

Population of Waterbirds in the Breeding Colony at Khuan Khi Sian, Thailand's First Ramsar Site

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ABSTRACT.— This study investigated the species composition, population size and population fluctuation of waterbirds in *Melaleuca* swamp forest at Khuan Khi Sian, Thale Noi Non-hunting Area, Phatthalung Province, southern Thailand. The study was conducted from April 1998 to March 1999. The number of waterbirds was counted monthly and some environmental factors were also observed. It was found that the *Melaleuca* swamp forest was a breeding site of five species of waterbirds, consisting of *Phalacrocorax niger*, *Ardea purpurea*, *Bubulcus ibis*, *Egretta garzetta* and *Nycticorax nycticorax*. This area was also served as a night roosting site for a rare migratory species, *Threskiornis melanocephalus* from April to July. The population density of waterbirds in the breeding colony greatly fluctuated throughout the year, but peaked in May when the number reached 20,430 individuals. The lowest number was 136 in September. Of all the waterbirds, only *P. niger* and *A. purpurea* used this breeding area throughout the year. Considering environmental factors, the number of *B. ibis*, *N. nycticorax* and *T. melanocephalus* showed correlations with mean temperature, relative humidity and total rainfall.

KEY WORDS: waterbirds; population study; breeding colony; Ramsar site; Thale Noi

INTRODUCTION

Thale Noi Non-hunting Area is one of the forty wetlands that have been considered by the International Union for the Conservation of Nature and Natural Resource (IUCN) as a wetland of international importance in Asia (Scott, 1989). Khuan Khi Sian within Thale Noi Non-hunting Area has been listed as the first Ramsar site when Thailand ratified the Ramsar Convention as its 110th Contracting Party in 13 September

1998. The *Melaleuca* swamp forest of Khuan Khi Sian is one of the two large bird breeding colonies in Thale Noi Non-hunting Area. The other is Khuan Thale Maung. However, the information of waterbird population in the breeding colony of Khuan Khi Sian is still lacking.

Thale Noi Non-hunting Area has a high diversity of wetland habitats used by numerous resident and migratory waterbirds. It comprises a unique *Melaleuca* swamp forest which is rarely found in Thailand. Except for Khao Sam Roi Yod National Park, Thale Noi Non-hunting Area is the only place which supports the breed-

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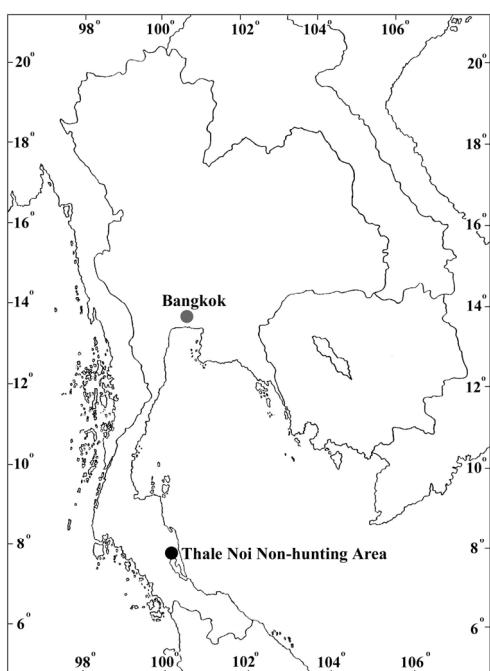


FIGURE 1. Location of Thale Noi Non-hunting Area in southern Thailand.

ing population of *Ardea purpurea* in Thailand (Gray, Piprell and Graham, 1991:132). Moreover, it might be the only breeding population of *Bubulcus ibis* in southern Thailand (Parr, 1994:10). Most of the previous studies on waterbirds were conducted in the entire area of Thale Noi Non-hunting Area, including the seasonal occurrence and distribution of waterfowl (Storer, 1977), species diversity and bird populations (Angkaphreechases, 1985), ecological study of waterbirds at Thale Noi and Kukut of Songkhla Lake (Thailand Institute of Scientific and Technological Research (TISTR), 1982) and breeding and food habits of some birds (Kanchanasaka et al, 1986). Few studies were conducted at Khuan Khi Sian. In order to determine the habitat value and conserve the international importance of the first Ramsar site of Thailand, a detailed study on waterbird population should be conducted.

