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Reptilian Diversity in Clarin River, Misamis Occidental, Philippines

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Abstract

Reptiles are considered one of the most ecologically important bioindicators. Reptilian diversity was examined in the riparian area around Clarin River which is one of the most important river systems in Misamis Occidental province. Three sampling sites representing the upstream, midstream, and downstream portions of the river were assessed, using visual encounter and cruising method. A total of 12 species were recorded, six of them are endemic. The results indicate a high level of endemism (50%), and conservation measures are critical to conserve the biodiversity in Clarin River, especially along the downstream, where the anthropogenic influence is the highest. Environmental strategies and plans should be implemented to ensure the conservation of the reptile species in the area.

Keywords: bioindicators, conservation, endemism, sampling, species

Introduction

Reptiles are among the most ecologically important organisms in the ecosystem. They are found around the world, represented on land, in freshwater, and in a great variety of habitats (Baard & de Villiers, 2000). They have been one of the important components of the food web in most ecosystems, either as a predator or a prey. As one of the dominant animals, reptiles have endured the drastic changes in the environment to be more influential with other populations. Lizards, particularly the herbivorous ones, serve as nectar and fruit consumers as well as pollinators and seed dispersers, commonly on islands (Olesen & Valido, 2003). Snakes are ecologically important as predators, such as gopher snakes on songbird nests (Eichwoltz & Koenig, 1992), while crocodilians play an important role in maintaining the productivity and diversity of wetland ecosystems to which humans depend (van der Ploeg et al., 2011).

Reptiles are considered as ecologically and phylogenetically diverse (Huey, 1982). However, reptile diversity has been the least studied among terrestrial vertebrates (McCain, 2010), especially in the Philippines. Recent studies in Cagayan and Isabela provinces (Brown et al., 2013), Subic Bay area (Devan-song & Brown, 2012), as well as in Mt. Hamiguitan (Relox et al., 2011), Agusan Del Sur (Balmores & Nuñeza, 2015), and Southern Mindanao (David et al., 2006) are evidences of the growing interest in studying them. Diversity among reptiles is particularly high in arid regions around the world (Cosentino et al., 2013). Information about their diversity is important in the conservation of the habitats to where each reptile lives (Schmidt et al., 2005). Globally, the diversity and population of reptiles along with amphibians are affected due to different factors, including the loss of habitat due to land-use practices (Hutchens & DePerno, 2009), planned infrastructures (Benayas et al., 2006), or commercial use (Tisdell et al., 2004).

High damage made by improper agricultural practices such as illegal logging leads to the loss of habitat and biodiversity (Botejue & Wattavinadage, 2012). Since reptiles are secretive in habits, they are poorly understood by the public compared to the other groups of animals

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in the wild. Being a significant indicator if the environment is disturbed or not, reptiles are known to have poor dispersal abilities, which could lead to a decrease in their diversity, should their habitats be disturbed. In fact the current situation is that their population is declining along with amphibians, given their limited dispersal (Benayas et al., 2006). Conservation methods are associated with likeability and commercial use of each reptile species (Tisdell et al., 2004).

Clarin River is considered as one of the most important river systems in the province of Misamis Occidental. It forms a natural boundary between the city of Ozamiz and the municipalitiy of Clarin (Labajo-Villantes & Nuñeza, 2014). It is a major provider of clean water needed for domestic, agricultural as well as for commercial use. Being an important source of water in the province as well as an abode for various wildlife, identifying the current status of Clarin River is important to know if the area is environmentally healthy or not. Unfortunately, no studies were conducted about the reptile diversity in the area. This study aimed to provide substantial data for the local inhabitants and to the general public about the relationship between biodiversity and the level of disturbance in and around the river. As a significant bioindicator (Webb et al., 1989), studying the reptile diversity in Clarin River will help identify the various species of reptiles that thrive within the area, and at the same time could be used as an invaluable evidence for conservation measures to be taken in the area. The importance of conserving the area and the preservation of the river is necessary not only for the sustainment of the water needs among the local residents, but as well as for the maintenance of biodiversity in the area.

Materials and Methods

Study area and sampling sites

Misamis Occidental is a province located along the northern part on the island of Mindanao. Covering three cities and fourteen municipalities, the province has five major river systems which include Clarin River (Figure 1).

Clarin River is one of the major river systems in the province situated along the boundary of the city of Ozamiz and the municipality of Clarin in Misamis Occidental, with coordinates of 123°37'30" to 123°13'10" E and 8°7'30" to 8°13'10" N. Located at the southeastern part of the province, it stretches approximately 20 km across, and its headwaters start from the foot of Mt. Malindang, sloping down the city of Ozamiz and the municipality of Clarin, where it empties into Panguil Bay. Three sampling sites were chosen for the study, which are representations of the upstream, midstream, and downstream portions of the river. The three sites are located within Barangay Stimson Abordo in Ozamiz for the upstream, Barangay Guba in Clarin for the midstream, and Barangay Pan-ay in Clarin for the downstream. The areas in the upstream are where the headwaters of Clarin River flow and there is limited anthropogenic influence, while the areas in the midstream and downstream have apparent anthropogenic influence, the river being located near households.

