

UPDATING THE SEABIRD FAUNA OF JAKARTA BAY, INDONESIA

FRANSISCA N. TIRTANINGTYAS¹ & KHALEB YORDAN²

¹ *Burung Laut Indonesia, Depok, East Java 16421, Indonesia (fransisca_noni@yahoo.com)*

² *Jakarta Birder, Jl. Betung 1/161, Pondok Bambu, East Jakarta 13430, Indonesia*

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ABSTRACT

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Jakarta Bay, with an area of about 490 km², is located at the edge of the Sunda Straits between Java and Sumatra, positioned on the Java coast between the capes of Tanjung Pasir in the west and Tanjung Karawang in the east. Its marine avifauna has been little studied. The ecology of the area is under threat owing to 1) Jakarta's Governor Regulation No. 121/2012 zoning the northern coastal area of Jakarta for development through the creation of new islands or reclamation; 2) the condition of Jakarta's rivers, which are becoming more heavily polluted from increasing domestic and industrial waste flowing into the bay; and 3) other factors such as incidental take. Because of these factors, it is useful to update knowledge of the seabird fauna of Jakarta Bay, part of the East Asian–Australasian Flyway. In 2011–2014 we conducted surveys to quantify seabird occurrence in the area. We identified 18 seabird species, 13 of which were new records for Jakarta Bay; more detailed information is presented for Christmas Island Frigatebird *Fregata andrewsi*. To better protect Jakarta Bay and its wildlife, regular monitoring is strongly recommended, and such monitoring is best conducted in cooperation with the staff of local government, local people, local non-governmental organization personnel and birdwatchers.

Key words: Christmas Island Frigatebird, Indonesia, Jakarta Bay, seabird

INTRODUCTION

Jakarta Bay, Indonesia, lies at the edge of Sunda Straits, on the coast of Java between the capes of Tanjung Pasir in the west and Tanjung Karawang in the east. There are a number of small islands within the bay, including Pulau Rambut, a nature reserve that protects several water bird species and has been identified as an Important Bird Area (IBA), and Ramsar site. In addition to a heronry, Pulau Rambut provides habitat for populations of the endangered Milky Stork *Mycteria cinerea*, which breed on this island, as well as several waterbirds such as Western Cattle Egret *Bubulcus ibis*, Great Egret *Ardea alba*, Little Egret *Egretta garzetta*, Intermediate Egret *Ardea intermedia*, and Glossy Ibis *Plegadis falcinellus*, all of which roost on this island (Ayat 2002, Arifin 2004, Wardhani 2011, BKSDA DKI Jakarta 2014). Otherwise, the bird fauna of surrounding waters are little known.

The ecology of the area is threatened by Jakarta's Governor Regulation No. 121/2012, which zoned the northern coastal area of Jakarta for development through the creation of new islands or reclamation (Gubernur Provinsi Daerah Khusus Ibukota Jakarta 2012). Another threat is the condition of the rivers, which are increasingly polluted by domestic and industrial waste. Jakarta Bay also serves as the gateway for shipping and marine transportation to and from the busiest fishing port in the capital city, Tanjung Priok Port. As a consequence of these activities, the carrying capacity of the ecosystem is degraded (Sachoeamar & Wahjono 2007, Rochello-Dolmen & Cleary 2007). Heavy metal concentrations exceed government standards (IADC/CEDA 1997, Haryati *et al.* 2013). Another pollutant is garbage; the sub-office of the sanitation district in 2015, reported 35.1 t per day of waste, consisting of inorganic and organic materials such as plastic bottles, plastic bags, sandals, styrofoam, banana trees, and water hyacinth plants (Sahwan 2004).

Incidental take of certain seabird species by fishing activities may also be a problem.