The objectives of this study were to study species composition, population density and population fluctuation of waterbirds in the breed-

ing colony in the *Melaleuca* swamp forest at Khuan Khi Sian, Thale Noi Non-hunting Area, Phatthalung Province. The results will provide baseline information on waterbird population before and after the area has been enforced as the first Ramsar site of Thailand. In addition, the results of this study can be used for the ecotourism management in the future.

MATERIALS AND METHODS

Study Area

Khuan Khi Sian is under the jurisdiction of Khuan Khi Sian Protection Unit of Thale Noi Non-hunting Area. It is located at latitude 7°49' to 7°51'N and longitude 100°07' to 100°09'E. The area is situated approximately 5 km north of Thale Noi lake. It covers an area of 3,085 rai (19,281.25 ha), consisting of *Melaleuca* swamp forest, grass lands, reed beds and wet meadows. Location of Thale Noi Non-hunting Area in southern Thailand is shown in Figure 1. The *Melaleuca* forest of Khuan Khi Sian is considered to be a secondary forest because most of the original trees were damaged by fire and replaced by new trees (TISTR, 1982:9). At present, most of them are approximately 10-15 m high. The study area is flooded almost year round: in April, the water level is not high and gradually decreases to the extent that it is absolutely dry in July and the area is flooded again in October, and the water level gradually increases in November and then slightly decreases toward March.

The study was conducted monthly from April 1998 to March 1999. The numbers of waterbirds were counted 3 days a month on the observation tower, situated approximately 300 m from the breeding colony, by using point count method with telescope (15-45x45), binocular (8x40) and naked eyes. The observation began at approximately 06.00 and ended by 18.30 or dusk. Each observation day was classified into 7 periods: 06.00-08.00, 08.01-10.00, 10.01-12.00, 12.01-14.00, 14.01-16.00, 16.01-17.30 and 17.31-dusk.



FIGURE 2. The breeding colony of waterbirds in *Melaleuca* swamp forest at Khuan Khi Sian in April 1998. (Aerial photograph).

The total numbers of each waterbird species were considered in the last period of the observation when all of the waterbirds returned to roost in the breeding colony at dusk. The highest count of each waterbird in each month was recorded as the total number. Some breeding activities of each waterbird were also recorded during each observation period.

The temperature and the relative humidity were also recorded during the bird count was operated. The total rainfall data was taken from the station 50002 of the Meteorological Department at Khuan Khanon District, about 17 km away from the study site. The environmental factors (temperature, relative humidity and total rainfall) were averaged.

RESULTS

Species composition

During the study period, 6 species of waterbirds were observed in the breeding colony. Among these waterbirds, 5 species nested colonially in this area i.e., *Phalacrocorax niger*, *Ardea purpurea*, *Bubulcus ibis*, *Egretta garzetta* and *Nycticorax nycticorax*, while *Threskiornis melanocephalus*, a rare migratory waterbird in Thailand, used the area as a night roosting site from April to July. However, only *P. niger* and *A. purpurea* were found in the study area throughout the year. The waterbirds that nested

colonially in *Melaleuca* swamp forest at Khuan Khi Sian from April 1998 to March 1999 are shown in Figure 3.

Population density and population fluctuation

The total number of waterbirds in each month greatly fluctuated throughout the year, of which the maximum number was 20,430 individuals in May, and the minimum number was 136 individuals in September. The population density of each waterbird species fluctuated throughout the year and coincided with their breeding periods. The numbers of waterbirds from April 1998 to March 1999 are shown in Figure 4.

