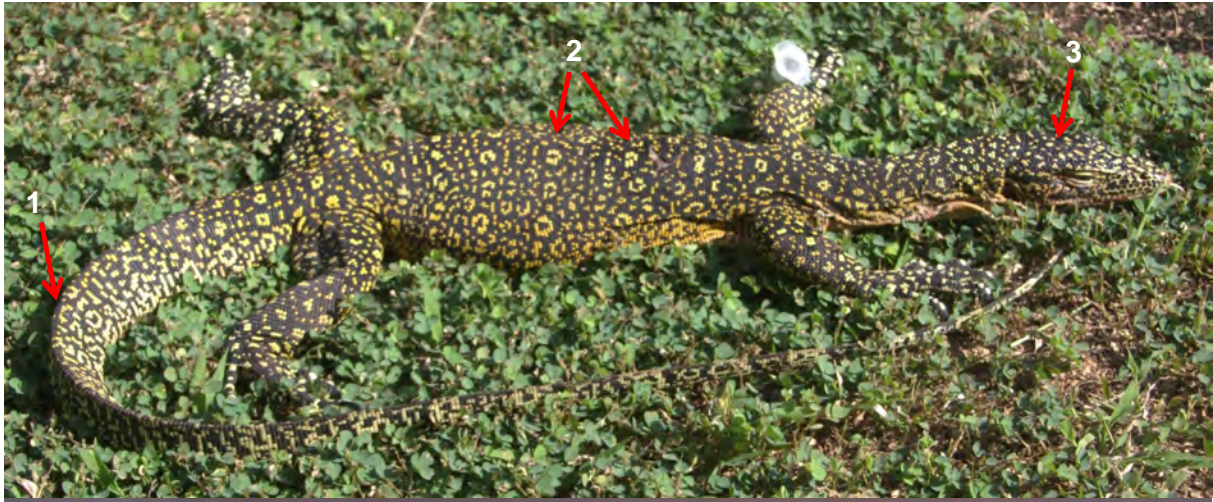
Size/weight of hatchlings: No published data; probably similar to *V. indicus*.

Growth rate: No published data; probably similar to *V. indicus*.

Captive breeding: So far, no successful keeping and breeding has been documented; conditions probably similar to *V. indicus*.

Ecology: Diurnal (↔); island endemic (↔); aggressive in handling; feeds mainly on small lizards and insects.

Remarks: According to the CITES trade database, only single specimens of *V. finschi* have been exported in recent years for scientific purposes due to effective prohibition of animal exports from Papua New Guinea. However, superficially similar monitor lizards from the Kai Islands of Indonesia are available in the international pet trade. These specimens are probably traded as *V. indicus*.



Varanus finschi. Above: adult, New Britain Island, Papua New Guinea, © Valter Weijola; centre: juvenile, Nodup village west of Rabaul, New Britain Island, Papua New Guinea, © Valter Weijola; below left and right: subadult, Matupit Peninsula, New Britain Island, Papua New Guinea, ZMH 7257, © André Koch

Varanus indicus (Daudin, 1802)

Subgenus: *Euprepiosaurus*

English names: Mangrove monitor, Pacific monitor

German name: Pazifik-Waran

Local names: Biawak indicus, biawak Pasifik, biawak Maluku (Indonesia), Biawak bakau, Gawi, Gomakara, Tetere (New Guinea), Chelub, Galufs, Kaluf (Micronesia)

Synonyms: *Monitor chlorostigma* Gray, 1831; *V. indicus rouxi* Mertens, 1926; *V. tsukamotoi* Kishida, 1929

Subspecies: None; formerly, *V. spinulosus* and *V. douarrha* were treated as subspecies of *V. indicus*.

International conservation status (CITES / Commission Regulation (EU) No 2017/160): Appendix II/B

IUCN Red List status: Least Concern (LC), population trend unknown (last assessed 2009)

Distribution: Eastern Indonesia (Moluccas), New Guinea and surrounding islands, Northern Australia, Solomon Islands, Micronesia, Palau, Pacific Territories of the USA and Japan

Total length (TL): 150 (perhaps up to 170) cm; **Snout-vent length (SVL):** 58 (♂ 42) cm (♂), 44.5 (♀ 32) cm (♀) on Guam

Morphological traits (adults): Medium-sized species; head, body and legs slim; tail 1.25-1.85 (♂ 1.5) times SVL, laterally flattened, with a keel (←) above (1); lateral tail scales smaller than lower ones; nostrils roundish to oval, closer to tip of snout than to eye; head scales above eyes enlarged

Colour pattern: Head, body, legs and tail grey-black with a fine mottling of whitish or yellow scales; tail not or only vaguely banded, without blue coloration (2); body underside whitish to yellow, sometimes with pale cross stripes or reticulated pattern on belly; throat plain bright, unpatterned (3); head without bright streak from eye to ear (4); iris dark brown; tongue dark blue-grey (5); **juveniles** more intensely coloured with larger yellow spots on back and legs, partly in cross rows; underside with lateral dark pointed markings or cross stripes; tail (indistinctly) light and dark banded (6)

Similar species: *V. cerambonensis* and *V. rainierguentheri* with a light streak between eye and ear; tongue only above dark blue, otherwise pink; back pattern in adult *V. cerambonensis* sometimes as indistinct broad transverse bands of yellow dots; back pattern in subadult *V. rainierguentheri* as black eye spots with light centre; *V. juxtindicus* shows a more vivid pattern of many yellow scales, the tongue is dark blue only at its tips and the tail lacks a dorsal double keel, juveniles exhibit black rosettes with bright centres on back; *V. lirungensis* with bright pink throat and pale grey cross stripes on belly, tongue only above dark blue, otherwise pink; *V. salvator* from **Sulawesi and eastern Lesser Sunda Islands** with similar colour pattern, but head without light dots, throat with black V-shaped markings, a below light-bordered dark stripe between eye and ear, light streak on the side of the neck; *V. togianus* with dark transverse bands or pointed lateral markings on belly and/or at least on throat, throat sometimes with dark mottling, head without light dots

Size/age at sexual maturity: ♂: >32 cm SVL; ♀: >27.5 cm SVL (on Guam); age unknown

Clutch size: 5-10 eggs per clutch; on Guam several clutches per year with 1-10 (♂ 2) eggs

Incubation period/temperature: 140-199 days at 26-34 °C

Size/weight of hatchlings: 23-25.9 cm TL, 17-22 g

Growth rate: After 1 year: 50-55 cm TL, after 3 years: 90-130 cm TL

Captive breeding: Rarely bred so far; due to morphological similarity with other species it cannot be excluded that some of the data provided above refer to closely-related species such as *V. juxtindicus*.

Specifics: Ability to reproduce parthenogenetically (←) is very likely.

Ecology: Diurnal (←); mainly ground-dwelling; prefers mangroves and coastal forests; opportunistic diet of crustaceans, spiders, and insects, besides vertebrates and molluscs.

Remarks: *V. indicus* is nationally protected in Indonesia; therefore, only exports of captive-bred specimens are allowed. Similar species as *V. cerambonensis* or *V. lirungensis* are probably exported under the name of *V. indicus*. Due to its large distribution area and differences, among others, in colour pattern, *V. indicus* probably includes more than one species.



Varanus indicus. Above: adult, Bensbach river, Papua New Guinea, © Mark O'Shea; centre left: subadult, Mount Bosavi, Papua New Guinea, © Ulla Lohmann; centre right: juvenile, Bristow Island, Papua New Guinea, © Mark O'Shea; below left and right: adult and juvenile, Buare, Mamberano River Basin, West New Guinea, Indonesia, © Michael Mühlenberg

Varanus jobiensis Ahl, 1932

Subgenus: *Euprepiosaurus*

English names: Sepik monitor, Peach-throated monitor

German name: Sepik-Waran

Local names: Biawak leher merah [jambu] (Indonesia)

Synonyms: *Varanus karlschmidti* Mertens, 1951

Subspecies: None; due to, among other things, differences in the colour pattern of the various *V. jobiensis* populations, the name *karlschmidti* could gain taxonomic validity in the future.

International conservation status (CITES / Commission Regulation (EU) No 2017/160): Appendix II/B

IUCN Red List status: Least Concern (LC), population trend unknown (last assessed 2014)

Distribution: New Guinea as well as Salawati, (Batanta?), Biak, Waigeo, Yapen and the Trobriand islands

Total length (TL): 120 cm; **Snout-vent length (SVL):** 45 cm (♂)

Morphological traits (adults): Medium-sized species; head, body and legs slim; tail 1.5-1.8 times SVL, laterally flattened with a keel (←) above (1); tail scales above smaller than lower ones; tapering head, eyes conspicuously large (2); head scales above eyes enlarged; nostrils roundish to oval, closer to tip of snout than to eye

Colour pattern: Bright form: head above dark grey/black; throat and back greenish/brownish with light mottling; back with 7-11 more or less distinct dark horizontal stripes (3); legs dark grey/black with light mottling; tail greenish-blackish marbled, turning into blue-black marbling, with indistinct blue and black bands toward the end (4); tongue pink/flesh-coloured, tips sometimes darker; iris medium brown; ventral side greyish/greenish, sometimes with dark cross stripes or reticulated pattern; throat unpatterned, pink/orange (5) or blue; **juveniles** coloured richer in contrast; distinct dark horizontal stripes on back; neck, legs and tail base with larger bright spots; tail more clearly banded; **dark form:** head, body, legs and tail base grey-black with many whitish spots (light blue on feet) (6); back sometimes with black horizontal stripes without bright spots; rest of tail blue and black banded (7); sides of head black-grey/dark blue (8); body underside plain whitish/yellowish, light and dark marbled or grey; throat whitish, pink, orange or blue-grey; head without bright streak between eye and ear; iris medium brown; tongue pink/flesh-coloured; **juveniles** sometimes with bright orange-red throat/belly; legs and belly with dark reticulated pattern/cross stripes; tail more clearly banded.

Similar species: *V. doreanus* and *V. semotus* have smaller eyes, a rather dull, bulky snout, no striped back pattern, darkly marbled throat (adults) or with light spots on a dark background (juveniles); *V. caerulivirens* has smaller eyes, no striped back pattern, no colourful throat; *V. yuwonoi* with smaller eyes, a light streak between eye and ear opening, and an intense yellow hind back; *V. indicus* and *V. lirungensis* without blue colour on tail and head/throat, smaller eyes, tongue (above) dark blue grey

Size/age at sexual maturity: No published data; probably similar to *V. indicus*.

Clutch size: 3-5 eggs per clutch

Incubation period/temperature: 179-258 days at 26-32.2 °C

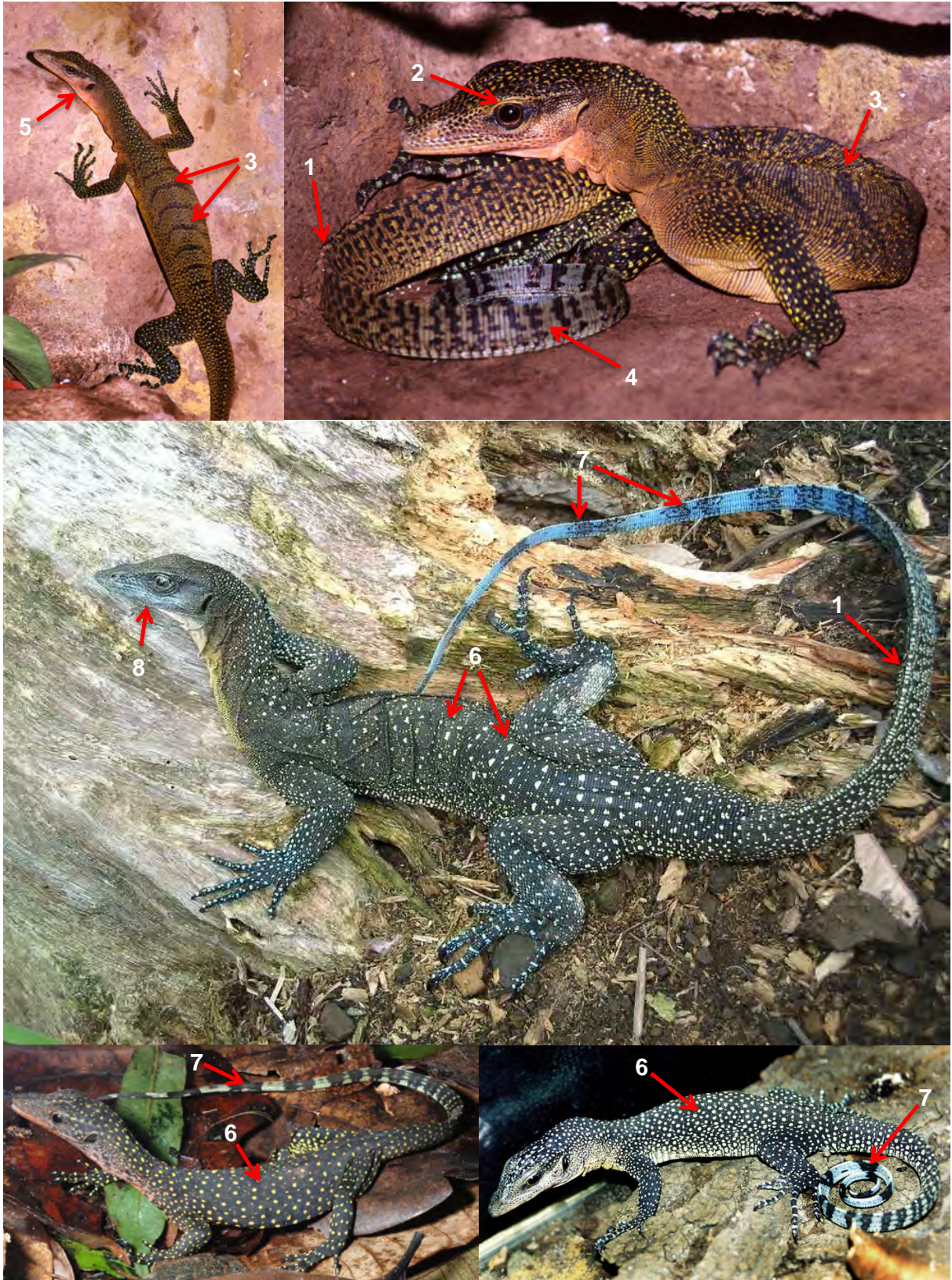
Size/weight of hatchlings: 7.9-12.1 cm SVL; 19.1-27 cm TL; weight unknown (<47 g)

Growth rate: After 4 months: 15 cm SVL, 35 cm TL; after 2.5 years: 22 cm SVL, 56 cm TL

Captive breeding: Breeding in zoos and private collections only rarely succeeded so far. Mating behaviour may be initiated by the simulation of a rainy season.

Ecology: Diurnal (←); ground and tree-dwelling; feeds mainly on insects next to frogs and reptile eggs.

Remarks: Due to its attractive colour pattern, *V. jobiensis* is in demand for the international pet trade. According to the CITES trade database, up to 600 live specimens were exported each year from Indonesia between 2010 and 2018. *V. jobiensis* is not nationally protected in Indonesia. Imports of wild-caught specimens from Indonesia into the EU have been suspended since 1997.



Varanus jobiensis. Above left and right: **bright form**, subadult, © Runde Midtgaard; centre: **dark form**, adult, Waigeo Island, Indonesia, © Amir Hamidy; below left: **dark form**, juvenile, Mount Victory, Oro Province, Papua New Guinea, © Fred Kraus; below right: **dark form**, juvenile, captive-bred, Leipzig Zoo, © Christian Kern

Varanus juxtindicus Böhme et al., 2002

Subgenus: *Euprepiosaurus*

English name: Rennell Island monitor

German name: Rennell Island-Pazifikwaran

Local name: te hokai (Solomon Islands)

Synonyms: None; prior to their scientific description, these monitor lizards were allocated to *V. indicus*.

Subspecies: None

International conservation status (CITES / Commission Regulation (EU) No 2017/160): Appendix II/B

IUCN Red List status: Least Concern (LC), population trend stable (last assessed 2011)

Distribution: Solomon Islands

Total length (TL): 140 cm (♂); **Snout-vent length (SVL):** <50 cm (♂)

Morphological traits (adults): Medium-sized species; head, body and legs slim; tail 1.5-1.7 (ø 1.6, in juveniles 1.3-1.5) times SVL, hardly flattened laterally, keel (←) above not or only weakly pronounced (1); lateral tail scales smaller than lower ones; nostrils roundish to oval, closer to tip of snout than to eye (2); head scales above eyes only slightly enlarged, head scales relatively large overall

Colour pattern: Head, body, legs and tail grey-black with intense yellow mottling, (almost) every scale bears a yellow dot (3); tail not banded, without blue coloration (4); body underside whitish to yellowish with pale marbling; throat bright, unpatterned; head without bright streak between eye and ear (5); head scales around eyes yellow (6); iris brown; tongue pink, tips darker; **juvenile** grey-black with many larger and smaller yellow spots on body (7), on tail in narrow cross rows; with increasing body size, the pattern changes to black-rimmed yellow eye spots on a grey background colour, which dissolves into the adult colour pattern at about 18 months; body underside whitish to yellowish with a dark reticulated pattern or cross stripes; throat slightly marbled (8)

Similar species: *V. indicus*, *V. cerambonensis*, *V. lirungensis*, and *V. rainerguentheri* have a more laterally flattened tail with a prominent keel above; the finely speckled colour pattern of many yellow scales is less conspicuous in adults; *V. indicus* with dark blue-grey tongue; *V. lirungensis* with light pinkish throat; *V. jobiensis*, *V. doreanus* and *V. caerulivirens* with blue colouration, especially on tail

Size/age at sexual maturity: Approximately 100 cm TL; at Prague Zoo the first mating attempt of a ♂ occurred at the age of 522 days. The first clutch was recorded at the age of 578 days.

Clutch size: Up to 3 clutches per year each with 4-7 eggs about 40 days after mating; minimum interval of 60 (ø 88) days between two clutches; Zoo Prague: clutches of 1-12 (ø 4) eggs every 2 months

Incubation period/temperature: 158-174 days at 28.5-30 °C; Prague Zoo: <180 days at 28 °C

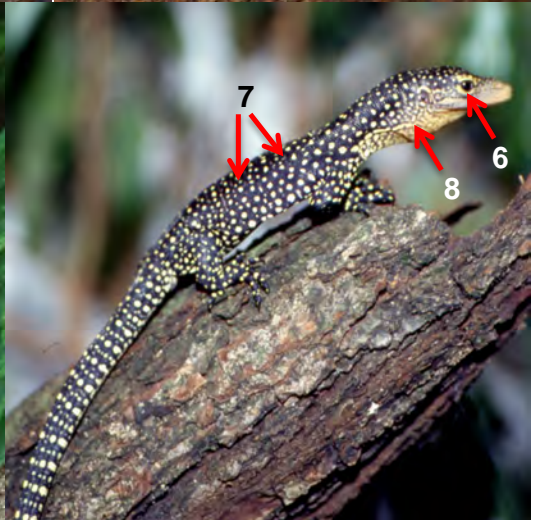
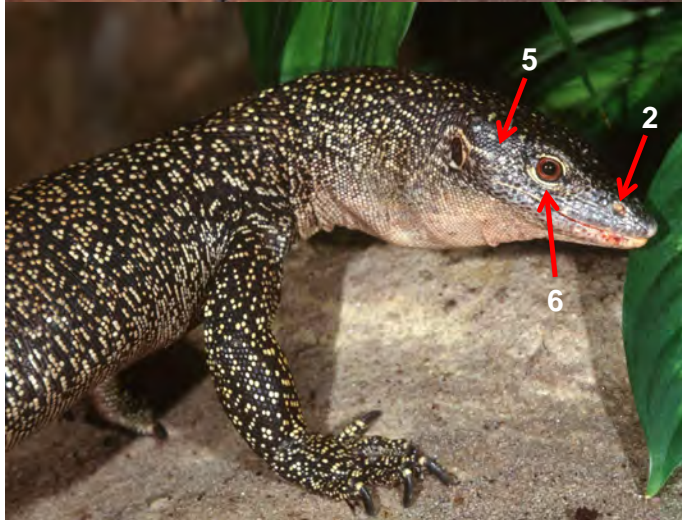
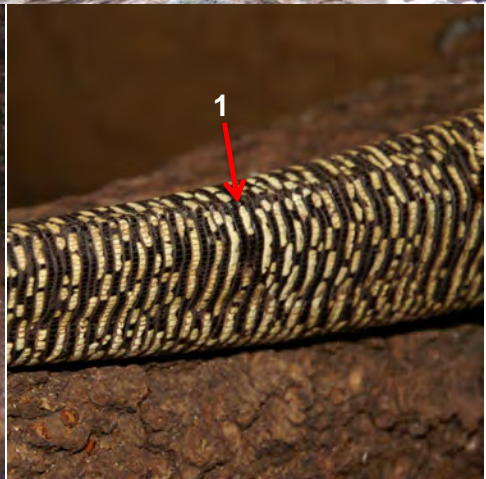
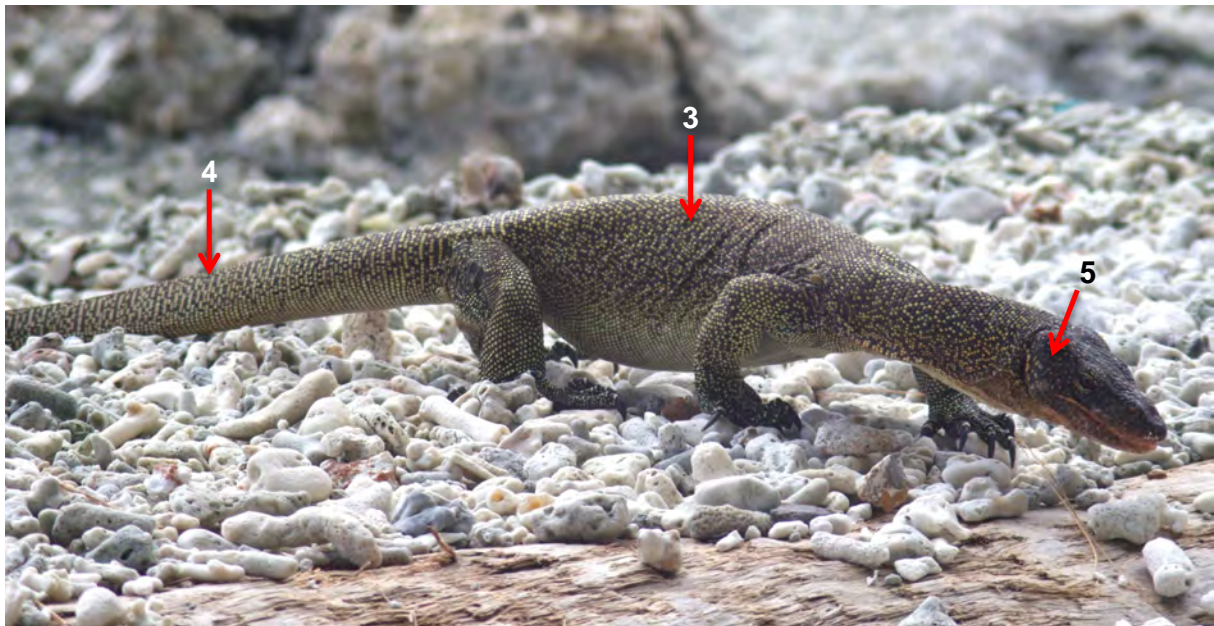
Size/weight of hatchlings: 11-12 cm SVL; 25.5-28.6 cm TL; 20-26 (ø 23.1) g; Prague Zoo: <12.7 (ø 12) cm SVL; <38 (ø 30) g

Growth rate: After 6 months: ø 18 cm SVL, ø 47 cm TL; after 12 months: 20.7-27.4 (ø 24) cm SVL, 51-68 (ø 60) cm TL; Prague Zoo: after 3 months: <17.7 (ø 15.9) cm SVL; after 6 months: <22.7 (ø 20.1) cm SVL; after 9 months: 27.4 (ø 25) cm SVL; after 12 months: <31.5 cm (ø 28.3) cm SVL

Captive breeding: The breed has occasionally been successful since the 1990s in zoos and private husbandry as *V. indicus*. However, the identity of some captive-bred monitor lizards cannot be precisely determined due to the large morphological similarity within the group of the Pacific monitors. This also includes still undescribed species.

Ecology: Diurnal (←); ground and tree-dwelling; island endemic (←); probably feeds on insects, spiders and vertebrates, but detailed observations from nature are missing.

Remarks: According to the CITES trade database, *V. juxtindicus* is not officially traded internationally, but the Solomon Islands exported up to 1300 live *V. indicus* annually between 2010 and 2017, probably including numerous *V. juxtindicus*.



Varanus juxtindicus. Above: adult, Rennell Island, Solomon Islands, © Valter Weijola; centre left: adult, © Rune Midtgaard; centre right: adult, detail of the tail lacking a dorsal (←) keel, © André Koch; below left and right: subadult and juvenile, captive-bred, © Gunther Köhler

Varanus lirungensis Koch et al., 2009

Subgenus: *Euprepiosaurus*

English name: Talaud mangrove monitor

German name: Talaud-Pazifikwaran

Local name: -

Synonyms: None; prior to their scientific description, these monitor lizards were allocated to *V. indicus*.

Subspecies: None

International conservation status (CITES / Commission Regulation (EU) No 2017/160): Appendix II/B

IUCN Red List status: Not Evaluated (NE)

Distribution: Talaud Islands, Indonesia

Total length (TL): Probably <100 cm (♂); 91 cm (♀); **Snout-vent length (SVL):** 35 cm (♀)

Morphological traits (adults): Medium-sized species; head, body and legs slim; tail length 1.4-1.75 (ø 1.6) times SVL, laterally flattened with a keel (↔) above; lateral tail scales smaller than lower ones; nostrils roundish to oval, closer to tip of snout than to eye (1); head scales above the eyes enlarged (2).

Colour pattern: Head, body, legs and tail black with intense pattern of yellow dots and irregular spots, running in indistinct rows on back and tail base; tail not banded, without blue coloration (3); body underside whitish to yellowish grey with pale grey cross stripes on stomach and legs; throat pale pink with pale grey spots (4); head without bright streak between eye and ear (5); iris dark brown; upper side of tongue dark blue grey (6), base and underside pink/flesh-coloured; **juveniles** with larger (eye) spots on back and legs; tail with narrow rows of spots; belly with dark cross stripes; underside of legs with dark reticulated pattern; tail underside bright and dark banded

Similar species: *V. cerambonensis* and *V. rainerguentheri* with a light streak between eye and ear opening, throat yellowish; *V. douarrha* with dark marbled yellowish throat, belly and legs without pale grey cross stripes; *V. juxtindicus* shows a more vivid dorsal (↔) pattern of single yellow scales, the tail lacks a dorsal keel, throat yellowish; *V. indicus* with yellowish to whitish throat, without pale grey cross stripes on belly, tongue completely dark blue grey; some populations of *V. salvator* from Sulawesi and the eastern Lesser Sunda Islands show a similar colour pattern, but head lacks light dots, instead they have black V-shaped markings on throat, a below light-bordered dark stripe between eye and ear opening, and a light streak on the sides of the neck; some populations of *V. togianus* show dark transverse bands or pointed markings on sides of belly and/or at least on throat, throat sometimes with dark mottling, head without light dots.

Size/age at sexual maturity: ♂: 30 cm SVL, 81 cm TL; ♀: 34 cm SVL, 85 cm TL; age unknown

Clutch size: Probably 2-3 eggs per clutch

Incubation period/temperature: No published data; probably similar to *V. indicus*

Size/weight of hatchlings: No published data; probably similar to *V. indicus*

Growth rate: No published data; probably similar to *V. indicus*

Captive breeding: No keeping and breeding has been documented so far; breeding conditions probably similar to *V. indicus*.

Ecology: Diurnal (↔); mainly ground-dwelling, in case of danger it flees up trees and palms; island endemic (↔); feeds mainly on insects, crustaceans, and spiders.

Remarks: *V. lirungensis* is not nationally protected in Indonesia and is not officially exported according to the CITES trade database. Due to the great similarity, however, this species could be in the international trade under the name of *V. indicus*. These monitors are hunted by the local human population as food.



Varanus lirungensis. Above: adult, Salibabu Island, Talaud Islands, Indonesia, © André Koch; centre left and right: adult, © Mark Auliya; below left and right: adult, Salibabu Island, Talaud Islands, Indonesia, MZB 5178, holotype (←), © André Koch

Varanus melinus Böhme & Ziegler, 1997

Subgenus: *Euprepiosaurus*

English name: Quince monitor

German name: Quittenwaran

Local names: Biawak kuning (Indonesia), biawak banggai (Indonesia)

Synonyms: None

Subspecies: None

International conservation status (CITES / Commission Regulation (EU) No 2017/160): Appendix II/B

IUCN Red List status: Not Evaluated (NE)

Distribution: Sula Islands (Mangole and possibly Taliabu), Indonesia

Total length (TL): 130 cm (♂), 95 cm (♀); **Snout-vent length (SVL):** 50 cm (♂), 39.5 cm (♀)

Morphological traits (adults): Medium-sized species; head, body, legs and tail slender; tail about 1.7 times as long as SVL, laterally flattened with a keel (←) above; lateral tail scales much smaller than those below; nostrils rounded, closer to the tip of snout than to eye (1); head scales above the eyes enlarged (2)

Colour pattern: Head bright yellow (3); body and legs yellow with black reticulated pattern (4); coloration may vary; there are almost entirely yellow and very dark specimens; tail with indistinct, narrow, light and dark banding; belly mostly unpatterned, plain light yellow, sometimes weak reticulated pattern visible; tongue pink/flesh-coloured (5); **juveniles** with body darker colouration (also head [6]), back and legs black-brown with yellow spots in cross-rows (7); belly black with many light points/spots; throat yellow with dark spots; tail more clearly banded (each >20 light and dark bands). One of only very few monitor lizard species whose young are darker coloured than adults. The colour change starts at an age of about 5 months.

Similar species: *V. cumingi* and *V. samarensis* have a black streak behind the eye and a dark blue tongue (at least in the front half); colour pattern on the back consists of transverse rows of spots or striped (also on the belly), not reticulated; tail banding is clearer and broader (11-14 light and dark bands each); light yellow local form of *V. salvator* ("sulphur salvator") with transverse banding on the back, tongue dark blue-grey.

Size/age at sexual maturity: ♂: >120 cm TL; ♀: >90 cm TL; age unknown, possibly >7 years

Clutch size: 2-12 (ø 5-8) eggs depending on the size of the female; up to 3 clutches per year possible; minimum distance of 77 days between two clutches

Incubation period/temperature: 164-192 days at 28.5-29.0 °C

Size/weight of hatchlings: 21.0-28.1 cm TL; 21-35 g

Growth rate: After 5.5 months: 37.0-39.5 cm TL at 41-55 g

Captive breeding: Breeding so far only rarely succeeded at zoos and private keepers. A temporary separation of the sexually mature monitors can support the breeding attempts; egg deposit box necessary.

Ecology: Diurnal (←); ground and tree-dwelling; island endemic (←); detailed observations from the wild are lacking.

Remarks: *V. melinus* is threatened due to the high demand from the international pet trade and possibly habitat destruction. According to the CITES trade database, 370-485 specimens were annually exported from Indonesia between 2010 and 2018. Despite the small distribution area and the high demand, the species was only played under national protection in Inonesia in 2018.



Varanus melinus. Above: adult, © Thomas Ziegler; centre left: adult specimen at a trader on Ternate Island, Moluccas, Indonesia, © Andrea & Dietmar Trobisch; centre right: juvenile, captive-bred, Cologne Zoo, © Thomas Ziegler; below left: adult, © Thomas Ziegler; below right: juvenile, © Mark Auliya

Varanus obor Weijola & Sweet, 2010

Subgenus: *Euprepiosaurus*

English name: Sago monitor

German name: -

Local names: Biawak obor, soa-soa hitam (Indonesia)

Synonyms: None

Subspecies: None

International conservation status (CITES / Commission Regulation (EU) No 2017/160): Appendix II/B

IUCN Red List status: Not Evaluated (NE)

Distribution: Sanana Island, Sula Islands, Indonesia

Total length (TL): 113 cm (♂), 91.5 cm (♀); **Snout-vent length (SVL):** 44 cm (♂), 35.5 cm (♀)

Morphological traits (adults): Medium-size species; head, body, and legs slender; tail about 1.5 times as long as SVL, laterally flattened with a keel (←) above (1); lateral tail scales smaller than those below; nostrils rounded, closer to tip of the snout than to eye (2); head scales above the eyes enlarged

Colour pattern: Head above dark brown to black, lateral side and snout orange-brown (extent of facial coloration varies); body, legs and tail dark brown to black, back often with isolated lighter scales (some specimens show larger, more or less pale, darkly edged eye spots (ocelli) on the back [3]); tail with 17-20 narrow, pale bands; belly dark grey, partly with diffuse paler spots; throat grey-brown with variable white markings (4); underside of snout usually white; tongue pink, tips dark pigmented; **juveniles** are not known with certainty, probably they exhibit a pattern of spots on the back.

Similar species: Melanistic (black) specimens of *V. nuchalis* and *V. salvator* (described as *V. komaini*) as well as *V. togianus* and *V. rasmusseni* lack the orange-brown head coloration and light spots on the belly; their tongue is dark blue-grey; the nostril lies further to the tip of the snout than to the eye; *V. togianus* also has a contrasting light and dark striped throat; *V. mabitang* has no orange-brown head colouration, the iris is reddish and the ventral scales are strongly keeled (smooth in *V. obor*).

Size/age at sexual maturity: No published data; probably similar to *V. melinus*.

Clutch size: No published data; probably similar to *V. melinus*.

Incubation period/temperature: No published data; probably similar to *V. melinus*.

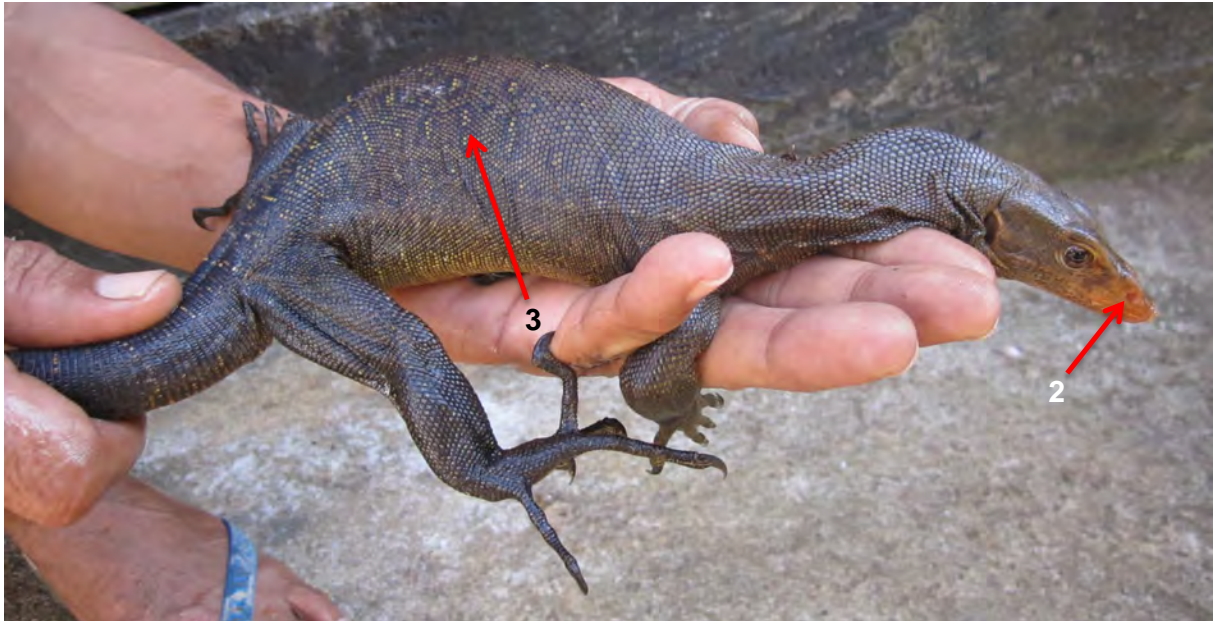
Size/weight of hatchlings: No published data; probably similar to *V. melinus*.

Growth rate: No published data; probably similar to *V. melinus*.

Captive breeding: No published data exist, but photos in social media suggest that offspring of *V. obor* has already successfully been bred in captivity; conditions might resemble those of *V. melinus*, with which *V. obor* is probably closest related.

Ecology: Diurnal (←); mainly ground-dwelling; prefers sago swamps near the coast and riverine environments; feeds on insects and their larvae as well as vertebrates and carrion; island endemic (←)

Remarks: Threat factors for *V. obor* can be the demand from the international pet trade, habitat destruction and introduced species. *Varanus obor* is not protected in Indonesia. According to the CITES trade database merely 15 specimens have been officially exported from Indonesia since 2010. Therefore, it is likely that *V. obor* is/was also traded under the name of other species such as *V. indicus*.



Varanus obor. Above and centre left: adult specimen at a trader on Ternate Island, Moluccas (centre left: together with *V. melinus*), Indonesia, © Ruud de Lang and Andrea & Dietmar Trobisch; centre right and below: adult, © Dmitry Telnov, Entomological Society of Latvia

***Varanus rainerguentheri* Ziegler et al., 2007**

Subgenus: *Euprepiosaurus*

English name: Rainer Günther's mangrove monitor

German name: Rainer Günthers Pazifikwaran

Local name(s): karianga, hahoro or litini (Tobelo language, Halmahera Island)

Synonyms: None; prior to their scientific description, these monitor lizards were allocated to *V. indicus*.

Subspecies: None

International conservation status (CITES / Commission Regulation (EU) No 2017/160): Appendix II/B

IUCN Red List status: Not Evaluated (NE)

Distribution: Halmahera, Ternate, Tidore, Morotai, Bacan, Gebe and Obi islands, Moluccas, Indonesia

Total length (TL): 133 (<150) cm (♂), 120 cm (♀); **Snout-vent length (SVL):** 50 cm (♀)

Morphological traits (adults): Medium-sized species; head, body, legs and tail slim; tail about 1.5 (in juveniles 1.3) times as long as SVL, laterally flattened with a keel (←) above (1); lateral tail scales smaller than lower ones; nostrils roundish to oval, closer to tip of snout than to eye (2); head scales above the eyes enlarged

Colour pattern: Head, body, legs and tail grey-black with a fine mottling of yellow scales; tail not or only vaguely narrow banded, without blue colouration (3); body underside yellowish, with pale grey cross stripes or reticulated pattern on belly, legs and tail; throat plain bright, unpatterned; head with light streak from eye to ear that may fade with age (4), usually less pronounced in specimens from Obi and Gebe islands compared to those from Halmahera and Morotai; iris dark brown; base of tongue pink/flesh-coloured, gradually becoming dark blue-grey (5); **juveniles** show a more regular pattern of small yellow spots (6), turning into blackish ocelli (←) with yellow centres with increasing age before they dissolve to the adult colour pattern; tail sometimes distinctly bright and dark banded (7); tongue pink with dark pigmentation towards bifurcation (←), tips light

Similar species: *V. cerambonensis* shows a cross banded dorsal pattern in adults, bears a well-defined yellow stripe between eye and ear opening, and has an entire light-coloured tongue in juveniles; *V. indicus* without bright stripes on the sides of head between eye and ear; tongue uni-coloured dark blue grey; adults of *V. juxtindicus* show a more vivid pattern of yellow scales, a light temporal stripe between eye and ear opening is missing, the tongue is dark blue only at its tips and the tail lacks a dorsal keel; *V. lirungensis* with light pink throat, without bright streak between eye and ear, larger yellow spots on back, tail not banded; some populations of *V. salvator* from Sulawesi and eastern Lesser Sunda Islands show a similar colour pattern but head is without light dots, instead with black V-shaped markings on throat, a light streak on the side of the neck; some populations of *V. togianus* show dark cross bands or pointed lateral markings on belly and/or at least on throat, throat sometimes with dark mottling, head without light dots

Size/age at sexual maturity: No published data; probably similar to *V. indicus*.

Clutch size: 4-9 eggs per clutch

Incubation period/temperature: 193-200+ days at 26-31 °C

Size/weight of hatchlings: 10 cm SVL; 26.5-27 cm TL; ca. 26 g

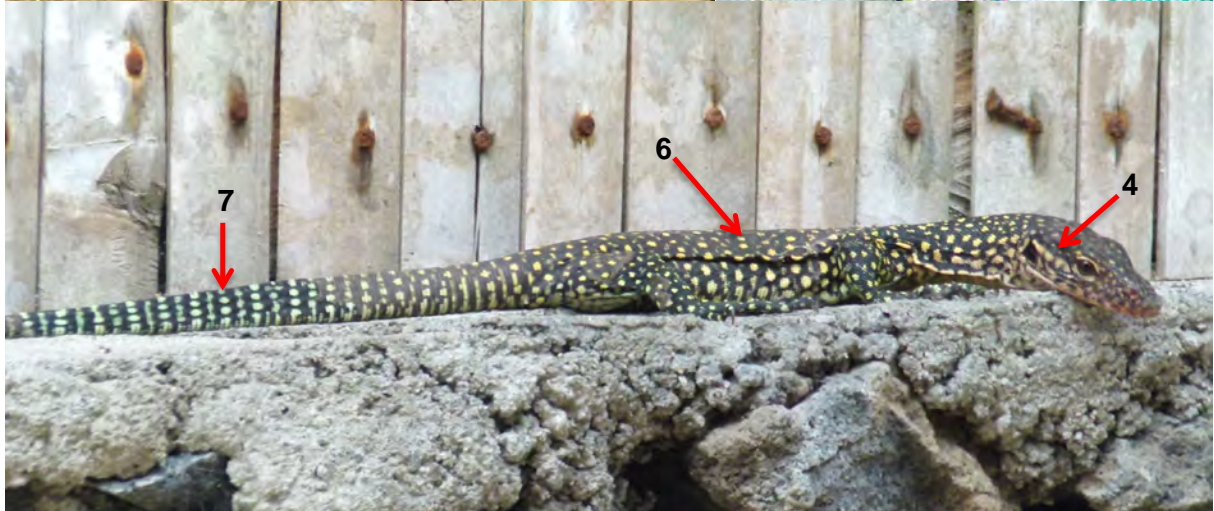
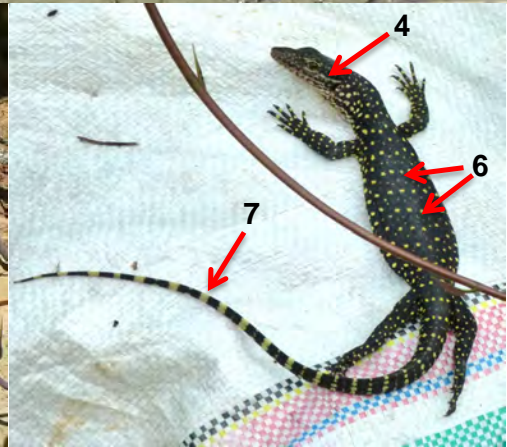
Growth rate: After 3 months: ca. 45 cm TL; after 6 months: ca. 55 cm TL; after 12 months: ca. 78 cm TL; after 18 months: 85 cm TL

Captive breeding: So far, *V. rainerguentheri* has only rarely been bred in captivity.

Specifics: Parthenogenesis (←) has been reported.

Ecology: Diurnal (←); island endemic (←); mainly ground-dwelling; habitat is largely restricted to coasts and mangrove swamps.

Remarks: Although no official trade with *V. rainerguentheri* has been documented so far according to the CITES trade database, the species is traded internationally. Because of its close resemblance to *V. indicus*, exports probably take place under the name of this widespread monitor lizard species.



Varanus rainerguentheri. Above and centre left: adult, Halmahera Island, Moluccas, Indonesia, © Andrea & Dietmar Trobisch; centre right: juvenile, Halmahera Island, Moluccas, Indonesia, © Andrea & Dietmar Trobisch; below: juvenile, Ternate Island, Moluccas, Indonesia, © Andrea & Dietmar Trobisch

Varanus semotus Weijola et al., 2016

Subgenus: *Euprepiosaurus*

English name: Mussau mangrove monitor

German name: Mussau-Pazifikwaran

Local name: -

Synonyms: None; prior to their scientific description as a new species in 2016, these monitors were allocated to *V. finschi*.

Subspecies: None; some authors, however, regard *V. semotus* a subspecies of *V. doreanus*.

International conservation status: (CITES / Commission Regulation (EU) No 2017/160): Appendix II/B

IUCN Red List status: Not Evaluated (NE)

Distribution: Mussau (St. Matthias) Island, Bismarck Archipelago, Papua New Guinea

Total length (TL): 120 cm; **Snout-vent length (SVL):** 48 cm

Morphological traits (adults): Medium-sized species; head, body and legs slender; tail about 1,5 times SVL, laterally flattened with a keel (←) above (1); lateral tail scales smaller than lower ones; nostrils roundish (young) to oval (adults), closer to tip of snout than to eye (2); head scales above eyes enlarged

Colour pattern: Upper side of head, body, legs and tail black, back and base of tail with irregular pattern of many yellow-orange scales forming lines, small groups or rings (3); light scales towards feet and on head bluish-green (4); second half of tail black and blue banded, fading with age into marbling (5); underside of body whitish to cream-coloured, throat and underside of head with dark marbling; head without light stripe between eye and ear opening (6); iris dark brown; tongue light pink to yellowish (7); **juveniles** with yellow to orange large round spots on back (8) turning white on neck, legs and tail base, rest of tail with distinct whitish/light blue and black banding (9); head with white spots (10); underside probably black with white spots or cross bands

Similar species: *V. doreanus* has smaller dorsal scales and therefore higher scale counts on the back between ear opening and hind legs (153-215 vs. 149-153 in *V. semotus*) and around mid-body (←) (158-180 vs. 152-161 in *V. semotus*); *V. jobiensis* has larger eyes, a tapering snout, sometimes a striped back pattern and a light underside of the body (throat reddish to orange or sometimes bluish vs. dark marbling [adults] or bright spots on a dark background [juveniles] in *V. semotus*); *V. yuwonoi* has a light stripe from the eye to the ear opening, a bicoloured body (head, neck and anterior back black-grey without yellow spots, rest of the back intense yellow, transitional area with black cross stripes) and a lighter underside; *V. caerulivirens* has a finer pattern of more and smaller patches on back and a lighter body underside, especially without dark throat region (adults) or without large bright spots (juveniles) and a broader tail banding (about 20 vs. about 40 blue and black sections).

Size/age at sexual maturity: No published data

Clutch size: No published data

Incubation period/temperature: No published data

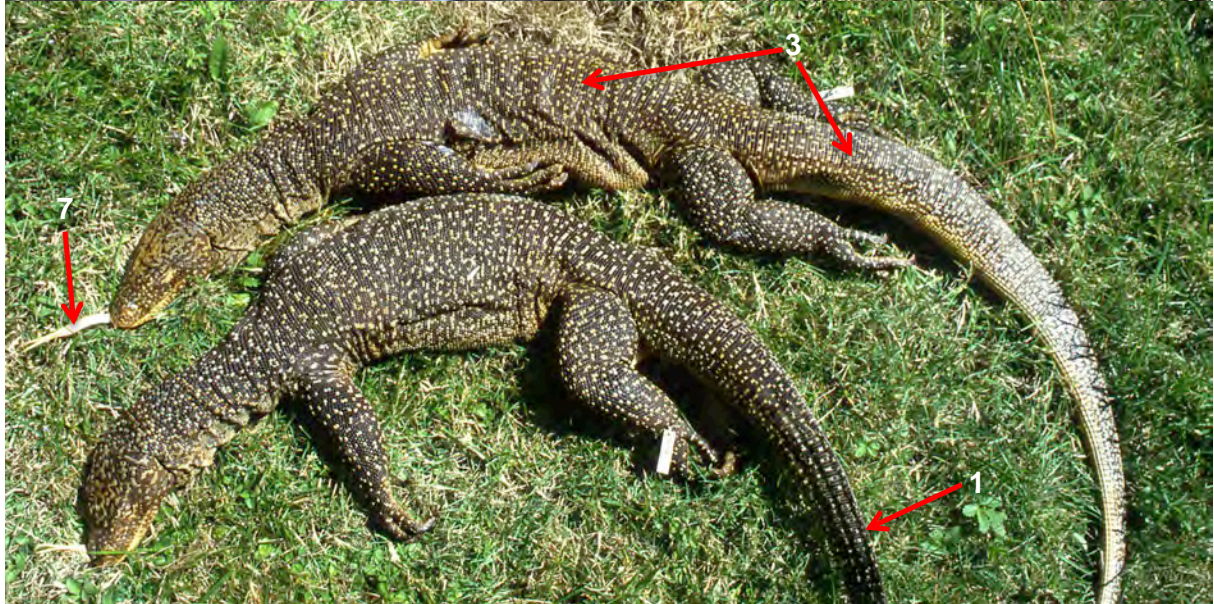
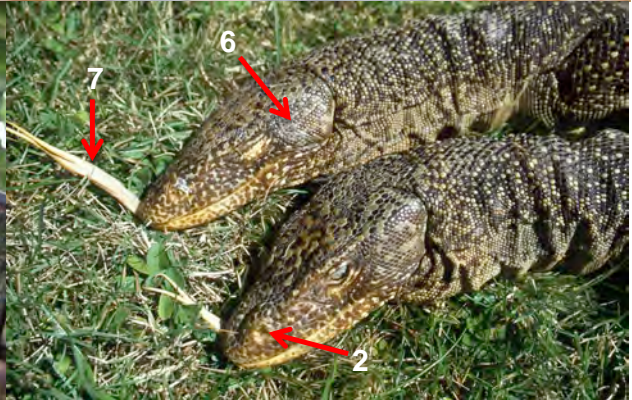
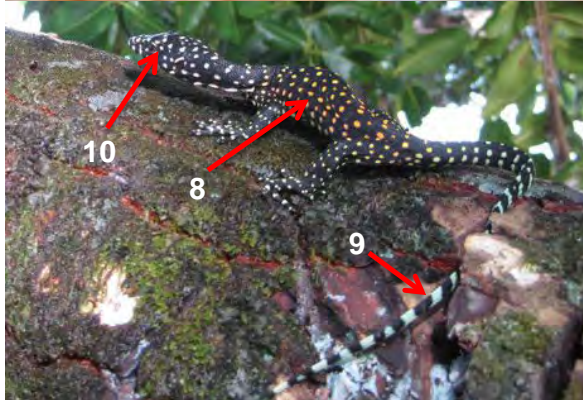
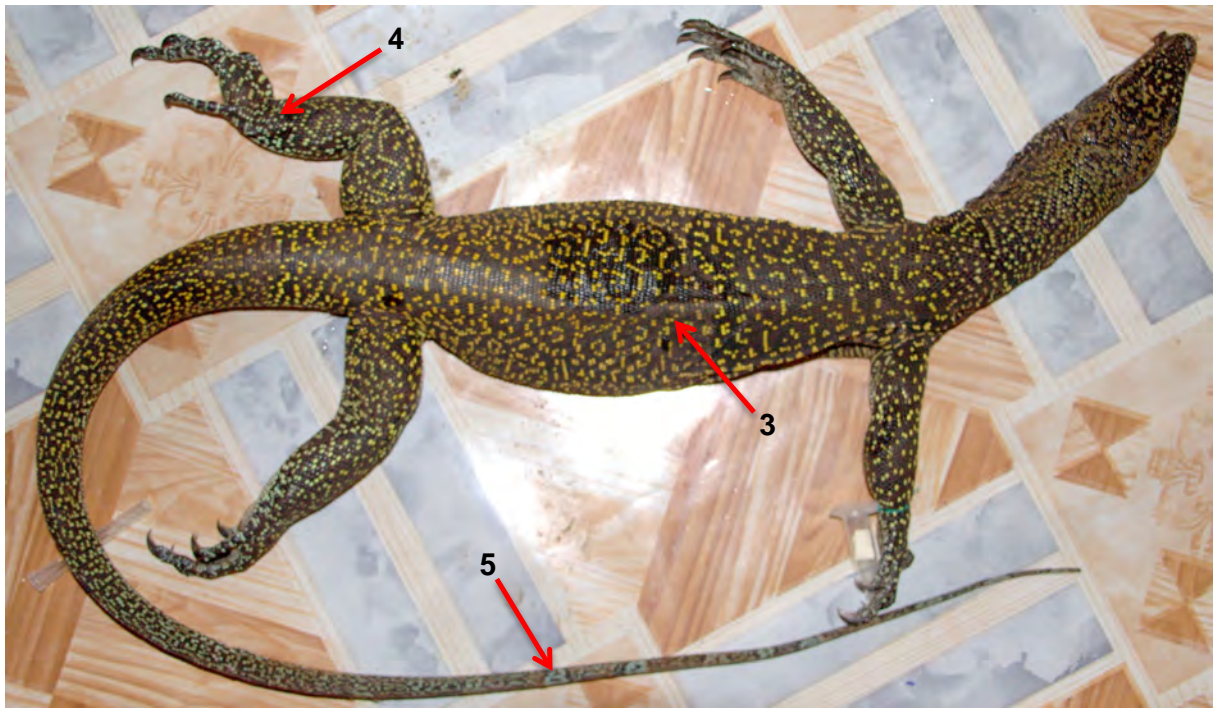
Size/weight of hatchlings: No published data

Growth rate: No published data

Captive breeding: No keeping and breeding have been documented so far.

Ecology: Diurnal (←); mainly ground-dwelling; island endemic (←); aggressive when handled; feeds on crabs, reptile eggs, lizards, and birds

Remarks: *V. semotus* has not yet been documented in the international trade according to the CITES trade database, but specimens could be traded under its look-alike species *V. doreanus*, from which it is hardly distinguishable.



Varanus semotus. Above: adult, Mussau Island, Papua New Guinea, © Valter Weijola; centre left: juvenile, Mussau Island, Papua New Guinea, © Quetzal Dwyer; centre right and below: adult, Talumalaus, Mussau Island, Papua New Guinea, Paratypes (↔) ZMUC 4272-73, © Wolfgang Böhme

Varanus yuwonoi Harvey & Barker, 1998

Subgenus: *Euprepiosaurus*

English names: Tricoloured monitor lizard, Black-backed mangrove monitor

German name: Dreifarbwaran

Local name: Biawak tiga warna (Indonesia)

Synonyms: None

Subspecies: None

International conservation status (CITES / Commission Regulation (EU) No 2017/160): Appendix II/B

IUCN Red List status: Not Evaluated (NE)

Distribution: Halmahera Island, northern Moluccas, Indonesia

Total length (TL): 150 cm (♂), 137 cm (♀); **Snout-vent length (SVL):** 53 cm (♀)

Morphological traits (adults): Medium to large-sized species; head, body and legs slender; tail about 1,6 times SVL, laterally flattened with a keel (←) above; lateral tail scales smaller than lower ones; nostrils roundish, closer to tip of snout than to eye (1); head scales above eyes enlarged

Colour pattern: Upper side of anterior body and forelegs black; posterior (←) back, thighs of hind legs and base of tail yellow/greenish and black marbled (2); shanks of hind legs, hind feet and rest of tail blue (3); tail also with pale dark bands; neck grey with black blotches; upper side of head black and light brown (pistachio) to greenish patterned; above black-bordered light stripe between eye and ear opening; iris dark brown; tongue tricoloured: tips yellow, main part (dark) blue, base pink/flesh-coloured (4); underside of body cream-coloured to yellowish, belly sometimes with pale dark cross stripes; throat with grey blotches (5), tail blueish; **juveniles** with more distinct colour pattern; markings on posterior back may be orange; tail with clear black and blue banding; hind legs with greenish blue/turquoise dots; snout with dark crossbands

Similar species: *V. doreanus* and *V. semotus* have dark marbled throats, unicoloured light tongues, and lack predominantly yellow colouration on posterior part of back and base of tail; *V. jobiensis* and *V. caerulivirens* lack a tricoloured pattern with predominantly yellow colouration on posterior part of back and base of tail and have a unicoloured light tongue; in addition, *V. jobiensis* sometimes has a pinkish throat or a blue snout.

Size/age at sexual maturity: No published data

Clutch size: No published data

Incubation period/temperature: No published data

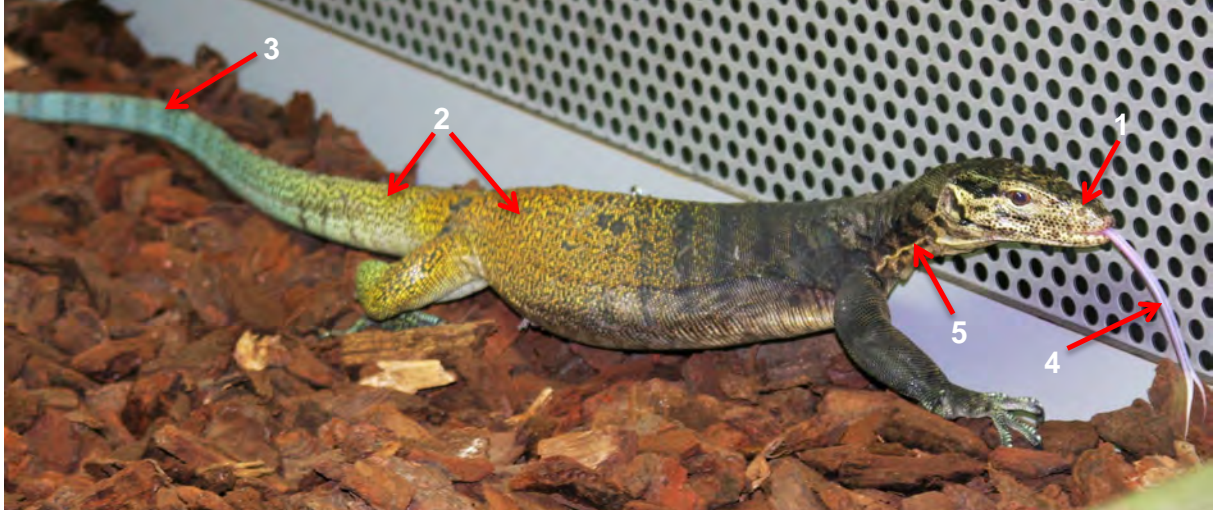
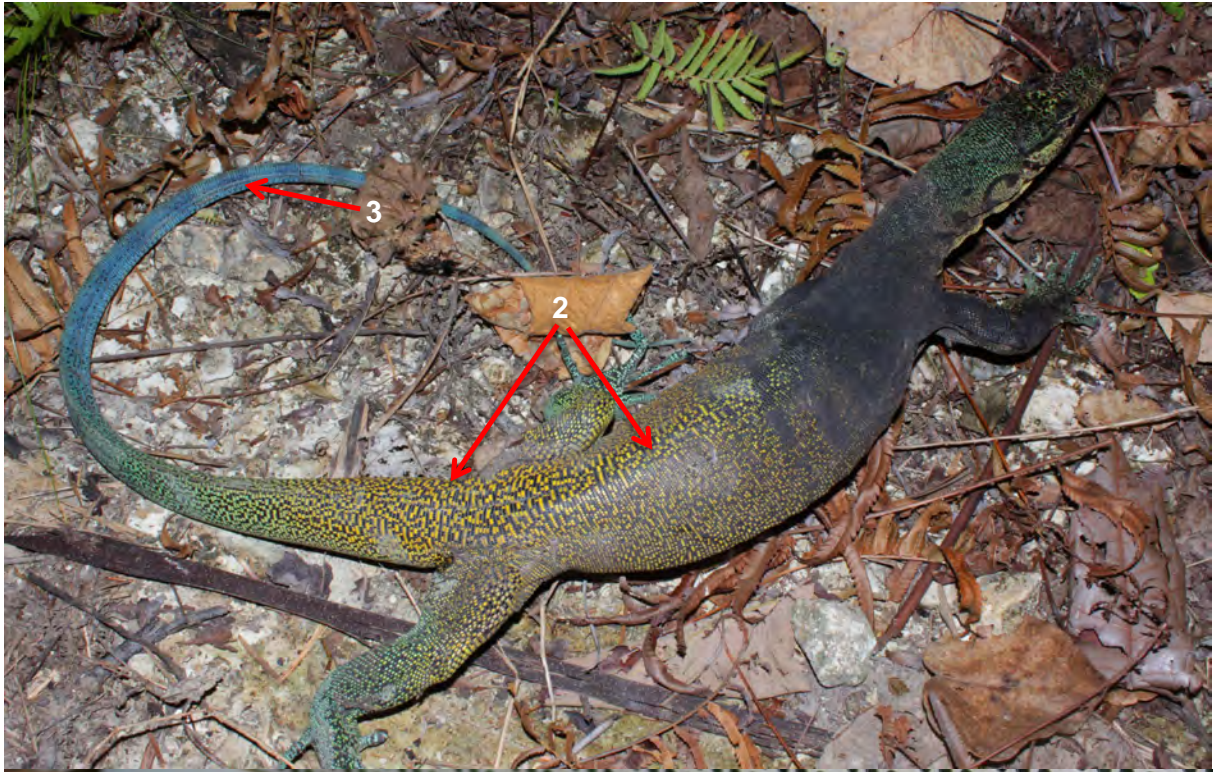
Size/weight of hatchlings: No published data

Growth rate: No published data

Captive breeding: No information about keeping and breeding has been published so far.

Ecology: Mainly diurnal (←), may eat partially at night; ground-dwelling, prefers forests; aggressive in handling; according to observations in nature, the species seems to be rare; island endemic (←)

Remarks: Due to the colourful pattern *V. yuwonoi* is in high demand by the international pet trade. The species is not protected nationally in Indonesia. According to the CITES trade database 25-110 declared captive-bred/captive-born (source codes C/F) specimens were annually exported from Indonesia between 2010 and 2017.



Varanus yuwonoi. Above: adult, 12 km north of Weda, Halmahera Island, Indonesia, © James L. McKay; centre and below left: adult, Cologne Zoo, © Thomas Ziegler; below right: adult, detail view of tail, © Dmitry Telnov, Entomological Society of Latvia

Varanus zugorum Böhme & Ziegler, 2005

Subgenus: *Euprepiosaurus*

English names: Zugs' mangrove monitor, Silver tree monitor

German name: (Zugs Pazifikwaran)

Local name: Possibly karianga, hahoro or litini (Tobelo language, Halmahera Island)

Synonyms: None

Subspecies: None

International conservation status: (CITES / Commission Regulation (EU) No 2017/160): Appendix II/B

IUCN Red List status: Not Evaluated (NE)

Distribution: Halmahera Island, northern Moluccas, Indonesia

Total length (TL): >36 cm; **Snout-vent length (SVL):** >15 cm

Morphological traits (adults): Probably medium-sized species; head, body and legs slender; neck distinctly elongated; tail about 1.4 times SVL, laterally flattened with a keel (↔) above; lateral tail scales smaller than lower ones; nostrils roundish, closer to tip of snout than to eye (1); head scales above eyes enlarged

Colour pattern: Upper side of head, body, legs, and most of tail patternless, greyish to greenish olive (2) (in the preserved holotype (↔) specimen with sparsely intermixed bluish scales); last 5 cm of tail with about twelve pale dark crossbands; head a bit darker than body, grey; area around eyes brighter, whitish/crème-coloured (3); no stripe between eye and ear opening present (4); tongue dark bluish anteriorly, becoming distinctly brighter posteriorly with broad whitish edges (5); iris dark brown; underside of entire body unpatterned, crème-coloured (6); **juveniles** and adults probably look the same.

Similar species: None.

Size/age at sexual maturity: No published data

Clutch size: No published data

Incubation period/temperature: No published data

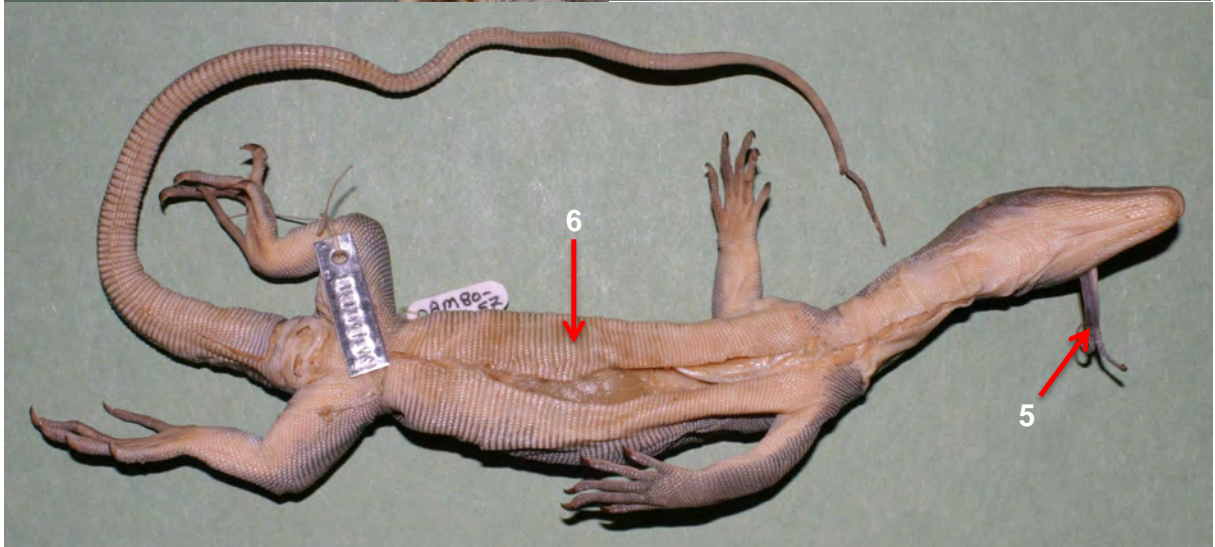
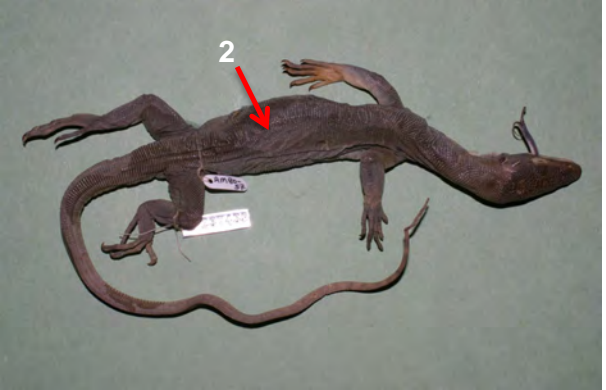
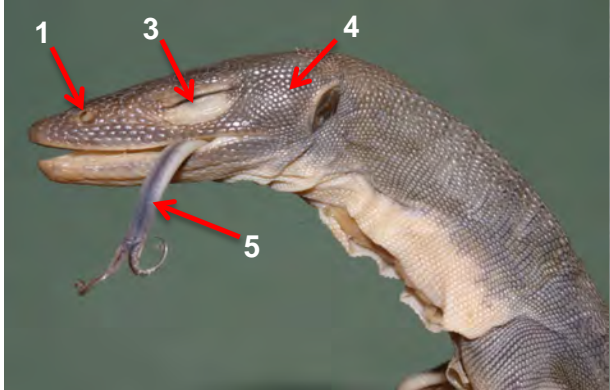
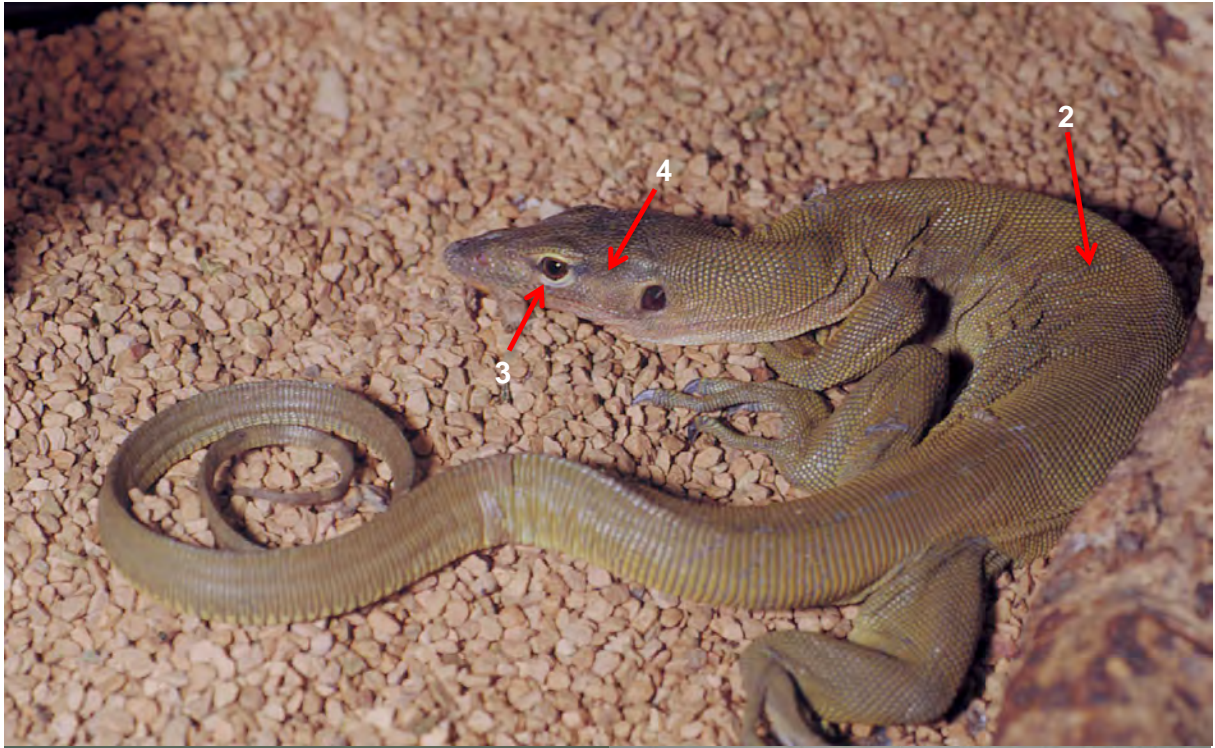
Size/weight of hatchlings: No published data

Growth rate: No published data

Captive breeding: No keeping and breeding have been documented so far.

