Breeding Season of Waterbird in Tanjung Rejo, North Sumatera Indonesia

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Keywords: *Ardea,* Breeding Season, *Egretta,* Indonesia, North Sumatra, Waterbirds.

Abstract: Breeding season is one of the natural events occurring annually with objectives on maintaning the population and producing the offsprings. Waterbirds require various conditions to enter the breeding season including the sites and time of breeding. Selection of breeding sites will determine the success of breeding waterbirds. Breeding season study was conducted using direct observation methods from August to June during 2016-2018. This study aims to determine the breeding cycle and life cycle of waterbirds in Tanjung Rejo district, Deli Serdang regency, North Sumatra, Indonesia. Based on the research results, the breeding season of waterbirds in Tanjung Rejo occurs twice in a year. This breeding season of water birds occurs simultaneously in September until December, and February-June for four identified species namely: *Egretta alba, E garzetta, Bubulcus ibis* and *Phalacocorax sulcirostris*. As for *Ardea cinerea* and *Nycticorax nycticorax*, breeding season occurs in August-November and January-May. The clutch size of each bird ranges from 2 to 4 eggs. The spawning interval for each species is between 1 and 4 days, while the spawning sequence takes place from 1 to 4 days. Incubation period ranges from 25 to 30 days. The success of waterbird breeding is determined by both climate and food factors.

1 INTRODUCTION

Breeding season is a seasonal timing to produce new offsprings which employ several strategies to increase the success during the breeding season (Martin, 1995; Perrins, 1996). Breeding is a natural event which occurs every year by all organisms, including water birds. The breeding season of water birds in tropical climates may occur throughout the year depending on the availability of resources such as food, nesting locations and nest materials.

Waterbirds in Indonesia enter the breeding season together with the beginning of rainy season in each year (Mardiastuti, 1993). The duration of breeding season for each waterbird may vary from the starting time of the breeding season until raising period of their. (Perrins and Birkhead, 1983). There are two important factors which determine the reproductive success of waterbirds, namely: breeding time and reproductive capacity (clucth-size) (Perrins and Birkhead, 1983; Harriman et al., 2017). The latter factor will also affect the size of the population and its sustainability in the future. Some reproduction patterns include: habitat, nesting behavior, the breeding time, number of eggs per nest, and breeding success (Fernandez and Reboreda, 2008; Harriman et al., 2017).

Tanjung Rejo is a habitat of waterbirds, commonly utilized for breeding by six species of waterbirds, within the genera of *Ardea*, *Egretta*, *Phalacrocorax*, *Nycticorax* and *Bubulcus ibis*). The mating pairs may exceed 2500 pairs of waterbirds. Every year this location is chosen by the resident waterbirds as a breeding site due to isolated and protected from predator and human interference (Jumilawaty and Aththorick, 2016). It is interesting to learn especially to find out how the species of waterbirds in this location determine the breeding season and strategies for successful breeding.

2 MATERIALS AND METHOD

2.1 Breeding Season and Clutch Size

Determination of breeding season time is based on the Julian calendar in which the date of January 1 is equivalent to the 1st day and December 31 is equivalent to the 365th day in a year. Observations

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were made by directly every two days by observing the color change of feathers on waterbirds until the chicks are able to fly and leave the nest. The number of nests observed was 50 nests and the number of eggs observed was 3 eggs per nest. The beginning of the breeding season is determined based on the time of laying eggs for the first time by the species until no more eggs were laid.

2.2 Hatchling Development

Breeding observations were observed directly for every 2 days. The observations were carried out on the nest of grey heron (*Ardea cinerea*) to determine whether the number of hatched eggs. The distance of laying eggs, hatching distance and number of chicks were measured numetrically. The number of surviving chicks were counted and expressed in percentage.

3 RESULTS AND DISCUSSION

3.1 Breeding Season

Breeding season for waterbirds in three consecutive years from 2016 to 2018, occurred throughout the year and is closely related to food availability, especially fish and insects (Jumilawaty and Aththorick, 2016; Jumilawaty and Andriayani, 2019). The breeding season for water birds in Tanjung Rejo occurred twice a year, season 1 from August to December and season 2 from February to June (Table 1).