Phalacrocorax niger (Vieillo, 1817)

Little Cormorant

The population density of *P. niger* fluctuated greatly throughout the year. The maximum number was 3,816 individuals in May whereas the minimum number was 88 individuals in September. The results showed that *P. niger* had 2 peaks of population density which were related to its breeding activities. The higher peak was recorded in May and the other was recorded in December. The high breeding activities consisting of nesting, egg laying, incubating and hatching in May resulted in the higher peak. This bird foraged for their young throughout the day in May and June. Then the numbers

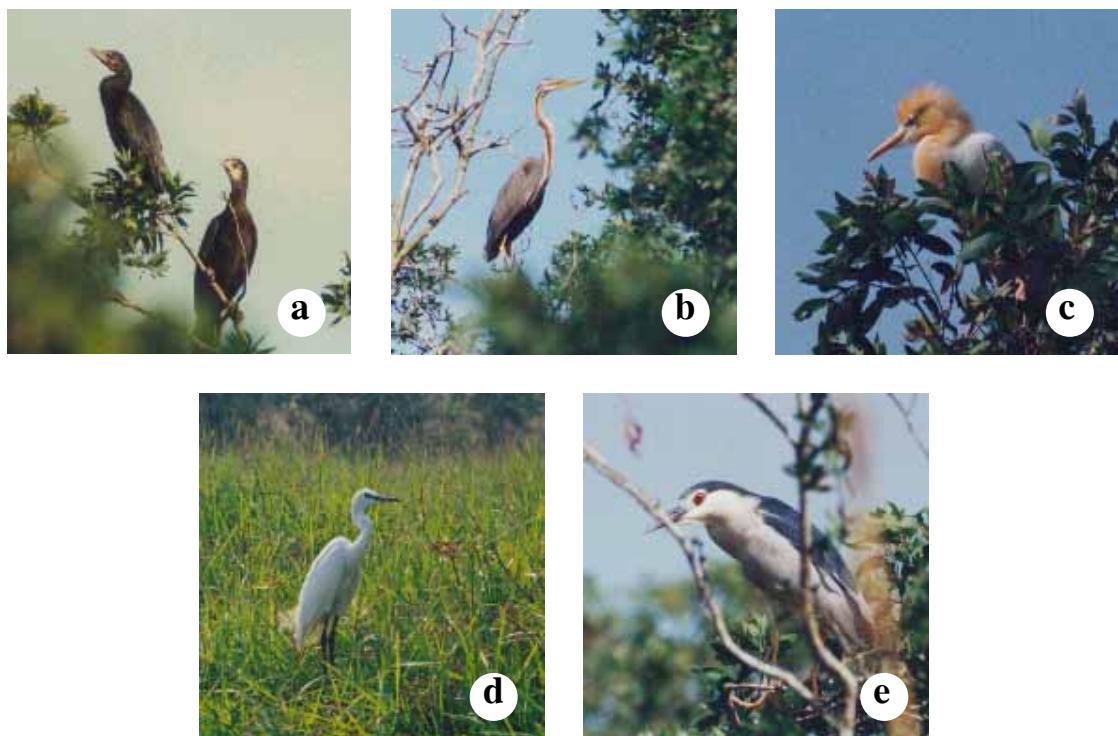


FIGURE 3. Waterbirds that nested colonially in *Melaleuca* swamp forest at Khuan Khi Sian from April 1998 to March 1999. a, *Phalacrocorax niger*; b, *Ardea purpurea*; c, *Bubulcus ibis*; d, *Egretta garzetta*; e, *Nycticorax nycticorax*.

decreased to the lowest value in September when the young of this species completely fledged and left their nests. It seems that most of the birds left the breeding colony to feed in other areas in this month. The breeding activities were observed again in October. The population of this species increased to the second peak in December when the breeding activities were high. This bird foraged throughout the day for rearing their young from November to February. After the second peak period, the population decreased slightly until March. Most of the young climbed out from their nest and some left their nest in February and March.

Ardea purpurea Linneaus, 1766

Purple Heron

In comparison with *P. niger*, monthly numbers of *A. purpurea* did not change greatly throughout the year. The maximum number was 774 individuals in March, whilst the mini-

mum was 23 individuals in October. The average was 340 individuals per month. The numbers increased to the first peak in June due to the high breeding activities comprising nesting, egg laying, incubating, hatching and fledgling. This species foraged throughout the daytime in June and July. Then the population gradually decreased to the lowest value in October. A few young were found in October when most of them fled from the breeding area. Besides, none of this bird was found in the breeding area during daytime. From November to February, the nests were found in the breeding colony again. The population slightly fluctuated from December to February when the birds foraged throughout the day for rearing their young. Owing to the high breeding activities in January and February, the population increased to the highest value in March. Most of the waterbirds found in the breeding area were hatchlings, fledglings and incubating adults.

