Notes on the forest frogs of Cleopatra's Needle Mountain Range, with special reference to the newly defined and expanded geographical range of *Pelophryne albotaeniata* (Barbour, 1938): fuel for the conservation of the forests of northern Palawan Island, Philippines

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ABSTRACT: Cleopatra's Needle Mountain Range, in northern Palawan, holds some of the last naturally forested habitat, supporting a significant number of locally endemic amphibians. As preparation for a new conservation program focused on this remote mountain range, a preliminary visual herpetological survey was undertaken to gather initial data on amphibian populations from this biogeographically distinct region.

Eleven frog species were documented during this study including the Palawan Toadlet, *Pelophryne albotaeniata* (Barbour, 1938). To date, Cleopatra's Needle is the fourth published locality for this species and the first record for the species in northern Palawan thereby extending the range of the species significantly.

Other endemic amphibians recorded during our survey include; *Barbourula busuangensis, Ingerophrynus philippinicus, Limnonectes acanthi, Hylarana moellendorffi, Sanguirana sanguinea, Leptobrachium tagbanorum, Megrophrys ligayae, Philautus longicrus, Staurois nubilus* and the widespread Asian tree frog *Polypedates macrotis.*

Journal of Natural History – National Museum of the Philippines, Volume 2 (2017) ISSN 2013-2001, page 33- 37.

INTRODUCTION

The Philippine island province of Palawan (approximately 12,000 km^2) is located in the southwest portion of the archipelago, its southern reaches adjacent to Borneo Island, to which it once might have been connected (Reis & Garong, 2001). Due to Palawan's relatively low human population density, the island has been spared the catastrophic deforestation that has taken place in the rest of the country (Widmann et al.2008). In contrast to the rest of the Philippine archipelago, for which estimates of remaining original forest range from 4–12% (DENR, 2012), approximately 40 - 50% of the primary forests of Palawan remain at present (Baltazar, 1997). Nevertheless Palawan's forests are currently being threatened by the rapid urban development on the island.

Although the prevailing biogeographic paradigm considers Palawan to be a relatively young island (Matsui et al., 2010), recent research has gathered evidence for a much older cretaceous origin of Palawan (Walia et al., 2012). Additionally, Palawan's hypothesized repeated connection to the landmasses of the Sunda shelf (Esselstyn et al., 2010) has resulted in an interesting evolutionary experiment leading to a terrestrial vertebrate diversity with very high levels of endemism (Diesmos et al., 2002; Esselstyn et al., 2010; Inger & Voris, 2001).

The importance of Palawan was further highlighted with its international recognition by the United Nations Educational, Scientific and Cultural Organization (UNESCO) as a Biosphere Reserve containing two World Heritage Sites, namely The Puerto Princesa Subterranean River National Park and the Tubbataha Reefs Natural Park (Baltazar, 1997). However, because of bureaucratic obstacles to biodiversity field research the island remains relatively understudied (Brown *personal communication*, 2014).

Palawan is home to at least 23 species of amphibians (Biju et al., 2007; Diesmos & Brown 2011; Diesmos et al., 2005) of which at least ten species are endemic to the province (Sanguila et al., 2011; Matsui et al., 2010). Palawan endemic amphibians include several species that are listed as threatened including the Palawan Horned Frog (*Megophrys ligayae*, Taylor, 1920), the Philippine Flat-headed Frog (*Barbourula busuangensis*, Taylor and Noble, 1924) and the Palawan Toadlet (*Pelophryne albotaeniata,* Barbour 1938). The Palawan Horned Frog and the Palawan Toadlet are listed as Endangered in the IUCN red list (IUCN, 2015), while *Barbourula busuangensis* is currently listed as Vulnerable but this status will most probably be upgraded to "Endangered" in a pending revision of the IUCN conservation status assessment for this species (Diesmos *personal communication*, 2014; IUCN, 2015).

