



Short Note of The Blue-Tailed Monitor Lizards (*Varanus doreanus*) in The Wild

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Abstract

The high wealth of monitor lizards in Indonesia has not been matched by the availability of accurate population and distribution data. Even though the data is needed by the Indonesian government to measure the balance between trade volume and the sustainability of monitor lizard populations in the wild. The purpose of writing is to obtain various information about data on blue-tailed monitor lizards. It is hoped that the availability of these data through various educational means can help reduce the burden on the government in predicting, recognizing and mapping the presence of monitor lizards accurately, so that trade traffic and their population can be controlled and remain sustainable. Methodology through literature review. Writing produces detailed and complete data information about the blue-tailed monitor lizard (*Varanus doreanus*) which includes morphology and character, sex differences in *Varanus doreanus*, determining body size, habitat and food, predators, reproductive biology, incubation period and temperature in monitor lizard eggs, distribution and the diversity of monitor lizards that live in Indonesia, conservation status, and studies of monitor lizard ethnozoology. Government involvement is urgently needed, especially in educating people (hunters, traders, collectors, and exporters of reptiles) who live in reptile trade areas such as North Sumatra, South Sumatra, Java, and West Kalimantan. The choice of education through measurable and continuous communication is a form of real action, so that in social life the community creates and grows a deep sense of empathy for the survival of monitor lizards in the wild. Thus, it will indirectly cut significantly the creation of an unequal distance between trade volume and the number of populations in nature.

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1. Introduction

The Reptilia animal group is one of five classes included in the Vertebrata phylum (group of animals with backbones). In general, animals belonging to the Reptilia class have the following characteristics: walking in slithering, their whole body is covered with dry, scaly skin, equipped with sensory organs in the form of eyes, ears and nose, breathing with lungs. In addition, reptiles have a body temperature regulation system by adjusting the environment temperature (cold-blooded/poikilothermic), usually reproduce by laying eggs (ovipar) but some lay eggs in the body and then immediately hatch (ovoviviparous), and have a heart but not perfect [1].

Several animal species in Indonesia that belong to the Reptilia group, which are quite famous and have economic value, include the Komodo dragon (*Varanus komodoensis*), blue-tailed monitor lizards (*Varanus doreanus*), estuarine crocodile (*Crocodylus porosus*), Irian freshwater crocodile (*Crocodylus novaeguineae*), reticulated python (*Python reticulatus*), and green snake (*Trimeresurus insularis*). There are also various types of turtles that are commonly found in the eastern region, such as the Ambon tortoise (*Cuora amboinensis*) endemic to Ambon, the forsteni tortoise (*Indotestudo forstenii*) endemic to Sulawesi, and the Sulawesi forest tortoise (*Leucocephalon yuwonoi*).

Approximately 723 species (8%) of the total number of reptiles in the world are found in Indonesia and the highest number of species are found in the Kalimantan region, followed by Sumatra, Papua, Java, Sulawesi, Maluku, and Nusa Tenggara [2]. At this time, one of the reptiles that receive special attention in terms of wildlife trade is monitor lizards. Not less than 40% of monitor lizards species throughout the world are found in Indonesia [2]. The high wealth of this monitor lizards has not received attention from the Government in terms of the availability of accurate data, because all species in the Varanidae family can be traded. Although based on the international convention, trade in wild animals has been regulated by the Convention on International Trades on Endangered Species of Wild Flora and Fauna (CITES) [3]. In fact, more than 80% of the wealth of these monitor lizards is spread in the eastern region, especially Papua and Maluku. In the Papua region the highest levels of monitor lizards diversity were identified in the Sorong, Merauke, and Jayapura areas [4,5].

The need for accurate information on population data and their distribution is intended so that there is a balance between trade volume and the sustainability of monitor lizards populations in the wild.