Ecology: Probably diurnal (↔); feeds at least partially on small lizards; island endemic (↔); *V. zugorum* seems to be very rare, published observations from nature are missing.

Remarks: *V. zugorum* is known only from a single museum specimen, the juvenile holotype (↔), and photographs of very few specimens from the international reptile trade. Although no reported exports or imports for this species are documented in the CITES trade database, *V. zugorum* has entered the reptile market at least in Japan in the past.



Varanus zugorum. Above: probably subadult trade specimen, Japan, © Gou Suzuki; centre left and right, below: juvenile, Halmahera Island, Indonesia, holotype (↔), USNM 237439, © Thomas Ziegler

Varanus beccarii (Doria, 1874)

Subgenus: *Hapturosaurus*

English names: Beccari's tree monitor, black tree monitor

German names: Schwarzer Baumwaran, Beccaris Baumwaran

Local names: Biawak hitam, Biawak aru (Indonesia), Wawayaro (New Guinea)

Synonyms: *Varanus prasinus beccarii* (Doria, 1874)

Subspecies: None; formerly, *V. beccarii* was considered a subspecies of *V. prasinus*.

International conservation status (CITES / Commission Regulation (EU) No 2017/160): Appendix II/B

IUCN Red List status: Data Deficient (DD), population trend decreasing (last assessed 2014)

Distribution: Aru Islands, west off New Guinea, Indonesia

Total length (TL): 95 cm; **Snout-vent length (SVL):** 34 (♂ 27.6 cm), 29.3 (♀ 28.1 cm)

Morphological traits (adults): Medium-sized species; head, neck, body and legs very slender; toes long with sharp claws (1); tail about twice (in juveniles 1.5 times) as long as SVL, circular in cross-section and prehensile (2), above without a keel (3); scales on tail above and below equal in size, forming continuous rings; nostrils roundish/oval, located closer to tip of snout than to eye (4); head scales above and between eyes enlarged (5); head scales smooth, not tubercular (6)

Colour pattern: Upper side of body plain black without pattern; underside dark grey to black; snout dark grey; tongue pink/flesh-coloured; iris dark brown to reddish; during the first weeks and months, **juveniles** show a fine pattern of single greenish or yellow scales on the back (7). These tiny bright dots are not present in all juveniles.

Similar species: *V. bogerti* has smaller and tubercular head scales (40-48 scales across head from corner of mouth to corner of mouth vs. 28-38 smooth scales across head in *V. beccarii*) and smaller ventral scales (78-90 scale rows between gular fold (8) and insertion of hind legs vs. 70-82 in *V. beccarii*); adults of *V. boehmei* and *V. keithornei* exhibit a bright pattern on the dark background colouration; *V. mabitang* and entirely black specimens of *V. salvator*, that were described as *V. salvator komaini* (= a synonym of *V. salvator macromaculatus*), have a laterally compressed (vs. round in cross-section in *V. beccarii*), non-prehensile tail; central head scales between eyes are not enlarged. In addition, *V. salvator* has a dark blue tongue. Both species reach a total length of distinctly more than 100 cm.

Size/age at sexual maturity: Probably >80 cm TL; age unknown, perhaps with 2-4.5 years **Clutch size:** Mostly only 1 (maybe up to 3) clutches per year with 2-6 (♂ 3-4) eggs; minimum inter-val of 85 days between two clutches

Incubation period/temperature: 157-240 days at 27-30.5 °C

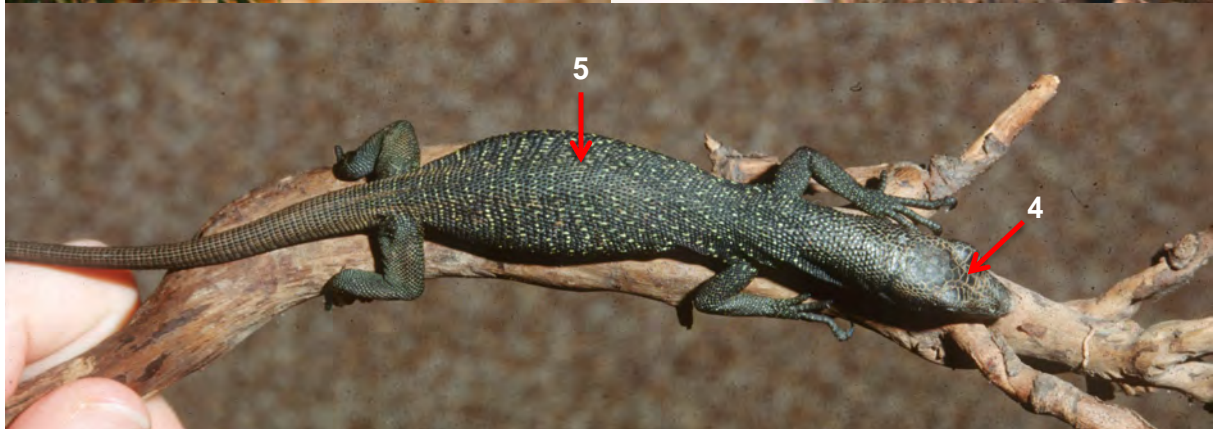
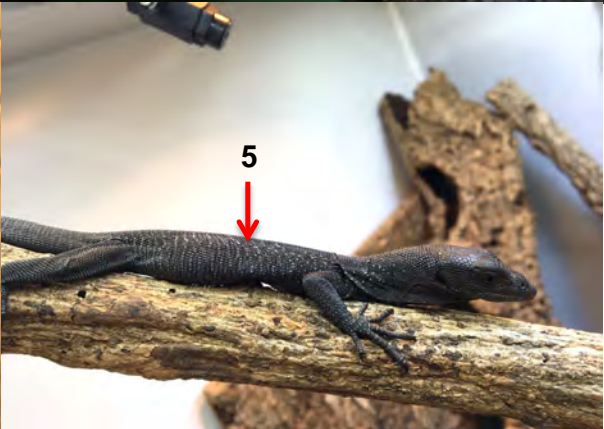
Size/weight of hatchlings: 6-9.6 cm SVL; 15.5-25.7 cm TL; 7.9-14 (28?) g

Growth rate: After 6 weeks: 10 cm SVL, 22.5 cm TL; after 15 weeks: 10.5 cm SVL, 24.5 cm TL; after 21 weeks: 11.5 cm SVL, 27 cm TL

Captive breeding: Often successfully bred in zoos and private keeping; rearing of young sometimes difficult. Keeping of groups (perhaps also of pairs) and higher humidity may increase the breeding success. Also separation of sexes for 3-12 weeks may be advantageous; nesting box for egg deposition necessary.

Ecology: Diurnal (9); tree-dwelling, island endemic (10); published observations from the natural habitat are lacking.

Remarks: Despite the lack of information about population size and trend, 200-570 allegedly captive-bred specimens of *V. beccarii* are exported each year for the international pet trade according to the CITES trade database. The species is nationally protected in Indonesia. Imports of wild-caught specimens of *V. beccarii* into the EU are suspended since 2000.



Varanus beccarii. Above: adult, © Mark Auliya; centre left: adult, © Dmitry Telnov, Entomological Society of Latvia; centre right: juvenile, © Florian Wagner; below: juvenile, © Gunther Köhler

Varanus boehmei Jacobs, 2003

Subgenus: *Hapturosaurus*

English name: Golden speckled tree monitor

German names: Gelbgefleckter Baumwaran, Böhmes Baumwaran

Local names: Biawak bontol kuning, biawak pohon bercak kuning, biawak waigeo (Indonesia)

Synonyms: None

Subspecies: None

International conservation status (CITES / Commission Regulation (EU) No 2017/160): Appendix II/B

IUCN Red List status: Data Deficient (DD), population trend unknown (last assessed 2014)

Distribution: Waigeo Island, Indonesia

Total length (TL): 90 cm (♂); 80 cm (♀); **Snout-vent length (SVL):** 30 cm (♂), 29 cm (♀)

Morphological traits (adults): Medium-sized species; head, body and legs very slender; toes long (1), with sharp claws; tail twice as long as SVL, circular in cross section and capable of grasping (prehensile ←), above without a keel (←); scales of tail above and below equal in size, forming continuous rings; nostrils oval, closer to tip of snout than to eye (2); head scales above eyes and scale row between them enlarged (3)

Colour pattern: Head black, light grey towards snout, often with a light band from eye to ear opening (4); body, legs and neck black; neck and back with irregular pattern of light yellow, small spots/dots, usually forming V-shaped lines (pattern largely fades with age); tail with narrow, light banding; snout and underside of body light, belly partly with unclear dark horizontal stripes, some specimens with reddish belly; iris reddish brown; tongue pink/flesh-coloured (5); **juveniles** with regular pattern of large light spots in V-shaped lines on neck and transverse rows on the back; head and neck with many light spots.

Similar species: *V. keithornei* possesses a light-grey colour pattern; juveniles have narrower cross-strips on back and body; adults of *V. beccarii* and *V. bogerti* lack the light band between eye and ear, the yellow pattern on the back and have a black ventral side; juveniles have also a black ventral side.

Size/age at sexual maturity: Females and males at about 80 cm TL; age unknown

Clutch size: 3-5 eggs per clutch depending on the size of the female; 1 clutch per year

Incubation period/temperature: 174-189 days at 28-29 °C

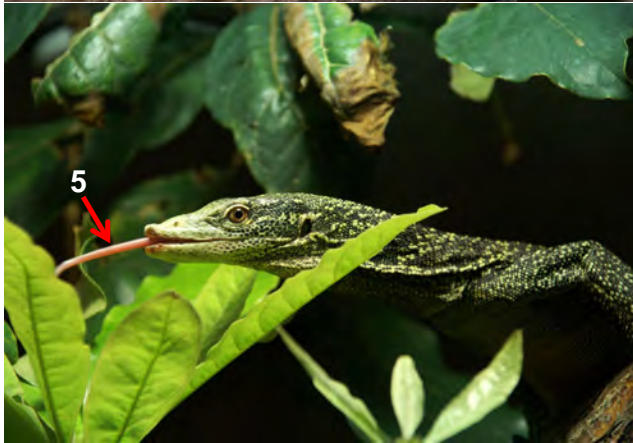
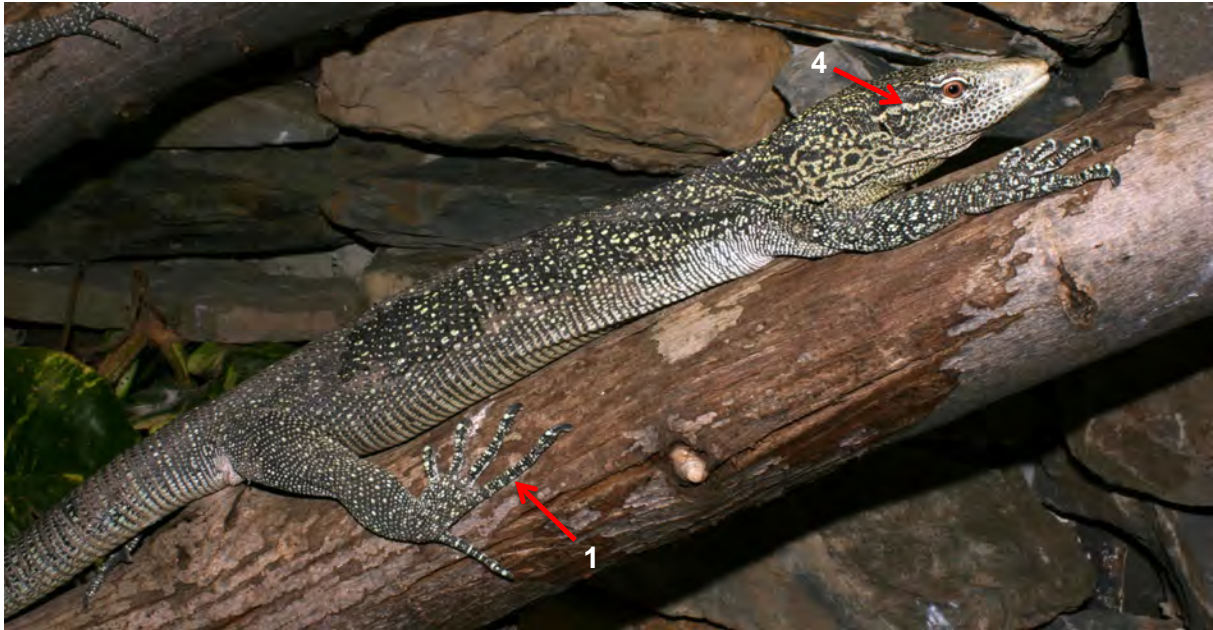
Size/weight of hatchlings: 22.3-25.0 cm TL; 9.1 cm SVL; 8.0-9.4 g

Growth rate: 60 days after hatching: 11.0-11.3 cm SVL; 28.0-29.0 cm TL; 11.8-13.7 g

Captive breeding: So far only rarely bred by private keepers; climatic conditions: temperatures during the day 27-33 °C in summer, 23-29 °C in winter; at night 23 °C in summer and 20 °C in winter; lighting from 7-21 o'clock throughout the year; humidity during the day 60-70 % from February-October, at night 80 %; from November-January 10-20 % lower; separation of the monitors for 3-12 weeks can be advantageous for breeding attempts; hollow tree trunk necessary for egg deposition.

Ecology: Diurnal (←); tree-dwelling; feeds mainly on insects and spiders; published observations from the wild are lacking; island endemic (←)

Remarks: *V. boehmei* is in demand for the international pet trade; in recent years 6-71 specimens are exported annually from Indonesia (all declared captive-bred or captive-born), whereas no export figures are available in the CITES trade database for 2016 to 2018. *V. boehmei* is nationally protected in Indonesia. In addition, the species is potentially threatened by habitat destruction through logging.



Varanus boehmei. Above: adult, © Thomas Ziegler; centre left: adult, © André Koch; centre right: adult, © Mark Auliya; below: adult, © Mark Auliya

Varanus bogerti Mertens, 1950

Subgenus: *Hapturosaurus*

English name: Bogert's tree monitor

German name: Bogerts Baumwaran

Local name: -

Synonyms: None; historically, a confusion occurred with *V. kordensis* despite the different colouration.

Subspecies: None; formerly, *V. bogerti* was considered a subspecies of *V. prasinus*.

International conservation status (CITES / Commission Regulation (EU) No 2017/160): Appendix II/B

IUCN Red List status: Least Concern (LC), population trend unknown (last assessed 2014)

Distribution: D'Entrecasteaux, Louisiade, and Trobriand Archipelagos (Fergusson, Normanby, and Misima [= St. Aignan] Islands), Papua New Guinea

Total length (TL): 94 cm; **Snout-vent length (SVL):** 32 cm

Morphological traits (adults): Medium-sized species; head, neck, body and legs long and slender; toes long with sharp claws; tail about twice (in juveniles only 1.5 times) as long as SVL, circular in cross-section and prehensile (↔), above without a keel (↔); scales on tail above and below equal in size, forming continuous rings; nostrils roundish/oval, located closer to tip of snout than to eye; head scales above eyes and between them (slightly) enlarged (1); head scales tubercular (2)

Colour pattern: Upper side of body plain black without pattern; underside dark grey to dark brown; snout dark grey; tongue pink/flesh-coloured to bright bluish (at least above); iris colour unknown; during the first weeks and months, **juveniles** (usually) have a fine pattern of single bright scales on the back extending to neck and back of head (3).

Similar species: *V. beccarii* has larger, hence fewer and smooth head scales (4) (28-38 scales across head from corner of mouth to corner of mouth vs. 40-48 tubercular scales in *V. bogerti*) and larger ventral scales (70-82 scale rows between gular fold and insertion of hind legs vs. 78-90 in *V. bogerti*); nostrils are located more at the sides (vs. more above in *V. bogerti*) on snout (5); adults of *V. boehmei* and *V. keithornei* exhibit a bright pattern on the dark background colouration; *V. mabitang* and entirely black specimens of *V. salvator*, that were described as *V. salvator komaini* (= a synonym of *V. salvator macromaculatus*), have a laterally compressed (vs. round in cross-section in *V. bogerti*), non-prehensile (↔) tail; central head scales between eyes are not enlarged. In addition, *V. salvator* possesses a dark blue tongue. Both species reach a total length of distinctly more than 100 cm.

Size/age at sexual maturity: No published data; probably similar to *V. prasinus* or *V. beccarii*.

Clutch size: No published data; probably similar to *V. prasinus* or *V. beccarii*.

Incubation period/temperature: No published data; probably similar to *V. prasinus* or *V. beccarii*.

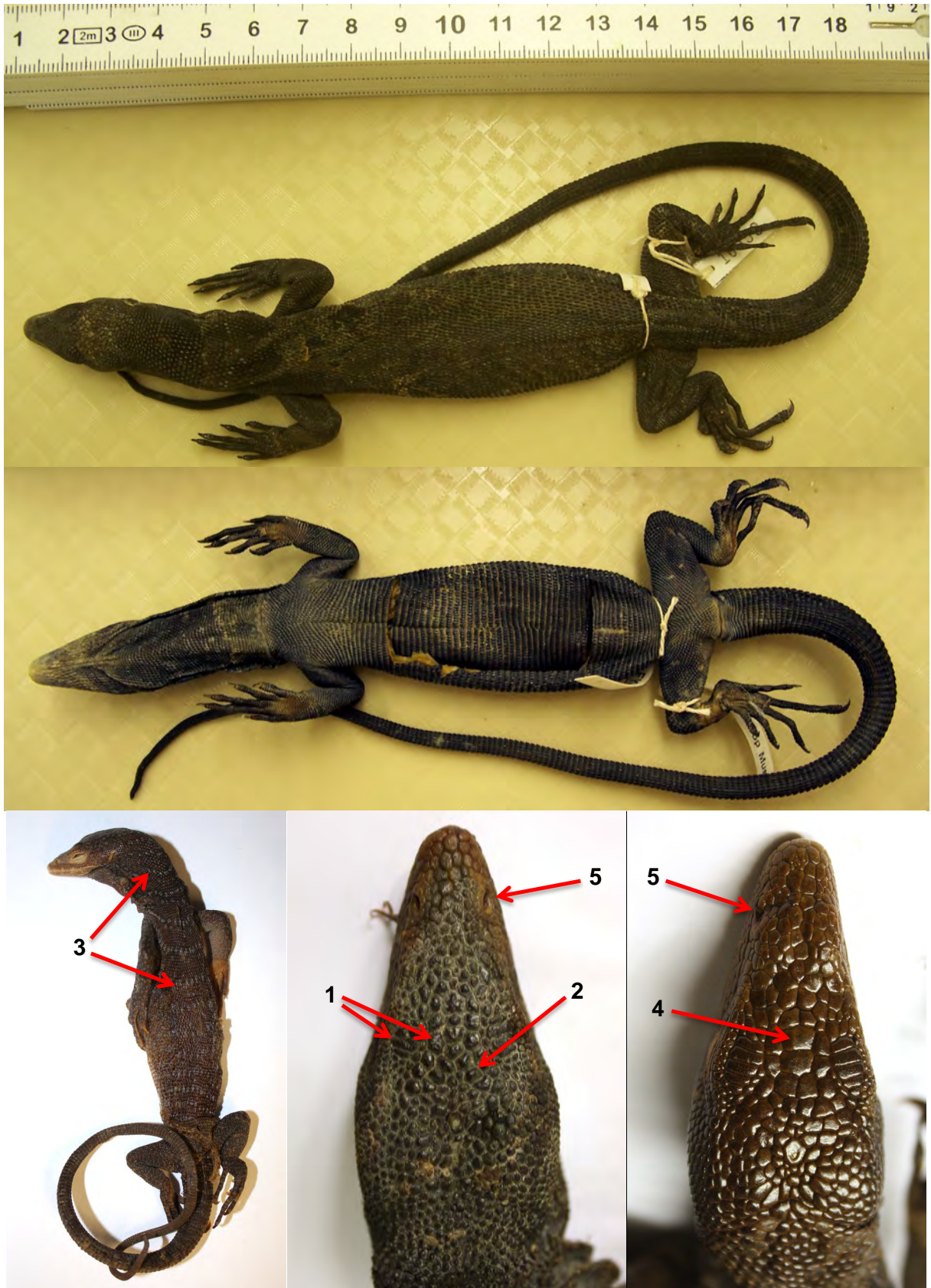
Size/weight of hatchlings: No published data; probably similar to *V. prasinus* or *V. beccarii*.

Growth rate: No published data; probably similar to *V. prasinus* or *V. beccarii*.

Captive breeding: No keeping and breeding has been documented so far. Probably similar parameters apply as in *V. prasinus* or *V. beccarii*, i.e. increase of humidity and separation of sexes for 3-12 weeks may be advantageous for breeding success; nesting box necessary for egg deposition.

Ecology: Diurnal (↔); tree-dwelling, island endemic (↔); published observations from the natural habitat and photos of live specimens of *V. bogerti* are lacking.

Remarks: According to the CITES trade database, *V. bogerti* is not documented in the international pet trade. However, due to the high similarity with *V. beccarii*, *V. bogerti* could be traded unnoticed under this name.



Varanus bogerti. Above and centre: subadult, Fergusson Island, Papua New Guinea, BPBM 16053, © Nicole Ernst; below left: juvenile, Fergusson Island, Papua New Guinea, BMNH 1895.4.26.14-16; below in the middle: adult, „New Guinea“, BMNH 1876.7.6.2; below right: ***V. beccarii***, adult, Aru Islands, Indonesia, BMNH 1910.4.26.25, © all Flora Ihlow

Varanus keithhornei (Wells & Wellington, 1985)

Subgenus: *Hapturosaurus*

English names: Canopy monitor/goanna, Nesbit river monitor, Blue-nosed monitor

German name: Australischer Baumwaran

Local name: -

Synonyms: *Odatria keithhornei* Wells & Wellington, 1985; *Varanus teriae* Sprackland, 1991

Subspecies: None

International conservation status (CITES / Commission Reg. (EU) No 2017/160): Appendix II/B

IUCN Red List status: Least Concern (LC), population trend stable (last assessed 2017)

Distribution: Cape York Peninsula, Queensland (Qld), Australia

Total length (TL): 77 cm; **Snout-vent length (SVL):** 26 cm

Morphological traits (adults): Medium-sized, very slender species; scales on dorsum (↔) with keels (↔); bulbous snout (1) with roundish nostrils located closer to tip of snout than to eye (2); enlarged supraoculars (↔) (3); sharp-clawed digits on slender fore and hind limbs (4); blackish pads/palms (↔) sticky to surfaces; tail long and prehensile (↔), round in cross section, without a dorsal keel, tail length about 1.7 times SVL; dorsal (↔) and ventral (↔) tail scales equal in size, forming continuous rings around tail; number of midbody scales (↔) ranges between 90-99

Colour pattern: Middle part of dorsum black with greyish/silvery cross rows (5), in some specimens more distinct dorsolaterally (↔); gular region (↔), ventrum (↔) and underside of tail greyish/silvery, gular region also with greenish tinge; snout to middle of upper head bluish/light greyish; in some specimens whitish to faint orange pigmented scales between posterior (↔) margin of eye and upper margin of ear opening individually variable (6); **juveniles** with black ground colour and silvery coloured chevrons arranged in cross-bands along entire body, alternating in light and dark rings along the tail; anterior (↔) head silvery coloured

Similar species: *Varanus beccarii* lacks greyish/silvery scales, belly blackish, head only lighter at tip of snout; number of midbody scales ranges between 81-86; in *V. boehmei* dorsum with yellowish/golden chevrons; snout region and chin yellow/golden, gular region and ventrum golden/yellowish; number of midbody scales ranges between 78-95 (Ø 87); upper surfaces of *V. bogerti* uniformly black without pattern including gular region; *V. rudicollis* with distinctly enlarged nuchal scales (↔); slit-shaped nostril closer to eye than to tip of snout; laterally compressed tail

Size/age at sexual maturity: No published data, probably similar to other species included in the subgenus *Hapturosaurus*

Clutch size: 2 clutches with 2-4 eggs per season

Incubation period/temperature: 170-190 days at 29-30 °C

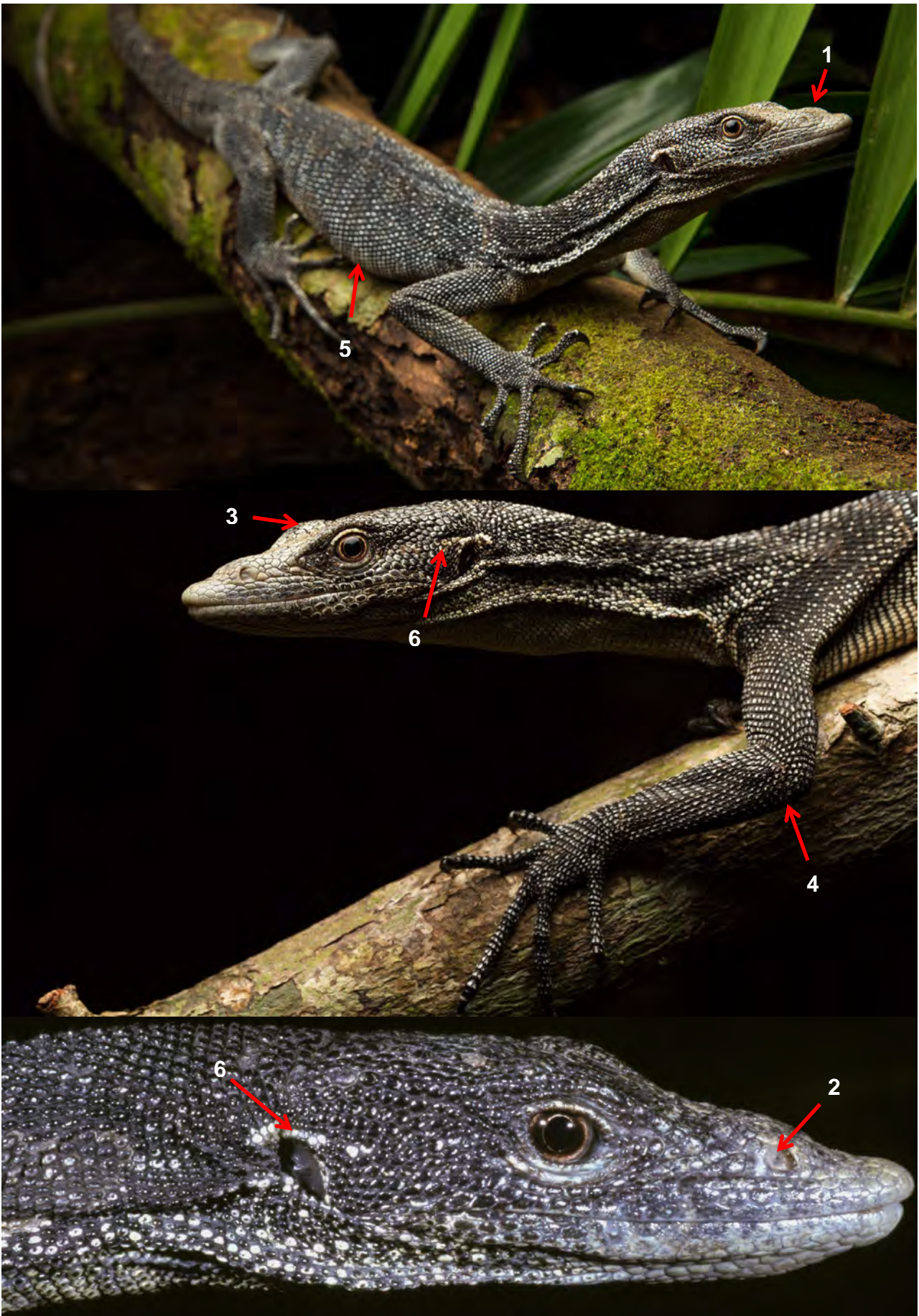
Size/weight of hatchlings: 9.7-10.1 cm SVL; 23.2-25.1 cm TL; 10-12 g

Growth rate: No published data, probably similar to other species included in the subgenus *Hapturosaurus*

Captive breeding: Only one successful breeding instance was reported; enclosure was 2.2 m high, 2 m long and 1.4 m wide; seasonal temperatures between 20-28 °C and 24-33 °C; the construction allowed sunlight and air to enter enclosure; interior was furnished with hard wood chips/eucalyptus leaf litter and a water bowl; a specifically designed fully enclosed nest box (12.4 x 68 x 24,5 cm) with a small entrance proved successful to breed the species; modification of heat sources to produce a suitable thermal gradient was crucial

Ecology: Likely only diurnal (↔); secretive behaviour; predominantly arboreal (↔), occasionally descends to the ground; shelters in tree hollows; diet likely similar to that of *Varanus prasinus* (in captivity insects, small rodents and fruit)

Remarks: Under the EPBC Act (↔) the export of live specimens of *V. keithhornei* for commercial purposes is prohibited; international trade is not documented (CITES trade database)



Varanus keithornei. Above and centre: adult, near Iron Range, Qld, Australia, © Jasmine Vink; below: adult, Iron Range, Qld, Australia, © Mark Sanders, EcoSmart Ecology

Varanus kordensis (Meyer, 1874)

Subgenus: *Hapturosaurus*

English name: Biak emerald tree monitor

German name: Biak-Baumwaran

Local names: Biawak kordensis, Biawak hijau [Biak] (Indonesia)

Synonyms: *Varanus prasinus kordensis*

Subspecies: None; formerly, *V. kordensis* was considered a synonym resp. subspecies of *V. prasinus*.

International conservation status (CITES / Commission Regulation (EU) No 2017/160): Appendix II/B

IUCN Red List status: Data Deficient (DD), population trend unknown (last assessed 2014)

Distribution: Biak Island, West Papua, Indonesia

Total length (TL): 85 cm (♂); **Snout-vent length (SVL):** 27 cm (♂)

Morphological traits (adults): Medium-sized species; head, neck, body and legs very slender; toes long, with sharp claws; tail about twice (in juveniles only 1.5 times) as long as SVL, circular in cross-section and prehensile (↔), above without a keel (↔) (1); scales on tail above and below equal in size, forming continuous rings; nostrils oval, located closer to tip of snout than to eye; head scales above eyes and scale rows between them enlarged

Colour pattern: Head, body and legs olive-green to turquoise, usually with black reticulated pattern, which may fade with age; toes light-dark striped (2); tail green and black patterned; lateral head scales grey-green, each with a black central point (3); sometimes with black double stripes from eye to ear; body underside unpatterned, greyish green; scales of the soles black; iris orange-brown/bronze-coloured; tongue pink/flesh-coloured; **juveniles** are darker, colour pattern with more contrast, many green spots in regular rows on a black background; head black and green patterned (4); tail indistinctly green and black banded; lateral belly with dark markings.

Similar species: *V. prasinus* with black V-shaped (vs. reticulated) pattern on back; legs and tail plain green, not patterned; has smaller and more scales around the middle of the body (85-110, ø 97 vs. 83-95, ø 89) and from the corner of the mouth to the corner of the mouth (33-47, ø 40 vs. 28-40, ø 34); *V. reisingeri* with black V-shaped (vs. reticulated) pattern on yellow-green background colour; legs and tail unpatterned; clear black stripe from eye to ear; *V. telensestes* has bright soles lacking black pigmentation and a marbled belly with dark horizontal stripes on throat and chest.

Size/age at sexual maturity: No published data; probably similar to *V. prasinus* or *V. beccarii*.

Clutch size: Up to 3 clutches with 2-5 (ø 3) eggs per year; minimum interval of 61 days between two clutches

Incubation period/temperature: 190-215 days at 28-30 °C

Size/weight of hatchlings: 10-10.5 cm SVL; 25-26 cm TL; 9-10 g

Growth rate: No published data; probably similar to *V. prasinus* or *V. beccarii*.

Captive breeding: So far rarely bred in zoos and private collections. Separation of adult monitors for 3-12 weeks and simulation of the rainy season may increase the breeding success; nesting box necessary for egg deposition.

Ecology: Diurnal (↔); tree-dwelling; island endemic (↔); published observations from the natural habitat are lacking.

Remarks: According to the CITES trade database, every year 25-75 specimens of *V. kordensis* declared as captive-bred were exported for the international pet trade between 2010 and 2018. The species is nationally not protected in Indonesia. Due to the great similarity with *V. prasinus* it can be assumed that *V. kordensis* is also traded under the name of this wide-spread species. Habitat loss through deforestation could additionally threaten the species.



Varanus kordensis. Above left and right: adult, © Esther Laue; centre: adult, © Dmitry Telnov, Entomological Society of Latvia; below: juvenile, © Petr Necas

Varanus macraei Böhme & Jacobs, 2001

Subgenus: *Hapturosaurus*

English name: Blue-speckled tree monitor

German name: Blaugefleckter Baumwaran

Local names: Biawak [pohon bercak] biru, soa soa (Indonesia)

Synonyms: None

Subspecies: None

International conservation status (CITES / Commission Regulation (EU) No 2017/160): Appendix II/B

IUCN Red List status: Endangered (EN), population trend unknown (last assessed 2014)

Distribution: Batanta Island, Indonesia

Total length (TL): 110 cm (♂), 89 cm (♀); **Snout-vent length (SVL):** 36 cm (♂), 31.3 cm (♀)

Morphological traits (adults): Medium-sized species; head, neck, body and legs very slender; toes long, with sharp claws; tail twice as long as SVL, circular in cross-section (1) and capable of grasping; scales of tail above and below equal in size, forming continuous rings, without a keel (↔) above; nostrils oval, located closer to tip of snout than to eye (2); head scales above the eyes and between them enlarged (3)

Colour pattern: Head, body, legs and tail black with brilliant light blue spotted pattern; spots on back in transverse rows, on neck usually forming V-shaped patterns; snout whitish; iris reddish brown; whitish line from eye to above ear opening (4); tongue pink/flesh-coloured (5); belly brownish blue; **juveniles** specimens with clearer pattern of blue spots with black centre in transverse rows; belly bluish with many indistinct dark transverse stripes; throat with concentric black pattern.

Similar species: None.

Size/age at sexual maturity: ♂: 64.5 cm TL, 32 cm SVL; ♀: unknown; ♂ at the age of 26 months

Clutch size: 2-7 (ø 4) eggs per clutch depending on the size of the female; up to 4 clutches per year possible, minimal interval of 95 days between two clutches

Incubation period/temperature: 150-240 days at 28.5-31 °C

Size/weight of hatchlings: 21.3-26.4 cm TL; 8.8-10.0 cm SVL; 10.0-15.0 g

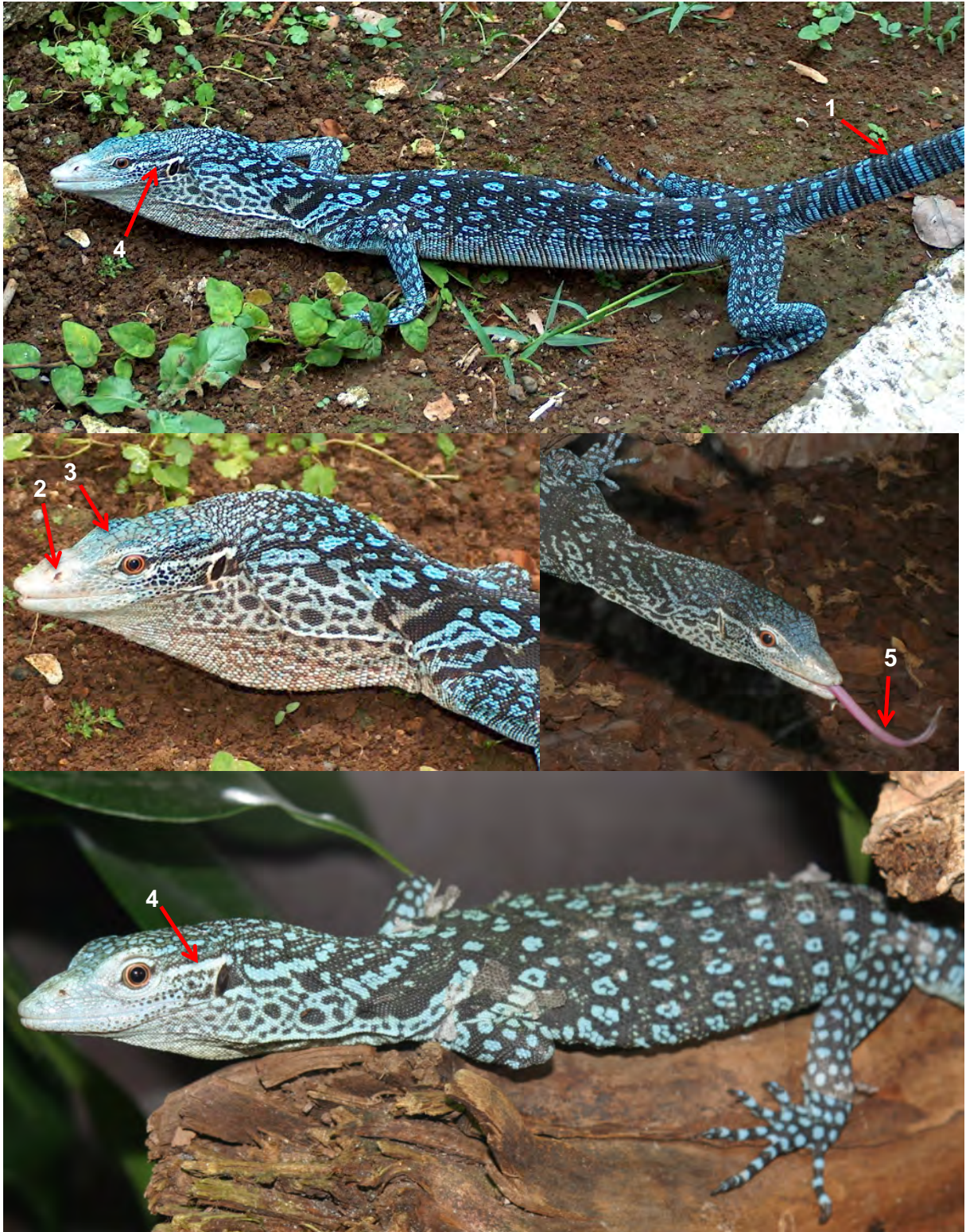
Growth rate: After 3 weeks: 29.0 cm TL; 11.0 cm SVL; after 17 months/500 days: 66.5-71.0 cm TL; 23.0-24.0 cm SVL

Captive breeding: The successful captive breeding has repeatedly been reported by zoos and private keepers; tropical temperatures of 29-32 °C, high humidity, and separation of both sexes for 3-12 weeks can be advantageous for breeding attempts; hollow tree trunk necessary for egg deposition.

Specifics: Parthenogenesis (↔) has been observed; no temperature-dependent sex determination during incubation has been documented.

Ecology: Diurnal (↔); tree-dwelling; feeds mainly on invertebrates such as insects and spiders; island endemic (↔); detailed observations from the wild are lacking.

Remarks: *V. macraei* is threatened by the high demand for the international pet trade and zoos, possibly also by habitat loss. According to the CITES trade database, 167-461 specimens declared as captive-bred or captive-born were annually exported from Indonesia between 2010 and 2017. Despite the restricted distribution range and the high demand the species is not nationally protected in Indonesia.



Varanus macraei. Above and centre left: adult, at a trader on Java Island, Indonesia, © André Koch; centre right: adult, © Thomas Ziegler; below: subadult, captive-bred, Cologne Zoo, © Thomas Ziegler

Varanus prasinus (Schlegel, 1840)

Subgenus: *Hapturosaurus*

English names: Emerald tree monitor, Green tree monitor

German names: Smaragdwaran, Grüner Baumwaran

Local names: Biawak hijau (Indonesia), Dudu (New Guinea)

Synonyms: None

Subspecies: None; formerly, *V. beccarii*, *V. bogerti*, and *V. kordensis* were considered subspecies of *V. prasinus*.

International conservation status (CITES / Commission Regulation (EU) No 2017/160): Appendix II/B

IUCN Red List status: Least Concern (LC), population trend stable (last assessed 2017)

Distribution: New Guinea and its offshore-islands Salawati, Yapen (Japan), Goodenough (= Nidula) and Torres Strait Islands (Australia)

Total length (TL): 100 (ø 65.4) cm; **Snout-vent length (SVL):** 30.8 (ø 22.6) cm (♂), 28.6 cm (♀)

Morphological traits (adults): Medium-sized species; head, neck, body and legs very slender; toes long, with sharp claws; tail about twice (in juveniles only 1.5 times) as long as SVL, circular in cross-section and prehensile (↔), without a keel (↔) above (1); scales on tail above and below equal in size, forming continuous rings; nostrils oval, located closer to tip of snout than to eye (2); head scales above eyes and scale rows between them enlarged (3)

Colour pattern: Head, body, legs and tail emerald-green to turquoise, mostly with 11-18 partly V-shaped black bands over the neck and back (4), rarely unpatterned; tail and legs unpatterned; snout light grey, yellowish or whitish; scales between eye and ear with a black central point; sometimes with black double stripes from eye to ear; body underside usually unpatterned, grey-green; throat sometimes with grey cross stripes; scales of the soles black; iris reddish brown/bronze-coloured; tongue pink/flesh-coloured; **juveniles** are more contrasty in colour pattern; tail, legs and toes black and green patterned/striped.

Similar species: *V. kordensis* with reticulated (vs. V-shaped) pattern on back; legs and tail black and green patterned; has larger and consequently less scales around the middle of body (83-95, ø 89 vs. 85-110, ø 97) and across head from corner of mouth to corner of mouth (28-40, ø 34 vs. 33-47, ø 40); *V. reisingeri* with a yellow-green background colour, sometimes the black colour dominates on the back with bright green elongated spots in transverse rows; *V. telenebetes* has bright soles and a dark marbled belly with dark cross stripes on the throat and chest.

Size/age at sexual maturity: No published data; at the age of about 2 years

Clutch size: Up to 4(5) clutches with 2-8 (ø 3-4) eggs per year, each 30-40 days after copulation; minimum interval of 68 (11?) days between two clutches

Incubation period/temperature: 123-215 (ø ca. 172) days at 26-34 °C

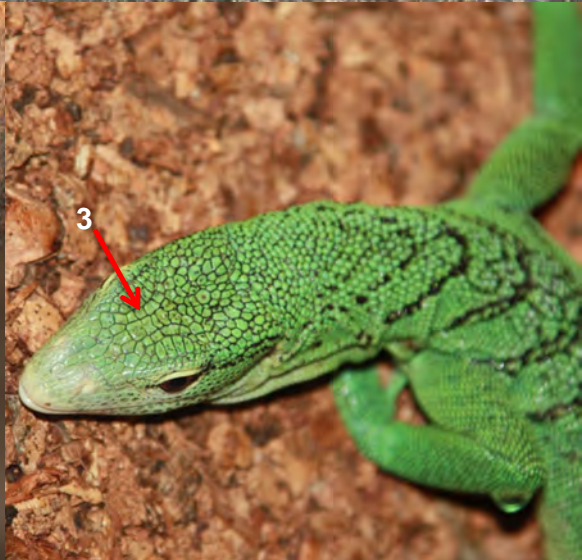
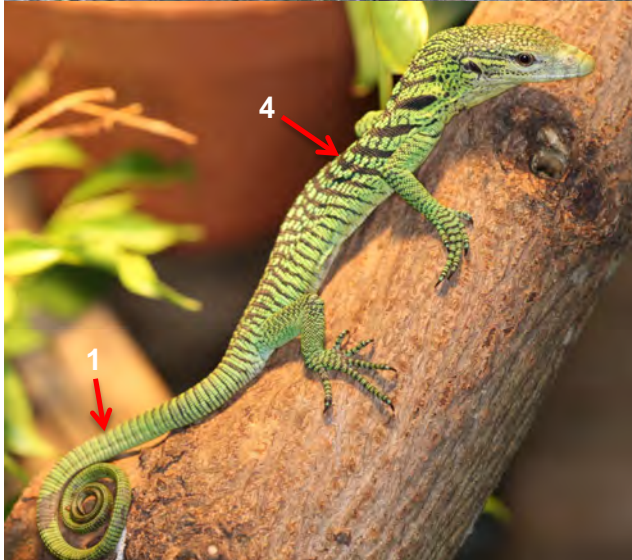
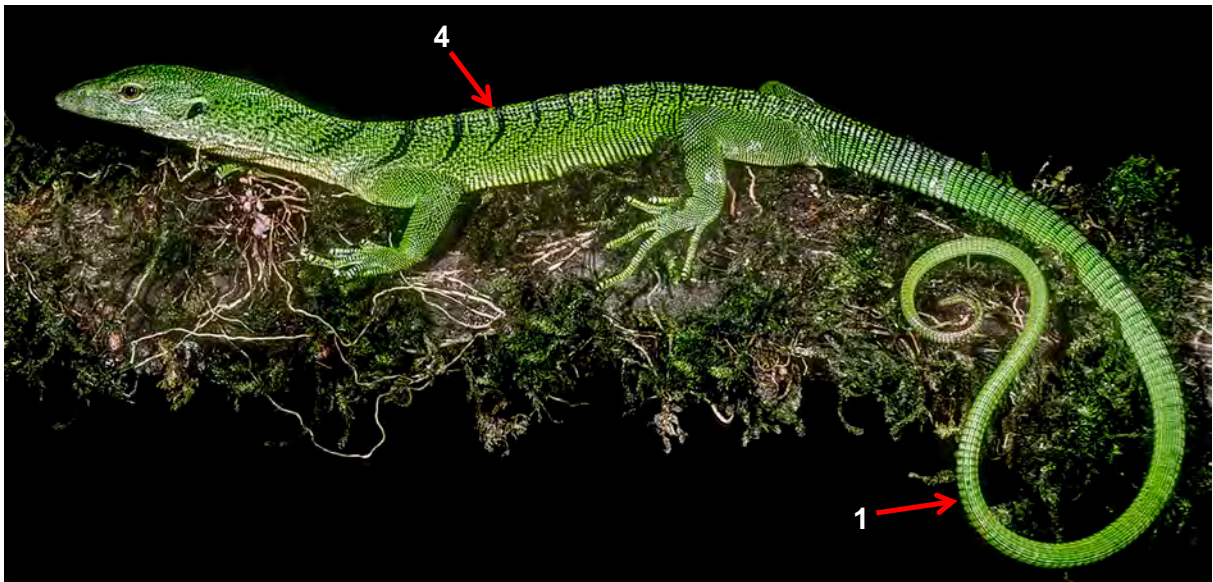
Size/weight of hatchlings: 6.8-10.5 SVL; (13.5?) 16-26.1 cm TL; 4.8-11 (ø ca. 8.5) g

Growth rate: 1.2 cm per month in subadults and 0.35 cm per month in adults

Captive breeding: Breeding regularly successful in zoos and private collections. Separation of the adult animals for 3-12 weeks and simulation of the rainy season may increase the breeding success; nesting box necessary for egg deposition.

Ecology: Diurnal (↔); tree-dwelling; island endemic (↔); feeds mainly on invertebrates (e.g., grasshoppers, beetles, and spiders), occasionally on rodents.

Remarks: For *V. prasinus* there is a great demand from the pet trade and zoos. According to the CITES trade database, annual exports of up to 730 specimens declared captive-bred from Indonesia are documented. *V. prasinus* is nationally protected in Indonesia. Therefore, only the export of captive-bred specimens is allowed. Due to its widespread distribution, *V. prasinus* is unlikely to be threatened.



Varanus prasinus. Above: adult, © Michael McCoy; centre: adult, Mount Shungol, Papua New Guinea, © Fred Kraus; below left: juvenile, © Bernd Eidenmüller; below right: subadult, © Dmitry Telnov, Entomological Society of Latvia

Varanus reisingeri Eidenmüller & Wicker, 2005

Subgenus: *Hapturosaurus*

English names: Misool tree monitor, Yellow tree monitor

German name: Reisingers Baumwaran

Local name: Biawak [pohon] kuning, biawak misool (Indonesia)

Synonyms: None; prior to their scientific description as a new species, these monitors were allocated to *V. prasinus*.

Subspecies: None; some authors, however, regard *V. reisingeri* as a subspecies of *V. prasinus*.

International conservation status (CITES / Commission Regulation (EU) No 2017/160): Appendix II/B

IUCN Red List status: Data Deficient (DD), population trend unknown (last assessed 2014)

Distribution: Miso(o)l Island, Indonesia

Total length (TL): 76 cm (♂), 68 cm (♀); **Snout-vent length (SVL):** 30 cm

Morphological traits (adults): Medium-sized species; head, neck, body, and legs very slender; toes long, with sharp claws; tail about 1.7 times to twice (in juveniles only 1.5 times) as long as SVL, circular in cross-section and prehensile (↔), without a keel (↔) above; scales on tail above and below equal in size, forming continuous rings; nostrils oval, located closer to tip of snout than to eye; head scales above eyes and scale rows between them enlarged

Colour pattern: Head, legs and tail yellowish-green to emerald-green; back black with 12-16 transverse rows of yellow-green oval spots, partly with black centre (1); tail especially at base with narrow black and green stripes; legs green, partially with fine black pattern; snout yellowish; indistinct black double stripe from eye to ear (2); body underside unpatterned, yellow-green; scales of the soles black; iris reddish brown; tongue pink/flesh-coloured (3); **juveniles** may be more contrasty in colour pattern (4).

Similar species: *V. prasinus* with emerald-green to turquoise ground colour, back predominantly green with black V-shaped stripes; *V. kordensis* with reticulated pattern on back and legs on turquoise background colour; tail especially in juveniles green and black patterned; weakly defined black double stripes from eye to ear; *V. telenesetes* has bright soles and a dark marbled belly with dark cross stripes on throat and chest.

Size/age at sexual maturity: No published data; probably similar to *V. prasinus* or *V. beccarii*.

Clutch size: Up to 5 eggs per clutch are laid about 1 month after copulation

Incubation period/temperature: 157-183 days at 28-30 °C

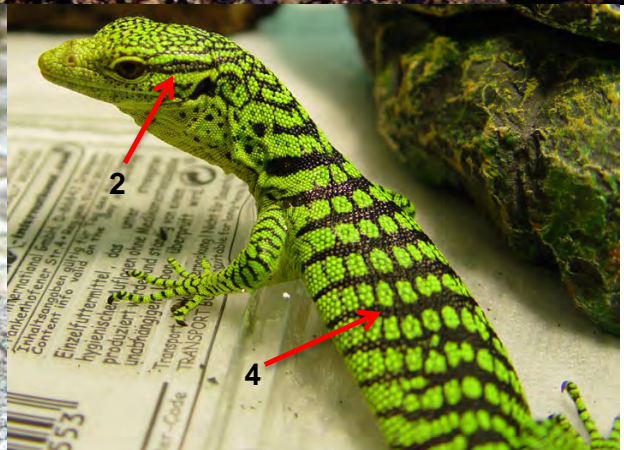
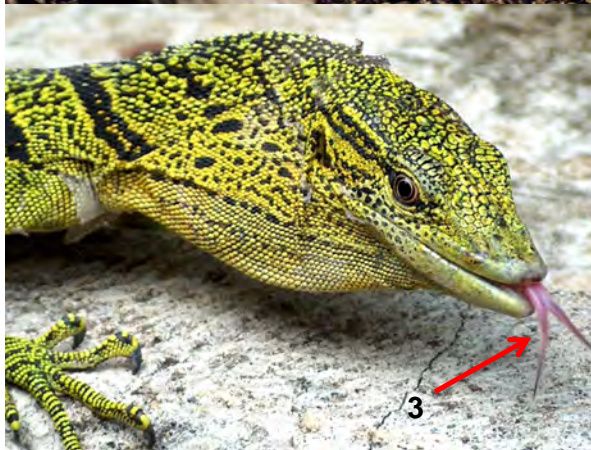
Size/weight of hatchlings: Ca. 10 cm SVL; 22-24.5 (ø 22.3) cm TL; 10-12.5 g

Growth rate: No published data; probably similar to *V. prasinus* or *V. beccarii*.

Captive breeding: So far, breeding was rarely successful in private collections. A harmonizing couple, separation of both sexes for 3-12 weeks and simulation of the rainy season may be the triggers for reproductive success.

Ecology: Diurnal (↔); tree-dwelling; island endemic (↔); published observations from the natural habitat are lacking.

Remarks: *V. reisingeri* is potentially threatened by the demand for the pet trade and habitat destruction. According to the CITES trade database, 20-200 captive-bred specimens were annually exported from Indonesia between 2010 and 2018. The species is nationally protected in Indonesia. Because of the great similarity with *V. prasinus*, it can be assumed that *V. reisingeri* is also traded under the name of this wide-spread species.



Varanus reisingeri. Above: adult specimen at a trader on Java Island, Indonesia, © André Koch; centre: adult, © Dmitry Telnov, Entomological Society of Latvia; below left: adult specimen at a trader on Java Island, Indonesia, © André Koch; below right: juvenile, © Thomas Hörenberg

Varanus telenesetes Sprackland, 1991

Subgenus: *Hapturosaurus*

English name: Rossel Island monitor

German name: (Rossel Island-Baumwaran)

Local names: Yaba, Kwalewe (Papua New Guinea)

Synonyms: None; but *V. telenesetes* itself is considered a synonym of *V. prasinus* by some authors.

Subspecies: None

International conservation status (CITES / Commission Regulation (EU) No 2017/160): Appendix II/B

IUCN Red List status: Data Deficient (DD), population trend unknown (last assessed 2014)

Distribution: Reportedly from Rossel (= Yela) Island, Louisiade Archipelago, Papua New Guinea, but this location is uncertain and needs confirmation.

Total length (TL): 65 cm; **Snout-vent length (SVL):** 22 cm

Morphological traits (adults): Medium-sized species; head, neck, body and legs very slender; toes long, with sharp claws; tail twice as long as SVL, circular in cross section and capable of grasping, prehensile (↔), above without a keel (↔); scales of tail above and below equal in size, forming continuous rings; nostrils oval, closer to tip of snout than to eye; head scales above eyes and scale rows between them enlarged (1)

Colour pattern: Colouration in life unknown; the only known specimen, a preserved museum voucher, shows a brown, unpatterned dorsal background colouration; the belly is dark grey, brighter in the middle; chest and throat are light grey with ca. 10 dark grey cross stripes (2); the soles of the feet are light (3); iris colour unknown; tongue pink/flesh-coloured (4); **juveniles** are unknown.

Similar species: *V. prasinus*, *V. reisingeri* and *V. kordensis* have black scales on the soles of their feet (5); the belly is light, unpatterned; chest and throat without dark cross stripes; *V. prasinus* and *V. reisingeri* exhibit black V-shaped bands on the back with a bright green background colour, while *V. kordensis* shows a reticulated dark pattern; *V. bogerti* and *V. beccarii* have a unicoloured black dorsum (↔) and a dark grey belly without cross stripes in adults; juveniles usually with lines of yellow dots on back; soles of the feet are black in both adults and juveniles (6).

Size/age at sexual maturity: No published data; probably similar to *V. prasinus* or *V. beccarii*.

Clutch size: No published data; probably similar to *V. prasinus* or *V. beccarii*.

Incubation period/temperature: No published data; probably similar to *V. prasinus* or *V. beccarii*.

Size/weight of hatchlings: No published data; probably similar to *V. prasinus* or *V. beccarii*.

Growth rate: No published data; probably similar to *V. prasinus* or *V. beccarii*.

Captive breeding: Not documented so far; probably similar to *V. prasinus* or *V. beccarii*.

Ecology: Probably diurnal (↔); tree-dwelling; island endemic? (↔); published observations from the natural habitat and photos of live specimens of *V. telenesetes* are lacking.

Remarks: *V. telenesetes* is known only from a single old museum specimen reportedly from Rossel Island in Milne Bay Province, Papua New Guinea, but this locality data needs confirmation. The same applies to the taxonomic validity of this species. According to the CITES trade database, no international trade has been reported in this species since 2004.



Varanus telesestes. Above, centre and below left resp. second from left: adult, reportedly from Rossel (= Yela) Island, Louisiade Archipelago, Papua New Guinea, holotype (←), QMJ1190, © Queensland Museum, Peter Waddington; below second from right: ***V. bogerti***, adult, forefoot, St. Aignan (= Misima) Island, Louisiade Archipelago, Papua New Guinea, BMNH 1889.7.1.8, © Flora Ihlow; below right: ***V. reisingeri***, adult, hind foot, ZFMK 83768, © Tim Pilch

Varanus acanthurus Boulenger, 1885

Subgenus: *Odatria*

English names: Ridgetail monitor, Ridge-tailed monitor

German name: Stachelschwanzwaran

Local name: Marndangatha (coastal central Western Australia)

Synonyms: None

Subspecies: *Varanus a. acanthurus* (northwestern and northern Australia), *Varanus acanthurus brachyurus* (West and Central Australia, Queensland), *Varanus acanthurus insulanicus* (Islands off the coast of Northern Territory); taxonomic status of these three subspecies is uncertain

International conservation status (CITES / Commission Reg. (EU) No 2017/160): Appendix II/B

IUCN Red List status: Least Concern (LC), population trend stable (last assessed 2017)

Distribution: Western Australia (WA), Queensland (Qld), Northern Territory (NT), South Australia (SA)?

Total length (TL): 80 cm; **Snout-vent length (SVL):** 25 cm (♂); 21 cm (♀)

Morphological traits (adults): Medium-sized species with elongated body; spinose and broad tail, first third dorsoventrally (←) compressed (oval in cross-section) (1), then more triangular/roundish in cross-section; tail less than double of SVL, usually between 1.49-1.8, but holotype (←) of *V. a. acanthurus* 2.04 times of SVL, and additional records up to 2.3 times of SVL; head short and high; nostrils roundish/oval, lateral and located closer to the tip of the snout than to eye (2); very small granular (←) supraoculars (←); scales on tail strongly keeled (←), those on sides elongated, spine-like (3); number of midbody scales (←) ranges between 70-150

Colour pattern: Extremely variable ground colour from yellow to orange/reddish and brown to black; in general *V. acanthurus* displays distinct ocelli (←) in more or less regular cross rows (4) or as a network (5) on dorsum (←); neck and temporal region (←) also show light and dark longitudinal stripes; ground colour of dorsum brown/blackish in *V. a. acanthurus* with cross-rows of yellowish ocelli (6); distinctly yellowish and dark striped nape, temporal region and neck sides (7); tail end commonly dark without pattern; *V. acanthurus insulanicus* (compared to mainland taxa) is the largest and most high-contrast taxon (←); ocelli can be dissolved, instead with horizontally angular-shaped and broken black bars; in *V. a. brachyurus* ocelli (light brown, centred with dark brown spot) in irregular cross-rows (8); these ocelli may gradually form longitudinal stripes on nape region (9); dark brown temporal streak bordered above and below by whitish/yellowish thin lines that frame the eye (10); **juveniles** not much differentiated from adults

Similar species: *V. baritji* with dark temporal streak, yellow gular region, usually neck without stripes, dorsum lacks ocelli, number of midbody scales ranges between 80-112; *V. primordius* distinctly smaller in size (9.5-11 cm SVL), number of midbody scales ranges between 60-66; *V. storri* distinctly smaller in size (4.9-13.2 cm SVL), head uniformly coloured, lacks temporal streak, body scales flattened, number of midbody scales ranges between 70-94

Size/age at sexual maturity: ♀ at ±14 cm and ♂ at ±12 cm SVL; 8-14 (Ø 5) months

Clutch size: 2 (wild) to 21 (captivity) eggs per clutch; mostly 2-3 clutches per year, but up to 9 clutches have been recorded

Incubation period/temperature: 79-172 days at 26-32 °C, or 144-190 days at 28 °C

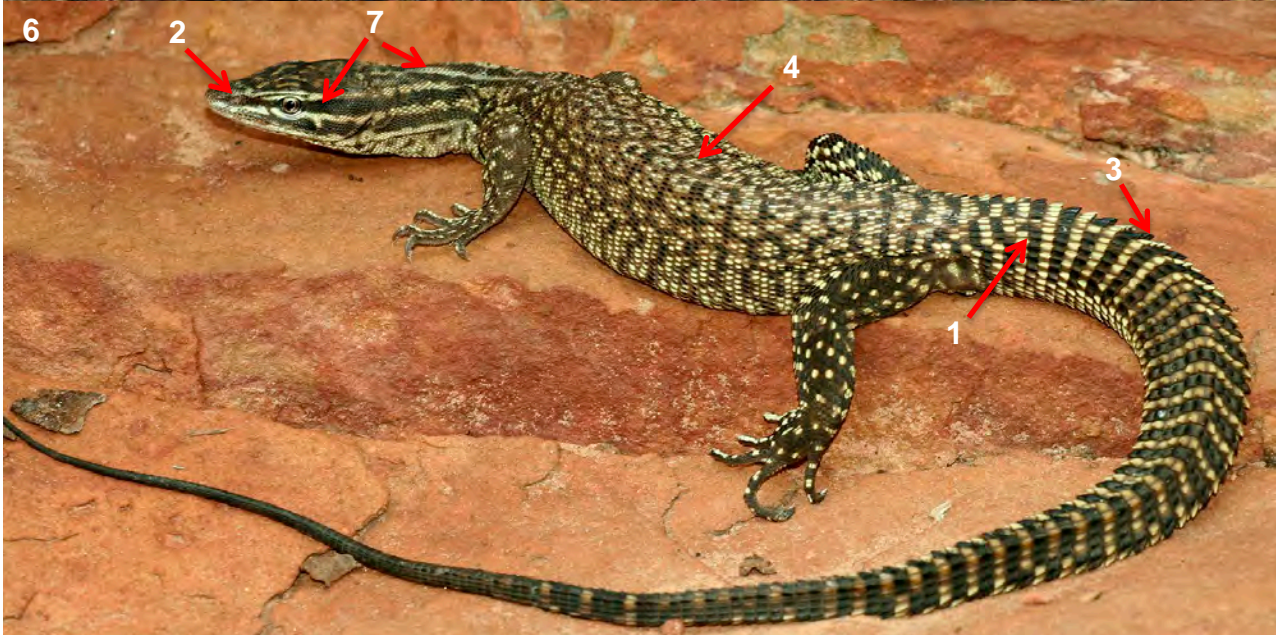
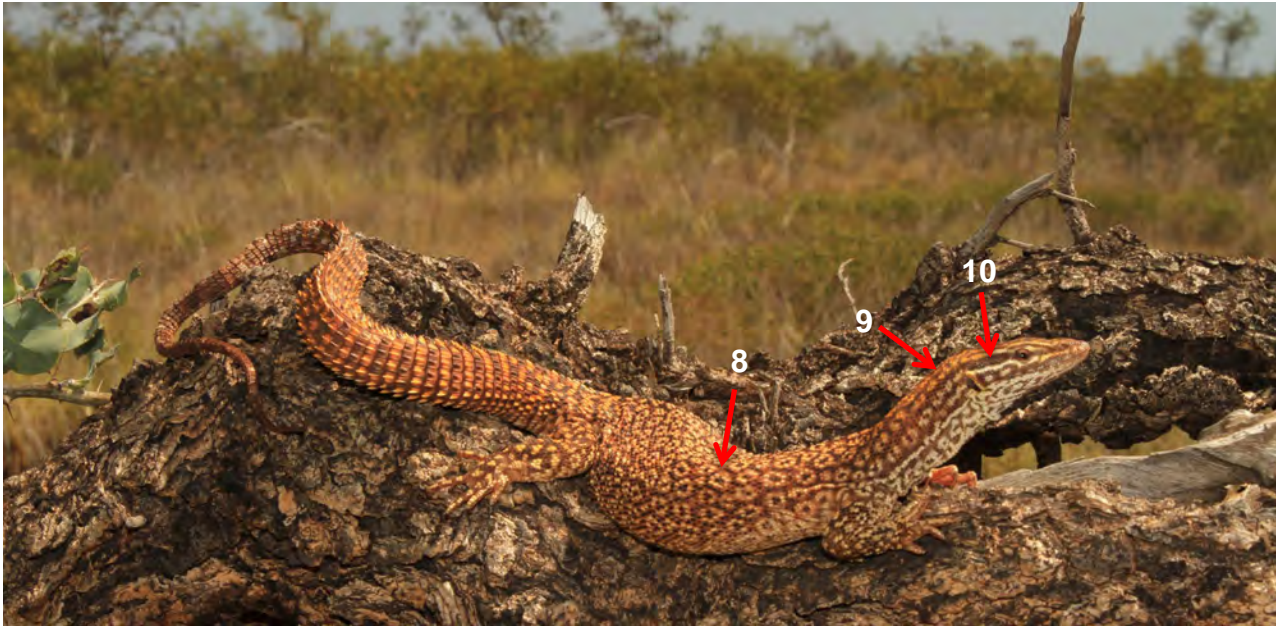
Size/weight of hatchlings: Ø 15 cm TL (n = 21); Ø 6.6 cm SVL (n = 8); 3.5-9 g

Growth rate: In captivity, at one-year TL of 40 cm or more possible.