Breeding season began with the physical changes of waterbirds until the chicks learned to fly. In this study, one breeding season occurred 3 to 4 months depending on the waterbird species. Physical changes can be observed in the form of discoloration of the feathers on the beak and legs and body feathers. The difference in the start of the breeding season among species is a strategy to avoid competition in food availability.

Table 1: Breeding season of waterbirds in Tanjung Rejo, Deli Serdang Regency, North Sumatra.

Species	Year 2016												Year 2017												Year 2018											
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Jun	Jul		Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Jun	Jul		Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Jun	Jul	
Ardea cinerea	•	•	•	•	-	-	•	•	•	-	-		•	•	•	•	-	-	•	•	•	-	-		•	•	•	•	-	-	•	•	•	-	-	
Bubulcus ibis	-	-	•	•	•	-	-	-	•	•	•		-	-	•	•	•	-	-	-	•	•	•		-	-	•	•	•	-	-	-	•	•	•	
Egretta alba	-	•	•	•	•	-	-	•	•	•	•		-	•	•	•	•	-	-	•	•	•	•		-	•	•	•	•	-	-	•	•	•	•	
Egretta garzetta	-	-	•	•	•	-	-	-	•	•	•		-	-	•	•	•	-	-	-	•	•	•		-	-	•	•	•	-	-	-	•	•	•	
Nycticorax nycticorax	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-		•	•	•	•	-	-	•	•	•	-	-	
Phalacrocorax sulcirostis	-	•	•	•	•	-	-	•	•	•	•		-	•	•	•	•	-	-	•	•	•	•		-	•	•	•	•	-	-	•	•	•	•	

In Table 1 It can be seen that there are three variations in the strategy of waterbirds in the breeding season. *Ardea cinerea* started the breeding season earlier than other waterbirds every year, followed by *Egretta alba* and *Phalacrocorax sulcirostris* then followed by *Egretta garzetta* and *Bubulcus ibis*. Interestingly enough in 2016-2017, *Nycticorax nycticorax* was not found to nest and breed in this location together with other waterbirds but in 2018, its nest was found at the same time with *A. cinerea* neir their nest trees. Selection of varying breeding time by waterbirds found in Tanjung Rejo aims to enhance the success rate of breeding whilst to avoid competition, leading to survivability of its offsprings in the future.

The large body size of grey heron (*Ardea cinerea*) require it to supply more food resources and nest material than other waterbirds species which explain the early start of their breeding season. Whereas, the great egret (*Egretta alba*), little black cormorant (*Phalacrocorax sulcirostris*) little egret (*E. garzetta*), and cattle egret (*Bubulcus ibis*) chose to breed simultaneously to avoid predators (Jumilawaty and Andriayani, 2019).

Different with black-crowned night heron (*Nycticorax nycticorax*), in 2016-2017, they preferred a further breeding site than any other waterbird species. This is assumed due to incompetitiveness by the species to gain access in breeding sites. In 2018, *N. nycticorax* chose to nest in mangrove palm near *A. cinerea* in which the trees cannot be climbed and surrounded by ponds making it difficult for predators and humans to reach their nests. The conditions showed that to guarantee the success of breeding, in addition to determining the breeding time, clutch size; the safety factor appeared to be a very decisive factor. Another factor which is also a consideration for waterbirds is occurrence of

the rainy season. During the rainy season, farmers and fishermen harvest which provide plenty of food for waterbirds in the form of fish, insects, worms and crustaceans. The presence of predators, the optimum environmental conditions and the food availability are factors that affect the breeding time of birds, this will ensure the survival of both mother and offspring (Prendergast, 2005; Passuni et al., 2016; Jumilawaty and Andriayani, 2019).

