A Reassessment of Three Species of Herpetofauna in Silliman University Campus, Dumaguete City, Philippines

ELY L. ALCALA*, ABNER A. BUCOL, and ANGEL C. ALCALA

**alcala_ely @yahoo.com*

Silliman University Angelo King Center For Research and Environmental Management, Angel C. Alcala Marine and Environmental Laboratories, Bantayan, Dumaguete City

Abstract

A study reassessing the population status of two anurans, *Fejervarya cancrivora,* and *Hylarana erythraea,* and one scincid lizard, *Lamprolepis smaragdina,* was conducted in Silliman University campus during the last quarter of 2011 up to the early quarter of 2012. The study made counts of the population sizes of the three species in their microhabitats. These species were studied earlier in the 1950s, 1970s, and 1980s, respectively. The habitats included ponds, rice fields, and rain trees. Results of the study indicate that there are now fewer *L. smaragdina* living on rain trees and fewer *H. erythraea* living in the artificial concrete ponds in the main campus. On the other hand, *F. cancrivora* was still observed in fairly large numbers in fishponds while *H. erythraea* was also observed to be common in the abandoned water-logged farm fields. The low populations of *L. smaragdina* and *H. erythraea* in the main campus were attributed to habitat change and human disturbance. The study recommends improvement in the management of the animal habitats which include the retention of tree epiphytes and the discontinuity in the use of toxic substances to clean ponds, among others. It also recommends the continuous monitoring of the three species together with the other campus wildlife.

Keywords: campus, herpetofauna, Philippines

INTRODUCTION

Amphibian and Reptilian population declines have been attributed to habitat destruction, overexploitation, disease outbreaks, and climate change (Stuart et al. 2004; Gallant et al., 2007). More so, climate change has been strongly associated with the decline and extinction of amphibian populations throughout the world during the last decade (Pithiyagoda et al., 2008). The impact of climate change on amphibian population is further exacerbated by the synergistic effects of habitat destruction and diseases (Puschendorf et al., 2008). On the other hand, although reptiles show resiliency towards climate change, they are equally vulnerable to habitat change caused by deforestation and urbanization (Gallant et al., 2007).

Although the Philippine herpetofauna has been studied since the early 1900s, only very few studies have focused on population changes, especially under campus conditions. Studies covering aspects of population change include the work of Alcala et al. (2004), which documented the loss of moisture-dependent species in rainforest` fragments, and of Ong et al. (1999) on campus wildlife.

It is of interest to resurvey the campus herpetofauna and compare the present population status with the findings of earlier studies of these species. These previous studies dealt with the Green Tree Skink Lamprolepis smaragdina philippinica (Reyes, 1958), the Common Green Frog Hylarana erythraea (Brown and Alcala, 1970) and the Brackishwater Frog Fejervarya cancrivora (Alcala and Alcala, 1980). The fourth species found on the campus, Kaloula conjuncta negrosensis, was not studied; it is a fossorial species and is still common on the Silliman University campus. The present campus herpetofaunal survey is part of a larger study to determine campus wildlife habitability on the campuses of Central Philippine Adventist College, Negros State College of Agriculture, and Silliman University.

MATERIALS AND METHODS

The study on campus herpetofauna employed the use of capture-release method (refer to Alcala, 1962; Brown et al., 1996) which allowed the researchers to handle the animal briefly and to identify them. Museum specimens were also referred to validate localities for species earlier collected in the area. Direct observation was employed to study the Green Tree Skink, Lamprolepis smaragdina. This was conducted during the mornings and afternoons when the skink was more active and conspicuous on their tree habitats (Fig.1). Night observations and frog counts were made in the former study sites of H. erythraea and F. cancrivora, which included the fish ponds, mangrove area (Fig. 2), and rice fields at the farm site, and artificial concrete ponds at the main campus. The population estimates were based on counts per unit area (density) expressed in terms of number of individuals per hectare and the ratio of number of skinks observed living on trees.

Fig. 1 Tree habitat of *Lamprolepis smaragdina*

Fig. 2 Mangrove habitat of *Fejervarya cancrivora*

Selected climatic variables, which included air temperatures, rainfall, and humidity were monitored during the study. These were compared with the climatic variables reported in the earlier studies. Historical records on air temperatures were obtained from published literature, which in turn were based on the nearest weather station (circa 300m from the study site). On-site temperature and humidity readings were also made using a portable digital hygrometer while habitat exposure to sunlight was made using a light meter. The data on temperature and humidity were analyzed using mean standard values and were compared with the local weather station data.

RESULTS

Environmental Factors

Temperature readings taken during the study show mean air temperatures of around 31.35±1.30°C inside the mangrove plantation while 33.01±1.03°C was recorded outside and adjacent to the mangrove forest. In addition to this, Relative humidity (RH) readings were higher in the mangrove forest at 62.87±4.6% compared to that in the open area with only 59.91±4.7% RH. Similarly, light penetration is lower in the mangrove forest (2,375.27±2,248.66 lux) compared to this recorded in the open area (61,227.27±10,858.19 lux).