Based on research results, it is known that there are seven species of the genus *Varanus* living in the Papua and Papua New Guinea (PNG) regions, namely *Varanus doreanus*, *V. indicus*, *V. jobiensis*, *V. panoptes horni*, *V. prasinus prasinus*, *V. salvadorii*, and *V. similis*. The existence of the blue-tailed monitor lizards, *Varanus doreanus*, can be found in these two regions and can also be found in Australia [6].

Various research results related to *Varanus doreanus* have been carried out, including: a). Notes on the natural history of the blue-tailed monitor lizards (*Varanus doreanus*) in Australia which discuss habitat associations, morphometrics, male fighting, diet, predation and abundance of *V. doreanus*; b).

The new blue-tailed lizards (Reptilia, Squamata, *Varanus*) from the *Varanus indicus* group from Mussau Island, Papua New Guinea discusses the discovery of a new blue-tailed lizards from the *V. indicus* species group on Mussau Island based on phylogenetic analysis, molecular genetic analysis, biogeography, natural history, and morphology; c) A guide for visual identification of lizards species in the world (Genus *Varanus*) contains guidelines for the identification of monitor lizards with current data distribution and a brief description of the characteristics of reproduction and captivity to support CITES authority; d). New records of the blue-tailed monitor lizards *Varanus doreanus* (Meyer, 1874) including maximum body size contains information about blue-tailed monitor lizards from Irian Jaya, Papua New Guinea, and Australia from 1933-1964 that have not been reported and the availability of new local information and predicted length sizes monitor lizards longer than 1.7 meters; and finally e).

The captive management, morphology and daily activities of the blue-tailed monitor lizards (*Varanus doreanus* AB Meyer 1874) at PT Mega Citrindo discusses the management of the blue-tailed monitor lizards in captivity.

Referring to the notes above, it is necessary to carry out an inventory of various information about *Varanus doreanus* data to support the sustainability of the blue tailed monitor lizard so that it continues to exist in the wild.

The purpose of writing is to obtain various information about blue-tailed monitor lizards, it is hoped that the availability of these data through various educational methods can help reduce the burden on the government in predicting, recognizing, and mapping the whereabouts of monitor lizards accurately, so that trade traffic and their population can be controlled and their presence maintained sustainable.

2. Method

2.1 Field research

Writing a brief review of the blue-tailed monitor lizard (*Varanus doreanus*) was carried out from January to May 2023, and 47 literature has been studied and researched. The libraries collected relate to data on all information on blue-tailed monitor lizards, whether in the form of journal articles, theses, dissertations, books, or other scientific reports.

2.2 Data sampling

Writing a brief review of the blue-tailed monitor lizard (*Varanus doreanus*) using the intensive literature review method.

2.3 Data analysis

Based on these data, data extraction is then carried out to obtain valid, detailed and complete data according to the needs of the author, and finally data analysis is carried out [7].

3. Results and discussion

3.1 Morphology and character of *Varanus doreanus*

Taxonomically the blue-tailed monitor lizards (*Varanus doreanus*) belongs to the genus *Varanus* and the sub-genus *Euprepiosaurus* [8, 9, 10, 11]. It is strongly suspected that this monitor lizards has a very close kinship with *Varanus indicus* and *Varanus jobiensis* [12, 13, 14]. This lizards species is medium to large in size with a head, body, slender legs, and a tail that is 1.5 times the length of its snout [14]. The blue-tailed monitor lizards has a grayish-brown to black body, the entire body to the upper surface of the limbs is covered with small yellowish-white dots, and is estimated to have a body length of around 135-160 cm [15, 16], even according to [11] longer than 1.7 meters (Fig. 1). It has a relatively large head and strong limbs [11]. The most striking character of the blue-tailed monitor lizards is its tail, which is dominated by blue with a combination of paired stripes from dark brown to black. The stripes line up vertically until the tip of the tail becomes thinner (Figure 1). When the monitor lizards reaches adulthood, the color of the blue tail will experience a slight fading [16, 14]. The lower skin surface on the neck that is in contact with the soil is white and striped while the scales on the neck that function as the outer skin are round-oval and finely textured [17]. This species has a yellow tongue [17, 11].