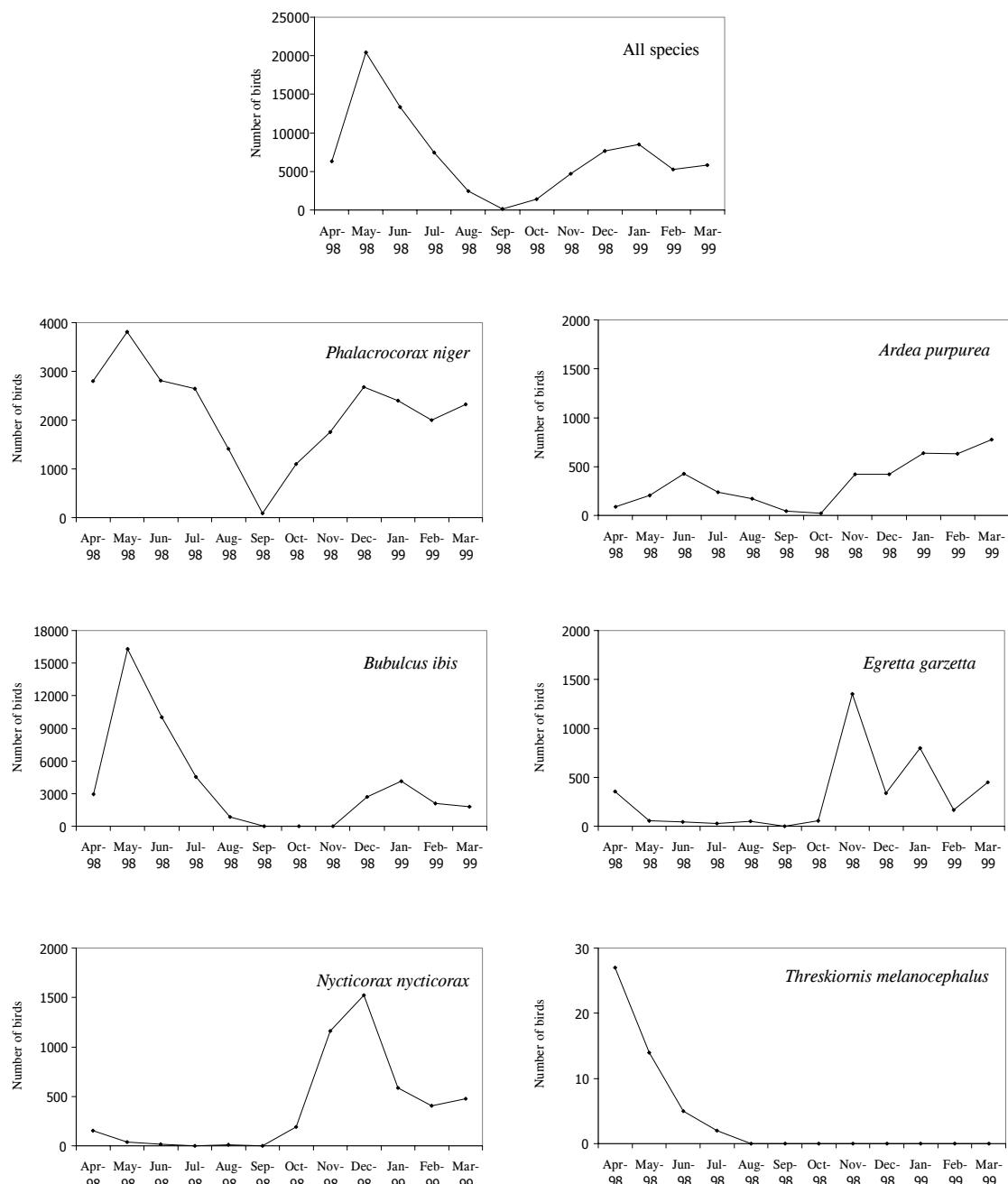


FIGURE 4. Population fluctuations of waterbirds in *Melaleuca* swamp forest at Khuan Khi Sian from April 1998 to March 1999.