Captive breeding: Extremely popular in international captive collections; breeding of various colour morphs complicates the assignment to the exact geographical origin.

Ecology: Diurnal (←); terrestrial (←); arboreal (←); mainly saxicolous (←), inhabits diverse, grasslands and woodlands; mainly associated to rocky outcrops, shelters in crevices, burrows or tree hollows; mainly preys on larger insects and small lizards

Remarks: Under the EPBC Act (←) the export of live specimens of *V. acanthurus* for commercial purposes is prohibited; in the period 1981-2017 international exports documented >2,400 specimens that were mainly sourced C (←) (CITES trade database).



Varanus acanthurus brachyurus. Above: adult, Indee Station, WA, © Ryan J. Ellis; *V. a. acanthurus*. centre: adult, Kimberly, WA; below: Pilbara, WA, © Ruchira Somaweera

Varanus auffenbergi Sprackland, 1999

Subgenus: *Odatria*

English names: Auffenberg's monitor, Pin-spot monitor, Peacock monitor

German name: Auffenbergs Waran

Local name: Biawak Rote (Indonesia)

Synonyms: None; prior to their description as a new species, these monitors were treated as *V. timorensis*.

Subspecies: None; some authors, however, regard *V. auffenbergi* a subspecies of *V. timorensis*.

International conservation status (CITES / Commission Regulation (EU) No 2017/160): Appendix II/B

IUCN Red List status: Not Evaluated (NE)

Distribution: Roti (Rote) Island, southwest off Timor, Indonesia

Total length (TL): 60 cm (♂), 45-50 cm (♀); **Snout-vent length (SVL):** 13.8-25.0 (ø 19.3) cm (♂), 15.7-23.5 (ø 18.1) cm (♀)

Morphological traits (adults): Small to medium-sized species; head, body and legs slender; legs and toes relatively short; tail circular in cross-section, above without a keel (↔) (1), about 1.6 times the SVL; scales on tail above and below equal in size, forming continuous rings; no enlarged, spike-like scales at base of tail close to cloaca; head scales above eyes not enlarged; nostrils roundish, located closer to tip of snout than to eye

Colour pattern: Head, body, legs and tail medium to dark brown; neck and back with irregular transverse rows of black encircled, bluish-grey eye spots with black centre (2), orange to reddish scales in between; tail dark with irregular bright mottling; bluish eye spots indistinct in older specimens; underside of body whitish to bright yellowish; throat with dark mottling; belly with thin cross stripes; light stripe between eye and ear opening (3); iris reddish brown; tongue pink/flesh-coloured; **juveniles** on back with distinct pattern of about 12 transverse rows of roundish yellow spots (4) on nearly black background; after some months the spots develop dark centres and turn bluish, while the scales between cross rows of spots turn brownish; head, neck and legs brightly dotted; tail with narrow stripes, dark parts broader than bright ones.

Similar species: *V. timorensis* and *V. similis* show whitish-yellow instead of bluish grey eye spots; ♂♂ of *V. similis* with slightly enlarged, spike-like scales at tail base close to cloaca.

Size/age at sexual maturity: ♂: ca. 60 cm TL, ♀: 45-50 cm TL, at the age of 18-24 months

Clutch size: Deposition of 4-6 eggs ca. 4-6 weeks after copulation in November/December; usually only 1 clutch per year

Incubation period/temperature: 119-154 days at 28.7-30°C

Size/weight of hatchlings: 6.3-6.7 cm SVL; ca. 14-16.3 cm TL; 4.2-4.8 g

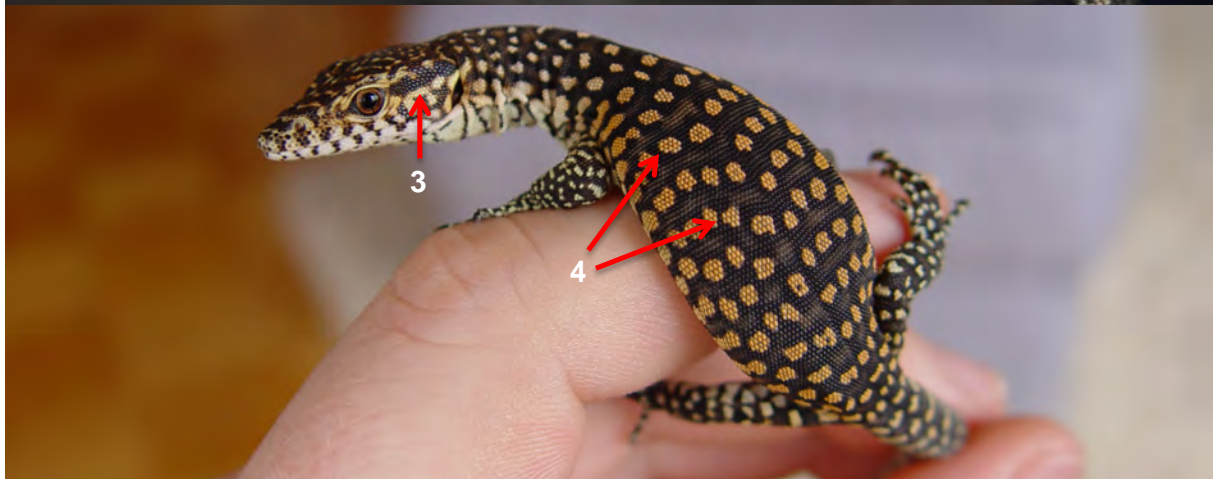
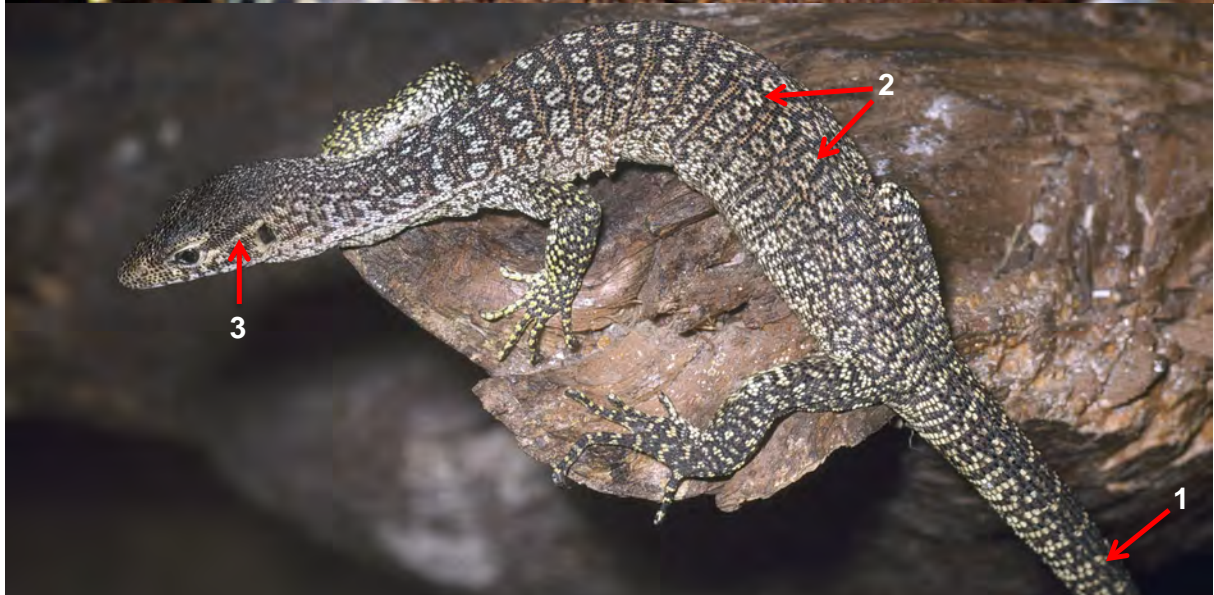
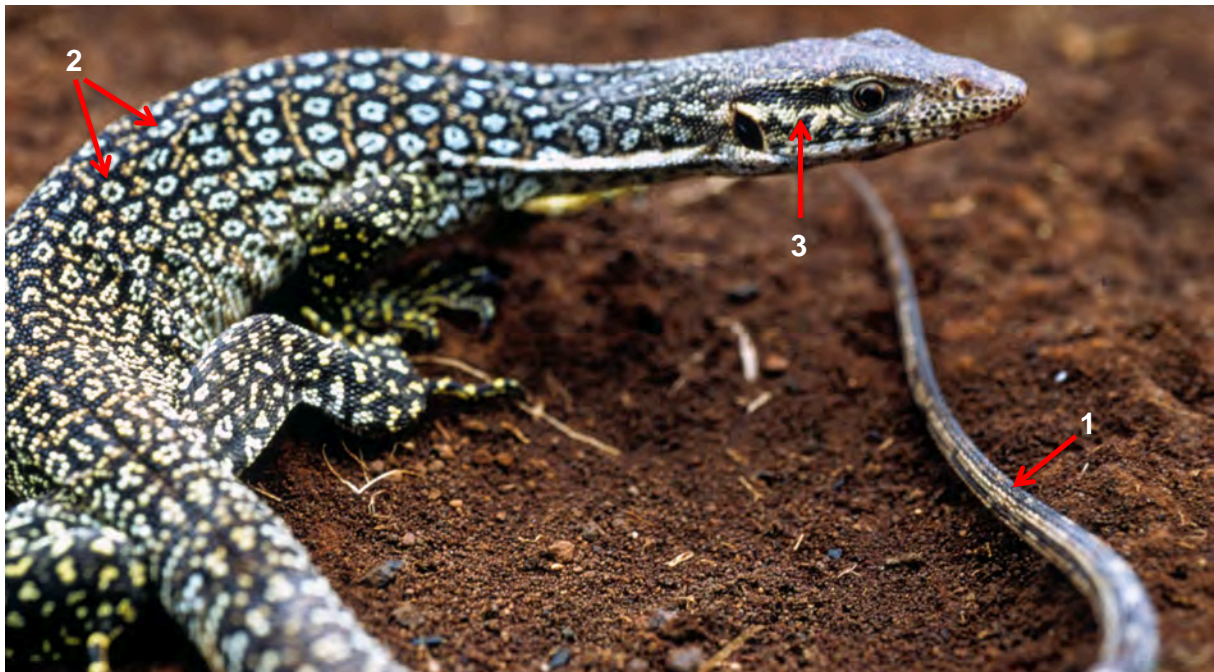
Growth rate: After 2 months: 7.8-8.8 cm SVL, 19.7-22.2 cm TL; after 6 months: 8.5-14.6 cm SVL, 21.9-38.1 cm TL; after 9 months: 13.8-16 cm SVL, 36.9-41.8 cm TL

Captive breeding: Breeding seems relatively easy. Hiding places and temporary separation of both sexes may be advantageous to minimise stress for females. Simulation of the natural dry and rainy seasons at the terrarium seems to stimulate reproduction.

Specifics: A suspected case of parthenogenesis (↔) has been reported.

Ecology: Diurnal (↔); *V. auffenbergi* prefers the crowns of palms as hiding places; island endemic (↔); feeds on invertebrates, occasionally geckos and small snakes. The species was commonly encountered in the coastal regions of Roti Island in the early 1980s; during two field trips on the island each during August 2004 and 2005 about 75-100 specimens could be sighted.

Remarks: *V. auffenbergi* is nationally protected in Indonesia. According to the CITES trade database merely 26 live specimens were officially exported between 2010 and 2017. It is reasonable to assume that the species is also traded as *V. timorensis*. For instance, in the Philippines *V. auffenbergi* was reported in the reptile trade without CITES import records.



Varanus auffenbergi. Above: adult, Roti Island, © Pauli Hien; centre: adult, © Mark O'Shea; below: juvenile, © Thomas Hörenberg

Varanus baritji King & Horner, 1987

Subgenus: *Odatria*

English names: Black-spotted ridge-tailed monitor, Black-spotted spiny-tailed monitor, White's monitor, Baritji, Lemon-throated monitor

German name: Whites Stachelschwanzwaran

Local name: -

Synonyms: -

Subspecies: None

International conservation status (CITES / Commission Reg. (EU) No 2017/160): Appendix II/B

IUCN Red List status: Least Concern (LC), population trend stable (last assessed 2017)

Distribution: Extreme north of Northern Territory (NT), Australia

Total length (TL): 46.8 cm; **Snout-vent length (SVL):** 25.2 cm

Morphological traits (adults): Small to medium-sized, slender species; tail anteriorly roundish (1), in the middle more triangular in cross-section; tail length about 1.7 times SVL; tail in the middle double-crested (↔) with dorsally and laterally prominent spine-like keels (↔) (2); tail scales form continuous rings around tail; nostrils roundish, located closer to tip of snout than to eye (3); slender head and pointed snout; supraoculars (↔) not enlarged; the number of midbody scales (↔) ranges between 80-112

Colour pattern: Ground colour of dorsum (↔) middle brown to reddish/ochre or olive/grey, while nape region (↔) is more reddish brown (4); dorsum with black spots (5) or dark brown reticulated pattern, also more indistinct in nape region (↔) (6); dark temporal streak (↔) (7) bordered below by white streak; white line extends from lower ear caudally to shoulder (8), then gradually changes to dotted line in some individuals (9); gular region (↔) (10) and sides of ventrum (↔) yellow (11); limbs brownish with black spots; tail alternating in dark brown and light brown rings of scales; **juveniles** look like adults, but reticulated pattern on dorsum more noticeable.

Similar species: *V. storri* is distinctly smaller in size (4.9-13.2 cm SVL), head uniformly coloured, lacks a temporal streak, the number of midbody scales (↔) ranges between 70-94; *V. primordius* is distinctly smaller in size (9.5-11 cm SVL), the number of midbody scales (↔) ranges between 60-66; *V. acanthurus* with ocelli (dark spots surrounded by lighter coloured and brownish rings) on dorsum, completely lacking in *V. baritji*; with longitudinal light/dark stripes on nape, number of midbody scales (↔) ranges between 88-112

Size/age at sexual maturity: At approximately 11 cm SVL; with 8-14 months

Clutch size: 3-9 eggs per clutch

Incubation period/temperature: 95-110 days at 30 °C

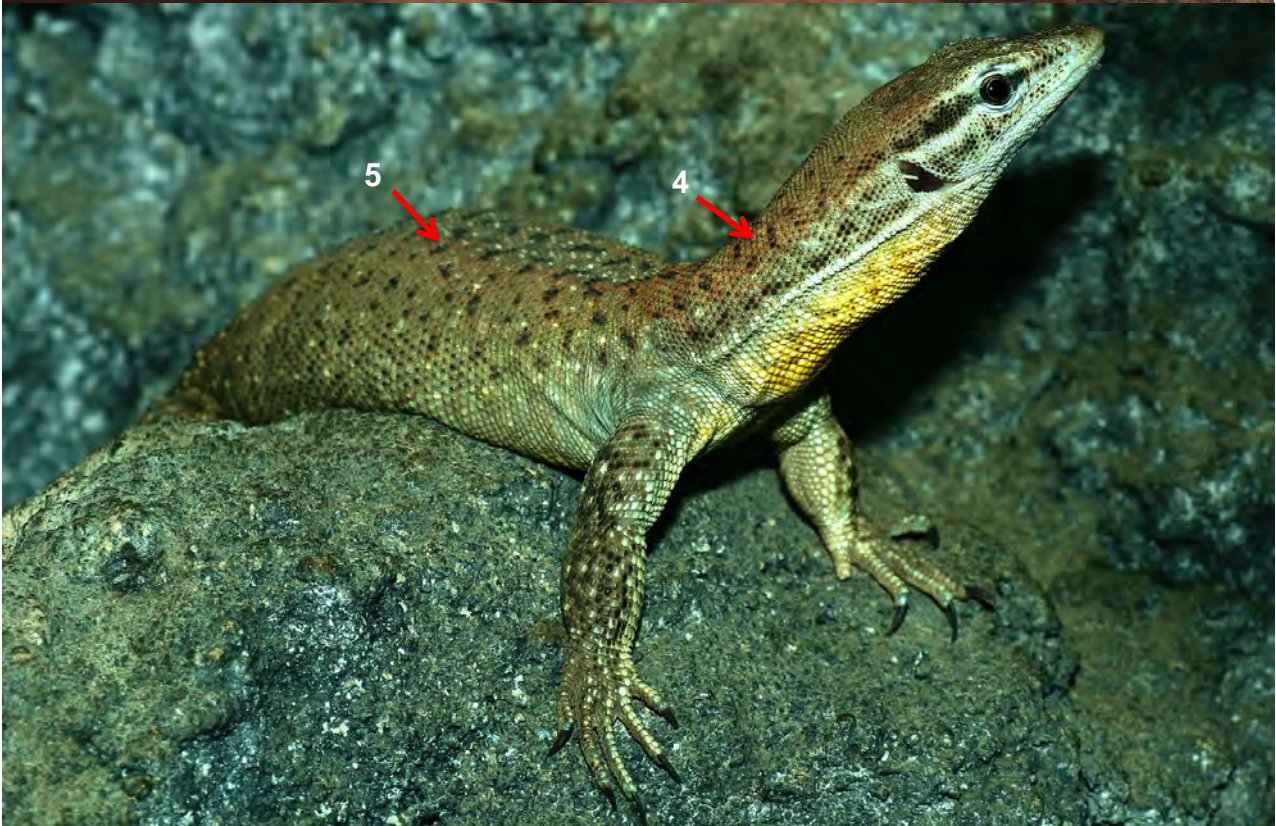
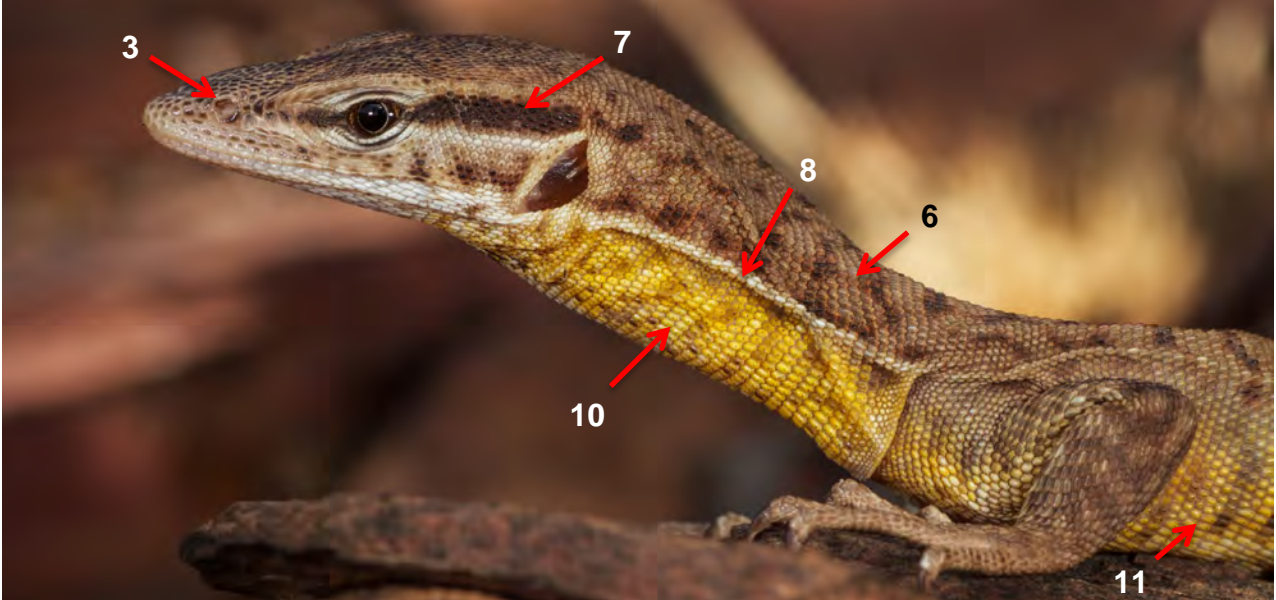
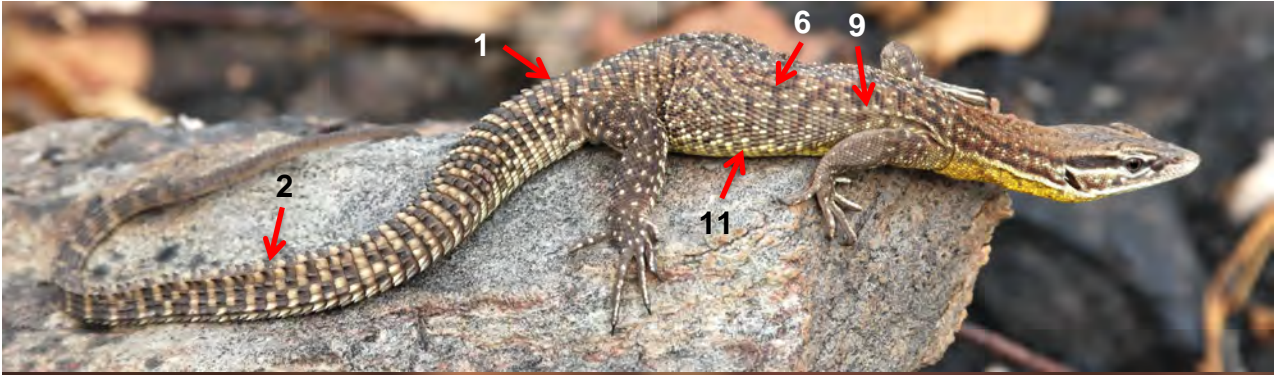
Size/weight of hatchlings: 7.8-9.4 cm TL; 5.2-6.2 cm SVL; weight unknown

Growth rate: See above

Captive breeding: The species is rarely kept and bred in captivity.

Ecology: Diurnal (↔) (morning and afternoon); terrestrial (↔); saxicolous (↔) in rocky outcrops; inhabits grasslands and diverse woodlands; shelters in crevices or in burrows under rocks; opportunistic feeding behaviour, preys on insects and spiders

Remarks: Under the EPBC Act (↔) the export of live specimens for commercial purposes is prohibited; in the period 1990-2018 no commercial exports are documented (CITES trade database); *V. baritji* is considered a member of Australia's spiny-tailed monitor lizards.



Varanus baritji. Above: adult, 70 km south of Adelaide River, NT, Australia, © Bernd Eidenmüller; centre: adult, Adelaide River, NT, Australia, © Jasmine Vink; below, adult, Adelaide River, NT, Australia, © Ruchira Somaweera

Varanus brevicauda Boulenger, 1898

Subgenus: *Odatria*

English names: Short-tailed Pygmy Monitor, Short-tailed monitor/goanna, Pygmy monitor

German name: Kurzschwanzwaran

Local name: -

Synonyms: None

Subspecies: None

International conservation status (CITES / Commission Reg. (EU) No 2017/160): Appendix II/B

IUCN Red List status: Least Concern (LC), population trend stable (last assessed 2017)

Distribution: Mainly Western Australia (WA), interior Northern Territory, northern South Australia, south-western Queensland

Total length (TL): 25 cm; **Snout-vent length (SVL):** 12.6 cm

Morphological traits (adults): Second smallest *Varanus* species (after *V. sparnus*); elongate body, short fore and hind limbs (1); tail short, about as long as SVL, in some populations smaller in some larger than SVL, first section broad, muscular and roundish in cross section (2), last third of prehensile (↔) tail rather triangular in cross section, without a keel (↔) above; scales on tail above and below equal in size, forming continuous rings; small oval-shaped nostrils located slightly closer to eye than to tip of snout (3); supraoculars (↔) not differentiated; less curved claws

Colour pattern: Dorsum (↔) and upper tail brownish to reddish-brown; distinct blackish network pattern on dorsum and legs (4), in some individuals also on body sides (5); dark faint temporal (↔) streak (6); upper head more greyish and occasionally covered with tiny white spots; ventral surfaces are whitish to pale brown

Similar species: *V. sparnus* is smaller and has a more elongated body, shorter extremities, less distinct pattern; fore limbs anteriorly (↔) with larger squarish scales that are not encircled by granules (↔)

Size/age at sexual maturity: ♂ at 7-8.2 cm SVL with 10 months; ♀ at 8.3-9.4 cm SVL with approximately 22 months

Clutch size: 2-3 eggs per clutch; in one instance 8 eggs in 3 clutches were laid within 6 weeks.

Incubation period/temperature: 70-84 days at 18-25 °C

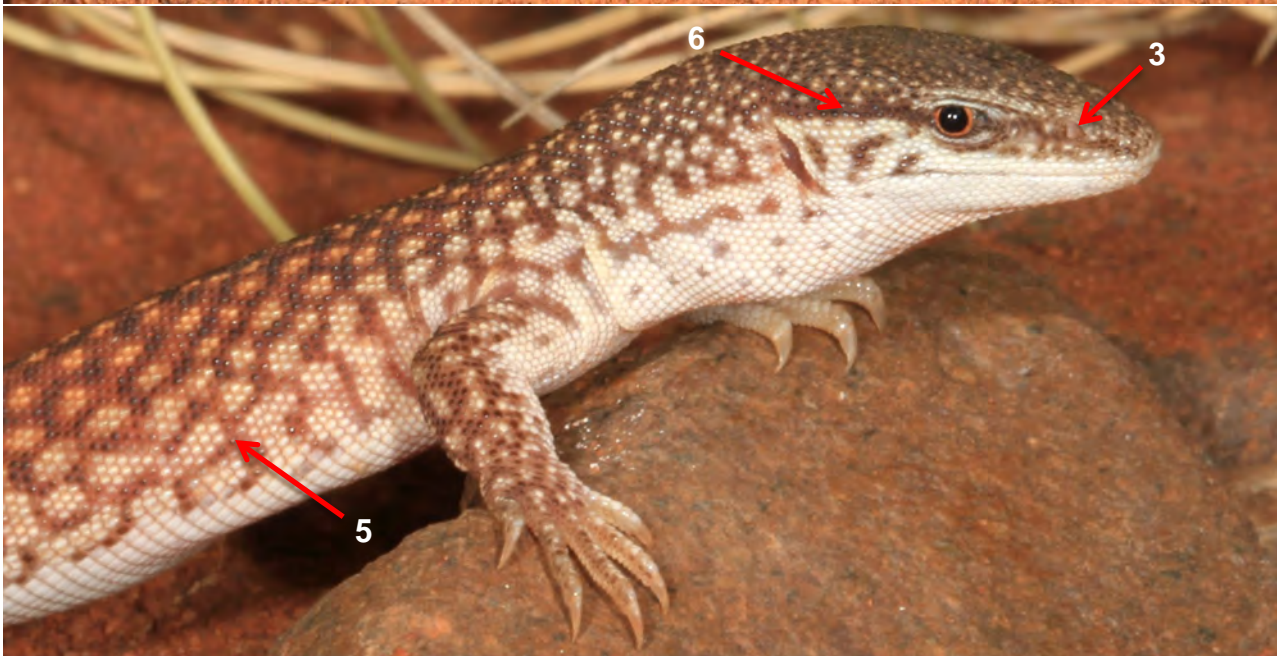
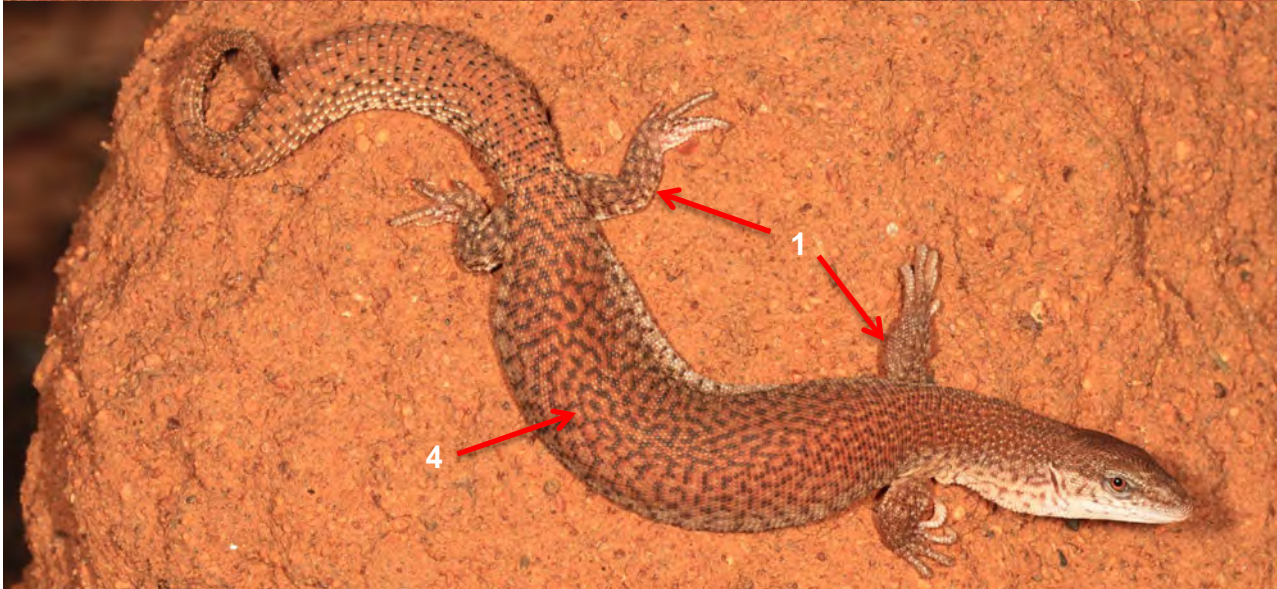
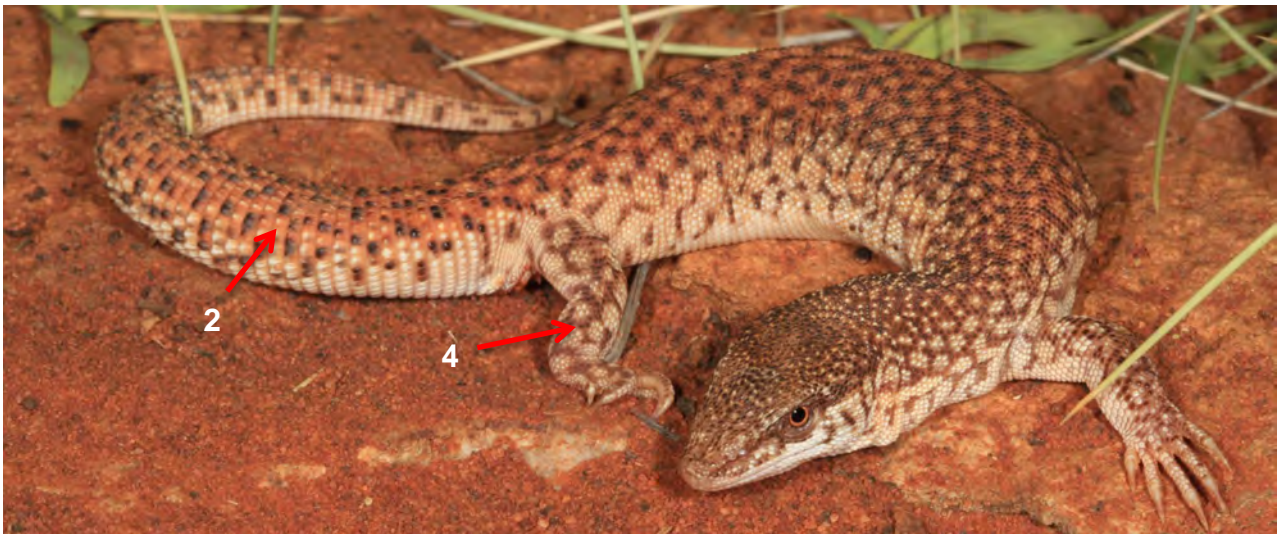
Size/weight of hatchlings: 4.2-4.5 cm SVL, 8-10 cm TL; approx. 1-3 g

Growth rate: In captivity weight can double within one month; sexual maturity with 2 years (see above)

Captive breeding: Not commonly housed and bred in captivity; sand as a digging substrate of about 25 cm depth is recommended.

Ecology: Diurnal (↔) in open shrub and grassland, sand dunes and desert sand plains; terrestrial (↔); distinctive burrowing behaviour; ambush predator that largely feeds on invertebrates (nematodes, spiders, insects) and opportunistically on small lizards (skinks, geckos).

Remarks: Under the EPBC Act (↔) the export of live specimens of *V. brevicauda* for commercial purposes is prohibited, but global trade in individuals sourced C (↔) and wild specimens (for scientific purposes) is documented (CITES trade database).



Varanus brevicauda. Above: adult, Lorna Glen Station, WA; centre: adult, Davidson Creek, WA; below: Lorna Glen Station, WA, © Ryan J. Ellis

Varanus bushi Aplin et al., 2006

Subgenus: *Odatria*

English names: Bush's monitor, Pilbara mulga goanna

German name: Bushs Waran

Local name: -

Synonyms: None; prior to its description *V. bushi* was scientifically treated as *V. caudolineatus* and/or *V. gilleni*.

Subspecies: None

International conservation status (CITES / Commission Reg. (EU) No 2017/160): Appendix II/B

IUCN Red List status: Least Concern (LC), population trend stable (last assessed 2017)

Distribution: Pilbara region, Western Australia (WA)

Total length (TL): 23.5 cm (♂); **Snout-vent length (SVL):** 14.5 cm (♂); 14 cm (♀)

Morphological traits (adults): Small species with slightly extended snout; nostrils located closer to eye (1) than to tip of snout; supraoculars (↔) smaller than scales on rostrum (↔), frontal (↔) and parietal (↔) region; elongate scales on dorsum (↔) (about twice as long as wide) lacking keels (↔); tail has no dorsal crest (↔), at base slightly triangular (2), distally (↔) with moderately spine-shaped scales (3), and roundish in cross-section, tail slightly longer than SVL; scales on tail above and below equal in size, forming continuous rings; number of midbody scales (↔) ranges between 98-123 (Ø 107.4; n = 21)

Colour pattern: Ground colour of head and entire dorsum greyish to reddish-brown; anterior (↔) dorsum with fine blackish spots; tail paler grey/light brown; occasionally specimens show varying dots, arranged into faint transverse bands of smaller and large dots beginning behind fore limbs (4); gular region (↔), neck and belly pale whitish and densely spotted (5); tail-base to first third shows cross-bands (6), further down with longitudinal stripes (7); **juveniles:** no published data

Similar species: In *V. gilleni* almost round dorsal scales, ventrum (↔) only marginally spotted, number of midbody scales ranges between 96-118 (Ø 109.4; n = 20); *V. caudolineatus* with less elongate ovate dorsal scales, head and neck distinctly spotted, pattern of tail more irregular, number of midbody scales (↔) ranges between 78-107 (Ø 91.2; n = 117)

Size/age at sexual maturity: No published data, probably similar to *V. caudolineatus*/*V. gilleni*

Clutch size: No published data, probably similar to *V. caudolineatus*/*V. gilleni*

Incubation period/temperature: No published data, probably similar to *V. caudolineatus*/*V. gilleni*

Size/weight of hatchlings: No published data, probably similar to *V. caudolineatus*/*V. gilleni*

Growth rate: No published data, probably similar to *V. caudolineatus*/*V. gilleni*

Captive breeding: No published data

Ecology: Diurnal (↔); terrestrial (↔) and arboreal (↔) in *Acacia* and *Eucalyptus* dominated dry woodlands; frequents hollow trees; prey probably similar to that of *V. caudolineatus*/*V. gilleni*

Remarks: Under the EPBC Act (↔) the export of live specimens of *V. bushi* for commercial purposes is prohibited, but global trade with the similar species *V. caudolineatus* and *V. gilleni* of individuals sourced C (↔), F (↔), and wild was documented (CITES trade database). Therefore, *V. bushi* was likely traded unnoticed under the names of these two species.



Varanus bushi. Adult, Munjina, WA, Australia, © Jordan Vos

Varanus caudolineatus Boulenger, 1885

Subgenus: *Odatria*

English names: Line-tailed pygmy monitor, Stripe-tailed pygmy monitor, Pygmy stripe-tailed monitor

German name: Streifenschwanzwaran

Local name: -

Synonyms: None

Subspecies: None

International conservation status (CITES / Commission Reg. (EU) No 2017/160): Appendix II/B

IUCN Red List status: Least Concern (LC), population trend stable (last assessed 2017)

Distribution: Western Australia (WA)

Total length (TL): 32 cm; **Snout-vent length (SVL):** 12.5 cm (♂); 11.8 cm (♀)

Morphological traits (adults): Small species; short, broad and dorsoventrally (←) compressed tail (1), not longer than 1.25 times SVL, without a keel (←) above; tail scales prominently keeled (←), above and below equal in size, forming continuous rings; nostrils roundish/oval located in the middle between tip of snout and eye (2); supraoculars (←) not differentiated; scales on upper arms and thighs without keels; scales in neck region and body slightly raised; number of midbody scales (←) ranges between 78-107 (Ø 91.2; n = 117)

Colour pattern: Two colour morphs exist; usually greyish to yellowish ground colour on dorsum (←) or some individuals with reddish-brown band on dorsum (3) occasionally extending to upper tail; head and neck dark, more densely spotted (4) than dorsum that shows larger brown/blackish spots (5); spots smaller on first part of upper tail, followed by about 4-6 broken longitudinal streaks (6); distinct dark supra-temporal stripe (7); gular region (←) with light greyish speckles that extend to the ventrum (←) (8), in some specimens entire ventrum indistinctly spotted; in **juveniles** spotting on head very dense, light grey ground colour appears as network

Similar species: Scales on neck and body in *V. gilleni* and *V. bushi* less protruding; in *V. bushi* ventrum more spotted, dorsum more irregularly spotted, lines on head and neck less distinct, scales on dorsum more elongate/ovate than in *V. caudolineatus/gilleni*, number of midbody scales ranges between 98-123 (Ø 107.4; n = 21); in *V. gilleni* dorsal scales roundish, only margins of ventrum with spots otherwise plain white-yellowish, number of midbody scales ranges between 96-118 (Ø 109.4; n = 20)

Size/age at sexual maturity: ♀ at about 8.5 cm, ♂ at about 9 cm SVL; age unknown

Clutch size: 3-6 eggs per clutch; up to 4 clutches per season; in captivity 2-3 clutches per year

Incubation period/temperature: 77 days at 29-31 °C

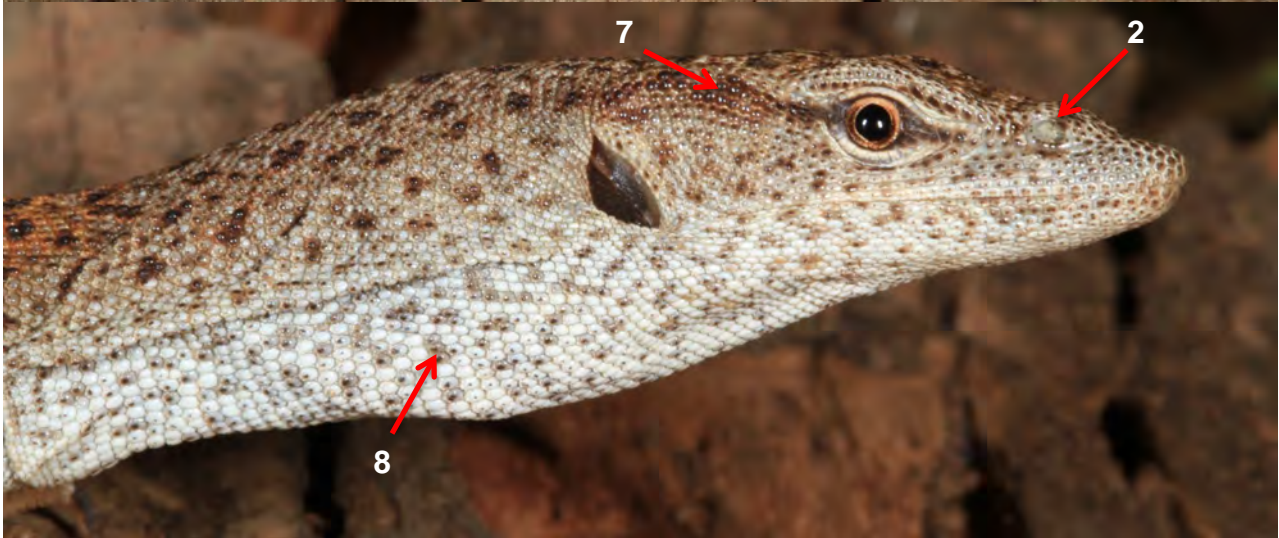
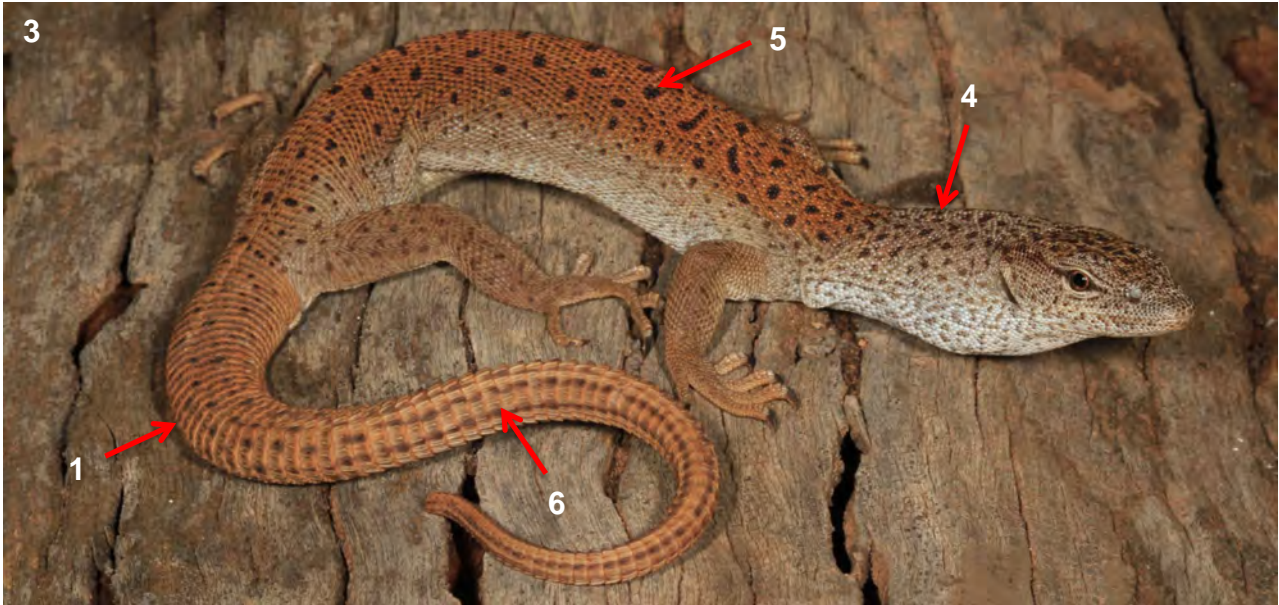
Size/ weight of hatchlings: 11.5 cm TL; 5.4 cm SVL; 1.5-2.5 (Ø 1.9) g

Growth rate: No published data

Captive breeding: Clearly less often bred than *V. gilleni*; husbandry conditions are probably similar to that of *V. gilleni*.

Ecology: Diurnal (←); semi-arboreal (←); inhabits *Acacia aneura* woodlands; shelters under bark, in tree hollows or in rock crevices; preys on arthropods and smaller reptiles (geckos and their tails, skinks)

Remarks: Under the EPBC Act (←) the export of live specimens of *V. caudolineatus* for commercial purposes is prohibited; however, since 1988 global trade of individuals sourced C (←) and wild (for scientific purposes) is documented (CITES trade database).



Varanus eremius Lucas & Frost, 1895

Subgenus: *Odatria*

English names: Rusty desert monitor, Desert pygmy monitor, Pygmy desert monitor

German name: Einsiedelwaran

Local name: -

Synonyms: None

Subspecies: None

International conservation status (CITES / Commission Reg. (EU) No 2017/160): Appendix II/B

IUCN Red List status: Least Concern (LC), population trend stable (last assessed 2017)

Distribution: Western Australia (WA), South Australia (SA), Northern Territory (NT), Queensland

Total length (TL): 50 cm; **Snout-vent length (SVL):** 17 cm

Morphological traits (adults): Small species; body mass \bar{X} 41.5 g (n = 33); about basal half of tail dorsoventrally (←) compressed (1), distally (←) more roundish in cross-section; tail length between 1.5-1.9 times SVL, without distinct double crest (←) above; scales on tail above and below equal in size, forming continuous rings; short and relatively high head; nostrils roundish oval to triangular located closer to tip of snout than to anterior edge of eye (2); supraoculars (←) slightly smaller than scales on interorbital (←) and parietal region (←); scales on top of head, temporal region (←), dorsum (←), thighs distinctly keeled (←); number of midbody scales ranges between 85-110

Colour pattern: Ground colour of dorsum and nape region reddish to grey-brownish with more or less distinct dark flecks (3), that may be arranged into 6 longitudinal rows alternating with lighter dots (4); dark supra-temporal (←) stripe individually variable pronounced (5); below ear white/yellowish line that extends to upper forearm (6); front and hind limbs with white dots, sometimes indicating blackish white-centred ocelli (←) (7); ground colour of upper and lateral tail dark greyish with white/yellowish longitudinal lines, median line always light, ochre (8), ventral surface of tail pale; gular region (←) with grey spots; chin with a light grey median longitudinal band showing a "V" tapering to the tip of the snout (9); upper head in some specimens with irregular dark and light lines; occasionally supraorbital region (←) with symmetrical dark lined triangular shapes (10); in **juveniles** the colour pattern is generally richer in contrast.

Similar species: None

Size/age at sexual maturity: ♀ at 11 cm SVL, ♂ at 11.6 cm SVL; at about 8-14 months

Clutch size: 2-6 eggs per clutch

Incubation period/temperature: 58-90 days at 28-30 °C

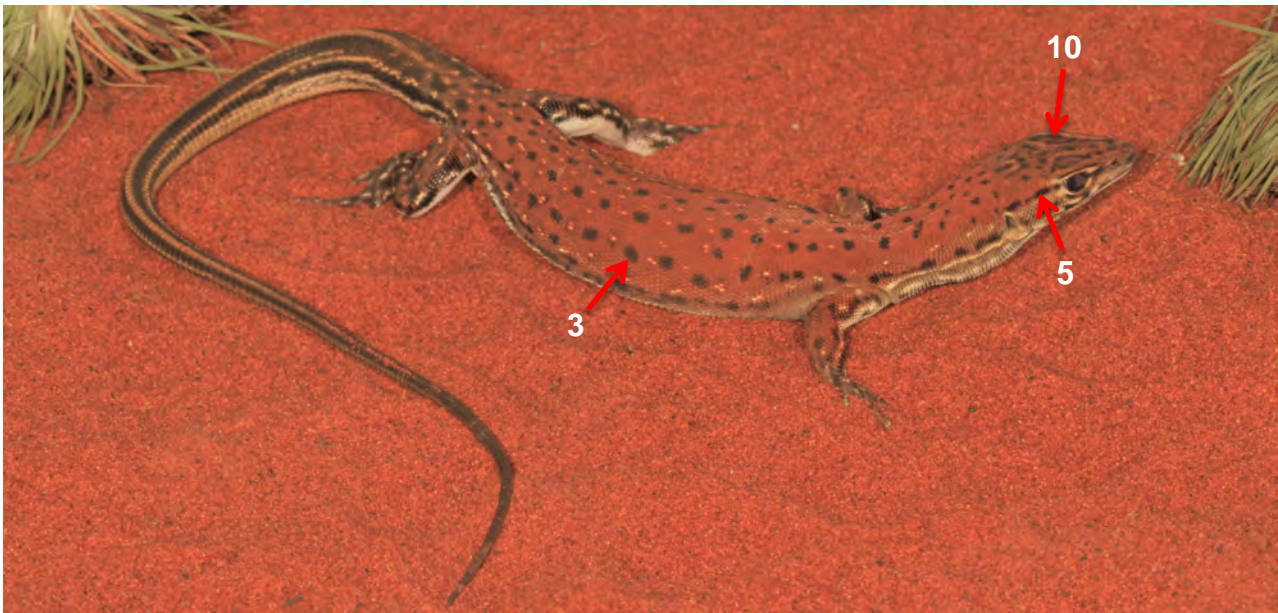
Size/weight of hatchlings: 5.9-6.4 cm SVL; 1.9-3.3 g

Growth rate: Unknown

Captive breeding: Rarely housed in captivity; breeding records are scarce

Ecology: Diurnal (←); pronounced terrestrial (←); associated with red sand deserts vegetated with spinifex (*Triodis* sp.); seeks shelter beneath shrubs and in burrows; predominantly preys on geckos, skinks, to a lesser amount takes larger arthropods (grasshoppers, scorpions)

Remarks: Under the EPBC Act (←) the export of live specimens for commercial purposes is prohibited; between 1979-2017 few exports of wild specimens for commercial and scientific purposes were documented worldwide (CITES trade database)



Varanus eremius. Above: adult, Beyondie Station, WA, Australia, © Ryan Ellis; centre, below left and right: adult, Pannawonica, WA, Australia, © Brian Bush

Varanus gilleni Lucas & Frost, 1895

Subgenus: *Odatria*

English names: Gillen's pygmy monitor, Gillen's monitor/goanna, Pygmy mulga monitor/goanna

German name: Gillens Zwergwaran

Local name: -

Synonyms: None

Subspecies: None

International conservation status (CITES / Commission Reg. (EU) No 2017/160): Appendix II/B

IUCN Red List status: Least Concern (LC), population trend stable (last assessed 2017)

Distribution: South Australia, Northern Territory (NT), Western Australia, Queensland, Australia

Total length (TL): 40 cm; **Snout-vent length (SVL):** 18 cm

Morphological traits: Small species; tail short not longer than 1.3 times SVL; front part of tail slightly laterally compressed, then round in cross-section (1); tail has no dorsal keel (↔); scales on tail above and below equal in size, forming continuous rings; head short and broad; nostrils roundish to oval, located in the middle between tip of snout and anterior eye or slightly towards eye (2); supraoculars (↔) not differentiated; smooth, unkeeled scales on upper arms and thighs (3); number of midbody scales (↔) ranges between 96-118 (Ø 109.4; n = 20); also smooth scales on dorsum (↔), roundish and slightly longer than wide; pineal organ (↔) distinct

Colour pattern: ground colour sand-coloured/greyish, dorsum in some individuals with yellow or reddish-brown tinge (4); irregular pattern with subtle cross stripes on top of front head (5); longitudinal lines in nape region (↔) (6) and reddish-brown cross-stripes on dorsum (7) and upper tail base (8); extent of up to 4 longitudinal stripes of tail varies individually (9), pattern can also be distinctively reduced; dark supra-temporal stripe distinct (10); gular region (↔) with light greyish speckles; ventrum (↔) only laterally spotted, otherwise plain yellowish white

Similar species: In *V. bushi* ventrum more spotted, dorsum more irregularly spotted, lines on head and neck less distinct, scales on dorsum more elongate/ovate than in *V. gilleni* and *V. caudolineatus*; number of midbody scales ranges between 98-123 (Ø 107.4; n = 21); in *V. caudolineatus* head pattern distinctly spotted, dorsum without streaks/lines; tail lacks transverse bands from base to about one third towards tail-tip, scales on dorsum more elongate than in *V. gilleni*; number of midbody scales ranges between 78-107 (Ø 91.2; n = 117)

Size/age at sexual maturity: ♀ at ca. 9.5 cm SVL, ♂ at 10 cm SVL; age unknown

Clutch size: 4-7 eggs per clutch in the wild, in captivity 1-6 eggs; several clutches per year

Incubation period/temperature: 84-131 days at 26-32 °C

Size/weight of hatchlings: 11-14.2 cm TL; 5-6 cm SVL; 2.2-3.8 g

Growth rate: SVL in captive-born specimens increased double-fold in 2 years, in the following six years increase of only 2.5 cm; at a SVL of 14.5 cm age is >10 years

Captive breeding: Successful breeding has been repeatedly reported in zoos and the private sector; breeding couples can be maintained in one enclosure; occasional separation is recommended; adding a second ♂ may stimulate copulation

Ecology: Diurnal (↔); semiariboreal (↔); occurs in arid to semi-arid woodlands (*Acacia*, *Casuarina*, *Eucalyptus*), displays secretive life habits, seeks refuge commonly under bark; preys on insects, smaller reptiles (gecko tails), bird's eggs and mammals

Remarks: Under the EPBC Act (↔) the export of live specimens for commercial purposes is prohibited, but since 1979 international exports of individuals sourced C (↔), F (↔) and wild (for scientific purposes) was documented (CITES trade database); loss of suitable habitat imposed by intensive livestock grazing



Varanus gilleni. Above and centre: adult, Barkly Tableland, NT, Australia, © Gary Stephenson; below: adult, Alice Springs, NT, Australia, © Jordan Vos

Varanus glauerti Mertens, 1957

Subgenus: *Odatria*

English names: Kimberly rock monitor, Glauert's monitor

German name: Kimberley Felsenwaran

Local name: -

Synonym: *Varanus timorensis glauerti*

Subspecies: None; formerly *V. glauerti* was scientifically described as a subspecies of *V. timorensis*; the taxonomic status of the western population remains uncertain

International conservation status (CITES / Commission Reg. (EU) No 2017/160): Appendix II/B

IUCN Red List status: Least Concern (LC), population trend stable (last assessed 2017)

Distribution: Kimberley region, Western Australia (WA) and north-western Arnhem, Northern Territory (NT)

Total length (TL): 80 cm; **Snout-vent length (SVL):** 25 cm

Morphological traits (adults): Medium-sized, slender species; weight of ♂ (∅) 95 g, ♀ (∅) 60 g; long whip-like tail, ca. 1.8 times SVL; tail base to first third distally (↔) slightly dorsoventrally (↔) compressed (1), further distally (↔) roundish in cross section; scales on tail above and below equal in size, forming continuous rings; long neck, flat head; nostrils roundish, located slightly closer to tip of snout than to eye (2); supraoculars (↔) (3) much smaller than scales in the interorbital region (↔) (4); number of midbody scales (↔) ranges between 122-151

Colour pattern: There is considerable variation of colour and pattern between populations in the western Kimberly and eastern Kimberly plus Arnhem Land; ground colour of dorsum (↔) is greyish in western populations, yellowish/reddish-brown in eastern populations; dorsally (↔) 5-8 transverse rows of light greyish spots with a tinge of turquoise/light blue merge into bands (5) and alternate with rows of smaller spots in-between that are individually differently pronounced (6); nape region also shows these cross bands, individually rows of smaller spots are lacking (7); in Arnhem populations ground colour of neck is distinctly rusty, with transverse rows of yellowish/orange spots, in some individuals of western populations nape appears overall light greyish with a bluish tinge, spots are completely merged with each other (8); temporal region (↔) with prominent black streak (9) and second dark streak (occasionally less distinct) commencing above last third of upper jaw across ear opening (10), both are separated by a whitish/yellowish streak (11); dark grey/blackish limbs with cross rows of pale spots; tail base, and in some individuals first third of tail, with less distinct light/dark bands (12), then distally sharply demarcated from each other in whitish and blackish bands (13); chin and gular region (↔) whitish/yellow; pale greyish ventrum (↔) sometimes with indistinct transverse bands; tongue pinkish; in **juveniles** the entire tail is prominently banded; colours of dorsum more bright

Similar species: None

Size/age at sexual maturity: Both sexes at ca. 15 cm SVL; at ca. 6-8 months

Clutch size: In captivity 3-12 (∅ 9) eggs per clutch; up to 8 clutches per year; one ♀ laid 68 fertile eggs in 8 months

Incubation period/temperature: 104-110 days at 28.5-29.5 °C

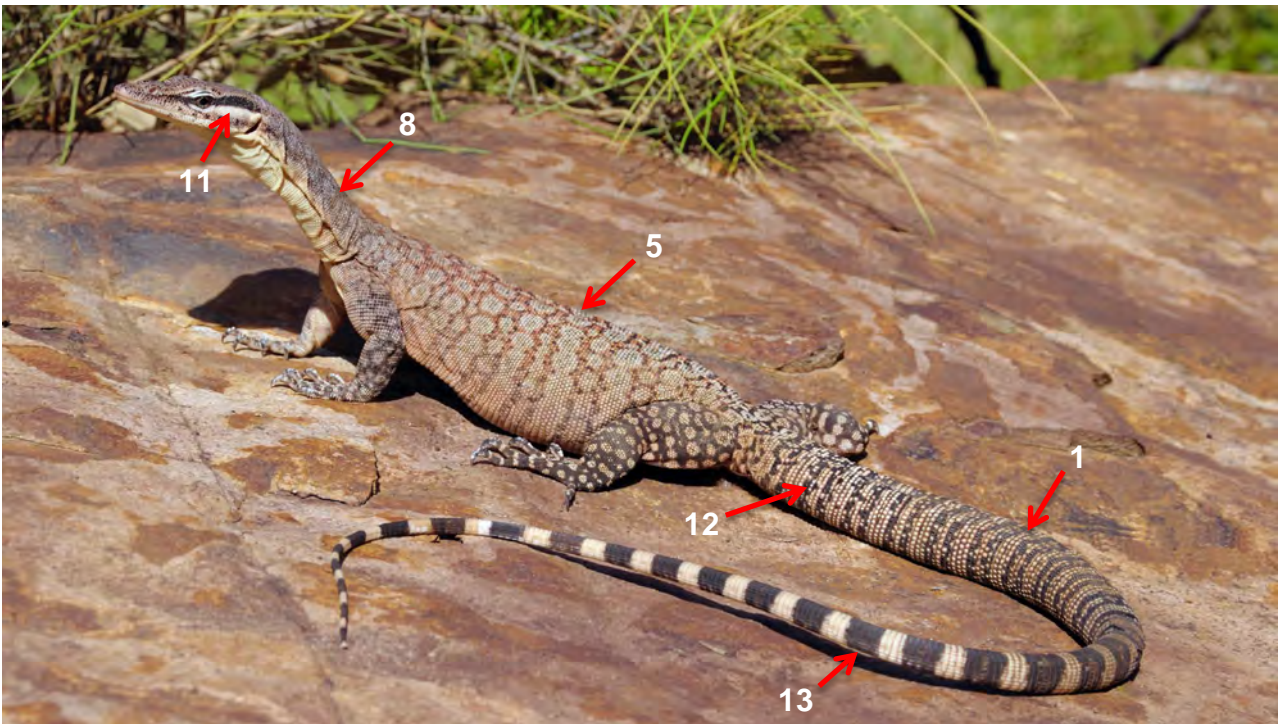
Size/weight of hatchlings: 18-25 cm TL; 5.6-7 cm SVL; 2.3-4.2 g

Growth rate: 6.5-month-old individuals have an increase in SVL of ca. 8-9 cm

Captive breeding: Internationally successfully bred in captivity on numerous occasions; as reported, breeders in Europe and the United States supply the international market with captive-bred specimens.

Ecology: Diurnal (↔), to some extent nocturnal (↔) hunting behaviour; arboreal (↔); terrestrial (↔); also utilizing rocky habitats; preys on insects, spiders, lizards (skinks, geckos) and their eggs

Remarks: Under the EPBC Act (↔) the export of live specimens for commercial purposes is prohibited; 90 shipments have been reported since 1997, mainly documenting the export of individuals sourced as C (↔) (CITES trade database).



Varanus glauerti. Above: adult, captive, foundation animals from the Bullo River district, NT, © Gary Stephenson; centre and below: adult, Lake Argyle, WA, © Ruchira Somaweera

Varanus glebopalma Mitchell, 1955

Subgenus: *Odatria*

English names: Black-palmed rock monitor, Black-footed rock monitor, Long-tailed rock monitor, Twilight goanna

German name: Polsterhandwaran

Local name: -

Synonyms: None

Subspecies: None

International conservation status (CITES / Commission Reg. (EU) No 2017/160): Appendix II/B

IUCN Red List status: Least Concern (LC), population trend stable (last assessed 2017)

Distribution: Western Australia (WA), Queensland, Northern Territory (NT), Australia

Total length (TL): 110 cm; **Snout-vent length (SVL):** 39 cm

Morphological traits (adults): Medium-sized, slender species, weight (\emptyset) in ♂ 240 g, in ♀ 130 g; long, whip-like tail; tail length approximately 1.7 times SVL, at base dorsoventrally (↔) depressed, distally (↔) roundish in cross section (slightly laterally compressed); long neck and distinctly flat head; underside of digits, palms and soles is rubbery; nostrils lateral, roundish, located in the middle between eye and tip of snout (1); supraoculars (↔) much smaller than scales in the interorbital region (↔); number of midbody scales (↔) ranges between 132-179 (\emptyset 150)

Colour pattern: Ground colour of dorsum (↔) brownish/olive to grey/blackish with either distinct blackish reticulations (also nape region) (2), or pale brownish to dark brownish with indistinct and fading reticulations (3); reticulations resemble honeycomb pattern, each "cell" is black-centred with a ring of whitish scales (4); uneven thin blackish streak from behind the nostril (5) to temporal region (↔) that shows indistinct reticulations (6), also on nape region (7); dark barred labial region (8); first part of tail dark with light indistinct bands, gradually these fade and tail is almost black; last third of tail pale ochre/yellowish to whitish without pattern (9); dark limbs with whitish spots; gular region (↔) and ventrally (↔) between fore limbs pale whitish/greyish with indistinct reticulated pattern (10), white spots and grey, or irregular transverse blackish bands; underside of digits, palms and soles glossy black; **juveniles** with crossbands of white/yellowish/ochre ocelli on dark dorsum; head sides, neck and anterior dorsum show distinct reticulated pattern; whitish/yellowish pale tail-tip, occasionally with indistinct darker crossbands

Similar species: None

Size/age at sexual maturity: Both sexes at about 17 cm SVL; age unknown

Clutch size: 4-6 eggs per clutch; number of clutches per year unknown

Incubation period/temperature: No published data

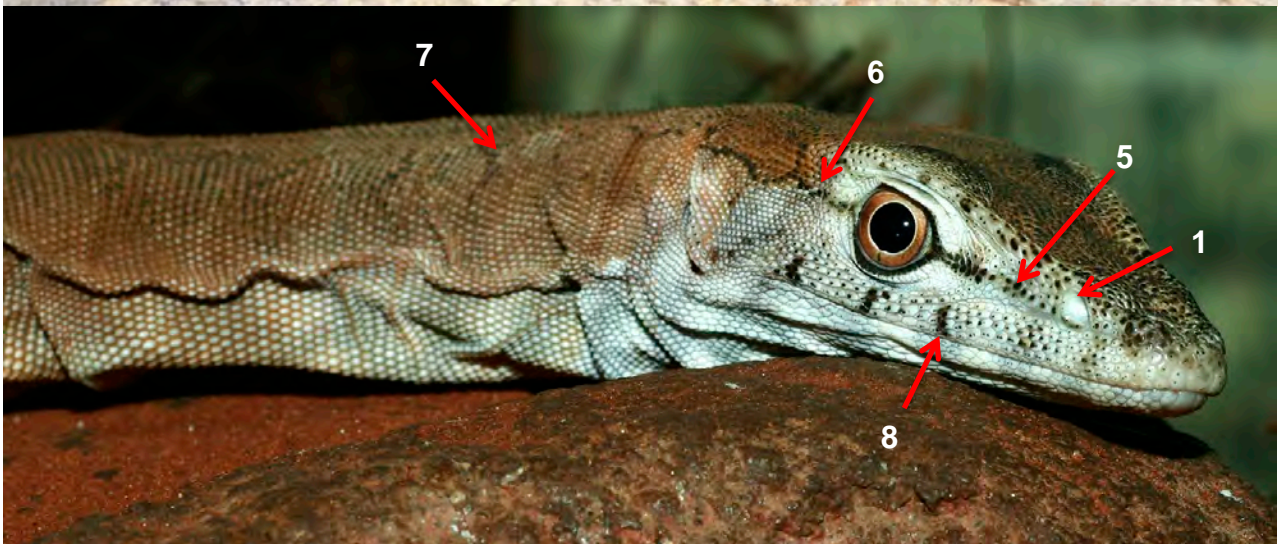
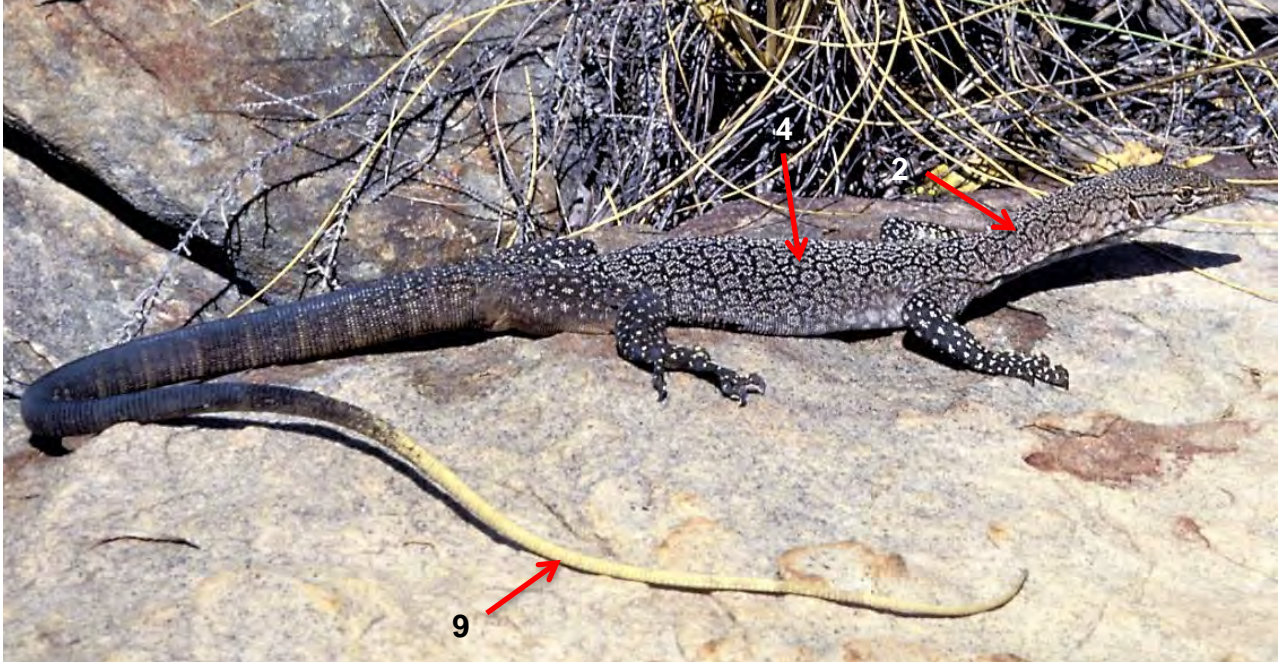
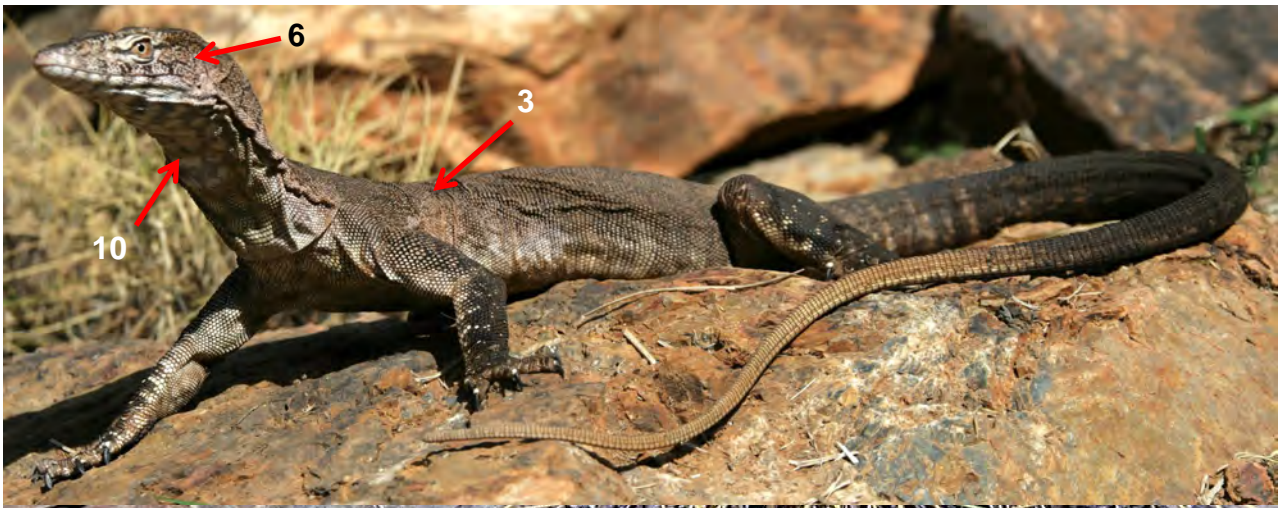
Size/weight of hatchlings: 9 cm SVL; weight unknown

Growth rate: No published data

Captive breeding: Rarely kept in captivity; breeding data in captivity is scarce

Ecology: Diurnal (↔), to some extent nocturnal (↔) hunting behaviour has been observed; saxicolous (↔); strongly associated to rocky habitats with a preference for granite and sandstone in Monsoon forests and dry woodlands; shelters in rocky crevices and caves; secretive nature; opportunistically feeds on a wide range of invertebrates and vertebrates, favourably preys on frogs and lizards including other monitor species; with seasonal shifts feeding either mainly on skinks or grasshoppers

Remarks: Under the EPBC Act (↔) the export of live specimens for commercial purposes is prohibited; the CITES trade database documents three transactions between 1998 and 2001, including one seizure of a commercial export and the export of 12 specimens for scientific purposes.



