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Zoo Indonesia  
Bidang Zoologi, Puslit Biologi LIPI  
Gd. Widyasatwaloka  
Jl. Raya Bogor-Jakarta KM. 46  
Cibinong 16911

Telp. (021) 8765056  
Fax. (021) 8765068  
zooindonesia@yahoo.com

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**THE HERPETOFAUNA OF THE GOLD MINING PROJECT AREA  
IN NORTH SUMATRA: SPECIES RICHNESS  
BEFORE EXPLOITATION ACTIVITIES**

**Hellen Kurniati**

*Zoology Division, Research Center for Biology  
Indonesian Institute of Sciences (LIPI)  
Widyasatwaloka Building  
Jln Raya Cibinong Km 46, Cibinong 16911,  
e-mail: hkurniati@yahoo.com*

**ABSTRACT**

**Kurniati, H. 2007. The herpetofauna of the gold mining project area in North Sumatra: Species richness before exploitation activities. Zoo Indonesia 16 (1): 1-11.** Field surveys of herpetofauna (amphibians & reptiles) were conducted in and around the PT Newmont Horas Nauli Martabe Project Area for 23 days prior the exploration. Surveys involved visual observations, light attraction, hand collection and trapping in all major amphibian and reptile habitats. A total of 42 species of amphibians and 28 species of reptiles (nine snakes, 16 lizards & three turtles) were identified. Based on interviews with local people at Batang Toru Village, there was reliable observation of two additional species of turtle (*Cyclemys dentata* & *Manouria emys*) and one species of snake (*Python curtus*). Of the more than 42 amphibians species and 28 reptile species observed, 12 represented unknown species (10 frogs & two skinks); one frog species (*Occidozyga laevis*) might be a new record for Sumatra. Similarity index calculations indicated that herpetofauna diversity at the six sites was divided between forested and heavily disturbed habitat.

**Keywords:** gold mining area, Martabe, Sumatra, herpetofauna, biodiversity.

**ABSTRAK**

**Kurniati, H. 2007. Herpetofauna Pada Area Proyek Tambang Emas di Sumatra Utara: Kekayaan Jenis Sebelum Aktivitas Eksplorasi. Zoo Indonesia Vol. 16 (1): 1-11.** Telah dilakukan studi keanekaragaman jenis herpetofauna (amfibia & reptilia) yang berlangsung selama 23 hari di area tambang emas PT. Newmont Horas Nauli, Sumatra Utara, sebelum aktivitas eksplorasi berlangsung. Metode yang digunakan untuk mendapatkan jenis adalah dengan cara observasi, tangkap langsung, penyinaran dan perangkap lem pada semua tipe habitat herpetofauna. Jumlah total jenis yang didapat adalah 42 jenis amfibia dan 28 jenis reptilia (9 jenis ular, 16 jenis kadal & 3 jenis kura-kura). Berdasarkan wawancara dengan penduduk lokal di Desa Batang Toru, didapatkan tambahan informasi dari jenis reptilia yang terdapat di area tambang emas, yaitu kura-kura *Cyclemys dentata* dan *Manouria emys*, serta satu jenis ular, yaitu *Python curtus*. Dari 42 jenis amfibia, 9 takson kodok belum diketahui jenisnya; sedangkan dari 28 jenis reptilia, 2 takson kadal belum diketahui jenisnya. Dari studi ini didapatkan kodok jenis *Occidozyga laevis* yang merupakan catatan baru untuk Sumatra. Hasil dari analisis kesamaan jenis diantara 6 lokasi studi didapatkan dua pengelompokan lokasi, yaitu kelompok hutan dan kelompok non-hutan.

