



**Full Length Research Article**

**POPULATION DENSITY AND DISTRIBUTION OF BLACK SHAMA (*COPSYCHUS CEBUENSIS* STEERE)  
IN MT. LANTOY KEY BIODIVERSITY AREAS IN ARGAO, CEBU, PHILIPPINES**

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**ABSTRACT**

Distance sampling point transect method was used to determine the population density of *Copsychuscebuensis* among the selected forest patches in Mt. Lantoy Key Biodiversity Areas in Argao—an area of high conservation importance in Cebu. Distance 6 Release 2 software was also used in estimating the population density of the target species in three sampling sites namely Barangays Tabayag, Cansuje, and Canbantug. Results have shown that brgy. Tabayag has 26 individuals per hectare for mixed and pure forest strata with coefficient of variation (CV) at 18.29%, brgy. Cansuje has 49 individuals per hectare with CV of 14.53% both for mixed and pure strata, and brgy. Canbantug has 36 individuals per hectare with CV of 59.23% for mixed and 31 individuals per hectare with CV of 59.37% for pure strata respectively. The higher CV obtained at brgy. Canbantug is may be attributed to the lesser number of samples (n=36) since Distance 6 Release 2 software requires at least 60-80 samples and the least is 40 to have more precise results. *C. cebuensis* were also widely distributed along median to lower elevation especially at valley bottom on areas with higher canopy cover and higher relative humidity. Though the target species is globally endangered yet at the local level especially on forest patches being sampled they are still widely distributed due to its tolerance across all habitat type be it mixed, pure and plantation forest.

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**INTRODUCTION**

*Copsychuscebuensis* whose common name is Cebu Black Shama and locally called “Siloy” is endemic to the island of Cebu, Philippines. It belongs to Order Passeriformis and Family Muscicapidae. It inhabits primary forest and the dense undergrowth of secondary habitats or along steep ravines, particularly beside ridge-top and valley-bottoms with a high percentage of canopy cover (Birdlife International 2012). Based on the International Union for the Conservation of Nature (IUCN) *Red List of Threatened Species* in 2013 this species qualifies as Endangered as it has a very small range and population, both of which are continuing to decline. Additionally, it suffers severe fragmentation owing to extreme pressure on the few remaining, already highly degraded, tracts of forest in Cebu Province that still support subpopulations (Birdlife International 2012). Mt. Lantoy Key Biodiversity Areas (KBA) cutting across 11 barangays located within Argao municipality is an area of high conservation importance

for it has been declared by IUCN as one of the 117 important bird area (IBA) and a key biodiversity area (KBA) in the country (National Biodiversity Strategic Action Plan 2002; Birdlife International 2012). However, the biodiversity of these areas are threatened posed by human activities such as illegal settlement, shifting cultivation, illegal cutting of trees for house construction, firewood gathering and habitat clearance for mining (Malaki and Buot, 2011). Consequently, this may eventually affect the present subpopulation of *C. cebuensis* or the target species. Previous studies on the target species has been very limited but no attempt has ever been done yet especially in quantifying the existing population size or density of *C. cebuensis* particularly in the three selected forest patches in Mt. Lantoy KBA in Argao, Cebu. Whether or not the population density of the target species within the study site is decreasing or increasing this remains to be seen. This proposed study however, intends to bridge this gap by means of generating approaches and/or strategies pertaining to the conservation, planning and management interventions of the target species through benchmarking from the findings of the proposed study. Intensive fieldwork in 2004 on Nug-as in Alcoy in Cebu revealed that the target species is significantly

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more widespread than was previously known. There have been 85 individuals sighted across 7 km of transects. Extrapolations based on these sightings suggest that up to 2,500 individuals could be present at Nug-as (Jakosalem *et al.*, 2005). But this finding has not ever been verified with the other site or location like the case of Mt. Lantoy KBA such as in Brgy. Tabayag, Brgy. Canbantug, and Brgy. Cansuje in Argao.

This study aimed to:

1. Estimate the population density of *C. cebuensis* in three selected barangays within the Mt. Lantoy KBA;
2. Recommend approaches and/or strategies for conservation and management initiatives of the target species.

## MATERIALS AND METHODS

### The Sampling Sites

Data collection were concentrated in three sampling sites (Fig.1) within the Mt. Lantoy KBA's composing 11 barangays within the jurisdiction of the municipality of Argao. These sampling sites are in Barangay Tabayag (sampling site 1), Barangay Canbantug (sampling site 2), and Barangay Cansuje (sampling site 3). These barangays have forest patches which are adequately stocked with forest trees including planted and natural vegetation—a potential habitat for Black shama or the target species.