Varanus glebopalma. Above: adult, Litchfield National Park, NT, © Bernd Eidenmüller; centre: adult ♀, Koongarra Saddle, south of Jabiru, Kakadu National Park, NT, (published in 1999, *Mertensiella* volume 11), © Samuel Sweet; below, adult, Kununurra, WA, © Ruchira Somaweera

Varanus hamersleyensis Maryan et al., 2014

Subgenus: *Odatria*

English names: Southern Pilbara rock goanna, Southern Pilbara rock monitor

German name: Südlicher Pilbara Felsenwaran

Local name: -

Synonyms: None; prior to its description, *V. hamersleyensis* was scientifically treated as *V. pilbarensis*.

Subspecies: None; species status of *V. hamersleyensis* is considered uncertain by some authors.

International conservation status (CITES / Commission Reg. (EU) No 2017/160): Appendix II/B

IUCN Red List status: Least Concern (LC), population trend stable (last assessed 2017)

Distribution: Hamersley Range, Western Australia (WA)

Total length (TL): 43 cm; **Snout-vent length (SVL):** 16 cm

Morphological traits (adults): Small, slender species; tail thin and long, in the middle roundish in cross section, without a dorsal (←) keel (←) (1), tail length can be more than double size of SVL; cloacal region (←) with long pointed scales in 4-6 rows; dorsal and ventral (←) scales of tail similar in size forming continuous rings around tail, at approximate half-length moderately keeled, near the tip of tail with sharp keels; nostrils slit-shaped, oval or roundish, located in the middle between eye and tip of snout (2); supraoculars (←) not enlarged; number of midbody scales (←) ranges between 120-122

Colour pattern: Distinctly pale orange to reddish brown head gradually darkening towards dorsum (←), hind limbs and tail; head in some specimens with irregular set of small darker spots, snout can be dark or orange/yellow at head sides; lower jaw with darker vertical stripes (3); gular region (←) with reddish cross bands on white/yellowish to white/greyish ground colour (4); dorsum with numerous small dark blackish spots/scales (5), which partly merge to narrow wavy lines and form network; forelimbs middle to dark reddish brown, speckled dark brownish/black while hind limbs show white/yellowish scales on dark grey/brownish ground colour (6); digits (←) on fore and hind limbs show indistinct pale whitish/yellowish bands; tail pale brownish speckled with dark spots along its entire length; ventrum (←) and underside of limbs greyish/white; **juveniles** are brighter and more contrasting in colour pattern, dorsum with more distinct dark spots, ventrum marked with cross-bands, tail ringed

Similar species: Tail of *V. pilbarensis* with distinct white/yellowish and black, then greyish cross-bands, prominent greyish ocelli on dorsum and body sides as well as on hind limbs, that change to white/light yellow dots on lower legs and toes; number of midbody scales ranges between 118-128.

Size/age at sexual maturity: No published data, probably similar to *pilbarensis*

Clutch size: No published data, probably similar to *pilbarensis*

Incubation period/temperature: No published data, probably similar to *pilbarensis*

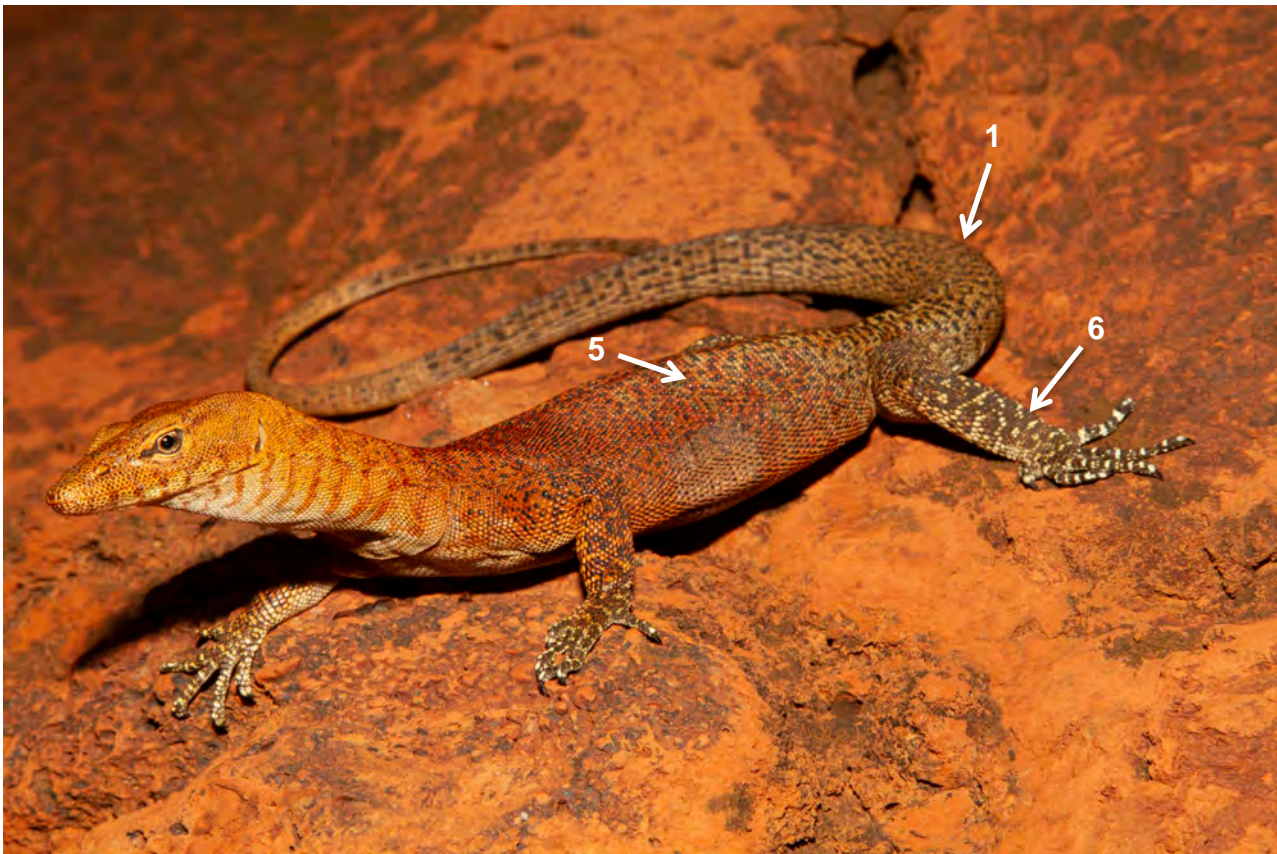
Size/weight of hatchlings: No published data, probably similar to *pilbarensis*

Growth rate: No published data, probably similar to *pilbarensis*

Captive breeding: No published data, probably similar to *pilbarensis*

Ecology: Diurnal (←) in rocky habitats favouring flat sheet ironstone; moves extremely agile in various rock formations and can shelter in overhangs or rock slabs; colour pattern is perfectly adapted to rocky underground; prey likely similar to that of *V. pilbarensis*

Remarks: Under the EPBC Act (←) the export of live specimens for commercial purposes is prohibited; no records of commercial trade in *V. hamersleyensis* exist, but global trade with individuals sourced C (←) and F (←) of *V. pilbarensis* was regularly documented (CITES trade database).



Varanus hamersleyensis. Above and below: adult, Rocklea Station, WA, Australia, © Ryan J. Ellis

Varanus kingorum Storr, 1980

Subgenus: *Odatria*

English names: Pygmy rock monitor, Long-tailed rock monitor, Kings' rock monitor

German name: Kings Felsenwaran

Local name: -

Synonyms: None

Subspecies: None

International conservation status (CITES / Commission Reg. (EU) No 2017/160): Appendix II/B

IUCN Red List status: Least Concern (LC), population trend stable (last assessed 2017)

Distribution: Interior of Western Australia (WA), Northern Territory (NT), Australia

Total length (TL): 40 cm; **Snout-vent length (SVL):** 12 cm

Morphological traits (adults): Small species; exceptionally long tail, at base oval, dorsoventrally (←) slightly compressed in cross-section (1), in the middle roundish to triangular, further down more elliptical in cross-section, tail length up to 2.5 times SVL, in juveniles about 1.7. times SVL; scales on tail with prominently keeled (←), equal in size above and below forming continuous rings around tail; bulged snout; nostrils dorsolaterally (←) located, closer to tip of snout than to eye (2); supraoculars (←) not differentiated; interorbital scales (←) enlarged; number of midbody scales (←) ranges between 97-108 (Ø 105; n = 5)

Colour pattern: Dorsum (←) and nape red-brown to greyish with angular shaped spots (3), that extend to body sides; reticulated pattern, occasionally forming ocelli (←) (4), that is less distinct in adults; ventrum (←) whitish, sometimes with spots; gular region (←) always dark spotted (5); tail without stripes or transverse bands, dorsolaterally with angular blotches (6); in **juveniles** reticulated pattern (honeycomb pattern) on dorsum and nape region distinct

Similar species: *V. gilleni*, *V. caudolineatus* and *V. eremius* have much shorter tails with longitudinal stripes; in *V. glebopalma* SVL more than three times longer, distal (←) part of tail pale ochre/yellowish to whitish without pattern; number of midbody scales ranges between 132-179 (Ø 150); *V. pilbarensis* with a colourful pattern, dorsum with transverse rows of ocelli that can merge, tail banded, number of midbody scales ranges between 118-128

Size/age at sexual maturity: At 70-75% of SVL in adults equal to about 8.4-9 cm SVL; both sexes at about 4 months

Clutch size: 2-6 eggs per clutch; up to 3-4 clutches per year or even 14 clutches in 14 months

Incubation period/temperature: 65-80 days at 30.6 °C or 89-126 days at 27-31 °C

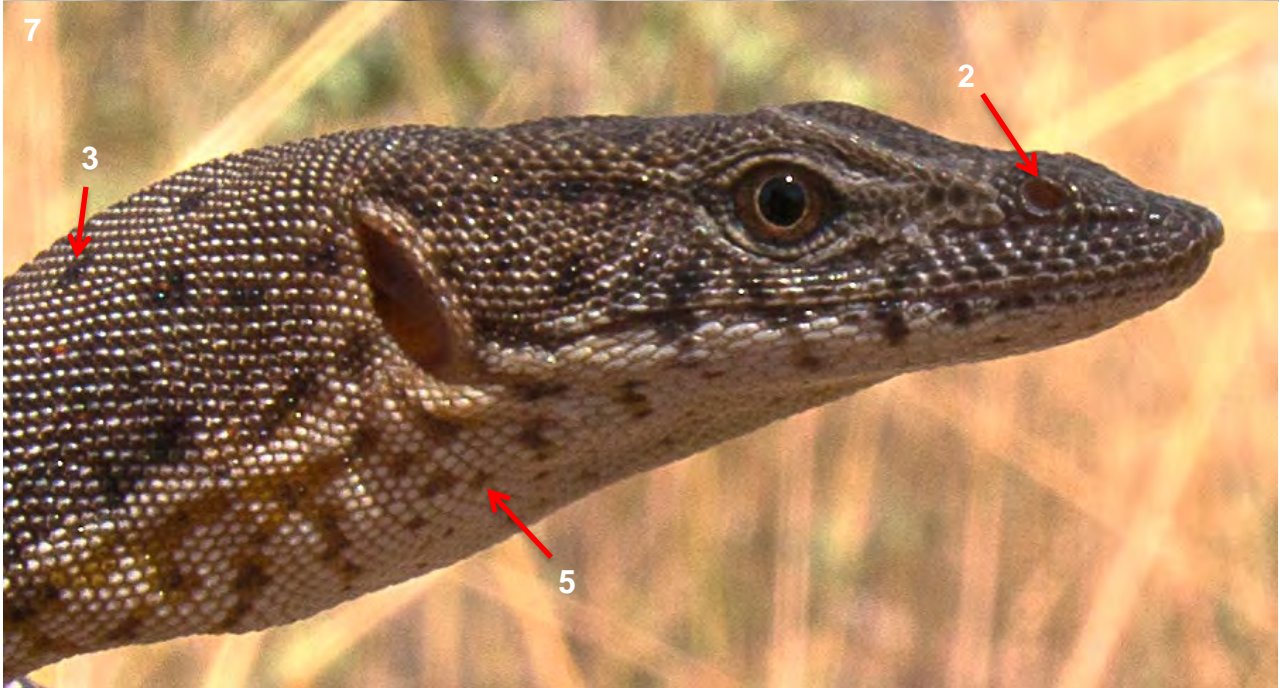
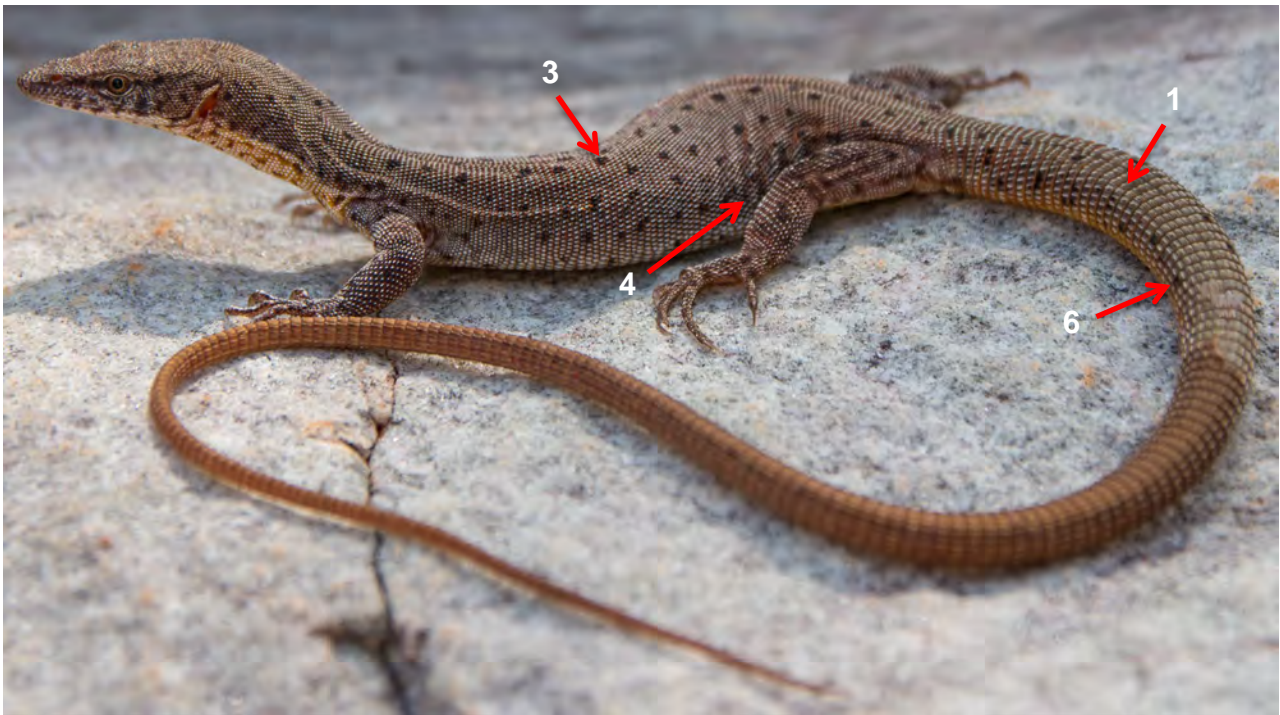
Size/weight of hatchlings: 13.1-14.5 cm TL; 4.4-5.5 cm SVL; 1.5-2.1 g

Growth rate: After 4 months: 8-9 cm SVL

Captive breeding: Remains uncommon in captive collections; still rarely bred in captivity; burrows are dug to lay eggs; productive period approximately 5 years long

Ecology: Diurnal (←); terrestrial (←); rock-dwelling species; associated to various rock habitats, outcrops in the plain or rock formations in hilly country; preys on larger insects

Remarks: Under the EPBC Act (←) the export of live specimens of *V. kingorum* for commercial purposes is prohibited; in the 1990s few exports of individuals sourced C (←), F (←) and wild were documented, while in the last 18 years more often shipments of predominantly C sourced individuals were documented (CITES trade database); *V. kingorum* is a species with a restricted range.



Varanus kingorum. Above and below: adult, Timber Creek, NT, Australia, © Chris Applin

Varanus mitchelli Mertens, 1958

Subgenus: *Odatria*

English names: Mitchell's water monitor, Mitchell's goanna

German name: Mitchells Waran

Local names: -

Synonyms: None

Subspecies: None

International conservation status (CITES / Commission Reg. (EU) No 2017/160): Appendix II/B

IUCN Red List status: Critically Endangered (CR), population trend decreasing (last assessed 2017)

Distribution: Western Australia (WA), Queensland, Northern Territory (NT), Australia

Total length (TL): 96 cm; **Snout-vent length (SVL):** 35 cm

Morphological traits (adults): Medium-sized, slender species; long tail, near base round in cross-section (1), distally (←) laterally compressed, triangular in cross-section; tail length 1.7-2.1 times SVL, with dorsal crest (←); nostrils oval-shaped, dorsolaterally (←), located slightly closer to tip of snout than to eye (2); supraoculars (←) not enlarged; number of midbody scales (←) ranges between 90-130

Colour pattern: Ground colour, olive/grey to black; along lower neck and dorsum (←) with distinct or less distinct ocelli (←) (3), or yellowish/orangish curls bordering black spots (4); neck and body sides with more whitish/yellowish or orange scales; black bars on lower jaw that taper off on whitish chin (5); anterior (←) gular region (←) yellowish with cross lines that become thinner towards the centre of gular region (←) (6); below eye to upper margin of ear opening pale orange stripe (7); front limbs blackish with yellow dots; hind limbs dark, occasionally with smaller orange dots; tail colour above brown/olive or black, near tail base laterally more yellow/orange scales; **juveniles** look almost as adults; blackish temporal (←) streak above an orange streak more distinct (more broken in adults)

Similar species: In *V. semiremex* the first quarter of tail is round in cross section; tail not longer than 1.5 times SVL; neck sides and gular region orange; dorsum without ocelli and yellowish/orange scales

Size/age at sexual maturity: At 22 cm SVL (sex unspecified)

Clutch size: 7-12 eggs per clutch in the wild, in captivity 13-27 eggs per clutch; in 7-9 weeks intervals up to six clutches per breeding season are possible

Incubation period/temperature: 90-150 days in the wild; in captivity 157-289 days at 26-31 °C

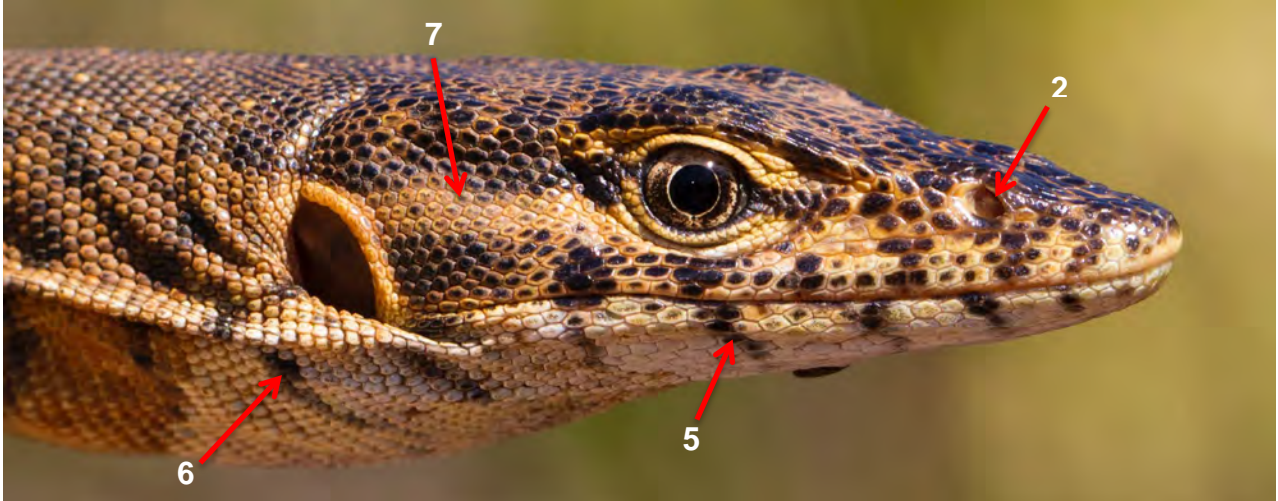
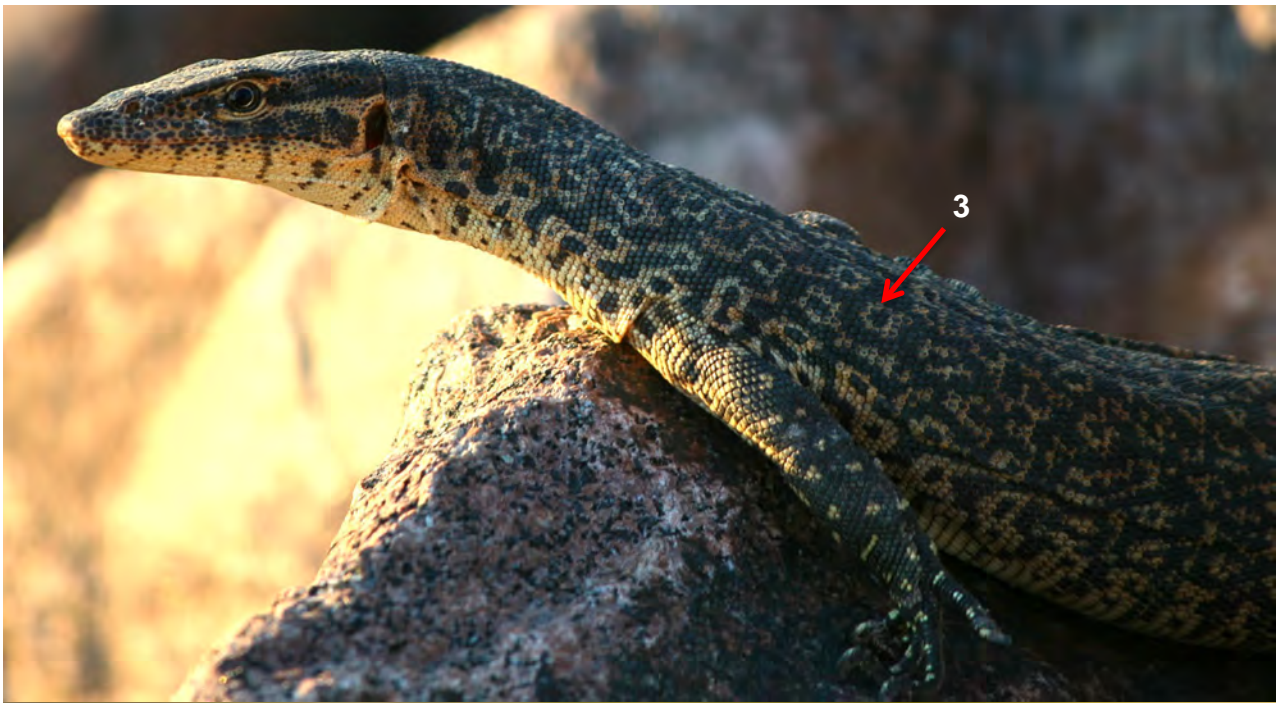
Size/weight of hatchlings: Ø 6.4 cm SVL; Ø 26.6 cm TL; Ø 3.6 g

Growth rate: SVL in hatchlings increased to 10 cm in about 7.5 weeks; growth then decreased, in about 24 months SVL increased 5 cm

Captive breeding: Rarely kept and bred in captivity; needs sufficient shelter opportunities; hatchlings display dominant behaviour, therefore they should be separated.

Ecology: Diurnal (←); terrestrial (←); arboreal (←); associated with different wetlands, displays semiaquatic (←) behaviour; shy and secretive species, shelters and sleeps underneath of bark, rock crevices, tree hollows or branches above various waters; opportunistically preys on invertebrates (←), vertebrates (←); favours grasshoppers, spiders and fish

Remarks: Under the EPBC Act (←) the export of live specimens for commercial purposes is prohibited; between 1983-1999 three shipments are documented including seizures of two specimens in Germany, one specimen for a zoo in Spain, and five individuals sourced C (←) to the United States (CITES trade database); more recently the species was recorded in illegal trade activities; still little is known about the biology and ecology of *V. mitchelli* in the wild; regionally, the species is threatened by the invasion of cane toads (*Rhinella marina*).



Varanus mitchelli. Above: adult, Darwin, NT, Australia, © Chris Applin; centre: adult, Theda Station, WA, Australia, © Jordan Vos; below: adult, Lake Argyle, WA, Australia, © Ruchira Somaweera

Varanus pilbarensis Storr, 1980

Subgenus: *Odatria*

English names: Pilbara rock monitor/goanna, Northern Pilbara rock goanna

German names: Pilbara Felsenwaran, Nördlicher Pilbara Felsenwaran

Local name: -

Synonyms: None; prior to the scientific description of *V. hamersleyensis* that species was treated as *V. pilbarensis*.

Subspecies: None; however, some authors consider *V. hamersleyensis* a subspecies of *V. pilbarensis*.

International conservation status (CITES / Commission Reg. (EU) No 2017/160): Appendix II/B

IUCN Red List status: Least Concern (LC), population trend stable (last assessed 2017)

Distribution: Pilbara region, Western Australia (WA), Australia

Total length (TL): 60 cm; **Snout-vent length (SVL):** 18 cm

Morphological traits (adults): Small, slender species; long, thin tail may reach twice the size of SVL, at the middle roundish in cross section, no dorsal (←) keel (←) (1); nostrils slit-shaped, oval to roundish, located in the middle between eye and tip of snout (2); supraoculars (←) not enlarged; dorsal and ventral (←) scales of tail are similar in size forming continuous rings around tail; in the centre moderately keeled, near tail-tip with sharp keels; cloacal region (←) with long pointed scales in 4-6 rows; number of midbody scales ranges between 118-128

Colour pattern: Ground colour of head and dorsum (←) reddish/brown, colour pattern individually different; dorsum with greyish ocelli (←) (3) and/or light flecks with black dots, in some specimens these flecks merge into rows bordered by black scales at the height of hind legs (4); hind legs with whitish ocelli and dots (5); front limbs with reddish dots on dark ground colour (6); tail distinctly banded with black-bordered white/yellowish, then greyish cross-bands; **juveniles** are more bright, head and nape orange (7) with greyish thin cross-lines and partly reticulated (8); dorsum with transverse rows of orange flecks (9) that are yellowish towards the end of dorsum (10).

Similar species: The colour pattern of *V. hamersleyensis* is darker and without distinct cross-bands on tail; whitish ocelli only located on limbs, more distinct on hind limbs; number of midbody scales ranges between 120-122

Size/age at sexual maturity: ♀ at 30-45 cm TL in 4-8 months

Clutch size: 2-4 eggs per clutch; up to 6 clutches per year

Incubation period/temperature: 65-136 days in general, 91-100 days at 27.5-28.5 °C or 99-136 days at 27 ±1 °C

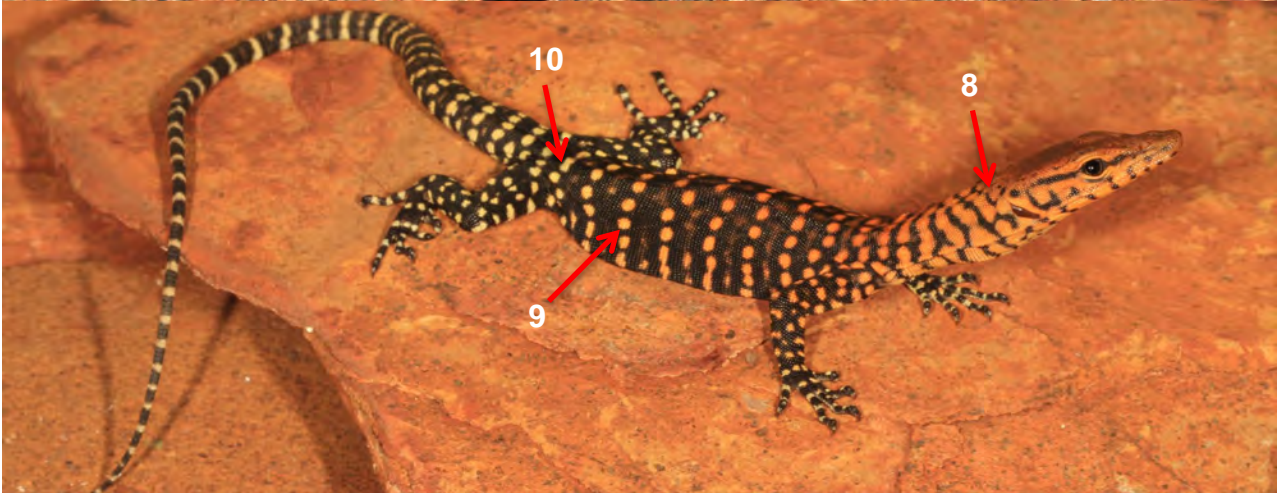
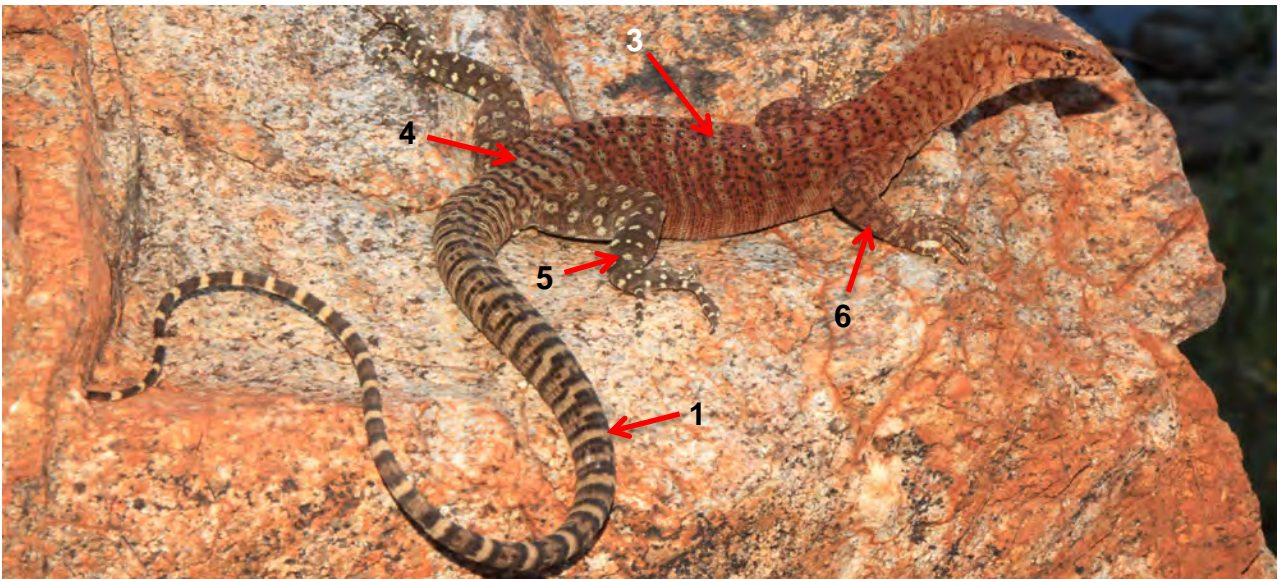
Size/weight of hatchlings: 12.5-15.1 cm TL; 4.7-5.9 cm SVL; 1.8-4.5 g

Growth rate: See above.

Captive breeding: Successfully bred by private owners and zoos.

Ecology: Diurnal (←), seasonally also active after dusk; found in rocky habitats, favouring flat sheet ironstone; moves extremely agile in various rock formations and can shelter in overhangs or rock slabs; colour pattern is perfectly adapted to rocky underground; prey consists of invertebrates (grasshoppers) and smaller lizards

Remarks: Under the EPBC Act (←) the export of live specimens of *V. pilbarensis* for commercial purposes is prohibited, but global trade with animals sourced C (←) and F (←) was regularly documented (CITES trade database).



Varanus pilbarensis. Above: adult, Mallina Station; centre and below: juvenile, Roy Hill Station, WA, Australia, © Ryan J. Ellis

Varanus primordius Mertens, 1942

Subgenus: *Odatria*

English names: Northern ridge-tailed monitor, Northern blunt-spined or blunt-nosed monitor

German name: Zwergwaran

Local name: -

Synonyms: *Varanus acanthurus primordius* Mertens, 1942

Subspecies: None; formerly *V. primordius* was scientifically described and treated as a subspecies of *V. acanthurus*.

International conservation status (CITES / Commission Reg. (EU) No 2017/160): Appendix II/B

IUCN Red List status: Least Concern (LC), population trend unknown (last assessed 2017)

Distribution: Far north of Northern Territory (NT), Australia

Total length (TL): 30 cm; **Snout-vent length (SVL):** 19 cm

Morphological traits (adults): Small species; tail near basis oval, dorsoventrally slightly compressed (1), distally (↩) almost round in cross-section (2), tail length 1.4-1.52 times SVL; tail scales dorsally and laterally strongly keeled (↩), thorn-like (2); tail scales above and below equal in size forming continuous rings around tail; body scales raised and appear glossy; short head with upper jaw in front slightly protruding lower jaw in front (3); roundish, large nostrils located closer to the tip of the snout than to eye (4); supraoculars (↩) not enlarged; number of midbody scales (↩) ranges between 60-66

Colour pattern: Ground colour of dorsum (↩) greyish/light brownish to reddish/brown with single intermingled black scales (show indistinct network) (5) that are also prominent on head, nape region, limbs and tail; whitish scales are individually differently interspersed on dorsum, head, nape and limbs (6); indistinct black temporal (↩) streak, more prominent in ♂ (7); chin, gular region (↩) and ventrum (↩) whitish/creamy coloured, chin and gular region with dark interspersed scales (individually variable) (8); in **juveniles** the white scales on dorsum are more distinct; last third of tail appears pinkish

Similar species: In *V. acanthurus* dorsum with ocelli, longitudinal light/dark stripes on nape, number of midbody scales (↩) ranges between 88-112; *V. baritji* with distinct dark temporal streak, yellow gular region, dorsum lacks ocelli, number of midbody scales (↩) ranges between 80-112; *V. storri* is distinctly smaller in size (up to about 13.2 cm SVL), head uniformly coloured, lacks a temporal streak, body scales are flattened and the number of midbody scales (↩) ranges between 70-94

Size/age at sexual maturity: At about 12-13 cm SVL (60-70 % SVL); with 8-14 months

Clutch size: 2-5 eggs per clutch; up to 5 clutches per year possible

Incubation period/temperature: 80-120 days at 28.5-30.5 °C

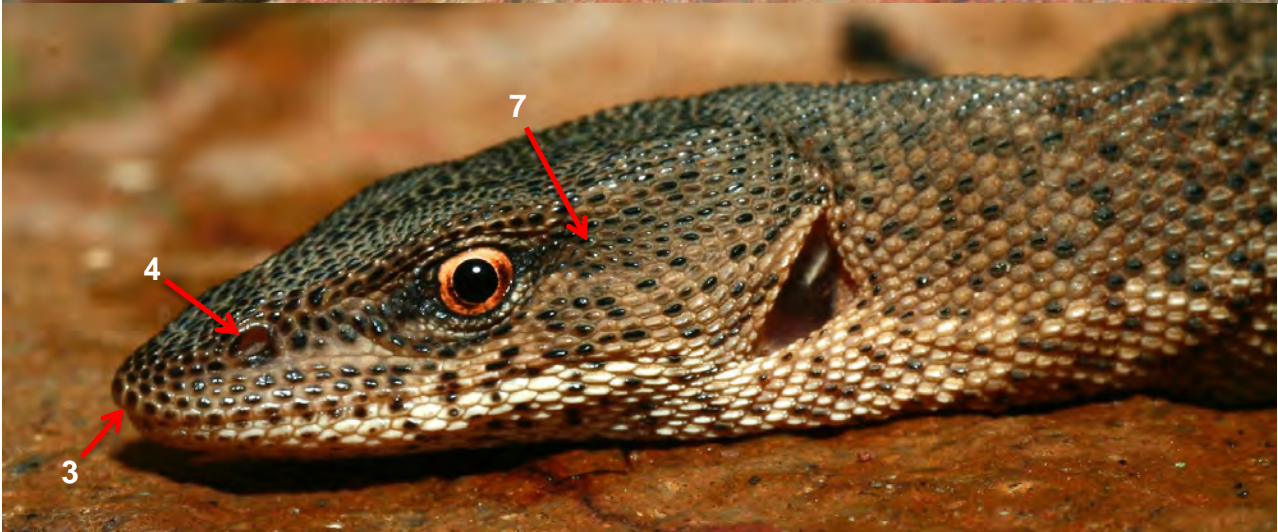
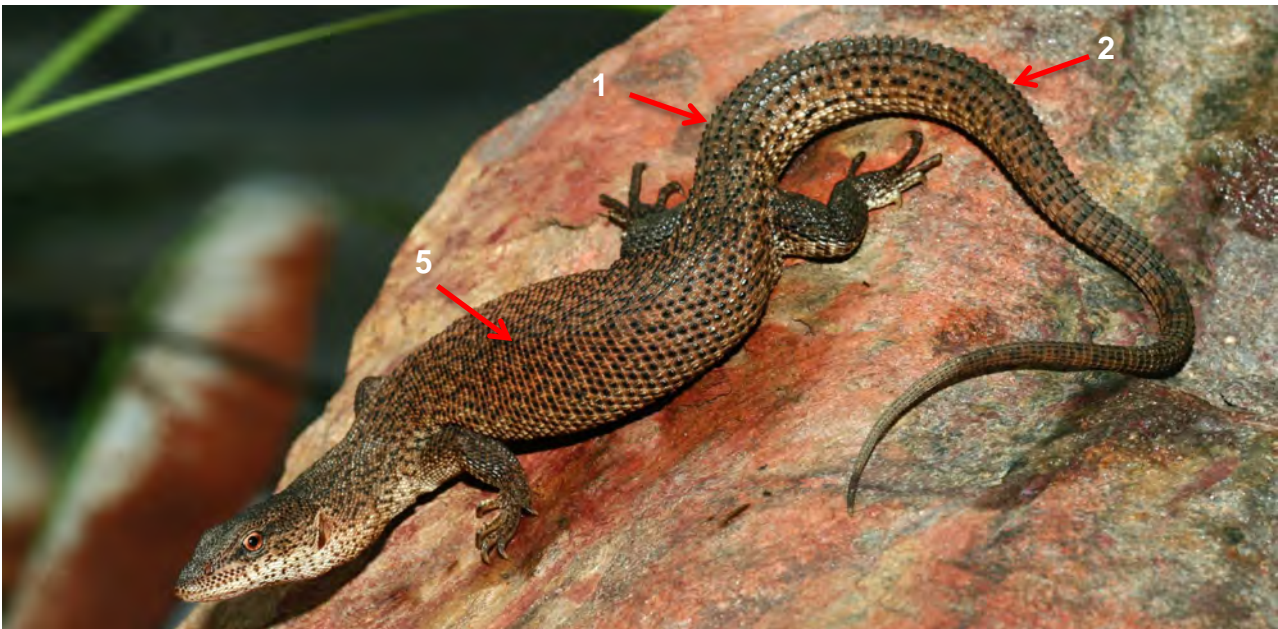
Size/weight of hatchlings: 4.1-5 cm SVL; 1-2.3 g

Growth rate: See above

Captive breeding: Rather uncommon in captivity; breeding records remain relatively scarce

Ecology: Diurnal (↩); terrestrial (↩); seasonally saxicolous (↩) in rocky outcrops; inhabits diverse forested ecosystems; shelters in crevices or in burrows under rocks; shy and secretive species; opportunistic feeding behaviour, preys on a wide range of arthropods, reptile eggs and lizards

Remarks: Under the EPBC Act (↩) the export of live specimens for commercial purposes is prohibited; in the period 2001-2017, exports reported included 42 specimens sourced C (↩), 39 F (↩) and 12 wild specimens for scientific purposes (CITES trade database); threat may potentially be imposed through the spread of settlements



Varanus primordius. Above and centre: adult, south of Adelaide River, NT, Australia, © Ruchira Somaweera; below: adult, Berry Springs, NT, Australia, © Jasmine Vink

Varanus scalaris Mertens, 1941

Subgenus: *Odatria*

English names: Banded tree monitor, Banded tree goanna

German name: (Gebänderter Baumwaran)

Local name: -

Synonyms: *V. timorensis scalaris* Mertens, 1941

Subspecies: None; some authors, however, regard *V. similis* a subspecies of *V. scalaris*. Originally, *V. scalaris* was described as a subspecies of *V. timorensis*.

International conservation status (CITES / Commission Regulation (EU) No 2017/160): Appendix II/B

IUCN Red List status: Least Concern (LC), population trend unknown (last assessed 2014)

Distribution: Dampier and Kimbolton peninsulas around King Sound, Western Australia

Total length (TL): 59 cm; **Snout-vent length (SVL):** 25 cm

Morphological traits (adults): Small to medium-sized species; head, body and legs slim; tail circular in cross-section, without a keel (↔) above (1), 1.3-1.6 times as long as SVL; tail scales of equal size on upper side and below, forming continuous rings (2); lateral (↔) scales on base of tail near cloaca slightly enlarged, thorn-like in ♂; snout pointed; head scales above the eyes not enlarged; nostrils roundish, closer to tip of snout than to eye (3)

Colour pattern: Head and body light grey to light brown/beige; back with banded pattern of about 10 dark grey transverse bands (4), spaces between bands with dark spots; base of tail indistinctly banded, rest unicoloured brown/grey; legs dark grey with many little light spots; head and neck with few little dark spots; head with a pale dark stripe between eye and ear (5); iris brown; tongue colour unknown, probably partly dark; ventral (↔) side unicoloured light brown/beige to grey without markings; **juveniles** unknown, probably similar to adults.

Similar species: *V. similis* with distinct pattern of light ocelli (↔) on dark brown/grey background colour (vs. dark banded pattern [4] on light background); head and neck light and dark mottled; narrow banding on tail extending to last third; throat dark spotted; *V. tristis* and *V. timorensis* with ocellated (↔) (vs. banded) pattern on back, the former species sometimes very dark; *V. timorensis* and *V. tristis* without/with distinctly enlarged, thorn-like scales at the sides of tail base close to cloaca.

Size/age at sexual maturity: No published data; probably similar to *V. similis*.

Clutch size: No published data; probably similar to *V. similis*.

Incubation period/temperature: No published data; probably similar to *V. similis*.

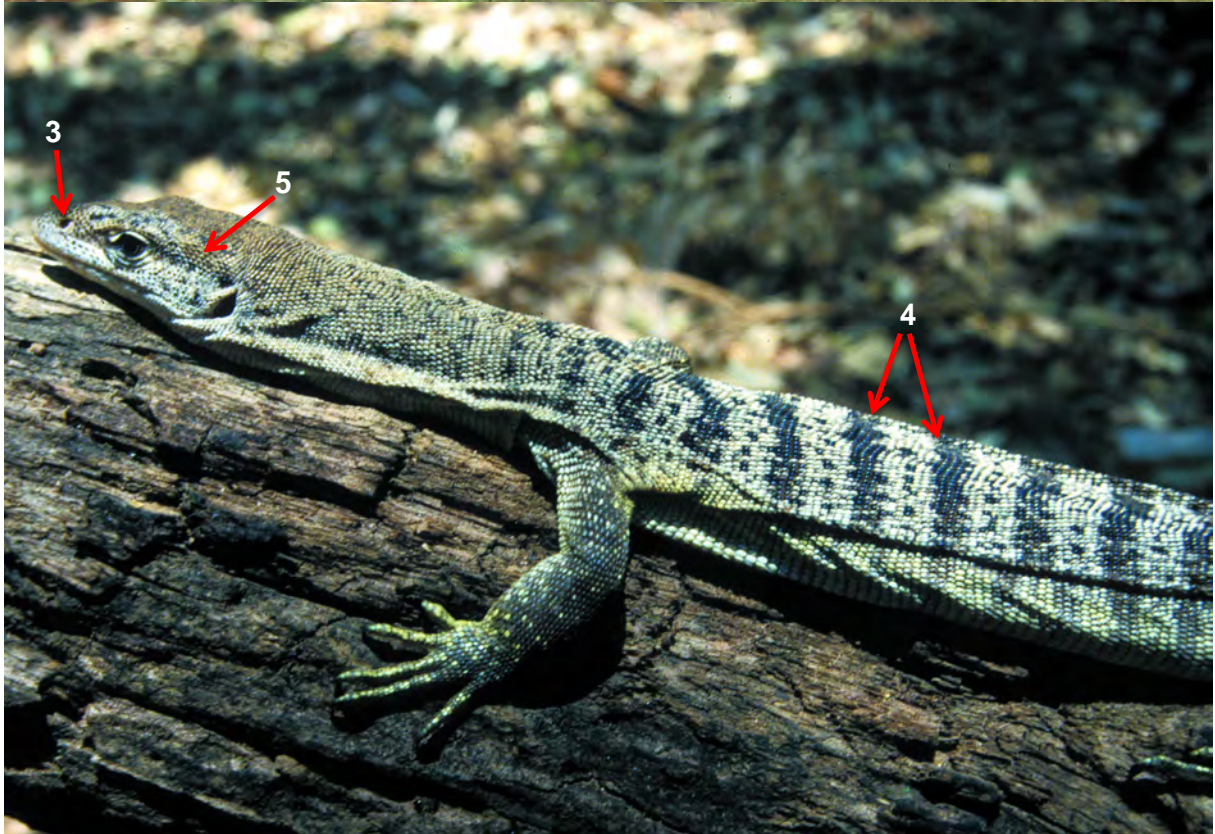
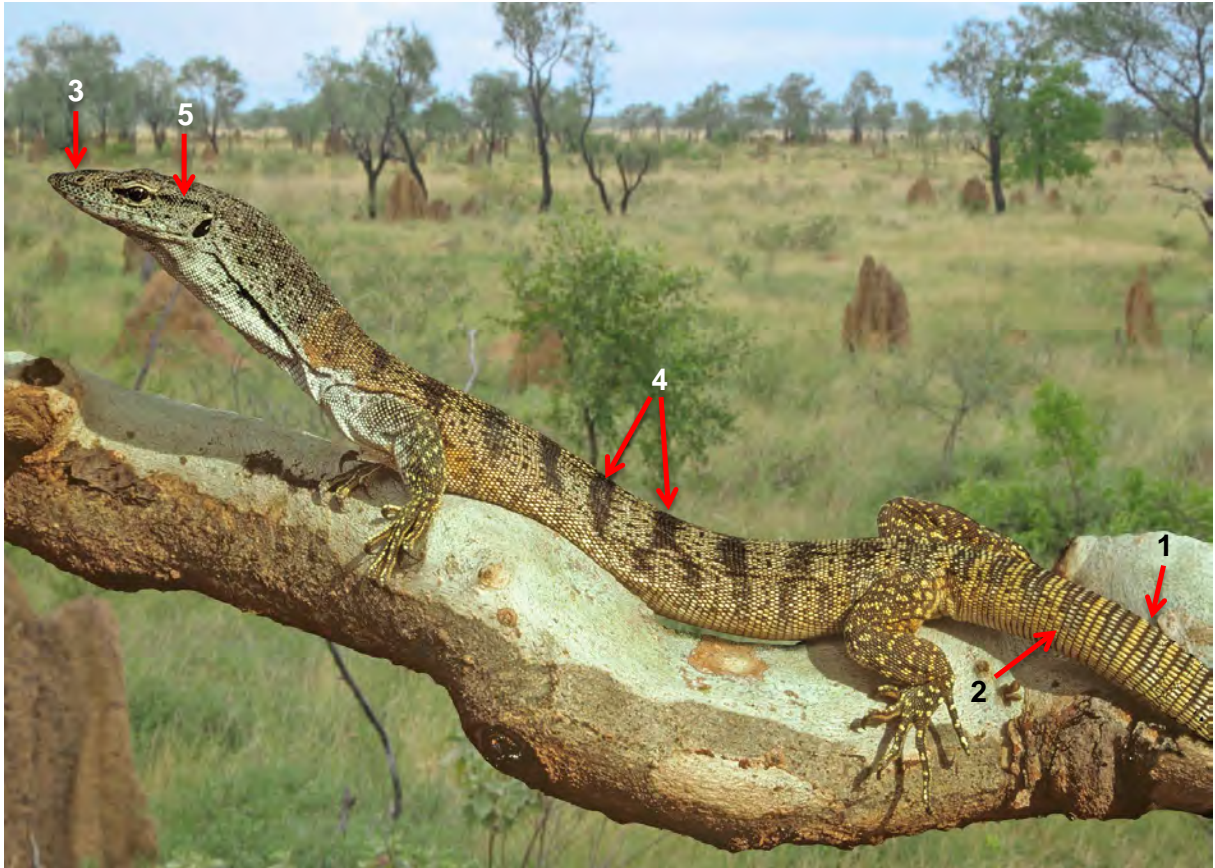
Size/weight of hatchlings: No published data; probably similar to *V. similis*.

Growth rate: No published data; probably similar to *V. similis*.

Captive breeding: No breeding has been documented so far.

Ecology: Diurnal (↔); mainly tree-dwelling; feeds on insects and lizards.

Remarks: Under the Australian EPBC Act (↔) the export of live specimens for commercial purposes is prohibited. Currently, *V. scalaris* represents more than one species and is in need of a thorough taxonomic revision. Given its rather small distribution range in Western Australia, published data about *V. scalaris* mostly refer to *V. similis* and yet unnamed species of this monitor group.



Varanus scalaris. Above: adult, Beagle Bay, Western Australia, © David Knowles; below: adult, Windjana Gorge, Western Australia, © James Lindley McKay

Varanus semiremex Peters, 1869

Subgenus: *Odatria*

English name: Rusty monitor

German name: Rostkopfwaran

Local name: -

Synonyms: None

Subspecies: None

International conservation status (CITES / Commission Reg. (EU) No 2017/160): Appendix II/ B

IUCN Red List status: Least Concern (LC), population trend unknown (last assessed 2017)

Distribution: Queensland (Qld), Australia

Total length (TL): 75 cm; **Snout-vent length (SVL):** 27 cm

Morphological traits (adults): Medium-sized species; first quarter of tail from its basis round in cross-section (1), remainder of tail distinctly laterally compressed, triangular in cross-section, with low dorsal crest (←); scales on tail above and below equal in size, arranged in rings; tail length about 1.5 times longer than SVL; nostrils roundish to oval, dorsolateral (←), located closer to tip of snout than to eye (2); supraocularia (←) are not enlarged or show two longitudinal rows of 3-5 crosswise broader scales; number of midbody scales (←) ranges between 85-105

Colour pattern: Ground colour brownish/olive or light greyish patterned with either irregular large blackish dots/curlicues (3) that can fuse to transverse bands or smaller blackish spots; two colour morphs are recognized, a western population which is darker with clearer pattern, while the eastern population is less dark and the pattern is less distinct with more light ocelli (←); upper head scales brown/blackish; upper limbs spotted light yellowish and black; tail gradually darkening from basis to tip (4); temporal region (←), snout, sides of neck, gular region (←) and chin with reddish/orange tinge (5) and/or yellow gular region in some specimens (6) and few yellow scales scattered particular in snout region; ventrum (←) yellowish/grey with grey cross-bands; gular region sparsely dotted grey; chin with five faint brownish cross-bars (7); **juveniles:** hatchlings with bright orange head, yellow chin, gular region and ventrum, dorsum dark brownish with irregular whitish; dorsum (←) with distinct blackish network including ocelli (←); ventrum with dark transverse rows; labial region (←) shows seven dark transverse bands of which five fuse in throat region; throat lacking the reddish/orange tinge (8)

Similar species: In *V. mitchelli* the tail is significantly more than 1.5 times longer than SVL; tail only slightly beyond base roundish in cross section; dorsoventrally (←) with ocelli and orange scales

Size/age at sexual maturity: ♂ at 18.7 cm SVL, ♀ at 20.4 cm SVL; at 15 months

Clutch size: 2-21 eggs per clutch, in 5-7 weeks intervals up to 3 clutches per breeding season

Incubation period/temperature: 200-242 days at 30 °C

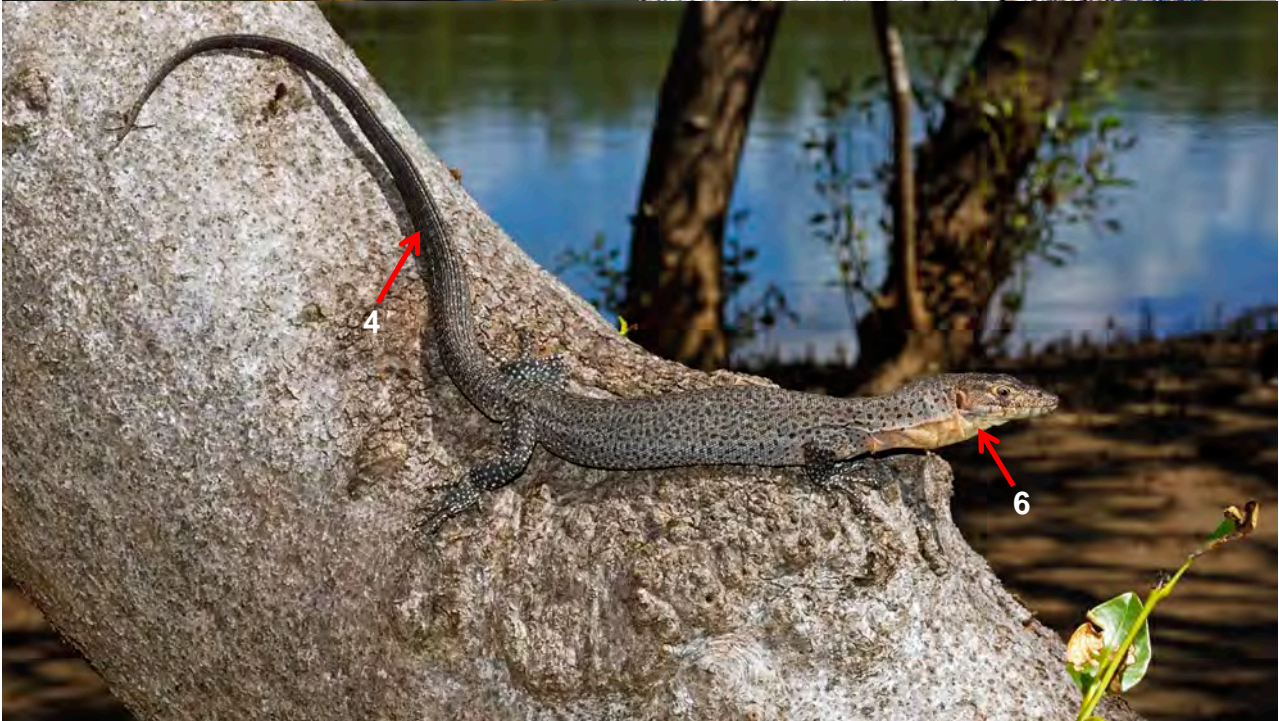
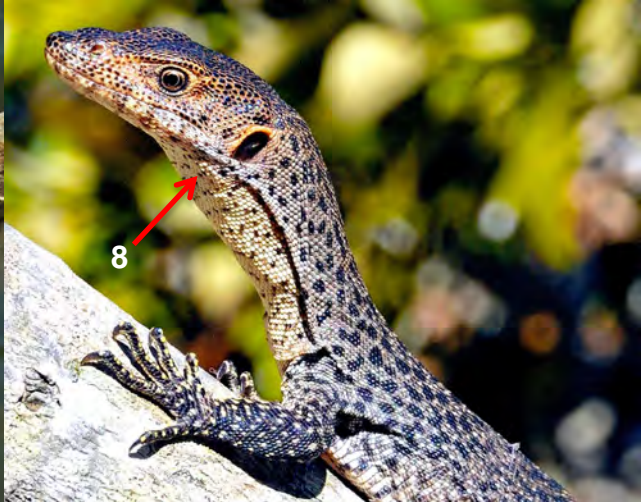
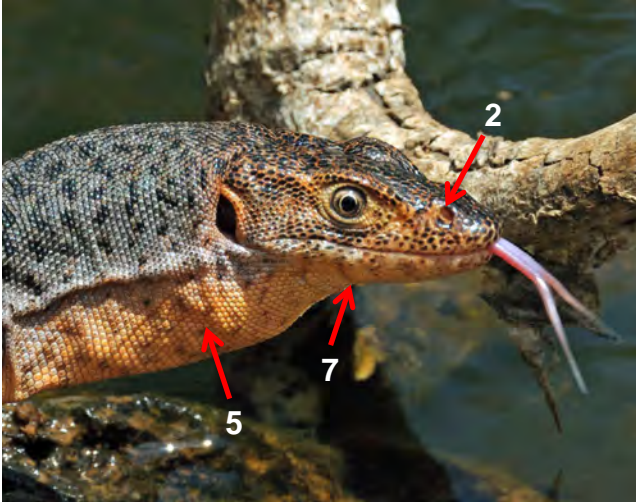
Size/ weight of hatchlings: 14.3-20.8 cm TL; 5.7-8.1 cm SVL; 3-6 g

Growth rate: In 15 months SVL of hatchlings increases about 12.65 cm.

Captive breeding: Rarely bred in captivity; specimens require sufficient shelter opportunities.

Ecology: Diurnal (←); semi-arboreal (←); semi-aquatic (←); inhabits varying (coastal) forests always near water bodies, also associated to mangrove habitats; shy and secretive species, shelters in hollows of old mangrove trees; feeds on invertebrates (←) and vertebrates (←); species possesses salt excretion glands.

Remarks: Under the EPBC Act (←) the export of live specimens for commercial purposes is prohibited; in the 1970s intensively collected for domestic pet trade; 1986-2002 imports of 500 specimens (leather products) to Spain were documented, and the United States reported the import of 35 specimens originating from Indonesia (CITES trade database); *V. semiremex* is threatened by the invasive cane toad (*Rhinella marina*) and destruction of mangrove forests; much of its ecological traits remain unknown.



Varanus semiremex. Above, centre left and below: adult, Bowen, Qld, Australia; centre right: juvenile, Cardwell, Qld, Australia, © Gary Stephenson

Varanus similis Mertens, 1958

Subgenus: *Odatria*

English names: Spotted tree monitor/goanna

German name: Gefleckter Baumwaran

Local names: Biawak similis, biawak pohon berbintik, biawak kerdil (Indonesia), Oke (New Guinea)

Synonyms: *V. timorensis similis*; *V. scalaris similis*

Subspecies: None; some authors, however, regard *V. similis* a subspecies of *V. scalaris*. Originally, *V. similis* was described as a subspecies of *V. timorensis*.

International conservation status (CITES / Commission Regulation (EU) No 2017/160): Appendix II/B

IUCN Red List status: Not Evaluated (NE)

Distribution: Southern New Guinea, Torres Strait Islands, and northern Australia

Total length (TL): 60 cm; **Snout-vent length (SVL):** 22-25 cm

Morphological traits (adults): Small to medium-sized species (120-150 g); head, body and legs slim; tail circular in cross-section, 1.3-1.6 times as long as SVL, without a keel (↔) above; tail scales of equal size on upper side and below, forming continuous rings; lateral (↔) scales on base of tail near cloaca slightly enlarged, thorn-like in ♂; snout pointed; scales above eyes not enlarged; nostrils roundish, closer to tip of snout than to eye

Colour pattern (differs regionally): **Arnhem Land/Kimberley region (A):** Upper side of body medium brown, back with many small whitish/yellow to light brown (eye)spots (1); legs with many small light dots; tail indistinctly light banded (2); head and neck more or less mottled; head without stripe between eye and ear (3); iris brown; sometimes a distinct light area below eyes (4); tongue pink/flesh-coloured with dark tips; ventral side unicoloured light brown/beige to yellowish, throat with few grey spots; **South New Guinea/Cape York (B):** Upper side of body dark grey, back with more or less distinct pattern of white (eye)spots (5), sometimes with indistinct reddish brown bands/spots (6); legs with light dots; tail on first half with light thin stripes, remaining part plain dark (7); head and neck with light spots/dots; indistinct light stripe between eye and ear (8); iris brown; tongue pink/flesh-coloured with dark tips; ventral (↔) side light, throat with few grey spots; **Cairns area (C):** similar to previous form, distinct rows of light ocelli on back (9); tail with broad light and dark bands (10); dark stripe from eye to ear (11); tongue dark (12) or bright; **juveniles** are similar to adults, the colour pattern is generally clearer.

Similar species: *V. scalaris* with dark banded pattern on light brown/grey background; head and neck unpatterned light grey; narrow banding only on tail base; throat unspotted; light form of *V. tristis (orientalis)* with reddish brown background colour; tongue dark; up to 75 cm TL; tail longer, 1.5-2.3 times SVL; *V. timorensis* with a dark brown background colour; distinct white stripe from eye to ear; tongue unicoloured pink/flesh-coloured; ♂ without enlarged, thorn-like scales at sides of tail base.

Size/age at sexual maturity: ♂: 50 cm, ♀: 45 cm TL; >12.5 SVL; with ca. 2 years

Clutch size: One clutch per year with 3-18 (ø 7-8) eggs ca. 4-6 weeks after mating

Incubation period/temperature: 108-174 days at 25-31 °C

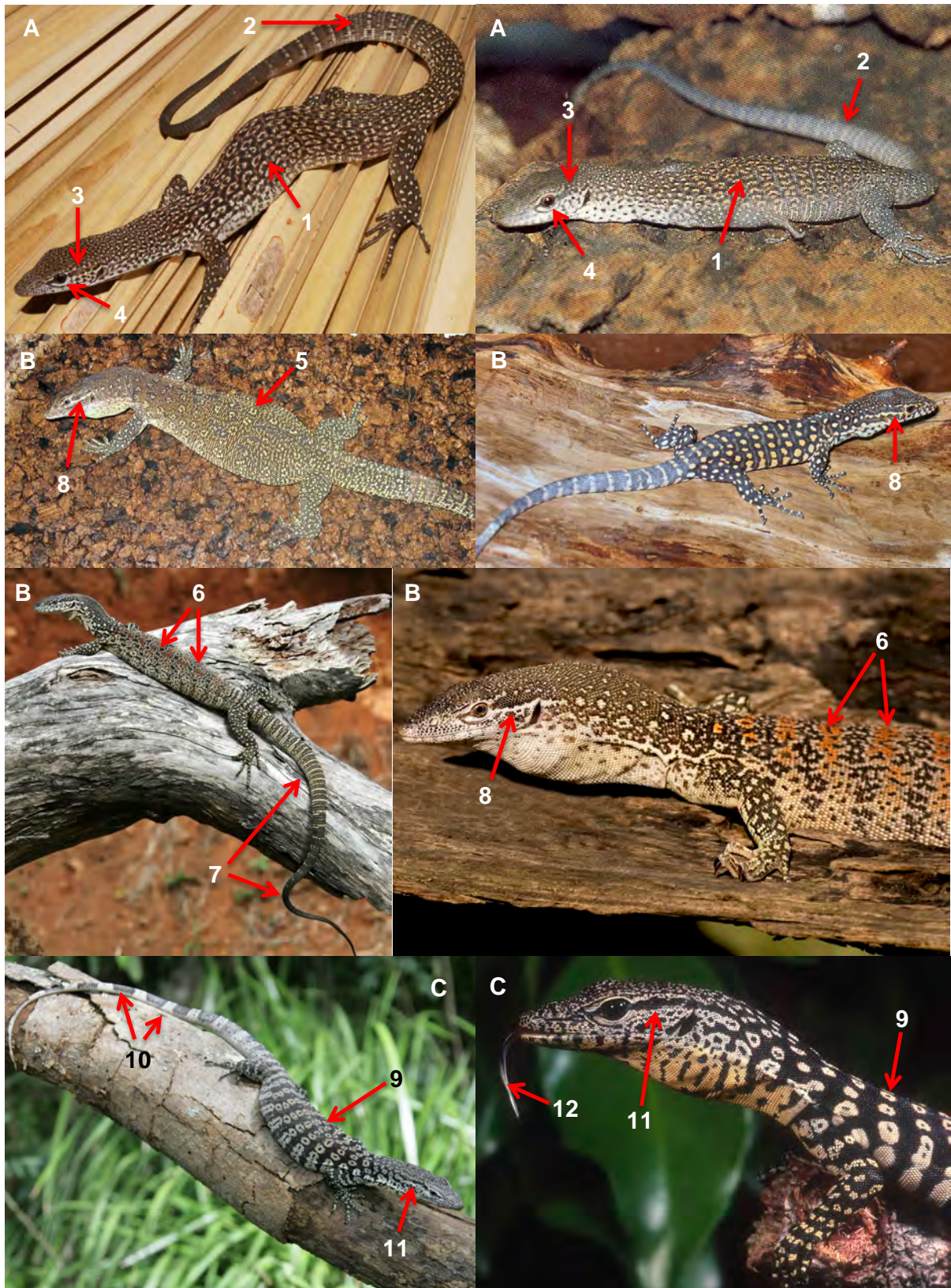
Size/weight of hatchlings: 5.7-6.5 (ø 6.4) cm SVL; 13-17.5 (ø 16) cm TL; 2.8-5.3 g

Growth rate: After 1 month: 6.2-8.5 cm SVL, 16-21.5 cm TL, 2.8-6 g; after 3 months: 6.8-9.5 cm SVL, 18.6-26 cm TL, 6.2-14.5 g; after 27 months: 14-14.5 SVL, 35.5-36.5 cm TL, 32-34.5 g; after 40 months: 13.5 cm SVL, 33-34 cm TL, 32-48 g

Captive breeding: Repeatedly bred in captivity; separation of sexes and simulation of rainy season can be advantageous for breeding.

