

Behavior of Bali Starling at Bali Barat National Park and Nusa Penida Island

(*PERILAKU JALAK BALI DI TAMAN NASIONAL BALI BARAT
DAN PULAU NUSA PENIDA*)

Sudaryanto¹, Tjut Sugandawaty Djohan²,
Satyawan Pudyatmoko³, Jusup Subagja²

¹Laboratory of Animal Taxonomy, Biology Department,
Faculty of Mathematics and Natural Sciences, Udayana University
Kampus Bukit Jimbaran Bali 80361. Telp. (0361) 701954

²Laboratory of Ecology, Faculty of Biology, Gadjah Mada University

³Laboratory of Wildlife Management, Faculty of Forestry, Gadjah Mada University
Email: sudaryanto2000@yahoo.com

ABSTRACT

Bali Starling (*Leucopsar rothschildi*) one of a threatened species with critical category by International Union for Conservation of Nature (IUCN) and Red List of Threatened Species by Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) since 1966, and it has been protected under the Indonesian law since 1970. The main objective of this research was to understand the behavior of Bali Starling residing at the Bali Barat National Park and Nusa Penida Island to the conservation of these birds. The behavior of this bird was observed by using a combination of scan and instantaneous sampling method. The Behavior of Bali Starling at Bali Barat National Park consisted of flying 17%, fruit feeding 3%, insect feeding 1%, preening 15%, cresting head 6%, bobbing 7%, singing 40%, drinking 0,5%, and walking 10%. In Nusa Penida during the rainy season its behavior consisted of flying 13%, fruit feeding 19%, insect feeding 4%, preening 7%, cresting head 7%, bobbing 8%, singing 11%, drinking 1%, bathing 1%, walking 16%, nesting 2%, brood 9% and parental care 3% and the dry season consisted of flying 11%, fruit feeding 9%, insect feeding 21%, preening 7%, cresting head 6%, bobbing 7%, singing 9%, drinking 2%, bathing 1%, walking 18%, and nesting 8%. It was also found in this research that this bird bred both during the rainy season and dry seasons in Nusa Penida, while it bred only during the rainy season in Bali Barat National Park.

Key words: behavior, Bali Starling, Bali Barat National Park, Nusa Penida

ABSTRAK

Jalak Bali (*Leucopsar rothschildi*) sejak tahun 1966 dimasukkan oleh *International Union for Conservation of Nature* (IUCN) *Red List of Threatened Species* dan *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES). Jalak Bali dikelompokkan sebagai satwa terancam punah dengan kategori kritis (*Critically Endangered*) dan di Indonesia telah dilindungi sejak tahun 1970. Tujuan penelitian ini adalah untuk mengetahui perilaku Jalak Bali di Taman Nasional Bali Barat dan Pulau Nusa Penida untuk konservasi burung tersebut. Metode yang digunakan adalah *scan sampling* dengan *instantaneous sampling*. Perilaku Jalak Bali di Taman Nasional Bali Barat terdiri dari terbang 17%, makan buah 3%, makan serangga 1%, menelisik bulu 15%, menegakkan jambul 6%, *bobbing* 7%, berkicau 40%, minum 0,5%, dan berjalan 10%. Sementara di Nusa Penida pada musim hujan terdiri terbang 13%, makan buah 19%, makan serangga 4%, menelisik bulu 7%, menegakkan jambul 7%, *bobbing* 8%, berkicau 11%, minum 1%, 1% mandi, berjalan 16%, bersarang 2%, mengeram 9% dan mengasuh anak 3%, dan di Nusa Penida pada musim kemarau terdiri terbang 11%, makan buah 9%, makan serangga 21%, menelisik bulu 7%, menegakkan jambul 6%, *bobbing* 7%, berkicau 9%, minum 2%, mandi 1%, berjalan 18%, dan bersarang 8%. Jalak Bali berkembang biak di Nusa Penida pada musim hujan dan musim kemarau, tetapi di Taman Nasional Bali Barat pada musim hujan.