**Kata kunci:** area tambang emas, Martabe, Sumatra, herpetofauna, biodiversitas.

## INTRODUCTION

In the main land of Sumatra, there are approximately 93 species of frogs, with 14 species are endemic (Iskandar & Colijn 2000; Mistar 2003; CI/CABS IUCN/SSC 2004), 72 species of lizards, with 16 species are endemic (Iskandar & Colijn inpress), 133 species of snakes, with 26 species are endemic (Iskandar & Colijn 2001) and 13 species of non-marine turtles (Iskandar, 2000) are all well described. However many new species are being discovered and described. Generally, the herpetofauna (amphibians and reptiles) of Sumatra remain very little to be studied; only in a portion that has been studied comprehensively such as in Leuser National Park (Mistar 2003).

The Newmont Horas Nauli gold mining areas (Figure 1) consist of Martabe Project Area that include Purnama, Kejora and Gerhana survey sites. Tailing area that include Rubber plantation and Terapung Wetland; and Teluk Nauli logging concession that to be proposed as wildlife refuge habitat. The large area (approximately 200,000 hectares) of rain forest that covers most of Martabe Project is an important habitat for amphibians and reptiles. Many of these species rely on specific habitats for their survival. The present herpetofauna study reviews the distribution and relative abundance of all the amphibians and reptiles recorded on Newmont Horas Nauli gold mining areas. The main objectives are to consolidate information on the distribution and habitat preference of amphibians and reptiles and to furnish baseline information that can be used for species richness and population changed indicator in the future.

## MATERIALS & METHODS

The main survey areas were located in six sites: Terapung Wetland, Rubber Plantation, Gerhana, Purnama, Kejora and Teluk Nauli; with altitudes between 50 meters at Terapung wetland to 850 meters above sea level (asl) at Teluk Nauli secondary forest. This ecology survey was based largely on field surveys conducted from 6<sup>th</sup> - 28<sup>th</sup> July 2003 together with records from local residents.

Five major habitat types were recognized within the survey area; brief descriptions of the habitats that were found during field survey are following:

1. **Edificarian:** Buildings and other manmade structures of wood and other materials provide an important habitat especially for some gecko special that are commensal with humans.
2. **Cultivated land:** Rubber, palm oil, banana and other fruit plans or hardwood plantation are dominant in this area.
3. **Secondary forest:** This habitat consists mainly of thickets of small trees, shrubs and vines where the forest has been more severely disturbed, and most of the mature trees have been removed.
4. **Rain forest:** This is the most widespread and abundant vegetation type on the main area of sites, and has been logged to varying degrees.
5. **Cloud forest:** This vegetation type is also known as moss forest. Mosses and fern festoon the trunks, limbs and branches of trees and shrubs, and they provide much of the ground cover.

Amphibians and reptiles occupy a wide variety of habitats, ranging from below the ground to the highest tree canopy. The microhabitat types for amphibians and reptiles were visited in six survey sites is:

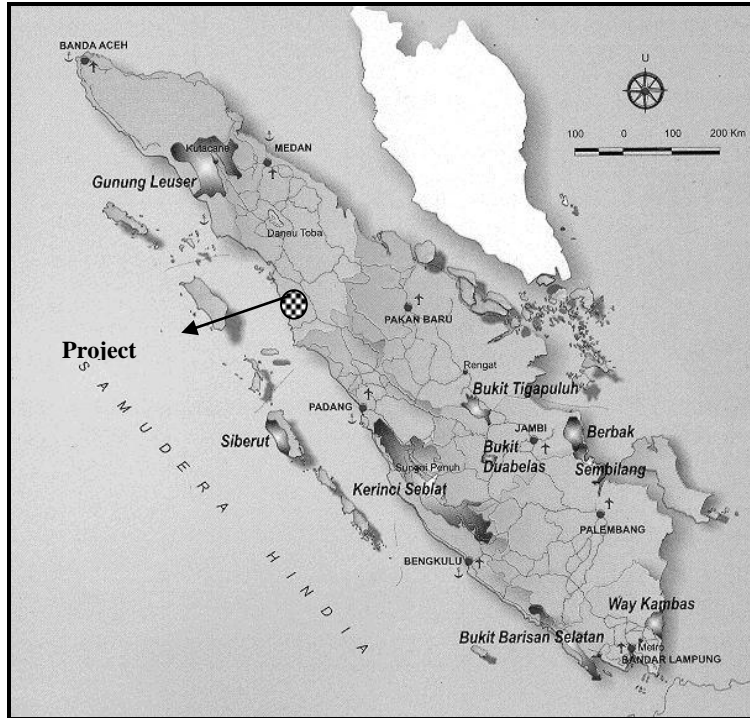


Figure 1. Location of Newmont Horas Nauli project area where the study of herpetofauna was conducted.