Ecology: Diurnal (↔); mainly tree-dwelling; feeds on insects and lizards

Remarks: Under the national EPBC Act (↔) the export of live specimens of *V. similis* from Australian for commercial purposes is prohibited. Between 2010 and 2017 Indonesia exported 170-330 mostly captive-born (source code F) specimens annually. *V. similis* represents more than one species and is in need of taxonomic revision.



Varanus similis. Above left: subadult, Darwin, Northern Territory, © James L. McKay; above right: juvenile, captive-bred, © Bernd Eidenmüller; second row left and right: adult and juvenile, © Géczy Csaba; third row left and right: adult, Almaden, Queensland, © Bernd Eidenmüller & Gunther Schmida; below left and right: adult and juvenile, Kuranda, Queensland, © Bernd Eidenmüller & Michael McCoy. See the text for details about the different forms of *V. similis*.

Varanus sparnus Doughty et al., 2014

Subgenus: *Odatria*

English names: Dampier peninsula goanna/monitor

German name: -

Local name: -

Synonyms: None; prior to their scientific description, these monitor lizards were allocated to *V. breviceuda*.

Subspecies: None

International conservation status (CITES / Commission Reg. (EU) No 2017/160): Appendix II/B

IUCN Red List status: Data Deficient (DD), population trend unknown (last assessed 2017)

Distribution: Dampier peninsula, Western Australia (WA), Australia

Total length (TL): 22.7 cm; **Snout-vent length (SVL):** 12 cm

Morphological traits (adults): Smallest monitor species (16.3 g), distinctly elongated body (1) and extremely short fore and hind limbs (2); prehensile (↔) tail shorter than SVL, from base to tail-tip (less than half the total length) roundish in cross section (3), distally (↔) triangular in cross-section with a ridge above (4); dorsal tail scales distinctly keeled (↔) and tip of the tail ends in a point; small roundish to triangular-shaped nostrils located closer to tip of snout than to eye (5); supraoculars (↔) not enlarged; front limbs anteriorly (↔) with larger squarish scales not surrounded by granules (↔)

Colour pattern: Pale dark streak from nostril to eye and posterior (↔) of the eye to upper edge of ear opening (6); temporal region (↔) with small grey dots (7); head sides along mouth and below the eye pale light brown; fine small dark spots on reddish-brown dorsum (↔) and body sides (9); **juveniles** are more densely spotted.

Similar species: In *V. breviceuda* the body is less elongated, head is broader, limbs more muscular, and spotted pattern more pronounced; front limbs anteriorly (↔) with oval-shaped scales surrounded by granules (↔)

Size/age at sexual maturity: No published data, probably similar to *V. breviceuda*

Clutch size: No published data, probably similar to *V. breviceuda*

Incubation period/temperature: No published data, probably similar to *V. breviceuda*

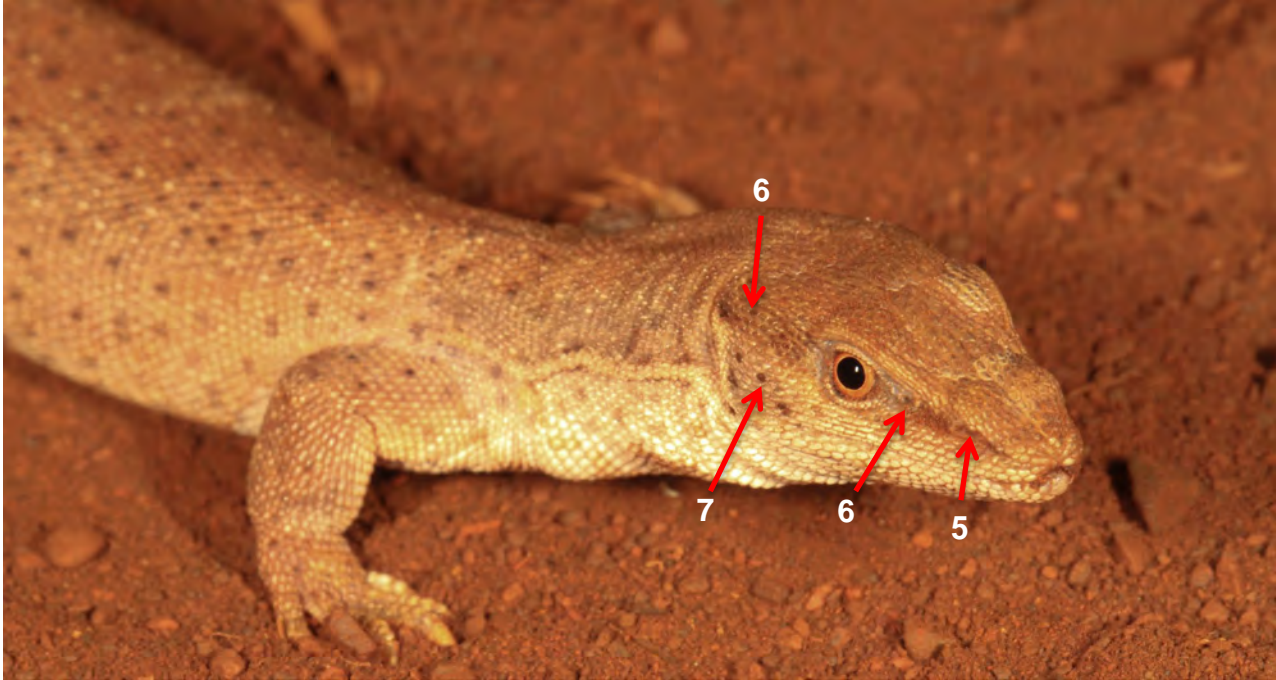
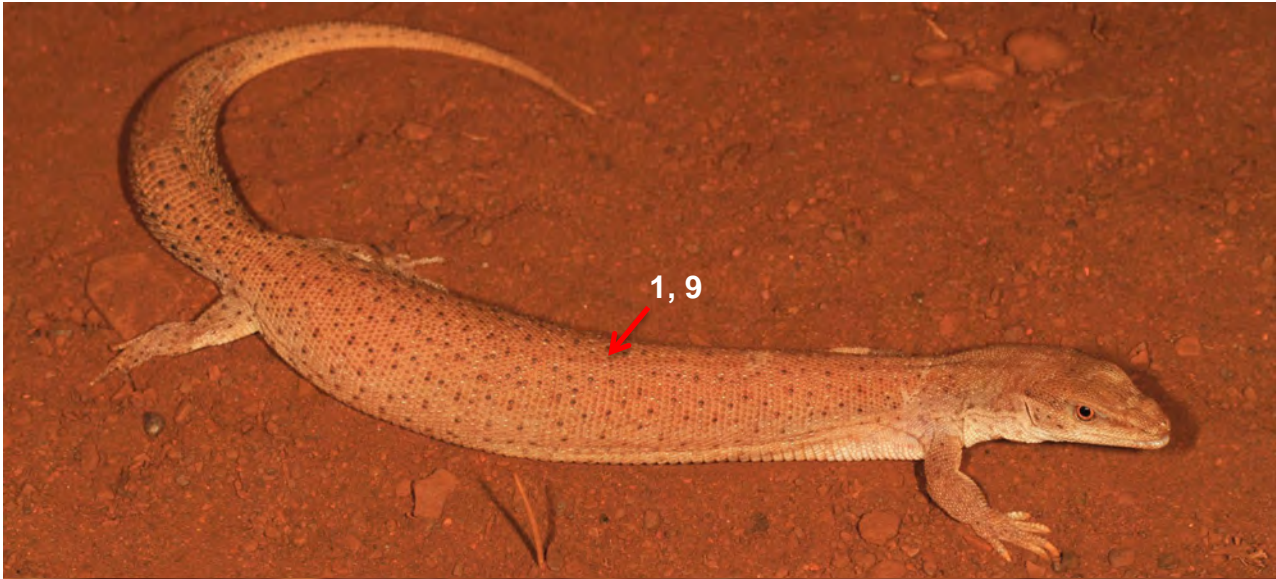
Size/weight of hatchlings: No published data, probably similar to *V. breviceuda*

Growth rate: No published data, probably similar to *V. breviceuda*

Captive breeding: No published data, probably similar to *V. breviceuda*

Ecology: Diurnal (↔); terrestrial (↔) in open shrub and grassland; displays marked burrowing behaviour; feeds on insects and likely carrion

Remarks: Under the EPBC Act (↔) the export of live specimens of *V. sparnus* for commercial purposes is prohibited; international trade is not documented (CITES trade database).



Varanus sparnus. All images: adult, southwest Mount Jowlaenga, WA, Australia, © Ryan J. Ellis

Varanus storri Mertens, 1966

Subgenus: *Odatria*

English names: Storr's monitor, Storr's western pygmy monitor, Spiny-tailed monitor, Ridge-tailed monitor

German name: Storrs Zwergwaran

Local name: -

Synonyms: None

Subspecies: *Varanus storri storri* (north-eastern Queensland), *Varanus storri ocreatus* Western Australia, Northern Territories, north-western Queensland)

International conservation status (CITES / Commission Reg. (EU) No 2017/160): Appendix II/B

IUCN Red List status: Least Concern (LC), population trend stable (last assessed 2017)

Distribution: Western Australia (WA), Queensland (Qld), Northern Territory (NT), Australia

Total length (TL): 30 cm; **Snout-vent length (SVL):** 16 cm

Morphological traits (adults): Small species; first quarter of tail from basis roundish in cross-section, then more dorsoventrally (←) compressed (1); tail length approximately <1.4 times SVL (*V. s. storri*) and 1.6 times SVL (*V. s. ocreatus*); at lower hind limbs, *V. s. ocreatus* shows enlarged scales lacking in *V. s. storri*; body scales are flattened; tail with dorsally and laterally protruding keels (←) (thorn-like) on scales (2), dorsal and ventral tail scales equal in size forming continuous rings around tail; short head with oval nostrils located dorsolaterally and slightly closer to tip of snout than to eye (3); supraoculars (←) not enlarged; the number of midbody scales (←) ranges between 70-94

Colour pattern: Ground colour of dorsum (←) in varying reddish/brown/grey shades interspersed with dark brown to black scales that can form a network (4); upper head, limbs and tail usually with less black scales; limbs with a mix of black and white scales, dark scales sometimes form a network (5); distinct or indistinct blackish streak running posteriorly from nostril "through" the eye to temporal region (←) (6); ventrum (←), gular region (←) and chin greyish to whitish/cream with dark spots; tail with irregular brown/black scales; in **juveniles** the colour pattern is more vivid, dorsum with prominent whitish spots and light mid-dorsal line bordered by black scales; upper head without or only with few dots

Similar species: In *V. acanthurus* dorsum with ocelli, longitudinal light and dark stripes on nape, number of midbody scales ranges between 88-112; *V. baritji* with distinct dark temporal streak, yellow gular region, dorsum lacks ocelli, number of midbody scales ranges between 80-112; *V. primordius* has raised body scales that appear glossy; number of midbody scales ranges between 60-66

Size/age at sexual maturity: Both sexes at about 9 cm SVL; with 8–14 months

Clutch size: 1-6 (Ø 3.9) eggs per clutch, up to 2 clutches per year

Incubation period/temperature: 100-129 (Ø 107) days at about 28-29.5 °C

Size/weight of hatchlings: 13-14.7 cm TL; 4.8-6.1 cm SVL; 2-3.6 g

Growth rate: During 8 months SVL increased from 6.2 cm to 7.5 cm, while tail length increased from 8.7 cm to 10.2 cm.

Captive breeding: Uncommon in captive collections, however, first successful breeding was already reported in the late 1960s.

Ecology: Diurnal (←); terrestrial (←); inhabits grasslands and open woodlands with rocky outcrops where it forms colonies; shy and secretive species that shelters under rocks or in burrows under rocks; opportunistic feeding behaviour, favours insects and spiders, occasionally preys on lizards

Remarks: Under the EPBC Act (←) the export of live specimens for commercial purposes is prohibited; however, between 1979-2017 around 340 live specimens were commercially exported, mainly sourced as C (←), and between 1979-2001 only four transactions documented exports from Australia (CITES trade database).



Varanus s. storri. Above: adult, Charters Towers, Qld, Australia, © Gary Stephenson; ***Varanus s. ocreatus***. centre: adult, Calvert Hills, NT, Australia, © Gary Stephenson; ***Varanus s. ocreatus***. below left: adult, Geikie Gorge National Park, Kimberley, WA, Australia, © Ruchira Somaweera; ***Varanus s. storri***. below right: adult, ♀, Charters Towers, Qld, Australia, © Gary Stephenson

Varanus timorensis (Gray, 1831)

Subgenus: *Odatria*

English name: Timor monitor

German name: Timor-Waran

Local names: Biawak Timor (Indonesia/West Timor), Lafaek raimaran (Tetun/Tetum language: Timor-Leste/East Timor), Loti (Mambae language), Puilolon (Fataluku language: Timor-Leste/ East Timor)

Synonyms: None

Subspecies: None; some authors, however, regard *V. auffenbergi* as a subspecies of *V. timorensis*.

International conservation status (CITES / Commission Regulation (EU) No 2017/160): Appendix II/B

IUCN Red List status: Not Evaluated (NE)

Distribution: Timor Island (Indonesia and Timor-Leste) and associated islands of Savu, Semau, and Kisar

Total length (TL): 59 cm; **Snout-vent length (SVL):** 13.8-25.0 (♂ 19.3) cm (♂), 15.7-23.5 (♀ 18.1) cm (♀)

Morphological traits (adults): Small species; head, body and legs slim; legs and toes relatively short; tail circular in cross-section, without a keel (←) above (1), 1.4-1.7 times as long as SVL; tail scales of equal size above and below, forming continuous rings; without enlarged, spike-like scales on the tail base to the left and right of cloaca; head scales above eyes not enlarged; nostrils round, closer to tip of snout than to eye (2)

Colour pattern: Head, body, legs and tail medium to dark brown; above dark bordered bright band running from eye to ear opening (3); neck and back with irregular transverse rows of dark-framed, yellowish (rarely bluish [4]) eye spots (←) with a dark centre, yellowish scales in-between; pattern of distinct eye spots may dissolve, especially in older animals (5); tail dark with light mottling; body underside whitish/yellowish; throat with dark marbling; belly with irregular thin dark transverse lines; iris reddish brown; tongue pink/flesh-coloured; **juveniles** have about 12 narrow rows of yellow spots on the back; head, neck and legs with many bright spots; throat with dark reticulated pattern (6); tail with narrow dark and bright bands, dark parts are wider than bright ones.

Similar species: *V. auffenbergi* exhibits bluish grey (vs. whitish yellow) eye spots; *V. similis* mostly lacks a white stripe (instead sometimes with a dark stripe) from eye to ear, sometimes with white area below eye, tongue with dark tips, with enlarged lateral (←) scales at tail base, spike-like in ♂; *V. scalaris* shows a distinct banded colour pattern on back, has a pale dark stripe from eye to ear, with enlarged lateral (←) scales at tail base, spike-like in ♂; light form of *V. tristis (orientalis)* has a reddish brown background colour, tongue dark, up to 75 cm TL, tail longer, 1.5-2.3 times SVL

Size/age at sexual maturity: ♀: 38 cm TL; with approximately 1 year

Clutch size: One clutch with 5-13 eggs per year, ca. 40 days after mating, mostly between December and March

Incubation period/temperature: 93-186 days at 27-34 °C

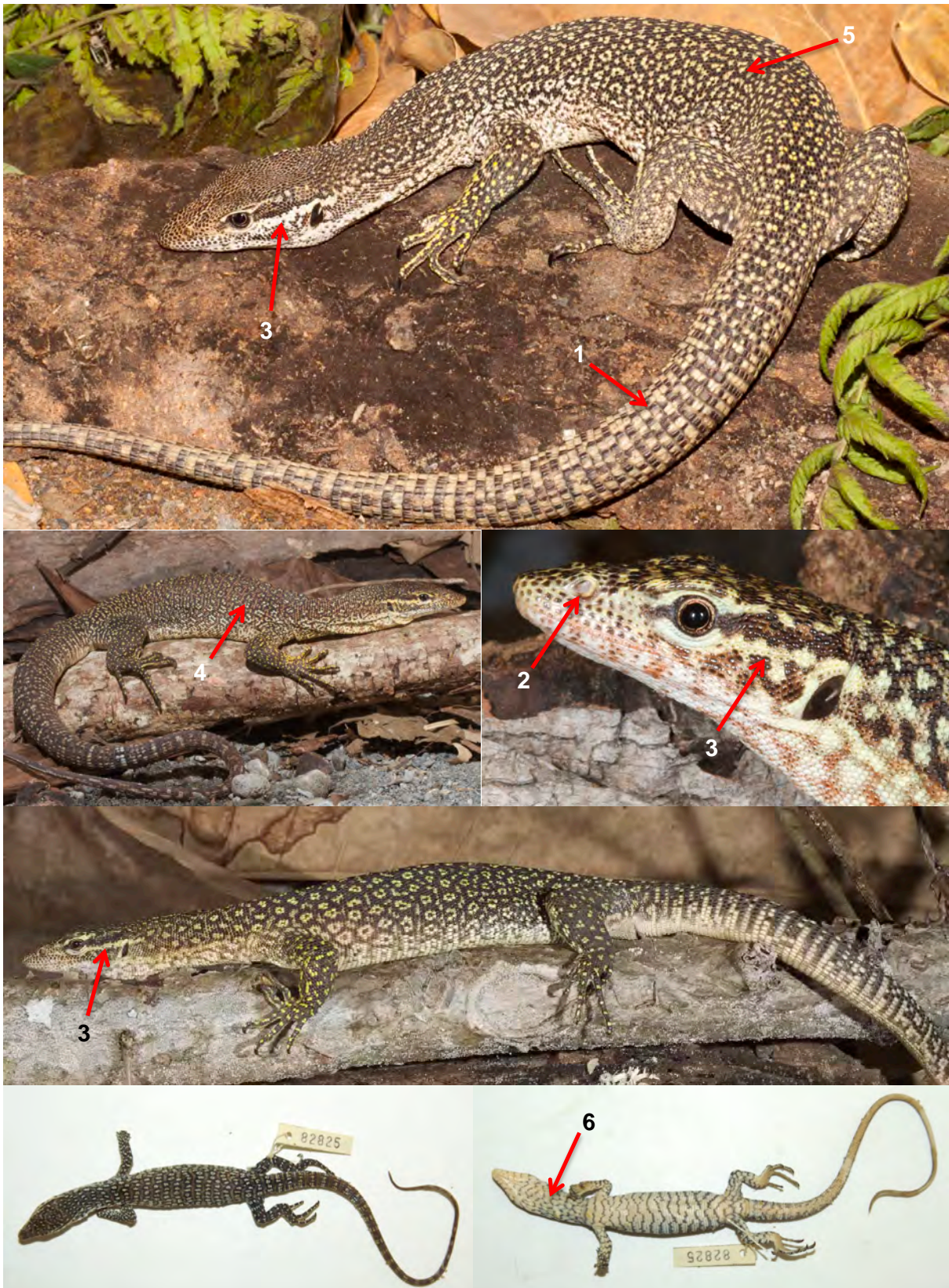
Size/weight of hatchlings: 5.5-8.5 (♂ 6.5) cm SVL; 14-17.4 (♂ 16) cm TL; 3.1-6 (♂ 4) g

Growth rate: After 2 months: 8.8-10 cm SVL; 22.5-26.3 cm TL; after 3 months: ca. 20 cm TL

Captive breeding: Several times successfully bred in zoos and private husbandry. Separation of sexes outside reproductive period as well as increasing the duration of lighting and moisture may stimulate reproductive behaviour.

Ecology: Diurnal (←); island endemic (←); ground and tree-dwelling; prefers coastal forests, rice fields and settlements; food consists of invertebrates (insects, spiders, and scorpions), rarely geckos and small snakes.

Remarks: *V. timorensis* is in great demand from the pet trade. The species is nationally protected in Indonesia. Therefore, only exports of captive-bred specimens are allowed. Between 2010 and 2017, 420-1340 specimens of *V. timorensis* were annually exported by Indonesia according to the CITES trade database.



Varanus timorensis. Above: adult, Dili City, Timor-Leste (East Timor), © Sven Mecke; second row left: adult, north of Maubisse, Nanu Suco, Covalima District, Timor-Leste (East Timor), © Mark O'Shea; second row right: adult, Com Aldeia, Com Suco, Lautém District, Timor-Leste (East Timor), © Mark O'Shea; third row: adult, Loré Aldeia, Lautém District, Timor-Leste (East Timor), © Mark O'Shea; below left and right: juvenile, ZFMK 82825, © Markus Patschke

Varanus tristis (Schlegel, 1838)

Subgenus: *Odatria*

English names: Black-tailed monitor, Black-headed monitor (*Varanus t. tristis*), Freckled monitor (*V. t. orientalis*); Mournful monitor, Racehorse monitor

German names: Getüpfelter Baumwaran, Fleckenwaran (*V. t. orientalis*), Trauerwaran (*Varanus t. tristis*)

Local names: Karda (southwestern WA), warrururga (coastal central WA), ngaarnurru (southwestern NSW)

Synonyms: None

Subspecies: *Varanus t. tristis* (interior of Australia), *Varanus tristis orientalis* (north-eastern Australia); due to its extensive distribution, *V. tristis* is considered a species complex and likely includes undescribed taxa (↩).

International conservation status (CITES / Commission Reg. (EU) No 2017/160): Appendix II/B

IUCN Red List status: Least Concern (LC), population trend stable (last assessed 2017)

Distribution: Western Australia (WA), South Australia, Queensland (Qld), Northern Territory (NT), New South Wales (NSW), Australia

Total length (TL): 80 cm (*V. t. tristis*), 65 cm (*V. t. orientalis*); **Snout-vent length (SVL):** 30 cm

Morphological traits (adults): Medium-sized, slender species; tail roundish in cross-section, lacking a dorsal keel (↩); tail scales above and below equal in size forming continuous rings around tail; interorbital scales (↩) (1) distinctly larger than supraoculars (↩) (2); *V. t. tristis*: tail in ♂ about 1.8-2 times SVL, in ♀ ca. 1.48 of SVL; wedge-shaped head clearly set off from a long neck; nostrils roundish/oval, located distinctly closer to tip of snout than to eye (3); the number of midbody scales (↩) ranges between 110-138; *V. tristis orientalis*: tail about 1.33-1.66 SVL; nostrils oval, located only slightly closer to tip of snout than to eye; number of midbody scales (↩) ranges between 110-121

Colour pattern: In *Varanus t. tristis*, posterior dorsum (↩), tail, head and nape region blackish with cross rows of clearly separated ocelli (↩) (4), with orange scales in-between that are arranged in a linear way (5); temporal streak more distinct than in *V. t. orientalis*, also in black-headed *V. t. tristis* visible (6); ventrum (↩) and gular region (↩) with black network or irregular black flecks; *V. t. orientalis* is more colourful, two morphs are recognized, “greybacks” and “red-heads”; dorsum can be blackish brown or light greyish with cross rows of larger yellow/brownish to greyish ocelli, that can merge and resemble serrated bands (7) with orange/reddish bands (intermingled with dark scales) in-between (8); nape region darker with smaller lighter spots; head occasionally reddish-brown (9); faint light temporal streak (↩) (10); upper tail dark with lighter cross bands (11), distally last third usually blackish; ventrum pale or with few irregular greyish dots that are more numerous in gular region; underside of fingers and toes dark; **juveniles** of both subspecies are chequered, black colour lacking also on head and tail (12)

Similar species: In *V. scalaris* dorsum with 10-12 cross bands; number of midbody scales (↩) ranges between 118-122

Size/age at sexual maturity: ♂ und ♀ at about 20 cm SVL; with 14-24 or 36 months

Clutch size: 3-17 eggs per clutch; 2-5 clutches per breeding season with 28-85 days break in-between two clutches

Incubation period/temperature: 114-117 days in the wild; 93-137 days at 27-29 °C

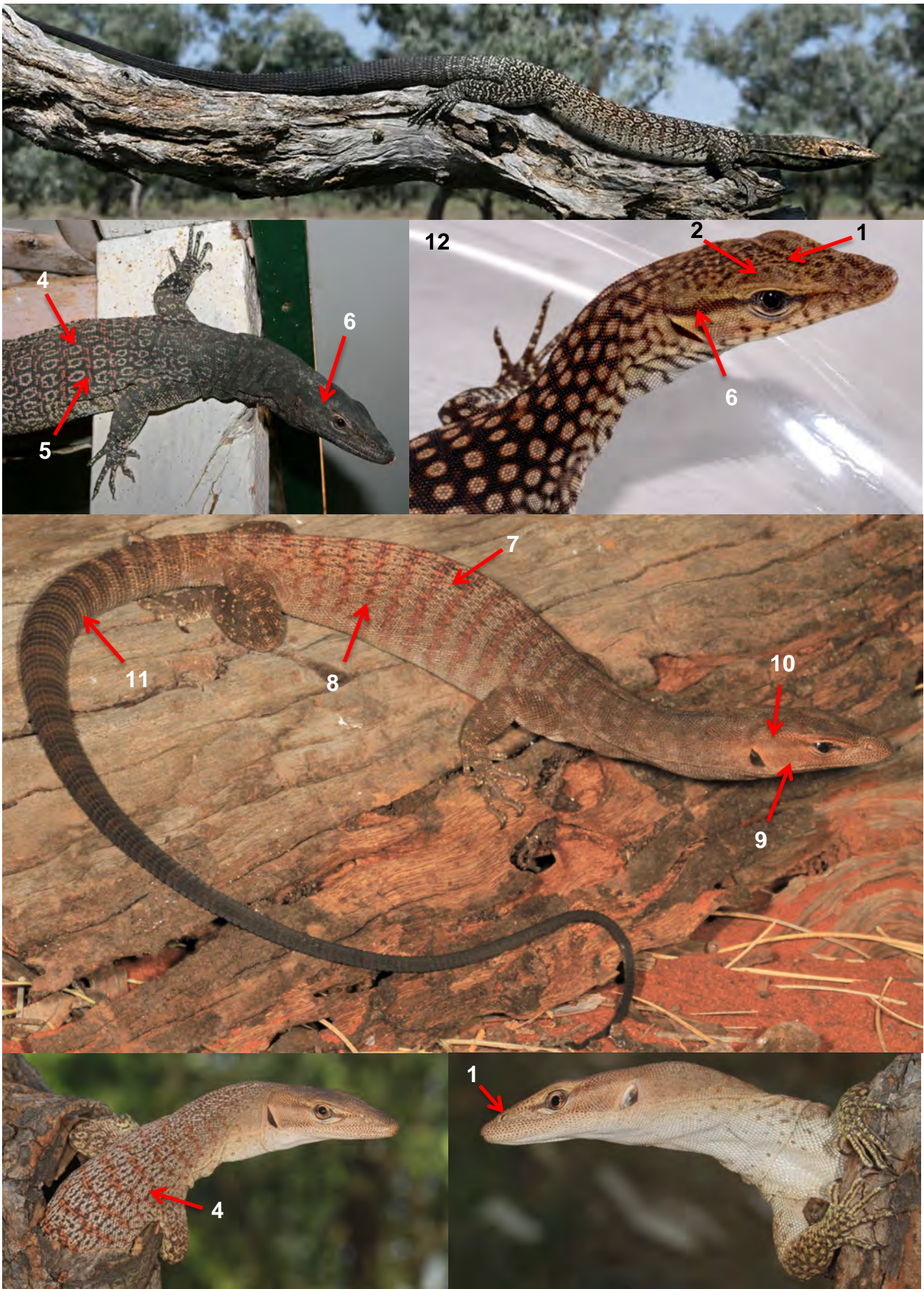
Size/weight of hatchlings: 16.8-21.6 cm TL; 6.2-7.3 cm SVL; ca. 4.3 g

Growth rate: SVL increased in 3 months from 6.2 cm to 4.1 cm and in 6 months to 8.2 cm.

Captive breeding: Internationally commonly kept and bred in captivity on numerous occasions

Ecology: Diurnal (↩) and nocturnal (↩) feeding behaviour; largely arboreal (↩), regionally terrestrial (↩) foraging behaviour; associated with diverse forested sub-/arid ecosystems; seeks shelter in tree hollows and rock crevices; mainly preys on lizards, but also on birds (e.g., parrot nestlings in tree hollows), larger insects and their larvae

Remarks: Under the EPBC Act (↩) the export of live specimens of *V. tristis* for commercial purposes is prohibited; however, in the period 1978-2017 more than 360 live specimens were commercially exported, mainly sourced as C (↩) and F (↩) (CITES trade database).



Varanus t. tristis. Above: adult, north of Wilcannia, NSW, Australia, © Bernd Eidenmüller; ***Varanus t. tristis***. second row: adult (left) juvenile (right); 50 km north of Ilfracombe, Qld, Australia, © Rod Shannon; ***Varanus t.* cf. (↵) *orientalis***. third row: subadult, Lorna Glen Station, WA, Australia, © R. J. Ellis; ***Varanus t.* cf. *tristis***. below: adult, El Questro Station, WA, © Ryan J. Ellis

Varanus salvadorii (Peters & Doria, 1878)

Subgenus: *Papusaurus*

English names: Crocodile monitor, Papuan monitor, Salvadori's monitor, Tree crocodile

German name: Papua-Waran

Local names: Biawak salvadorii, biawak Papua (Indonesia), Artrellia, Totoro, Wa'o, Wuo'o (New Guinea)

Synonyms: None

Subspecies: None

International conservation status (CITES / Commission Regulation (EU) No 2017/160): Appendix II/B

IUCN Red List status: Least Concern (LC), population trend unknown (last assessed 2014)

Distribution: New Guinea and Salawati Island

Total length (TL): 255 cm; **Snout-vent length (SVL):** 85 cm

Morphological traits (adults): Very large species; head, body and legs slim; tail 2-2.7 times as long as SVL, round in cross-section (1) and able to grasp (prehensile ←), triangular towards the end with a keel (←) above (2); lateral tail scales much smaller than lower ones; snout strongly prominent and bulged and long (3) (more pointed and slimmer in juveniles); nostrils oval, located close to tip of snout (4); head scales above the eyes slightly or not broadened

Colour pattern: Body black with about five cross rows of large yellow spots (partly with black centre) on back (5), in between more or less numerous small spots; legs yellow dotted; toes black with yellow stripes; tail with irregular and indistinct yellow banding; neck and head intensely yellow and black patterned; tongue pink/flesh-coloured (6); iris dark brown; body underside dark grey and dirty yellow patterned; tail underside grey and yellow banded; soles of the feet are black; **juveniles** more distinctly patterned; tail with wider light bands; belly dark grey with yellow cross stripes; throat yellow and grey marbled

Similar species: *V. salvator* and *V. spinulosus* have a shorter and more pointed snout; the tail is shorter and laterally flattened (←) with a distinct keel (←) above; in *V. salvator* the tongue is dark blue-grey; in *V. spinulosus* the large yellow spots are often replaced by diffuse transverse bands on the anterior back; the belly is brown with yellow dots; scales of the neck and back are spiny, the skin feels like sandpaper.

Size/age at sexual maturity: Ca. 170 cm TL, ♀: >45 cm SVL; age unknown

Clutch size: Up to 3 clutches per year with 4-12 (ø 7) eggs

Incubation period/temperature: 155-246 (ø 200) days at 27-30.5 °C

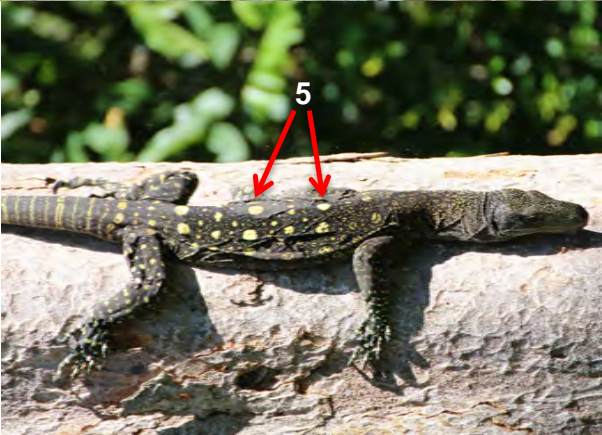
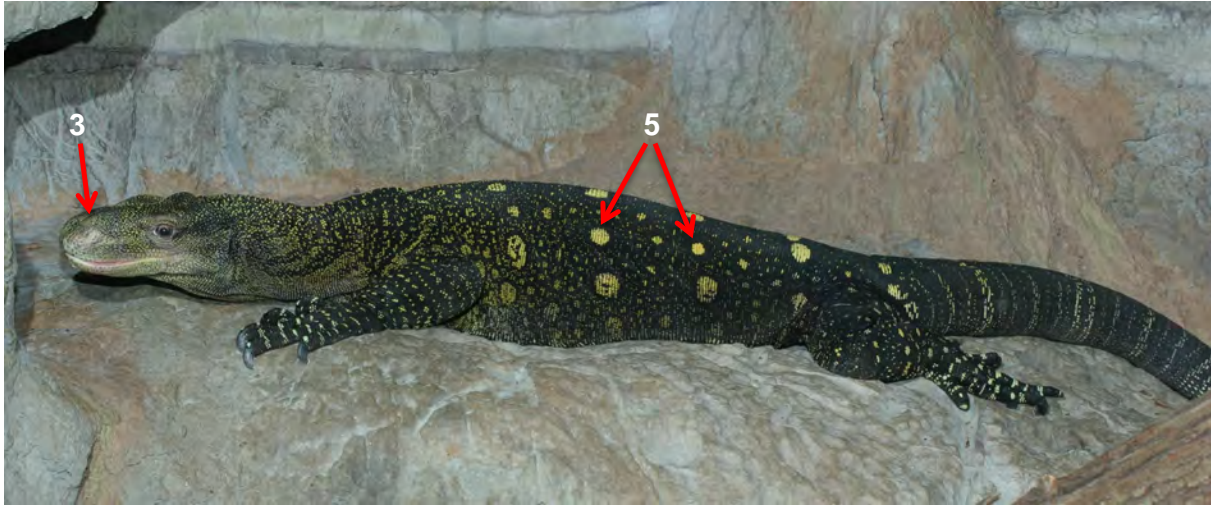
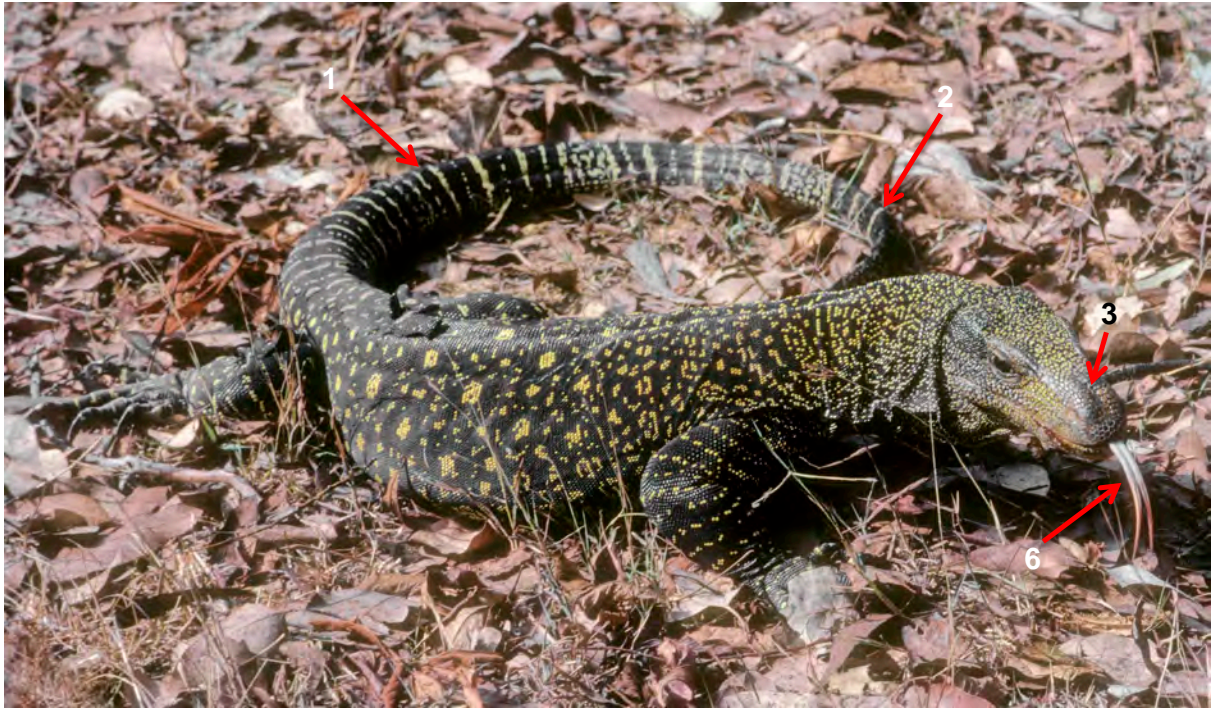
Size/weight of hatchlings: 11.5-16.5 cm SVL; 41-50.6 (ø 45) cm TL; 42.4-69.4 (ø ca. 60) g

Growth rate: No published data

Captive breeding: Breeding so far only rarely succeeded in zoos and private collections. Temporary separation of both sexes, increase of humidity, temperature and day length can be beneficial for breeding attempts.

Ecology: Diurnal (←); predominantly tree-dwelling; feeds on insects and mainly vertebrates (reptiles, birds, mammals, eggs); detailed observations from nature are missing.

Remarks: According to the CITES trade database 256-313 live specimens of *V. salvadorii* were annually exported from Indonesia between 2010 and 2017. The import of wild-caught specimens from Indonesia into the EU is suspended since 1998. The species is not nationally protected in Indonesia, but in Papua New Guinea, from where no live specimens are exported.



Varanus salvadorii. Above: adult, Moitaka wildlife sanctuary, Port Moresby, New Guinea, Papua New Guinea, © Michael McCoy; centre and below left: adult, © Rune Midtgaard; below right: adult, Wau, New Guinea, Papua New Guinea, © Martin Mandak

Varanus bitatawa Welton et al., 2010

Subgenus: *Philippinosaurus*

English names: Sierra Madre forest monitor, Northern Sierra Madre forest monitor

German name: -

Local name: Bitatawa (Agta tribe)

Synonyms: None; prior to its description, populations of *V. bitatawa* were allocated to *V. olivaceus*

Subspecies: None

International conservation status (CITES / Commission Reg. (EU) No 2017/160): Appendix II/B

IUCN Red List status: Not Evaluated (NE)

Distribution: Northern Luzon, Philippines

Total length (TL): 200 (∅ 132) cm; **Snout-vent length (SVL):** 76.6 cm

Morphological traits (adults): Large species, up to 9 (∅ 3.12) kg; muscular front limbs (1); strong tail, at base and short distance distally ovate in cross section (2), then more triangular (3) with a prominent keel (↔); tail smaller to slightly beyond 1.5 times of SVL; bulged snout (4) with slit-shaped nostrils (at about a 45° angle) located closer to tip of snout than to eye (5); supraoculars (↔) not markedly pronounced; number of midbody scales (↔) ranges between 175-193 (n = 3)

Colour pattern: Ground colour of dorsum (↔) black with four yellow/golden transverse rows of bigger spots (6) and some with smaller ones; forelimbs more yellow than black compared to hind limbs that show irregular yellow spots on black ground colour (7); yellow/golden speckles less dense on neck than on top of head, but density in yellow scales varies individually; ground colour of tail blackish with wide yellow bands (8), 11 in holotype (↔) and yellow speckles on black in-between, first band consisting of fused larger dots is near tail base (9); tongue pink/greyish; iris reddish/brown (10); **juveniles** with dark gular region (↔); yellow dots in transverse rows on dorsum proportionally smaller than in adult animals

Similar species: In *V. olivaceus* colour pattern markedly different, with blackish cross bands along the nape region and dorsum; number of midbody scales ranges between 169-214

Size/age at sexual maturity: No published data, probably similar to *V. olivaceus*

Clutch size: No published data, probably similar to *V. olivaceus*

Incubation period/temperature: No published data, probably similar to *V. olivaceus*

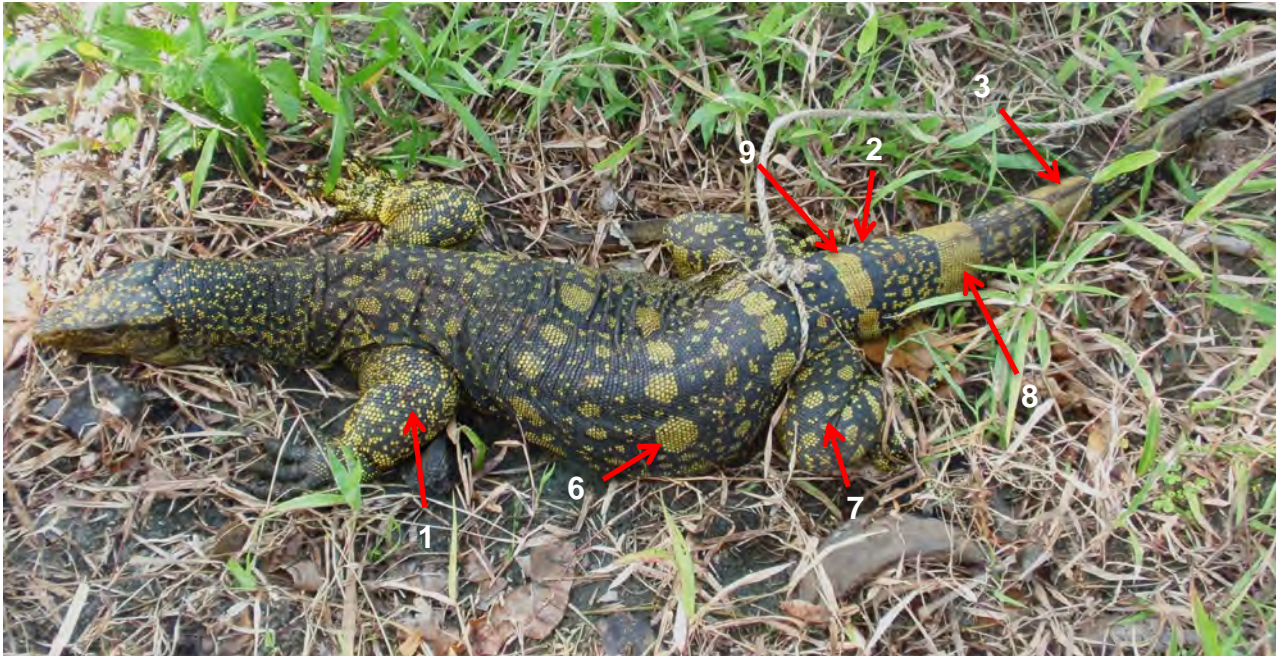
Size/weight of hatchlings: No published data, probably similar to *V. olivaceus*

Growth rate: No published data, probably similar to *V. olivaceus*

Captive breeding: No published data

Ecology: Likely diurnal (↔); strictly arboreal (↔); shy and secretive species; associated with dense mountain forests; activity areas of ♂ 23,300 m², that of ♀ 5,200 m²; largely frugivorous (↔) and dependant on fruiting trees e.g., *Pandanus* species; diet also includes snails

Remarks: No legal exports of wild animals for commercial purposes reported (CITES trade database); however, illegal offer on social media is documented; species is locally hunted for bushmeat; threatened by habitat loss through illegal logging; *V. bitatawa* is nationally protected under the Wildlife Act 2001 of the Philippines.



Varanus bitatawa. Above and below: adult ♂, holotype (♂) (PNM 9719), Aurora Province, Luzon Island, Philippines, © Luke Welton

Varanus mabitang Gaulke & Curio, 2001

Subgenus: *Philippinosaurus*

English names: Mabitang, Panay monitor lizard

German names: Mabitang, Panay-Waran

Local name: Mabitang (Panay Island)

Synonyms: None

Subspecies: None

International conservation status (CITES / Commission Reg. (EU) No 2017/160): Appendix II/B

IUCN Red List Status: Endangered (EN), population trend decreasing (last assessed 2007)

Distribution: Panay Island, Philippines

Total length (TL): 200 cm; **Snout-vent length (SVL):** 68 cm

Morphological traits (adults): Large, slender species, >5.7 kg; muscular limbs (1); tail triangular in cross-section; tail length >1.7 times SVL, with prominently keeled scales; upper tail ridge with keel (↔); nostrils slit-shaped (2), closer to tip of snout than to eye; long head, triangular shape from above; slightly bulbous snout (3) and prominent bulbous temporal (↔) and parietal region (↔) (4); long neck with smaller scales in nape region that border head scales (5); particularly small scales on neck, body and tail; scales on ventrum (↔) distinctly keeled; blunt dentition; long fingers and claws; number of midbody scales (↔) in the holotype (↔) 212

Colour pattern: Body almost uniform dark grey to black (6); underside of head, gular region (↔), limbs and tail also dark grey to black; scales in neck region, dorsum (↔) and particularly at hind legs posteriorly (↔) with tiny yellow spots; tongue light pink/flesh-coloured; iris reddish brown (7); **juveniles** also black according to locals

Similar species: Uniformly black colouration is common in taxa (↔) of the *Varanus salvator* species group, such as melanistic (↔) *V. salvator* (occasionally reported from Thailand), or *V. salvator andamanensis*; also dark grey to blackish individuals of *V. nuchalis* are found on Panay Island; *V. rudicollis* is a more slender species with distinctly enlarged nuchals (↔)

Size/age at sexual maturity: No published data

Clutch size: 6-12 eggs (from dissected specimens)

Incubation period/temperature: No published data

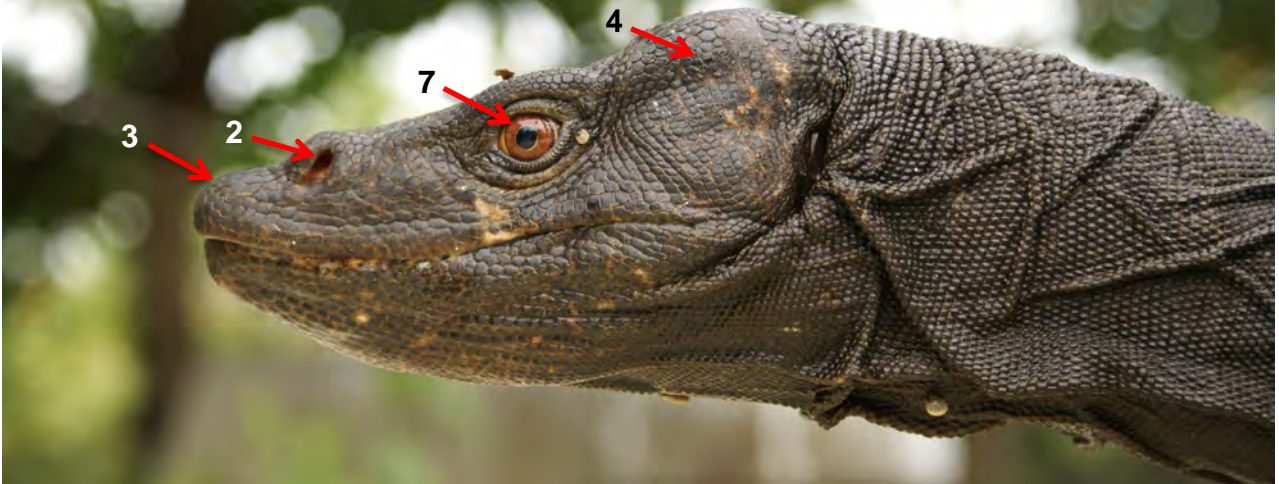
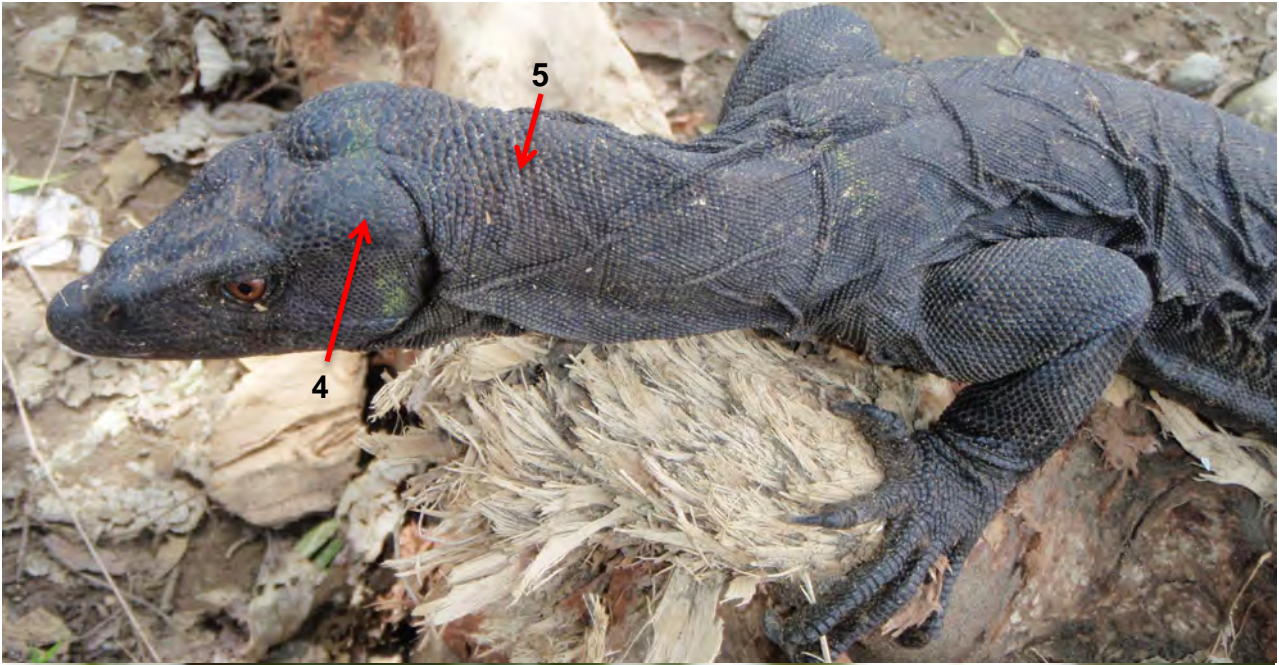
Size/weight of hatchlings: No published data

Growth rate: No published data

Captive breeding: No published data

Ecology: Likely diurnal (↔); predominantly arboreal (↔); frugivorous (↔), occasionally plant matter and invertebrates such as snails, crabs and insects are eaten

Remarks: Occurrence on Mindoro Island remains doubtful; *V. mabitang* is locally hunted for consumption; mainly threatened by illegal deforestation (fire, logging) in western/north-western Panay Island; since its scientific description in 2001, no commercial trade has been documented (CITES trade database); the species is nationally protected under the Wildlife Act 2001 of the Philippines.



Varanus mabitang. Above and centre: adult ♂, Panay Island, © Maren Gaulke; below: captive adult, Mari It Wildlife Conservation Park, Lambunao, Iloilo, © Daniel Bennett

Varanus olivaceus Hallowell, 1857

Subgenus: *Philippinosaurus*

English names: Gray's monitor lizard, Butaan

German names: Butaan, Philippinenwaran

Local names: Butaan, Shabu (Philippines)

Synonyms: None

Subspecies: None

International conservation status (CITES / Commission Reg. (EU) No 2017/160): Appendix II/A

IUCN Red List status: Vulnerable (VU), population trend decreasing (last assessed 2017)

Distribution: Southern Luzon, Polillo and Catanduanes Islands, Philippines

Total length (TL): 175.5 cm (♂); **Snout-vent length (SVL):** 73 (Ø 65.4) cm (♂); 50.8 cm (♀)

Morphological traits (adults): Large species, up to 10 kg (Ø 6.12 kg in ♂; Ø 2.6 kg in ♀); muscular, relatively long extremities; tail strong, laterally compressed and rather ovate in cross-section; tail length about 1.5 times of SVL; bulged snout with slit-shaped nostrils (at about a 45° angle) located closer to tip of snout than to eye (1); supraoculars (↔) are individually differently pronounced, number and size vary; the number of midbody scales (↔) ranges between 169-214 (Ø 186)

Colour pattern: Ground colour of dorsum (↔) is greenish/olive to greyish, in large ♂ partially melanistic (↔); pattern of transverse dark blackish stripes/bars on nape and dorsum varies individually, those in nape and shoulder region arch-shaped and open anteriorly (2), followed by either two closely spaced (open) streaks/bars (3), or solid (closed) wide ones; head with light yellow to orange around nostrils, upper snout, around eyes and labial region (4), on top dark with yellowish/green to brown/greyish irregular spots (5); back head darkest with dark temporal streak (↔) (6); tail with more indistinct 11-12 darker bands intermingled with lighter speckles; limbs dark with individually differently pronounced light spotting; pink tongue; iris red/brownish (7); **juveniles:** ground colour of first third/half of dorsum yellow/greenish (8) with five solid black double stripes/bands that can diverge at body sides, in-between these some fine black speckles; remainder of dorsum bluish/black/whitish mottling in-between the less prominent black cross stripes (9)

Similar species: In *V. bitatawa* colour pattern markedly different, with larger yellow spots across the dorsum; number of midbody scales ranges between 175-193

Size/age at sexual maturity: ♀ at about 42 cm SVL, likely at 2-3 years; ♂ at >45 cm SVL at ca. 3 years

Clutch size: 4-16 (Ø 8) eggs per clutch, depending on ♀ size; one captive ♀ laid 2 clutches/year

Incubation period/temperature: 137-270 days at 27.5-34 °C

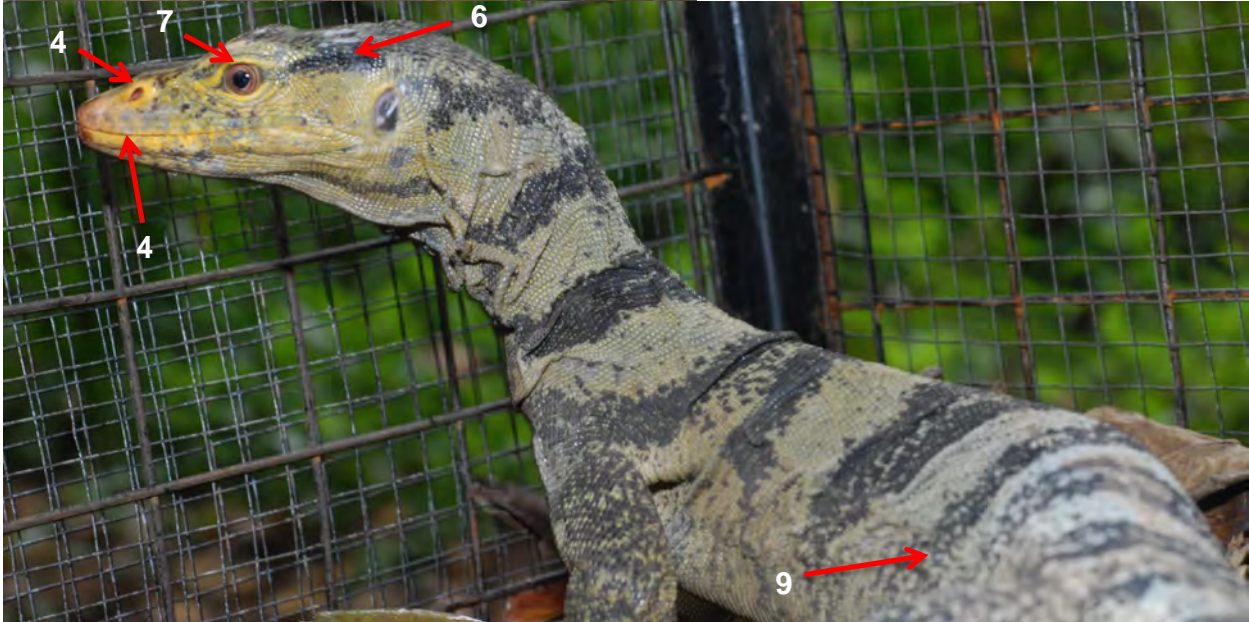
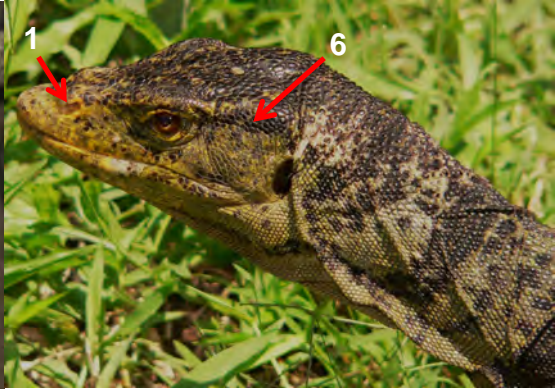
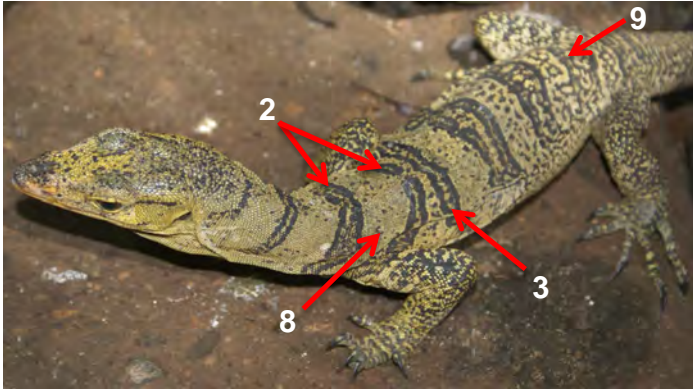
Size/weight of hatchlings: 25.5-41.8 cm TL; 11 cm SVL (one hatchling); 19-26.3 g

Growth rate: At 30-40 cm SVL increase of Ø 3.5 cm/month; at 40-60 cm SVL increase of Ø 0.3 cm/month

Captive breeding: The species is maintained in several zoological gardens in the United States; it is the only frugivorous Philippine monitor species that has been bred in captivity.

Ecology: Likely diurnal (↔); terrestrial (↔) and arboreal (↔); shy and secretive species; associated with intact forests; small home range, in 108 days an area of merely 2.7 ha was utilized; largely frugivorous (↔), predominantly feeds on e.g., *Pinanga* and *Pandanus* species, and to a lesser extent on snails and crabs

Remarks: In the period 1990-2014, the export of 31 specimens was documented, including 22 specimens sourced C (↔) and F (↔) (CITES trade database); the species is illegally supplied by local pet traders and locally hunted for bushmeat; habitat loss through illegal logging; nationally protected under the Wildlife Act 2001 of the Philippines



Varanus olivaceus. Above and centre right: adult, reptile trade facility, Indonesia, © Mark Auliya; centre left: juvenile, zoo near Manila, Philippines, © Maren Gaulke; below: subadult, seized, DENR rescue center, Quezon City, Luzon Island, Philippines, © Emerson Y. Sy

Varanus albigularis (Daudin, 1802)

Subgenus: *Polydaedalus*

English names: White-throated monitor (*V. a. albigularis*), rock/savanna monitor, Angola monitor (*V. a. angolensis*), Black-throated monitor (*V. a. microstictus*), Southern savanna monitor

German names: Weißkehlwaran (*V. a. albigularis*), Schwarzkehlwaran (*V. a. microstictus*), Kapwaran

Local names: Mbulu (Zambia), Kama (Kenya), Kgwater (Botswana), UmBulu (South Africa)

Synonyms: *Varanus exanthematicus albigularis* Mertens, 1963; *V. exanthematicus angolensis* Mertens, 1963; *Varanus exanthematicus microstictus* Mertens, 1963

Subspecies: *Varanus albigularis albigularis* (Southern Africa, north to Angola, Zambia, Mozambique), *Varanus albigularis angolensis* (mainly Angola, also Namibia, Zambia, DR Congo), *Varanus albigularis microstictus* (northeastern Africa, Ethiopia to North-Central Mozambique)

International conservation status (CITES / Commission Reg. (EU) No 2017/160): Appendix II/B

IUCN Red List status: Not Evaluated (NE)

Distribution: Central, north-eastern and eastern Africa to South Africa

Total length (TL): 150 cm; **Snout-vent length (SVL):** 60 cm (♀); 75 cm (♂)

Morphological traits (adults): Large stout-bodied species; strong but relatively short tail, up to 1.44 times SVL; tail laterally compressed (↔) and double-crested (↔) (1); broad head with blunt snout and prominent bulges between tip of snout and nostrils (2); slit-shaped nostrils located closer to eye than to tip of snout (3); scales in the nape region and posterior neck distinctly larger (4); number of midbody scales (↔) ranges between 110-167

Colour pattern: Overall main colour ochre, brown to greyish shades; subspecies *microstictus* with blackish throat (more distinct in juveniles); subspecies *albigularis* is whitish-throated (5); prominent blackish temporal streak (↔) behind eye that extends to shoulder region, more distinct in juveniles and subadults (6); colour pattern in adults less distinct, otherwise whitish/yellowish flecks, also ocelli (↔), more distinct dorsolaterally (↔), in some specimens in bands across dorsum (↔); tail with cross-bands (7); **juveniles** with more prominent/contrasting bands on tail

Similar species: In *V. exanthematicus* the snout is shorter and bulges on top of snout less prominent, tail is more compressed, number of midbody scales ranges between 58-73; *V. yemenensis* with yellow band across snout, markedly smaller scales in nape region and body, number of midbody scales ranges between 134-158; *V. flavescens* with transverse rows of yellow spots on dorsum, nostrils are closer to tip of snout, number of midbody scales ranges between 82-94

Size/age at sexual maturity: Both sexes at about 50 cm SVL; with approximately 4-5 years; mature ♀ also recorded at 35-45 cm SVL; in captivity earliest at 2 years

Clutch size: 8-50 eggs per clutch, larger ♀ lay bigger clutches; 2 clutches per year recorded

Incubation period/temperature: <120 days at 30-33 °C, 135-150 days at 27-29 °C or 150-180 days at 28-31 °C; in the wild up to 12 months

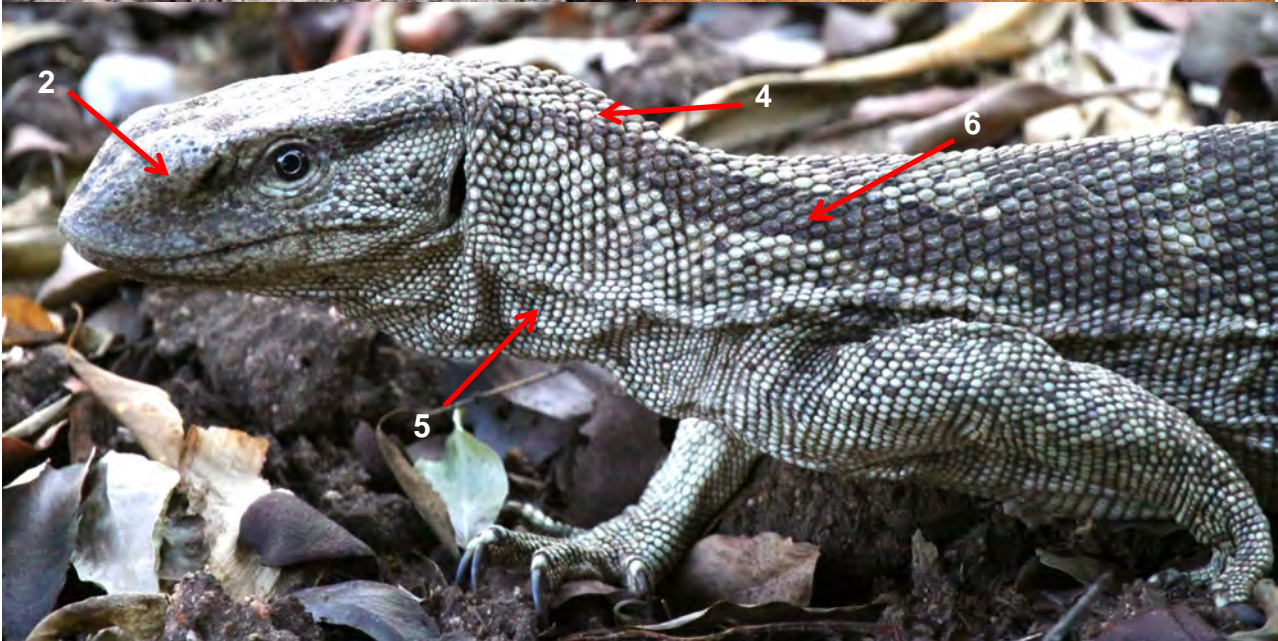
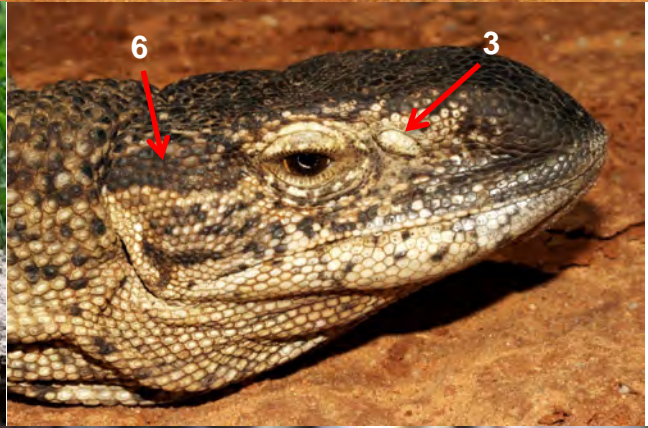
Size/weight of hatchlings: Ø 25 cm TL; ca. 12 cm SVL; 20-30 g

Growth rate: See above

Captive breeding: Repeatedly successful in private collections and zoos

Ecology: Diurnal (↔), mainly terrestrial (↔), trees utilized for refuge (e.g., predators, heat); ground burrows, termite mounds as breeding sites; opportunistically preys on invertebrates (↔), reptiles (snakes regionally favoured), birds' eggs, birds, and smaller mammals

Remarks: Commercial trade in specimens of *V. albigularis* sourced C (↔) is documented and exports of live wild animals are particularly documented from Mozambique (CITES trade database); locally consumed and utilized in traditional medicines; conservation status assessed as "Least Concern" for South Africa



Varanus albigularis. Above and centre right: adult, Ongava Game Reserve, Etosha, Namibia, © Mark O'Shea; centre left: adult, Tshokwane, Kruger National Park, Mpumalanga, South Africa; below: subadult, Skukuza, Kruger National Park, Mpumalanga, South Africa, © Robin Maritz

Varanus exanthematicus (Bosc, 1792)

Subgenus: *Polydaedalus*

English names: Savannah monitor, Bosc's monitor

German name: Steppenwaran

Local names: Gueule-tapee (Senegal), Damo (Nigeria), A-nak-a-nak (Kenya)

Synonyms: None

Subspecies: None; formerly *V. albigularis* was scientifically treated as a subspecies of *V. exanthematicus*.