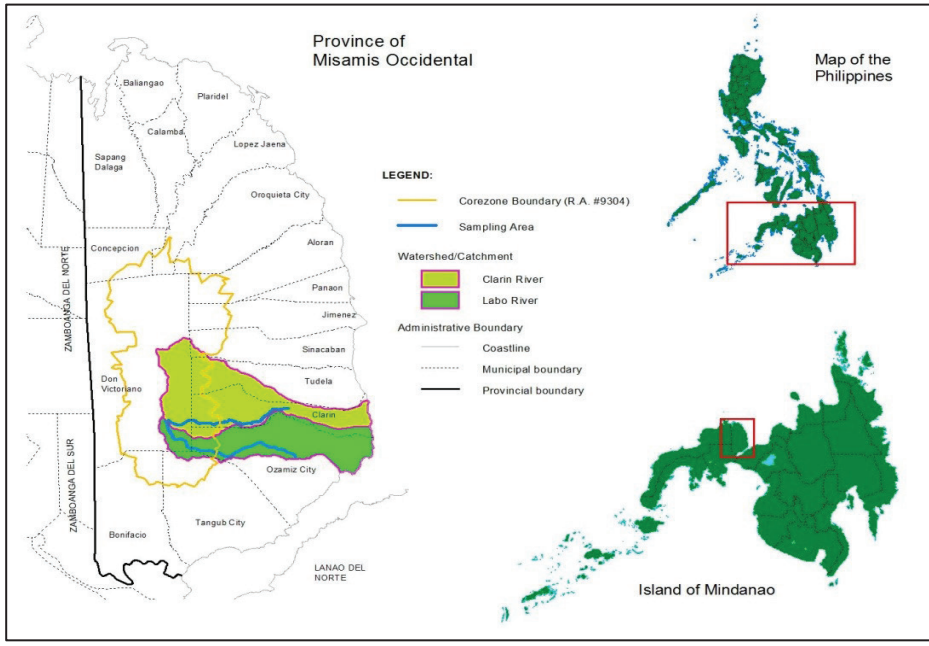

Figure 1. Map of the province of Misamis Occidental, showing the location of Clarin River. (Source: googlemap.com)

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Data gathering

Field study for the collection of samples was done along the three sampling sites for three to five days for each site. Samples were collected through visual encounter surveys and cruising method. This is done during the morning, early in the afternoon as well as during the night, as some reptiles are nocturnal. These are considered as the period of greatest activity for reptiles (Nuñeza et al., 2015). The captured samples were placed in sample bags with adequate ventilation. All encountered reptile species were captured, however, some of them escaped prior to capture. Those individuals that escaped were identified to species level (Hanson & McElroy, 2015).

Data processing

Each collected specimen was measured using the following morphometrics: Head length (HL), Head width (HW) Eye diameter (ED), Snout to vent length (SVL), Tail to vent length (TV), Total length (TL). Body weight (BW) was taken using a spring balance.

The identification of each species was based on Photographic Guides while the verification was done by Dr. Rafe Brown, a renowned and expert herpetologist from the University of Kansas. Biodiversity indices such as species richness, relative abundance, species diversity (Shannon H'), evenness, and degree of endemism for each site sampled were also determined using the PAST Software. The conservation status of the species was also determined based on the IUCN (The International Union for Conservation of Nature) 2018 list. The ecological use of species was obtained from existing documents and people in the community.

Results and Discussion

A total of 12 species belonging to six families and 10 genera were recorded from the three sampling sites of Clarin River (Table 1). Four species were documented in sampling site 1 (Upstream, Brgy. Stimson Abordo), five species in Sampling Site 2 (Midstream, Brgy. Guba), and five species in sampling site 3 (Downstream, Brgy. Pan-ay).

Table 1. Reptile species recorded at Clarin River, Misamis Occidental.

Family and Scientific names	Common Name	Philippine Endemic	Conservation Status (IUCN 2018)	Sampling Sites			Total
				1 Upstream	2 Midstream	3 Downstream	
Agamidae							
Draco cyanopterus	Flying lizard	Yes	Least Concern	0	0	2 (14.29%)	2
Draco bimaculatus	Two-spotted Flying Lizard	Yes	Least Concern	0	1 (11.1%)	0	1
Bronchocela cristatella	Green crested lizard		Not Evaluated	1 (10%)	0	0	1
Colubridae							
Boiga cynodon	Dog-toothed Cat Snake		Least Concern	0	1 (11.1%)	0	1
Dendrelaphis caudolineatus	Striped Bronzeback		Least Concern	0	2 (22.22%)	0	2
Chrysopelea paradisi	Garden flying Snake		Least Concern	0	0	1 (7.14%)	1
Elapidae							
Naja samarensis	Samar Cobra	Yes	Least Concern	0	0	1 (7.14%)	1
Gekkonidae							
Gekko gecko	Tokay gecko		Not Evaluated	0	3 (33.33%)	5 (35.71%)	8
Hemidactylus frenatus	Common House Gecko		Least Concern	0	2 (22.22%)	5 (35.71%)	7
Natricidae							
Rhabdophis auriculata	White-lined Water Snake	Yes	Least Concern	3 (30%)	0	0	3
Rhabdophis lineatus	Zigzag-lined Water Snake	Yes	Least Concern	4 (40%)	0	0	4
Scincidae							
Tropidophorus misaminius	Misamis Waterside Skink	Yes*	Least Concern	2 (20%)	0	0	2

