

THE BIRD LIFE OF THE NATURE RESERVE PULAU DUA

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Introduction

The nature reserve Pulau Dua (6°01'S, 106°12'E) is one of the major sanctuaries for colonial breeding herons, egrets, cormorants, and ibis in Indonesia. Located in Banten Bay, on the north coast of West Java, it was established as a sanctuary in 1937, and by 1942 Hoogerwerf (1947) estimated 8,000–10,000 birds were present during the breeding season. At that time, the channel separating Pulau Dua from Java was greater than 500 m wide. However, Java has a rapidly accreting northern coastal plain and by 1978 the narrowed channel had become completely silted and colonized by rapidly growing *Avicennia marina*, a mangrove tree species.

From this time, the *Avicennia* forest has grown to a height of six to eight meters, and is now used as a nesting area. However, lying outside the boundaries of the reserve, this area was threatened by disturbance, cutting for firewood, and conversion into fish ponds (tambak). Efforts to have protection extended to this new area were successful and on 26 Dec 1984, the Minister of Forestry signed a ministerial decree which enlarged the reserve from its former 8 ha to approximately 30 ha.

The enlarged area includes not only the new *Avicennia* forest, but a small coral island lying approximately 600 m to the east (Pulau Satu) and a 200 m wide buffer zone extending southwards into the area of tambak.

Between February 1984 and June 1985, we have made eight trips to this reserve to inventory the avifauna and perform a census of the breeding colony. This article reports on some of our findings which are reported in greater detail in Milton and Marhadi (in prep).

Description of Island (see Fig. 1)

The original reserve is a low-lying island (8 ha) rising to not more than 3–4 m above mean sea level. The northern part is a coral rampart with sand, covered by a 6–8 m high *Diospyros maritima* forest. The trees form a closed canopy with low light penetration and thus a poorly developed herb/shrub layer. The central section of this forest is overgrown by the bindweeds *Ipomoea tuba*, *I. trichosperma*, and *I. pes-caprae* which suppress the growth of the dominant vegetation. Within this *Diospyros maritima* forest can also be found scattered *Ixora timorensis*, *Allophylus cobbe*, *Sterculia foetida*, *Tamarindus indicus*, and *Erythrina variegata*. Westward the vegetation becomes more open because of former cutting (Hoogerwerf 1947) and is dominated by *Hibiscus tiliaceus*.

The central dry area of the island is covered by low (<2m) herbs and shrubs, consisting of stands of *Barteria prionitis*, *Pluchea indica*, *Lantana camara*, *Eupatorium odoratum*, *Opuntia vulgaris*, and clumps of *Diospyros maritima* overgrown by bindweed.

Southward the land slopes to sea level and there is a narrow stand of 4–5 m high *Lumnitzera racemosa*, *Bruguiera cylindrica*, and *Hibiscus tiliaceus*.

The former southern boundary is dominated by mangrove *Rhizophora* spp. with small numbers of *Aegiceras corniculatum* and *Avicennia marina*, ranging in height from 6–8 m in the east to 4–5 m in the west. In the extreme southwest of the former reserve is a small stand of 4–5 m high *Sonneratia alba*.

