Distribution mapping of Koak kaok (*Philemon buceroides*) in the edge forest of Gunung Rinjani National Park, Lombok, Indonesia

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**ABSTRACT** *Philemon buceroides* (Lombok: koak kaok) is a Wallacea endemic bird found in Lombok. In 1980s, koak kaok was widely distributed in all areas of Lombok. Because of hunting to keep as pet, koak kaok is rarely found in Lombok nowadays. The aim of this study is to obtain the distribution map of koak kaok in the edge forest of Gunung Rinjani National Park, so that this site could be managed as a conservation area to conserve koak kaok in Lombok. Two methods (interview and observation) were used in this study. Interview was directed to the people living around the forest, and then followed by field observation. Forest areas where koak kaok could be found were marked using Global Positioning System (GPS). Data from the GPS were processed using MapSource, ArcView GIS and AutoCAD in order to obtain the distribution map of koak kaok in Lombok. Based on the interview there were 15 areas that contained koak kaok, whereas from field observation there were only eight areas where koak kaok could be found. As koak kaok rearing is still a problem, it is advocated that the only way to conserve it in Lombok is to gazette the edge forest of Gunung Rinjani National Park into a conservation area.

**Keywords** *Philemon buceroides* – Gunung Rinjani National Park – mapping – distribution

**INTRODUCTION**

*Philemon buceroides* (Lombok: koak kaok) is a Wallacea endemic bird. Lombok Island is one area that contains koak kaok [1]. Koak kaok is a nectarivore but also eats insects and fruits [2]. It usually lives singly or in pairs, rarely found in groups except when plants are in blossom or bearing fruits [3].

Based on Indonesia’s Government Policy Number 7 in 1999, koak kaok is a protected species. Nevertheless, hunting of koak kaok cannot be stopped yet because of its high economic value. Lack of strict monitoring and law enforcement and the low awareness of people about nature conservation are factors contributing to the decrease of koak kaok population in Lombok. The threat of extinction becomes more serious because koak kaok ex-situ rearing is still a problem [4, 5]. Therefore the best solution is in-situ conservation.
Up to 1980s, koak kaok was usually found in Lombok. It looked for food and nested in plantation near the human settlement (Nursati, personal communication). Because of increasing hunting, it is difficult to find koak kaok around the village nowadays. Based on the information from people around the village, koak kaok still exists in the limited area in the edge forest of Gunung Rinjani National Park. It is therefore important to conduct a study to determine the occurrence and distribution of koak kaok in that area. The resulting distribution map could be a reference for forest management in Gunung Rinjani National Park to gazette the edge forest as a conservation area to preserve the koak kaok in Lombok.

MATERIALS AND METHODS

Study site
This study was carried out in the edge forest of Gunung Rinjani National Park in July till December 2010.

Sampling
Two methods, interview and field observation, were used in this study. Interview was directed to 90 respondents domiciled around the study area. Interview was also directed to the officials of Gunung Rinjani National Park Office, Natural Resources Office and World Wide Foundation for Nature. Data from the interview served as early guideline for field observation.

Field observation was conducted by visiting the area that presumably contained the koak kaok, based on the interview. Areas that contained koak kaok were then marked using GPS. Point coordinates of the location where koak kaok could be found were plotted on digital maps of Lombok Island and Gunung Rinjani National Park. In addition to marking the location coordinates, data on the abundance of koak kaok and characteristic of the habitat were also collected.

Data analysis
Data collected from observation were processed using MapSource 3.00, ArcView GIS 3.3 and AutoCAD, and then analyzed descriptively.

RESULTS AND DISCUSSION

Based on the interview, koak kaok was presumably present in 15 areas of the forest of Gunung Rinjani National Park. However field observation revealed only eight areas that contained koak kaok (Table 1, Fig. 1).

At Gangga forest, koak kaok twitter was heard during observation at about 1100 hr. The bird was not seen because of the steep area. The forest in Gangga is dominated by *Erythrina subumbrans*. The plantations directly adjacent to the
Table 1. Distribution of koak kaok in the edge forest of Gunung Rinjani National Park based on the interview and observation.

<table>
<thead>
<tr>
<th>No.</th>
<th>Forest</th>
<th>Interview</th>
<th>Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gangga</td>
<td>Present</td>
<td>Present</td>
</tr>
<tr>
<td>2</td>
<td>Monggal</td>
<td>Present</td>
<td>None</td>
</tr>
<tr>
<td>3</td>
<td>Santong</td>
<td>Present</td>
<td>Present</td>
</tr>
<tr>
<td>4</td>
<td>Salut</td>
<td>Present</td>
<td>Present</td>
</tr>
<tr>
<td>5</td>
<td>Belanting</td>
<td>Present</td>
<td>Present</td>
</tr>
<tr>
<td>6</td>
<td>Obel-Obel</td>
<td>Present</td>
<td>Present</td>
</tr>
<tr>
<td>7</td>
<td>Loloan</td>
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<td>None</td>
</tr>
<tr>
<td>8</td>
<td>Semotoh</td>
<td>Present</td>
<td>Present</td>
</tr>
<tr>
<td>9</td>
<td>Joben</td>
<td>Present</td>
<td>Present</td>
</tr>
<tr>
<td>10</td>
<td>Jeruk Manis</td>
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</tr>
<tr>
<td>11</td>
<td>Lemor</td>
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<td>None</td>
</tr>
<tr>
<td>12</td>
<td>Perigi</td>
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<td>None</td>
</tr>
<tr>
<td>13</td>
<td>Kerandangan</td>
<td>Present</td>
<td>Present</td>
</tr>
<tr>
<td>14</td>
<td>Sesaot</td>
<td>Present</td>
<td>None</td>
</tr>
<tr>
<td>15</td>
<td>Kumbi</td>
<td>Present</td>
<td>None</td>
</tr>
</tbody>
</table>

Figure 1. Distribution map of koak kaok in the edge forest of Gunung Rinjani National Park, Lombok, Indonesia.

forest were cultivated with coffee, banana and cacao. In addition to nectar from *E. subumbrans*, the people around the forest said koak kaok frequently entered their plantation looking for food.
Koak kaok was also being caught by some people using birdlime. A bird was kept in the cage in a villager’s house. This bird was caught from the villager’s plantation area.