Kata-kata kunci: Jalak Bali, Taman Nasional Bali Barat, Nusa Penida

INTRODUCTION

Bali Starling (*Leucopsar rothschildi*) belongs to the family *Sturnidae* and being part of *Passeriformes* order. This bird has a body size of approximately 25cm long, with white furs, except on the wing tip and tail are black, open the skin around the eyes are bright blue. Its crest plumage is very long, especially in the males. Its iris and beak is gray, while the legs are bluish gray. In an Indonesian Ornithological Seminar held at Bogor Agriculture University in December 23, 2006, it was agreed that the indigenous species *L.rothschildi* was *Curik* Bali and non indigenous species was Bali Starling (Suwelo Pers. Com.). The heterozygote rate of the captive Bali Starling was extremely very low. The phenomenon showed that the genetic status of the Bali Starling was extremely in critical quality. This is probably due to only a small population used in the captive breeding program (Thohari *et al.*, 1991). The genetic diversity of the indigenous *Curik* Bali was not found to be different after many generations. However, by acknowledging that DNA samples can be analysed from deceased bird tissues which was preserved in formaldehyde was a novel. This result can be used as a reference of technical analysis of DNA particularly in animal samples that was exceptionally rare as in Bali Starling (Watiniasih *et al.*, 2011).

Bali Starling is an endemic bird of Bali Island, firstly found in the 1911 by Erwin Stresemann in Bubunan Buleleng and its distribution reaches Bali Barat National Park (van Balen *et al.*, 2000). In 1950's this bird was not anymore in Bubunan area. In the 1960's, 1980's, and 1990's its distribution reached Selemadeg, Melaya, and Pupuan areas, respectively (Fig. 1) (Sudaryanto, 2009). Bali Starling has allegedly been found in the island of Nusa Penida Island (Schmidt, 1983) (Fig. 1). Bali Starling has been considered as a critically endangered species by International Union for Conservation of Nature (IUCN) and Red List of Threatened Species by Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), it has also been included into Appendix I, and it has been protected under the Indonesian law since 1970. (Alikodra, 1991; Sodhi *et al.*, 2004; Jepson and Ladle, 2005, 2008; Sodhi and Smith, 2007; Jepson *et al.*, 2008).

Not much behavior research the Bali Starling in the wild. This research was aim to

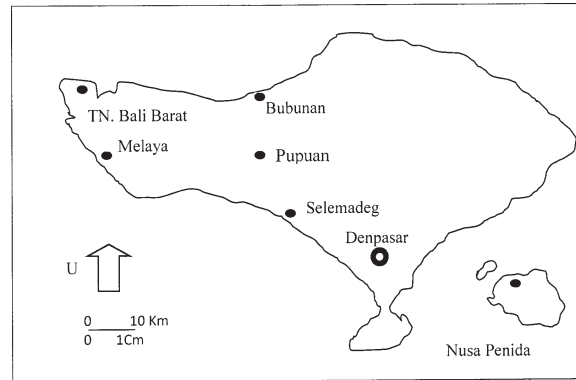


Figure 1. Distribution of Bali Starling

study the behavior of Bali Starling at the Bali Barat National Park and Nusa Penida Island, and the results were used as an attempt for the conservation of this bird and their habitats.

RESEARCH METHODS

The Research of Bali Starling's behavior were conducted between September 2001–March 2002, in the Peninsula Prapat Agung (8°05'30"S; 114°28'30"E), Bali Barat National Park and between November 2013–July 2014 in Ped (8°40'36.2"S; 115°30'48.1"E), Nusa Penida island. The behavior of this bird was observed by using a combination of scan and instantaneous sampling method (Altman, 1974; Martin and Bateson, 1987).

