Psittacidae community in Mbeliling landscape, Flores

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Abstract. A study of Psittacidae community has been conducted in the area of Mbeliling landscape, Flores, East Nusa Tenggara. The purpose of this study was to assess the community of Psittacidae which includes the relative abundance, dominance and species composition in three locations with their different representations of habitats and altitudes. Data were collected in May and July 2013 from three locations, namely Lengkong Ra'beng, Dencang Mese and Wae Ndae. The data collection method used is Point Count. As many as 330 individual Psittacidae were found which are included in 4 different species; Tanygnathus megalorynchos, Geoffroyus geoffroyi, Trichoglossus haematodus weberi and Loriculus flosculus. Amongst the four species found, Loriculus flosculus is listed as Flores’s endemic species and Trichoglossus haematodus weberi is listed as Flores’s endemic sub-species. The relative abundance of each species are expressed in encounter rates. The dominance index value of Mbeliling region is at 0.547. Results shows that these four species are dispersed in different group clusters in composition dependant to the type of habitats represented at three sampling sites. Results pointed out the importance of Mbeliling Landscape area for Psittacidae conservation in Flores.

Keywords: Psittacidae, parrots, flores, endemic birds, altitude

1. Introduction
Flores is an oceanic island in the Wallacean region with relatively high birds endemicity rate [1, 2]. Flores owns 85 % of limitedly distributed bird species that’s included in Endemic Birds List of Northern Nusa Tenggara. Mbeliling and Sesok region (Sano Nggoang Lake) are two sites amongst 11 forest regions that are proposed by the FAO/UNDP in 1985 to be listed as conservation region. Both locations are well-known for their diverse habitat types that represents the home needed for birds of Flores [3].

The parrots family (Psittacidae) is considered to be under a big threat of extinction because of illegal trading and degradation of their habitat [4]. During 1983–1999, 61 species of Indonesian native parrots were exported for international trades, 3 of those parrot species are endemic to Flores [5]. The depleting number of habitat coverages and high threat of poaching for trades kept pressing the communities of wild Psittacidae, but there is not enough research on the community of Psittacidae in Flores. That is why this research is important. Providing basic information such as abundance and population diversity is important as a fundamental step of conserving parrot communities in Mbeliling region of Flores.
A community consists of several populations that co-exists in a certain habitat, interacting with one another and creating a form of balance [6]. Interactions within a certain community are organized and, as a result, creates patterns that often defines the structure of that specific community, differentiating them from another community. Krebs mentioned that there are few characteristics that can be used to identify a community, which is diversity, dominance, abundance, shape and structure of growth and trophic structure [7].

There are four different parrots that are included as resident species in Flores, each represent one specific genus found in Flores: Betet-kelapa paruh-besar (Tanygnathus megalorynchos), Nuri pipi-merah (Geoffroyus geoffroyi), Perkici pelangi (Trichoglossus haematodus subjenis weberi) dan Serindit flores (Loriculus flosculus) [1]. Each of those parrot species have distinct physical features and behavioral characteristics that can be easily distinguished from one another.

Great-billed Parrot (Tanygnathus megalorynchos). The Great-billed parrot is about 33–43 cm long. Their plumage is dominated by green feathers, with yellow markings on their shoulders and blue underparts. The easiest way to spot a Great-billed Parrot is from their big red bills. Tanygnathus usually perch high atop the canopy, dwelling in primary and secondary forests with dense foliages and high treelines. They are well distributed at the altitude range up to 900 m above sea level [1].

Red-cheeked Parrot (Geoffroyus geoffroyi). Red-cheeked Parrot is about 21–30 cm in length, with mostly green plumage. The male can be easily identified by their rose-red cheek feathers, while the females has brown face mask. Geoffroyus occupies mainly primary forest and secondary forest with high canopies, but sometimes can be found foraging for food at forest edges and coffee plantations. Geoffroyus are distributed quite evenly from lowlands to altitude up to more than 1400 m above sea level [1, 8].