Figure 1: The blue tailed monitor lizards in its natural habitat.

Source: [14]

3.2 Determining the body size of *Varanus doreanus*

The body shape of the blue-tailed monitor lizards is relatively very similar between females and males, thus giving rise to various interpretations of how its evolutionary journey went, even making it quite difficult to determine sex when in the field [18]. The following shows how to measure the body parts of a monitor lizards in detail:

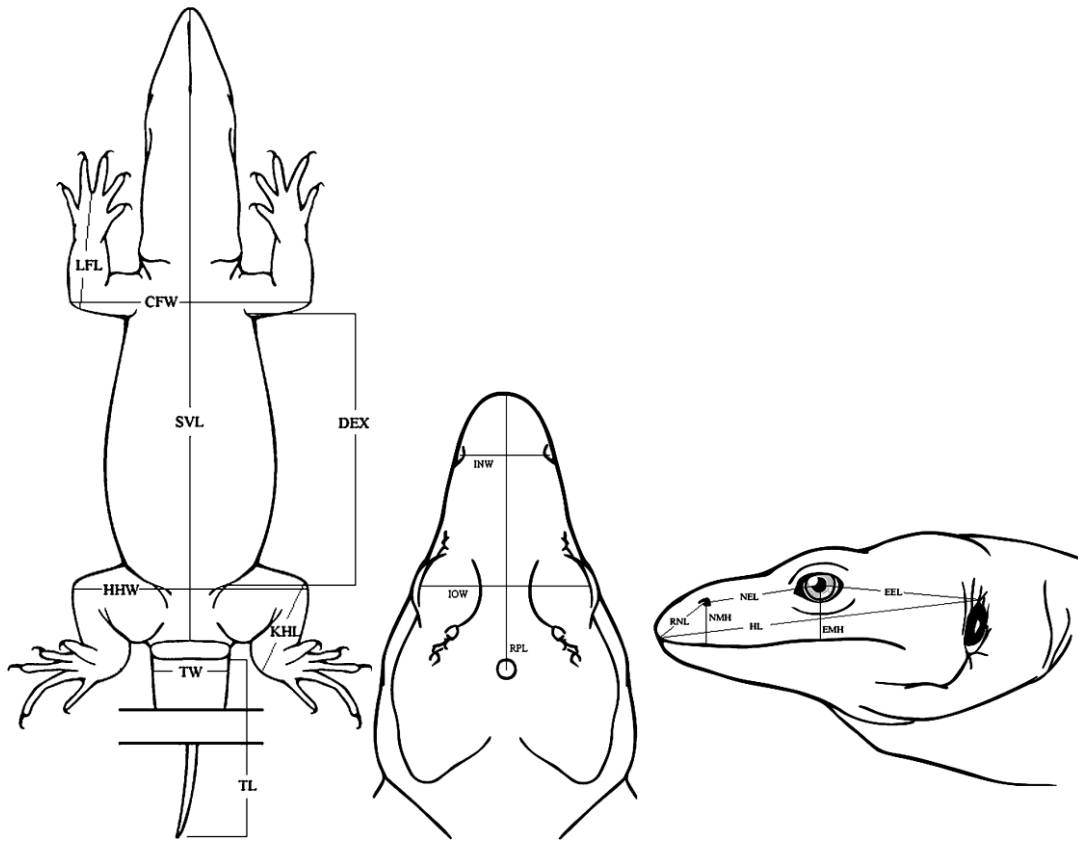


Figure 2

Source: [18]

Figure description for measuring the monitor lizard's head: RPL: mouth length measured from the parietal; IOW: distance between the eyes; INW: distance between nostrils; HL: head length measured from mouth to ear; RNL: mouth to nostril length; NEL: length of nostril to middle of eye; EEL: eye to ear length; NMH: nostril to maxilla height; EMH: eye height to maxilla.