The Cleopatra's Needle Mountain Range, in northern Palawan, is one of the last "stronghold" habitats for the island's locally endemic species as the forest covering the mountain has remained relatively undisturbed as shown in Fig. 4. In conjunction with a new intended conservation program by the Centre for Sustainability, a Palawan-based conservation group, for this remote mountain range, an initial visual rapid assessment survey was undertaken to gather more data on the amphibians in the area. Here we report on the species encountered, and undertake particular reference to the newly expanded geographical range of *Pelophryne albotaeniata*, a species much more widely distributed than previously thought.

MATERIALS AND METHODS

While trekking to the peak of the Cleopatra's Needle on 3 – 8 January 2014, rivers, creeks and adjacent forests were opportunistically visually surveyed for amphibians using passive encounter surveys and incidental observations (Eekhout, 2010) during the daily 8 hour hikes. Visual surveys were only performed during the day while following a predetermined route from Barangay San Rafael, following the Tanabag

River, then summiting the peak of Cleopatra's Needle at 1593 meters above sea level (MASL) via an approach from the eastern flank of the mountain. The team consisted of the two authors and three colleagues of the Batak tribe. All encountered amphibian species were documented through photographs only and no specimens were collected. Specimens were identified by photographs using literature (Brown et al., 2009; Das, 2008; Diesmos & Brown, 2011; Diesmos et al., 2002) and through identification by experts via email (Diesmos & Brown, 2014).

RESULTS AND DISCUSSION

A total of 11 amphibian species were encountered during our brief survey. Ten of these species are locally endemic; and one is known to occur throughout Southeast Asia (Table 1).

Table 1: Amphibian species encountered during the survey at Cleopatra's Needle Mountain Range, Palawan.

Species	Habitat	Extent of Occurrence
Barbourula busuangensis	Lowland riverine forest streams (aquatic)	Palawan
Ingerophrynus philippinicus	Lowland forest and disturbed areas	Palawan
Pelophryne albotaeniata	Cloud forest	Palawan
Limnonectes acanthi	Riverine forest and streams	Palawan
Leptobrachium tagbanorum	Lowland riverine forest	Palawan
Megophrys ligayae	Lowland to montane forest	Palawan
Hylarana moellendorffi	Lowland riverine forest	Palawan
Sanguirana sanguinea	Lowland forest	Palawan
Staurois nubilus	Lowland forest	Palawan
Philautus longicrus	Lowland to montane forest	Palawan
Polypedates macrotis	Forest and disturbed habitats	Southeast Asia

Among the findings, the recording of the Palawan Toadlet (*Pelophryne albotaeniata*) was most notable. *Pelophryne albotaeniata* was originally described from Thumb Peak (the type locality) by Barbour in 1938 (Barbour, 1938; Inger, 1954; Inger, 1960) at an altitude of 4500 feet (which is noteworthy as the mountain

measures only 1296 meter, approximately 4250 feet) with a second locality recorded by Wemer (1947) for Mount Balabag (located in the Mantalingahan Mountain Range). Although the IUCN red list details the research on the species as "no field observations of this species for more than 40 years" (IUCN, 2015), a third locality was confirmed by Brown et al. (2007) at Mount Mantalingahan. To date, Cleopatra's Needle is the fourth recorded locality for the species, which is a significant northern Palawan range extension (Fig. 1), especially given the paucity of records for the species over the past 75 years since its discovery (Barbour, 1938).