Population counts

The present *Lamprolepis smaragdina* counts total to 10 individuals. Three of the individuals observed were found separately inhabiting different rain trees *(Samanea saman)* at the main campus while seven were found on three separate rain trees at the Farm campus. The observed density was roughly one skink per 27 trees in 12 hectares planted with 273 Rain trees. We also observed some Green Tree Skinks inhabiting trees other than the rain tree in residential areas outside the campus. We did not observe the species venturing into open grass areas and buildings adjacent to their tree habitats at the main campus.

Our recent counts of the *H. erythraea* species living in ponds and paddies (ca. 100 m^2) adjacent to the SU Marine Laboratory and farm fields is between 20 to 30 individuals with an average density of 1 individual per 4 m^2. In addition to this, only eight individuals of the species were found in one of the three artificial concrete ponds on the main campus. On the other hand, *Fejervarya cancrivora* was also found common in the mangrove garden (demonstration forest) of SU Marine Laboratory (circa 1.0 hectare). During one of the sampling runs, 28 individuals were observed in an area of 100 m x 10 m (1000 m^2).

DISCUSSION

Temperature and Rainfall

Our temperature readings were slightly higher than those recorded by the PAGASA weather station from 2006 2009, probably due to the difference in calibrations and degree of sensitivity of instruments used by the study and weather station. In comparison, during the period 1954 1958, Alcala (1962) reported that mean annual air temperatures were 26.0°C (January) and 29.1°C (May), representing the lowest and highest values, respectively. From 1962 -1964, Brown and Alcala (1970) reported minimum ranges of 20–-25°C and maximum ranges of 29-34°C. Moreover, rainfall data recorded from 2009–2010 by PAGASA, was relatively higher in September to October 2009, varying between 120–150 mm while low rainfall (below 50 mm) was observed in February to May 2010 (Fig. 3). The decline in rainfall in 2010 was attributed to the El Niño Southern Oscillation (ENSO) Event (Yumul et al., 2010).

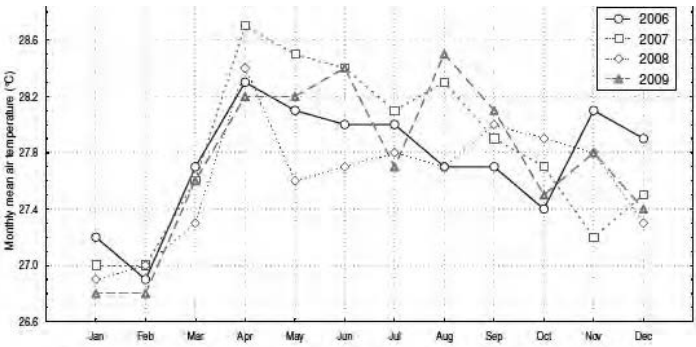

Figure 3. Monthly mean air temperature data from PAGASA Dumaguete Weather Station (2006–2009).

Reduction of Green Tree Skink and Frog Populations

The results of the re-survey showed that fewer Green Tree Skinks are living on the campus today. The present ratio of 1 skink per 27 rain trees is a stark comparison to the 1:5 ratio obtained by Reyes (1957) in 1955. In the same year, Reyes counted at least 45 individuals living on 224 Rain trees (Reyes, 1957). In the same study, he was also able to observe a maximum of four individuals living in one tree. After six decades approximately the recent counts show a reduction of at least 80%, from 45 to 10 individuals of the Green Tree Skink population (Table 1).

Table 1. Comparison of population counts and estimates of three herpetofauna species studied during the early years and recent times.

Species	Earlier counts/estimate (1960s & 1970s)	Recent counts (2011-2012)
L. smaragdina	45 individuals	10 individuals
H. erythraea	450 individuals in three artificial ponds	8 individuals in one artificial pond
F. cancrivora	circa 30 individuals per pond *	28 individuals in one pond

*Alcala, pers. comm.

The apparent decline of L. smaragdina population in the campus could be attributable to habitat change and environmental perturbations. Observations of Reyes

(1957) on the Green Tree Skink feeding range extended beyond the skink's tree habitats to include nearby buildings which were then mostly made of thatched nipa roofs and wooden beams and rafters. These structures may have harbored insects because they served as favorite haunts for the Green Tree Skink. The present buildings lying adjacent to these tree habitats are now made of concrete and steel and are treated with insecticides (Ami, pers comm.). In addition to this, the removal of Sampaguita (Jasminum sambac) hedgerows growing under the rain trees may have adversely affected the skink's feeding habits. Indeed, Sampaguita plants are known to harbor lepidopterans, the major source of food for the skinks (Reyes, 1957). These plants, which were deliberately removed during the 1980s, have been lately replanted.