### Barangay Tabayag

Barangay Tabayag lies 14 kilometers west (UTM: 1094773 E; 559276 N) of the town of Argao, Cebu (Fig. 1). It occupies the northwestern and southern mountain ridges and some of the lower slopes in Argao Watershed. It cuts across the watershed with steepest slopes ( $26^{\circ} - 50^{\circ}$ ) to the top of the mountain range and gentler slopes of  $9^{\circ} - 15^{\circ}$  towards lower part. Most part lies between  $6^{\circ} - 25^{\circ}$  in slope. The elevation of this study site ranges from 300 to 700 m above sea level (a.s.l). Tabayag is covered by faraoon clay loam (SEARCA 1995). The productivity of cropping on faraoonclay loam is limited by the soils susceptible to erosion particularly in upper slope position. The soil pH ranges from 6.5 to 8.2. Barangay Tabayag has a total population of 782, distributed over 185 households. The female-male ratio of the population is 1.06: 1.16 (SEARCA, 1995). Most of the residents are concentrated in the sitios of Cabalawan, Binalabag and Pinogot, which are located in the lower parts of Argao Watershed. Farmers generally reside in or near one of their farms resulting in the formation of widely dispersed houses. A number of them, however, reside in the lower portion of the watershed near the barangay elementary school and the DENR checkpoint. Majority of the residents are semi-subsistence maize cultivators. They also engage in contractual employment as source cash income. Alternative forms of local employment include weaving, furniture making and doing part-time job in mining, construction and factory in urban centers. Most households also cultivate home gardens and raise livestock, mostly pigs, chickens and goats. Some households have coconut holdings and others produce vegetables for sale in Cebu City markets.

### Barangay Canbantug

Barangay Canbantug is located 20 kilometers southeast (UTM: 1092566 E; 556407 N) of the municipality of Argao (Fig. 1). A motorcycle can reach the site in one hour and a four-wheel vehicle in less than an hour. The topography of the area is moderately sloping with some portions that are quite steep. The elevation ranges from 500 m to 800 meters a.s.l. Abundant water flows from springs in the central and lower portions of the barangay. This irrigates small rice fields downstream. This site has two soil types, namely; Mantalongonclayloam and Lugo soils. Mantalongonclayloam was also the most extensive soil type in this site. Forest patches left were both native and plantation. Figs were abundant within this sampling site occurring on steep slopes and rocky areas usually dominate native forest patches. Mahogany (*Swieteniamacrophylla* King) and gmelina (*Gmelinaarborea*) were also the species planted by DENR in their reforestation projects which started in the late 1960's. The barangay has 150 households. The average number of children is 5. About 95% of the residents depend on farming, such as corn, rice and other vegetable crops, as means of livelihood. Households have an average annual income of ₱10, 000.00. Due to low income, husbands and teenage children move to Cebu City and other urban areas to seek employment and augment family income (DENR 2001).

### Barangay Cansuje

Cansuje is located northeast (UTM: 1096083 E; 555974 N) and about 15 kilometers from the town of Argao (Fig. 1) via Usmad road on the northern side of the Argao watershed. The elevation ranges from 600-700 m asl. Natural or native forest patches left also mixed with mahogany, gmelina and other species. This sampling site was also reforestation area of the former Southern Cebu Reforestation Development Project (SCRDP) of DENR formerly Bureau of Forest Development (BFD) back in the 1970's. Both strangler and erect figs in the Moraceae family were also abounds within the site growing on steep and rocky slopes. Grasses such as bamboos both climbing and erect which are favorite habitat for Black shama were also abundant in the area (Kennedy *et al.*, 2000). However, the site was also surrounded by cultivation planted with coconuts, corn and a variety of vegetation.

### Identification and Selection of Sampling Sites

Land use land cover (LULC) map of the study site (Argao watershed) was used as guide in the identification and selection of the sampling sites. There were three sampling sites (Fig. 1) being determined on the basis of the availability of forest habitat patches and being part of Mt. Lantoy KBAs where conservation importance is highlighted. The initial identification and selection of survey/sampling areas were solely confined on areas classified as forest land or timberland. The sampling areas were pre-identified and selected and where marked off on the LULC map of the watershed and then verified on the ground based on the random ground truth or GPS generated coordinates from the LULC map of Argao that generated from SPOT-5 using ArcInfo version 10 software program.