Rainbow Lorikeet (Trichoglossus haematodus weberi). The Rainbow lorikeet’s body is about 26 cm, easily noticed on field by their loud and noisy flight calls. They usually travel in groups of 2–5 individuals. The subspecies that is endemic to Flores islands has mostly green plumage with bursts of greenish-yellow on their chest, different from the plumage of their relatives from other parts of Indonesia. Trichoglossus occupies forest edges, secondary forests, plantations and other cultivated farmlands with spaced foliages. They are normally distributed from lowlands to the altitude range up to 1400 m above sea level [1].

Flores Hanging-parrot (Loriculus flosculus). Flores Hanging-parrot is the smallest in size (12 cm long) amongst other endemic Psittacidaes present in Flores. It’s body is covered in mainly green feathers, with noticeably red beaks and slightly red underparts. The males can be identified by it’s spots of red plumage right under it’s throat [1]. Loriculus dwells spesifically in primary forests at the altitude ranging from 400 m up to 1,035 m above sea level [1, 8].

2. Methodology

Methods used to collect data in this research is point count. This is done by recording number of individuals encountered in the sample plot within the time limit given at each point (usually in 10 minutes) [9]. This method is chosen for this research based on several reasons: point count helps amateur researchers to identify and record their encounters more easily because they stay at point and it facilitates researcher to detect and observe species around the point. The method is also applicable for tropical forest which sometimes have rugged terrain and closed canopy forest like Mbeliling which usually does not allow for visual detection [9]. Presence data were collected from three sites; two camps were located at Blok Hutan Mbeliling (Wae Ndae and Dencang Mese) and one camp was located at Blok Hutan Sesok (Lengkong Ra’beng).

Data was collected each morning, starting from 6:00 AM–11:00 AM and then resumed in the afternoon 15:00 PM–18:00 PM. The data collection was repeated for six days at each camp. At each camp, four separate observation tracks (2 Kilometres long each) were stretched out to four different directions. On each track ten sampling points were placed, each was separated 200 metres away from each others. Every morning, each researcher set out to collect data successively from the first point of the
track on to the next points until they reach the 10th point at the end of the track, spending the afternoon break there, then continue to collect the afternoon data in reverse order of points, back-tracking to the camp. The next morning the researchers have to switch tracks. Researchers were limited to observe encounters within 10 minutes of time in each sampling point. Each sampling point was considered randomly chosen, calculated as independent data, regardless of the order of the points. The team that collects data consists of 2 researchers at Lengkong Ra’Beng and Dencang Mese site, and 3 researchers at Wae Nda’e site. Recorded data onsite includes: number of each individuals from the detected species, estimated distance, altitude on point, general weather and habitat type. Overall habitat types are set to four different groups based on majority of it’s vegetations: Primary forest, Secondary forest, Cultivated farmland and Grasslands. Relative density of each species are presented in encounter rates. Dominance in overall areas of study is calculated with Simpson Index of Dominance. Species Composition of the whole area is calculated with Hierarchical Cluster method using SPSS ver.16.0 software.

3. Results and discussion

3.1. Relative abundance

Relative abundance of each Psittacidae species is counted in encounter rates (number of encounter/10 hours). Encounter rates (ER) value gives overall picture of how common is a species found in total effort of time of research. In this research, the total observing hours counted as effort is 113 hours and 30 minutes. From the four species of Psittacidae found in Mbeliling Landscape, each species varies in ER values. *Geoffroyus geoffroyi* was found in three locations, hence gaining highest ER value (ER = 21.50). *Trichoglossus haematodus* was listed as second-highest ER value (ER = 6.43), followed by *Loriculus flosculus* (ER = 0.97) and *Tanygnathus megalorynchos* comes fourth (ER = 0.18).

*Geoffroyus geoffroyi* was the most often encounters observed in sample plots. Higher number of encounters counted implies a relatively bigger abundance of that species in the area [9]. Other factors that could contribute to that number is the easeness of spotting this species. *Geoffroyus geoffroyi* has loud vocalizations while actively roam the forest, has a quite noticeable body size and colourful feather markings so that they could be easily spotted by observers [1].