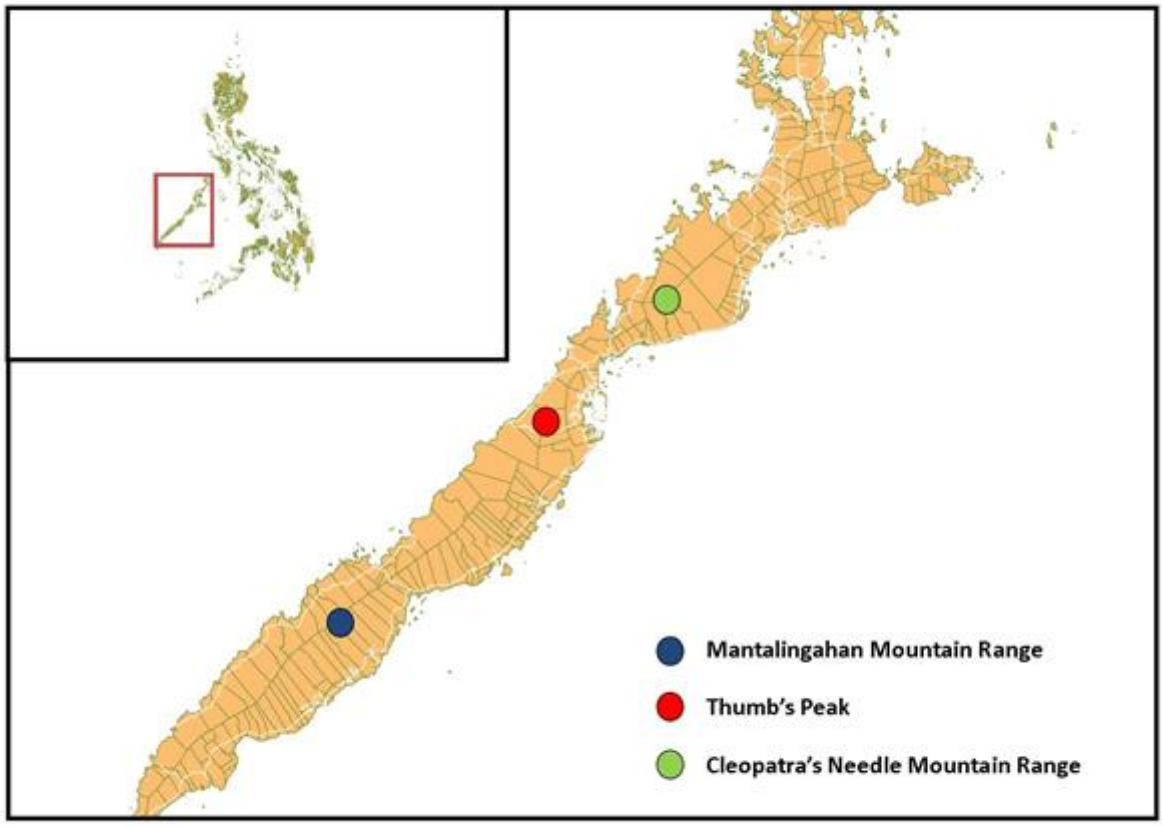

Fig.1: Map of the Philippines (inset) and the three main recorded localities of *Pelophryne albotaeniata* in Palawan, Philippines.

On 7 January 2014, four Palawan Toadlets, *Pelophryne albotaeniata* (Barbour, 1938), were encountered at elevations ranging from 1400 to 1580 meter above sea level. The species was recorded in the two types of vegetation present at this altitude; the first vegetation type consists of fine leaved bamboo species

(*Bambusa species*) at elevations from 1400 to 1475 MASL, and the second vegetation type is mature cloud forest (dominated by *Quercus* species) at approximately 1475 MASL, which persists till the peak (1593 MASL).

The first individual of *Pelophryne albotaeniata* was encountered calling (10:20 AM), resting (Fig. 2a,b) in bamboo leaf litter, the second individual was found in the same bamboo dominated vegetation. Later in the morning, two individuals (Fig. 2c) were encountered perched in lichen of a tree trunk (*Quercus species*), in cloud forest at approximately 1490 MASL at 1.5 – 1.8 m above the ground. It is interesting to note that one of these individuals feigned death upon discovery (as the specimen was approached for photographing purposes) and it jumped from the tree landing on its back and remaining motionless for about 1 minute (Fig 2d). Both individuals that were found perched in a tree, exhibited a clear black spotted pattern on the ventral surface (Fig. 2d). Additionally these two specimens did not possess the parallel polymorphic white colored stripes, which were previously identified as diagnostic for this species (Barbour, 1938; Inger, 1954; Inger, 1960) and that we found on the specimens found in the bamboo forest.