**1. Terapung Wetland :**

The survey area was a swampland, which had been drained to create land for cultivation. Palm oil, banana and the other fruit trees were dominant in this area. Microhabitat types for amphibians and reptiles were ditches, slow moving water and swamp. Elevation of the area was about 40 meters asl. Available coordinate position for the survey site was N 1°25.798'; E 98°58.958'.

**2. Rubber Plantation :**

Microhabitat of amphibians and reptiles at the rubber plantation survey site consisted of ditches, temporary pools, slow moving water and herbage. Elevation of the area was about 400 meters asl. Available coordinate position for the

survey site was N 1°27.965'; E 99°01.496'.

**3. Gerhana :**

Habitat at Gerhana survey site consisted of rain forest that has been disturbed for several years. Elevation of survey areas was about 400 meters asl. Microhabitat types of amphibians and reptiles were slow and strong moving waters, animal wallow, under fallen logs and leaf litter on forest floor, and tree trunks. Available coordinate position for the survey site was N 1°32.893'; E 99°04.533'.

**4. Purnama :**

Habitat at Purnama survey site consisted of edificarian, cultivated land and secondary forest. Elevation for amphibian and reptiles survey areas in this site were

between 300 to 500 meters asl. Microhabitat types of amphibians and reptiles were slow moving water, fast moving water, temporary and permanent pools, beneath fallen logs and among leaf litter on forest floor, and water-filled holes in tree trunks. Available coordinate position for the survey site was N 1°30.526'; E 99°03.712'.

#### 5. Kejora :

Habitat at Kejora survey site consisted of cloud forest and hill forest. Elevation of survey areas was about 800 meters asl. Microhabitat types of amphibians and reptiles were slow moving water, under fallen logs and leaf litter on forest floor, and water-filled holes in tree trunks. Available coordinate position for the survey site was N 1°32.136'; E 99°03.931'.

#### 6. Teluk Nauli :

Most of habitat at Teluk Nauli survey sites consisted of secondary forest that had been cut by selected logging for ten years by Teluk Nauli Logging Company, however the logging activities stopped in 2002. Microhabitat types for amphibians and reptiles in this sites were slow moving streams, temporary and permanent pools (including animal wallows), beneath fallen logs and among leaf litter on the forest floor, and water-filled holes in tree trunks. Elevation of the area was about 850 meters asl. Available coordinate position for the survey sites were: (1) Teluk Nauli base camp was N 1°41.123'; E 99°02.451'. (2) Teluk Nauli Km 28 was N 1°41.409'; E 99°02.215'. (3) Teluk Nauli Km 27 was N 1°40.983'; E 99°02.525'.

Terms of abundance followed Buden (2000); the terms were used to appraise overall status are:

1. Common (at least 30 sightings/day in suitable habitat

and under optimal weather condition).

2. Fairly common (10-30 sightings/day).
3. Uncommon (up to 10 sightings/day on most days).
4. Scarce (up to 5 sightings/day, but possibly unrecorded on more than half days).
5. Rare (under 5 sightings in most time survey).

Most of the sites were sampled only once during day or night or both. Counts were made by slowly walking through a selected habitat and recording individual encounters for each species. Voucher specimens were collected whenever possible. The suitable techniques of collecting of the species are:

##### a. Lighting

This technique is used to catch frogs in the night using a powerful flashlight. The frogs are temporary blinded when the flashlight shines in their eyes, making them easy to catch.

##### b. Catching by hand

This technique is suitable for snake and lizard by searching in microhabitats such as leaf litter, tree bark and buttresses, low-lying vegetation and in or under logs.