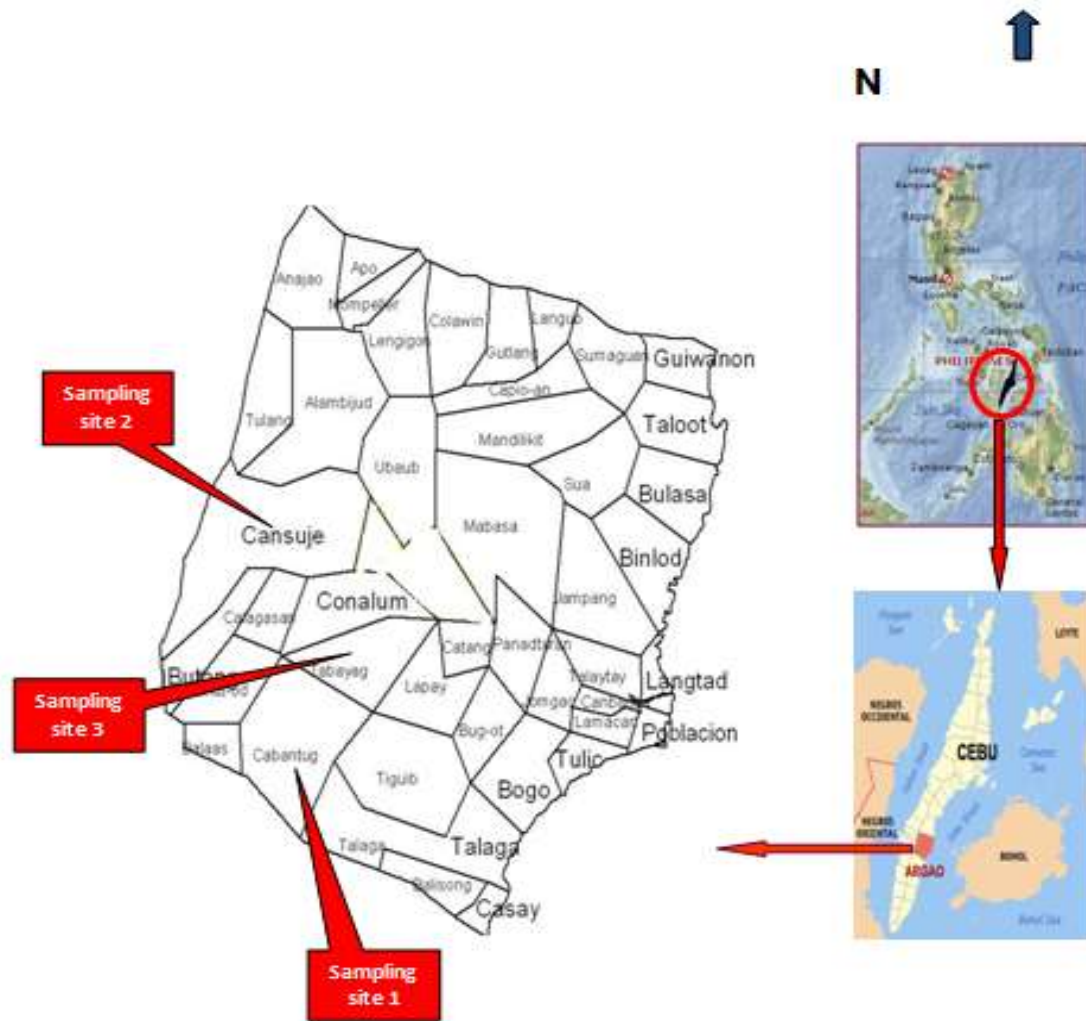


Figure 1. Location map of the sampling sites (with Philippine map and map of Cebu inset)

GPS receiver was then used in this later operation especially in taking down the ground coordinates of the three sampling sites, respectively.