*Tanygnathus megalorhynchos* is listed as common in Flores area but has low encounter rates in this research (ER = 0.18). That value does not literally translate into the conclusion of small population size of *Tanygnathus* in Mbeliling. The distribution pattern of *Tanygnathus megalorynchos* in Flores is more common in coastal area and palm oil plantation up to 900 metres above sea level [1]. Another research in Buru island by Poulsen and Lambert (2000) also noted that *Tanygnathus megalorynchos* distribution is even lower than that, only up to 750 metres above sea level [10]. In this research most of the sample plots were separately distributed higher than 500 metres above sea level, thus excludes any chance of happenstance in *Tanygnathus* encounter lower than that.

Explanation for *Loriculus flosculus* low encounter rates consists of some factors namely: their minute body size, indistinguishable feathers with their background, also they are known for small population abundance in Flores. Previously *Loriculus* encounters in Flores has been recorded in altitudes between 600 metres to 1,100 metres above sea level [1, 11, 12]. Other than those latitude range, *Loriculus* might also have moved away from those areas due to human interference. Specific to the Mbeliling Landscape area, many of the conserved forest cite regions have crossed paths with areas of human activities such as agricultural farms, road ways and villages. Each avian community reacts differently to a certain degree of human interference, specifically avian communities in small islands [13]. The recorded encounter of *Loriculus* in Rinca island by Imansyah also indicates possible probability for Psittacidae population to move away to much lower altitudes than ever found in Flores (coastal area 0–20 metres above sea level) [14].

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3.2. Habitat characteristics

Each sampling point has different habitat characteristics with different altitude profiles. To better explain the Mbuling Landscape, we separated each altitude every 100 metres to see their respective habitat profile as explained in table 1. In Dencang Mese the altitude range of points sampled are between 550–1277 metres above sea level. In Lengkong Ra’Beng the altitude range of points sampled are between 826–1348 metres above sea level. In Wae Ndæ the altitude range of points sampled are between 419–948 metres above sea level.

The combination of habitat profile and altitude of each location of sampling provide the suitable living condition for a certain avian community. Based on habitat profiles found in each location, Lengkong Ra’Beng has the most distinct feature compared to Dencang Mese and Wae Ndæ (table 1) which contained grassland area. Based on respective altitudes in each location, Wae Ndæ has the most distinct and separate profile other than Dencang Mese and Lengkong Ra’Beng for it’s coverage of much lower areas (all sample points below 1000 metres mark). These characteristics can better explain the diversity of avian communities found in each locations when collecting data.

In the results, all four Psittacidae species preferred locations i.e. Primary Forests and Secondary Forests, were in line with what was explained by Coates & Bishop [1] also by Collar [4]. Habitat types play an important role in determining avian species diversity in the region of Molluccan islands, as demonstrated by the findings of *Geoffroyus geoffroyi*, *Tanygnathus megalarynchos* and *Trichoglossus haematodus* recorded in Buru, Seram dan Sumba by Marsden [15]. Recent data findings support that Psittacidae has higher preference in primary forest habitats rather than secondary forests. This case can be seen in the numbers of *Loriculus flosculus* which are recorded in two locations (Wae Ndæ and Lengkong Ra’Beng) more widely encountered than *Tanygnathus megalarynchos*. Even so, *Loriculus flosculus* in proportion still counted as the lowest encountered compared to other species in Flores Psittacidae community. Endemic species populations with high rarity are more prone to decline affected by changes in environment due to human interference. Moreover, those endemic species often times are specialized to certain habitat type that limits their distributions elsewhere outside of their community [13].

3.2.1. Encounter rates within different altitude ranges. The total number of individuals of the Psittacidae family encountered in each altitude ranges are represented in table 2. For ease of compiling, each altitude ranges are classified into score for each 100 meters.