Source: [18]

Figure description for monitor lizard body measurements: SVL: snout length; DEX: distance between extremities (length from chest to abdomen); TL: tail length; TW: tail width (at base); CFW: upper forelimb and chest width; LFL: long lower forelimb (no toes); HHW: hind leg width over hips; KHL: knee to heel length.

3.3 Sex differences in *Varanus doreanus*

Phylogenetically, monitoring monitor lizards is not only based on variations in body size [19,20] but also variations between sexes. In general, the body size of adult males is larger than females [21], but usually the body shape of the two sexes is very similar [22]. The similarity of male and female body shapes makes morphometric determination of sex difficult in the field [23,24,22]. Through a fairly thorough research [22] revealed that sexually, differences in body shape are relatively small, but these differences will appear after the

monitor lizards reach adulthood. Female monitor lizards have a relatively longer abdomen than males, while male monitor lizards have a wider chest and longer upper forelimbs. Thus, differences in body shape between male and female monitor lizards can occur due to fecundity and sexual selection [22].

3.4 Habitat and food of *Varanus doreanus*

Naturally, *Varanus doreanus* mostly lives in lowland rain forests and on river banks [17,12,24,16], but is also often found in habitats with poorly maintained conditions and slightly dry soil [14]. Characteristically, the behavior of blue-tailed monitor lizards is included in diurnal animals or active during the day [12]. This species forages solitary and aggressively for prey during the day. Various types of food for blue-tailed monitor lizards include invertebrate animals such as beetles, grasshoppers, small snakes, lizards, lizards eggs, chicks, bird eggs, mice, insects (crickets, grasshoppers), German caterpillars, bamboo caterpillars, river crabs [12,25,15,14].

3.5 Predator *Varanus doreanus*

One of the defense mechanisms of various predators in reptile groups is the color and pattern of their bodies [26]. In the wild, the natural enemies of the blue-tailed monitor lizards besides humans are carnivorous animals that have larger body sizes, such as hunting dogs and eagles. Some research results state that one of the natural predators of *Varanus doreanus* is the male black-headed python (*Aspidites melanocephalus*), which is about 1.7 meters large and weighs 1068 grams. The python has preyed on the blue-tailed monitor lizards and has had most of its limbs digested, but can still be identified by the remaining blue tail [16].

3.6 Reproduction biology of monitor lizards

One of the peculiarities of animals that live in the wild is that when they enter the mating season to get the attention of female monitor lizards, the male monitor lizards will fight to show their masculinity by standing on the strength of their two hind legs. The male monitor lizard who wins will get his rights to mate with the female monitor lizard. Monitor lizards reproduce by laying eggs, with their animal instincts monitor lizards will look for places to lay their eggs in sandy or muddy areas on the banks of rivers, which are mostly covered with rotting twigs and leaves. Under these conditions, temperature greatly influences the sex of the baby monitor lizards that hatch. The large number of male baby monitor lizards that hatch is due to the high temperature, conversely if the surrounding temperature is low, more female babies will hatch [27,28].

3.7 Incubation period and temperature in monitor lizard eggs

According to some literature records, more information about the number of days and temperature range during incubation time in monitor lizard eggs is known to come from published captive data, while data from wild animals is relatively lacking. This is because the microclimatic conditions (air temperature, wind speed and direction, air humidity, solar radiation, and radiative temperature) in nature tend not to be constant and very dynamic over long periods/times. In contrast to the case in captivity, microclimatic conditions can be regulated and controlled in such a way that the desired grip can be achieved. This applies to monitor lizard eggs that come from both wild-born monitor lizards and those raised in captivity. Observational data from monitor lizard

captive breeding shows that the incubation period for monitor lizard eggs is relatively long, can reach more than 300 days [14].

3.8 Distribution and diversity of monitor lizards living in Indonesia

Based on the distribution of flora and fauna, Indonesia's biogeographical area is divided into 3 regions, namely Sundaland (western part of Indonesia), Wallacea, and Sahulland (eastern part of Indonesia). Sundaland and Wallacea are areas with relatively high density and uniqueness of biodiversity, and are often categorized as biodiversity hotspots. Sahulland is an area of eastern Indonesia including the Aru Islands and Papua which still has natural ecosystems with very high biodiversity [29].