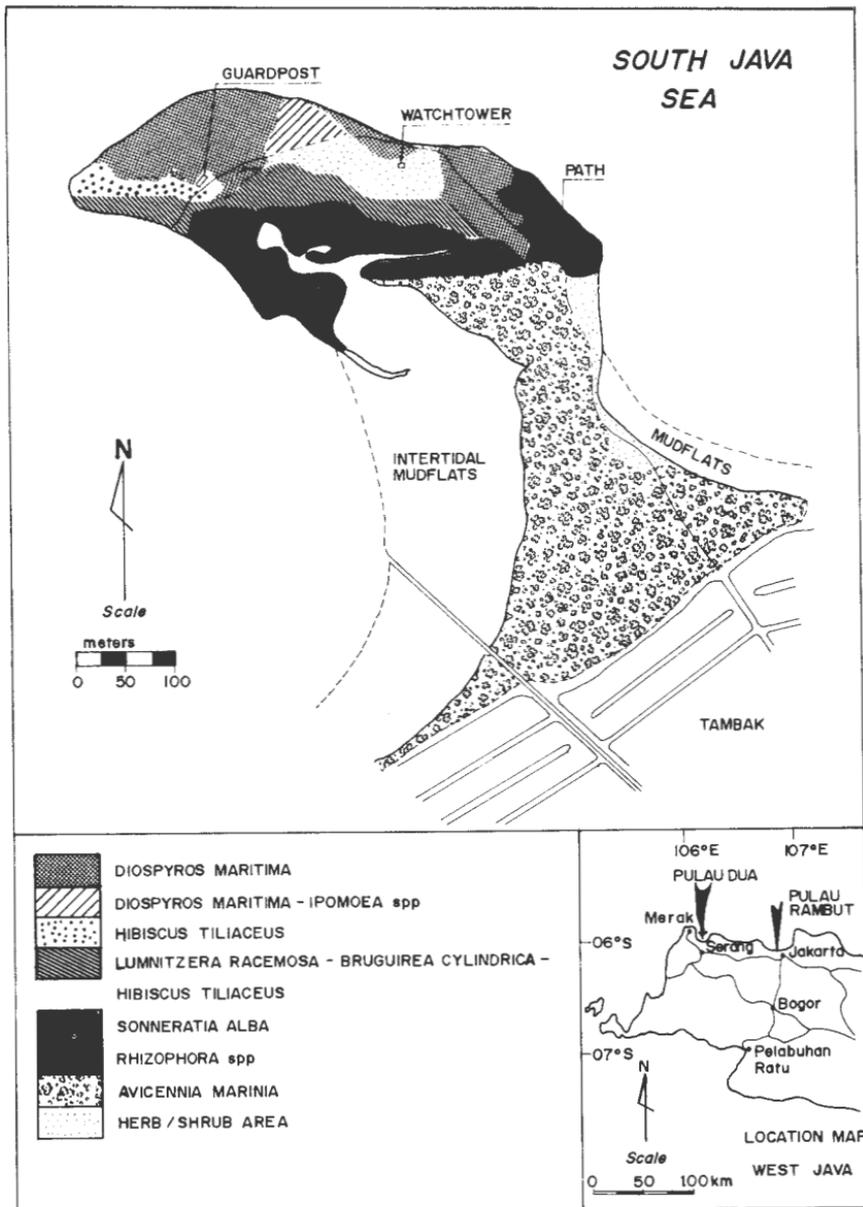


Figure. 1 PULAU DUA VEGETATION TYPES

The newly protected area is principally *Avicennia marina* that is approximately 6–8 m high. The silt substrate is more settled to the east than the accreting western boundary where the depth exceeds 1.5 m. The 200 m wide buffer zone is part of a 1–2 km wide stretch of lowland that has been converted into tambak. The vegetation on the dykes of the tambak is varied (Schuster 1952) but species commonly encountered are *Avicennia marina*, *Pluchea indica*, *Opuntia vulgaris*, *Acanthus ilicifolius*, *Suaeda maritima*, and *Scirpus* spp.

Discussion

a. Colonial birds

During the 1985 breeding season, extending from February through June, a total of 7308 nests was counted. The survey method is outlined in detail in Milton and Marhadi (in prep). Briefly, the old reserve and new *Avicennia* forest were divided into 25 by 25 m plots, and the number of nests within each plot counted. Due to the difficulty of distinguishing nests to species level, it was necessary to apply proportionality values to the total number of nests. These values were determined by recording the number of nests with breeding birds in attendance over the area of the colony from selected vantage positions. The colony was divided into five areas, distinguished by topographic features and vegetation structure. It was then possible to apply the proportionality values to the total number of nests counted in each area.

There are at present 11 species of birds breeding colonially in this reserve (Table 1). Past and current population estimates of these and former breeders are annotated in Appendix 1.