##### c. Trapping

This technique is fit only for small lizard such as gekkonid (Gekkonidae) or skinkid (Scincidae). The applied technique is using some small woods (size 20x30 cm) covered by rat glue will be used as lizard traps. The capture animals were released by cooking oil.

Relatively little collecting effort was expanded for animals that were easily identified, even at considerable distance. Greater effort was directed toward collecting examples of the animals, which are at times difficult to distinguish, by sight under field conditions. All of specimens were deposited in Museum Zoologicum

Bogoriense (MZB), Cibinong, West Java, Indonesia.

For identification, major taxonomy of amphibians followed Inger (1966), Inger and Stuebing (1989); for lizards, the gekkonid and skinkid were based on Das (2004), de Rooij (1915) and Lim and Lim (1992); for Ophidia or snakes were based on de Rooij (1917), Tweedie (1983) and Stuebing and Inger (1999); and for agamid based on Musters (1983) and Manthey and Schuster (1996). Major nomenclature of amphibians Iskandar and Colijn (2000) was used, for lizards and snakes Iskandar and Colijn (2001) and Iskandar and Colijn (in printed) were used; and for gekkonid, Bauer (1994) was used.

To measure the association of amphibian and reptiles resemblance as similarity among species in six survey sites based on absent and present of the species, cluster analysis (Minitab version 13) was used to estimate similarities in amphibian and reptile species richness between survey sites.

## RESULTS & DISCUSSION

A total of 42 species of amphibians and 28 species of reptiles were obtained during the survey in six survey sites; consisting of five families of frogs, four families of snake, three families of lizards and two families of turtle. Detail of classification and species list of the amphibians and reptiles which were recorded in six survey sites were shown in Tables 1 & 2. The family Ranidae dominated the frogs fauna, with more than half of the species (22 species; 52.49%). The Rhacophoridae or treefrogs, with seven species (16.67%). The three remaining families, Bufonidae, Microhylidae and Megophryidae, are represented by just six species (14.28%), four species (9.52%) and three species (7.14%) respectively. From the well known species found,

we got no endemic species to Sumatra, however 11 of these represented unknown species (9 frogs and two skinks); *Occidozyga laevis* is a new record for Sumatra. All of the unknown species are likely new to science, but to ascertain the species, further study of collected materials is needed. Additional information on reptile species was obtained from a reptile collector in Batang Toru Village. Based on interviews with the collector, two species of snake *Python curtus* and *Python reticulatus*; and three species of turtle and a tortoise, *Cuora amboinensis*, *Cyclernys dentata*, *Heosemys spinosa* and *Manouria emys* were collected from the forest inside Newmont Horas Nauli gold mining area.

Results of similarity cluster analysis is presented in Figure 2. The cladogram showed two distinct groups were apparent; forested sites (Gerhana, Teluk Nauli, Kejora & Purnama) were closely related, as were disturbed areas (Terapung Wetland & Rubber Plantation). The Rubber Plantation and Terapung Wetland were the most closely related sites followed by Gerhana and Teluk Nauli. Gerhana and Teluk Nauli were more closely related to the other forested sites (Kejora and Purnama) than to the disturbed Rubber Plantation and Terapung Wetland. Specific non-forest species were found only in disturbed areas including the frogs *Rana Baramica* and *Rana glandulosa*, and the lizard, *bronchocela cristatella* (Table 3). These species were not observed in any of the forested sites. Although, Rubber Plantation and Terapung Wetland were such degraded areas created by human, however certain species inhabited in these areas as well as in the rain forest. These comparisons suggest that several species had fairly wide ecological tolerance and were found in a range of vegetation types.

Vegetation type and microhabitat variability appear to affect species



richness of amphibians and reptiles in the six survey sites. Purnama site had the highest species richness (41 species), and then following by Gerhana (20 species), Kejora (19 species), Teluk Nauli (16 species), Rubber Plantation (13 species) and Terapung Wetland (12 species). Vegetation types in Purnama consisted of rain forest, rubber and hardwood plantation; whereas the

microhabitat types consisted of edificarian, slow moving water, fast moving water, temporary and permanent pools, beneath fallen logs and among leaf litter on forest floor, and water-filled holes in tree trunks. The fact that higher species in Purnama than the other survey sites correlated with vegetation type and number of microhabitat convenient.