International conservation status: (CITES / Commission Reg. (EU) No 2017/160): Appendix II/B

IUCN Red List status: Least Concern (LC), population trend unknown (last assessed 2009)

Distribution: West, Central and East Africa

Total length (TL): 100 cm (in captivity 150 cm); **Snout-vent length (SVL):** 50 cm (in captivity 75 cm)

Morphological traits (adults): Large stout-bodied species; short extremities; short tail with a double-crest (↔) in the middle third of length, triangular in cross-section (1), shorter than SVL or up to 1.2 times longer than SVL; almost vertical positioned slit-shaped nostrils, located slightly closer to eye than to tip of snout (2); supraoculars (↔) not differentiated; head scales of frontal (↔) and parietal (↔) region enlarged; large prominent scales on nape (3), scales on neck sides with low keels (4); number of midbody scales (↔) ranges between 58-73

Colour pattern: Ground colour brownish/grey to yellowish/ochre, limbs darker; dorsum (↔) either with almost no pattern or with light centred large ocelli (↔) that form transverse bands (5); dorso-ventrally (↔) ocelli can fuse and resemble a network pattern (6); tail with narrow light and dark bands (7); **juveniles** with much more contrasting colour pattern, particularly ocelli (8) and cross-bands along the tail (9); in the first weeks snout of hatchlings yellowish/ochre

Similar species: In *V. yemenensis* yellow band across snout; markedly smaller scales in nape region and body; 134-158 scales around midbody; *V. albigularis* with blackish temporal streak (↔) that extends to shoulder region, prominent bulges on longer snout; number of midbody scales ranges between 110-167; in *V. flavescens* nostrils are closer to tip of snout than to eye; dorsum with transverse rows of yellow spots; number of midbody scales ranges between 82-94

Size/age at sexual maturity: ♀ at 27.4 cm SVL; ♂ at ca. 34 cm SVL; age unknown

Clutch size: Up to 50 eggs recorded in one clutch, but clutch size normally ranges between 6 and 29 eggs; in captivity up to 4 clutches per breeding season

Incubation period/temperature: 100-200 days at 29-34 °C; more narrowly defined examples, 127-132 days at 32 °C or 169-194 days at 29 °C

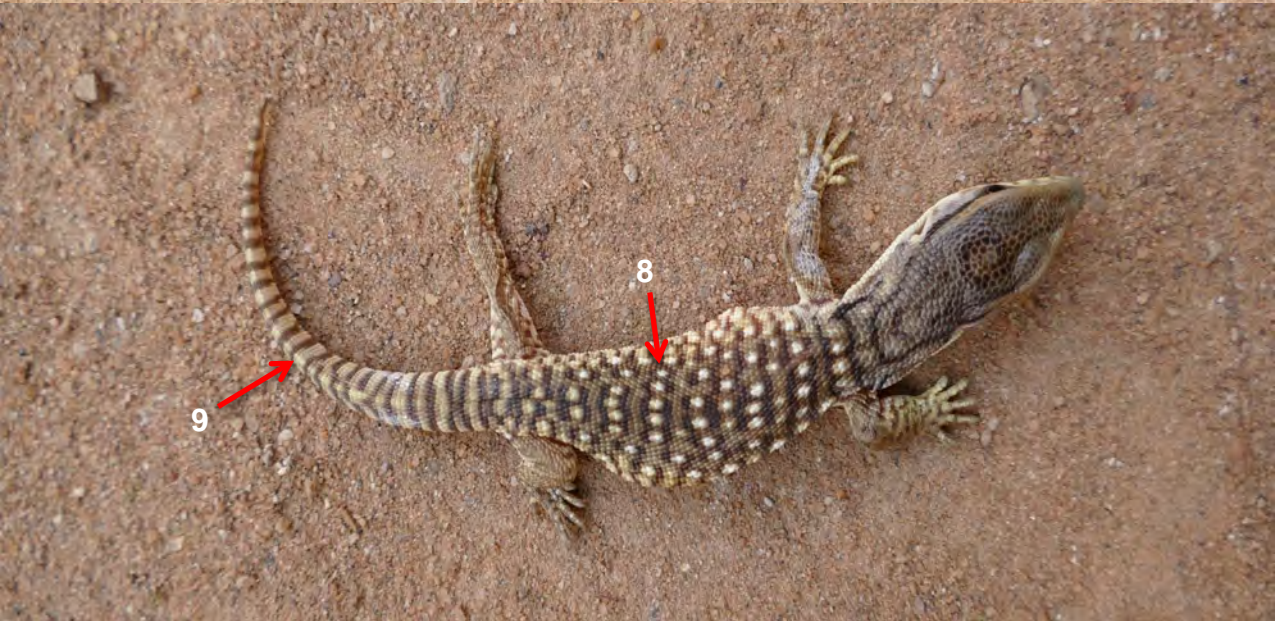
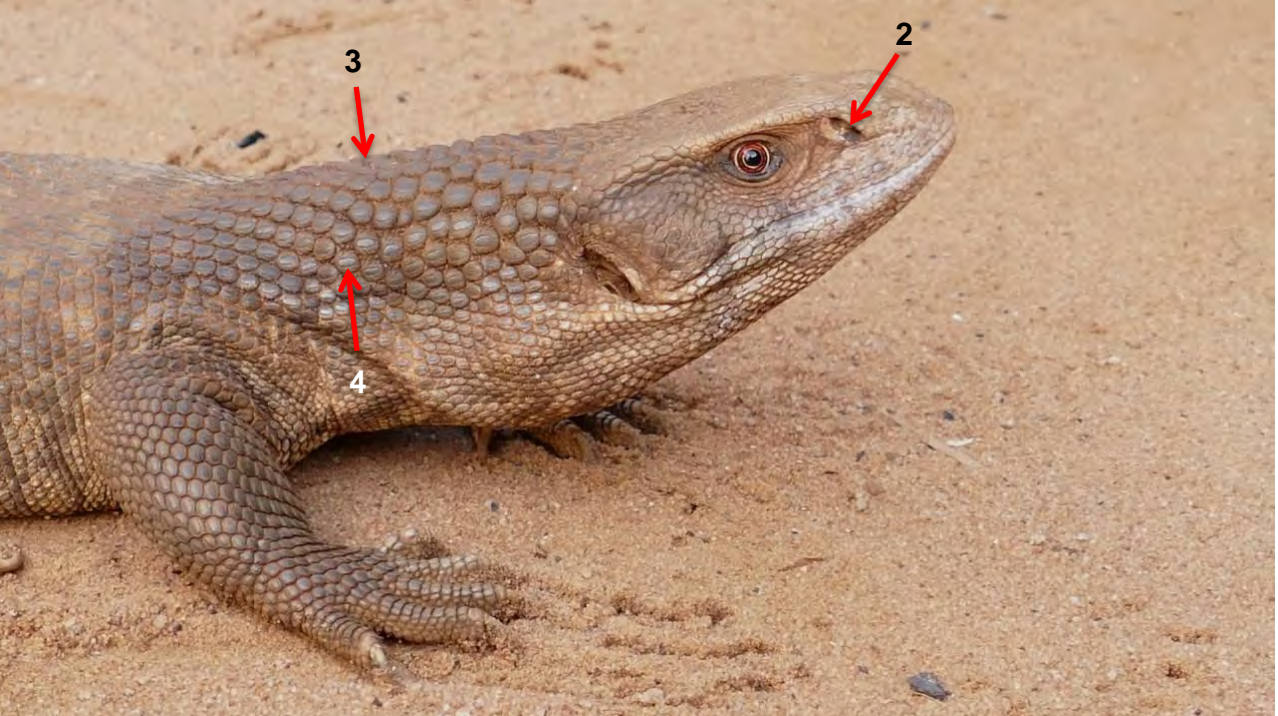
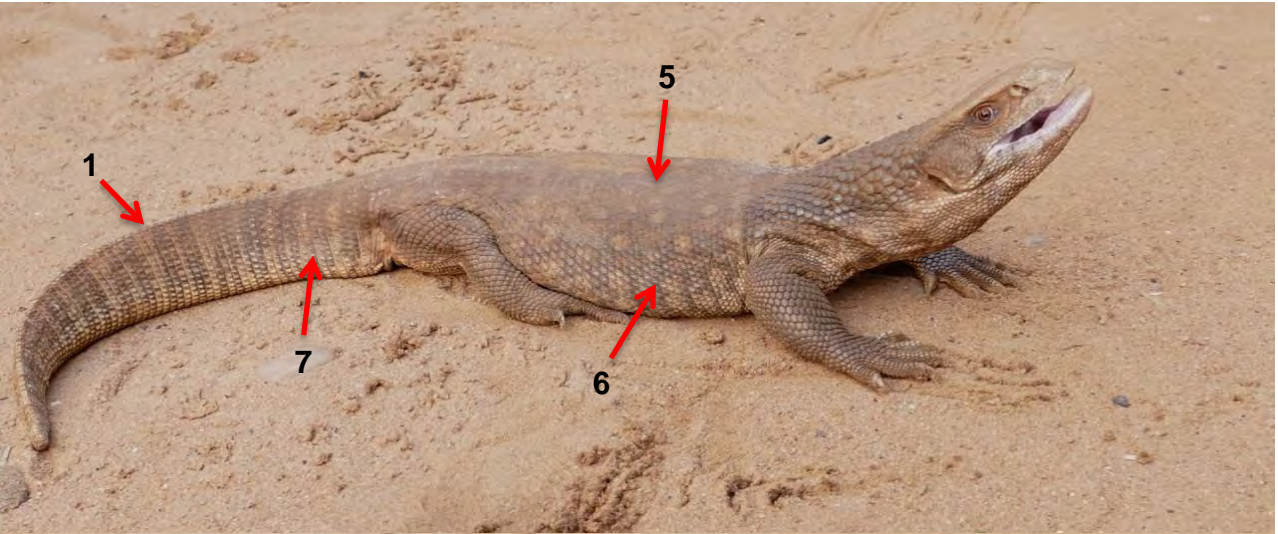
Size/weight of hatchlings: 12 cm TL; 7-8 cm SVL; 6-7 g (wild), 9-12 g in captivity

Growth rate: 1.3 cm increase/month in first 6 months of life; 5-7-week-old individuals may weigh between 22-28 g; at one year ♂ reach 61 cm TL and 3.63 kg, ♀ 50.8 cm TL and 3.1 kg

Captive breeding: Internationally widespread in captive collections, but relatively few reports about successful breeding beyond first generation

Ecology: Diurnal (↔); terrestrial (↔); savannah species, also associated to agro-ecosystems with loose sandy soil; burrowing species, seeks shelter in burrows, termite mounds, and occasionally in tree hollows; regionally juveniles favour crickets (*Brachytrupes*) in burrows they occupy until they reach a body mass of ca. 200 g; mainly preys on arthropods (scorpions, millipedes, larger insects and their larvae), snails, amphibians, lizards eggs (also of their own kind), and rodents

Remarks: Internationally, *Varanus exanthematicus* is the most traded monitor species for the pet industry; major exporting countries are Ghana, Togo and Benin; in the period 2010-2017, these three countries exported 211,050 live specimens according to the CITES trade database; regionally the species is also sought after for its meat and internationally for its skin.



Varanus exanthematicus. Above and centre: adult, below: juvenile, Togo, © Mark Auliya

Varanus niloticus (Linnaeus, 1766)

Subgenus: *Polydaedalus*

English name: Nile monitor

German name: Nilwaran

Local names: Guana (Guinea-Bissau), Ngombi (Cameroon), Kenge (Swahili, Uganda), Hopani (Lozi, Zambia), Uxamu (Zulu, South Africa)

Synonyms: None

Subspecies: None; but formerly, *Varanus ornatus* was scientifically treated as a subspecies of *V. niloticus*; across its African-wide distribution *V. niloticus* represents a species group, genetically a western, northern, and southern lineage are distinct.

International conservation status: (CITES / Commission Reg. (EU) No 2017/160): Appendix II/B

IUCN Red List status: Not Evaluated (NE)

Distribution: South of the Sahara, western, central, and eastern Africa to southern Africa

Total length (TL): 240 cm; **Snout-vent length (SVL):** 80 cm

Morphological traits (adults): Large species, muscular hind legs; muscular, long, and high tail (1), near base roundish, then laterally compressed, triangular in cross-section, tail length approximately 1.5-1.8 times SVL; tail flattened at the upper sides; nostrils roundish to oval, slit-shaped in old individuals, located slightly closer to eye than to tip of snout (2); head is high with a short, bulged snout (3); large ear openings (4); supraoculars (↔) not enlarged; number of midbody scales (↔) ranges between 128-183

Colour pattern: Ground colour olive/grey with single yellow scales; dorsum (↔) between fore and hind limbs with 6-9 (rarely 5) cross rows of black ocelli (↔) with yellow inside or spots fused to bands (5); proportion of yellow colour differs individually and varies between populations (6); upper head dark with 8-10 whitish/yellowish cross-lines (7); black temporal streak (↔) (8); labial region (↔) with dark cross bars (9); yellow lines on nape forming half circles (10); chin whitish/yellowish with black cross stripes and speckles; gular region (↔) occasionally with network (11) and black speckling (12); pale yellowish ventrum (↔) with black partly broken cross stripes; tail banded with narrow yellow and broader black bands (13); tongue bluish/black; **juveniles** more contrasting; dorsum with transverse rows of ocelli; gular region with network (14)

Similar species: Dorsum of *V. ornatus* with 3-5 transverse bands of yellow ocelli between fore and hind limbs; head broader and higher particularly in older specimens; number of midbody scales ranges between 146-175; tongue white/pinkish; in *V. salvator* nostrils closer to tip of snout than to eye; lower head and longer snout; supraoculars enlarged; head on top without cross-lines

Size/age at sexual maturity: ♀ approximately at 34-48 cm SVL, ca. 24 months, ♂ >36 cm SVL (Chad, Mali populations); in western Africa ♂ at 90 cm, ♀ at 86.5-100 cm TL; southern and central African populations with 120 cm TL at 3-4 years age, while populations in the Gambia attain sexual maturity with 80-90 cm TL also in 3-4 years.

Clutch size: 5-60 (∅ ca. 25) eggs per clutch depending on ♀ size

Incubation period/temperature: 6-9 or 12 months in wild populations; in captivity between 120-126 days at 30° C or 141-150 days at 27-30.5 °C

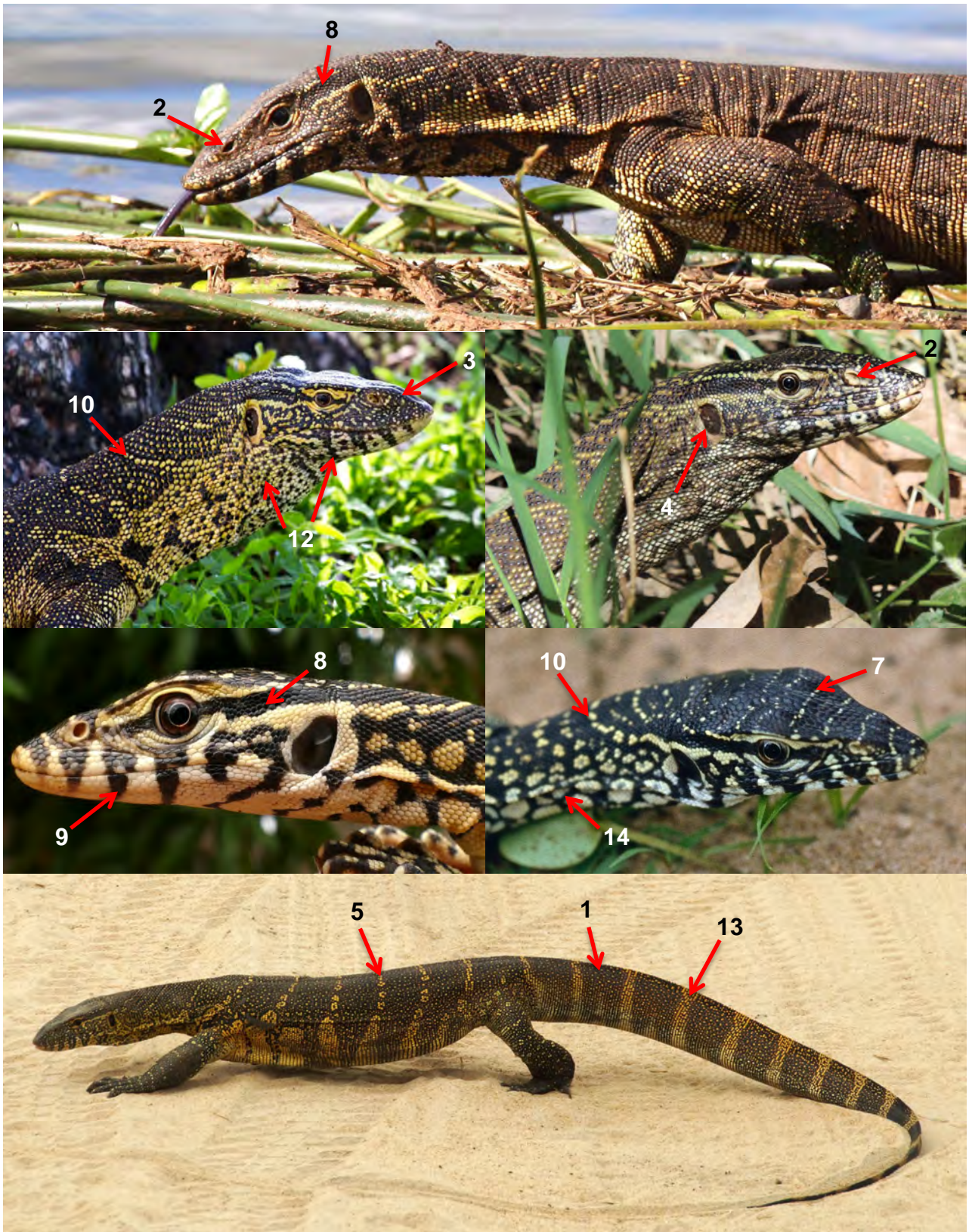
Size/weight of hatchlings: 12.5 cm SVL; 16.5-30 cm TL

Growth rate: In Chad populations: 9 year-old ♂ have a TL of 207 cm; ♀ ca. 155 cm TL at 6 years of age; in early development, growth rate is high (also compare above)

Captive breeding: Due to the species' large body size, it is rarely kept and breeding records remain scarce.

Ecology: Diurnal (↔); adults mainly terrestrial (↔); juveniles more arboreal (↔); semiaquatic (↔); associated with various ecosystems (moist/dry savanna, woodlands, wetlands, agroecosystems); preys opportunistically on invertebrates (↔), vertebrates (↔) and carrion

Remarks: It is the most utilized species of African monitor lizards for the international leather industry; juveniles originate mainly from Western Africa to supply the international pet trade; in the 1990s introduced to Florida; regionally exploited for bushmeat and traditional medicines



Varanus niloticus. Above: adult, Kruger National Park, Mpumalanga, South Africa, © Robin Maritz; second row left: adult, Selou Game Reserve, Tanzania, © Gregoire Dubois; second row right: adult, Gambia, © Hubert Laufer; third row left: juvenile, Togo, © Mark Auliya; third row right: juvenile, Guinea-Bissau, © Mark Auliya; below: adult, Tarangire River, Tarangire National Park, Tanzania, © Deborah van Beek



Varanus niloticus. Above: adult, Tarangire National Park, Tanzania, © Ashley Hockenberry; centre: adult, Lake Manyara, Tanzania, © Gordon E. Robertson; below: adult, St. Louis-Rosso, Senegal, © Wolfgang Böhme

Varanus ornatus Daudin, 1803

Subgenus: *Polydaedalus*

English names: Ornate monitor, Ornate Nile monitor

German names: Regenwald-Nilwaran, Regenwaldwaran

Local names: Guana (Benin), Dgyou dgyou, Geedee (southern Nigeria), Ju-ju (Nigeria)

Synonyms: None

Subspecies: None; formerly, *V. ornatus* was scientifically treated as a subspecies of *V. niloticus*; *V. ornatus* is a member of the *V. niloticus* species group.

International conservation status (CITES / Commission Reg. (EU) No 2017/160): Appendix II/B

IUCN Red List status: Not Evaluated (NE)

Distribution: Tropical western and central (eastern?) Africa

Total length (TL): >200 cm; **Snout-vent length (SVL):** >62 cm

Morphological traits (adults): Large species, muscular hind legs; strong, long and high tail, laterally compressed, triangular in cross-section (1), above with a wide keel (2); tail length approximately 1.6-1.89 times SVL; nostrils roundish to oval, slit-shaped in old individuals, located slightly closer to eye than to tip of snout (3); head distinctly high and broad with bulged parietal region (↔) in older ♂ specimens (4); large ear openings (5); supraoculars (↔) not enlarged; number of midbody scales (↔) ranges between 146-175

Colour pattern: Ground colour olive/grey/blackish with single yellow speckled scales; dorsum (↔) between fore and hind limbs with 3-5 transverse rows of larger yellow round/oval spots or encircled ocelli (↔) with black in the centre (6); spots/ocelli may fuse to bands (7); upper head blackish (in older individuals no pattern) (8); black temporal streak (↔); labial region (↔) with grey/blackish bars, individually more or less distinct (9); chin whitish/yellowish with greyish (speckled) cross stripes (10); body sides with yellow triangular shapes that widen towards ventrum (↔) (11); dark fore and hind limbs with yellowish spots; tail with 9-12 yellow bands that are broader below (12); **juveniles:** overall more contrasting (13); distinct yellowish cross-lines on top of head (14); nape region with few arched yellow horizontal stripes (15); temporal streak more distinct (16); white/pinkish tongue

Similar species: *V. niloticus* with 6-9 transverse rows of yellow spots/ocelli between fore and hind limbs that may fuse to bands; on average 10-18 yellow bands along tail; tongue bluish/black; tail on average slightly shorter; in *V. salvator* nostrils are closer to tip of snout than to eye; lower head and longer snout; enlarged supraoculars; head on top without cross-lines

Size/age at sexual maturity: Unknown, probably similar to *V. niloticus*

Clutch size: 21 eggs in one clutch (reported by a 10-year-old ♀); otherwise probably similar to *V. niloticus*; 2 clutches per year

Incubation period/temperature: Unknown, probably similar to *V. niloticus*

Size/weight of hatchlings: Unknown, probably similar to *V. niloticus*

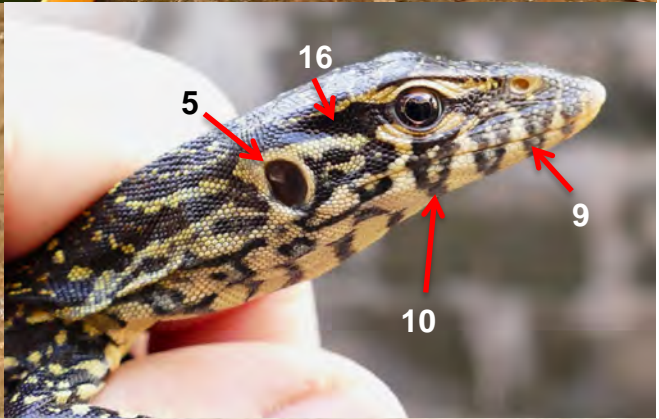
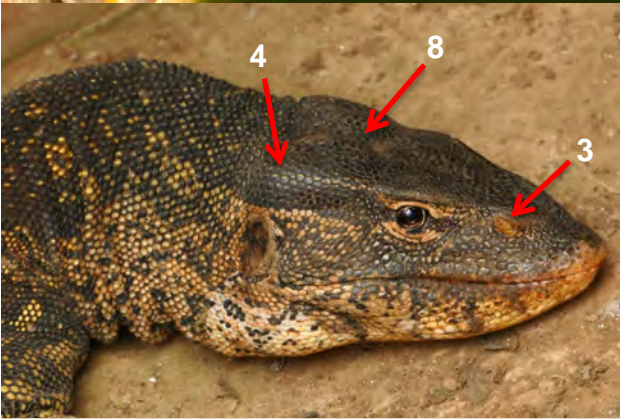
Growth rate: Unknown, probably similar to *V. niloticus*

Captive breeding: No published information

Specifics: Parthenogenesis (↔) has been reported.

Ecology: Diurnal (↔); terrestrial (↔); arboreal (↔); semiaquatic (↔); associated to lowland rain forests, edges of forest bordering savannah, agroecosystems with human settlements; usually near waterbodies; juveniles likely more arboreal as *V. niloticus*; both juveniles and adults predominantly prey on crabs

Remarks: Genetically *V. ornatus* matches *V. niloticus* despite specific morphological differences and variation in colour pattern; juveniles originating mainly from Western Africa are involved in the international pet trade; between 2010-2018 >5,300 live specimens were exported from mainly Togo (CITES trade database).



Varanus ornatus. Above & centre left: adult specimen at a trader in Benin, © Mark Auliya; centre right & below: juvenile specimen at a trader in Togo, © Mark Auliya



Varanus ornatus. Above left & centre: subadult, Loango National Park, Gabon, © Gregoire Dubois; above right: juvenile, Bobiri, Ghana, © Les Catchick; below: adult, Loango National Park, Gabon, © Gregoire Dubois

Varanus yemenensis Böhme et al., 1989

Subgenus: *Polydaedalus*

English name: Yemen monitor

German name: Jemenwaran

Local name: -

Synonyms: None

Subspecies: None

International conservation status (CITES / Commission Reg. (EU) No 2017/160): Appendix II/B

IUCN Red List status: Data Deficient (DD), population trend unknown (last assessed 2012)

Distribution: Southwest Yemen, Saudi Arabia

Total length (TL): 86.8 cm (♀), 115 cm (♂); **Snout-vent length (SVL):** 39.5 cm (♀), 59 cm (♂)

Morphological traits (adults): Medium-sized, stout-bodied species; muscular fore limbs; front digits (←) with longer claws than those on hind digits; double-crested (←) tail, laterally compressed, triangular in cross-section (1), slightly longer than SVL; slit-shaped nostrils closer to eye than to tip of snout (2); bulged snout (3), parietal (←) (4) and temporal region (←) (5); supraoculars (←) not enlarged; nuchals (←) larger than on upper head (6); number of midbody scales (←) ranges between 134-160

Colour pattern: Ground colour of dorsum (←) in brown shades, spots/ocelli (←) lacking; hind limbs brownish with yellowish spots (7), fore limbs yellow (8); dorsum posteriorly (←) (at level of hind legs) with dark narrow cross-bands (9); snout with distinct broad yellowish/ochre band (10); parietal region blackish (11); tail lighter than dorsum with dark cross-bands (12); dorsum of **juveniles** posteriorly (←) with more distinct cross-bands

Similar species: *V. albigularis*, particularly the East African population of *V. a. microstictus* (most closely related to *V. yemenensis*) with more pronounced dorsal colour pattern, without yellow band across snout and with larger dorsal scales, nostrils closer to eye than to tip of snout and number of midbody scales ranges between 110-167; *V. exanthematicus* with larger, but fewer body scales, short snout with less prominent bulges, tail more laterally compressed and number of midbody scales ranges between 58-73; dorsum of *V. flavescens* with transverse rows of yellow spots, nostrils closer to tip of snout than to eye, number of midbody scales ranges between 82-94

Size/age at sexual maturity: No published data, probably similar to *V. albigularis*

Clutch size: No published data, probably similar to *V. albigularis*

Incubation period/temperature: No published data, probably similar to *V. albigularis*

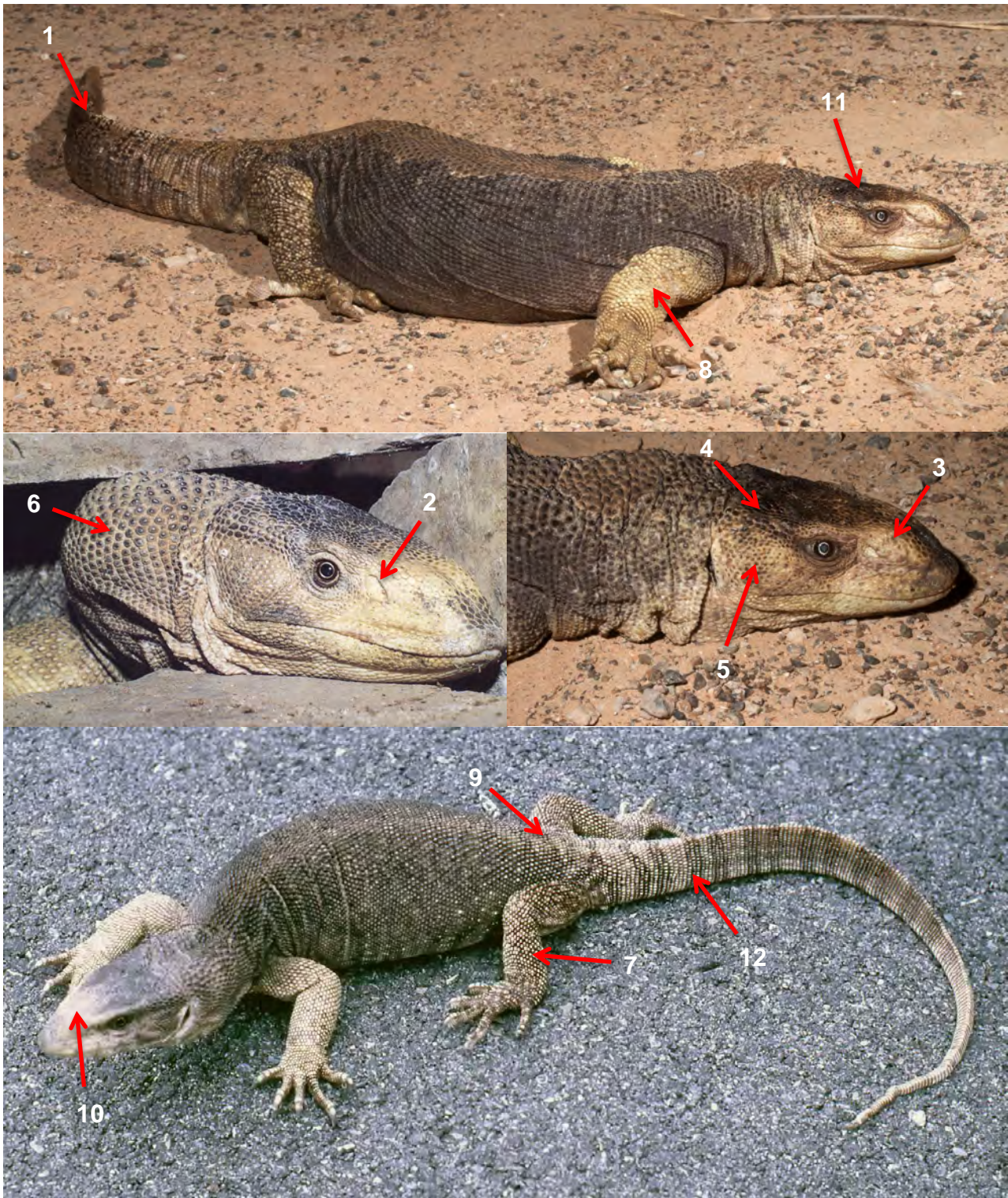
Size/weight of hatchlings: 14.5 cm SVL; 32 cm TL

Growth rate: ♂ specimen with 45.8 cm SVL and 99.9 cm TL increased to 47.5 cm SVL and 101.8 cm TL over a period of 20 months

Captive breeding: No published data

Ecology: Diurnal (←); mainly terrestrial (←); shelters in excavated burrows and tree hollows; occurs in scrub and dry forested habitats in mountain foothills; preys on various invertebrates (←) such as insects and snails.

Remarks: Between 1991 and 2013 exports of almost 300 live specimens were documented (CITES trade database).



Varanus yemenensis. Above and centre right: adult, Al Batayah, Sharjah, United Arab Emirates, © Mark O'Shea; centre left and below: adult, holotype (♂) ZFMK 46500, As Sukhnah, type locality (♂), northern Yemen, © Wolfgang Böhme

Varanus griseus (Daudin, 1803)

Subgenus: *Psammosaurus*

English names: Desert monitor, Grey monitor (*V. g. griseus*), Caspian monitor (*V. griseus caspius*)

German name: Wüstenwaran

Local name: Koah Afor (Israel)

Synonyms: None

Subspecies: *V. g. griseus* (North Africa, Arabian Peninsula), *V. griseus caspius* (from Iran to Kazakhstan and West Pakistan), *V. griseus konieczyi* (West Pakistan, Northwest India)

International conservation status (CITES / Commission Regulation (EU) No 2017/160): Appendix I/A

IUCN Red List status: Not Evaluated (NE)

Distribution: Northern Africa, Arabian Peninsula, South Asia (to Kazakhstan and India)

Total length (TL): *griseus*: 62-110 (♂ 83) cm; *caspius*: 83-130 (♂ 105) cm; *konieczyi*: 44.9-83.5 cm (♂); 41.2-75.2 cm (♀); **Snout-vent length (SVL):** *griseus*: 46 cm (♂), 38 cm (♀); *caspius*: 58.5 cm (♂), 46 cm (♀); *konieczyi*: 18.3-36.5 (♂ 28.7) cm (♂); 19-33.5 (♂ 26.8) cm (♀)

Morphological traits (adults): Medium-sized species; head, body and legs slim; tail relatively short, 1.3-1.5 (*griseus*, **A**), 1.25-1.7 (*caspius*, **B**) and 1.1-1.3 (*konieczyi*, **C**) times SVL, round (**1**) (*griseus*) or slightly laterally flattened (**2**) (*caspius/konieczyi*) in cross section with a low keel (**↔**) above; tail scales above and below equal in size, mostly forming continuous rings around tail; head scales above eyes not enlarged; nostrils slit-shaped to oval, relatively large, closer to eye than to tip of snout (**3**)

Colour pattern: Upper side of body yellowish, light brown or dark grey, sometimes pink (*konieczyi*); back with 5-8 (♂ 6 in *griseus/caspius*) or 3-5 (♂ 4 in *konieczyi*) black horizontal stripes (often pale with increasing age), especially in older specimens white/yellow spots and/or black spots in between; tail with 7-15 (*konieczyi*), 13-19 (*caspius*) and 19-28 (*griseus*) black bands; end of tail sometimes plain dark (**4**) (*griseus*) or whitish/pink (**5**) (*caspius/konieczyi*); legs sometimes with dark stripes (*caspius*) (**6**); dark stripe running from eye to ear along the neck, below sometimes further longitudinal stripes; dark cross stripes over snout; body underside yellowish, sometimes pink, with dark cross stripes; tongue pink/flesh-coloured, bluish grey at bifurcation, tips lighter; iris pale yellow, sometimes dark encircled (**7**); **juveniles** show a higher contrast and colour intensity; the tail is banded to the end (**8**)

Similar species: *V. nesterovi* has greatly enlarged, spiky neck scales and an almost unicoloured back; a laterally flattened, light coloured tail (vs. round with dark or light end) and a convex (rather than concave shaped) snout.

Size/age at sexual maturity: ♀: >24.5 cm SVL; 50-60 cm TL; at the earliest with 2 years, perhaps just with 4-5 years

Clutch size: One clutch/year with 5-19 (*griseus*), 8-24/34 (*caspius*), 2-15 (♂ 8.7) (*konieczyi*) eggs

Incubation period/temperature: 99-122 (♂ 110) days at 29-32 °C; after hatching, the juveniles spend another 5-6 months in the nesting room; *V. g. konieczyi*: about 10 months or 284 days

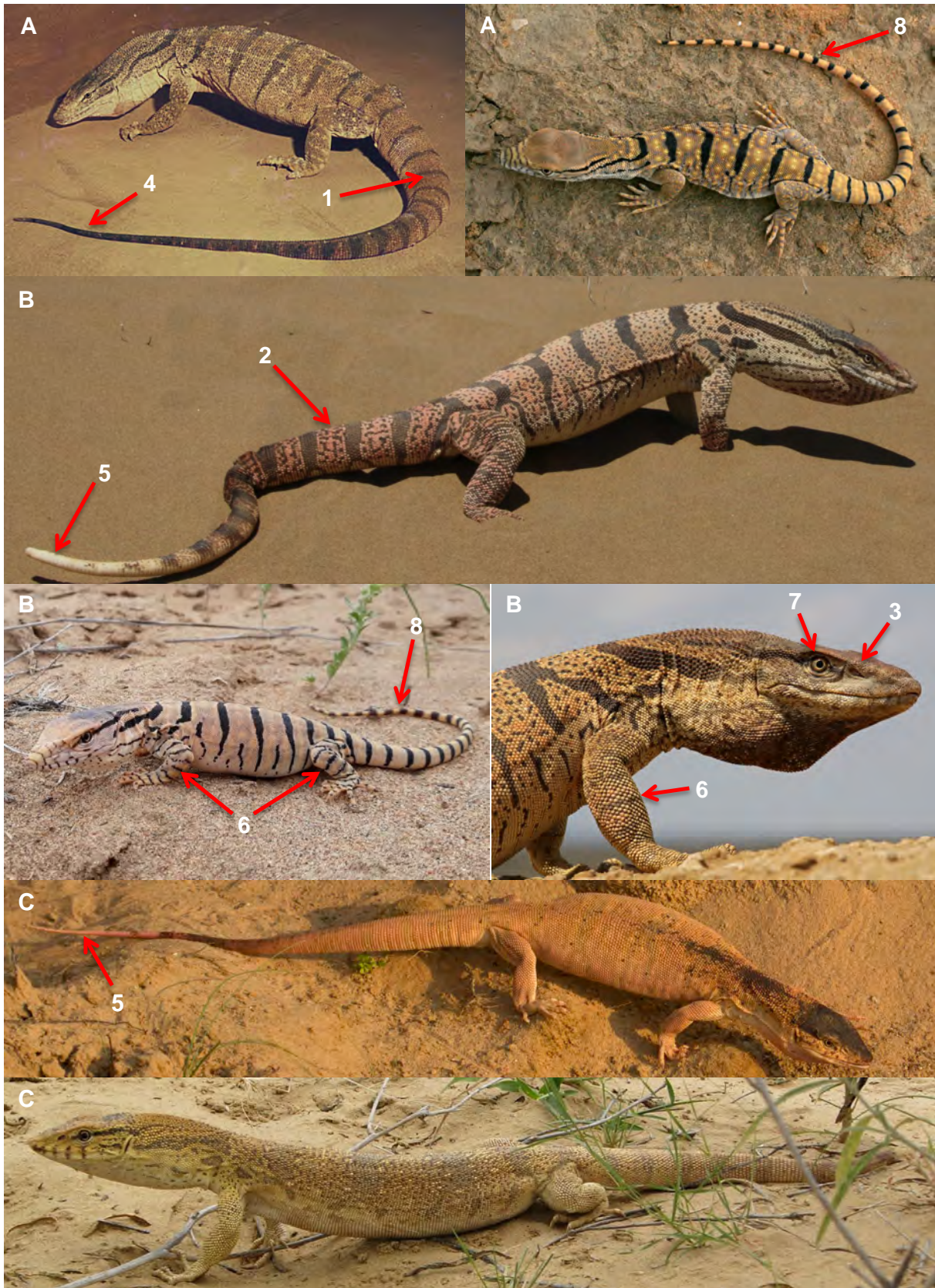
Size/weight of hatchlings: ♂ 10.5-10.9 cm SVL; ♂ 25.3 cm TL; ♂ 19 g

Growth rate: *V. g. griseus*: after 1 year: 17.5-21 (♂ 18.7) cm SVL, 43.5-50.5 (♂ 46.1) cm TL; after 2 years: 22-26.9 (♂ 23.8) cm SVL, 54.5-65.4 (♂ 59) cm TL; *caspius*: after 1 year: ca. 25 cm SVL; after 2 years: 37-39 cm SVL; after 3 years: 46-48 cm SVL

Captive breeding: Successful breeding has been very rare in zoos. Reproduction is regulated by the temperature (hibernation necessary), the amount of rainfall, and the day length.

Ecology: Diurnal (**↔**); ground-dwelling; *V. griseus* feeds on reptiles, rodents, and birds; *V. g. konieczyi* mainly eats insects (beetles), along with lizards, snakes, and eggs; symptoms of slight poisoning after bites by desert monitors have been reported.

Remarks: Due to its high protection status *V. griseus* is rarely traded internationally; however, the species is offered illegally. The three subspecies do not adequately reflect the morphological diversity of this widespread monitor. Populations of *V. nesterovi* originally belonged to *V. griseus*.



Varanus g. griseus. Above left: adult, Tel Aviv University Zoo, Israel, © Heinrich Mendelssohn & Amikam Shuv; above right: juvenile, Negev desert, Israel, © Guy Haimovitch; ***V. g. caspius***. Second (adult) and third (juvenile/adult) row: Kyzylkum desert, Kazakhstan, © Mark Pestov & Julia Zima; ***V. g. konieczyi***. Fourth row and below: adult, Rajasthan, India, © Dharmendra Khandal

Varanus nesterovi Böhme et al., 2015

Subgenus: *Psammosaurus*

English name: Nesterov's desert monitor

German name: Nesterovs Wüstenwaran

Local name: -

Synonyms: None; prior to their description, these monitor lizards were scientifically treated as *V. griseus*.

Subspecies: None

International conservation status (CITES / Commission Reg. (EU) No 2017/160): Appendix II/B

IUCN Red List status: Not Evaluated (NE)

Distribution: Southwestern Iran, eastern Iraq

Total length (TL): 120 cm; **Snout-vent length (SVL):** 50 cm

Morphological traits (adults): Large species with slender extremities; entire tail is dorsally ridged, laterally compressed, triangular in cross-section (1), tail approximately 1/3 longer than SVL; massive head, short and broad; upper snout distinctly convex (2); vertically oval nostrils closer to eye than to tip of snout (3); supraoculars (4) not enlarged; scales along neck and particularly neck sides distinctly larger, pointed into spines (4)

Colour pattern: Dorsum (5) light-brown/beige with indistinctive pattern of greyish irregularly distributed spots; faint greyish bands on posterior dorsum (6) continuing until first half of tail (5); lower tail without bands; all limbs like dorsum with dark irregularly placed pigmentation; gular region (7) with indistinct greyish stains on light brown background particularly when inflated (6); tongue bluish-pink with lighter pinkish tips; **juveniles:** unknown

Similar species: In *V. griseus* upper snout is concave (8), nostrils formed as slits, scales on neck much less pronounced (not spine-like), dorsum shows distinct cross stripes and/or lighter spots on darker ground colour; almost entire tail not laterally compressed, round in cross-section, but in the subspecies *V. g. caspius* and *V. g. koniecznyi* the tail is distally (9) slightly compressed

Size/age at sexual maturity: No published data, probably similar to *V. griseus*

Clutch size: No published data, probably similar to *V. griseus*

Incubation period/temperature: No published data, probably similar to *V. griseus*

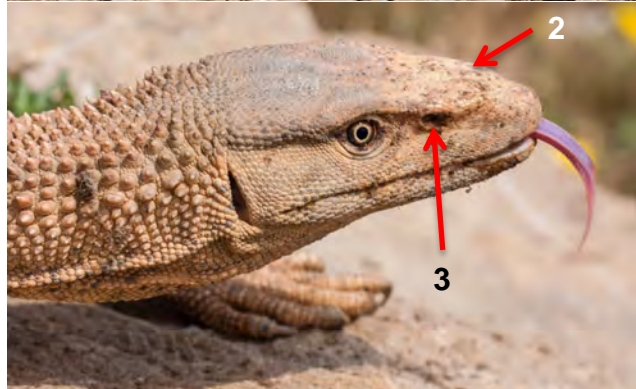
Size/weight of hatchlings: No published data, probably similar to *V. griseus*

Growth rate: No published data, probably similar to *V. griseus*

Captive breeding: No published data

Ecology: Diurnal (10); terrestrial (11); suspected to be a gravel dweller

Remarks: Current distribution range is considered distinctly smaller compared to its close relative *Varanus griseus* which is listed in Appendix I of CITES and Annex A of the Commission Reg. (EU) No 2017/160; international trade is not yet documented (CITES trade database).



Varanus nesterovi. Above, centre and below: Adult, Northern Khuzestan, Zagros Mountains, West Iran, © Willi Schneider

Varanus spinulosus Mertens, 1941

Subgenus: *Solomonsaurus*

English names: Santa Isabel monitor, Spiny-backed monitor

German name: Stachelnackenwaran

Local name: Saba (San Jorge Island)

Synonyms: *V. indicus spinulosus*

Subspecies: None; originally, *V. spinulosus* was described as a subspecies of *V. indicus*.

International conservation status: (CITES / Commission Regulation (EU) No 2017/160): Appendix II/B

IUCN Red List status Least Concern (LC), population trend stable (last assessed 2011)

Distribution: Bougainville Island, Papua New Guinea, and Choiseul, (Santa) Isabel, and San Jorge Islands, Solomon Islands

Total length (TL): 100 cm; **Snout-vent length (SVL):** 31 cm

Morphological traits (adults): Medium-sized species (840 g); head, body, legs, and tail slender; tail length 1.7 times SVL, laterally flattened, above with a ridge (↔); lateral tail scales smaller than lower ones; nostrils roundish to oval, located closer to tip of snout than to eye (1); head relatively short, tapered; eyes relatively large (2); head scales above eyes slightly enlarged; scales on neck and back small and spinose (3), feels like sandpaper; unusual baggy skin

Colour pattern: Body, legs, and tail dark brown/black to chocolate-coloured, sometimes with a greenish hue; head sometimes brighter, no light stripe between eye and ear; three to five transverse rows of large yellow spots (rarely with dark centre) on back (4), anterior two rows partly missing or as diffuse yellow transverse bands (5); interspaces with more or less small yellow spots/single scales, occasionally forming additional transverse rows, sometimes missing on anterior dorsum, resulting in black transverse bands; legs yellow dotted; tail with indistinct thin light bandings (6), fading with age; tongue pink/flesh-coloured; iris dark brown; underside brown with many small yellow dots; soles of fore feet in a male were orange; **juveniles** with a clearer pattern; toes patterned with yellow spots (7); underside of body with larger yellow spots

Similar species: *V. salvadorii* has a longer and more bulbous/prominent snout; the tail measures 2-2.7 times the SVL; pattern of yellow spots on back is always clear, not replaced by diffuse broad transverse bands on the anterior back; scales of the neck and back are not spiny, skin feels not sandpaper-like; *V. salvator* has a dark blue grey tongue; light spots on back are smaller and more numerous in each transverse row; scales of the neck and back are not spiny, skin feels not sandpaper-like.

Size/age at sexual maturity: No published data

Clutch size: No published data

Incubation period/temperature: No published data

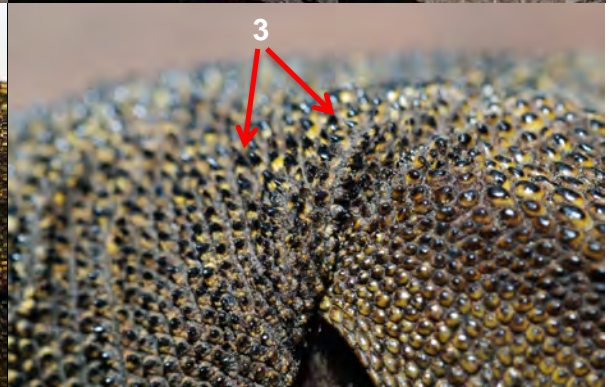
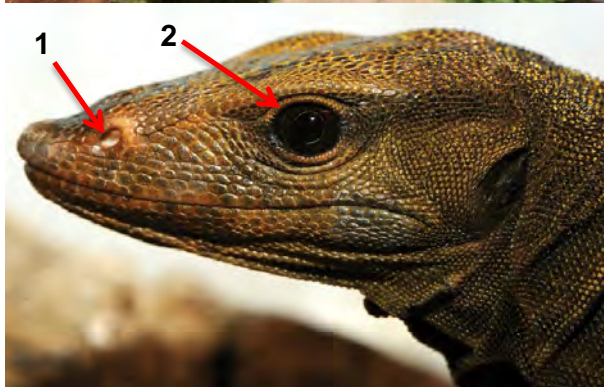
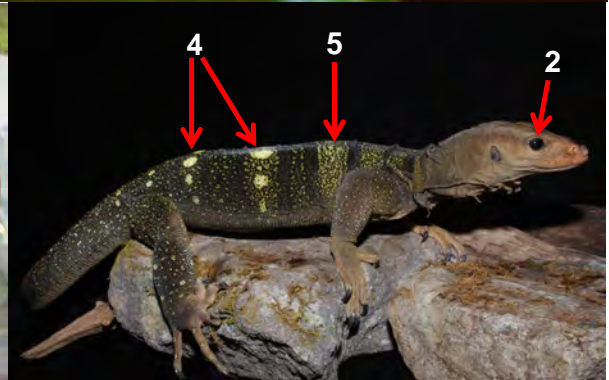
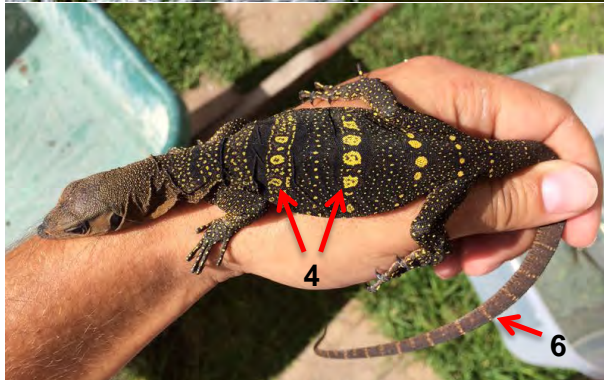
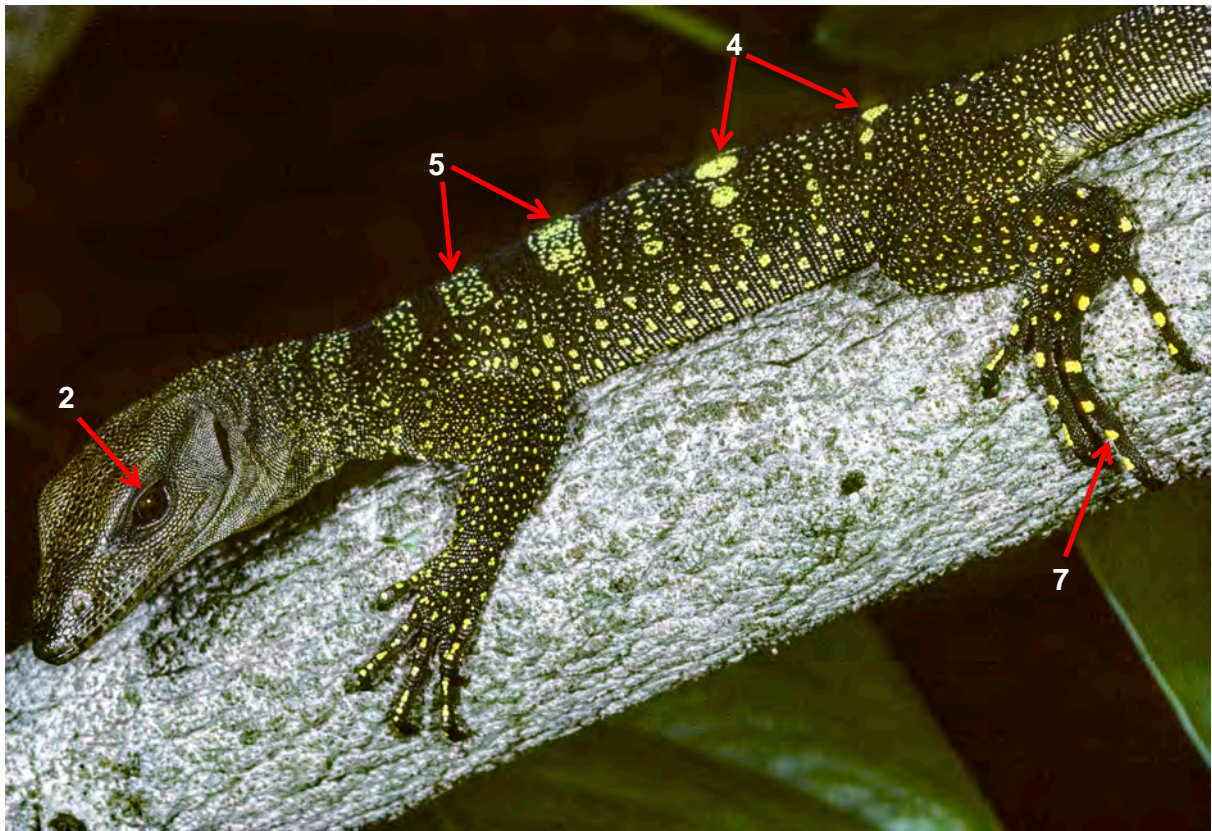
Size/weight of hatchlings: No published data

Growth rate: No published data

Captive breeding: No breeding has been documented so far.

Ecology: Diurnal (↔); island endemic (↔); ground-dwelling, flees up trees, when disturbed; is found in mangrove areas, but also in coconut groves and close to human habitation near the coast; probably feeds mainly on insects and spiders, perhaps also (dead) fish, birds and their eggs and other vertebrates

Remarks: According to the CITES trade database, the Solomon Islands exported 40-300 live specimens of *V. spinulosus* annually between 2010 and 2017. Imports of wild-caught specimens into the EU are suspended since 2010. The species could be locally threatened by the introduced toxic cane toad (*Rhinella marina* = *Bufo marinus*).



Varanus spinulosus. Above: subadult, San Jorge Island, Solomon Islands, © Michael McCoy; centre left: juvenile, © Alex Monsalve; centre right: adult, © Go Suzuki; below left: adult, © Robert Sprackland; below right: detail of the typically spinose neck scales of *V. spinulosus*, © Nobuhiro Kawazoe

Varanus bangonorum Welton et al., 2014

Subgenus: *Soterosaurus*

English name: Bangon monitor lizard

German name: -

Local name: -

Synonyms: None; prior to its description *V. bangonorum* was scientifically treated as *V. (salvator) marmoratus*

Subspecies: None

International conservation status (CITES / Commission Reg. (EU) No 2017/160): Appendix II/B

IUCN Red List status: Not evaluated (NE)

Distribution: Mindoro and Semirara Islands, Philippines

Total length (TL): 60 cm (♂, subadult); **Snout-vent length (SVL):** 39 cm (♂, subadult)

Morphological traits (adults): Medium-sized slender species; tail distinctly triangular in cross-section, with a dorsal (←) ridge (1); lateral tail scales smaller than lower ones; nostrils oval, located dorsolaterally (←) closer to tip of snout than to eye (2); supraoculars (←) enlarged; nuchals (←) distinctly larger than head scales (3); number of midbody scales (←) 136 Ø

Colour pattern: Dorsum (←) dark, greyish to black ground colour; dorsum with cross rows of smaller yellowish ocelli (←) (4), in some specimens less distinct; colour pattern of nuchal region (←) varies from uniform black, spotted, mottled or mixed with blotches and stripes posteriorly; posterior of eyes yellowish streak (5); another yellowish streak from underside of ear opening to upper front limb (6); gular region (←) conspicuously dark spotted (7); tail alike dorsum blackish ground colour with yellowish cross-bands of spots which become smaller towards tail crest (8); fore and hind limbs blackish with small yellowish spots; in **juveniles** the cross-bands of yellow to whitish ocelli on the dorsum are much more pronounced, occasionally the anterior ones are less distinct.

Similar species: Gular region of *V. marmoratus* with distinct speckling and transverse bands, number of midbody scales (←) is 133 Ø; gular region of *V. palawanensis* irregular speckled and transverse bands anteriorly; in *V. nuchalis* dark gular region without pattern, number of midbody scales ranges between 136-169 (150 Ø); *V. dalubhasa* with variable speckled gular region anteriorly and faint transverse bands, number of midbody scales is 138 Ø

Size/age at sexual maturity: No published data, probably similar to *V. cumingi*, *V. salvator*

Clutch size: No published data, probably similar to *V. cumingi*, *V. salvator*

Incubation period/temperature: No published data, probably similar to *V. cumingi*, *V. salvator*

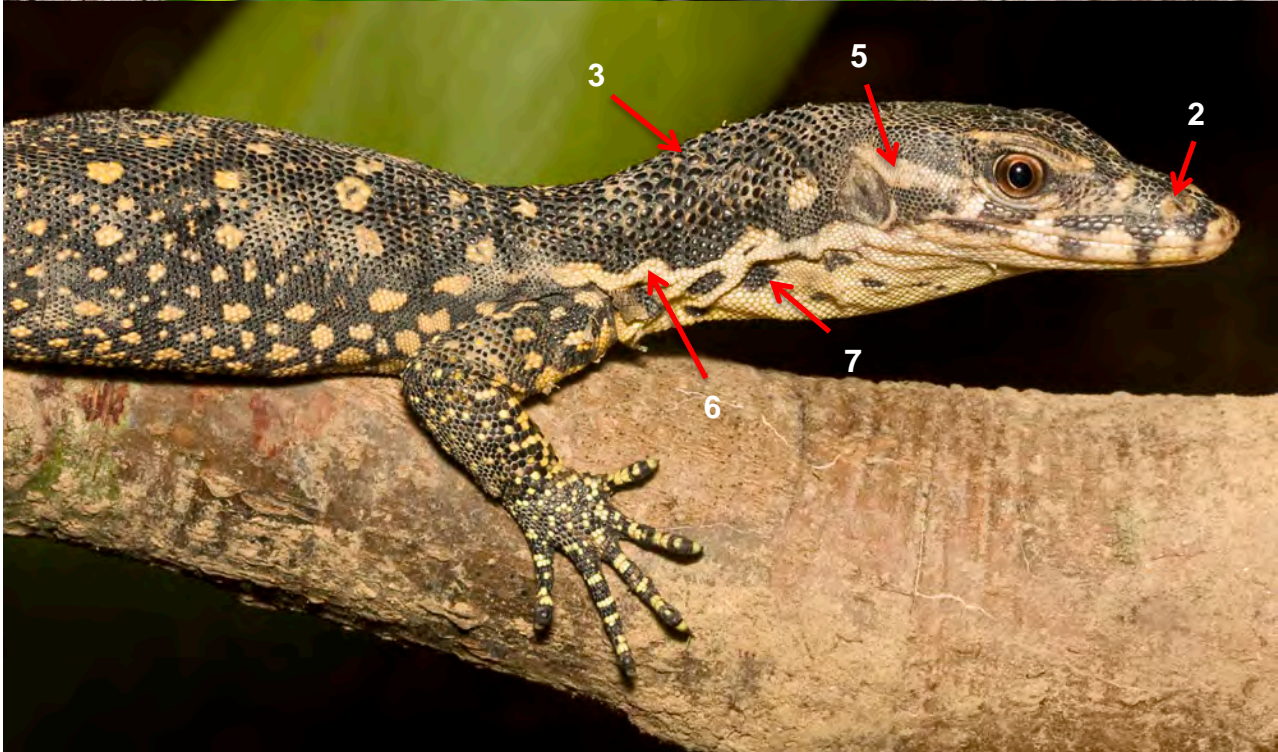
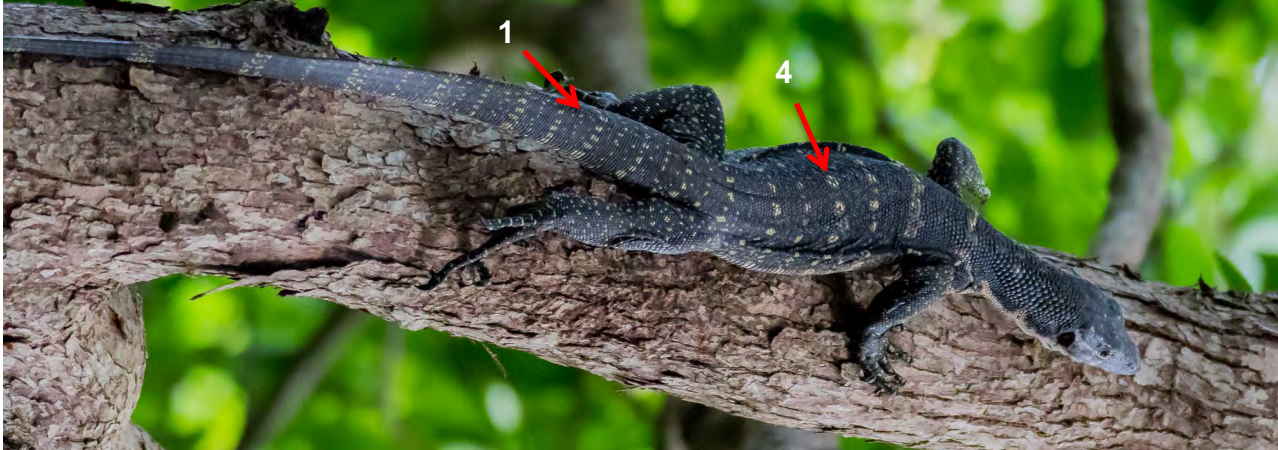
Size/weight of hatchlings: No published data, probably similar to *V. cumingi*, *V. salvator*

Growth rate: No published data, probably similar to *V. cumingi*, *V. salvator*

Captive breeding: No published data

Ecology Diurnal (←), like *V. salvator* a habitat generalist which is found in pristine forests to agroecosystems; terrestrial (←), arboreal (←); opportunistically feeds on invertebrates (←), vertebrates (←) and carrion

Remarks: No commercial exports reported according to CITES trade database; illegal domestic trade recorded; *V. bangonorum* is nationally protected under the Wildlife Act 2001 of the Philippines



Varanus bangonorum. Above and centre: subadult, Mindoro Island, Philippines, © Bob Natural; below: Paratopotype (↩) (KU 335742) from type locality (↩) Sitio Aruyan, Barangay Malisbong, Municipality of Sablayan, Occidental Mindoro Province, Mindoro Island, © Scott L. Travers

Varanus cumingi Martin, 1838

Subgenus: *Soterosaurus*

English names: Cuming's water monitor, Mindanao water monitor

German name: Mindanao-Bindenwaran

Local name: Bayawak (general name for monitor lizards in Tagalog language)

Synonym: *V. salvator cumingi*

Subspecies: None; formerly *V. cumingi* was scientifically treated as a subspecies of *V. salvator*.

International conservation status (CITES / Commission Reg. (EU) No 2017/160): Appendix II/B

IUCN Red List status: Least Concern (LC), population trend decreasing (last assessed 2007)

Distribution: Mindanao and associated smaller islands, Philippines

Total length (TL): 150 cm; **Snout-vent length (SVL):** 60 cm

Morphological traits (adults): Large species, up to 2.5 kg; muscular extremities; strong tail, triangular in cross-section with a dorsal keel (←) (1), tail length about 1.5 times SVL; lateral tail scales smaller than lower ones; nostrils roundish oval, located closer to tip of snout than to eye (2); supraoculars (←) enlarged; occipital scales (←) around pineal eye (←) enlarged; number of midbody scales ranges between 121-150 (n = 10)

Colour pattern: Overall intense black and yellow; black temporal (←) stripe (3); dorsum (←) with partly distinct yellow transverse stripes/rows of spots and ocelli (←) (4), that can fuse posteriorly (5); some specimens with central yellow longitudinal stripe on dorsum (6); colour pattern of head, neck and dorsum individually variable; limbs black with yellow spots, forelimbs more speckled and less rich in contrast; tail black and yellow banded, anteriorly (←) tail bands taper upwards from below (7); underside of tail base with black ocelli; chin usually plain yellow; whitish ventrum (←), 8 to 15 dark transverse bands; tongue at base and below flesh-coloured, above dark blue-grey; **juveniles** clearly darker with low-contrast colouration; transverse rows of yellow spots across black dorsum; snout with dark cross-bars (8); black limbs with yellow dots, also fore limbs rich in contrast; tail bands in the middle and posteriorly (←) rather whitish/greyish.