RESULT AND DISCUSSION

Habitat

Trees widely used by the Bali Starling to roost and sleep in Bali Barat National Park consisted of: white-bark acacia (*Acacia leucophloea*) (48.1%) and East Indian wood (*Schoutenia ovata*) (17%). Other trees, such as berry (*Grewia koordersiana*), lebbeck tree (*Albizia lebbeck*), Indian gooseberry (*Phyllanthus emblica*), Ceylon oak (*Schleichera oleosa*) and Indian lilac (*Azadiracta indica*) were also used by this type of bird. In addition to perching, this bird also obtained caterpillars, ants and termites for feeding. Noerdjito *et al.* (2011) and Roemantyo (2011) found 146 and 94 species of plants, respectively as habitat of the Bali Starling in the Bali Barat National Park

In the 2014, 45 species of trees were indicated to be used to by the Bali Starling's

Table 1. Daily behavioral activities of Bali Starling

No	Activity	BBNP raining	NP raining	NP dry
1	Flying	17%	13%	11%
2	Fruit Feeding	3%	19%	9%
3	Insect Feeding	1%	4%	21%
4	Preening	15%	7%	7%
5	Cresting head	6%	7%	6%
6	Bobbing	7%	8%	7%
7	Singing	40%	11%	9%
8	Drinking	0,5%	1%	2%
9	Bathing	-	1%	1%
10	Walking	10%	16%	18%
11	Nesting	-	2%	2%
12	Brood	-	9%	8%
13	Parenting	-	3%	-

Notes : BBNP : Bali Barat National Park; NP : Nusa Penida; - : nothing

feeding, roosting and sleeping. Sudaryanto (2009) reported that 28 tree species were used by the Bali Starling for roosting and sleeping in Nusa Penida Island. In other research, Ginantra *et al.* (2009) identified 105 plants species as the habitat of the bird and 30 of those plant species were used for feeding.

Behavior

Animal behavior can be either innate or learning behavior. According to Van Balen *et al.* (2000) Bali Starling is a diurnal bird and monogamy bird. Bali Starling juveniles tend to live in groups in order to find food easier and to prevent predators attack. Bali Starling’s daily activities consists of flying, feeding, preening, cresting head, bobbing, singing, drinking, bathing, walking/hopping, and reproduce. Its feeding behavior can be distinguished into two namely fruit feeding and insect feeding. While, its reproductive behavior consists of nesting, brood and parental care (Table 1)(Altman, 1974; Martin and Bateson, 1987; van Balen *et al.*, 2000).

The flying behavior of Bali Starling in Bali Barat National Park was 17%, while in Nusa Penida were 13% and 11% during rainy and dry seasons, respectively. This difference happened because less food sources are found in the Bali Barat National Park when compared to that found in Nusa Penida. To obtain more food, the birds should spend more time for flying to search for food (McLaughl and Montgomerie, 1990; Symes and Perrin, 2003; Delacasaet *al.*, 2011). In the Bali Barat National Park trees widely

used by the Bali Starling to roost and sleep were White Bark Acacia (*A. leucophloea*)(48.1%) and East Indian wood (*S.ovata*) (17%). Other trees, such as berry (*G.koordersiana*), Lebbeck tree (*A. lebbeck*), Indian gooseberry (*P.emblica*), Ceylon oak (*S. oleosa*) and *Neem tree* (*Azadiracta indica*) were also used by the birds to roost and sleep. Ginantra *et al.*, (2009) identified 105 plants species in Nusa Penida, and about 30 of those plans were used as food resources by the Bali Starling. At approximately the same time, Sudaryanto (2009) reported that 28 species of trees were used by the Bali Starling for roosting and sleeping in Nusa Penida Island. In more recent study, Sudaryanto (2014) found 45 species of trees were used for roosting, feeding and sleeping by the birds. According to Winteret *al.*, (2003) the productivity of these birds is one of the most critical components and this is affected by its habitat quality.

During the rainy season in Nusa Penida, Bali Starling was found to eat fruit more frequently (19%). During the dry season its frequency to eat fruit was only 6% in Nusa Penida and 3% in the Bali Barat National Park. In Nusa Penida, the birds eat types of fruits, such as papaya (*Carica papaya*), Singapur cherry (*Muntingia calabura*), Java plum (*Syzygium cumini*), white fig fruit (*Ficus glabella*), rumpfs fig fruit (*Ficus rumphii*), soursop (*Annona muricata*), Spanish Flag (*Lantana camara*), whereas in the Bali Barat National Park they only eat Spanish Flag (*L. camara*), berry (*G.koordersiana*), Indian gooseberry (*P. emblica*). During the dry season in Nusa Penida,