Bubulcus ibis (Linneaus, 1758)

Cattle Egret

The numbers of *B. ibis* fluctuated from 0 to 16,303 individuals, of which the maximum number was recorded in May. Only 1 individual was recorded in September and October. The average was 3,783 individuals per month. The population density increased steeply from April to the higher peak in May due to the breeding activities. Most of these birds were incubating and rearing their young in April and May. Then the numbers decreased dramatically to zero in November. The young of this species completely fledged in August. Few birds were observed in the breeding area from September to November. It appears that *B. ibis* temporarily left the breeding colony in these months. This species disappeared during daytime in December and January, but some were found after dusk. Moreover, some breeding birds with distinctive plumage were observed again in these months. As a result, the numbers increased to the second peak in January. It is likely that this bird prepares to occupy its nesting site in February and March. Unlike *P. niger*, the second peak of *B. ibis* did not relate to its breeding activities. A considerable number of *B. ibis* returned to the breeding area at dusk from December to March but its breeding activities were not observed. It is likely that this bird still uses the area as a night roosting site after its breeding period.

Egretta garzetta (Linneaus, 1758)

Little Egret

The number of *E. garzetta* from April to October did not fluctuate. The average number per month of *E. garzetta* was 308 individuals. The maximum number was 1,354 individuals in November, whereas the minimum was 51 individuals in August. The data obtained indicated that the number of *E. garzetta* was low from May to October, even though some of its breeding activities could be observed. It is probable that some factors are not suitable for this bird to complete its breeding activities during these months. For example, a large number of *B. ibis* may compete with *E. garzetta* for the nesting

site, thereby limiting the population of *E. garzetta* during its breeding period from April to September. None of this bird was found during daytime in September. Most individuals left the breeding site from September to October. The number sharply increased and peaked in November, then fluctuated moderately from December to March. High breeding activities were also observed in December and January. However, the population of this species was high from November to January when *B. ibis* did not nest.

Nycticorax nycticorax (Linneaus, 1758)

Black-crowned Night Heron

Like *E. garzetta*, the population density of *N. nycticorax* from May to October did not fluctuate. The average number of *N. nycticorax* was 381 individuals per month. The maximum number was 1,523 individuals in December, whereas the minimum was 2 individuals in July. The population density was low from April to October. The breeding activities of this bird were not recorded during these months. Furthermore, none of this bird was found in September. The population density peaked in December. The breeding activities were high from November to January. This bird foraged throughout the daytime during these months. The reduction of almost half of its original number was recorded since December. It is likely that the young completely fledged and left the breeding area.

Threskiornis melanocephalus (Latham, 1790)

Black-headed Ibis

Since the beginning of the study period in April 1998, the population of *T. melanocephalus* tended to decrease significantly so that after July it had completely disappeared from Khuan Khi Sian area. The maximum was 27 individuals in April. *T. melanocephalus* did not nest in Khuan Khi Sian; however, it flew into this area for roosting after dusk from April to July. It left the colony for feeding before dawn, thus none was found in the study area during daytime. According to the observation by Thale Noi Non-hunting Area personnel (personal comm.), this species traveled to feed during daytime in wetland areas at Ban Pran and Khuan

Thale Maung, which is located in the north and the northeast of Thale Noi lake.

The climatic condition and the relationship between the waterbird population and the environmental factors

The monthly rainfall ranged from 0 to 342.7 mm, of which the maximum was in October. The minimum rainfall recorded in June was 24.5 mm. The mean temperature and relative humidity did not change greatly. The climatic condition of Khuan Khi Sian from April 1998 to March 1999 is shown in Figure 5.

Table 1 shows the correlation between environmental factors and the number of waterbirds at Khuan Khi Sian from April 1998 to March 1999. Although the number of *N. nycticorax* showed negative correlation to the mean temperature, it revealed positive to the total rainfall. In contrast, the number of *T. melanocephalus* showed positive correlation to the mean temperature and showed negative correlation to the total rainfall. The mean temperature and total rainfall might be the main factors influencing the change in number of these waterbirds.