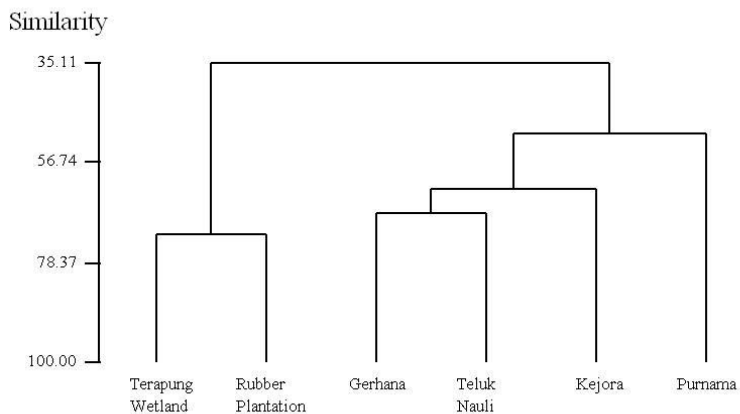


Figure 2. Cladogram of herpetofauna species richness similarity among the six survey sites.

There were more than half species occurred in rain forest (41 species; 55.94%), ten species inhabited disturbed area (13.89%), and 21 species were confined to forest or disturbed area (29.17%) (Table 3). According to their general habits and habitats especially for amphibians, there are three major groups of frogs in the survey sites by following Inger and Stuebing (1989). One group, the smaller, consists of species very closely associated with man, frogs that live in cultivation. The species fall into non-forest species. Not only do these species live close to people, but they also seem dependent on us to create those environmental conditions in which they thrive: open space, disturbed ground, or puddle of

standing water. Some frogs have fairly broad ecological tolerance; they fall into forest or non-forest species. None of these species is truly at home in rain forest, although *Rana chalconota* and *Polypedates leucomystax* do well in cultivated land and penetrate of the edge of rain forest. By far most of frogs in the survey sites were confined to rain forest or its edges; the species fall into forest species.

The general rule, however, is confinement to a life in rain forest. Although the details of their life styles vary widely, these forest species spend their lives in four major principal ways:

(1) Some frogs never leave the bank of streams. Frogs with this mode of life is *Limnonectes kuhlii* and *L. laticeps*, which live sympatric in similar microhabitat such as slow moving water. There also include here frogs that are confined to animal wallow in the forest, species such as *Microhyla berdmorei*, *M. superciliaris* and *Ocidozyga laevis*.

(2) Certain species of frogs found along stream banks live away from water coarsely as juvenile. The froglets hop away into the forest often moving several hundred meters. There they feed and grow. As they approach adult size, they return to a stream where they remain, like species of the first group, to breed and feed for as long as they live. The frogs with this mode of life include *Leptophryne borbonica*, *Rana hosii*, and *R. luctuosa*.

(3) The frogs species use streams only for breeding. The adult frog lives in the forest floor such as leaf litter the remainder of its life. They return to a stream at intervals only for breeding. The frogs with this mode of life include *Megophrys nasuta* and *Leptobrachium* spp.

(4) Many of forest frogs wander widely through the forest all ages and are seen along stream banks only as accidental visitors. Most of them lay eggs in small pools of water on the forest floor, but some use water-filled tree holes and few even lay their eggs under floor litter where there is no standing water but humidity is high. The species that usually use this microhabitat are *L. microdiscus* and *Pelophryne brevipes*. Pools on the forest floor form when a large tree falls pulling its root mass out of the soil or where forest pigs make mud wallow. Several species of tree frogs descent to deposit their foam nest at the edge of such pools or attach them to low overhanging vegetation. The frogs with this mode of life include *Phrynella pulchra*, and most of three frogs, *Nyctixalus pictus*, *P. colletti*, *P. macrotis* and *Rhacophorus pardalis*.

