Monitoring and inventory of the seabirds and their breeding areas in Tubbataha Reefs Natural Park & World Heritage Site

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Pilipinas Shell Foundation, Inc.

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TUBBATAHA REEFS NATURAL PARK
WORLD HERITAGE SITE

Field Report:

Monitoring and inventory of the seabirds and their breeding areas in Tubbataha Reefs Natural Park & World Heritage Site, 2021

Produced by the Tubbataha Management Office, Puerto Princesa, Palawan, Philippines

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Cover photo: Retch Alaba

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MONITORING AND INVENTORY OF THE SEABIRDS AND THEIR HABITATS IN TUBBATAHA REEFS NATURAL PARK & WORLD HERITAGE SITE, 2021

OBJECTIVES

The objectives of the seabird monitoring and inventories at Tubbataha Reefs Natural Park (TRNP) are:

- Determine developments and trends in seabird populations, the condition of habitats, and emerging threats;
- Identify management actions to respond to and deflect on emerging threats to seabirds;
- Enhance the method and skills of TMO staff and partners in seabird monitoring;
- Prepare the annual monitoring and inventory report on the seabirds and their habitats;
- Formulate recommendations to improve the conservation and management of the seabirds.

FIELDWORK

Period: The field work was delayed by lockdowns caused by the COVID 19 pandemic. The team arrived at the Ranger Station on 26 May. The inventory was conducted from 27 May to 28 May at Bird Islet and on 31 May, from 9:00am to 12 noon (high tide) at South Islet.

TMO Research Officer, Ma. Retchie Alaba, reviewed the inventory methods and assigned tasks for the field work. The marine park rangers' (MPR) monitoring and inventory reports from June 2020 to August 2021 were evaluated.

Prior to the fieldwork, an online discussion was held between TMO staff and Mr. Arne Jensen on actions taken in response to the 2020 recommendations.

Weather: The weather was dominated by limited wind coming from a southwesterly direction with wind speed ranging from 0 to 3 meters/second. Daily cloud cover averaged 2/8 or 20%. Daytime temperatures raged from 30° to 34.5°Celsius.

SEABIRD INVENTORY TEAM

A total of 19 TMO staff and MPRs headed by the Park Superintendent (PASu) of TRNP, and three local volunteers participated in the seabird inventory (Annex 1). The team included nine researchers and MPRs from the TMO and WWF Philippines, three MPRs from the Philippine Coast Guard, one from the Philippine Navy, and three from the Municipal Government of Cagayancillo. Due to continued travel restrictions brought about by the COVID 19 pandemic, the avifauna consultant and volunteers from outside of Palawan were unable to join the survey. M/Y Navorca of WWF Philippines transported the team to Tubbataha.

METHODS

The field work followed methods for distance count monitoring and for inventories of breeding seabirds established and used since 2004 (Jensen 2004). For methodologies, see the 2020 inventory report.

The counts of the breeding bird populations represent a combination of different count methods. These include direct day-time inventories of adults, immatures, juveniles, pulli, eggs, and nests. To determine the total seabird population, an afternoon count of boobies flying in to roost is conducted from 4:30pm to 6:30pm on 28 May at Bird Islet (Annex 7) and on 31 May at South Islet (Annex 8). Standardized measurements of the Bird Islet and vegetation development are also carried out.

Major equipment used were handheld binoculars (10 x 50), spotting scopes (20-60 x), GPS and cameras. The patrol boat and dinghy are also used to conduct the distance counts.

Taxonomic treatment and sequencing follow the IOC World Bird List Version 11.2 (10 July 2021) and Wild Bird Club of the Philippines Checklist of Birds of the Philippines 2021.

Calculation of land area and vegetative cover

Photos of permanent photo documentation sites in Bird Islet and South Islet were taken (Annex 10). These sites were established in 2004 to measure changes in land area and in vegetation. GPS readings were taken measuring the land area of Bird Islet at high tide.

Vegetative cover was monitored by conducting a census of the condition of trees and other vegetation on the islets. Trees, all planted saplings mostly of *Pisonia grandis* (Anuling, Bird-catcher Tree, Lettuce) were located and classified as either in optimal (good), moderately deteriorating (fair) or severely deteriorating (bad) condition, and lastly, as dead. For photos of beach forest species, see Jensen et al. 2019. The vegetation inventory of 2021 was carried out using the same methodology as all other years and the trend over time is therefore comparable.

Calculation of breeding populations

The methods used to calculate the seabird populations followed the previous years' approach:

- Day time direct counts of birds, nests, and eggs;
- In-flight data of Red-footed Booby *Sula sula* and, Brown Booby *Sula leucogaster*;,
- Dawn count (5 am) of Brown Booby and Red-footed Booby populations at the 'Plaza';
- Count of Great Crested Tern *Thalasseus bergii* and Brown Noddy *Anous stolidus* along the shoreline at high tide;
- Assessment of the MPRs' quarterly inventories enabling calculations and estimations of the annual breeding populations of the seabirds.