Another explanation for the decline in skink population is arboreal habitat disturbance. We noted that many of the aerial ferns that used to grow on the bows of the century-old rain trees have significantly declined due to frequent clearing and pruning. The reduction of aerial ferns (Drynaria quercifolia, Davallea denticulata, and Pyrrosia adnascens) and other epiphytes may have reduced the skink habitats and feeding grounds while the constant pruning may have affected the habitability of the tree due to the increased exposure of the tree trunks and branches. The hazard of overexposure has been elucidated by Alcala and Brown (1966) who observed lizards dying from overexposure to the midday sun. Linking climate change to overexposure of skink habitats cannot be ascertained by the present study and may require further investigation.

Earlier reports of Brown and Alcala (1970) showed that from 1962 to 1964, between 1,000 to 4,000 *Hylarana erythraea* individuals were observed living along the 1 km stretch of Mojon creek and its immediate vicinity. The recent density count of one individual per 4 m^2 shows a healthy population still living near the creek. However, it should be noted that the recent study no longer involved the creek due to its polluted condition and presence of fence and other structures which made it difficult to access. On the other hand, the population of frogs living in ponds on the main campus was represented only by eight individuals. Only one of the three ponds now harbors the species. This particular pond called the Biology Pond (Fig. 4a) is a presumably habitat for a large population of *H. erythraea* (Fig. 4b). Brown and Alcala (1970) marked some 450 individuals living in this pond during their study. One of the authors, Ely Alcala, recalls seeing many individuals living in and around all three ponds during the 1980s. Although we have not fully ascertained when and how the population declined, it has been suggested that the frog population was affected by the regular draining of these ponds, which often left the pond dry for over a long period, and the removal of pond vegetation which served as cover for the frogs. Another possible cause for the loss of frogs in the other two ponds is poisoning. The use of herbicides to control pond vegetation can have drastic effects on frogs living in the ponds (Howe et al. 2004).

Fig. 4a an artificial breeding pond of anurans within the main campus.

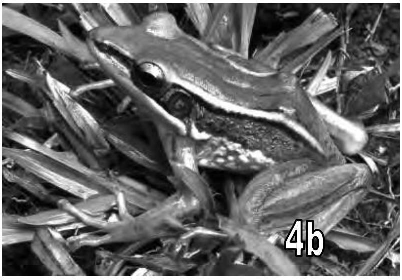

Fig. 4b *Hylarana erythraea*, a species that has since declined on the main campus but still common on the farm fields of Silliman.

The population of the two frog species (*F. cancrivora* and *H. erythraea*) at the farm ponds appeared stable since the 1970s and 1980s up to the present. We observed several adults and tadpoles in the area during sampling.

The two species of frogs have been classified as Least Vulnerable to climate change (Alcala et al., 2012).

Other factors affecting the campus herpetofauna population

In addition to habitat and climate change, predation was also considered a limiting factor for population change (Table 2). We noted the apparent absence of the Dog-faced Water Snake Cerberus rynchops, a major predator of frogs during the recent survey. Instead only the mud crab and kingfisher, also known predators of the frogs were observed in the fishpond area. Similarly, predation was also not apparent at the main campus artificial ponds, where *H. erythraea* is found in low numbers. In addition to this, we did not observe a predator feeding on the Green Tree Skink. Although the effects of predation are not apparent in all the studied sites, it is presumed that animal populations fluctuate under natural conditions (refer to Vuolevi, 2001).

Table 2. Summary of observed effects of climate change, habitat change, and predation on the surveyed herpetofauna species in Silliman campus.

Species	Climate change	Habitat change	Predation
L. smaragdina	Possible but requires further investigation	Apparent; mainly due to human disturbance	Not apparent
*H. erythraea**	Not apparent; Least vulnerable to climate change*	Apparent; mainly due to human disturbance	Not apparent
*F. cancrivora**	Not apparent; Least vulnerable to climate change*	Not apparent	Not apparent

*classified as Philippine amphibians least vulnerable to climate change (after Alcala *et al.* 2012)

CONCLUSION AND RECOMMENDATIONS

The study showed that between climate change, habitat change, and predation, habitat change appears to be the prevailing factor affecting the Silliman herpetofauna (Table 2). The *L. smaragdina* and *H.*

erythraea are both prone to the adverse effects of habitat change caused by human activities

The study recommends further monitoring of the Green Tree Skink population at the main campus. It also recommends the preservation of aerial ferns and other aerial epiphytes growing on rain trees so that it can continue to provide shelter for lizards and other animals. Last but not the least, ground maintenance should put more effort in making the ponds more habitable by not draining the ponds, discontinuing the use of herbicides, and maintaining enough vegetation for animal cover.

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