About half of reptiles in Newmont Horas Nauli gold mining areas were found in rain forest (14 species); two species only found in disturbed habitat, including edificarian and cultivated land; and the other species occur in rain forest or disturbed habitat (13 species) (Table 3). Although about half species seem to be restricted in rain forest, but many species of reptiles use disturbed habitat as temporary place, they still need rain forest for their native habitat. Therefore, the enormous changes that take place when forest is removed can quickly bring about the demise of species through desiccation, lethal temperatures and loss of prey items (Steubing and Inger, 1999).

## CONCLUSIONS

Several conclusions can be made from the herpetofauna field surveys:

1. Frogs were the most common amphibian collected and constituted about 60% of total species found which are about 25% likely to be new to science.
2. Based on the result of species similarity cluster analysis, the six survey sites (Purnama , Kejora, Gerhana, Teluk Nauli, Rubber Plantation and Terapung Wetland) were clustered into two distinct groups, disturbed area group and forested area group, of which Rubber Plantation and Terapung Wetland are the most closely sites, followed by Gerhana and Teluk Nauli.

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Table 1. Preliminary list of amphibian species of six survey sites in Newmont Horas  
Nauli gold mining area, North Sumatra.

Classification and Species list	Sites						Abundance status
	Terapung Wetland (40 m asl)	Rubber Plantation (400 m asl)	Gerhana (400 m asl)	Purnama (300-500 m asl)	Kejora (800 m asl)	Teluk Nauli (850 m asl)	
Class Amphibia							
Order Anura							
Family Megophryidae							
<i>Leptobrachium</i> sp. 1	-	-	+	-	+	-	Uncommon
<i>Leptobrachium</i> sp. 2	-	-	-	+	-	-	Uncommon
<i>Megophrys nasuta</i>	-	-	-	-	+	-	Rare
Family Bufonidae							
<i>Bufo asper</i>	+	+	-	+	-	-	Common
<i>Bufo melanostictus</i>	-	-	-	+	-	-	Common
<i>Bufo parvus</i>	-	+	-	+	-	-	Rare
<i>Bufo</i> sp.	-	-	-	+	-	-	Rare
<i>Pelophryne brevipes</i>	-	-	-	-	+	-	Rare
<i>Leptophryne borbonica</i>	-	-	-	+	-	-	Rare
Family Microhylidae							
<i>Microhyla berdmorei</i>	-	-	-	-	-	+	Rare
<i>Microhyla heymonsi</i>	+	-	-	-	-	-	Common
<i>Microhyla superciliaris</i>	-	-	-	-	-	+	Rare
<i>Phrynella pulchra</i>	-	-	-	+	+	-	Uncommon
Family Ranidae							
<i>Fejervarya cancrivora</i>	+	-	-	+	-	-	Common
<i>Fejervarya limnocharis</i>	+	+	-	-	-	-	Common
<i>Limnonectes blythii</i>	-	-	+	+	+	-	Fairly common
<i>Limnonectes kuhlii</i>	-	-	+	+	+	+	Common
<i>Limnonectes laticeps</i>	-	-	+	+	+	+	Common
<i>Limnonectes malesianus</i>	-	-	-	+	-	-	Fairly common
<i>Limnonectes microdiscus</i>	-	-	-	+	-	-	Fairly common
<i>Limnonectes paramacrodon</i>	-	+	-	-	-	-	Common
<i>Limnonectes</i> sp. 1	-	-	-	-	-	+	Rare
<i>Limnonectes</i> sp. 2	-	-	+	+	+	+	Common
<i>Limnonectes</i> sp. 3	-	-	-	+	-	-	Fairly common
<i>Limnonectes</i> sp. 4	-	-	+	-	+	+	Fairly common
<i>Occidozyga laevis</i>	-	-	+	-	-	-	Fairly common
<i>Rana baramica</i>	+	-	-	-	-	-	Fairly common
<i>Rana chalconota</i>	+	+	+	+	+	-	Common
<i>Rana erythraea</i>	+	-	+	+	-	-	Common
<i>Rana glandulosa</i>	+	+	-	+	-	-	Uncommon
<i>Rana hosii</i>	-	-	-	+	+	-	Uncommon
<i>Rana luctuosa</i>	-	-	-	+	-	-	Rare
<i>Rana nicobariensis</i>	+	+	-	-	-	-	Common
<i>Rana picturata</i>	-	-	-	+	-	-	Common
<i>Rana</i> sp.	-	-	-	-	+	-	Rare