### Establishment of Survey Stations

At least two survey field guides were hired for every sampling site that have been visited. The survey runs from April 21 to May 23, 2014 (almost 1 ½ months) and it was conducted during the breeding period of the Black shama or the target species. Each sampling site has been surveyed and sampled based on their pre-determined schedule. Random establishment of different sampling point count stations have been undertaken among sampling sites depending on the availability of the forest patches. A target of 80 point transect stations with 20 meter radius where supposedly established (Fig. 2) for every sampling sites as a requirement of the software (Distance 6, release 2), however, this was not made possible on this survey owing to the very limited time available during the semestral break. However, GPS receiver was subsequently used in taking down the geographic coordinates on every point station established prior to data collection on the target species population. The following aspects, hereunder, were observed during the establishment of the survey point count stations:

- Survey point transect stations have been established taking into account the elevation and the heterogeneity of vegetation or habitat in such a way that possible distribution/occurrence of the target species across elevational gradient and vegetational heterogeneity were covered;
- In sampling areas that are difficult to access and where random establishment of the survey transect stations are not possible, trails were made as basis in establishing as such, however, in order to avoid bias when point transect stations are to be located along trails due to disturbance made by the passers (e.g. edge effects). In this study some modifications were made like for example the stations were randomly established along trails yet to some distance away from it (Jones *et al.*, 1995);
- Hand held GPS receiver had been utilized for determining the distance between point transect stations wherein the distance between stations were approximately 200 to 250 m from each other to avoid double counting of the target species (Bibby *et al.*, 2000);
- Fixed radial distance from the center of the point transect stations where observations have been made was 20 m (Bibby *et al.*, 2000; Rosli *et al.*, 2010; Posa and Sodhi, 2006) with little or some modification as regards to the characteristics of the habitat within the sampling sites. Best

for tropical rain forest and for cryptic, sedentary or skulking species such as the target species (Rosli *et al.*, 2012); and

- However, in an instance where forest edges are encountered within and/or among the sampling sites survey stations were established at some distant away from these edges to address the bias usually brought about by disturbance along edges to target species (Jones *et al.*, 1995).
- As a summary of the points mentioned above here below is a sketch or lay-out of the survey point transects stations (Fig. 2) especially when encountering forest edge/s.

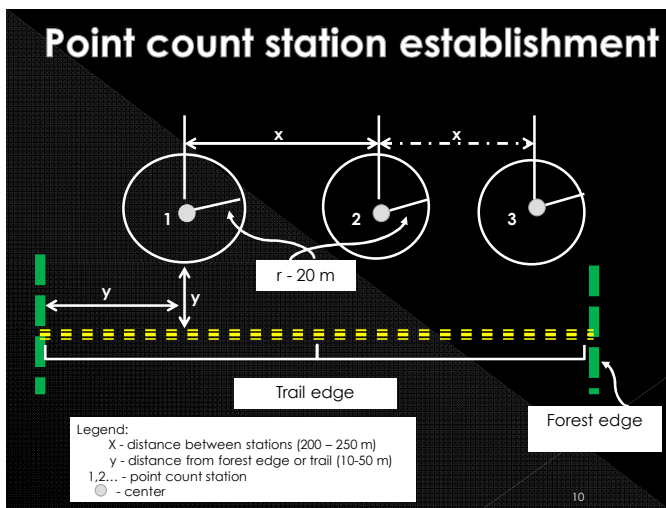


Figure 2. Lay-out of the point count sampling station

### Data Collection Technique for Population Counts of *Copsychuscebuensis*

Distance point transect survey method with single observer was adopted in this study; this is a group of related survey methods for estimating the density and/or abundance of wildlife populations (Bibby *et al.*, 2000; Thomas *et al.*, 2009). This survey method is the most suitable method to survey vertebrate animals and birds most importantly in tropical rain forest or in difficult terrain particularly the three identified sampling sites for this study (Bibby *et al.*, 2000). Upon the survey stations were established, the data collection for the population counts and other variables have been conducted. Before the observer begin to record the occurrence of the target species for every survey station, about two minutes was allowed to pass so the target species can settle down after the disturbance produced by the observer's arrival. Once this period was over, the observer had to stand still at each station and subsequently variables needed to estimate target species population density and distribution were recorded. A 10 min period was allocated for the observation. The target species or the black shama that can be seen or heard around plot within the fixed radial distance of 20 m were recorded. Other variables like: *start time, estimated distances to all target species encountered, no. of contacts or cluster, height of contact and the exact time when the contact happened* were also recorded. Target species that flew away from the immediate area were also recorded and the distance made to their point of departure from the center of the survey station

was then estimated and recorded. The same thing also for the target species that flush as the observer arrived at the station, however, it has not been included in the record for the no. of contacts unless it will settle to allow for radial distance estimation from the observer or from the center of the circular plot. A play back was also used as an aid in ascertaining the presence of the target species within the sampling plot because of its nature of being territorial and its high potential response can be expected (Kennedy *et al.*, 2000). The conduct of the survey was undertaken 30 min before sunrise until 1000 hrs as birds are active during this time and late in the afternoon until sunset or 1730 hrs (Bibby *et al.*, 2000). The survey was undertaken especially during days with fair weather or bright sunny day and definitely no survey has been made during rainy days where bird occurrences are expectedly to be very few or scanty.