Similar species: *V. samarensis* with predominantly black head, dorsum with 6-8 transverse rows of more or less distinctive yellow spots, ocelli or markings; ventrum with 9-15 more or less distinctive dark bars or crossbands; in juvenile *V. melinus* head and neck are less black pigmented; juvenile *V. salvator* and *V. marmoratus* resemble pattern of dorsum; adult *V. salvator bivittatus* allegedly from south of Java (known in trade as "**sulphur salvator**") with more yellow colouration, head mostly yellow almost no black, wide yellow cross-bands on dorsum

Size/age at sexual maturity: ♀ at ca. 50 cm SVL; ♂ at ca. 40 cm; with about 2 years; see also *V. salvator*

Clutch size: 5-10 eggs per clutch depending on ♀ size; up to 3 clutches per year

Incubation period/temperature: 190-220 days at 27-31.5 °C

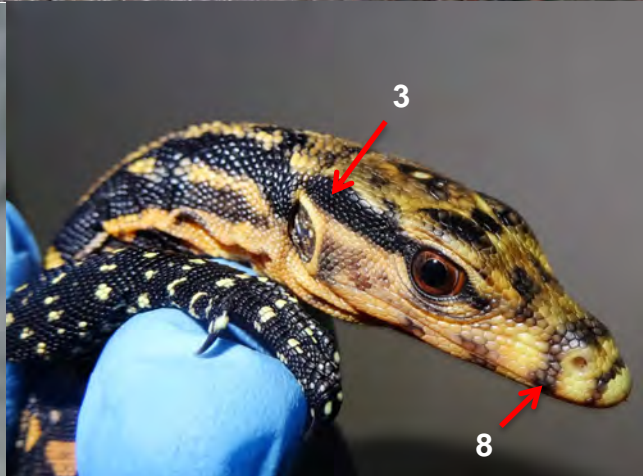
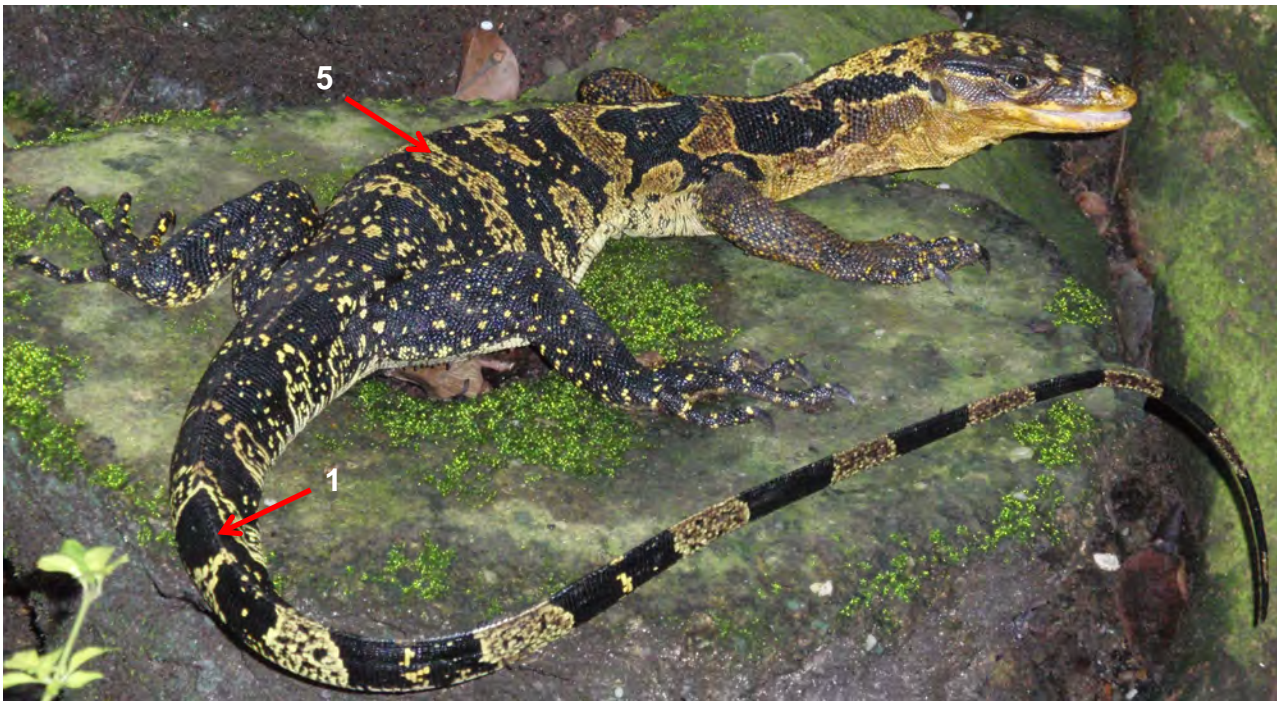
Size/weight of hatchlings: 28-31 cm TL; 12-14 cm SVL; 26-42 g

Growth rate: 100 days after hatching: 16 cm SVL, 38 cm TL; 1 year after hatching: 85-100 cm TL

Captive breeding: Successfully bred in zoos; spacious heterogeneously designed facility; various light and heat sources; regulated humidity by large water basin; stress avoidance for ♀ by spatially separate keeping of males; egg deposition box necessary

Ecology: Diurnal (←); predominantly terrestrial (←); feeds on various animals and carrion; see also *V. salvator*

Remarks: Commercial exports of individuals of *V. cumingi* sourced C (←), F (←) and wild (skins, science) documented (CITES trade database); local consumption and illegal domestic trade despite protection status under the Wildlife Act 2001; potentially threatened by habitat loss through deforestation and mining



Varanus cumingi. Above: adult, Zamboanga, Mindanao Island, Philippines, © Rafe M. Brown; centre left: adult, Mindanao Island, Philippines, © Maren Gaulke; centre right: hatchling, Cologne Zoo, © Thomas Ziegler; below: juvenile, seized by Philippine airport customs, © Emerson Y. Sy/TRAFFIC

Varanus dalubhasa Welton et al., 2014

Subgenus: *Sotosaurus*

English name: Enteng's monitor lizard

German name: -

Local name: -

Synonyms: None; prior to its description, *V. dalubhasa* was scientifically treated as *V. marmoratus* (Wiegmann, 1834), *V. salvator marmoratus* or *V. salvator philippinensis* Deraniyagala, 1944.

Subspecies: None

International conservation status (CITES / Commission Reg. (EU) No 2017/160): Appendix II/B

IUCN Red List status: Not Evaluated (NE)

Distribution: Bicol peninsula of Luzon Island, Polillo Island, and Catanduanes Islands, Philippines

Total length (TL): 116 cm (♂); **Snout-vent length (SVL):** 50.5 cm (♂)

Morphological traits (adults): Medium to larger-sized species; tail at base almost round (1), immediately thereafter with double crest and triangular in cross-section (2); lateral tail scales smaller than lower ones; nostrils oval, located close to tip of snout than to eye (3); supraoculars (↔) enlarged (4); nuchals (↔) distinctly larger than scales on head and neck sides increasing towards forelimb insertion (5); number of midbody scales (↔) Ø 138

Colour pattern: Dorsum (↔) dark greyish/black ground colour with faint brownish network pattern (6); dorsum with cross rows of yellow/golden ocelli (↔) (7), that are more intensely coloured posteriorly (↔) (8); a blackish temporal (↔) streak (9) bordered below by a broken whitish/yellowish stripe that extends across ear opening to neck sides (10); white/yellowish to golden yellow gular region (↔) with individual differently pronounced pattern of dark speckling/transverse bands; upper tail with distinct transverse rows of yellowish/golden dots/ocelli (11), that gradually fuse into broad broken cross bands (12); tail tip blackish; fore- and hindlimbs dark with yellow spots, individually different; some specimens with pronounced yellow pigmentation on the inner sides of limbs (13); ventrum (↔) variable with prominent greyish cross bands on whitish ground colour opposed to less distinct cross bands on yellowish ground colour; **juveniles:** no published data

Similar species: *V. marmoratus* with distinct speckling or less distinct transverse bands on gular region, number of midbody scales Ø 133; *V. nuchalis* uniformly dark gular region, number of midbody scales Ø 150

Size/age at sexual maturity: No published data, probably similar to *V. cumingi*

Clutch size: No published data, probably similar to *V. cumingi*

Incubation period/temperature: No published data, probably similar to *V. cumingi*

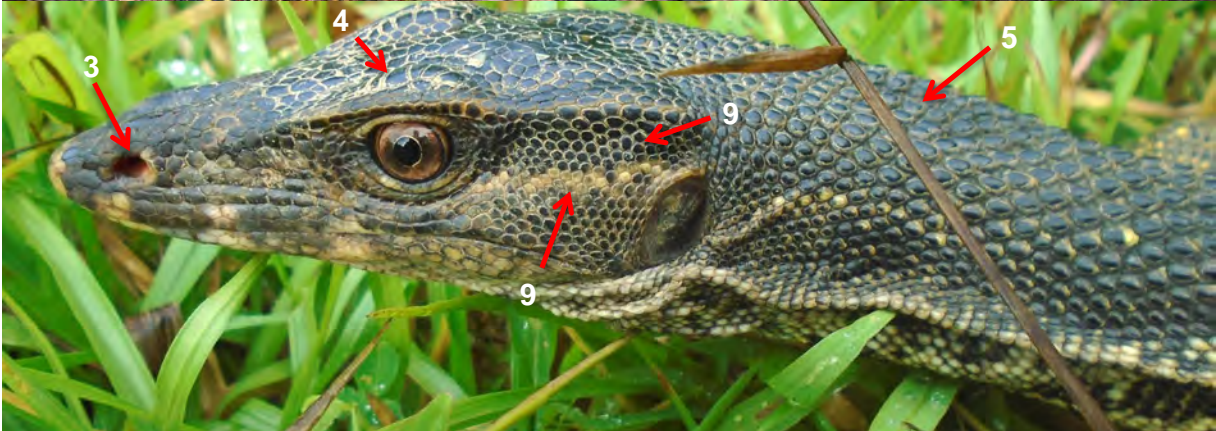
Size/weight of hatchlings: No published data, probably similar to *V. cumingi*

Growth rate: No published data, probably similar to *V. cumingi*

Captive breeding: No published data

Ecology: Similar to *V. salvator*; habitat generalist that inhabits pristine forests to agro-ecosystems; diurnal (↔); terrestrial (↔), arboreal (↔); opportunistically feeds on invertebrates (↔), vertebrates (↔) and carrion

Remarks: No commercial exports of *V. dalubhasa* are reported (CITES trade database), but illegal domestic trade recorded; the species is nationally protected under the Wildlife Act 2001 of the Philippines.



Varanus dalubhasa. Above: adult, Irosin Sorsogon, Luzon Island, © Rafe M. Brown; centre: subadult, Catanduanes Island, © Jake Wilson Binaday; below: holotype (♂), Barangay Madlangdungan, Municipality of Calauag, Quezon Province, Luzon Island, © Charles W. Linkem

Varanus marmoratus (Wiegmann, 1834)

Subgenus: *Sotosaurus*

English name: Marbled water monitor

German name: Luzon-Bindenwaran

Local names: Bayawak (general name for monitor lizards in Tagalog), Halo (Cebu Island); Bijawak (Luzon Island), Banyas (Camiguin Island)

Synonyms: *Varanus salvator philippinensis* Deraniyagala, 1944; *V. salvator marmoratus*

Subspecies: None; formerly, *V. marmoratus* was scientifically treated as a subspecies of *V. salvator*.

International conservation status (CITES / Commission Reg. (EU) No 2017/160): Appendix II/B

IUCN Red List status: Least Concern (LC), population trend stable (last assessed 2007)

Distribution: Northern Luzon, Lubang islands, Batanes and Babuyan Islands, Philippines

Total length (TL): 196 cm (♂); 180 cm (♀); **Snout-vent length (SVL):** 45 cm

Morphological traits (adults): Large species; muscular tail, triangular in cross-section (1); tail length more than 1.5 times SVL; nostrils roundish/oval, located closer to tip of snout than to eye (2); supraoculars (↔) enlarged; nuchal scales (↔) enlarged (3); number of midbody scales (↔) ranges between 115-145 (Ø 133)

Colour pattern: Dorsum dark grey/black with yellowish flecks/ocelli (↔) in cross rows, individually differently pronounced; dark grey temporal streak (↔) with a light yellowish stripe below posterior to upper margin of ear opening (4); some partially melanistic (↔) specimens lack this lighter pigmentation (5); yellow/whitish spots on front/hind limbs on uniformly dark greyish/black background; tail with transverse bands of yellow spots, less distinct or almost lacking; gular region (↔) finely speckled, marbled (6), anteriorly with transverse band(s); ventrum (↔) whitish with blackish transverse bands that can fuse; ground colour in **juveniles** lighter olive/brownish; yellowish gular region with few dark spots (7); tail with distinct cross-bands of yellow spots (8)

Similar species: *V. bangonorum* with prominent dark spots in gular region, number of midbody scales Ø 136; number of midbody scales in *V. nuchalis* ranges between 136-169 (Ø 151), dark coloured gular region; gular region of *V. palawanensis* lacking distinct blotches, rather finely greyish mottled with transverse bands, number of midbody scales ranges between 129-178 (Ø 142)

Size/age at sexual maturity: No published data, probably similar to *V. cumingi/V. salvator*

Clutch size: No published data, probably similar to *V. cumingi/V. salvator*

Incubation period/temperature: No published data, probably similar to *V. cumingi/V. salvator*

Size/weight of hatchlings: No published data, probably similar to *V. cumingi/V. salvator*

Growth rate: No published data, probably similar to *V. cumingi/V. salvator*

Captive breeding: No published data

Ecology: Diurnal (↔); terrestrial (↔), arboreal (↔) life habits similar to *V. salvator*; habitat generalist, found in pristine forests to agroecosystems; opportunistically feeds on invertebrates, vertebrates, and carrion

Remarks: Older information on *V. (salvator) marmoratus* in part relates to *V. dalubhasa* on Polillo Island; since 2010, 31 specimens sourced C (↔), F (↔), and wild were documented in international trade, the majority for scientific purposes (CITES trade database); *V. marmoratus* is locally heavily utilized as bushmeat; potentially threatened by habitat loss through deforestation; the species is nationally protected under the Wildlife Act 2001 of the Philippines.



Varanus marmoratus. Above: adult, Laguna, Luzon Island, © Emerson Y. Sy; centre: adult, Barangay Magsaysay, Municipality of Infanta, Quezon Province, Luzon Island, KU 344720, © Jason B. Fernandez & Rafe M. Brown; below: juvenile, Los Banos, Luzon Island, © Paul Bourdin

Varanus nuchalis (Günther, 1872)

Subgenus: *Soterosaurus*

English name: Rough-necked water monitor

German name: Rauhnacken-Bindenwaran

Local names: Bayawak (general name for monitor lizards in Tagalog), Halo (Cebu Island)

Synonym: *V. salvator nuchalis*

Subspecies: None; formerly, *V. nuchalis* was scientifically treated as a subspecies of *V. salvator*.

International conservation status (CITES / Commission Reg. (EU) No 2017/160): Appendix II/B

IUCN Red List status: Near Threatened (NT), population trend decreasing (last assessed 2007)

Distribution: Western Visayan Islands (Negros, Cebu, Masbate, Panay, Ticao, and the smaller associated islands Guimaras, Boracay, Tablas, Sibuyan, Romblon, Siquijor, and Sicogon), Philippines

Total length (TL): 145 cm; **Snout-vent length (SVL):** 53 cm

Morphological traits (adults): Medium-sized species (one of the smaller members of the *V. salvator* species group); tail triangular in cross-section, with a dorsal keel (←); tail length 1.4-1.7 (Ø 1.6) times SVL; lateral tail scales smaller than lower ones; nostril roundish to oval, located closer to tip of snout than to eye (1); supraoculars (←) enlarged; number of midbody scales (←) ranges between 136-169; scales of nuchal region (←) strongly enlarged, largest among all members of the subgenus *Soterosaurus* (2)

Colour pattern: Two distinct colour morphs (←) exist; a melanistic (←) form and a colourful form; head individually different white and black coloured; both morphs have a thin, whitish mid-dorsal line extending from nape across entire dorsum to tail base (←) (3), and on both sides of this line rows of more or less distinct whitish spots (4); black temporal streak (←) to upper ear opening (5); gular region (←) uniform dark or with few lighter flecks; front and hind limbs with distinct yellow scales, more prominent on front limbs (6); tail dark with more or less distinct cross-bands of yellow spots (7); tongue flesh-coloured with dark pigmentation on distal half of upper side; **juveniles** with more contrasted colour pattern (8)

Similar species: *V. dalubhasa* has a white/yellowish/golden gular region and individually different pattern of dark speckling/transverse bands; number of midbody scales Ø 138 (n = 10); *V. bangonorum* has Ø 136 (n = 17) midbody scales and dark prominent spots on gular region; gular region of *V. palawanensis* without distinct blotches, rather finely greyish mottled with transverse bands, number of midbody scales ranges between 129-178 (Ø 142; n = 9); *V. rudicollis* with oval-shaped (juveniles) to slit-shaped (adults) nostrils, located closer to eye than to tip of snout (in the middle in juveniles); tongue unicoloured pink/flesh-coloured

Size/age at sexual maturity: No published data, probably similar to *V. cumingi* and *V. salvator*

Clutch size: No published data, probably similar to *V. cumingi* and *V. salvator*

Incubation period/temperature: No published data, probably similar to *V. cumingi* and *V. salvator*

Size/weight of hatchlings: No published data, probably similar to *V. cumingi* and *V. salvator*

Growth rate: No published data, probably similar to *V. cumingi* and *V. salvator*

Captive breeding: No published data

Ecology: Similar to *V. salvator*, diurnal (←); terrestrial (←), arboreal (←); habitat generalist, inhabits various habitats from pristine forests to agroecosystems; opportunistically feeds on invertebrates (←), vertebrates (←) and carrion

Remarks: Commercial exports of *V. nuchalis* are rare. However, exports of individuals sourced C (←), F (←) and wild (skins only) are documented (CITES trade database); locally hunted for bushmeat; potentially threatened by habitat loss through deforestation; nationally protected under the Wildlife Act 2001 of the Philippines



Varanus nuchalis. Above: partially melanistic adult, Cebu Island, © Emerson Y. Sy; second row left: adult, north-western Panay Island, © Maren Gaulke; second row right: juvenile, seized on Cebu Island, © Emerson Y. Sy/TRAFFIC; third row: partially melanistic adult, captive, Manila (from Cebu Island), © Emerson Y. Sy; below: juvenile, north-western Panay Island, © Maren Gaulke

Varanus palawanensis Koch et al., 2010

Subgenus: *Soterosaurus*

English name: Palawan water monitor

German name: Palawan-Bindenwaran

Local name: -

Synonyms: None; prior to their description as a new species, the monitor lizards of Palawan and surrounding islands were allocated to *V. marmoratus*.

Subspecies: None

International conservation status (CITES / Commission Regulation (EU) No 2017/160): Appendix II/B

IUCN Red List status: Not Evaluated (NE)

Distribution: Palawan, Balabac, Calamian, and Sibutu islands, Philippines

Total length (TL): 200 cm, ♂ 129-152 cm (♂); ♀ 101-124 cm (♀); **Snout-vent length (SVL):** 78.8 (♂ 55) cm

Morphological traits (adults): Large species; head, body and legs strong; tail length 1.3-1.8 (♂ 1.5) times SVL, laterally flattened, with a keel (←) above (1); lateral tail scales smaller than lower ones; nostrils roundish to oval, closer to tip of snout than to eye (2); head scales above the eyes enlarged

Colour pattern: Head mostly dark, sometimes with whitish markings (3), rarely predominantly bright; a bright streak between eye and ear more or less pronounced; body, legs and tail base dark brown to blackish brown, mostly speckled with single yellow to whitish scales, sometimes with larger, mostly irregular spots on back in up to 8 transverse rows; tail after first third alternating light and dark banded, bright bands interspersed with many dark scales (4); body underside whitish to yellowish; chin sometimes with 3-5 indistinctive dark bars; throat with dark spots or marbling (5); belly with 7-11 more or less distinctive dark pointed bars or crossbands; iris dark brown; tongue above and below dark blue-grey, base pink/flesh-coloured; in **juveniles** the light spots are more roundish and black encircled, the dark ventral markings are more distinct.

Similar species: *V. dalubhasa* and *V. bangonorum* have a light throat with few dark spots (vs. dark speckled to marbled in *V. palawanensis*), without whitish coloration on head (not always present in *V. palawanensis*), underside of tongue pink/flesh-coloured; *V. marmoratus* without whitish colour on head, tongue underside pink/flesh-coloured; *V. nuchalis* with strongly enlarged neck scales, sometimes with large round spots on the back, tongue underside pink/flesh-coloured; *V. rasmusseni* without whitish colour on head, tongue underside pink/flesh-coloured; juveniles with a large number of closely spaced streak rows on the back and continuous dark horizontal streaks on the belly and tail underside; *V. salvator* usually with distinct transverse rows of spots on back, without whitish coloration on head

Size/age at sexual maturity: No published data; probably similar to *V. salvator*.

Clutch size: 14 eggs in one clutch have been reported.

Incubation period/temperature: No published data; probably similar to *V. salvator*.

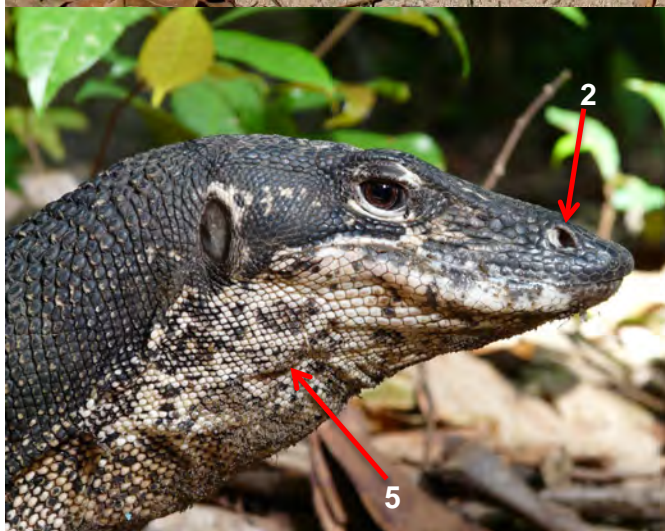
Size/weight of hatchlings: No published data; probably similar to *V. salvator*.

Growth rate: Juveniles grow about 2.5 cm per month; in the third year of life only 1.33 cm per month.

Captive breeding: No breeding success has been documented so far; conditions probably similar to *V. salvator*.

Ecology: Diurnal (←); island endemic (←); feeds mainly on crabs and arthropods as well as various vertebrates.

Remarks: Due to the national Philippine legislation (Wildlife Act 2001) international trade in *V. palawanensis* is prohibited. Nevertheless, the species is considered potentially threatened due to the demand by the illegal pet trade and the lack of biological information.



Varanus palawanensis. Above: adult, Puerto Princesa National Park, Palawan Island, Philippines, © Rachel Poole; below left: adult, Puerto Princesa National Park, Palawan Island, Philippines, © Jeremy Barker; below right: subadult, small island near El Nido, north off Palawan Island, Philippines, © Maren Gaulke

Varanus rasmusseni Koch et al., 2010

Subgenus: *Soterosaurus*

English name: -

German name: Rasmussens Bindenwaran

Local name: Pahang (Sulu Islands, Philippines)

Synonyms: None; prior to their description as a new species, the monitor lizards of the Sulu Islands were allocated to *V. marmoratus*.

Subspecies: None

International conservation status (CITES / Commission Regulation (EU) No 2017/160): Appendix II/B

IUCN Red List status: Not Evaluated (NE)

Distribution: Tawi-Tawi, Jolo, and Bitinan islands, Sulu Islands, Philippines

Total length (TL): 121.5 cm (♂); **Snout-vent length (SVL):** 46.6 cm (♂)

Morphological traits (adults): Medium-sized species; head, body and legs strong; tail length 1.6 (in juveniles 1.5) times SVL, laterally flattened with a keel (←) above; lateral tail scales smaller than lower ones; nostrils roundish to oval, closer to tip of snout than to eye; head scales above eyes enlarged

Colour pattern: Head, body, legs and tail base dark brown to blackish brown without clear pattern (1), speckled with many single or partly bright scales; tail after first third unclearly light and dark banded, bright bands interspersed with many dark scales; body underside predominantly dark brown; belly and chest with indistinct bright cross stripes in the middle (2); throat dark with little bright mottling; chin becomes bright towards the tip of snout; head without bright streak between eye and ear (3); iris dark brown; tongue above dark blue grey, at base pink/flesh-coloured; **juveniles** show a distinct dorsal colour pattern of about 12 transverse rows of many small bright spots on the back (4); head with light band from eye to ear; tail on second half with clear light-dark banding (5); belly bright with distinct narrow dark stripes (6); underside of tail base with narrow light and dark stripes; throat bright with many small dark spots (7); chin with three faint dark stripes

Similar species: *V. palawanensis* sometimes whitish colour on head; tongue underside also dark blue grey; belly mainly bright; juveniles with less (about 7 vs. about 12) cross rows of spots on back; *V. salvator* usually with distinct transverse rows of spots on back (juveniles with fewer transverse rows, but usually larger spots); ventral (←) side bright with more or less distinct dark pointed markings; throat lighter; tongue also below dark blue grey; *V. dalubhasa* and *V. bangonorum* without whitish colouring on head, belly light with dark cross stripes, throat light with few dark spots; *V. marmoratus* without whitish colouration on head, usually with distinct spots on back; *V. nuchalis* with strongly enlarged neck scales, sometimes with large bright spots on the back

Size/age at sexual maturity: No published data; probably similar to *V. salvator* and *V. cumingi*.

Clutch size: No published data; probably similar to *V. salvator* and *V. cumingi*.

Incubation period/temperature: No published data; probably similar to *V. salvator* and *V. cumingi*.

Size/weight of hatchlings: No published data; probably similar to *V. salvator* and *V. cumingi*.

Growth rate: No published data; probably similar to *V. salvator* and *V. cumingi*.

Captive breeding: No breeding success has been documented so far; conditions probably similar to *V. salvator* and *V. cumingi*.

Ecology: Diurnal (←); adults mostly terrestrial (←), juveniles probably rather tree-dwelling, island endemic (←); published data about the biology are lacking.

Remarks: Due to the limited distribution range and lack of biological information *V. rasmusseni* is classified as potentially endangered on the Philippines. International trade does not take place according to the CITES trade database. The species is nationally protected under the Wildlife Act 2001 of the Philippines.



Varanus rasmusseni. Above left and right: adult, Tawi-Tawi Island, Philippines, © Ng Bee Choo; centre left and right: subadult, Bongao, Tawi-Tawi Island, Philippines, © Maren Gaulke; below left and right: juvenile, Tawi-Tawi Island, Philippines, ZFMK 89391 (formerly ZMUC R42153), paratype (←), © André Koch

Varanus salvator (Laurenti, 1768)

Subgenus: *Soterosaurus*

English names: (South-East Asian) Water monitor, Common water monitor, Malayan monitor

German name: Bindenwaran

Local names: Biawak air (Malaysia, Indonesia [Sumatra, Kalimantan, Java]), Alu (Bali), Ghora, Weti (Flores), Soa-soa (Sulawesi, Ambon), Hiah, Laan Dok-mai, Tua nguen tua tong (Thailand), Kabaragoya (Sri Lanka), Yay-Phut, Phut-Hyin-gan (Myanmar), pani godhi, pani goisap (Bangladesh), ram godhika (Bengali)

Synonyms: *V. salvator kabaragoya* Deraniyagala, 1947; *V. salvator nicobariensis* Deraniyagala, 1947; *V. komaini* Nutphand, 1987

Subspecies: *Varanus s. salvator* (Sri Lanka), *V. salvator andamanensis* (Andaman Islands, India), *V. salvator bivittatus* (Java, Lesser Sunda Islands), *V. salvator celebensis* (North Sulawesi), *V. salvator macromaculatus* (north-eastern India, continental Southeast Asia, Hainan [China], Greater Sunda Islands [except Java] and offshore islands), *V. salvator zieglerei* (Obi Island, Moluccas, Indonesia); taxonomic status of some island populations and colour morphs in trade (e.g., “sulphur *salvator*”) remains uncertain, likely bearing undescribed (sub)species; several Philippine species (i.e., *V. marmoratus*, *V. nuchalis*, and *V. cumingi*) and *V. togianus* were formerly scientifically treated as subspecies of *V. salvator*.

International conservation status (CITES / Commission Reg. (EU) No 2017/160): Appendix II/ B

IUCN Red List status: Least Concern (LC), population trend unknown (last assessed 2009)

Distribution: South Asia as well as continental and insular Southeast Asia (except Philippines)

Total length (TL): 321 cm, but usually below 230 cm; **Snout-vent length (SVL):** 91 cm

Morphological traits (adults): Large to very large species, weighing up to 20 kg, even 25 kg are recorded; tail length 1.27-1.65 times SVL, roundish at base, distally (←) laterally compressed, triangular in cross-section, with relatively high double crest (←) (1); lateral tail scales smaller than lower ones; head long with slightly bulged snout; nostrils oval-shaped, located closer to tip of snout than to eye (2); supraoculars (←) enlarged, larger than scales of interorbital region (←); number of scales around midbody scales (←) ranges between 135-178 (∅ 151) in *V. s. macromaculatus*, 101-175 (∅ 150) in *V. s. bivittatus*, 142-165 (∅ 153) in *V. s. salvator*, 116-162 (∅ 143) in *V. s. celebensis*, 143-161 (∅ 153) in *V. s. andamanensis*, and ca. 140 in *V. s. zieglerei*.

Colour pattern: *V. salvator* shows some variation across its wide range. General colour pattern consists of 4-7 cross rows of large yellowish spots/ocelli (←) on a dark brown/blackish back (3), areas between cross rows and legs irregularly bright dotted; occasionally unicoloured black specimens (4), also underside, especially in populations of Thailand, Malaysia and western Java (formerly described as *V. komaini* which is considered synonymous); rarely very bright specimens in trade (so-called “sulphur *salvator*”), allegedly from Java, with yellow to cream-white ground colour (5), back with dark cross bands (large bright spots/ocelli in younger specimens), head plain bright or with little dark markings and stripes across snout, legs with dark reticulated pattern; tail with light and dark banding, more clear towards tail-tip (6); body underside pale yellowish with dark pointed markings laterally on belly and legs; chin and gular region (←) with black cross-bands or pointed markings; head with dark streak between eye and ear; snout with 1-3 indistinct dark cross bands; iris dark brown; tongue dark bluish/blackish (7); in (juvenile) *V. s. salvator* (A) dorsal (←) cross rows of ocelli alternate with lines of smaller light dots (8); *V. s. andamanensis* (B) is rather melanistic (←) dorsally, ocelli are often dissolved; *V. s. macromaculatus* (C) and *V. s. bivittatus* (D) have a yellowish line below the temporal streak that extends to neck and sometimes to shoulders, first cross row of ocelli behind fore limbs resembles a band of ocelli merging with each other, or forms a rather dissolved band (9), specimens from the Lesser Sunda islands with largely reduced dorsal spots (10); *V. s. celebensis* (E) exhibits rather small dorsal ocelli with many light dots in-between, dark V-shaped markings on underside interconnected across belly and throat, often faded in large specimens; in *V. s. zieglerei* (F) the first cross row of ocelli behind fore limbs is dissolved (11), neck plain medium brown (12), head with distinct dorsal colour pattern consisting of light-encircled dark-coloured supraoculars, a bright spot above the pineal organ, which is surrounded by a dark brown area; in **juveniles** the colour pattern is usually brighter and more contrasting with distinct large spots and ocelli, which dissolve with age.

Similar species: In *V. niloticus* and *V. ornatus* the supraoculars are not enlarged, nostrils located in the middle between eye and tip of snout, moreover *V. ornatus* has a whitish/pinkish tongue;

V. bangonorum, *V. dalubhasa* and *V. marmoratus* have enlarged nuchal scales (↔) (three to four times larger than dorsal scales), tongue dark blue/blackish only in the dorsal distal part, remaining parts flesh-coloured, a finely speckled/marbled gular region, and \varnothing 133-138 scales around midbody; *V. palawanensis* usually without distinct cross rows of large spots on back, head with whitish coloration; *V. rasmusseni* usually without distinct cross rows of large bright spots and/or ocelli on back (juveniles with more cross rows, but usually smaller spots), body underside mostly dark, belly and chest with indistinct bright cross stripes in the middle (in juveniles mostly bright with dark cross stripes), throat dark with little bright mottling (in juveniles bright with dark spots), tongue only above dark blue/blackish, at base pink/flesh-coloured; *V. nuchalis* has much larger nuchal scales (three to four times larger than dorsal scales), tongue dark blue/blackish only in the dorsal distal part, remaining parts flesh-coloured, head sometimes with whitish parts, and often a dark-coloured gular region; *V. togianus* usually without distinct cross rows of large yellow spots/ocelli on back, belly and throat are mostly dark with bright diamond-shaped markings or cross bands; *V. melinus* closely resembles the rare “sulphur *salvator*” form, but has a reticulated pattern on the back, the tongue is pink/flesh-coloured.

Size/age at sexual maturity: ♂ at ca. 40 cm SVL, 111-133 cm TL, 1.5-3.3 kg; ♀ at 45-49 (\varnothing 46.5) cm SVL, 108-125 (\varnothing 113) cm TL, 1.3-2.5 (\varnothing 1.9) kg; at 2 years in captivity, 2-3 years in the wild

Clutch size: 5-24 (\varnothing 14-17) eggs per clutch depending on female size; 2 clutches per year in India, more elsewhere; up to 40 eggs can be laid in the course of a year; in continental and insular Southeast Asia egg deposition peaks in June/July at the onset of the rainy season, or between November and March, but may occur year-round.

Incubation period/temperature: 171-327 days at 25-33 °C, reasons for high variation unknown

Size/weight of hatchlings: 25-39 (\varnothing 29.5-32) cm TL, 12-14 cm SVL, and 25-62 g

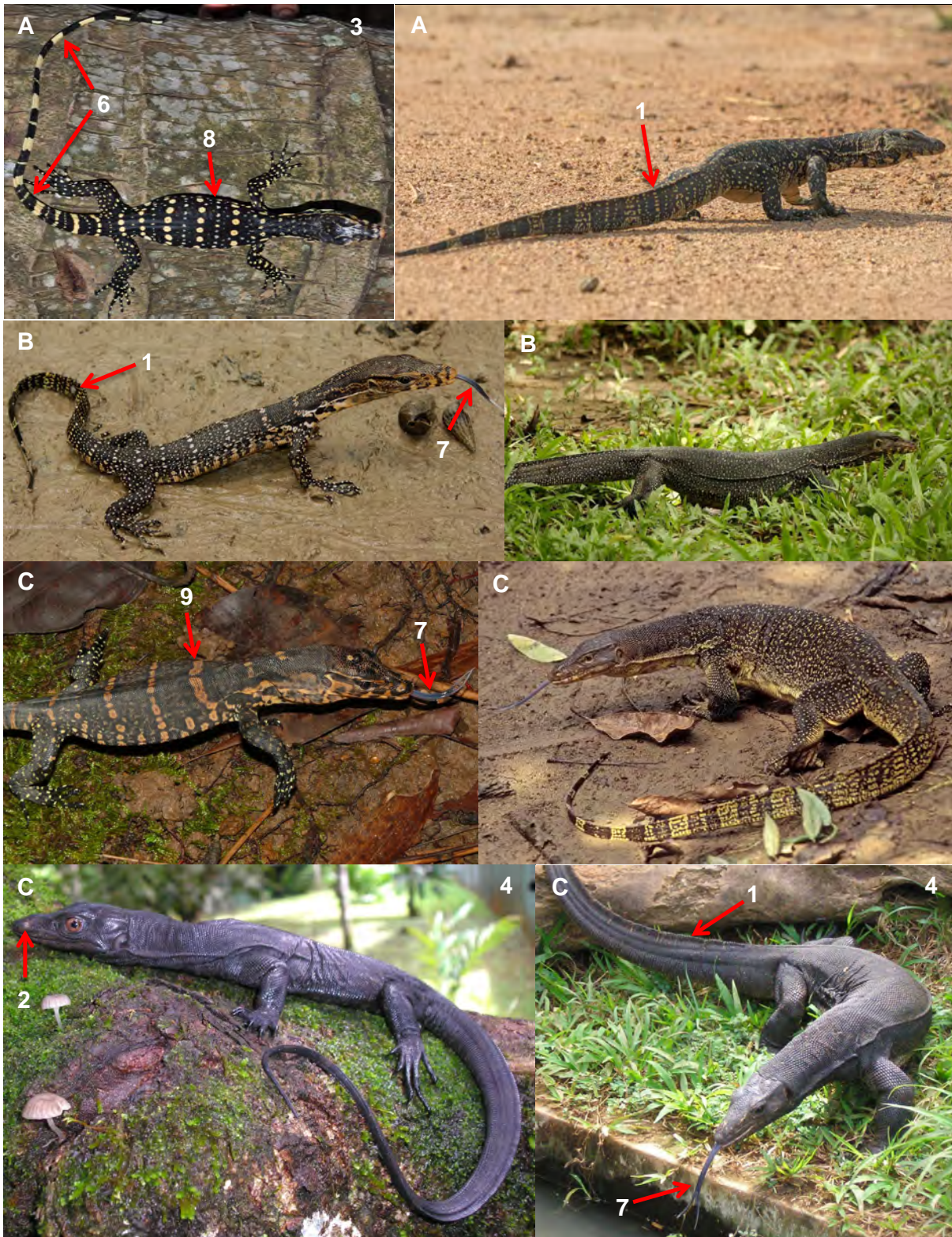
Growth rate: In captivity, hatchlings grow fastest during the first 5 months, with an increase to 18.5-30 cm SVL, ca. 50 cm TL; in one-year-old individuals SVL can increase by 21-23.7 cm; after 18 months: 86 cm TL; after 3 years: 110 cm TL; after 4 years: 138 cm TL; after 6 years: 164 cm TL

Captive breeding: Readily available in the pet trade; however, rarely bred in zoos and by private keepers, but artificially generated colour morphs such as albinos are becoming popular in herpetoculture, while entirely melanistic specimens (traded as “black dragons”) are a naturally occurring mutation; simulation of rainy season and lower temperatures may stimulate reproductive behaviour; large enclosures or periodic separation of both sexes outside the mating season may be necessary to avoid fatalities; a harmonising breeding couple of similar size is advantageous.

Specifics: Ability of parthenogenesis (↔) is very likely.

Ecology: Diurnal (↔); foraging behaviour at night reported; terrestrial (↔) to semiaquatic (↔), juveniles more arboreal (↔); euryoecious (↔), often found in coastal and wetland habitats, agricultural areas, close to villages and cities; opportunistically preys on a wide range of invertebrates (↔), vertebrates (↔), domestic fowl, carrion and human leftovers

Remarks: *V. salvator* is the most intensely traded lizard species worldwide; between 2010-2018, major source countries Malaysia and Indonesia exported >2.3 million skins of wild-caught specimens mainly destined for the fashion industry (CITES trade database). The species is also harvested for the pet trade and domestically utilized for human consumption and traditional medicines, and regionally killed as a pest and on roads. Field studies are warranted to investigate demographic changes, the species' ecological role in the various habitats and local over-harvesting of populations. *V. salvator* is regionally protected by cultural beliefs and taboos.



Varanus salvator salvator. Above left: juvenile, Sri Lanka, © Achyuthan Srikanthan; above right: subadult, Thalawathugoda, Sri Lanka, © Dinal Samarasasinghe & Kaja Thieme; *V. s. andamanensis*. Second row left and right: juvenile and adult, both South Andaman Island, India, © Hari Krishnan Surendran; *V. s. macromaculatus*. Third row left: juvenile, Camorta Island, Nicobar Islands, India, © Hari Krishnan Surendran; third row right: adult, Tioman Island, Malaysia, © Pauli Hien; **melanistic form** (formerly described as *V. komaini* but considered a synonym now). Below left: juvenile, captive-bred; below right: adult male, Malaysia, © Quetzal Dwyer



Varanus "*sulphur salvator*". Above left: adult specimen of unknown origin at a pet shop in Japan, © Mark Auliya; *V. s. bivittatus*. Above right: subadult, Java, Indonesia, © Andrea & Dietmar Trobisch; second row left: juvenile, Flores Island, Lesser Sunda Islands, Indonesia, © Mark Auliya; second row right: adult, Alor Island, Lesser Sunda Islands, Indonesia, © Pauli Hien; *V. s. celebensis*. Third row left: adult, Palu, Sulawesi Island, Indonesia, © André Koch; third row right: adult, Tambun, near Kotamobagu, Sulawesi Island, Indonesia, © Pauli Hien; *V. s. ziegleri*. Below: subadult, Obi Island, Indonesia, © Valter Weijola

Varanus samarensis Koch et al., 2010

Subgenus: *Soterosaurus*

English name: Samar water monitor

German name: Samar-Bindenwaran

Local name: -

Synonyms: *V. salvator cumingi* Martin, 1838; *V. cumingi samarensis* Koch et al., 2010; prior to their description as a new subspecies, the monitor lizards from Samar, Bohol and Leyte islands were allocated to *V. (salvator) cumingi*.

Subspecies: None; originally, *V. samarensis* was described as a subspecies of *V. cumingi*. Later, these monitor lizards were elevated to full species status.

International conservation status (CITES / Commission Regulation (EU) No 2017/160): Appendix II/B

IUCN Red List status: Not Evaluated (NE)

Distribution: Samar, Bohol, and Leyte islands, Philippines

Total length (TL): 140 cm; **Snout-vent length (SVL):** 53 cm

Morphological traits (adults): Large species; head, body, legs and tail strong; tail length 1.6 times SVL, laterally flattened with a keel (↔) above (1); lateral tail scales smaller than lower ones; nostrils roundish to oval, closer to tip of snout than to eye; head scales above eyes enlarged

Colour pattern: Head, body, legs and tail predominantly black; back with 6-8 transverse rows of more or less distinctive yellow spots, ocelli (↔) or markings (2); tail base with transverse rows of spots, second half with indistinct yellow bands (3); legs yellow dotted; head with irregular yellow markings, a dark streak between eye and ear (4); iris reddish brown/bronze; tongue underside and base pink/flesh-coloured, second half above dark blue-grey (5); belly yellow, with 9-15 more or less distinctive dark bars or crossbands; throat yellow, sometimes with small dark spots; underside of tail light and dark banded; **juveniles** with distinct banded pattern on tail and clear pointed black bars on belly (6)

Similar species: In *V. cumingi* the head is predominantly yellow; back with 5-6 indistinctive yellow transverse bands (adults) or rows of spots (juveniles) (vs. 6-8 rows of spots/ocelli (↔) in adults and juveniles), sometimes with a yellow stripe in the middle; belly with 8-11 (vs. 9-15) more or less distinct dark bars or crossbands; *V. melinus* has no black streak between eye and ear, a plain pink/flesh-coloured tongue; colour pattern on the back reticulated; tail banding is more indistinct and narrower (> 20 light and dark bands each)

Size/age at sexual maturity: No published data; probably similar to *V. cumingi*.

Clutch size: No published data; probably similar to *V. cumingi*.

Incubation period/temperature: No published data; probably similar to *V. cumingi*.

Size/weight of hatchlings: No published data; probably similar to *V. cumingi*.

Growth rate: No published data; probably similar to *V. cumingi*.

Captive breeding: No breeding success has been documented so far; conditions probably similar to *V. cumingi*.

Ecology: Diurnal (↔); island endemic (↔); predominantly ground-dwelling; feeds on various animals and on carrion

Remarks: Officially, no international trade in *V. samarensis* is documented by the CITES trade database, but specimens could be traded under the name of *V. cumingi*, to which these populations formerly belonged. Due to limited biological information, local hunting and illegal animal trade, the species is considered under threat. The species is nationally protected under the Wildlife Act 2001 of the Philippines.



Varanus samarensis. Above: subadult, Loboc, Bohol Island, Philippines, © Wouter Beukema; centre left: adult, Leyte Island, Philippines, © Maren Gaulke; centre right: adult, Maasin City, Leyte Island, Philippines, © Wojtek Nieszporek; below left: juvenile, Samar Island, Philippines, © Maren Gaulke; below right: juvenile, Maasin City, Leyte Island, Philippines, © Wojtek Nieszporek

Varanus togianus (Peters, 1872)

Subgenus: *Soterosaurus*

English name: Togian water monitor

German name: (Togian-Bindenwaran)

Local names: Biawak [togian], Soa-soa (Sulawesi, Indonesia)

Synonyms: *V. salvator togianus*

Subspecies: None; formerly, however, *V. togianus* was considered a subspecies of *V. salvator*.

International conservation status (CITES / Commission Regulation (EU) No 2017/160): Appendix II/B

IUCN Red List status: Not Evaluated (NE)

Distribution: Sulawesi Island (except for the northern Minahassa Peninsula) and the adjacent Togian Islands as well as Selayar and Buton islands, Indonesia

Total length (TL): 150 cm; **Snout-vent length (SVL):** 65 cm

Morphological traits (adults): Large species; head, body, legs and tail strong; tail length 1.35-1.75 (\approx 1.6) times SVL, laterally flattened with a keel (↔) above (1); lateral tail scales smaller than lower ones; nostrils roundish to oval, closer to tip of snout than to eye; head scales above eyes enlarged

Colour pattern: *V. togianus* shows some variation across its range. Head, body, legs and tail nearly plain dark brown to black (2), or speckled with many single or partly bright scales or small spots (3); tail plain dark, without banding; body underside predominantly dark brown to dark grey, belly with indistinct yellow cross stripes; throat and chin with distinct yellowish diamond-shaped spots or cross bars (4); or underside of body pale yellow with lateral dark pointed markings, dark marbled throat (5); head dark, with or without bright streak between eye and ear; yellow stripes running over snout (6); neck sometimes with yellow stripe at the sides; iris reddish brown; tongue above dark blue grey, base pink/flesh-coloured (7); **juveniles** look the same, sometimes the dotted pattern is more intense.

Similar species: *V. obor* has a plain dark belly, throat with white markings, yellow stripes across snout lacking; the tongue is pink; *V. mabitang* has a plain dark underside, the tongue is pink; *V. indicus*, *V. lirungensis* and *V. rainierguentheri* have a yellow dotted head above, a yellow underside, sometimes with a pale grey reticulated pattern, and lack yellow stripes across snout; *V. beccarii* and *V. bogerti* have a plain dark underside, are smaller and have a more slender body and limbs, the tail is longer and prehensile (↔); *V. salvator* usually has several cross rows of large yellow (eye)spots on the back, belly and throat are mostly bright, sometimes with dark V-shaped dark markings.

Size/age at sexual maturity: No published data; probably similar to *V. salvator*.

Clutch size: No published data; probably similar to *V. salvator*.

Incubation period/temperature: No published data; probably similar to *V. salvator*.

Size/weight of hatchlings: No published data; probably similar to *V. salvator*.

Growth rate: No published data; probably similar to *V. salvator*.

Captive breeding: No breeding has been documented so far; probably similar to *V. salvator*.

Specifics: Probably, *V. togianus* is able to reproduce via parthenogenesis (↔).

Ecology: Diurnal (↔); mainly ground-dwelling; island endemic (↔); feeds mainly on invertebrates such as insects, spiders, and scorpions, but also eggs, e.g. of sea turtles and ground-breeding birds.

Remarks: *V. togianus* is nationally protected in Indonesia. Officially, no trade takes place in this species according to the CITES trade database, but for the international reptile leather trade (probably declared as *V. salvator*) and as food source of the local human population, these monitor lizards are harvested. Road traffic is another threat factor.



Varanus togianus. Above: adult, Bantaeng, Southwest Sulawesi, Indonesia, © André Koch; second row left: adult, Bantimurung, Southwest Sulawesi, Indonesia, © Andrea & Dietmar Trobisch; second row right: subadult, Luwuk, Central Sulawesi, Indonesia, © André Koch; third row left and right: subadult/juvenile, Langger, Batudaka Island, Central Sulawesi, Indonesia, © André Koch; below left and right: subadult, Bantaeng, Southwest Sulawesi, and Togian Island, Central Sulawesi, Indonesia, © André Koch & Evy Arida

Varanus giganteus (Gray, 1845)

Subgenus: *Varanus*

English names: Perentie, Laced lizard

German names: Australischer Riesenwaran, Riesenfelswaran

Local names: Atypunpe (southeastern NT), banthawayi (coastal WA)

Synonyms: None

Subspecies: None

International conservation status (CITES / Commission Reg. (EU) No 2017/160): Appendix II/B

IUCN Red List status: Least Concern (LC), population trend stable (last assessed 2017)

Distribution: Western Australia (WA), South Australia (SA), Queensland, Northern Territory (NT)

Total length (TL): 250 cm **Snout-vent length (SVL):** 90 cm

Morphological traits (adults): Very large slender species, rarely beyond 200 cm TL; up to 17 kg (♂ > ♀); long extremities, particular hind limbs with long digits and claws; tail base almost roundish, towards tail-tip laterally compressed, triangular in cross-section (1), tail length less than 1.5 times of SVL; tail shows a low double-crest (←); long head and neck; nostrils roundish to oval, located about twice the size from eye to tip of snout (2); supraoculars (←) not differentiated, rather granular (←); upper eye-lid clearly visible; dorsum (←) with keeled scales (←); number of midbody scales (←) ranges between 150-155

Colour pattern: Ground colour olive/grey to blackish on tail, dorsum with yellowish/reddish mottling (3) in-between prominent large yellow dark encircled dots/ocelli (←) that form transverse rows (4); neck sides and gular region (←) with distinct blackish network pattern on white/yellowish ground colour (5), that can be less distinct in larger specimens (6); upper head more dark with irregular yellow flecks; from tip of snout to anterior eye approx. five greyish bars (7); dark/blackish limbs on upper side with clear yellow dots; tail with transverse rows of dots; approx. last quarter of tail without pattern and yellowish (8); tongue colour overall pinkish; **juveniles:** clearly higher contrast colour pattern (9)

Similar species: None

Size/age at sexual maturity: ♀ at ca. 49 cm SVL, 110 cm TL, likely with 3 years; ♂ at ca. 45 cm SVL and 140 cm TL, likely with 2-3 years

Clutch size: 7-16 eggs per clutch, depending on ♀ size

Incubation period/temperature: 197-249 days at 30-32° C; on average about 223 days at 30 °C

Size/weight of hatchlings: Ø 39.3 cm TL, Ø 15 cm SVL, and Ø 46.7 g

Growth rate: Rapid growth up to 55 cm SVL, thereafter growth decreases; hatchling (unspecified sex) with 21.5 cm SVL increased SVL 1.1 cm in 53 days; in 1 year hatchling could have a SVL of 30 cm; a ♀ between 40-45 cm SVL may refer to an age of 2-3 years; a ♀ with 40 cm SVL increased SVL 4.4 cm in 328 days; another ♀ at 61.3 cm increased SVL 0.6 cm in 802 days; a ♂ at 53.1 cm SVL increased SVL by 4.4 cm in 471 days; another ♂ at 73.6 cm SVL increased SVL 1.1 cm in 611 days

Captive breeding: Repeatedly bred successful in Australian outdoor enclosures

Ecology: Diurnal (←); terrestrial (←); associated to arid ecosystems; mean home range (←) sizes for ♂ of more than 320 ha (breeding season), compared to less than 50 ha for ♀; preys mainly on vertebrates e.g., snakes, sea turtle hatchlings, but particularly on lizards, including adult *Varanus panoptes*, *V. tristis* and conspecifics (←), birds, mammals and carrion

Remarks: Under the EPBC Act (←) the export of live specimens for commercial purposes is prohibited; during 1979-2016 exports mainly for zoos and scientific purposes are documented (CITES trade database); *V. giganteus* has also been reported in illegal trade; invasive species such as dingoes and foxes may impact wild populations.



Varanus giganteus. Above and centre left: adult, Barrow Island, WA, Australia, © Ryan J. Ellis; centre right: adult, Old Andado Station, NT, Australia, © Craig Nieminski; below: juvenile, Indee Station, WA, Australia, © Ryan J. Ellis

Varanus gouldii Gray, 1838

Subgenus: *Varanus*

English names: Sand monitor, Gould's monitor/goanna, Racehorse goanna, Bungarra

German name: Gouldswaran

Local names: Maru (northeastern NSW), Tchulii (central NSW), Thaakurlu, Parna (southwestern NSW), Dhuuleeyn (central eastern NSW), Watha (south-western and north-western Victoria), Gurrumanthu (coastal central WA), Alewatyerre (south-eastern NT, central northern SA), Kunungkama (northern WA, north-western NT)

Synonyms: None

Subspecies: *Varanus g. gouldii* (all of Australia except the extreme southwest, parts of northern Qld and most of Victoria), *Varanus gouldii flavirufus* (interior of WA, SA, NT, Qld); the taxonomic status of all populations remains uncertain; *V. gouldii* is a species complex and likely includes a number of new species.

International conservation status (CITES / Commission Reg. (EU) No 2017/160): Appendix II/B

IUCN Red List status: Least Concern (LC), population trend stable (last assessed 2017)

Distribution: Western Australia (WA), Victoria, South Australia (SA), Queensland (Qld), Northern Territory (NT), New South Wales (NSW); *V. gouldii* has the most extensive distribution of all *Varanus* spp. in Australia.

Total length (TL): 160 cm; **Snout-vent length (SVL):** 67 cm

Morphological traits (adults): Large robust species, muscular front limbs; tail base almost roundish, distally strongly laterally compressed, triangular in cross-section (1), a low double-crest (2), tail length approximately 1.3-1.6 times SVL; nostrils roundish to triangular-shaped, lateral, located slightly closer to tip of snout than to eye (2); interorbital scales (3) slightly larger than supraoculars (3); number of midbody scales (4) ranges between 132-216

Colour pattern: In *V. g. gouldii* ground colour is yellowish to blackish; occasionally more or less clear whitish/yellowish/brownish black centred ocelli (5) in transverse rows across dorsum (3); ventrum (6) either immaculate or banded or with dark brownish spots not arranged in cross-rows; limbs with larger irregularly placed yellow spots (4); in *V. gouldii flavirufus* dorsum yellow-ish/reddish, occasionally with dark reticulations or coalesced ocelli (5) on dorsum (5), also distinct on first third of tail (6), or with cross rows of black curls/small angular lines (7) and upper tail with diffuse wider dark or narrow yellowish bands; limbs with yellowish honeycomb pattern (8); mostly last tail-third yellowish without bands (9); prominent black wider or narrow temporal streak (10) that fades along neck sides (11), and bordered by white/yellowish lines (12); tail dark grey and yellowish banded, occasionally spots aligned to rows; in **juveniles** the colour pattern is brighter and more distinct.

Similar species: Usually dorsum of *V. panoptes* with transverse rows of blackish spots alternating with yellowish spots; tail usually banded to the tip; number of midbody scales (4) ranges between 171-242

Size/age at sexual maturity: At ca. 25 cm SVL; with 18-36 months

Clutch size: 3-20 per clutch; Ø 5.9 eggs per clutch in the wild; Ø 7.3 eggs per clutch in captivity

Incubation period/temperature: 223-270 days at 30 °C, or 169-172 days at 30-32 °C

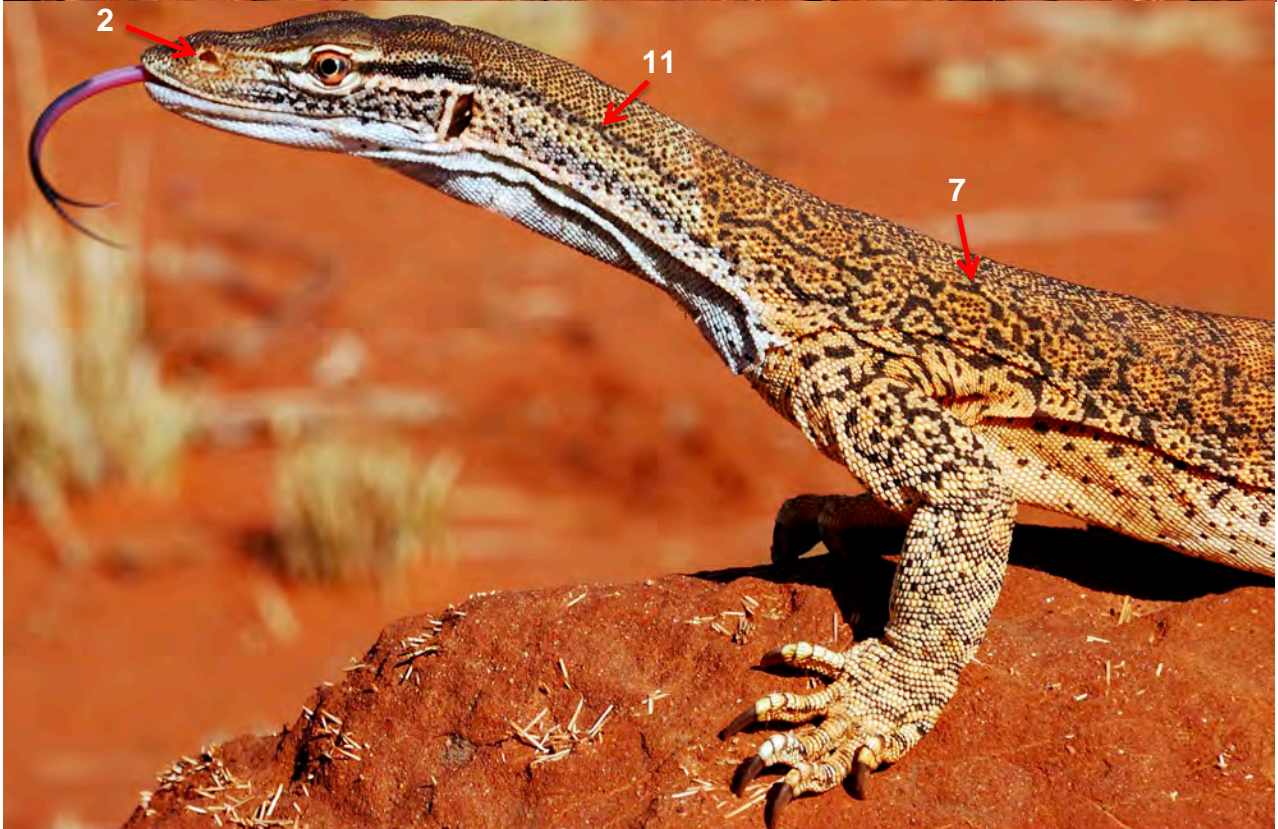
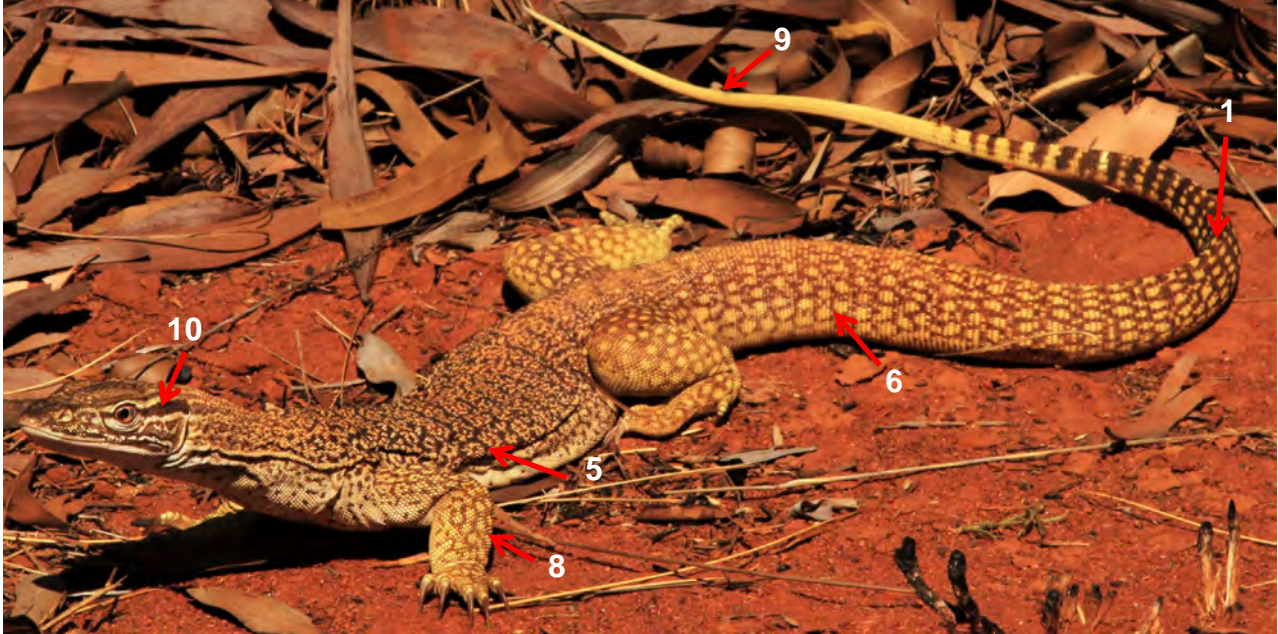
Size/weight of hatchlings: 26 cm TL; 9.4-11 cm SVL; 27.8-32.2 g

Growth rate: No published data

Captive breeding: A moderately widespread species in captive collections

Ecology: Diurnal (13); nocturnal (13) hunting behaviour known; terrestrial (13); associated with deserts, semi-arid *Spinifex* habitats and various forested habitats on sandy soils; shelters in burrows; opportunistically feeds on various invertebrates (13) and vertebrates (13) and carrion.

Remarks: Under the EPBC Act (13) the export of live specimens for commercial purposes is prohibited; international commercial trade data are misleading; between 2010-2018, Indo-nesia was the only country recording exports of individuals sourced C (13) and F (13) (CITES trade database). However, these exports probably refer to *V. panoptes horni* because *V. gouldii* is not native to Indonesia.



Varanus g. gouldii. Above: subadult, Woody Point, Bundjalung National Park, NSW, Australia, © Michael J Barritt; ***V. gouldii flavirufus***. Centre: adult, Indee Station, WA, Australia, © Ryan J. Ellis; below: adult, Windorah, Qld, Australia, © Gary Stephenson

Varanus komodoensis Ouwens, 1912

Subgenus: *Varanus*

English name: Komodo dragon

German name: Komodo-Waran

Local names: Biawak komodo, Biawak Raksara, Buaya darat, Ora, Lawora, Pendugu, Rugu (Indonesia)

Synonyms: None

Subspecies: None

International conservation status (CITES / Commission Regulation (EU) No 2017/160): Appendix I/A

IUCN Red List status: Vulnerable (VU), population trend unspecified (last assessed 1996)

Distribution: Lesser Sunda Islands of Komodo, Rinca, (Padar), Gili Motang, Gili Dasami, and Flores, Indonesia

Total length (TL): 304 cm (♂), 267 cm (♀); **Snout-vent length (SVL):** ♂ 90 cm, 157 cm (♂), 135 cm (♀)

Morphological traits (adults): Very large species, more than 70 kg; head, body and legs strong; tail length equal to SVL (slightly longer in juveniles); tail at base round in cross-section, laterally flattened, with a low keel (←) above (1); tail scales above and below usually of the same size, forming continuous rings; nostrils oval, close to the tip of the snout (2); head scales above eyes small, not broadened

Colour pattern: Head, body, legs and tail earth brown, in subadult specimens the neck and back are often yellowish to rusty red; head and legs grey to black, the latter with yellow spots; tail indistinctly banded; body underside greyish brown; head scales around eyes pale yellow to whitish (3); iris brown, sclera reddish brown; tongue bright pink; **juveniles** are more colourful, background colour black-grey, neck with pale yellow V-shaped pattern (4); legs with bright yellow spots; back with many larger and smaller orange to rusty red spots and dots (5), continuing on tail, indistinctly light and dark banded towards the end (6); body underside whitish to pale yellow with distinct dark cross stripes

Similar species: In *V. bengalensis*, the nostrils are located midway between eye and tip of snout (vs. near the tip of snout), up to 175 cm (vs. >200 cm) TL.

Size/age at sexual maturity: ♂: >190 cm TL; ♀: >150 cm TL; 3.5-4 years in captivity, possibly 8-11 years in nature

Clutch size: Usually 1 clutch per year with up to 33 (♂ 18) eggs, 40-50 days after copulation

Incubation period/temperature: 205-280 (♂ 220) days at 27.5-29 °C

Size/weight of hatchlings: 14.5-19.6 (♂ 17.3) cm SVL; 25.3-55.5 (♂ 30-46) cm TL; 53-135 (♂ 80-100) g

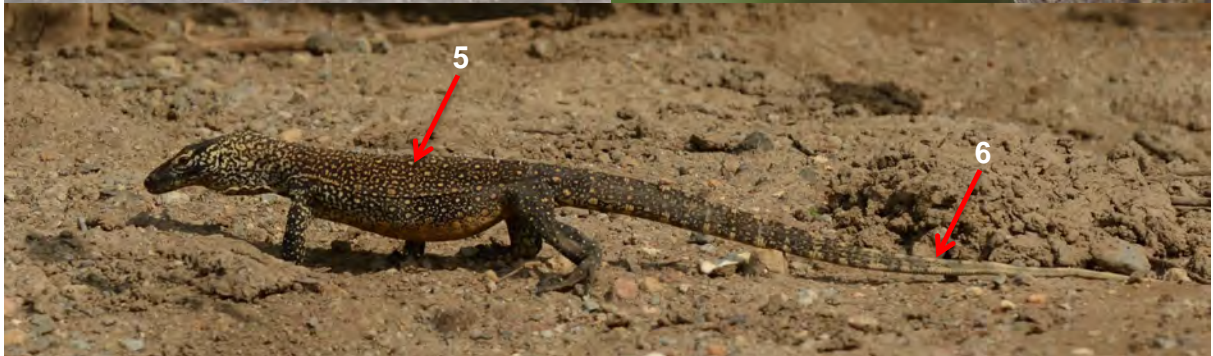
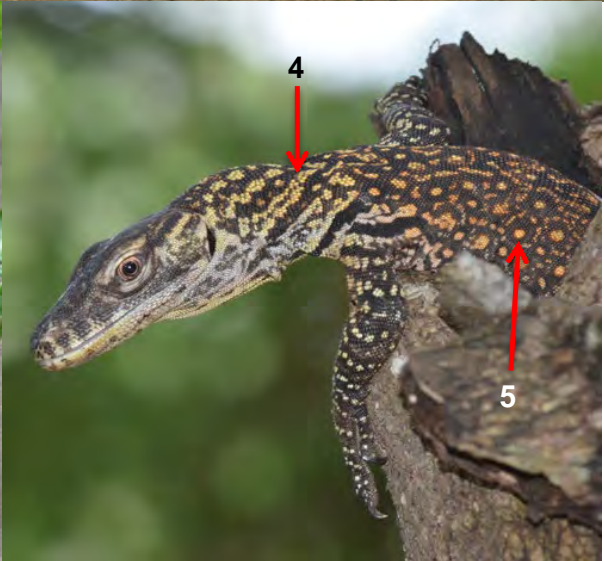
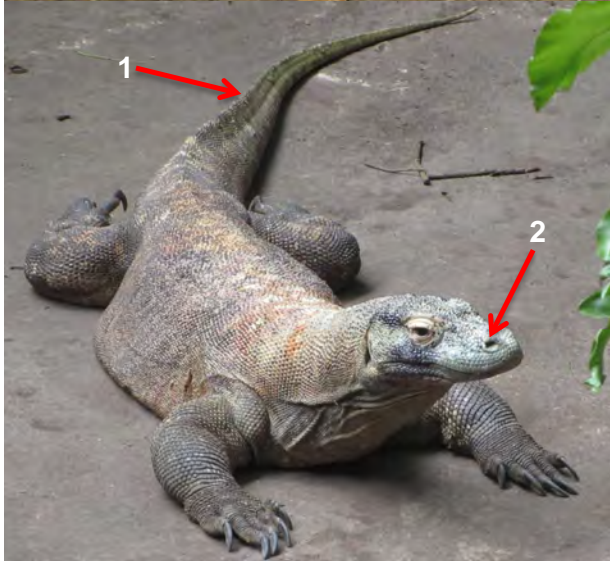
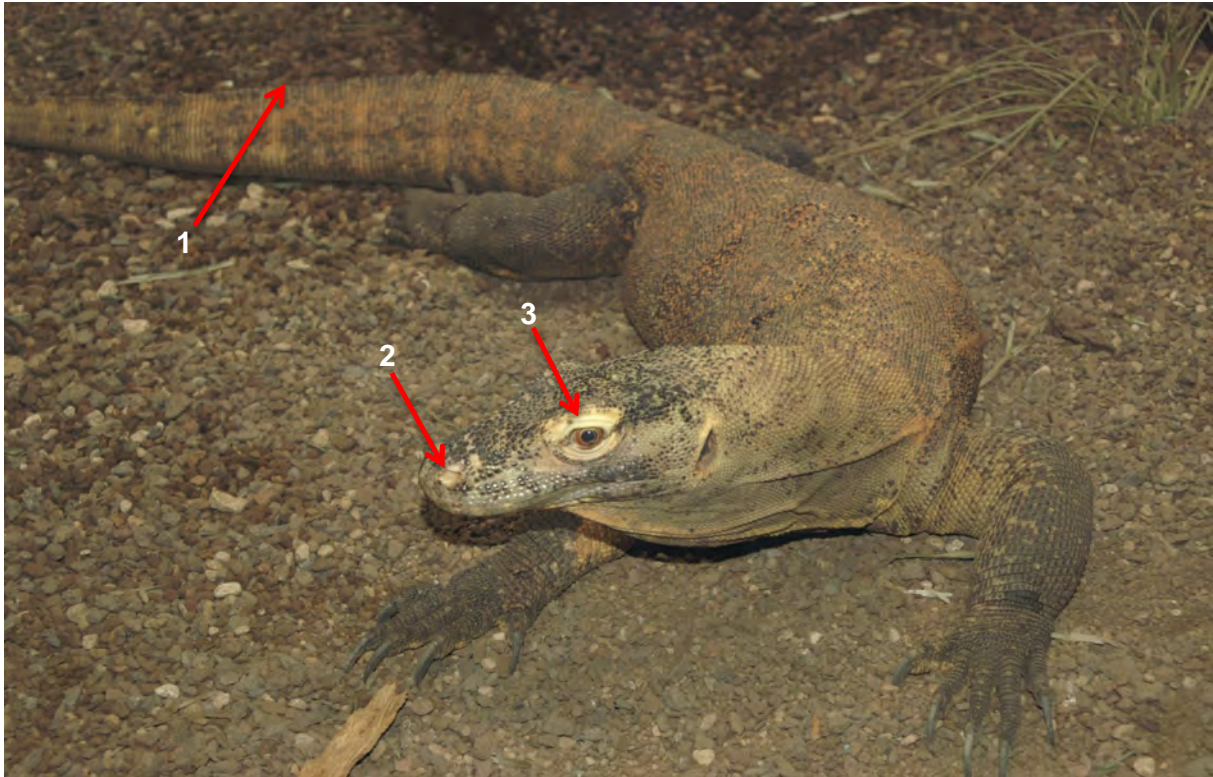
Growth rate: After 3 months: ♂ 55.2 cm TL (♂ 300 g); after 1 year: ca. 100 cm TL; after 3 years: ca. 170 cm TL

Captive breeding: The species is regularly successfully bred and reared in zoos. Temporary separation of both sexes and high temperatures are helpful for reproductive purposes.