From all three locations, highest Psittacidae encounters are recorded in Wae Ndæ. Wae Ndæ also held the most number of species encountered in one location. The profile of Wae Ndæ consists more range of altitudes than other locations. This condition made it possible for encounters to record certain species of Psittacidae with lower altitude preferences, such as *Tanygnathus megalarynchos*.

| Altitude (m dpl) | Dencang Mese | Lengkong Ra’Beng | Wae Ndæ |
|------------------|--------------|------------------|---------|
| 400–499          | -            | -                | HP, KC  |
| 500–599          | HP, KC       | -                | HP, HS, KC |
| 600–699          | HP, HS, KC   | -                | HP      |
| 700–799          | HP           | -                | HP      |
| 800–899          | HP           | HP, HS           | HP, HS  |
| 900–999          | HP           | HP, HS, PR       | HP, HS  |
| 1000–1099        | HP           | HP               | -       |
| 1100–1199        | HP           | HP               | -       |
| >1200            | HP           | HP               | -       |

Details: HP = Primary Forest; HS = Secondary Forest; KC = Agricultural Farm; PR = Grasslands.
Table 2. Presence of Psittacidae species recorded at each altitudinal range.

| Species                | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  |
|------------------------|----|----|----|----|----|----|----|----|----|
| Geoffroyus geoffroyi   | 59 | 56 | 27 | 21 | 54 | 10 | 4  | 4  | 9  |
| Loriculus flosculus    | 0  | 4  | 1  | 0  | 0  | 2  | 0  | 3  | 1  |
| Tanygnathus megalorhynchus | 2  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| Trichoglossus haematodus | 3  | 14 | 8  | 17 | 24 | 3  | 2  | 2  | 0  |
| Total individuals      | 64 | 74 | 36 | 38 | 78 | 15 | 6  | 9  | 10 |

Altitude scoring: 1= 400–499 metres; 2= 500–599 metres; 3= 600–699 metres; 4= 700–799 metres; 5= 800–899 metres; 6= 900–999 metres; 7= 1000–1099 metres; 8= 1100–1199 metres; 9= over 1200 metres above sea level.

Tanygnathus megalorhynchus was only recorded in Wae Ndae, which made the overall diversity data in this whole research even more rich.

3.2.2. Number of encounter according to habitat types. Overall, the four species of Psittacidae found in Mbeliling are more likely to be encountered in habitats of primary and secondary forests with high tree lines. This occurrence is inline with the findings in Coates & Bishop [1] and also Collar [4]. Total number of individuals from Psittacidae community found in each respective habitat types are presented in table 3. Habitat types is an important factor of determining parrots community.

Trichoglossus haematodus is considerably common species, residing in secondary forests to the forest edges and sometimes down into the coconut farmlands, but rarely encountered in dense primary forests. Nevertheless, highest number of Trichoglossus encountered in this research was recorded in Dencang Mese with mostly primary forest as the described habitat profile (table 3). This occurrence can be occurred due to different habitat edges which are closely connected. Other factors that can contribute to this is the opportunistic behaviour of some forest-edge species that uses nearby primary forest as shelter and coverage [13]. As recorded in Hamzati & Aunurohim [16], Trichoglossus haematodus are more commonly found in nearby agricultural farms and secondary forests because of their natural foraging behaviour.

3.2.3. Species dominance. Results from Dominance Index calculations provide information on dominancy of species on a given area. Based on data collected, the dominance index value for overall Psittacidae found in three locations is 0.597. This value suggested that there is a relatively high dominance of species amongst Psittacidae community in Mbeliling Landscape area [6]. The dominance number calculated is inline with the number of relative abundance of each species found. A dominant species within a structure of a community is described simply as a species with higher abundance than other species found in the area [13]. It’s clear to see that Geoffroyus geoffroyi has bigger numbers proportional to the rest of the Psittacidae species found, which makes the dominance number high. Geoffroyus geoffroyi can utilize a large range of habitat, from dense primary forests to edges of forest tree lines to the low grassland areas [1].