Varanus doreanus or Birumoipoko (Papua New Guinea language) has a distribution area covering Papua New Guinea with offshore islands including Papua such as Salawati (Sorong), Biak, Merauke (Papua), Wammer, Aru Islands, North Queensland, and parts of Cape York north of Australia [30,31,10,6,13, 16,14]. Apart from the three areas (Salawati, Biak, and Merauke), blue-tailed monitor lizards can also be found in West Papua, such as Waigeo, Sabang, Noord River, Wendessi, Sermonai River, Digoel River, Gariau-lake jamoer, Fak Fak, Manokwari [13].

Around the world there are 81 species of monitor lizards belonging to the Varanidae family. Based on the distinctive characteristics of morphology and molecular genetic evidence, all monitor lizards species are grouped into 11 subgenera, namely, 1) *Empagusia*, 2) *Euprepiosaurus*, 3) *Hapturosaurus*, 4) *Odatria*, 5) *Papusaurus*, 6) *Philippinosaurus*, 7) *Polydaedalus*, 8) *Psammosaurus*, 9) *Solomonsaurus*, 10) *Sotosaurus*, and 11) *Varanus*. Most of the monitor lizards that live in Indonesia belong to the subgenus *Varanus*, these monitor lizards include *Varanus aufferbergi*, *Varanus beccarii*, *Varanus boehmei*, *Varanus caerulivirens*, *Varanus cerambonensis*, *Varanus doreanus*, *Varanus dumerilii*, *Varanus indicus*, *Varanus komodoensis*, *Varanus kordensis*, *Varanus lirungensis*, *Varanus macraei*, *Varanus melinus*, *Varanus nebulosus*, *Varanus obor*, *Varanus prasinus*, *Varanus rainerguentheri*, *Varanus reisingeri*, *Varanus rudicollis*, *Varanus salvator*, *Varanus timorensis*, *Varanus togianus*, *Varanus yuwonoi*, *Varanus jobiensis*, *Varanus panoptes*, *Varanus salvadorii*, *Varanus similis*, and *Varanus zugorum* [14].

The number of monitor lizards that live in the territory of the island of Papua and Kep. Aru has 4 subgenera (*Varanus*, *Euprepiosaurus*, *Odatria*, and *Papusaurus*) out of 11 subgenera found in the world with 11 species and only 4 species are endemic to Papua [32,5]. The four endemic monitor lizard species, namely *Varanus boehmei* can be found on Waigeo Island [33]; *Varanus kordensis* is only found on Biak Island [34]; *Varanus macraei* only lives on Batanta Island [34]; and *Varanus reisingeri* endemic to Misool Island [35].

The eleven species that live in Papua and Aru island in question are *Varanus panopteri horni* (brown monitor lizards), *Varanus doreanus* (blue tail monitor lizards), *Varanus indicus* (Pacific monitor lizards), *Varanus jobiensis* (red neck monitor lizards), *Varanus boehmei* (yellow spot monitor lizards), *Varanus kordensis* (green monitor lizards), *Varanus macraei* (blue-spotted tree monitor lizards), *Varanus prasinus prasinus* (green monitor lizards), *Varanus reisingeri* (yellow monitor lizards), *Varanus similis* (spotted tree monitor lizards), and

Varanus salvadorii (Papuan monitor lizards) [36].

3.9 *Varanus doreanus* conservation status

One of the Varanidae groups that is very relevant in international trade is monitor lizards. This trade is regulated by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). To date, as many as 82 monitor lizards species have been scientifically described, which vary widely in different conservation and protection statuses (CITES Appendix I or II) in world trade. The importance of accurate identification of monitor lizards species is necessary for proper application of the CITES convention and monitor lizards conservation.