At Monggal forest, field observation did not record any koak kaok, although the interview indicated its presence in this area. Its absence might be due to weather and food availability. Cloudy weather can influence the presence of birds, not only koak kaok but also birds in general. Besides, the koak kaok’s favourite nectar source (E. subumbrans) was not in bloom.

Because of heavy rain, koak kaok was not observed in Santong forest during the observation period, although the interview indicated its existence in this area, and evidenced by a villager keeping a koak kaok baby bird taken from its nest in Santong forest several days before this observation.

Based on the characteristic of the habitat and food availability, Santong forest is a suitable site for koak kaok’s existence. Koak kaok prefers tall tree with low density of branches, like Ceiba pentandra and E. subumbrans which are abundant in this area.

Field observation at Salut forest did not record any koak kaok in this area. However some birds were kept by a villager. The owner revealed that those birds were caught using birdlime, around the plantation. This is indicative of koak kaok’s existence in this area.

Based on the interview, koak kaok twitter was still heard frequently from Belanting forest and Tritip forest situated across Belanting. Sometimes, the villagers who looked for firewood near Tritip forest could hear the koak kaok twitter. This bird was heard twitting at 0900 hr during the field observation, indicating its existence in this area.

Obel-Obel forest in the north coastal-area of Lombok consisted of rice cultivation area, human settlements or production forest and primary forest. According to the villagers, koak kaok twitter could be heard frequently very early in the morning or about 0400 hr and in the afternoon at about 1800 hr. During the field observation, koak kaok twitter was heard at about 1500 and 1600 hr around the primary forest beside the production forest.

Loloan forest, adjacent to Bayan area, is dominated by shrubs. Field observation did not record any koak kaok because this was an open area. Koak kaok does not like open area because it needs a place for going back after foraging [2]. Some respondents stated that koak kaok was difficult to find since 1990s.

Semotoh forest, close to Teratak village, is a distribution zone for koak kaok. This forest was not too dense and had many big trees, making it suitable for foraging and roosting. The edge of this forest also contained a lot of E. subumbrans. Koak kaok twitter was heard at 0900 hr during the field observation.

Based on the interview with the villagers around the edge of Joben forest, koak kaok frequently twittered back and forth in the morning and at night. Field
observation however did not record any koak kaok in the hill close to the entrance of Joben forest. Nonetheless a bird was kept by a villager who trapped it with birdlime.

At Jeruk Manis forest, the villagers stated that koak kaok twitter was frequently heard around the forest. Because of heavy rain, no bird was evident during the field observation. It also might be because the *E. subumbrans* was not in bloom at that time.

Lemor forest is close to the entrance of Gunung Rinjani National Park. Based on the interview, the villagers carrying out some activities in this forest heard koak kaok twitter frequently. However there were no signs of koak kaok during the field observation.

Perigi forest is close to coconut cultivation. Field observation did not reveal any koak kaok, although some villagers stated that they usually heard koak kaok twitter in this area.

At Kerandangan forest, koak kaok was found at about 1600 hr around Taman Wisata Alam Kerandangan, after hearing their twitter earlier.

The interview indicated some koak kaoks to be present in Sesaot forest. However no bird was observed during the study.

Field observation did not reveal any koak kaok in Kumbi forest, although some respondents stated that the bird still existed here.

The presence of koak kaok in a particular habitat is not determined by dominant plant species, but more influenced by blooming season of the plant and the height of the tree [2]. One of the suitable plant species for koak kaok’s habitat is *E. subumbrans*, especially when it is in bloom [3]. Most of the *E. subumbrans* in the study area were not blooming during field observation, hence the absence or slim chance of finding the bird. Besides, koak kaok is a solitary bird rarely found in large number.

The tall trees with branches and twigs which are not too dense are the favourite habitat of koak kaok. Shrubs and open area are not preferred by koak kaok, because they always roost after catching their prey [2]. All these factors make the secondary forest between primary forest and cultivation area in Gunung Rinjani National Park a suitable habitat for koak kaok.

Koak kaok is frequently seen foraging at the villager’s cultivation areas adjacent to the forest. This attracts the villagers to hunt them, especially the market demand of this bird is high. The increase of koak kaok hunting for pet or for trading can cause the decrease of its population in the natural environment especially its presence is rare nowadays. If this situation persists for a long time, it will possibly result in the extinction of koak kaok in Lombok. It therefore requires serious thoughts and action to preserve the koak kaok in nature. It is of paramount importance because koak kaok is difficult to rear in captivity [4]. In-situ conservation is the most suitable way for conserving the species.
Illegal logging, as in Belanting, can also cause disturbances in koak kaok habitat. In addition to damaging the koak kaok’s habitat, felling of trees using sawing machine can also lead to sound pollution. The sound of sawing machine can be heard within the radius of two kilometers from the logging area. It is without doubt that it can disturb the koak kaok, considering that this bird is very sensitive to noise.

**CONCLUSION**

Some of the areas at the edge of Gunung Rinjani National Park are the natural habitat for koak kaok in Lombok. The edge forest of Gunung Rinjani National Park should therefore be turned into in-situ conservation area for koak kaok to preserve it in Lombok.

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**REFERENCES**