Fig. 2a: Typical walking posture of *Pelophryne albotaeniata*; Fig. 2b: *Pelophryne albotaeniata* in calling posture, Fig. 2c: *Pelophryne albotaeniata* lacking diagnostic while lateral stripes (Barbour, 1938; Inger, 1954), Fig. 2d: *Pelophryne albotaeniata* showing its spotted ventrum after jumping from a small tree (© Jonah van Beijnen).

Although previous studies have used the two parallel polymorphic white colored stripes along the dorsolateral body surface as diagnostic characters (Barbour, 1938; Inger, 1954; Inger, 1960), we suspect that color variation observed here is indicative of sex, ontogenetic, or inter-population variation. Further study of geographic variation in color variation of the species will be required to distinguish between these hypotheses.

CONCLUSION AND RECOMMENDATION

The occurrence of *Pelophryne albotaeniata* and the presence of other locally endemic amphibian species are indicators of a viable and intact forest ecosystem in northern Palawan. Taking into consideration the 'Endangered' and 'Vulnerable' IUCN conservation status of three recorded species, Cleopatra's Needle Mountain Range can be considered a key area for amphibian species conservation in the Palawan faunal region. The first step in this conservation effort is enlisting local stakeholders in public education, sustainable use of forest resources, and establishment of administratively formalized protected area status for the Cleopatra's Needle Mountain Range.

Additional research is needed to increase our understanding about of population status and conservation biology of *Pelophryne albotaeniata* and other amphibians in northern Palawan. The genetic relationships of the population of *P. albotaeniata* on Cleopatra's Needle (northern Palawan), the original type locality (Thumb Peak, central Palawan) and Mt. Mantalingahan Mountain Range (Southern Palawan) should be investigated to get a clearer picture about the relationship between these populations in an effort to gain more understanding about the biogeography and dispersal of amphibians on the island.

It is our hope that the results of this initial survey will trigger further research and conservation action focused on the amphibians at Cleopatra's Needle and other parts of Palawan. As updated field surveys

and new distributional data have become available elsewhere in the archipelago (Siler et al., 2011; Siler et al., 2012; Devan-Song & Brown, 2012; Diesmos et al., 2005; Diesmos et al, 2002), Palawan amphibian studies have conspicuously lagged behind due to bureaucratic obstacles to research (Brown *personal communication*, 2014). Great strides could be made if a comprehensive Palawan faunal region amphibian biodiversity inventory (and full taxonomic and conservation status assessment) were undertaken in a coordinated fashion in the years to come.

ACKNOWLEDGEMENTS

The preliminary herpetological survey at the Cleopatra's Needle Mountain Range was made possible through the financial contributions of the Centre for Sustainability for an upcoming conservation program in collaboration with Rainforest Trust, Global Wildlife Conservation and the Amphibian Survival Alliance. We especially thank Samuel, Tirso and Oliver from the Batak tribe of Kalakwasan for their assistance in the field and Dr. Rafe Brown for his feedback on the manuscript.

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APPENDIX

Barbourula busuangensis

Ingerophrynus philippinicus

Pelophryne albotaeniata

Limnonectes acanthi

Leptobrachium tagbanorum

Megophrys ligayae

Hylarana moellendorffi

Sanguirana sanguinea

Staurois nubilus

Philautus longicrus

Polypedates macrotis

Fig. 3: Amphibian species encountered during the visual survey at Cleopatra's Needle, Palawan.

Fig. 4: Aerial shot of Cleopatra's Needle, Palawan (© Jonah van Beijnen).