Previous reports of the breeding population on Pulau Dua have probably been over-estimates as they were based on either the number of birds returning to the island (Hoogerwerf 1947), or a composite of adult birds in breeding plumage and occupied nests (5000 pairs-Harvey 1976). Both of these previous estimates do not consider a common feature of large colonial birds which is delayed breeding, i.e. adult birds do not become reproductively active until they are several years old. However, these non-breeders return daily to use the breeding colony as a roost site. Our value (7308) on the number of breeding pairs is from nests only, which may under-estimate the population because of failure to record late or failed (and destroyed) nests. Table 2 gives the species make-up of the colony with the 95 percent confidence interval for those species with proportionality values. Although these intervals are sometimes wide, particularly for *Nycticorax nycticorax*, the accuracy of the estimate could only be improved with a substantial increase in time and resources. This survey provides a minimum estimate of 14616 breeding birds, although the total population utilizing the island is undoubtedly much higher because of the factors discussed above.

Hoogerwerf (1947, 1948a) compiled the first record of the colonial species found on the island. His subsequent papers on Pulau Dua provide additional information on selected species (Hoogerwerf 1948b; 1951a,b; 1952, 1953) which are beneficial in tracing the status of colonial breeders. Colonial species reported by Hoogerwerf which no longer breed in the colony are: *Platalea leucorodia*, *Anhinga melanogaster*, *Ardea purpurea*, *Ibis cinerea* and *Threskiornis melanocephalus*.

It is difficult to explain the disappearance of these birds as breeding species, especially as all but the first still occur regularly on the island, and breed in the nature reserve Pulau Rambut (5°58' S, 106°42' E), in Jakarta Bay. However, disturbance may have been an important factor as *Threskiornis melanocephalus*, *Ibis cinerea*, and *Anhinga melanogaster* were last reported breeding in 1975 (Beuninger *et. al.* 1976, Harvey 1976), when overland access to the island first became possible (Win 1976).

Recent observations have also seen a cessation of breeding by *Egretta garzetta* in the *Diospyros maritima* near the observation tower on the north coast of the island, and through which the trail to the guard post passes. Moreover, birds do not breed, within a 25 m radius of

this post. It is within these two areas that are found the large *Sterculia foetida*, *Tamarindus indicus*, and *Erythrina variegata* in which the species would be expected to breed.

b. Avifaunal inventory

Throughout the period of study, 90 species were identified (Table 1). Also provided is their status, relative abundance and the habitats in which they were observed. The high number of species is not unexpected due to the reserve's close proximity to the larger landmass of Java. The tambak area harbours a number of species that were not recorded inside the reserve during the present survey. However some of these species such as *Pycnonotus aurigaster* and *Dendrocygna javanica* occur commonly and it is expected they will visit the island occasionally. Moreover, several species formerly reported by Hogerwerf (1948a) as occurring on the island, *Prinia polychroa*, *Padda oryziuora*, *Lalage nigra*, *Porzana cinerea* and *Gallinula chloropus* are present in the tambak and rice fields.

The number of species recorded breeding in this small reserve is relatively high, particularly as 29 of the 90 species are migrants to Java. Van Strien (1981) records 16 species as reportedly breeding on the island but four of these are colonial species which have since ceased breeding. Our survey records 19 breeding species and an additional eight species are believed to breed. A total of 27 potentially breeding species is good for this vegetatively simple reserve. Moreover several additional species regularly occur on the island that formerly bred; *Anas gibberifrons*, *Haliastur indus*, and *Haliaeetus leucogaster* (Hoogerwerf 1942). As with several of the colonial species, the breeding efforts of the last two species have possibly been influenced by disturbance.

As commented upon by Wilson & Allport (1985), movement of raptorial and other migrants is poorly documented. (Interestingly a reverse movement of raptors to the northwest was observed by G.R.M. on 7.4.85 while on Sangiang island in the Sunda Strait - between 1130 and 1230, approximately 150-200 *Accipiter* sp were observed flying high over the island with 20-25 *Pernis ptilorhynchus* and two *Falco peregrinus*.) Harvey (1976) reports 100+ *Merops philippinus* roosting on the island over the period 2-5.5.75, while we noted two groups of 300-350 and 65-70 birds roosting in the *Avicennia* forest on the evenings 7.3.85 and 1.4.85 respectively. Neither group was observed the following day.