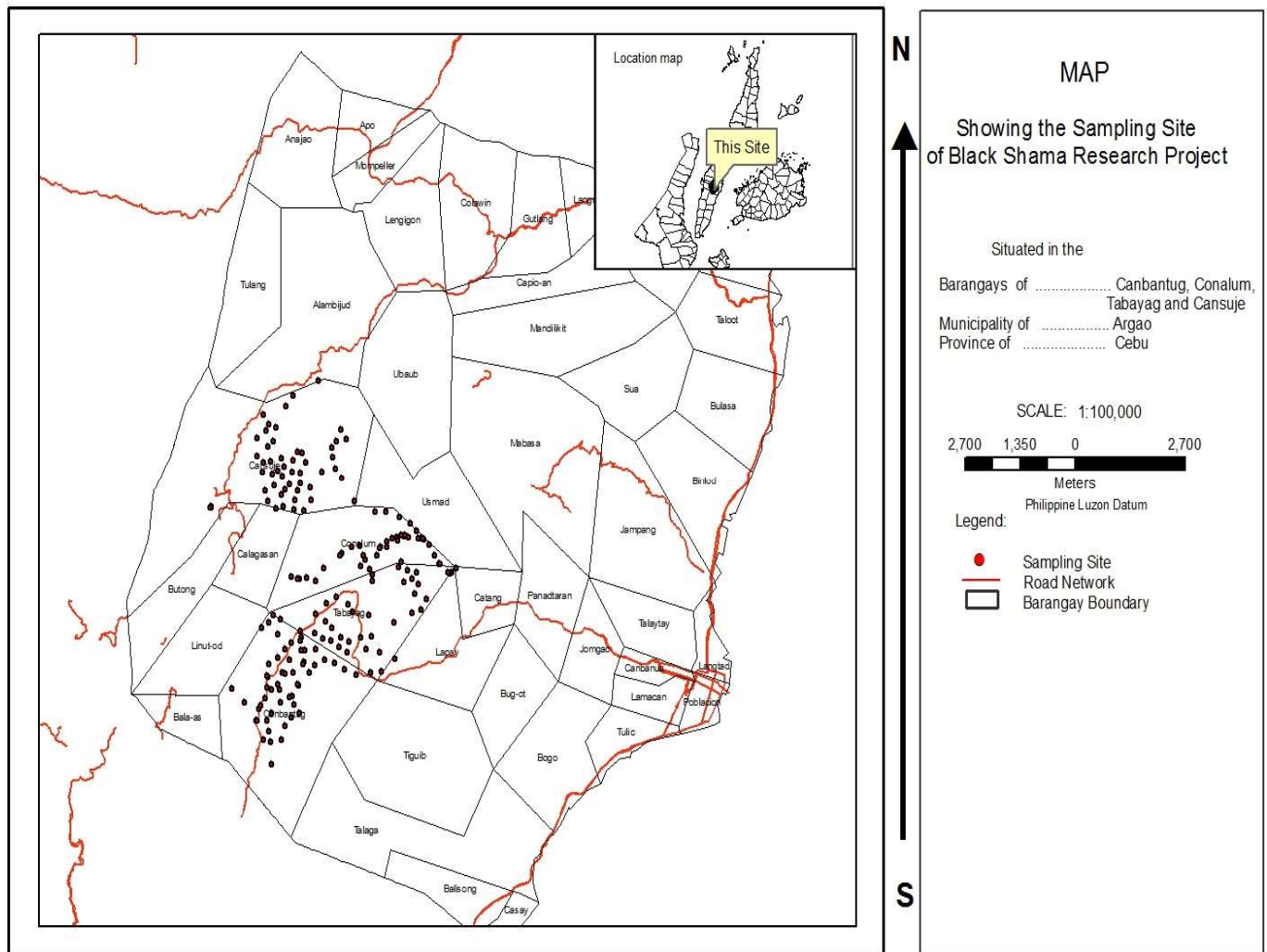
### Estimating Population Size or density of *Copsychuscebuensis*