the Bali Starling mainly eats insects 21%. In the rainy season they eat less (only 4% and 1% for the birds in Nusa Penida and in the Bali Barat National Park, respectively). Insects consumed by the birds live in Nusa Penida included larvae and eggs of Ants (*Oecophylla smaragdina*), termites (*Coptotermes curvignathus*), gray flesh fly (*Sarcophaga aurifrons*), house fly (*Musca domestica*), grasshopper (*Valanga nigricornis*). In the mean time, the birds live in the Bali Barat National Park tend consumed ants and termites, also caterpillars (Geometridae and Pieridae), ants (Formicidae) and Locusts (*Ducetia thymifolia*) (Cahyadin, 1993). The Bali Starling found in Nusa Penida also frequently eats nectar of African tulip (*Spathodea campanulata*) during the dry season. Bali Starling feeding behavior also include non aerial foragers. Cueto and Lopez de Casenavei (2002) claimed that passerine bird species in Argentina, based on its foraging maneuvers, can be divided into two groups: (1) nonaerial foragers that are hopping on branches and twigs while searching and gleaning prey from the nearby foliage, and (2) aerial foragers that are searching for and detected prey while perching, and capturing it from foliage or in the air. Nonaerial foragers found their prey primarily in the canopy while the aerial foragers captured their prey at all heights in the woodland

Preening activity of the Bali Starling in Bali Barat National Park and in Nusa Penida were found to be 15% and 7%, respectively. This was probably due to ectoparasites of the Bali Starling in Bali Barat National Park were more than that of Bali Starling found in Nusa Penida. Preening in birds is closely associated with the cleaning of ectoparasites, especially on their feathers directly exposed to sunlight (Rozsa, 1993; Koop *et al.*, 2012). Sometimes, preening in certain birds, such as in Wandering Albatross (*Diomedea exulans*) is used to attract their partner (Pickering and Berrow, 2001)

Cresting display by the Bali Starling in Nusa Penida during the rainy and the dry season were at rate of 7%, and 6%, respectively, while at the rate of 6% in the Bali Barat National Park. This activity is a courtship display to attract different sexual individuals (Graves, 1990; Chaves, 2006).

Bobbing activity during the rainy and dry seasons in Nusa Penida were 8% and 7%, respectively, while in the Bali Barat National Park was 7%. Bobbing in Bali Starling distinctive from that generally found in other birds. In Bali

Starling, bobbing is used to attract opposite sex individuals, such as that found in the Wandering Albatrossbird (*D.exulans*) (Pickering and Berrow, 2001). According to Cronin *et al.*, (2005), Necker (2007) and Nyatakura and Andrada (2014), bobbing behavior in birds is used to stabilize images on their retina so that their vision is not blurred.

The rate of Bali Starling singing activity in the Bali Barat National Park was 40%, while 11% and 9% were respectively observed for Bali Starling Nusa Penida during rainy and dry season, respectively. Patterns and aggressive behaviors of passerines can be fully understood, on both male and female songs throughout the reproductive cycle (Kroodsmma *et al.*, 1987; Freeber, 1998; Pickering and Berrow, 2001). Because the Bali Starlings in the Bali Barat National Park, did not have a partner yet or they are still looking for a partner, they did more singing activity than that found Bali Starling in Nusa Penida where they already had their partners.

During the dry and the rainy seasons, the Bali Starling at the in Nusa Penida drank the rates of 2%, and 1%, respectively, while at the at the rate of 0,5% in the Bali Barat National Park. In order to maintain the activity and thermoregulation, it was necessary for the birdsto drink (Williams and Koenig, 1979; Bizeray *et al.*, 2002). Low frequency of drinking (0,5%) of the Bali Barat National Park's Bali Starling was related to the difficulties in finding water sources.

Bathing activity of the Bali Starling in Nusa Penidawas 1%, while no bathing activity was observed on the Bali Starling found was in the Bali Barat National Park, because Bali Starling there was no water sources in this area. Generally birds enjoy bathing, but each species has its own specific bathing behaviors. In addition to thermoregulation, bathing activity is also used for cleaning ectoparasites (Verbeek, 1991; Negro *et al.*, 1999, Clayton *et al.*, 2010; Brooks, 2013).