Conclusion

This reserve will continue to be an important nesting colony for herons, egrets, and cormorants provided protection is maintained. With the recent expansion of the boundaries to include the nesting area of nearly 50% of the breeding colony (1985), it should now be possible to restrict access to this area. In the past this has caused an unnecessary loss of eggs and chicks. Stringent enforcement of regulations regarding access to the colony should dramatically reduce this loss.

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TABLE 1 Bird species recorded during eight visits to Pulau Dua.

Dates of visitation are: 25—28.2.84, 3—6.8.84, 3—6.10.84, 21—22.2.85, 31.3—2.4.85, 4—8.3.85, 13—15.4.85 and 13—15.6.85.

G.A. — Gary Allport A.L. — Adrian Long.

Species	Common Name	Status ¹	Habitat ²
<i>Phalacrocorax niger</i>	Little Cormorant	Cb—A	Rz—Av
<i>P. sulcirostris</i>	Little Black Cormorant	Cb—A	Rz—Av
<i>Anhinga melanogaster</i>	Oriental Darter	V—C	D—Tmb
<i>Fregata andrewsi</i>	Christmas Frigatebird	V—R	P
<i>Ardea sumatrana</i>	Great-billed Heron	V—R	Av—Imf
<i>Ardea cinerea</i>	Grey Heron	Cb—C	Rz
<i>Ardea purpurea</i>	Purple Heron	V—C	Imf—Tmb
<i>Butorides striatus</i>	Little Heron	(B)—A	Tmb
<i>Ardeola speciosa</i>	Javan Pond-Heron	Cb—A	Rz—Av
<i>Bubulcus ibis</i>	Cattle Egret	Cb—A	Rz—Av
<i>Egretta sacra</i>	Pacific Reef-Egret	Cb—C	D—Rz—Av
<i>Egretta alba</i>	Great Egret	Cb—C	Rz
<i>Egretta intermedia</i>	Plumed Egret	Cb—C	Rz—Av
<i>Egretta garzetta</i>	Little Egret	Cb—A	D—Rz—Av
<i>Nycticorax nycticorax</i>	Black-crowned Night Heron	Cb—A	Av—Rz—D
<i>Ixobrychus cinnamomeus</i>	Cinnamon Bittern	V—R	Av—Tmb
<i>Ibis cinerea</i>	Milky Stork	V—C	D—Imf
<i>Threskiornis melanocephalus</i>	Black-headed Ibis	V—C	Rz—D—Imf
<i>Plegadis falcinellus</i>	Glossy Ibis	Cb—C	Av—Rz
<i>Anas gibberifrons</i>	Grey Teal	V—C	Imf—Tmb
<i>Nettapus coromandelianus</i> (AL)	Cotton Pygmy Goose	V—R	Sp
<i>Pandion haliaetus</i>	Osprey	V—R	P
<i>Pernis apivorus</i> (GA)	Eurasian Honey Buzzard	M—Sa	P
<i>Haliaeetus indus</i>	Brahminy Kite	V—Cln	D
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	V—Cln	D
<i>Accipiter gularis</i> (GA)	Japanese Sparrowhawk	M—Sa	P
<i>Accipiter soloensis</i> (GA)	Chinese Goshawk	M—Sa	P
<i>Falco peregrinus</i> (GA)	Peregrine Falcon	M—Sa	P
<i>Turnix suscitator</i>	Barred Buttonquail	(B)—C	Pulau Satu
<i>Amaurornis phoenicurus</i>	White-breasted Waterhen	B—C	D—Hs
<i>Rallus striatus</i>	Slaty-breasted Rail	V—R	Rz
<i>Pluvialis dominica</i>	Lesser Golden Plover	M—Sa	Imf—Tmb
<i>Pluvialis squatarola</i>	Grey Plover	M—R	Imf—Tmb
<i>Charadrius leschenaulti</i>	Greater Sand-Plover	M—R	Imf
<i>Charadrius mongolus</i>	Mongolian Plover	M—R	Imf
<i>Charadrius veredus</i>	Oriental Plover	M—R	Imf
<i>Numenius arquata</i>	Eurasian curlew	M—C	Imf—Tmb
<i>Numenius phaeopus</i>	Whimbrel	M—C	Imf—Tmb
<i>Tringa totanus</i>	Common Redshank	M—C	Imf—Tmb
<i>Tringa nebularia</i>	Common Greenshank	M—C	Imf—Tmb
<i>Tringa stagnatilis</i>	Marsh Sandpiper	M—C	Imf—Tmb
<i>Tringa glareola</i>	Wood Sandpiper	M—Sa	Imf—Tmb
<i>Xenus cinereus</i>	Terek Sandpiper	M—R	Imf
<i>Actitis hypoleucos</i>	Common Sandpiper	M—A	Imf—Tmb
<i>Calidris ruficollis</i>	Rufous necked Stint	M—Sa	Imf—Tmb