*Mindanao Endemic; () Relative Abundance

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Continued: Table 1. Reptile species recorded at Clarin River, Misamis Occidental.

	Sampling Sites			Total
	1 Upstream	2 Midstream	3 Downstream	
Total No. of individuals	10	9	14	33
Total No. of species	4	5	5	12
Total No. of endemic species	3	1	2	6
Relative abundance	30.3%	27.27%	42.42%	
Endemism	50.00%	16.67%	33.33%	50.00%

Out of the 12 species, six are endemic, including five Philippine endemic (*Draco cyanopterus, Draco bimaculatus, Naja samarensis, Rhabdophis auriculata, Rhabdophis lineatus*) and one Mindanao endemic (*Tropidophorus misaminius*), which was only documented in Sampling Site 1 (Upstream), the forested site. Photos of four endemic reptiles are shown in Figure 2. Of the 12 species, three (*R. auriculata, R. lineatus* and *T. misaminius*) are direct river-dwellers, while the rest are tree and grass dwellers near the river. The river-dwellers were caught underneath rocks, and in the case of *R. auriculata*, swimming in the river. Of the tree-dwellers, they were encountered residing in coconut trees found along the riverbanks. The lone grass dweller, *Dendrelaphis caudolineatus*, was encountered along the damp grass area near the river along sampling site 2 (Midstream, Brgy. Guba).

Sampling site 3 (Downstream, Brgy. Pan-ay) had the highest relative abundance (42.42%) while sampling site 2 had the lowest (27.27%). This can be attributed to the fact that sampling site 3 has lower elevation compared to sampling sites 1 and 2, and therefore has more heat in the surroundings, which is needed by reptiles to provide optimum heat for their survival. It reflects the results of studies conducted by Relox et al. (2011) and Balmores and Nuñeza (2015), in which they concluded that lowland areas tend to harbor higher species richness and diversity of reptiles. This is probably due to the tendency of

reptiles, especially snakes, to move to lowland areas, which bears more rice fields and households, as these places harbor more rodents, which serve as their food.

Rhapdophis lineatus

Rhabdophis auriculata

Tropidophorus misaminius

Naja samarensis

Figure 2. Endemic reptile species found in Clarin River, Misamis Occidental.

In terms of endemism, sampling site 1 (Upstream, Brgy. Stimson Abordo) recorded the highest level of endemism among the three sampling sites (50.00%), while sampling site 2 (Midstream, Brgy. Guba) had the lowest (16.67%). This high level of endemism in the upstream can be attributed to the fact that the area in Brgy. Stimson Abordo is less disturbed and less influenced by anthropogenic activities compared to the other two sampling sites.

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All the sites showed moderate species diversity and well distributed species (based on the evenness result), as indicated on Table 2. Sampling site 2 (Midstream, Brgy. Guba) scored the highest species diversity (1.523) and evenness (0.9172), while Sampling site 1 (Upstream, Brgy. Stimson Abordo) scored the highest species dominance (0.3).

Table 2. Species richness, dominance, species diversity, and evenness of the reptile species recorded at Clarin River, Misamis Occidental.

	Sampling Sites		
	1 Upstream	**2 Midstream**	**3 Downstream**
Total no. of individuals	10	9	14
Total no. of species (Species Richness)	4	5	5
Dominance	0.3	0.2346	0.2857
Species Diversity (Shannon H')	1.28	1.523	1.39
Evenness	0.899	0.9172	0.8033

The relatively low number of captured reptiles reflects the findings of Delima et al. (2008) and Relox et al. (2011), which attributed it to the fact that some individuals have small sizes and often residing underneath leaf litter, while some are camouflaged well, in addition to their ability to escape even before they were noticed or captured. The nature of reptiles living in their habitats also affected the number of encountered individuals (Harings et al., 2014). These results can contribute heavily to the ultimate goal of a near-complete understanding of the reptile diversity of the Philippines and the understanding of the evolutionary history of Philippine biodiversity (Siler et al., 2011).

Conclusion and Recommendations

The reptilian diversity in Clarin River is moderate with species that are well distributed. The river upstream supports a relatively high level of endemism compared to midstream and downstream. It is therefore important to conserve the forested area around the upstream as far as possible. The increased anthropogenic influence around the river

must also be minimized, as it poses a threat to reptile diversity, which could result to long-term effects.

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