Specifics: Parthenogenesis (←) has been reported. The resulting offspring are always males.

Ecology: Diurnal (←); island endemic (←); young Komodo dragons are tree-dwelling and insect or lizard eaters. Adult specimens are ground-dwelling and predominantly mammalian eaters and cannibalistic.

Remarks: The species is nationally protected in Indonesia. Due to the high protection status of *V. komodoensis* only single (captive-bred) specimens are exchanged between international zoos. However, it is assumed that there is a demand by private keepers and that juveniles are illegally collected by e.g. tourists. The conservation status of the Komodo dragon is currently under revision.



Varanus komodoensis. Above: subadult, Leipzig Zoo, © André Koch; centre left: adult, © Sven Mecke; centre right: juvenile, Komodo Island, Indonesia, © Markus Schmidbauer & Pauli Hien; below: juvenile, Komodo Island, Indonesia, © Roxane Jouan

Varanus mertensi Glauert, 1951

Subgenus: *Varanus*

English names: Mertens' water monitor, Mertens' monitor/goanna

German names: Mertens Wasserwaran, Australischer Wasserwaran

Local names: Bulliwallah, Giwilli (northwestern WA)

Synonyms: *Varanus bulliwallah* Worrell, 1956

Subspecies: None

International conservation status (CITES / Commission Reg. (EU) No 2017/160): Appendix II/B

IUCN Red List status: Endangered (EN), population trend decreasing (last assessed 2017)

Distribution: Western Australia (WA), Queensland, Northern Territory (NT), Australia

Total length (TL): 130 cm; **Snout-vent length (SVL):** 48 cm

Morphological traits (adults): Medium to large, slender species; tail base more roundish, then distinctly compressed laterally, triangular in cross-section, with distinct double-crest (←), tail length about 1.5 times SVL; nostrils oval, located on top of snout, closer to tip of snout than to eye (1); supraoculars (←) (2) smaller than scales of interorbital region (←) (3); number of midbody scales (←) ranges between 150-180

Colour pattern: Ground colour of dorsum (←), limbs and upper side of tail olive/grey/brown with very small whitish/yellowish scattered spots edged with black scales (4); upper side of head dark olive, occasionally with orange/brown tinge on head sides, around eyes, temporal region (←) and ear openings (5), this colouration describes ♀, while in ♂ head sides show a blue tinge (more prominent in western populations of species range); labial region (←) barred greyish (6); pale yellowish/brownish gular region (←) and lower tail distinctly demarcated from dark lateral body parts; ventrally (←) between fore limbs and ventrum (←) equally pale yellowish, but with grey speckles, or irregular scattered flecks, or greyish/brown network pattern; tongue black; **juveniles** with small whitish spots also at the back of the head, more distinct on nape region and tail; barred labial region more contrasting, tinge on head sides brighter and yellowish (7)

Similar species: None

Size/age at sexual maturity: At approx. 70-75% of SVL, ca. 35 cm SVL; between 2-4 years

Clutch size: 3-18 eggs per clutch with up to 5 clutches per breeding season and breaks of 5-12 weeks between single clutches

Incubation period/temperature: 180-320 days at 28-32 °C or 265-316 days at 27.5 ± 0.5 °C

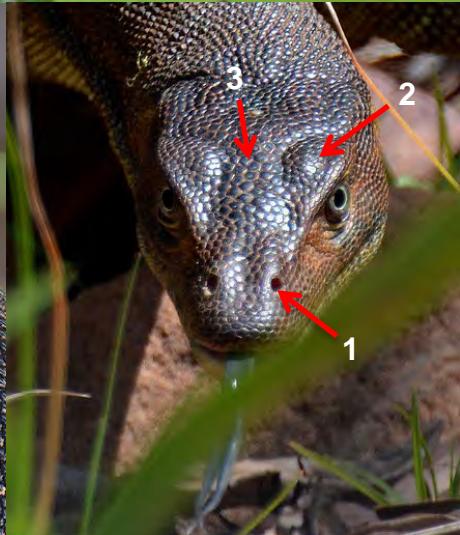
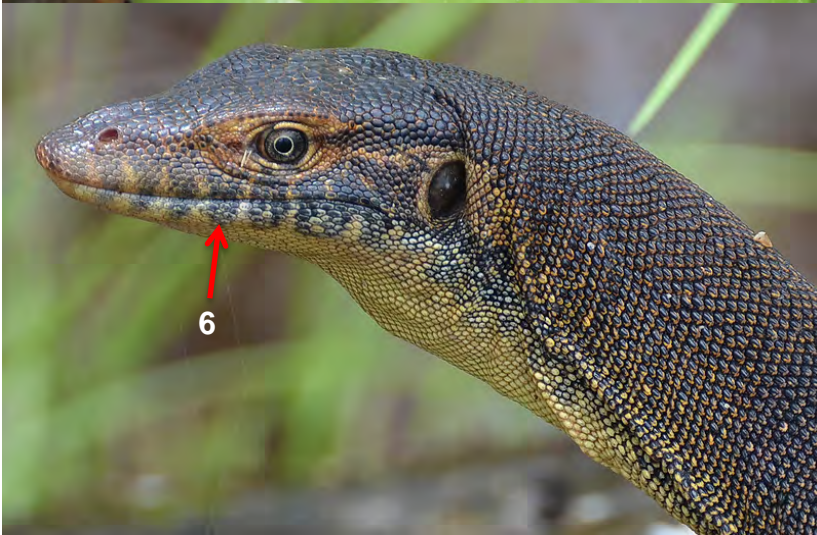
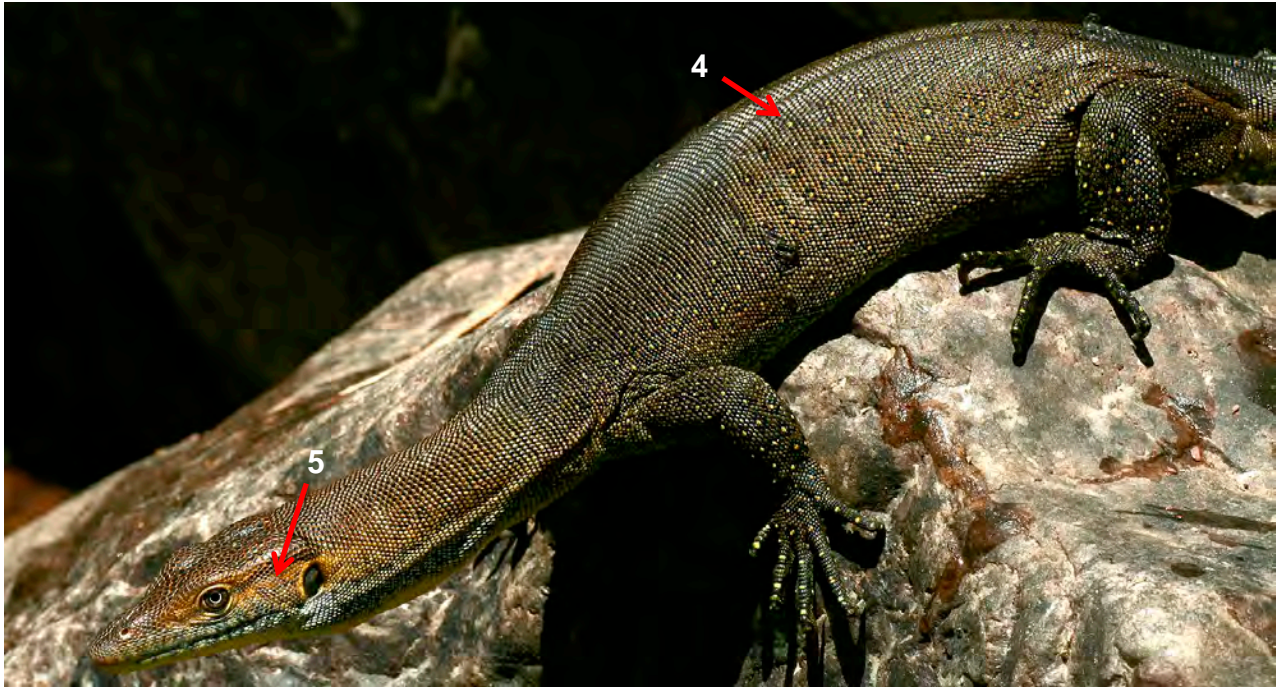
Size/weight of hatchlings: 26-32 cm TL; 11.6-13.1 cm SVL; 23.1-27.9 g

Growth rate: Hatching period of one clutch can last 85 days; 2 years after hatching SVL can increase threefold

Captive breeding: Repeatedly successfully bred in zoos and private sector.

Ecology: Diurnal (←); semiaquatic (←); associated with permanent water bodies; morphologically most well-adapted monitor species to an aquatic lifestyle (nostrils can be sealed during diving events); escapes into water; commonly sleeps in trees fringing water, into which they escape; also has been observed sleeping in water; preys on wide range of aquatic and terrestrial animals e.g., insects, crayfish, fish, amphibians, reptiles, birds and smaller mammals plus turtle eggs

Remarks: Under the EPBC Act (←) the export of live specimens for commercial purposes is prohibited; between 1981-2017 the export of approximately 232 specimens sourced C (←) was documented, with only two out of 51 shipments exported from Australia (CITES trade database); regional populations of *V. mertensi* have been severely decimated through the ingestion of toxins after preying on exotic cane toads (*Rhinella marina*).



Varanus mertensi. Above: adult, centre: juvenile, Lake Argyle, WA, © Ruchira Somaweera; below left: adult, near Florence Falls Litchfield National Park, NT; below right: adult, Douglas River, Tjuwaliyn/Douglas Hot Springs Park, NT, © Craig Nieminski

Varanus panoptes Storr, 1980

Subgenus: *Varanus*

English names: Yellow-spotted monitor, Argus monitor, Sand goanna, Flood-plains goanna

German name: Arguswaran

Local names: Minh thech, Nhengk yit (Cape York, Queensland), biawak coklat (Indonesia)

Synonyms: None; prior to its description, *V. panoptes* was scientifically treated as *V. gouldii*.

Subspecies: *Varanus p. panoptes* (northern Western Australia, Northern Territory, coastal and interior of Queensland), *Varanus panoptes horni* (southern New Guinea), *Varanus panoptes rubidus* (north-western and interior of Western Australia); *V. panoptes* is included in the *Varanus gouldii* species complex, the taxonomic status of all populations remains uncertain

International conservation status (CITES / Commission Reg. (EU) No 2017/160): Appendix II/B

IUCN Red List status: Least Concern (LC), population trend decreasing (last assessed 2017)

Distribution: Western Australia (WA), Northern Territory (NT), Queensland (Qld), Australia, Papua province, Indonesia; Papua New Guinea

Total length (TL): 160 cm (♂); **Snout-vent length (SVL):** 74 cm (♂)

Morphological traits (adults): Large robust species, up to 7 kg; muscular extremities; strong tail, at base almost roundish, distally strongly laterally compressed, triangular in cross-section (1), tail length ca. 1.4 times SVL; nostrils lateral, located closer to tip of snout than to eye (2); interorbital scales (↔) larger than supraoculars (↔); in *V. p. panoptes* number of midbody scales (↔) ranges between 192-242, in *V. panoptes rubidus* 176-223, and in *V. panoptes horni* 171-205

Colour pattern: Alternating transverse rows of larger/smaller spots on dorsum (↔) (3) and tail, and corresponding rows of spots on ventrum (↔); in *V. p. panoptes* ground colour of dorsum olive/dark brown/grey to reddish brown, with whitish/yellow black edged dots and curls in-between; usually entirely banded tail (but see 4); in *V. panoptes rubidus* ground colour of dorsum reddish brown (5) with alternating cross rows of dark brown to black-edged pale spots (6); reddish brown upper tail, tail-end yellowish without bands (7); in *V. panoptes horni*, dorsum brownish/olive to dark grey, and tail banded (spots aligned in rows); head sides with two dark streaks bordered by white/yellowish lines (applies to *V. panoptes* in general), temporal (↔) streak running across the eye to nostril (8), lower streak along upper lip (9); white line below ear opening that almost extends to level of front limb (10); chin pale or with few smaller spots; upper gular region (↔) with irregular dark spots or curls (11), while lower gular region and ventrum with dark spots that fade and merge with ground colour; curls and dark spots on body sides; limbs with small irregular yellowish spots (occasionally edged with darker scales); colour pattern in **juveniles** brighter and more distinct (12)

Similar species: *V. gouldii* is less robust, dorsum lacking larger blackish spots, tail tip usually lacks bands; number of midbody scales ranges between 132-242

Size/age at sexual maturity: At approximately 30-36 cm SVL; between 6.5-36 months

Clutch size: 7-16 eggs per clutch; in the wild up to 2 clutches per year, in captivity >3 clutches

Incubation period/temperature: 185-214 days at 27-29 °C or 270-356 days at 26-28 °C

Size/weight of hatchlings: 29-34.2 cm TL; 10.5-14.2 cm SVL; 27.8-32.2 g

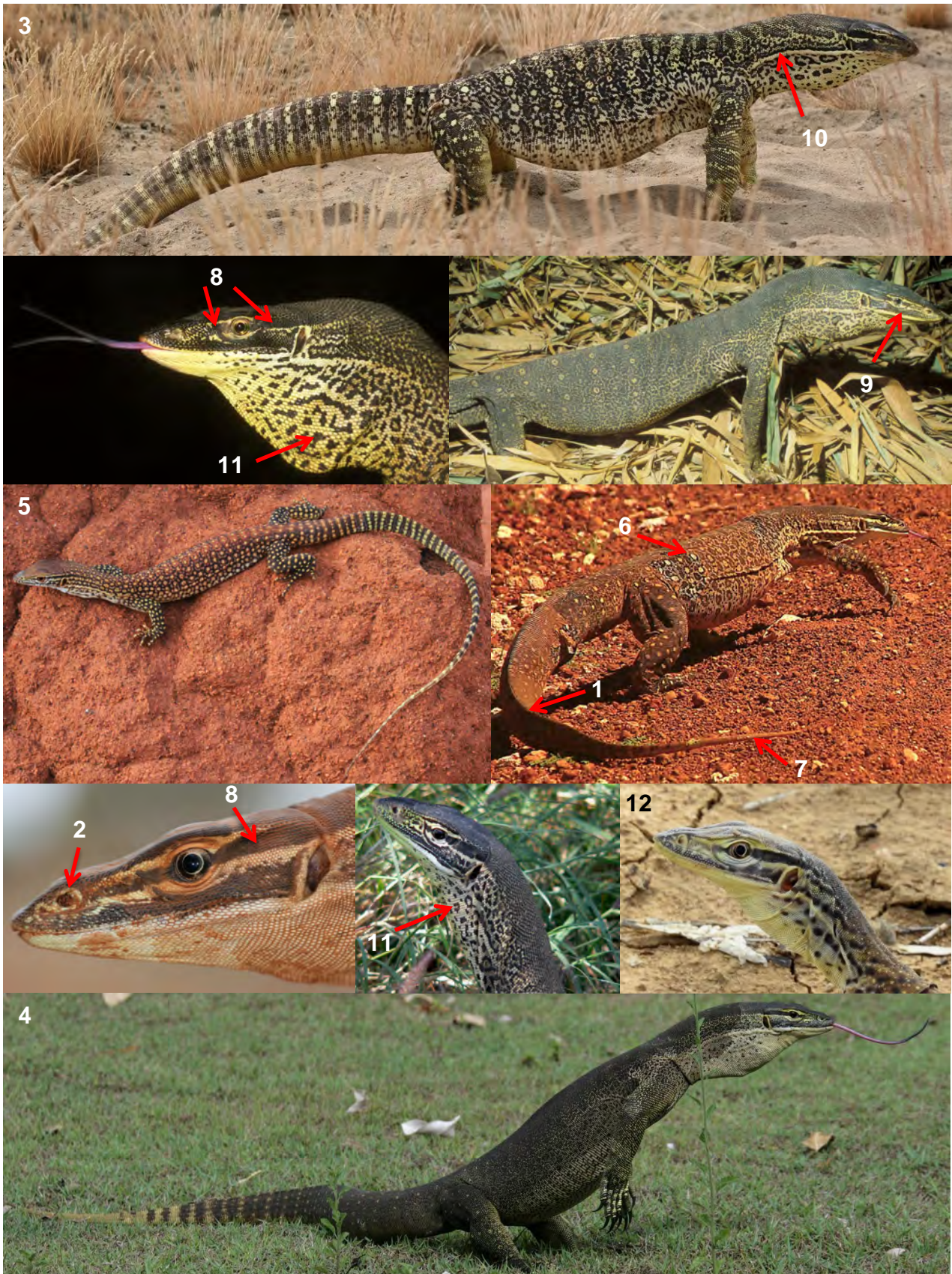
Growth rate: At about 6.5 months: ca. 17.5 cm SVL in ♀, and ca. 24 cm SVL in ♂

Captive breeding: *V. panoptes horni* is the internationally most commonly kept subspecies and has been bred frequently.

Specifics: Parthenogenesis (↔) has been reported.

Ecology: Diurnal (↔); terrestrial (↔); arboreal (↔) behaviour rather uncommon; various habitats are utilized, such as floodplains, woodlands, mangrove and riparian ecosystems (↔) next to urban areas; communal nesting behaviour; opportunistically feeds on invertebrates (↔) and vertebrates (↔) (including venomous snakes) and carrion

Remarks: Under the EPBC Act (↔) the export of live specimens for commercial purposes is prohibited; for international trade see *V. gouldii*; *V. panoptes* populations have experienced severe declines since the introduction of cane toads (*Rhinella marina*).



Varanus p. horni. Above: adult, captive specimen, © Bernd Eidenmüller; second row left and right: adult, Western Province, Papua New Guinea, © Mark O'Shea; ***Varanus p. rubidus***. Third row left: juvenile, Robertson Range, WA, © Ryan J. Ellis; third row right: adult, between Menzies and Lake Ballard, WA, © Maureen Pierre; fourth row left: adult, Lorna Glen Station, WA, © Ryan J. Ellis; ***Varanus p. panoptes***. Fourth row centre/right: adult/juvenile, Ilfracombe, Qld, © Rod Shannon; below: adult, near Gladstone, Queensland, © Bernd Eidenmüller

Varanus rosenbergi Mertens, 1957

Subgenus: *Varanus*

English names: Heath monitor, Rosenberg's monitor/goanna, Sydney Gould's monitor

German names: Buntwaran, Rosenbergs Waran

Local name: -

Synonyms: *Varanus gouldii rosenbergi* Mertens, 1957

Subspecies: None; but formerly *V. rosenbergi* was scientifically treated as a subspecies of *V. gouldii*.

International conservation status (CITES / Commission Reg. (EU) No 2017/160): Appendix II/B

IUCN Red List status: Least Concern (LC), population trend unknown (last assessed 2017)

Distribution: South Australia including Kangaroo Island, Western Australia (WA), Victoria, Australian Capital Territory, New South Wales (NSW), Australia

Total length (TL): 160 cm; **Snout-vent length (SVL):** 70 cm

Morphological traits (adults): Large species with long and slender tail; tail base roundish and distally laterally compressed, triangular in cross-section (1); tail length approximately 1.3 times SVL; nostrils laterally, roundish and located closer to the tip of the snout than to eye (2); supraoculars (↔) not enlarged; scales of interorbital region (↔) distinctly larger than surrounding head scales; number of midbody scales (↔) ranges between 165-209 (∅ 185)

Colour pattern: Varies between eastern and western populations; dorsum (↔) and tail with blackish transverse bands (also arranged in pairs) (3), those across nape chevron-like (4), those between fore and hind limbs number in about 12 (variably shaped, 5) and about 19-27 on tail; melanistic (↔) specimens are known, with blurred barely visible pattern (see below); in all age classes prominent back streak through eyes and across temporal region (6); gular region (↔) and ventrum (↔) with dark cross-bands, rows of spots or reticulations (black network with yellowish in-between) particularly distinct in gular region (7); upper head dark/blackish; labial region barred (8); **juveniles** with a tinge of orange on neck, limbs and distal (↔) half of tail (9); hatchlings vividly bright coloured with orange/red on head (10), throat sides and flanks with reddish spots; limbs with yellow spots; ground colour glossy blue/dark grey or blackish

Similar species: In *V. varius* the tail ends with distinctly broad bands; snout is banded; juveniles lack orange/red pigmentation

Size/age at sexual maturity: At approximately 50 cm (70-75% of adult) SVL; between 1.5-3 years

Clutch size: Usually 3-19 eggs per clutch; Kangaroo Island populations between 6-17 (usually >10) eggs per clutch; one clutch per year, but breaks of 1-2 years occur.

Incubation period/temperature: 227 days at 23-37.8 °C (termite mounds), or 190 days at 30 °C (Kangaroo Isl.); in captivity 180-210 days at 30.5 °C or 226-243 days at 29 °C

Size/weight of hatchlings: 21-25.4 cm TL; 9.6-11 cm SVL; 17-21 g

Growth rate: No data available

Captive breeding: Uncommon species in captivity and breeding records are scarce.

Ecology: Diurnal (↔), however nocturnal (↔) nesting behaviour is reported; terrestrial (↔); predominantly ♀ guard and defend their egg mounds; shelters in tree hollows, burrows, rock crevices; opportunistically preys on invertebrates (↔) and vertebrates (↔), and feeds on carrion

Remarks: Under the EPBC Act (↔) the export of live specimens for commercial purposes is prohibited; international trade refers exclusively to the period 1988-2008, with importing countries reporting shipments of 13 specimens, among these one commercial export was reported from Indonesia with three wild-sourced specimens sent to the United States (CITES trade database); it is the most well-studied Australian monitor species particularly regarding its breeding biology and ecological requirements; eastern population disjunct (↔); originally, *V. rosenbergi* was described as a melanistic subspecies of *V. gouldii* with overall black ground colour and few light spots from Stirling Range (WA).



Varanus rosenbergi. Above left and right, second row right: adult, Fitzgerald River National Park, WA, © Ryan J. Ellis; second and third row left: juvenile, Stirling Range, WA, © Gary Stephenson; third row right: hatchling, Sydney, NSW, © Ruchira Somaweera; below: juvenile, Fitzgerald River National Park, WA, © Ryan J. Ellis

Varanus spenceri Lucas & Frost, 1903

Subgenus: *Varanus*

English names: Spencer's monitor/goanna, Plains goanna

German name: Spencers Waran

Local name: -

Synonyms: None

Subspecies: None

International conservation status (CITES / Commission Reg. (EU) No 2017/160): Appendix II/B

IUCN Red List status: Least Concern (LC), population trend stable (last assessed 2017)

Distribution: Northern Territory (NT), Queensland (Qld), Australia

Total length (TL): 125 cm; **Snout-vent length (SVL):** 55 cm

Morphological traits (adults): Large species, up to 6 kg; distinct sexual dimorphism (♂ with almost twice the size of ♀); slender muscular extremities; tail base dorsoventrally (1) compressed (2), distally (3) laterally compressed, triangular in cross-section (4); tail is short and double-crested (5); tail length approximately <1.2 times SVL; nostrils lateral and oval, located closer to tip of snout than to eye (6); snout blunt, short and bulged (7); supraoculars (8) not enlarged, interorbital area (9) with distinctly larger scales than surrounding head scales; the number of midbody scales (10) ranges between 150-175

Colour pattern: Ground colour of dorsum (1) yellowish/brown/greyish with broad dark transverse bands, that either lie close to each other or run further apart from each other, and run evenly across the middle of dorsum (2), or are broken across the middle of dorsum and run offset on the other side (3); chevron-like cross stripes on nape region (4); tail with irregular light and dark bands; neck sides spotted or with ocelli (5) (6); chin, gular region (7) and ventrum (8) pale with irregular dense spots, more pronounced on gular region (9); head more dark, in some specimens snout area is whitish; labial region (10) shows triangular bars (11); white ring around eyes; **juveniles** with more vivid colour pattern of yellowish/pinkish bands across a dark glossy dorsum; yellow and black striped neck sides rich in contrast

Similar species: None

Size/age at sexual maturity: At approx. 70-75% of adult SVL (around 36 cm SVL); between 1.5-3 years

Clutch size: 4-31 eggs per clutch; in the wild 1-2 clutches per year, in captivity ≥3 clutches per year

Incubation period/temperature: 123-140 days at 29-30 °C

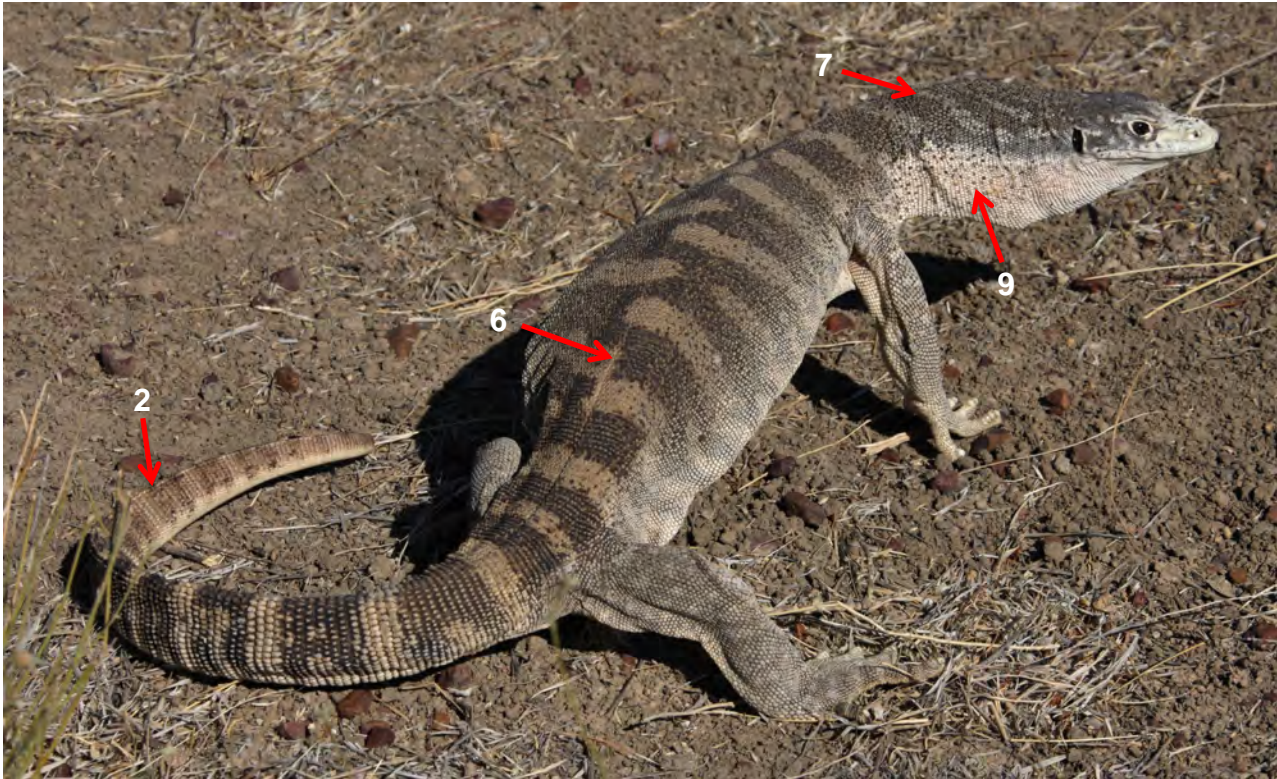
Size/weight of hatchlings: 22 cm TL; 12.4-13 cm SVL; weight unknown

Growth rate: Size of juveniles can double within 6 weeks.

Captive breeding: The species is rarely kept in zoos or by private owners.

Ecology: Diurnal (1), some observations indicate nocturnal (2) activities; terrestrial (3); associated with black soil/clay plains in semi-arid to arid ecosystems commonly without trees; seeks shelter in burrows or fissures in the clay; opportunistically feeds on a wide range of invertebrates and vertebrates including venomous snakes

Remarks: Under the EPBC Act (1) the export of live specimens of *V. spenceri* for commercial purposes is prohibited; exports are reported between 2001-2016, with shipments of 20 specimens sourced C (2) (CITES trade database); *V. spenceri* is considered one of the least known Australian monitor species; field studies are long overdue to improve our understanding of the species' biological and ecological traits.



Varanus spenceri. Above: adult, Barkly Tableland, NT, Australia, © Bernd Eidenmüller; centre & below: adult, 50 km north of Ilfracombe, Qld, Australia, © Rod Shannon

Varanus varius (Shaw, 1790)

Subgenus: *Varanus*

English names: Lace monitor/goanna, Tree goanna

German name: Buntwaran

Local name: -

Synonyms: None

Subspecies: None

International conservation status (CITES / Commission Reg. (EU) No 2017/160): Appendix II/B

IUCN Red List status: Least Concern (LC), population trend stable (last assessed 2017)

Distribution: Victoria, South Australia (SA), Queensland (Qld), New South Wales (NSW), Australia

Total length (TL): 200 cm; **Snout-vent length (SVL):** 77 cm

Morphological traits (adults): Large species, up to 14 kg; muscular extremities; strong tail, tail length 1.5-1.7 times SVL, round at its base, then triangular in cross-section (1), with a low dorsal double-crest (←); hind limbs long, digits long with prominent curved claws; nostrils lateral, roundish and located closer to tip of snout than to eye (2); supraoculars (←) not enlarged; number of mid-body scales (←) ranges between 177-227

Colour pattern: Variable colour pattern across the species' range; ground colour of entire body grey/blackish with bluish tinge; transverse bands of yellowish/whitish/cream larger (3) and smaller flecks (4) on dorsum (←) and anterior (←) third of tail with distinct yellowish mottling in-between (5); also cross-bands of single spots on anterior part of tail from tail base can merge to bands; distal (←) half of tail with wide yellowish/dark bands (6); limbs with transverse rows of yellowish dots; gular region (←) brightly coloured, occasionally with a tinge of blue; pale ventrum (←) with paired cross-bars or flecks similar to ocelli (←); snout with light and dark bands (7), that can fade in older individuals (8); blackish temporal streak (9); the "Bell's" colour phase refers to individuals with wide bands of cream/yellow and greyish/black from nape region to tail (10); **juveniles** with a more contrasting colour pattern; cross bands of larger spots more distinctly alternate with bands of smaller dots on dorsum and anterior third of tail from tail base (11), those on nape show arch-shaped diffuse bands (12).

Similar species: In *V. rosenbergi* the tail end is uniformly banded or blackish; ventrum and gular region with either dark cross bands or network pattern; juveniles with orange/red pigmentation

Size/age at sexual maturity: ♀ at ca. 38.5 cm SVL; ♂ at ca. 41.5 cm SVL, in about 50 months

Clutch size: 3-15 eggs per clutch; up to 2-3 clutches/breeding season with 39-80 days in-between

Incubation period/temperature: 290 days in the wild, eggs overwinter in termite mounds; in captivity between 70-317 days or 153-295 days at 29-30 °C

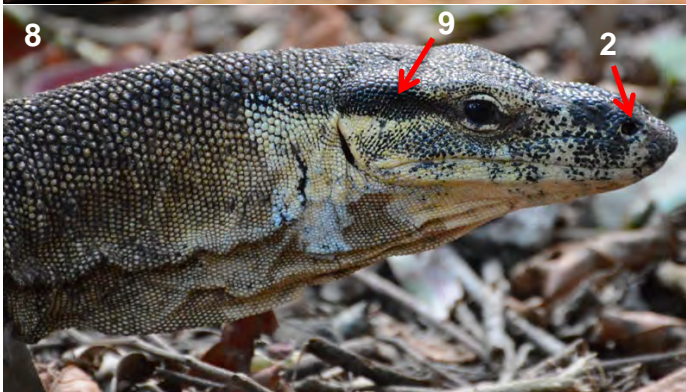
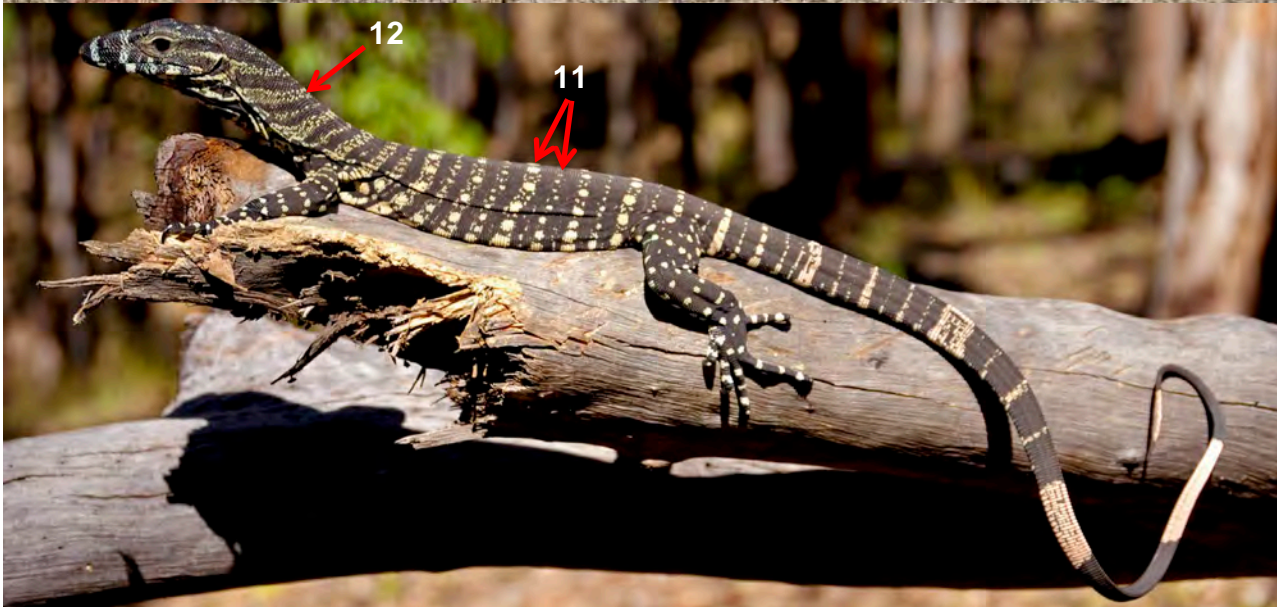
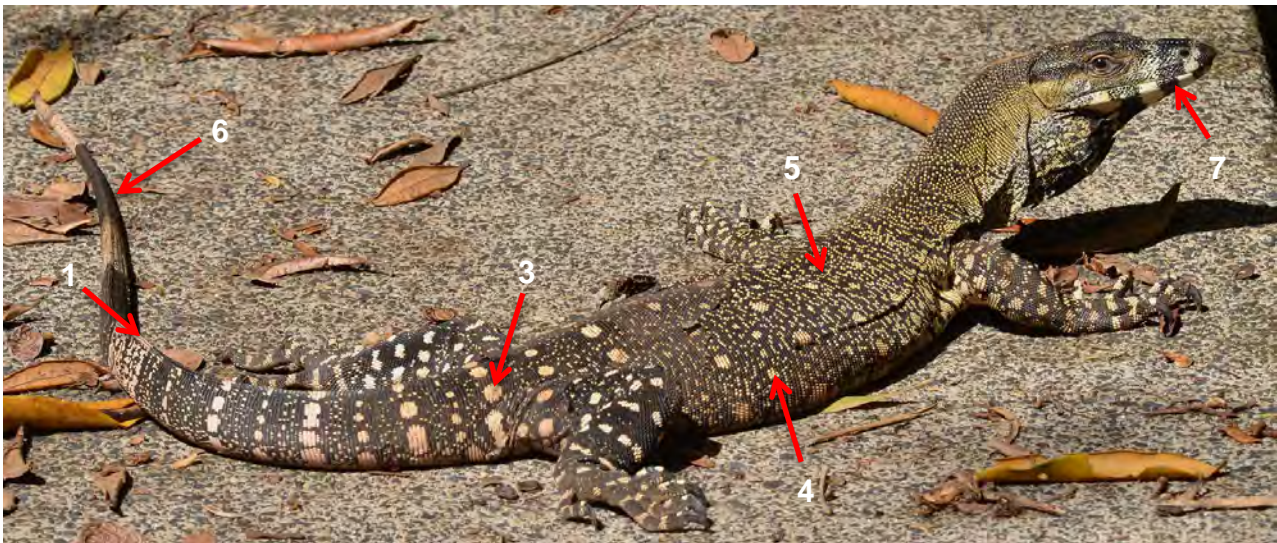
Size/weight of hatchlings: 26-37 cm TL; 10.3-21 cm SVL; 16-25 g

Growth rate: At 10 months 30 cm SVL and >300 g

Captive breeding: More or less common in captive collections

Ecology: Diurnal (←), arboreal (←), but terrestrial (←) when searching for prey; inhabits lowland forests or forest strips with waterways in more arid ecosystems; density appears to correlate with the number of termite mounds; ♀ guard nests in termite mounds on the ground or in trees; in the hatching period, ♀ dig mounds up to release hatchlings; opportunistic feeding behaviour with a range of invertebrates and vertebrates and their eggs including carrion

Remarks: Under the EPBC Act (←) the export of live specimens for commercial purposes is prohibited; however, between 1977-2017, 65 live specimens, mainly sourced C (←), were commercially exported (CITES trade database); the "Bell's" colour phase is known from populations west of the Great Dividing Range, east to northern NSW, and south to central and southern Queensland.



Varanus varius. Above: adult, Kuranda, Qld, Australia, © Mike McKoy; centre: juvenile, Lower Beechmont, Qld, Australia, © Gary Stephenson; below left: adult, Ravensbourne National Park, Qld, Australia, © Craig Nieminski; below right: adult couple, Bell's phase, Sydney, NSW, Australia, © Ruchira Somaweera

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IUCN: www.iucn.org

IUCN Red List: www.iucnredlist.org

IUCN Monitor Lizard Specialist Group: <http://varanus.org/>

Reptile Database: <http://www.reptile-database.org>

Species+: <https://speciesplus.net/species>

Annex 1:

The following text about the IUCN Red List categories was taken from the IUCN Red List homepage available at www.iucnredlist.org.

IUCN RED LIST

The IUCN Red List is the world's most comprehensive information source on the global conservation status and extinction risk of animal, plant and fungi species, and thus serves to critically assess the health status of the global biodiversity. A full assessment includes information on a species' range, population size, habitat and ecology, use and/or trade, as well as threats, and provides recommendations for conservation measures if a species has been assessed threatened.

Overall the global biodiversity is declining and a huge number of species previously not threatened now show decreasing global or regional populations. Among all 10,793 currently recognized reptile species (Status: July 2018), almost 70% have been assessed in the IUCN Red List. Among these, 24% have been assessed as Near Threatened or in one of the three threat categories (see below). Species that are assessed are categorized in one of the following nine defined categories according to certain criteria (www.iucnredlist.org/resources/redlistguidelines) which reflect the current conservation status of a species:

EXTINCT (EX)

A taxon (☞) is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycles and life form.

EXTINCT IN THE WILD (EW)

A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past distribution range. A taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.

CRITICALLY ENDANGERED (CR)

A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered, and it is therefore considered to be facing an extremely high risk of extinction in the wild.

ENDANGERED (EN)

A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered, and it is therefore considered to be facing a very high risk of extinction in the wild.

VULNERABLE (VU)

A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable, and it is therefore considered to be facing a high risk of extinction in the wild.

NEAR THREATENED (NT)

A taxon is Near Threatened when it has been evaluated against the criteria, but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.

LEAST CONCERN (LC)

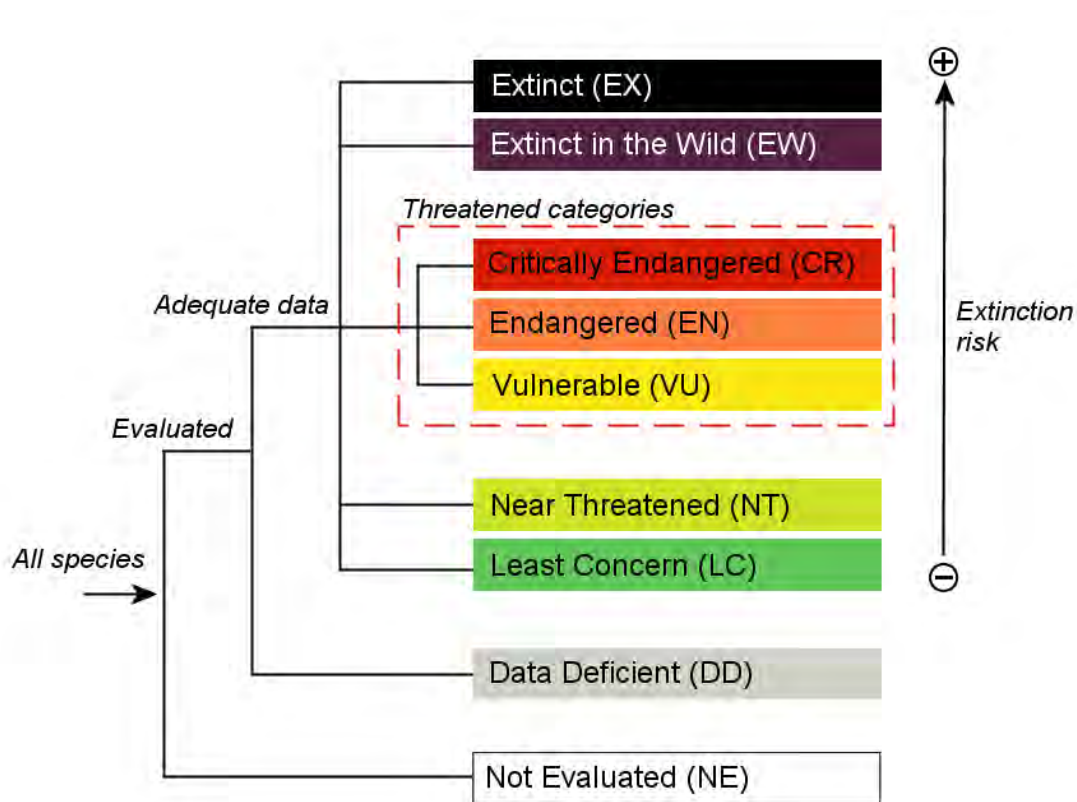
A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.

DATA DEFICIENT (DD)

A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, if a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified.

NOT EVALUATED (NE)

A taxon is Not Evaluated when it has not yet been evaluated against the criteria.



Structure of the IUCN Red List Categories. Source: http://nc.iucnredlist.org/redlist/content/attachment_files/RedListGuidelines.pdf.

Annex 2:

The following text about the purpose of the CITES trade convention and the three CITES Appendices was taken from the CITES homepage available at www.cites.org.

CITES

CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival.

The wildlife trade is diverse. In the case of monitor lizards international trade ranges from live animals to various body parts of monitor lizards, such as their skins destined for the international fashion industries, claws and feet used as key pendants, the collection of male genitals (called “hatha jodi”) falsely declared as a plant root and used as a talisman, and fat bodies used to treat several illnesses.

The levels of harvest and trade in some animal and plant species is high and raises concerns with regard to sustainability. Together with other (potential) threats, such as the loss and fragmentation of habitat, pollution and climate change, international trade can heavily deplete or bring species and populations even close to extinction.

Because the trade in wild animals and plants crosses borders between countries, the effort to regulate it requires international cooperation to safeguard certain species from over-exploitation. Today, CITES accords varying degrees of protection to more than 35,000 species of animals and plants.

CITES is an international agreement to which States (countries) adhere voluntarily. States that have agreed to be bound by the Convention (“joined” CITES) are known as Parties. Although CITES is legally binding on the Parties – in other words they have to implement the Convention – it does not take the place of national laws. Rather it provides a framework to be respected by each Party, which has to adopt its own domestic legislation to ensure that CITES is implemented at the national level.

How does CITES work?

CITES works by subjecting international trade in specimens of selected species to certain controls. All import, export, re-export and introduction from the sea of species covered by CITES has to be authorized through a licensing system. Every member State of CITES must designate one or more Management Authorities to administer the licensing system and one or more Scientific Authorities to advise them on the impact trade may have on the status of species.

The species covered by CITES are listed in three Appendices, according to the degree of protection they need.

Appendices I and II:

- Appendix I includes species threatened with extinction. Trade in specimens of these species is permitted only in exceptional circumstances.
- Appendix II includes species not necessarily threatened with extinction, but in which trade must be controlled in order to avoid utilization incompatible with their survival.

Since 1975 all monitor lizard species of the family “Varanidae” are listed in the appendices of CITES, of which five species are listed in CITES Appendix I (*Varanus bengalensis*, *V. flavescens*, *V. griseus*, *V. komodoensis*, and *V. nebulosus*) and the remaining 76 species in Appendix II. The Conference of the Parties (CoP), which is the supreme decision-making body of the Convention and comprises all its member States, has agreed in Resolution Conf. 9.24 (Rev. CoP13) on a set of biological and trade criteria to help determine whether a species should be included in Appendices I or II. At each regular meeting of the CoP, Parties submit proposals based on those criteria to amend these two Appendices. Those amendment proposals are discussed and then submitted to a vote. The Convention also allows for amendments by a postal procedure between meetings of the CoP (see Article XV, paragraph 2, of the Convention), but this procedure is rarely used.

Appendix III

Appendix III contains species that are protected in at least one country, which has asked other CITES Parties for assistance in controlling the trade. Changes to Appendix III follow a distinct procedure from changes to Appendices I and II, as each Party is entitled to make unilateral amendments to it. A specimen of a CITES-listed species may be imported into or exported (or re-exported) from a State party to the Convention only if the appropriate document has been obtained and presented for clearance at the port of entry or exit. There is some variation of the requirements from one country to another and it is always necessary to check on the national laws which may be stricter.

Annex 3: List of Country Records per Monitor Lizard Species

Below, for all monitor lizard species the known country records are listed. The monitor lizard species are sorted alphabetically according to the respective subgenus, which are also dealt with in alphabetical order. For each species, the known countries from the respective distribution range are likewise listed alphabetically. Doubtful or unconfirmed country records are marked with a "?" after the country name.

Subgenus	Species	Distribution (countries in alphabetical order)
Empagusia	<i>Varanus bengalensis</i>	Bangladesh, Bhutan, India, Iran, Myanmar, Nepal, Pakistan, Sri Lanka
	<i>Varanus dumerilii</i>	Indonesia, Malaysia, Myanmar, Thailand
	<i>Varanus flavescens</i>	Bangladesh, India, Nepal, Pakistan
	<i>Varanus nebulosus</i>	Cambodia, China, Indonesia, Laos, Malaysia, Myanmar, Thailand, Vietnam
	<i>Varanus rudicollis</i>	Indonesia, Malaysia, Myanmar, Thailand
Euprepiosaurus	<i>Varanus caerulivirens</i>	Indonesia
	<i>Varanus cerambonensis</i>	Indonesia
	<i>Varanus doreanus</i>	Australia, Indonesia, Papua New Guinea
	<i>Varanus douarrha</i>	Papua New Guinea
	<i>Varanus finschi</i>	Papua New Guinea
	<i>Varanus indicus</i>	Australia, Indonesia, Micronesia, [Pacific Territories of the USA and Japan], Palau, Papua New Guinea, Solomon Islands
	<i>Varanus jobiensis</i>	Indonesia, Papua New Guinea
	<i>Varanus juxtindicus</i>	Solomon Islands
	<i>Varanus lirungensis</i>	Indonesia
	<i>Varanus melinus</i>	Indonesia
	<i>Varanus obor</i>	Indonesia
	<i>Varanus rainerguentheri</i>	Indonesia
	<i>Varanus semotus</i>	Papua New Guinea
	<i>Varanus yuwonoi</i>	Indonesia
	<i>Varanus zugorum</i>	Indonesia
Hapturosaurus	<i>Varanus beccarii</i>	Indonesia
	<i>Varanus boehmei</i>	Indonesia
	<i>Varanus bogerti</i>	Papua New Guinea
	<i>Varanus keithhornei</i>	Australia
	<i>Varanus kordensis</i>	Indonesia
	<i>Varanus macraei</i>	Indonesia
	<i>Varanus prasinus</i>	Australia, Indonesia, Papua New Guinea
	<i>Varanus reisingeri</i>	Indonesia
	<i>Varanus telenesetes</i>	Papua New Guinea
Odatria	<i>Varanus acanthurus</i>	Australia
	<i>Varanus auffenbergi</i>	Indonesia
	<i>Varanus baritji</i>	Australia

	<i>Varanus brevicauda</i>	Australia
	<i>Varanus bushi</i>	Australia
	<i>Varanus caudolineatus</i>	Australia
	<i>Varanus eremius</i>	Australia
	<i>Varanus gilleni</i>	Australia
	<i>Varanus glauerti</i>	Australia
	<i>Varanus glebopalma</i>	Australia
	<i>Varanus hamersleyensis</i>	Australia
	<i>Varanus kingorum</i>	Australia
	<i>Varanus mitchelli</i>	Australia
	<i>Varanus pilbarensis</i>	Australia
	<i>Varanus primordius</i>	Australia
	<i>Varanus scalaris</i>	Australia
	<i>Varanus semiremex</i>	Australia
	<i>Varanus similis</i>	Australia, Indonesia, Papua New Guinea
	<i>Varanus sparnus</i>	Australia
	<i>Varanus storri</i>	Australia
	<i>Varanus timorensis</i>	East Timor (Timor Leste), Indonesia
	<i>Varanus tristis</i>	Australia
Papusauros	<i>Varanus salvadorii</i>	Indonesia, Papua New Guinea
Philippinosaurus	<i>Varanus bitatawa</i>	Philippines
	<i>Varanus mabitang</i>	Philippines
	<i>Varanus olivaceus</i>	Philippines
Polydaedalus	<i>Varanus albigularis</i>	Angola, Botswana, Congo?, Democratic Republic of the Congo, Eswatini (formerly Swaziland), Ethiopia, Kenya, Lesotho?, Malawi, Mozambique, Namibia, Somalia, South Africa, Tanzania, Uganda, Zambia, Zimbabwe
	<i>Varanus exanthematicus</i>	Benin, Burkina Faso, Cameroon, Central African Republic (CAR), Chad, Democratic Republic of the Congo, Republic of the Cote d'Ivoire, Equatorial Guinea, Eritrea, Ethiopia, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, South Sudan, Sudan, Togo, Uganda
	<i>Varanus niloticus</i>	Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Congo?, Democratic Republic of the Congo, Republic of the Cote d'Ivoire, Djibouti?, Egypt, Equatorial Guinea?, Eritrea, Eswatini (formerly Swaziland), Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Malawi, Mali, Mauritania, Mozambique, Namibia, Niger, Nigeria, Rwanda?, Senegal, Sierra Leone, Somalia, South Africa, South Sudan?, Sudan, Tanzania, Togo, Uganda, Zambia, Zimbabwe

	<i>Varanus ornatus</i>	Benin, Cameroon, Central African Republic, Congo?, Democratic Republic of the Congo, Gabon, Equatorial Guinea, Guinea, Guinea-Bissau, Liberia, Nigeria, Republic of Cote d'Ivoire, Rwanda?, Sierra Leone, Tanzania?, Togo
	<i>Varanus yemenensis</i>	Saudi Arabia, Yemen
Psammosaurus	<i>Varanus griseus</i>	Afghanistan, Algeria, Egypt, India, Israel, Iran, Iraq, Jordan, Kazakhstan, Kuwait, Lebanon, Libya, Morocco, Oman, Pakistan, Qatar, Saudi Arabia, Sudan, Syria, Tajikistan, Tunisia, Turkmenistan, United Arab Emirates, Uzbekistan, Yemen
	<i>Varanus nesterovi</i>	Iran, Iraq
Solomonsaurus	<i>Varanus spinulosus</i>	Papua New Guinea, Solomon Islands
Soterosaurus	<i>Varanus bangonorum</i>	Philippines
	<i>Varanus cumingi</i>	Philippines
	<i>Varanus dalubhasa</i>	Philippines
	<i>Varanus marmoratus</i>	Philippines
	<i>Varanus nuchalis</i>	Philippines
	<i>Varanus palawanensis</i>	Philippines
	<i>Varanus rasmusseni</i>	Philippines
	<i>Varanus salvator</i>	Bangladesh, Cambodia, China, India, Indonesia, Laos, Malaysia, Myanmar, Singapore, Sri Lanka, Thailand, Vietnam
	<i>Varanus samarensis</i>	Philippines
	<i>Varanus togianus</i>	Indonesia
Varanus	<i>Varanus giganteus</i>	Australia
	<i>Varanus gouldii</i>	Australia
	<i>Varanus komodoensis</i>	Indonesia
	<i>Varanus mertensi</i>	Australia
	<i>Varanus panoptes</i>	Australia, Indonesia, Papua New Guinea
	<i>Varanus rosenbergi</i>	Australia
	<i>Varanus spenceri</i>	Australia
	<i>Varanus varius</i>	Australia

Annex 4: List of Species Records per Country

In the following, for all countries within the distribution range of the family Varanidae the known records of all monitor lizard species are listed. The countries are sorted alphabetically according to the respective continent. For each country, the known monitor species are also listed alphabetically. Doubtful or unconfirmed country records are marked with a "?" after the scientific species name.

COUNTRIES	SPECIES PER COUNTRY
Africa	
Algeria	<i>Varanus griseus</i>
Angola	<i>Varanus albigularis</i> , <i>Varanus niloticus</i>
Benin	<i>Varanus exanthematicus</i> , <i>Varanus niloticus</i> , <i>Varanus ornatus</i>
Botswana	<i>Varanus albigularis</i> , <i>Varanus niloticus</i>
Burkina Faso	<i>Varanus exanthematicus</i> , <i>Varanus niloticus</i>
Burundi	<i>Varanus niloticus</i>
Cameroon	<i>Varanus exanthematicus</i> , <i>Varanus niloticus</i> , <i>Varanus ornatus</i>
Central African Republic	<i>Varanus exanthematicus</i> , <i>Varanus niloticus</i> , <i>Varanus ornatus</i>
Chad	<i>Varanus exanthematicus</i> , <i>Varanus niloticus</i>
Congo	<i>Varanus albigularis</i> ?, <i>Varanus niloticus</i> ?, <i>Varanus ornatus</i> ?
Republic of the Cote d'Ivoire,	<i>Varanus exanthematicus</i> , <i>Varanus niloticus</i> , <i>Varanus ornatus</i>
Democratic Republic of the Congo	<i>Varanus albigularis</i> , <i>Varanus exanthematicus</i> , <i>Varanus niloticus</i> , <i>Varanus ornatus</i>
Djibouti	<i>Varanus niloticus</i> ?
Egypt	<i>Varanus griseus</i> , <i>Varanus niloticus</i>
Equatorial Guinea	<i>Varanus exanthematicus</i> , <i>Varanus niloticus</i> ?, <i>Varanus ornatus</i>
Eritrea	<i>Varanus exanthematicus</i> , <i>Varanus niloticus</i>
Eswatini (formerly Swaziland)	<i>Varanus albigularis</i> , <i>Varanus niloticus</i>
Ethiopia	<i>Varanus albigularis</i> , <i>Varanus exanthematicus</i> , <i>Varanus niloticus</i>
Gabon	<i>Varanus niloticus</i> , <i>Varanus ornatus</i>
Gambia	<i>Varanus exanthematicus</i> , <i>Varanus niloticus</i>
Ghana	<i>Varanus exanthematicus</i> , <i>Varanus niloticus</i>
Guinea	<i>Varanus exanthematicus</i> , <i>Varanus niloticus</i> , <i>Varanus ornatus</i>
Guinea-Bissau	<i>Varanus exanthematicus</i> , <i>Varanus niloticus</i> , <i>Varanus ornatus</i>
Kenya	<i>Varanus albigularis</i> , <i>Varanus exanthematicus</i> , <i>Varanus niloticus</i>
Lesotho	<i>Varanus albigularis</i> ?, <i>Varanus niloticus</i>
Liberia	<i>Varanus exanthematicus</i> , <i>Varanus niloticus</i> , <i>Varanus ornatus</i>
Libya	<i>Varanus griseus</i>
Malawi	<i>Varanus albigularis</i> , <i>Varanus niloticus</i>
Mali	<i>Varanus exanthematicus</i> , <i>Varanus niloticus</i>
Mauretania	<i>Varanus exanthematicus</i> , <i>Varanus niloticus</i>
Morocco	<i>Varanus griseus</i>
Mozambique	<i>Varanus albigularis</i> , <i>Varanus niloticus</i>
Namibia	<i>Varanus albigularis</i> , <i>Varanus niloticus</i>
Niger	<i>Varanus exanthematicus</i> , <i>Varanus niloticus</i>
Nigeria	<i>Varanus exanthematicus</i> , <i>Varanus niloticus</i> , <i>Varanus ornatus</i>

Rwanda	<i>Varanus niloticus</i> ?, <i>Varanus ornatus</i> ?
Senegal	<i>Varanus exanthematicus</i> , <i>Varanus niloticus</i>
Sierra Leone	<i>Varanus exanthematicus</i> , <i>Varanus niloticus</i> , <i>Varanus ornatus</i>
Solomon Islands	<i>Varanus indicus</i> , <i>Varanus juxtindicus</i> , <i>Varanus spinulosus</i>
Somalia	<i>Varanus albigularis</i> , <i>Varanus niloticus</i>
South Africa	<i>Varanus albigularis</i> , <i>Varanus niloticus</i>
South Sudan	<i>Varanus exanthematicus</i> , <i>Varanus niloticus</i> ?
Sudan	<i>Varanus exanthematicus</i> , <i>Varanus griseus</i> , <i>Varanus niloticus</i>
Tanzania	<i>Varanus albigularis</i> , <i>Varanus niloticus</i> , <i>Varanus ornatus</i> ?
Togo	<i>Varanus exanthematicus</i> , <i>Varanus niloticus</i> , <i>Varanus ornatus</i>
Tunisia	<i>Varanus griseus</i>
Uganda	<i>Varanus albigularis</i> , <i>Varanus exanthematicus</i> , <i>Varanus niloticus</i>
Zambia	<i>Varanus albigularis</i> , <i>Varanus niloticus</i>
Zimbabwe	<i>Varanus albigularis</i> , <i>Varanus niloticus</i>
Middle eastern countries	
Israel	<i>Varanus griseus</i>
Iran	<i>Varanus bengalensis</i> , <i>Varanus nesterovi</i>
Iraq	<i>Varanus griseus</i> , <i>Varanus nesterovi</i>
Jordan	<i>Varanus griseus</i>
Kuwait	<i>Varanus griseus</i>
Lebanon	<i>Varanus griseus</i>
Oman	<i>Varanus griseus</i>
Qatar	<i>Varanus griseus</i>
Saudi Arabia	<i>Varanus griseus</i> , <i>Varanus yemenensis</i>
Syria	<i>Varanus griseus</i>
United Arab Emirates	<i>Varanus griseus</i>
Yemen	<i>Varanus griseus</i> , <i>Varanus yemenensis</i>
Central Asia	
Afghanistan	<i>Varanus griseus</i>
Kazakhstan	<i>Varanus griseus</i>
Tajikistan	<i>Varanus griseus</i>
Turkmenistan	<i>Varanus griseus</i>
Uzbekistan	<i>Varanus griseus</i>
South Asia	
Bangladesh	<i>Varanus bengalensis</i> , <i>Varanus flavescens</i> , <i>Varanus salvator</i>
Bhutan	<i>Varanus bengalensis</i>
India	<i>Varanus bengalensis</i> , <i>Varanus flavescens</i> , <i>Varanus griseus</i> , <i>Varanus salvator</i>
Nepal	<i>Varanus bengalensis</i> , <i>Varanus flavescens</i>
Pakistan	<i>Varanus bengalensis</i> , <i>Varanus flavescens</i> , <i>Varanus griseus</i>
Sri Lanka	<i>Varanus bengalensis</i> , <i>Varanus salvator</i>
Southeast Asia	
Cambodia	<i>Varanus nebulosus</i> , <i>Varanus salvator</i>
China	<i>Varanus nebulosus</i> , <i>Varanus salvator</i>

East Timor (Timor Leste)	<i>Varanus timorensis</i>
Indonesia	<i>Varanus auffmanbergi</i> , <i>Varanus beccarii</i> , <i>Varanus boehmei</i> , <i>Varanus caerulivirens</i> , <i>Varanus cerambonensis</i> , <i>Varanus doreanus</i> , <i>Varanus dumerilii</i> , <i>Varanus indicus</i> , <i>Varanus komodoensis</i> , <i>Varanus kordensis</i> , <i>Varanus lirungensis</i> , <i>Varanus macraei</i> , <i>Varanus melinus</i> , <i>Varanus nebulosus</i> , <i>Varanus obor</i> , <i>Varanus prasinus</i> , <i>Varanus rainerguentheri</i> , <i>Varanus reisingeri</i> , <i>Varanus rudicollis</i> , <i>Varanus salvator</i> , <i>Varanus timorensis</i> , <i>Varanus togianus</i> , <i>Varanus yuwonoi</i> , <i>Varanus zugorum</i>
Laos	<i>Varanus nebulosus</i> , <i>Varanus salvator</i>
Malaysia	<i>Varanus dumerilii</i> , <i>Varanus nebulosus</i> , <i>Varanus rudicollis</i> , <i>Varanus salvator</i>
Myanmar	<i>Varanus bengalensis</i> , <i>Varanus dumerilii</i> , <i>Varanus nebulosus</i> , <i>Varanus rudicollis</i> , <i>Varanus salvator</i>
Philippines	<i>Varanus bangonorum</i> , <i>Varanus bitatawa</i> , <i>Varanus cumingi</i> , <i>Varanus dalubhasa</i> , <i>Varanus mabitang</i> , <i>Varanus marmoratus</i> , <i>Varanus nuchalis</i> , <i>Varanus olivaceus</i> , <i>Varanus palawanensis</i> , <i>Varanus rasmusseni</i> , <i>Varanus samarensis</i>
Singapore	<i>Varanus salvator</i>
Thailand	<i>Varanus dumerilii</i> , <i>Varanus nebulosus</i> , <i>Varanus rudicollis</i> , <i>Varanus salvator</i>
Vietnam	<i>Varanus nebulosus</i> , <i>Varanus salvator</i>
New Guinea (Indonesia & Papua New Guinea), Australia & Pacific Islands	
Australia	<i>Varanus acanthurus</i> , <i>Varanus baritji</i> , <i>Varanus brevicauda</i> , <i>Varanus bushi</i> , <i>Varanus caudolineatus</i> , <i>Varanus eremius</i> , <i>Varanus giganteus</i> , <i>Varanus gilleni</i> , <i>Varanus glauerti</i> , <i>Varanus glebopalma</i> , <i>Varanus gouldii</i> , <i>Varanus hamersleyensis</i> , <i>Varanus indicus</i> , <i>Varanus keithhornei</i> , <i>Varanus kingorum</i> , <i>Varanus mertensi</i> , <i>Varanus mitchelli</i> , <i>Varanus panoptes</i> , <i>Varanus pilbarensis</i> , <i>Varanus prasinus</i> , <i>Varanus primordius</i> , <i>Varanus rosenbergi</i> , <i>Varanus scalaris</i> , <i>Varanus semiremex</i> , <i>Varanus similis</i> , <i>Varanus sparnus</i> , <i>Varanus spenceri</i> , <i>Varanus storri</i> , <i>Varanus tristis</i> , <i>Varanus varius</i>
New Guinea (Indonesia & Papua New Guinea)	<i>Varanus indicus</i> , <i>Varanus jobiensis</i> , <i>Varanus panoptes</i> , <i>Varanus prasinus</i> , <i>Varanus salvadorii</i> , <i>Varanus similis</i>
New Guinea (only Papua New Guinea)	<i>Varanus bogerti</i> , <i>Varanus doreanus</i> , <i>Varanus douarrha</i> , <i>Varanus finschi</i> , <i>Varanus indicus</i> , <i>Varanus semotus</i> , <i>Varanus similis</i> , <i>Varanus spinulosus</i> , <i>Varanus telenesetes</i>
Pacific Islands	<i>Varanus indicus</i> , <i>Varanus juxtindicus</i> , <i>Varanus spinulosus</i>

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