3.2 Clutch Size

The observation on three heron species resulted in 1 – 4 eggs or clutch size per nets (Figure 1). The difference in the clutch size is strongly influenced by food factors, age of parents, species and geographic area. The parent will lay eggs according to their ability to ensure the survival and success of the nestlings, especially regarding the food availability. Female parents must be able to predict the number of chicks produced and raised with environmental conditions which exist when the breeding season arrives. This number is the result of natural selection that is adjusted to maximize the contribution of the body of the female parent to the next generation and is characteristic of each species and region (Barati et al., 2008; Fernandez and Reboreda, 2008; Jumilawaty and Aththorick 2016; Harriman et al., 2017).

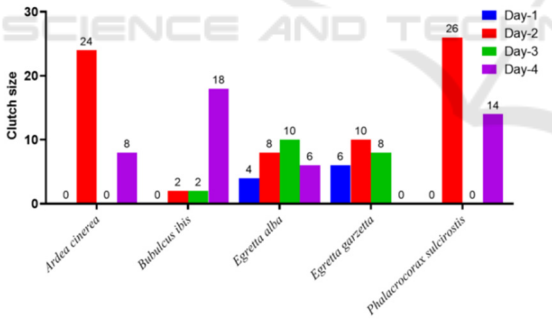

Figure 1: Clutch size per nest of waterbirds.

Based on the field observation, the food supply is sometimes very varied and it is difficult to predict whether the availability of food is sufficient as expected, especially when raising a chick. As a strategy to solve the limited food availability, some species will only breed in a single breeding season, Cormorants and generally other waterbirds have a strategy by hatching their eggs not simultaneously (asynchronous) using day breaks. This is intended to be able to supply sufficient food for the chicks to be hatched and raised and may guarantee the health of the female parents (Jumilawaty, 2004; Harriman et al., 2017).

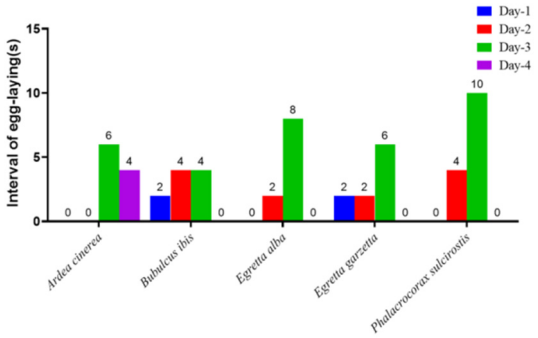

Figure 2: Interval of egg-laying of waterbirds.

Clucth size is very closely related to the egg-laying interval (Figure 2) and hatching (Figure 3). The results showed that the egg laying interval varied from 1 to 4 days (Figure 2). The strategy of laying eggs and hatching by waterbirds is greatly influenced by environmental factors, the physiology of the female parent, age and experience of each individual. The hatching of water bird eggs in Tanjung Rejo occurs not simultaneously (asynchronous) (Figure 3). This strategy is carried out by birds to ensure that the waterfowl puppies get adequate food and ensure the welfare of both the mother and puppies that will be raised. This is consistent with the results of research from Svagelj et al. (2015) that the egg laying and hatching intervals are highly dependent on the food source, the physiology of the mother and its environmental factors. Spawning and hatching intervals are strategies of female parent to avoid predators (such as eagles, snakes and monitor lizards) and human disturbance. The spawning and hatching intervals of water birds in Tanjung Rejo show no difference when compared to the previous studes (Jumilawaty, 2004; Fernandez and Reboreda, 2008). This shows that the pattern of egg laying and hatching of water bird eggs is very dependent on environmental factors.