Walking activity of the Bali Starling in Bali Barat National Park was 10%, while in Nusa Penida during the rainy and the dry seasons were 16%, and 18% respectively. Van Balen *et al.*, (2000) reported that the Bali Starling behavior in their habitat was not conspicuous, because they usually take refuge in the tree tops. Birds normally went down to the ground only if they need to drink or to search for materials for their nest. However, in Nusa Penida Bali the starlings

often walk around on the ground in order to lookfor insects under litters.

Nesting activity of the Bali Starlingin Nusa Penida was 2%. During the study no nesting activity of this birds was observed Bali Starling in the Bali Barat National Park. The breeding season of the Bali Starling in the Bali Barat National Park occurs during the raining season (November-April). The rain appears to trigger the leaf buds as well as foliage-eating caterpillars development. These caterpillars are the main food sourcefor the juvenile birds (Cahyadin, 1992; Prana *et al.*, 2006). A juvenile Bali Starling was once found in the Bali Barat National Park, in March 2002(Sudaryanto *et al.*, 2003). In Nusa Penida, the Bali Starling breeds during rainy and dry seasons, because many fruits and insects, respectively are easily found these two seasons.

According to Cahyadin (1993) the Bali Starling in the Bali Barat National Park make their nestsin treesof kalumpit (*Terminalia edulis*), East Indian wood(*S.ovata*), damson (*T.microcarpa*), leaf flower (*P.emblica*) and berry trees (*G. koordensis*). Noerdjito (2005) reported that the Bali Starling in Bali Barat National Park make nestsin berry trees (*G.koordensis*). In Nusa Penida Island,the Bali Starling made their nestson ninetree species, ie coconut palm (*Cocos nucifera*), tamarind (*Tamarindus indica*), rumpf's fig tree (*F. rumphii*), white fig fruit (*F. glabella*), white mangrove (*Avicennia marina*), breadfruit (*Artocarpus altilis*), sugar palm (*Arenga pinnata*), guava (*Psidiumguajava*) and lead tree (*Leucaena leucocephala*) (Sudaryanto, 2009). Winter *et al.*, (2003) said that the productivity of birds is one of the most critical components of their natural histories affected by habitat quality. Birds might occur in high densities in a given habitat patch but have low nesting success.

The brood activity of the Bali Starling in Nusa Penida during the rainy and the dry seasons were 9%, and 8%, respectively. During this study, no brooding activity of this bird Bali Starling in the Bali Barat National Park was observed . In Nusa Penida,the brooding activity was observed both the in the wet and dry seasons, because Bali Starling sufficient foods are available during these two seasons.

Parenting activity of the Bali Starling in Nusa Penida was 3% in the rainy season. During

this research, no parenting activity of this bird was observed in the Bali Barat National Park. Bali Starling in Nusa Penida, parenting of the young was 9% in the rainy season, whilein the dry season their eggs from four nests failed to hatch because the temperature was too cold during the night due to the effects of Rammasun storms.

CONCLUSION

The behavior of Bali Starling at the Bali Barat National Park consisted of flying 17%, fruit feeding 3%, insect feeding 1%, preening 15%, cresting their head 6%, bobbing 7%, singing 40%, drinking 0,5%, and walking 10%. While in Nusa Penida during the rainy season consisted of flying 13%, fruit feeding 19%, insect feeding 4%, preening 7%, crested head 7%, bobbing 8%, singing 11%, drinking 1%, bathing 1%, walking 16%, nesting 2%, brood 9% and parental care 3%. During the dry season in Nusa Penida consisted of flying 11%, fruit feeding 9%, insect feeding 21%, preening 7%, crested head 6%, bobbing 7%, singing 9%, drinking 2%, bathing 1%, walking 18%, and nesting 8%.The breeding of Bali Starlingin Nusa Penida occurredduring both the rainy and in the dry seasons, while in Bali Barat National Park it occurred during the rainy season only.

RECOMMENDATION

1. Bali Starling census regularly in Bali Barat National Park and on the island of Nusa Penida.
2. Research the *awig-awig* (common law) protect the Bali Starling on the island of Nusa Penida.

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