As many as 65% of monitor lizards species have been assessed by the IUCN for their conservation status and it is known that only 7 species are considered threatened, and there are also 39 species that have been identified as not threatened, the remaining 35% have not been assessed or lack data. In the world of trade, all monitor lizards species are listed in Appendix I and II of CITES, so there are different trade restrictions. In this condition it is important to identify monitor lizards correctly and scientifically at the species level. Correct identification of species is a major requirement in enforcing regulations and laws relevant to nature conservation [14].

The national conservation status of *V. doreanus* in Indonesia is not protected or IUCN Red List status: Not Evaluated (NE) [7]. This species is regularly exported for the live pet trade. According to the CITES trade database, the annual export quota for live specimens from Indonesia is currently still valid, and according to Commission Regulation (EU) No 2017/160 the status is: Appendix II/B [14].

3.10 Monitor lizards ethnozoology

Local wisdom possessed by traditional communities contains life values that are considered good and true in their cultural environment. Local wisdom is passed down from generation to generation verbally [7]. Lizards are used by some local communities for consumption, as traditional medicine, and for traditional customary culture (traditional rituals, magical rituals, and lucky charms). In North Kalimantan, Papua, and North Maluku, monitor lizards species, especially *Varanus domerilii* and *Varanus* sp. used for traditional ritual materials and traditional amulets [37,38,39]. In general, the species used as part of traditional ritual ceremonies are always maintained in a balanced population so that their existence remains sustainable when needed in the ceremony [40].

According to [41,7], monitor lizards (*Varanus salvator*) are used by the Anak Dalam tribe in Jambi as a medicine for skin diseases, allergies, and ringworm. The organ parts of the monitor lizards are used to treat skin diseases and ringworm, namely all the organs in the body, and the treatment is by burning them and then eating them. Monitor lizards are also used for health purposes, namely for their skin, bile, teeth and fat organs by the Yaur tribe at National Park of Cendrawasih Gulf, Manokwari, West Papua [38]. In the Lampung community, especially the West Coast District, use monitor lizards for traditional medicine [42], while in India, the Adi tribe community in East Siang, Arunachal Pradesh uses the tail of the monitor lizards (*Varanus bengalensis*) as a traditional medicine to treat their livestock [43].

3.11 Discussion

At this time, Indonesia has a problem on a fairly high scale of importance, namely the discovery of excessive exploitation of animal natural resources, especially those with high exotic and economic value, so that there are concerns about the threat to the conservation status and the continuity of fauna reproduction in times of which will come. One form of animal exploitation in question is the inter-regional and inter-provincial trade in monitor lizard reptiles, even the reptile trade has also reached cross-country (international) levels. In general, monitor lizards traded locally tend to be used for meat or used as traditional medicine by the community, while monitor lizards traded internationally tend to meet world market demand for reptiles. It is known that there are two forms of demand for monitor lizard exports to countries abroad, namely in the form of skin exports and exports of live monitor lizards.

The history of the trade of lizards on a large scale abroad, especially the Asian water monitor (*Varanus salvator*), began around 1980 by the world reptile skin industry, so that trade made it one of the most important export commodities in Indonesia [44]. The existence of Asian water monitors is quite abundant in this archipelago [45], it is known that the distribution of these monitor lizards includes forested areas, especially along rivers and mangroves in North Sumatra, South Sumatra, Java, and West Kalimantan [46,47], so as to create domination of the monitor lizard trade around the region.

According to research results, Indonesian reptile exports experienced a golden age around 1984's. This is shown from data on the average export of Asian water monitor lizard skins from Indonesia between 1983-1999 amounting to 650,000 pieces/year, the acquisition value is much higher than the skins of the Papuan crocodile, *Crocodylus novaeguineae* (3,477 pieces/year) and estuarine crocodile, *Crocodylus porosus* (1,230 sheets/year) [44]. Some of the countries that are exported to Asian water monitor skins are Japan, the United States, Spain, Singapore, Mexico and Hong Kong. This condition is also supported by data released by the Directorate General of Forest Protection and Nature Conservation in 1999, it was recorded that 54 out of 161 species of reptile skin from Indonesia were traded abroad in the form of skin, meat, carapace and finished products, the rest in live form for consumption as meat or pets [44]. Even the peak of the pet monitor lizard trade occurred in the early 1990s, which was marked by the export of several species of Asian water monitor lizards abroad, namely the brown roughneck monitor (*Varanus dumerilii*), black roughneck monitor (*Varanus rudicollis*), and crocodile monitor (*Varanus salvadori*). Around the end of the 1990s, the trade in monitor lizards experienced a significant decline. It was estimated that this was due to the increasingly uncertain market demand and the trend of export domination of certain reptile species.