Despite the state of the Bay, seabird fauna still exist! However, only a few studies have been conducted on seabirds in Indonesian waters, especially in the Java Sea (e.g., Cadee 1985, Noni 2012, Tirtaningtyas 2014, Tirtaningtyas & Henniscke 2015), although research on sea- and waterbirds in East Asia has been increasing (see reviews by de Korte 1989, van Balen 1991, Bishop 1992, Erfteimeijer 1992, de Jong 2011, Poole *et al.* 2011). Despite that research activity, the record of seabirds in Jakarta Bay remains limited; some records come from one researcher, Cadee (1985), who saw only three frigatebirds *Fregata* spp. in Jakarta Bay. The other records are from bird tour reports: at least 50 Christmas Island Frigatebirds *Fregata andrewsi* were observed by Eaton (2013) and by Lambert (2012), and over 200 by Robson (2008a), around Rambut Island. All of these authors also recorded a variety of terns, typically Great Crested Tern *Thalasseus bergii*, Lesser Crested Tern *T. bengalensis*, and Common Tern *Sterna hirundo*, but Robson (2010) also recorded Aleutian Tern *Onychoprion aleuticus* in Ancol Harbour. Our study aimed to survey the occurrence of seabirds in Jakarta Bay more systematically than had been done previously, to attain a better perspective on species composition.

STUDY AREA AND METHODS

Jakarta Bay covers an area of about 490 km² and is composed of waters of the strait between Java and Sumatra, as well as input from several coastal rivers. The nutrient condition in Jakarta Bay is dynamic, due to the influence of the surrounding environment, including natural factors but also the waste derived from various activities around the region, including port, residential, industrial, and recreational activities, which enters these waters. The bay

is affected by runoff from 13 rivers. The depth of Jakarta Bay is <30 m, and the bottom consists of terrestrial mud, coral sand, rubble, and coralline algae (Prayitno 2011, Arifin 2004, van der Meij *et al.* 2009).

Owing in part to its shallow depths, the waters of Jakarta Bay are not stationary, and depth circulation is strongly influenced by tides. The flood tide ranges 0.71–1.23 m/s and the ebb tide 0.34–1.31 m/s, while the average wind speed is between five and 10 knots (2.7 and 5.4 km/h; Suriwati *et al.* 2005; maritim.bmkg.go.id), further contributing to mixing of the various water inputs. Jakarta Bay is also an important fishing ground for small-scale fishermen. Since the area is relatively narrow, only a small selection of fishing gear is used: stationary liftnet (known as *bagan* or *sero*, and traps known as *bubu*), gillnet, and hook and line. Some mollusc fishermen also operate in the estuarine areas. Fishery production is dominated by demersal fish, such as groupers *Epinephelus* spp. and red snappers *Lutjanus* spp. (Anna & Akhmad 2008).

Our study was conducted in the western part of Jakarta Bay, Java (5°59'29"S, 106°41'01"E; Fig. 1), ~15 km northwest of Jakarta. The study covered three periods: July 2011–July 2012, April–July 2013, and July 2014. In July 2011–July 2012 and April–July 2013, we conducted two-day surveys every month from a vessel using the line transect method, for a total of 17 surveys. On the first survey day, we visited a core area covering 50 km² that was divided into 1 × 1 km grid cells (Fig. 1). During each survey, the boat stopped for 10 min in the center of each cell (determined by global positioning system [GPS]), and the observers counted the birds within a radius of 500 m and within a 360° arc. On the second day, the boat travelled over a larger area to the small islands near the core study area, including Untung Jawa, Rambut, Bokor, and Lancang islands. We also included species seen on a bird tour led by one of us (KY) in Jakarta Bay in July 2014.

RESULTS

We encountered 18 seabird species, 13 of which were new for Jakarta Bay, as follows (see also Table 1).