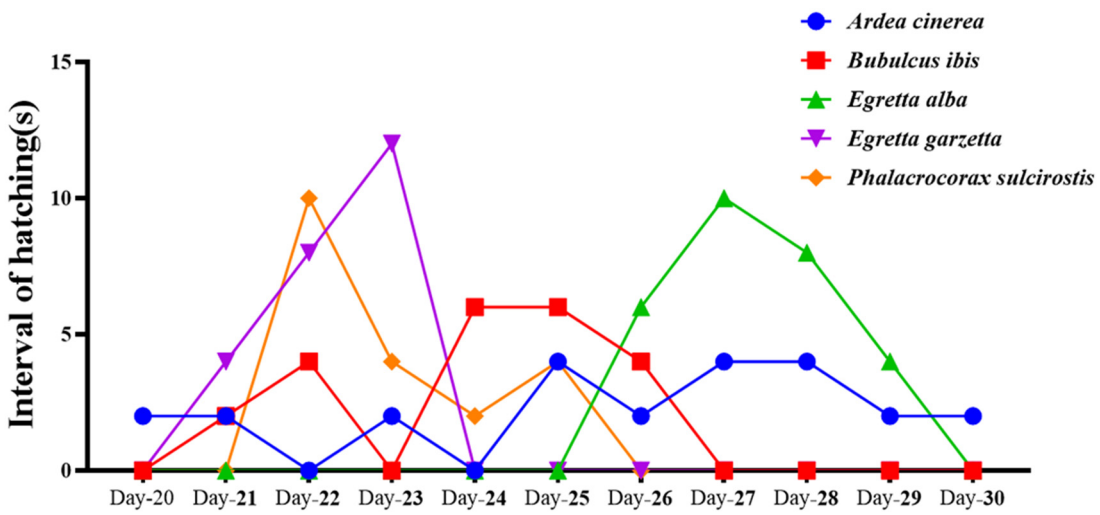

Figure 3: Interval of hatching of waterbirds.

The experience and age of the parent also largely determines the success of egg-laying and hatching eggs. Generally for younger birds, it takes a little time to learn to adapt to adjust the temperature to the state of the environment. More young birds are outside the nest and leave their eggs. In water, hatching birds are carried out alternately between males and females, but it cannot be distinguished which one incubates the most. Bird age is thought to be a factor in the incubation of incubation and hatching of water bird eggs without differentiating the sex. An equally important factor for the success of breeding is the incubation period. The incubation period is strongly influenced by environmental factors between temperature and rainfall. Temperatures that are too high and too humid will cause the eggs to rot or fail to hatch. To overcome unsuitable environmental conditions, the mother's ability to incubate eggs requires a normal temperature of 38°C.

We also happened to count the duration of incubation until hatching by the waterbirds. In Figure 4, it can be seen that the incubation time for *A. cinerea* and *E. alba* requires a longer time compared to other species, in exception to *B. ibis*. This is because the former two species have a larger egg size compared to other eggs. The larger egg size is attributed by its parents, having a size from 92-95 cm while other waterbirds have sizes between 40-55 cm. The results of this study are in accordance with Figuerola and Green (2005) which states that the length of the incubation period is strongly influenced by the size of the bird's egg, the body mass of the bird (g), the sex of the bird. Furthermore, Watson et al. (1993) said that clutch size greatly influences the egg-laying interval, hatching interval and incubation period. It really depends on the physiology of the female parents, despite of the presence of predator and human disturbance. Birds will leave the nest if there is interference and will return after feeling safe. Noise caused by humans such as screaming and other sounds will make the female parent disturbed and leave the nest being incubated.

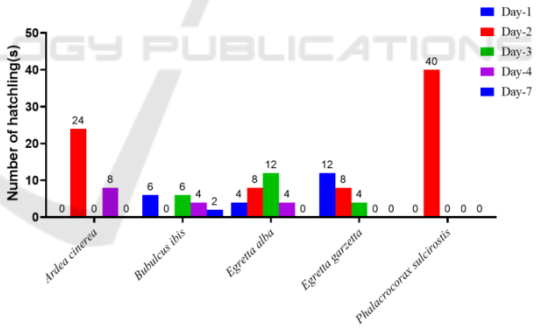

Figure 4: Number of hatchling(s) based on incubation time (day).

4 CONCLUSIONS

The breeding season of waterbirds in Tanjung Rejo, North Sumatra occurs twice in one year to coincide with the rainy season and harvest season. The quality of eggs to be produced and the ability of chicks to survive is determined by the spawning interval, hatching interval and the length of the egg incubation period. The success of breeding water birds is largely determined by the availability of

food, the choice of breeding time, the choice of nesting sites, temperature, weather (wind and rain), parent experience, parent age and clucth size. Another factor that also determines the success of breeding waterbirds is the safety factor and avoid predators.

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