One of the important problems that have arisen in the monitor lizard trade in Indonesia to date is the unavailability of data on the population size and distribution of monitor lizards in nature that are identified correctly, accurately and validly. These data are needed to measure the balance between trade volume and the viability of monitor lizard populations in the wild, even though collecting these data is not easy and inexpensive. In this regard, to control trade, the government through the Ministry of Trade has issued Regulation of the Minister of Trade of the Republic of Indonesia Number 122 of 2018 concerning Provisions for the export of natural plants and wild animals that are not protected by law and are included in the CITES list. The main

objective with the issuance of this Ministerial Regulation is to limit the export of the wealth of natural plants and wild animals, including 16 species of monitor lizards, one of which is the blue-tailed monitor lizard (*Varanus doreanus*). In addition, the government must also be orderly and consistent in carrying out the rules that have been agreed upon and apply as a member of CITES. There were indications of violations committed by the government which resulted in a warning from CITES for exporting reptiles in excess of the quota agreed by both parties. It is hoped that in the future, similar incidents will not be repeated. The difficult condition of obtaining data on the size and distribution of the monitor lizard population is exacerbated by the declining number of reptile species due to high harvest rates and their habitat being damaged by forest fires and illegal logging.

Another effort that is expected of the government in collecting data on the population size and distribution of monitor lizards is to immediately issue a Decree of the Minister of Environment and Forestry which contains the initial determination of identification and data collection, along with the need for the involvement of several experts in the field of reptiles which include biologists, taxonomists, ecologists, conservation, health, and trade in reptiles. Furthermore, the government must ensure the implementation of its implementation in the field through ways of coordinating relevant cross ministries, direct monitoring activities, making decisions on solutions found if there are several obstacles. The government is also expected to make various educational breakthroughs to the public, especially reptile traders and exporters, in reptile trade pockets such as the regions of North Sumatra, South Sumatra, Java and West Kalimantan, about the importance of preserving the existence of monitor lizards by introducing various characteristics, characters, behaviors, ways breeding, ecology, monitor lizard predators to their conservation status. It is hoped that by means of education like this, a sense of love and care will be created in the community for the continued existence of monitor lizards in the wild. If all of these efforts can be realized properly and smoothly, then this idea will at least reduce the burden on the government in efforts to limit the trade in reptiles, especially monitor lizards, so as not to trigger an unequal gap between trade volume and its population in nature.

3.12 Conclusion

On the basis of the preservation of blue-tailed monitor lizard populations in the wild, and the lack of availability of accurate data relating to populations and their distribution needed in the world of wildlife trade, this paper produces detailed data information on morphology and character, sex differences in *Varanus doreanus*, determining body size, habitat and food, predators, reproductive biology, incubation period and temperature in monitor lizard eggs, distribution and diversity of monitor lizards living in Indonesia, conservation status, and ethnozoological studies of monitor lizards. The involvement of the government is very much needed in an effort to obtain data on the size of the monitor lizard population and its distribution, especially in educating the public (poachers, traders, collectors, and exporters of reptiles) who live in reptile trade areas such as North Sumatra, South Sumatra, Java, and West Kalimantan. It is hoped that by means of education through measurable and continuous communication, then in the social life of the community there will be a sense of love and care for the survival of monitor lizards in the wild. Thus, it will cut significantly the creation of an unequal distance between trade volume and the number of populations in nature.

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