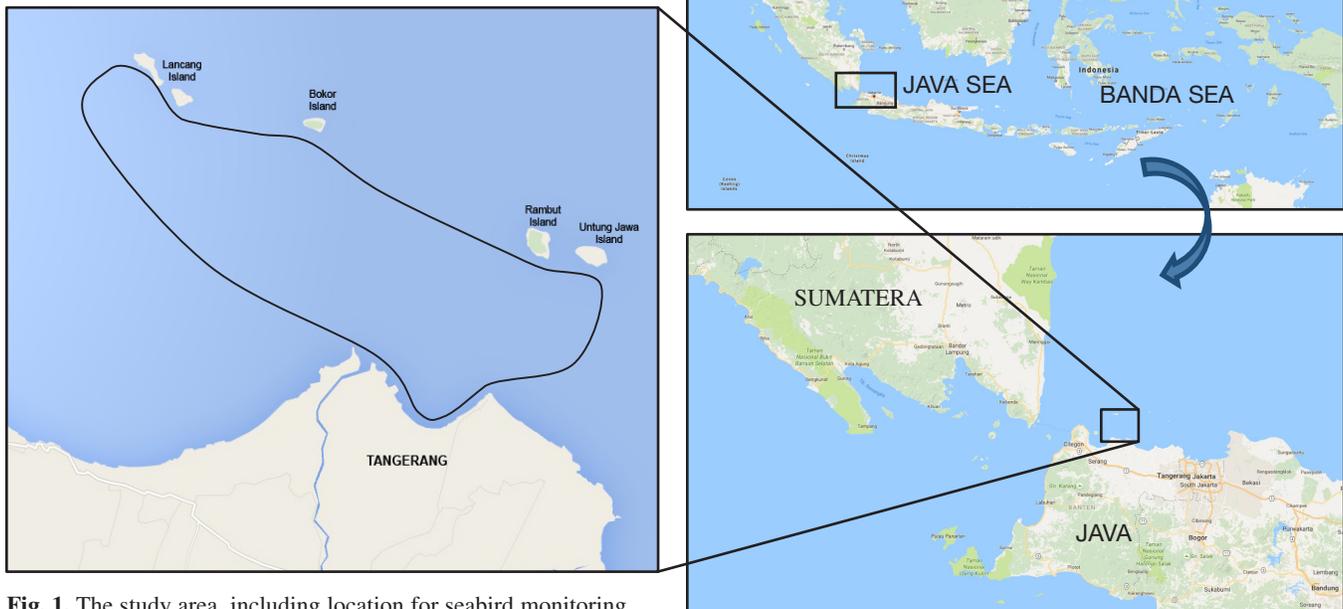


Fig. 1. The study area, including location for seabird monitoring.

Swinhoe's Storm Petrel *Hydrobates monorhis*

First recorded near Bokor Island on 18 September 2011, when nine birds were observed. On 14 October 2011 three birds were recorded near Rambut Island, and on 19 November 2011 one bird was seen near Bokor Island. The birds were also recorded in the Sunda Straits between April and October 2008 (Brickle 2009).

Brown Booby *Sula leucogaster*

Two birds were observed flying close to Rambut Island on 21 August 2011, and an immature bird was seen resting on a *sero*, along with frigatebirds and cormorants, near Rambut Island on 21 October 2011. This species is pantropical and is considered resident in the region (Strange 2001).

Christmas Island Frigatebird *Fregata andrewsi*

Recorded throughout the year of 2011/12. The highest numbers, 209 individuals, were seen in July 2012. In 2013, it was recorded during April and May, with a high of 113 birds in May. This species used Jakarta Bay for foraging, roosting on the *sero*, as well as on Rambut Island at night. We observed it attempting to steal fish from five species: four times from Grey Heron *Ardea cinerea*, and one time each from Black-crowned Night Heron *Nycticorax nycticorax*, Oriental Darter *Anhinga melanogaster*, Little Egret, Western Cattle Egret, and an unidentified tern (Tirtaningtyas 2014). Previous records of Christmas Island Frigatebird from Jakarta Bay were summarised by BirdLife (2001): two birds on June 1989 and three in September 1995 at Rambut Island; 20 birds between Jakarta and Rambut Island in July and August 1988; and one bird at Muara Angke in 1994. The nearest breeding colony is at Christmas Island, Indian Ocean.

Great Frigatebird *Fregata minor*

Single birds were recorded flying or resting on fish traps four times: 31 July 2011, 20 August 2011, 17 September 2011, and 4 December 2011. The nearest confirmed breeding colony is on Christmas Island in the Indian Ocean. Other breeding colonies have been recorded in Manuk and Gunung Api in the Banda Sea ~2 200 km from Jakarta Bay (MacKinnon & Phillips 1993). De Jong (2011) counted 300–500 Great Frigatebirds roosting on Suangi Island in the Banda Sea. Mittermeier *et al.* (2015) saw this species on Obi Island, North Moluccas, in 2013.