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Family							
Rhacophoridae							
<i>Nyctixalus pictus</i>	-	-	-	-	+	-	Rare
<i>Polypedates colletti</i>	-	-	-	+	-	-	Scarce
<i>Polypedates leucomystax</i>	+	-	-	+	-	+	Common
<i>Polypedates macrotis</i>	-	-	-	+	+	-	Fairly common
<i>Rhacophorus baluensis</i>	-	-	-	-	-	+	Rare
<i>Rhacophorus pardalis</i>	-	-	-	+	-	-	Scarce
<i>Rhacophorus</i> sp.	-	-	-	-	-	+	Fairly common
Number of species	10	7	9	25	14	10	

Note: (+) species found; (-) species not found

Table 2. Preliminary list of reptile species of six survey sites in Newmont Horas Nauli gold mining area, North Sumatra.

Classification and Species list	Sites						Abundance status
	Terapung Wetland (40 m asl)	Rubber Plantation (400 m asl)	Gerhana (400 m asl)	Purnama (300-500 m asl)	Kejora (800 m asl)	Teluk Nauli (850 m asl)	
Class Reptilia							
Order Ophidia (Snakes)							
Family Boidae							
<i>Python reticulatus</i>	-	-	-	+	-	-	Scarce
Family Colubridae							
<i>Ahaetulla prasina</i>	-	-	-	-	-	+	Rare
<i>Boiga dendrophila</i>	-	-	-	+	-	-	Rare
<i>Dendrelaphis pictus</i>	+	+	-	-	-	-	Rare
<i>Oligodon purpurascens</i>	-	-	-	-	-	+	Rare
<i>Rhabdophis chrysargos</i>	-	-	+	-	+	-	Rare
<i>Xenochrophis trianguligerus</i>	-	-	-	+	-	-	Common
Family Elapidae							
<i>Maticora bivirgata</i>	-	-	-	+	-	-	Rare
Family Viperidae							
<i>Trimeresurus puniceus</i>	-	-	+	-	-	-	Rare
Order Lacertilia (Lizards)							
Family Agamidae							
<i>Aphaniotis acutirostris</i>	-	-	+	+	+	-	Fairly common
<i>Bronchocelea cristatella</i>	-	+	-	+	-	-	Common
<i>Draco maximus</i>	-	-	+	-	-	-	Rare
<i>Draco melanopogon</i>	-	-	+	+	-	-	Fairly common
<i>Draco volans</i>	-	+	-	+	-	-	Common
<i>Gonocephalus grandis</i>	-	-	-	+	-	-	Scarce
Family Gekkonidae							
<i>Cyrtodactylus consubrinus</i>	-	-	+	+	-	-	Uncommon
<i>Cyrtodactylus marmoratus</i>	-	-	+	-	-	+	Fairly common
<i>Hemidactylus frenatus</i>	-	-	-	+	-	-	Common
Family Scincidae							
<i>Dasia olivacea</i>	-	-	-	+	-	-	Fairly common
<i>Mabuya multifasciata</i>	+	+	+	+	-	+	Common
<i>Mabuya rudis</i>	-	+	+	+	+	+	Common
<i>Mabuya rugifera</i>	-	-	+	+	+	+	Fairly common
<i>Sphenomorphus cyanolaemus</i>	-	-	+	-	-	-	Rare
<i>Sphenomorphus</i> sp. 1	-	-	-	-	+	-	Rare
<i>Sphenomorphus</i> sp. 2	-	-	-	+	-	-	Scarce

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Order Testudinata (Turtles)							
Family Trionychidae							
<i>Amyda cartilaginea</i>	-	-	-	+	-	-	Rare
Family Geoemydidae							
<i>Cuora amboinensis</i>	-	+	-	-	-	-	Rare
<i>Heosemys spinosa</i>	-	-	+	-	-	-	Rare
Number of species	2	6	11	17	5	6	

Note: (+) species found; (-) species not found.