<i>Calidris ferruginea</i>	Curllew Sandpiper	M—Sa	Imf—Tmb
<i>Chlidonias leucopterus</i>	White-winged Tern	M—C—Sa	Imf—Tmb
<i>Chlidonias hybrida</i>	Whiskered Tern	M—C—Sa	S—Tmb
<i>Treron vernans</i>	Pink-necked Pigeon	V—R	D—Hs
<i>Streptopelia bitorquata</i>	Javanese Turtle-Dove	B—A	D—Hs—Rz—Tmb
<i>Streptopelia chinensis</i>	Spotted Dove	V—R	D
<i>Geopelia striata</i>	Peaceful Dove	B—A	D—Hs—Tmb
<i>Tyto alba</i>	Barn Owl	V—R	D
<i>Ketupa ketupu</i>	Buffy Fish-Owl	V—R	D
<i>Caprimulgus affinis</i>	Savanna Nightjar	(B)—C	Pulau Satu
<i>Collocalia esculenta</i>	White bellied swiftlet	V—C	P
<i>Alcedo caeruleascens</i>	Small Blue Kingfisher	(B)—C	Thr
<i>Halcyon chloris</i>	Collared Kingfisher	(B)—C	Thr
<i>Halcyon sancta</i>	Sacred Kingfisher	M—C	Thr
<i>Merops philippinus</i>	Blue-tailed Bee-eater	M—C—Sa	Thr
<i>Hirundo rustica</i>	Barn Swallow	M—C	Thr
<i>Hirundo tahitica</i>	Pacific Swallow	V—C	Thr
<i>Delichon dasypus</i>	Asian House-Martin	M—R	D—Rz
<i>Pycnonotus goiavier</i>	Yellow-vented Bulbul	(B)—C	Hs—Tmb
<i>Oriolus chinensis</i>	Black-naped Oriole	V—R	D
<i>Corvus macrorhynchos</i>	Large-billed Crow	V—Ln	D
<i>Copsychus saularis</i>	Magpie Robin	B—C	D
<i>Gerygone sulphurea</i>	Flyeater	B—C	Rz—Av
<i>Phylloscopus borealis</i>	Arctic Warbler	M—R	Av
<i>Acrocephalus sp</i>	Great Reed-Warbler sp	M—Ln	D—Hs
<i>Prinia familiaris</i>	Bar-winged Prinia	B—A	Hs—Rz—Av
<i>Cisticola juncidis</i>	Zitting Cisticola	V—R	Pulau Satu
<i>Orthotomus sutorius</i>	Common Tailorbird	V—Ln	D—Hs
<i>Culicicapa ceylonensis</i>	Grey-headed Flycatcher	V—R	Av
<i>Rhipidura javanica</i>	Pied Fantail	(B)—C	Thr
<i>Artamus leucorhynchos</i>	White-breasted Wood Swallow	V—C	Thr
<i>Sturnus contra</i>	Asian Pied Starling	V—C	D—Hs—Tmb
<i>Sturnus melanopterus</i>	Blackwinged Starling	V—C	D—Hs—Tmb
<i>Sturnus sturninus</i>	Purple-backed starling	M—R	D—Hs
<i>Acridotheres javanicus</i>	White-vented Myna	V—C	D—Hs—Rz
<i>Antheptes malacensis</i>	Brown-Throated Sunbird	V—C	D—Hs—Tmb
<i>Nectarinia jugularis</i>	Olive-backed Sunbird	(B)—C	Thr
<i>Arachnothera longirostris</i>	Little Spiderhunter	V—R	D
<i>Dicaeum trochileum</i>	Scarlet-headed Flower pecker	(B)—C	D—Hs
<i>Zosterops flava</i>	Javan White-eye	V—C	D—Hs
<i>Ploceus manyar</i>	Streaked Weaver	B—C	D—Hs
<i>Lonchura leucogastroides</i>	Javan Munia	V—R	Hs
<i>Lonchura maja</i>	White-headed Munia	B—C	Hs
<i>Lonchura punctulata</i>	Scaly-breasted Munia	V—R	Hs
<i>Lonchura malacca</i>	Chestnut Munia	V—R	Hs