Lesser Frigatebird *Fregata ariel*

Recorded every month through 2011/12, except in July 2011 and July 2012. This species often rests on *sero* with Christmas Island Frigatebirds. The maximum number recorded was 39 birds in June 2012; also, seven birds were recorded in July 2013. Mittermeier *et al.* (2015) saw this species on Obi Island, North Moluccas, in 2013.

Parasitic Jaeger *Stercorarius parasiticus*

An individual, second-year bird was seen flying near Bokor Island on 19 November 2011. This species is a rare passage migrant seen near Java, Bali, Sulawesi, Sula, Flores, and some smaller islands (Strange 2001). An adult of this species was found in Kai Kecil-Ambon on October 2007 (Robson 2008b).

Long-tailed Jaeger *Stercorarius longicaudus*

A single adult in breeding plumage and three adults in non-breeding plumage were recorded near Bokor Island on 14 and 15 October 2011, respectively. This species is a rare visitor to waters around Greater Sunda islands, with sighting records in West Java and Bali.

Whiskered Tern *Chlidonias hybrida*

Several records were logged by one of us (KY) and Boas Emmanuel (pers. comm.) during 2011–2013: in 2011 — 19 individuals in September, six individuals in October, and a single bird in November; in 2012 — a single bird in May and 10 individuals in July; and in 2013 — 23 individuals in May. These birds were seen in flight and perched on *bagan* or *sero*, as well as on floating logs,

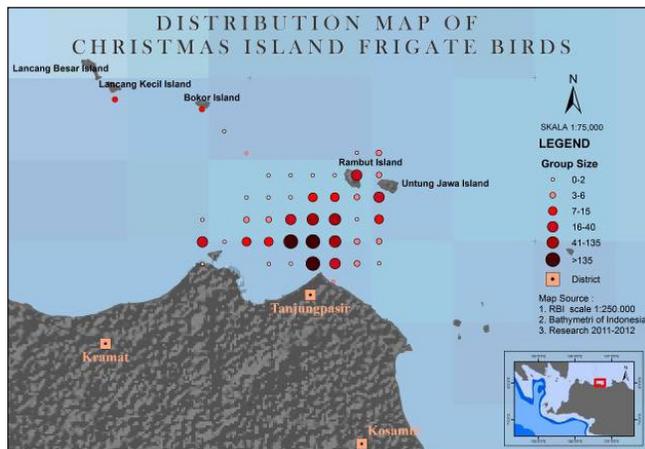


Fig. 2. Map of the distribution and group size of Christmas Island Frigatebirds seen in Jakarta Bay during 2011/12.

styrofoam, and once on a floating banana tree trunk with Lesser Crested Terns. This species is widespread in Indonesia, being a common visitor in West Papua, Wallacea, and Bali (Strange 2001). Some birds are also seen in summer (MacKinnon & Phillips 1993).

White-winged Tern *Chlidonias leucopterus*

A common non-breeding visitor, this tern was encountered during September to November in 2011. It was observed perching with the other terns on *bagan* and *sero*. It is a widespread and locally common passage migrant and visitor throughout Indonesia during the boreal winter (Strange 2001).

Little Tern *Sternula albifrons*

Recorded only once, flying across the Bay on July 2013. Hoogerwerf (1938) noted the bird breeding in Tanjung Priok. In Java (Wonorejo Fishpond, East Java) and Bali there is a small resident population, augmented in winter by the migrant race (MacKinnon & Phillips 1993). In Kupang Bay, a single Little Tern was seen on June 2014 (Trainor & Hidayat 2014).