3.2.4. Psittacidae species composition. The Psittacidae species composition can be seen based on number of presence in each habitat type. This research uses hierarchical cluster processings to calculate similarity between habitats [14]. In the results from hierarchical cluster, psittacidae species composition in four habitat types found in Mbeliling Landscape are separated into two large groups. One cluster classifies Secondary Forest habitat (HS), Agricultural Farms habitat type (KC) and Grasslands habitat type (PR) into the same group, while Primary Forest (HP) habitat is separated on it’s own category. Based on similarity degrees in the dendogram presented (figure 1) we can conclude that...
Table 3. Number of Psittacidae species present in each respective habitat type.

| Species                   | HP  | HS  | KC  | PR  |
|---------------------------|-----|-----|-----|-----|
| Geoffroyus geoffroyi      | 212 | 30  | 1   | 1   |
| Loriculus flosculus       | 10  | 1   | 0   | 0   |
| Tanygnathus megalorhynchus| 2   | 0   | 0   | 0   |
| Trichoglossus haematodus  | 51  | 15  | 7   | 0   |
| Total Individuals         | 275 | 46  | 8   | 1   |

Details: HP = Primary Forest; HS = Secondary Forest; KC = Agricultural Farms; PR = Grassland

Figure 1. Dendogram of similarity of each habitat profile based on Psittacidae species presence (HP = Primary Forest; HS = Secondary Forest; KC = Agricultural Farm; PR = Grasslands).

Psittacidae species composition in secondary forest, agricultural farms and grasslands are almost similar to one another. Based on Psittacidae species found, the primary forest habitat type is significantly separated from other types of habitat found in Mbeliling Landscape.

4. Conclusion

Study on Psittacidae community around Mbeliling landscape is important to assess the current state of avian community in Flores. The wide distribution of Psittacidae in Flores indicates that it needs more further research to cover more sampling areas of the subject. Further research is also needed to specify the correlations between Psittacidae presence and its habitat, including topics on vegetation coverage in Mbeliling Landscape. Evaluation on community structure of Psittacidae in this research is considerably relative to the actual number of population discussed, therefore a more detailed research on the approximate estimate to the absolute number of population size of Psittacidae community in Flores is recommended to further refine this topic in the future.

References

[1] Coates B J, Bishop K D and Gardner D 2000 A guide to the birds of Wallacea: Sulawesi, the Moluccas and Lesser Sunda Islands, Indonesia (Alderley: Dove Publications)
[2] Mees G F 2006 Zool. Med. Leiden 25 1-261
[3] Trainor C and Lesmana D 2000 available at https://elib.unikom.ac.id/gdl.php?mod=browse&op=read&id=jkpkjplh-gdl-res-2000-colin-642-biodiversi
[4] Collar N J 2000 Int. Zoo Yb. 37 21-35
[5] Soehartono T and Mardiastuti A 2002 CITES Implementation in Indonesia (Jakarta: Nagao NEF)
[6] Odum E P 1993 *Fundamentals of Ecology* 3rd edition (Yogyakarta: Gadjah Mada University Press)
[7] Krebs C J 1989 *Ecology: The Experimental Analysis of Distribution and Abundance* (New York: Haper & Row)
[8] Butchart S and Symes A 2012 The IUCN Red List for Birds: Species Factsheets, available at http://www.birdlife.org
[9] Bibby C, Jones M and Marsden S 1998 *Expedition Field Techniques: Bird Survey* (London: Expedition Advisory Centre)
[10] Poulsen M K and Lambert F R 2000 *Ibis* 142 566-86
[11] Jones M J, Marsden S J and Linsley M D 2002 *Biodiversity and Conservation* 12 1013-32
[12] Insansyah M J, Purwadana D, Jessop T S 2007 *Forktail* 24 131-32
[13] Marsden S J 1999 *Ibis* 141 377-90
[14] McGarigal K, Cushman S and Stafford S 2000 *Multivariate Statistics for Wildlife and Ecology Research* (New York: Springer)
[15] Mees G F 1973 *Zool. Med. Leiden* 46 179-81
[16] Aunurohim A and Hamzati N S 2013 *Jurnal Sains dan Seni Pomits* 2 2337-3520