1. Status: : B— breeding; (B)— presumed breeding; Cb— colonial breeding; M— migrant; V— visitor; A— abundant (regularly greater than 50 individuals or breeding pairs); C— common (regularly 6—49 individuals or breeding pairs); Ln— low numbers (regularly 5 or less individuals or breeding pairs); R— rare (seen only occasionally or in low numbers) Sa— sometimes abundant.

2. Habitat: : Av—*Avicennia* forest; D—*Diospyros* forest; Hs— herb and shrub areas; Imf— intertidal mudflat; p— passage over island; Rz— *Rhizophora* forest; S—sea; Tmb—Tambak; Thr— Throughout.

TABLE 2. The number and 95% confidence interval (C.I) of nests per species in the bird colony on Pulau Dua during the breeding season (Feb—June) in 1985.

Species	Common name	Estimated No. of nests	± 95% C.I
<i>Phalacrocorax</i> spp	Cormorants	1286	± 244
<i>Ardea cinerea</i>	Grey Heron	11	
<i>Ardeola speciosa</i>	Javan-pond Heron	978	± 230
<i>Bubulcus ibis</i>	Cattle Egret	3649	± 297
<i>Egretta sacra</i>	Pacific Reef-Egret	210	
<i>Egretta alba</i>	Great Egret	34—37	
<i>Egretta intermedia</i>	Plumed Egret	63	± 42
<i>Egretta garzetta</i>	Little Egret	1121	± 213
<i>Nycticorax nycticorax</i>	Black-crowned Night Heron	213	?
<i>Plegadis falcinellus</i>	Glossy ibis	ca. 40	
Total nests counted on colony		7308	

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APPENDIX 1 An annotated checklist of the present and former colonial breeding birds on reserve Pulau Dua.

Phalacrocorax niger Little Cormorant

Resident and colonial. The most common of the two species of cormorant with a total estimated population of 1286 (± 244) breeding pairs. Wind (1978) estimated the breeding population of the two species to be only 500 pairs.

Phalacrocorax sulcirostris Little Black Cormorant

Resident and colonial. First reported to breed on Pulau Dua in 1951 (Hoogerwerf 1951b) and since then it has been a regular breeder in low numbers.

Anhinga melanogaster Oriental Darter

Small numbers regularly roost on the island. Formerly bred (Hoogerwerf 1948 a) and last reported nesting in 1975 (1 pair, Harvey 1976).

Ardea cinerea Grey Heron

Resident and colonial. Reported breeding by Hoogerwerf (1948 a), estimated by Harvey to number 70 breeding pairs in 1975, declining to three pairs in 1978 (Wind), and 11 pairs in 1985.

Ardea purpurea Purple Heron

Regular visitor. Formerly bred on island (Hoogerwerf 1948 a) but by 1975 no birds were reported by Harvey. Small numbers commonly observed roosting and foraging in adjoining tambak and intertidal mudflat.

Ardeola speciosa Javan Pond-Heron

Resident and colonial. Recorded breeding by Hoogerwerf (1948 a) and a minimum 200 breeding pairs in 1975 (Harvey). This number had increased to 978 (± 230) in 1985.

Bubulcus ibis Cattle Egret

Resident and colonial. The most abundant species on the island with an estimated 3649 (± 297) in 1985. Harvey also comments that this is the most common species with at least 2500 breeding pairs.