Greater Crested Tern *Thalasseus bergii*

This species was recorded from September to December in 2011, then May and July 2012, as well as May and June 2013. The maximum number of 27 birds was seen in September 2011. It often associated with Lesser Crested Terns on *bagan*. In the Greater Sundas it is one of the commonest terns in inshore waters and

Table 1
Compilations of seabird sightings in Jakarta Bay

Species	F&K ^a	GC ^a	CR ^a	FL ^a	JE ^a
Swinhoe's Storm Petrel	•				
Brown Booby	•				
Christmas Island Frigatebird	•	•	•	•	•
Great Frigatebird	•				
Lesser Frigatebird	•			•	
Parasitic Jaeger	•				
Long-tailed Jaeger	•				
Whiskered Tern	•				
White-winged Tern	•				
Little Tern	•				
Greater Crested Tern	•		•	•	
Lesser Crested Tern	•		•	•	
Common Tern	•		•		
Roseate Tern	•		•		
Aleutian Tern	•		•		
Bridled Tern	•				
Black-naped Tern	•				
Brown Noddy	•				

^a Sources: F&K = authors of this study; GC = Cadee (1985); CR = Robson (2008, 2010); FL = Lambert (2012); JE = Eaton (2013).

around small rocky islets. It breeds on Karimun Jawa islands and is suspected of breeding on small islands off Sumatra (MacKinnon & Phillipps, 1993). This species was found on the tiny islet of Lusaolate Sawai in November 2014 (Robson 2014).

Lesser Crested Tern *Thalasseus bengalensis*

This is a common non-breeding visitor to Jakarta Bay, including around Lancang and Kotok islands in the bay. It often associates with Greater Crested Tern. The numbers of this species were as follows: in 2011 — 21 birds in October, 103 in November, and 465 in December; in 2012 — 261 birds in February, 21 in May, and eight in July; in 2013 — up to 11 birds were seen from March through July; and in 2014 — five in July. This species is a regular non-breeding visitor in waters of Kalimantan, Sumatra, Java, and Bali (MacKinnon *et al* 2010, MacKinnon & Phillipps 1993, Strange 2001).

Common Tern *Sterna hirundo*

A common non-breeding visitor to the bay, it was recorded from September (maximum 85 birds) through October (54) and November (160) to December (three) in 2011, in July 2012 (74) and in July 2013 (two). Most birds were observed perching on *sero* and *bagan*, but some perched on floating logs, styrofoam, and water hyacinth plants close to Lancang Island. In the Greater Sundas it is an irregular visitor, occasionally present in very large flocks, with some non-breeding birds over summer (MacKinnon & Phillipps 1993).

Roseate Tern *Sterna dougallii*

This is cosmopolitan species (MacKinnon & Phillipps 1993) but uncommon in Jakarta Bay. On 21 August 2011, eight to 10 birds were perched on *bagan* with a flock of Black-naped Terns; and on 17 December 2011, one bird was perched on *bagan* with a flock of Lesser Crested, Common and Black-naped Terns. A scarce winter visitor reported throughout the Greater Sundas, breeding is suspected in Sumatra (islands in Malacca Straits) and breeding is known on an islet off Brunei and locally around the coast of Java (MacKinnon & Phillipps 1993).

Aleutian Tern *Onychoprion aleuticus*

There are five records of this rare non-breeding migrant. Single birds were observed flying with a group of Common Terns on 13 September 2011, and two birds were observed perching on styrofoam on 14 September 2011 between Bokor Island and Lancang Island. A single bird was seen flying close to our boat on 14 October 2011; three birds were seen on the following day, and a single bird was seen foraging with Common Terns on 21 October 2011. Breeding in the sub-Arctic, the species apparently spends the boreal winter in coastal waters around the Thai–Malay Peninsula, Kedah coast in the north of peninsular Malaysia, Greater Sundas (Sunda Straits), Sulawesi, and Maluku (Poole *et al.* 2011; Ding Li *et al.* 2013). Elsewhere in Indonesia, one individual was seen in Ambon Bay on October 2007 and a moulting adult was seen between Manado and Bunaken Island on September 2007 (Robson 2008b).

Bridled Tern *Onychoprion anaethetus*

Although a widespread species, we recorded just a single adult bird flying near Pramuka Island on 3 July 2014.