The population size or density is expressed in terms of the number of individuals per unit area where area can be expressed either in hectares for small to medium landscape and for a large one in square kilometer. For this study, the estimate of the population size or density of *Copsychuscebuensis* or the Black shama was undertaken through the use of a distance software program, (Distance version 6.0 Release 2, by Thomas *et al.*, 2009). Specifically, multiple covariate distance sampling (MCDS) analysis engine was utilized to model the detection function where covariates are being used. For this study, the covariates was used including the estimated radial distances of the occurrence target species from center of the plot and the number of contacts.

## RESULTS

A total of 153 point transect stations have been established (Fig. 3) with 142 observations or contacts with the target species across the three sampling sites. In which 112 samples and 106 observations were in mixed while 39 samples and 36 observations were in pure forest habitat. Barangay Canbantug has 36 stations or samples with 25 observations overall of which 25 samples and 19 observations were in mixed stratum while nine samples containing six observations were in pure habitat. Barangay Cansuje had a total of 65 samples with 65 observations where in 43 samples with 43 observations were in mixed forest while 22 samples with 22 observations were in pure forest habitat, respectively. Lastly, in barangay Tabayagit had a total of 52 samples and 52 observations with 44 samples and 44 observations in mixed habitat and eight samples with eight observations were found in pure stratum, respectively. Using Distance 6 Release 2 software program in estimating the population density of black shama with the use of the above data particularly radial distance and the no. of contacts with the target species as covariates (Thomas *et al.*, 2009), the following findings were noted. In barangay Canbantug (1<sup>st</sup> sampling site) the estimated density of the population of the target species was 36.065 or 36 individuals—h—1 with coefficient of variation (CV) 59.23% for mixed stratum with an average cluster size of 1.2 with detection probability of 98.7%.





**Figure 3. Showing the three sampling sites namely Brgys. Canbantug, Tabayag, and Cansuje.**

While, for pure forest habitat it had 31.636 or 31 individuals— $h-1$  and a CV of 59.37% with a detection probability of 98.3% with an average cluster size of 1.2. For barangay Cansuje it had a population density of 49.641 or 49 individuals— $h-1$  with a CV of 14.53% with a detection probability of 91.5% and had an average cluster size of 8.5. In addition, for pure forest habitat it had 49.641 or 49 individuals— $h-1$  with a CV of 14.53% with a detection probability of 91.5% and a cluster size of 8.5. Lastly, for barangay Tabayag it had a population density of 26.633 or 26 individuals— $h-1$  with a CV of 18.29% and detection probability of 93.6% and with an average cluster size of 6.4. Whereas, for pure forest in Tabayag it had a density of 26.633 of 26 individuals with a CV of 18.29% with a detection probability of 93.6% and a cluster size of 6.4, respectively.

## DISCUSSION

Results have shown that, among the three sampling sites, only Canbantug had the highest CV for both pure and mixed forest habitat, respectively (59.23% and 59.37%). This CV is not considered to be acceptable (Franzetti & Foccardi, 2006), however, its population estimate also not precise due the less number of observations as well as the samples, hence, this requires additional sampling effort to meet the software

standards (Thomas *et al.*, 2010). This suggests that there is high variation in the data gathered with respect to the mean such as the two covariates included in the estimation of the density of population of the target species. The other source of variation may be attributed to the least number of samples or observations in Canbantug which is only 36 and 25, respectively. The software used in this study requires at least (Distance 6 Release 2) 60-80 samples per sampling sites and the cut off is 40 beyond this said requirement the precision of estimation may be considerably affected (Thomas *et al.*, 2009). As for the two habitat type sampled in Canbantug they are considerably differ in the density of population of the target species estimated wherein mixed forest was higher than the natural forest (36 versus 31). This could be attributed mainly to the fact that about 90% of the sampling site is covered by mixed forest whereas only about 10% of the area is covered by natural forest owing to the fact that the study site was a former reforestation site of the DENR wherein the reforestation species used were mostly fast growing, e.g. *Swieteniamacrophylla* King. And *Gmelinaarborea*, and many others. In terms of detection probability the two habitats (Canbantug) they both have very high percentage and are almost equal with only a very slight difference of 0.04%. They are also equal in terms of the average cluster size of the target species which is 1.02. However, in barangay Cansuje,