Egretta sacra Pacific Reef-Egret

Resident and colonial. Present in low numbers during 1985 (less than 10 pairs) but possibly more abundant due to mistaking white forms for *E. garzetta*. Harvey estimated a minimum two pairs and concludes the same.

Egretta alba Great Egret

Resident and colonial. Reported breeding by Hoogerwerf (1948 a) and estimated by Harvey to have a minimum breeding population of 100 — 200 pairs. The numbers had declined to approximately 20 and 30 pairs in 1976 and 1978 respectively (Wind). The breeding population in 1985 was 34 — 37 pairs.

Egretta intermedia Plumed Egret

Resident and colonial. Breeding reported by Hoogerwerf (1948 a) with a minimum estimate of 200 pairs in 1975 (Harvey). During the 1985 nesting season an estimated 63 (± 42) breeding pairs.

Egretta garzetta Little Egret

Resident and colonial. The second most common breeding species, reported present by Hoogerwerf (1948 a), estimated by Harvey to have a minimum breeding population of 1000 pairs; 1121 (± 213) breeding pairs in 1985.

Nycticorax nycticorax Black-Crowned Night-Heron

Resident and colonial. Estimated by Harvey in 1975 to be 500 — 700 breeding pairs. The estimate in 1985 is 213 (± 302) breeding pairs. The actual population is probably in the upper end of the range as the survey method is believed to have under-estimated the number. It was also reported by Hoogerwerf (1948 a) to be a common breeder numbering hundreds.

Ibis cinerea Milky Stork

Regular visitor. Formerly bred on the island (Hoogerwerf 1948 a) and last reported nesting in 1975 (7 nests, Beuningen *et. al.* 1976). Roosts in small groups (2 — 10) although a group of 32 was recorded 13.6.85.

Threskiornis melanocephalus Black-headed Ibis

Common. Formerly bred (Hoogerwerf 1948 a) and in 1953 greater than 400 birds (Hoogerwerf 1953) were estimated nesting in several sub-colonies on the island. Harvey reported 15 pairs beginning to nest in 1975 but by 1978 (Wind) only 41 birds were observed roosting. Currently, approximately 40 — 50 birds regularly roost on the island.

Plegadis falcinellus Glossy Ibis

Resident and colonial. First reported to occur in 1941 (Hoogerwerf 1948 a) and breeding in 1951 (Hoogerwerf 1953). The breeding population is now estimated at approximately 40 pairs, the same as reported by Harvey. Both Hoogerwerf (1953) and Wind (1978) report breaks in breeding.

Platalea leucorodia White Spoonbill

First reported on island in 1941 (Hoogerwerf 1948 b) with breeding occurring in 1951 and 1952 (Hoogerwerf 1951, 1952). No recent records.

APPENDIX 2. Addendum of additional species recorded by W.G. Harvey and D.A. Holmes (*pers. comm.*) between 1976 and 1980. Most of these were observed on the immediately adjacent waters or mudflats of Banten Bay. With the exception of the iora, all are migrants or casual visitors.

(The editors).

<i>Charadrius dubius</i>	Little Ringed Plover
<i>Numenius madagascarensis</i>	Eastern Curlew
<i>Limosa lapponica</i>	Bar-tailed Godwit
<i>Calidris tenuirostris</i>	Great Knot
<i>Calidris alba</i>	Sanderling
<i>Calidris subminuta</i>	Long-toed Stint
<i>Himantopus himantopus</i>	Black-winged Stilt
<i>Glareola maldivarum</i>	Oriental Pratincole
<i>Sterna bergii</i>	Great Crested Tern
<i>Sterna bengalensis</i>	Lesser Crested Tern
<i>Sterna dougallii</i>	Roseate Tern
<i>Sterna sumatrana</i>	Black-naped Tern
<i>Sterna albifrons</i>	Little Tern
<i>Gelochelidon nilotica</i>	Gull-billed Tern
<i>Apus pacificus</i>	Fork-tailed Swift
<i>Aegithina tiphia</i>	Common Iora