Black-naped Tern *Sterna sumatrana*

These are the most common terns in the Greater Sundas (MacKinnon & Phillipps 1993) and a widespread and fairly common resident throughout Indonesia (Strange 2001). We recorded the following: in 2011 — 22 birds perched in *bagan* near Lancang Island in September, two birds flying around Bokor Island in October, and 14 birds perched on iron poles in December; in 2012 — 12 birds perched in *bagan* with Lesser Crested Terns in January, 48 birds in February, three in May, and 34 in July. Its range extends from India east to Japan, south through Indonesia (seasonally common in Bali, Buru, Seram, and Papua), Malaysia, the Philippines, and New Guinea to northern Australia (Strange 2001).

Brown Noddy *Anous stolidus*

This is an uncommon species in Greater Sundas (Harrison 1983, MacKinnon & Phillipps 1993). One bird perched in *bagan* with groups of Common Terns was recorded on 15 October 2011. On 20 January 2012, one bird was flying close to Untung Jawa Island and one bird (perhaps the same one) was seen on 21 January 2012 foraging around Untung Jawa Island.

DISCUSSION

This paper summarizes four years of seabird observation in Jakarta Bay and its surrounding waters, with reference to earlier observations spanning 29 years. Seabirds in this area can be monitored only by boat.

Of the 18 seabird species described, only five (Lesser Frigatebird, Christmas Island Frigatebird, Great Crested Tern, Lesser Crested Tern, and Aleutian Tern) had previously been recorded in Jakarta Bay (Table 1). However, only one previously recorded species was not recorded during our surveys, the Red-tailed Tropicbird *Phaethon rubricauda*. It was recorded in Tanjung Priok in 1883 (Hooogerwerf 1938), and is an uncommon to rare non-breeding visitor to offshore Indonesian waters, except Kalimantan (Strange 2011). In 2015, this species was recorded offshore near Gunung Kidul, Yogyakarta, by Budi Hermawan (pers. comm.). During observations in the Sunda Straits, Poole *et al.* (2011) found 12 seabird species, including three species that were observed in Jakarta Bay: Swinhoe's Storm Petrel, Aleutian Tern, and Christmas Island Frigatebird.

Our findings show that Jakarta Bay contributes importantly to the East Asian–Australasian Flyway, which extends from the Arctic, through east and southeast Asia to Australia and New Zealand (www.eaaflyway.net). As noted, some seabirds use Jakarta Bay for roosting and foraging during their migration, with the closest known breeding ground being Christmas Island for Christmas Island Frigatebirds; Brown Boobies and Bridled Terns use rocks for roosting in Sunda Straits and Karimun Jawa, East Java.

During observations from 2011 to 2013, we documented eight dead Christmas Island Frigatebirds, with mortality resulting from shooting, poisoning, or sedation, capture and attachment of string to leg, or entanglement in fishing gear. In addition, several Little Cormorants *Microcarbo niger* had been shot (Tirtaningtyas & Henniecke, 2015). Christmas Island Frigatebirds are protected under Indonesian Government Regulation (*Peraturan Pemerintah*) No. 7 Tahun 1999 and are considered as Critically Endangered by the International Union for Conservation of Nature. This species is

endemic to Christmas Island, Australia, but, as noted, forages and roosts in Jakarta Bay and Rambut Island Nature Reserve (see also Birdlife International 2001, Noni 2012, Wardhani 2011).

Other than one of us (KY, pers. obs.) observing three Little Black Cormorants *Phalacrocorax sulcirostris* feeding on styrofoam, the impact of pollution on seabirds is difficult to quantify. Haryati *et al.* (2013) calculated the effect of pollution on productivity in green mussel farming, and found that the possible loss of revenue due to pollution was around US\$2,700 per year. Cooperation among conservation organizations that focus on different groups of organisms (e.g., seabirds, turtles, vegetation) is needed. Because the immediate threat to seabirds is exploitation of island resources by local people who are themselves struggling to survive, the basic needs of these people must be considered by conservationists if effective measures are to be successfully enacted (de Korte, 1989). In addition, continuous monitoring in Jakarta Bay is strongly recommended and should be conducted in cooperation with the staff of Balai Konservasi Sumber Daya Alam (Nature Conservancy Agency) Jakarta to protect Jakarta Bay and its wildlife.

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