(2<sup>nd</sup> sampling site) the two habitat being surveyed did not vary each other especially in all the variables being calculated and/or processed by the software namely, population density (49 individuals—h<sup>-1</sup>), CV (14.53%), detection probability (91.5%), and cluster size (8.5), respectively. This sampling site was also higher in terms of the calculated population density of the target species with lower and more acceptable CV compared to the two sampled barangays Canbantug and Tabayag. On the other hand, the calculated CV can be considered small, hence, the calculated population density is more precise (Franzetti and Foccardi, 2006). These finding indicate that, the population of target species in barangay Cansuje is widely and uniformly distributed among the remaining forest patches in the sampling area. Secondly, it had also the largest forest cover (987 ha) and more contiguous and higher forest cover which favors understory birds species particularly the target species or black shama. This is consistent with the findings of the study on the microhabitat associations of terrestrial insectivorous birds in Amazonian rainforest and second-growth forests that all nine focal species were associated with arrays of microhabitat variables, such as leaf litter depth, tree densities and abundant canopy cover which is not properly provided by second-growth forest (Stratford and Stouffer, 2013).

As for the last sampling site in barangay Tabayag it had the lowest calculated target species population density of 26 individuals—ha<sup>-1</sup>. There is no difference between the two habitat type (pure and mixed forest) in terms of their calculated target species density of population with coefficient of variation (18.29%) that is considerably acceptable (Franzetti and Foccardi, 2006). This indicates that the number of samples as well as the no. of observations obtained in this sampling site have satisfied the requirements of the software used in the calculations (Thomas *et al.*, 2010). The findings suggest that the black shama or the target species is uniformly distributed all throughout the two habitat strata and it can considerably tolerate or persist variations in habitat type as observed during the survey. This is also consistent with the findings on the study of spatial variation in bird community composition in Central Amazonian Rainforest found out that there is no significant relationship between landscape features and forest components and the number of bird species and individuals sampled, however, bird species composition changes along a topo-graphic gradient (plateau-slope-valley) (Cintra and Naka, 2012).

## Conclusion

The target species or the black shama (*Copsychus cebuensis* Steere) is considered 'Endangered at national and global scales (Birdlife International, 2012) on the basis that it has limited or restricted range and highly threatened from human activities resulting to habitat change. However, this study shows that its population still widespread or widely distributed among the forest habitat patches being sampled. In the first sampling site in barangay Canbantug the calculated population density is 36 and 31 individuals per ha on the mixed and pure forest habitat with coefficient of variation (CV) of 59.23% and 59.37%. This higher CV could be attributed to the least number of samples or observations which is 36 and 25, respectively (Thomas *et al.*, 2010). Secondly, for sampling site no.2, barangay

Cansuje it has the same population density estimate for mixed and pure habitat type with 49 individuals per hectare and a CV of 14.53% which is considerably acceptable (Franzetti and Foccardi, 2006). Lastly, for sampling site no. 3 in barangay Tabayag it has also the same in terms of the estimate in population density of the target species with 20 individuals per hectare in mixed and pure forest strata with also the same CV of 18.29% which is also largely acceptable (Franzetti and Foccardi, 2006). This study further concludes that at the local level black shama is still widely distributed among the forest habitat patches being surveyed and it can tolerate or persist both mixed and pure forest habitat and even in pure forest plantation as observed during the survey.

## Scope for the future research

- In order to sustain black shama population among the forest habitat patches especially those that are inhabiting in small isolated forest patches: there is a need to institute vegetative connections among these patches in order to facilitate movement of the endangered species especially black shama and other equally important and threatened bird species;
- There is an urgent need to rehabilitate riparian corridor or river banks for these will serve as linkage across different forest habitat patches. Based on the field observation that black shama are widely distributed on the valley bottom or near depressions especially where vegetation are still abundant;
- Develop more core areas of forest patches for the black shama and other forest dwelling/interior species since forest in the study site is fragmented and many are being reduced into small sizes;
- There is need to aggressively implement forest protection, laws and policies in such a way to check further encroachment of upland/lowland people into the forest or timber land areas and to fend off illegal activities in the forest especially in the study site;
- Design a more sustainable program on information, education, and communication targeting especially elementary students through forging strong linkage with upland communities and local leaders in order to win more champions in biodiversity especially the target species.

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