DISCUSSION AND CONCLUSION

Six species of waterbirds were found in the *Melaleuca* swamp forest at Khuan Khi Sian. Five species nested in this area, consisting of *P. niger*, *A. purpurea*, *B. ibis*, *E. garzetta* and *N. nycticorax*. Another species was *T. melanocephalus*, which used this area as a night roosting from April to July. Kanchanasaka, et al (1986) reported that 3 species of waterbirds nested in the *Melaleuca* swamp forest of Thale Noi Non-hunting Area, namely *Mycteria leucocephalus*, *A. purpurea* and *B. ibis*. Among these waterbirds, only *M. leucocephalus* was not found in the present study whereas, *P. niger*, *E. garzetta* and *N. nycticorax* were not reported in the previous study. This may be because the previous study did not mention the definite boundary of *Melaleuca* forest so it can lead to the difficulty when comparing the species composition between these 2 studies.

TABLE 1. Pearson's correlation coefficient relating environmental data and the number of waterbirds in *Melaleuca* swamp forest at Khuan Khi Sian from April 1998 to March 1999.

Parameters	Mean Temp.	RH	Total Rainfall
<i>P. niger</i>	0.508	0.069	-0.356
<i>A. purpurea</i>	-0.371	-0.151	0.163
<i>B. ibis</i>	0.418	-0.097	-0.350
<i>E. garzetta</i>	-0.109	0.209	0.333
<i>N. nycticorax</i>	-0.582*	0.253	0.597*
<i>T. melanocephalus</i>	0.630*	0.418	-0.576*

* Correlation is significant at $P \leq 0.05$ (2-tailed)

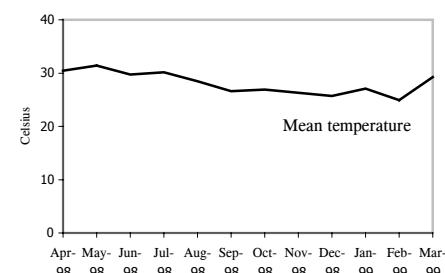
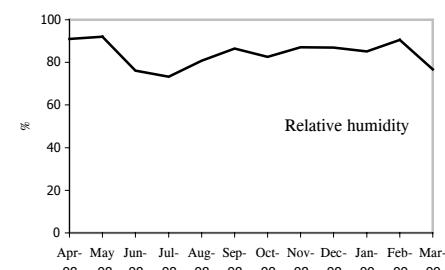
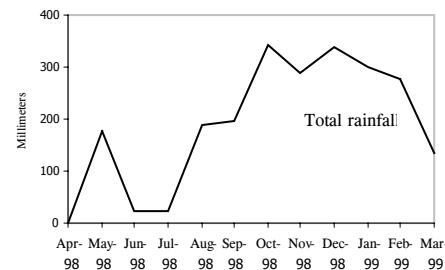


FIGURE 5. The climatic condition of Khuan Khi Sian from April 1998 to March 1999.

The numbers of waterbirds in the *Melaleuca* swamp forest at Khuan Khi Sian fluctuated throughout the year, coinciding with the breeding periods of each species. The population density peaked between April and June when all species used the area for their breeding activities. The population density was low in a non-breeding period when most of young birds completely fledged and left the breeding colony temporarily for feeding with their parents in nearby wet areas.

It can be concluded that the *Melaleuca* swamp forest at Khuan Khi Sian is one of the most important breeding areas of waterbirds in Thailand. Except for Khao Sam Roi Yod National Park, the *Melaleuca* swamp forest at Khuan Khi Sian might be the only place which supports the breeding population of *A. purpurea* in Thailand. It might also be the only place which supports the breeding population of *B. ibis* in the south.

The breeding period of waterbirds is considered as a critical stage in their life cycles. It is best not to disturb them when all species use this area for their reproduction from April to June. During this period, tourism activities into this area should be prohibited.

To conserve the international importance and justify the Ramsar site status of the *Melaleuca* swamp forest of Khuan Khi Sian, it is necessary to conduct long-term simultaneous studies on the breeding ecology and habitat utilization of waterbirds. In addition, monitoring of the waterbird population should be carried on regularly in order to determine the sustainability of the area.

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