Table 3. Major habitats of frogs and reptiles in Newmont Horas Nauli gold mining area.

Habitat types		Forest species	Non-forest species	Forest or non-forest species
Terrestrial		Frogs: <i>Leptobranchium</i> sp. 1 <i>Leptobranchium</i> sp. 2 <i>Megophrys nasuta</i> <i>Bufo</i> sp <i>Leptophryne borbonica</i> <i>Rana luctuosa</i>  Reptiles: <i>Maticora bivirgata</i> <i>Trimeresurus puniceus</i> <i>Cyrtodactylus consubrinus</i> <i>Mabuya rugifera</i> <i>Sphenomorphus cyanolaemus</i> <i>Sphenomorphus</i> sp. 1 <i>Sphenomorphus</i> sp. 2 <i>Heosemys spinosa</i> <i>Cyclernys dentata</i> <i>Manouria emys</i>	Frog: <i>Bufo melanostictus</i>  Reptiles: <i>Hemidactylus frenatus</i>	Frog: <i>Bufo parvus</i>  Reptiles: <i>Python curtus</i> <i>Python reticulatus</i> <i>Rhabdophis chrysargos</i> <i>Xenochrophis trianguligerus</i> <i>Mabuya multifasciata</i> <i>Mabuya rudis</i>
Aquatic	Strong moving water	Frogs: <i>Limnonectes</i> sp. 3 <i>Rana picturata</i>		Frogs: <i>Bufo asper</i> <i>Limnonectes blythii</i> <i>Limnonectes malesianus</i> <i>Rana hosii</i>
	Slow moving water	Frogs: <i>Limnonectes kuhlii</i> <i>Limnonectes laticeps</i> <i>Limnonectes</i> sp. 1 <i>Limnonectes</i> sp. 2 <i>Limnonectes</i> sp. 4 <i>Rana</i> sp.  Reptile: <i>Amyda cartilaginea</i>	Frogs: <i>Fejervarya cancrivora</i> <i>Fejervarya limnocharis</i>	Frogs: <i>Limnonectes paramacrodon</i> <i>Rana chalconota</i>  Reptile: <i>Cuora amboinensis</i>
	Standing water	Frogs: <i>Microhyla berdmorei</i> <i>Microhyla superciliaris</i> <i>Phrynella pulchra</i> <i>Limnonectes microdiscus</i> <i>Occidozyga laevis</i>	Frogs: <i>Microhyla heymonsi</i> <i>Rana baramica</i> <i>Rana glandulosa</i> <i>Rana erythraea</i> <i>Rana nicobariensis</i>	Frog: <i>Rana chalconota</i>
Arboreal		Frogs: <i>Pelophryne brevipes</i> <i>Nyctixalus pictus</i> <i>Polypedates colletti</i> <i>Polypedates macrotis</i> <i>Rhacophorus baluensis</i> <i>Rhacophorus pardalis</i> <i>Rhacophorus</i> sp.  Reptiles: <i>Aphaniotis acutirostris</i> <i>Draco maximus</i> <i>Gonocephalus grandis</i>	Reptiles: <i>Bronchocela cristatella</i>	Frog: <i>Polypedates leucomystax</i>  Reptiles: <i>Ahaetulla prasina</i> <i>Boiga dendrophila</i> <i>Dendrelaphis pictus</i> <i>Draco melanopogon</i> <i>Draco volans</i> <i>Dasia olivacea</i>
Number of species		41	10	21