The result of the fieldwork was compared with several data sets: the WWF Philippines data from 1998 to 2004; the annual inventory results from 2004 to 2020; and data gathered by MPRs from June 2020 to August 2021. The data from 1981 to 2013 were analyzed in detail by Jensen and Songco (2016) and published in the Journal of Asian Ornithology (FORKTAIL 32 (2016): 72–85). Other analyses are found in the 28-year seabird population development report published in 2009, in 2004 to 2006, and in the 2010 to 2020 seabird field reports (see Jensen 2004 to 2006 and 2009 to 2016, and Jensen *et al* 2017-2020).

RESULTS AND CONCLUSION

Monitoring of Changes in Land Area

Independent sets of measurements were taken using two GPS units. The measurements were taken at high tide along the shoreline as the vegetation line previously used as reference has disappeared. Due to this shift in methodology, data sets from 2016 onwards are not comparable to the previous years. Measurements in May 2021 were taken during springtide of 1.6 meters compared to measurements taken during high tides of around 0.9 meters the previous years. Therefore, a comparison of the land area is only indicative.

Bird Islet: From two separate GPS measurements, it appears the land area has substantially decreased by 27.5% - from 19,297 m^2 in 2020 to 14,009 m^2 in 2021. Compared to the 18,760 m^2 land area in 1981, (Kennedy 1982), the decrease is to about 4,571 m^2 or 25% (See Table 1). The circumference of the islet measured along the high tide line was 513 meters compared to 610 meters in 2020 and 574 meters in 2019, or a decrease by 16%. Erosion was particularly observed at the northeast part of the islet, Figure 1.

The 'Plaza', defined as the central area of the islet dominated by compacted barren soil with very limited vegetation (Figure 2), was measured to be 3,253m^2 representing a very substantial area decline of 44.2% 6.1% (5,826 in 2020). However, the circumference of the 'Plaza' is not demarcated and the substantial regrowth of grasses that had expanded into 'Plaza' by May 2021 may have affected the measurements.

Table 1. Approximate changes in the land area of Bird Islet from 1911 to 2021. Source: Worcester 1911, Kennedy 1982, Heegaard and Jensen 1992, Manamtam 1996, WWF Philippines 2004 and Tubbataha Management Office 2004 to 2021.

Year	Land area (length x width)/circumference (m)	Land area (high tide) (m^2)	Open area ("Plaza") (m^2)	Major sandbars position and condition	Erosion area
1911	400 x 150	60,000	No data	>40,000 m^2 (?)	No data
1981	268 x 70	18,760	18,000	NW, SE	South coast
1991	>220 x 60	> 13,200	>8,000 (est.)	NW, SE	South coast
1995	265 x 82	21,730	8,000 (est.)	NW, SE	South coast

2004	219 x 73	17,000	>1,100 (est.)	NW: Stable SE : Decrease	South coast
2005	No data	15,987	>4,000 (est.)	NW, SE: Stable	South coast
2006	No data	14,694	7,900 (est.)	NW, SE: Stable	South coast
2007	No data	13,341	8,000 (est.)	NW, SE: Stable	South coast
2008	No data	12,211	< 8,000	NW: Decreasing SE : Stable	South coast
2009	No data	10,557	< 7,000	NW: Eroded SE : Decreasing	West coast
2010	No data	11,038	4,367	NW: Eroded SE : Stable	South coast
2011	No data	12,968	4,000 (est.)	NW: Stable SE : Stable	Northeast coast
2012	590	12,494	3,892	NW: Stable SE : Stable	Northeast coast
2013	548	10,955	4,840	NW: Decreasing SE : Stable	Northeast coast
2014	503	>10,220	4,124	NW: Decreasing SE : Stable	Northeast coast
2015 [1]	<561	<13,408	3,279	NW: Stable SE : Stable	Northeast coast
2016 [2]	590	15,649	4,513	NW: Disappeared SE : Decreasing	Northeast coast
2017 [3]	588	15,307	6,704	NW: Disappeared SE : Decreasing	Northeast coast
2018 [4]	568	15,373	2,572	NW: Two small sandbars off the coast SE : As above	Northeast coast
2019 [5]	574	17,987	6,202	NW: Two small sandbars off the coast SE: Three sandbars off the coast	None compared to 2018
2020	610	19,297	5,826	NW: Two stable sandbars SE: One stable and one expanding sandbar	No erosion
2021 [6]	>513	>14,009	3,253	NW: stable sandbars SE: Stable sandbars	Erosion of NE-part

Note 1: In 2015, new GPS equipment were used. Detailed comparison with previous year's data is therefore not possible.

Note 2: Measurement approach changed from measurement along shore vegetation line to measurement along the high tide line. Data can therefore not be compared.

Note 3: Expansion in area of Plaza is due to inclusion of former forested areas.

Note 4: Reduction in area of Plaza is due to expansion in grass areas.

Note 5: Expansion in area of Plaza is due to reduction in grass areas. Change in land area may have been caused by the variation in the route walked as this is not physically demarcated.

Note 6: Reduction in area of Plaza is due to expanding grass areas. Change in land area may have been caused by measurements taken during springtide of 1.6 meters.

Figure 2. Erosion of Bird Islet, May 2021. Photo: Joan Pecson

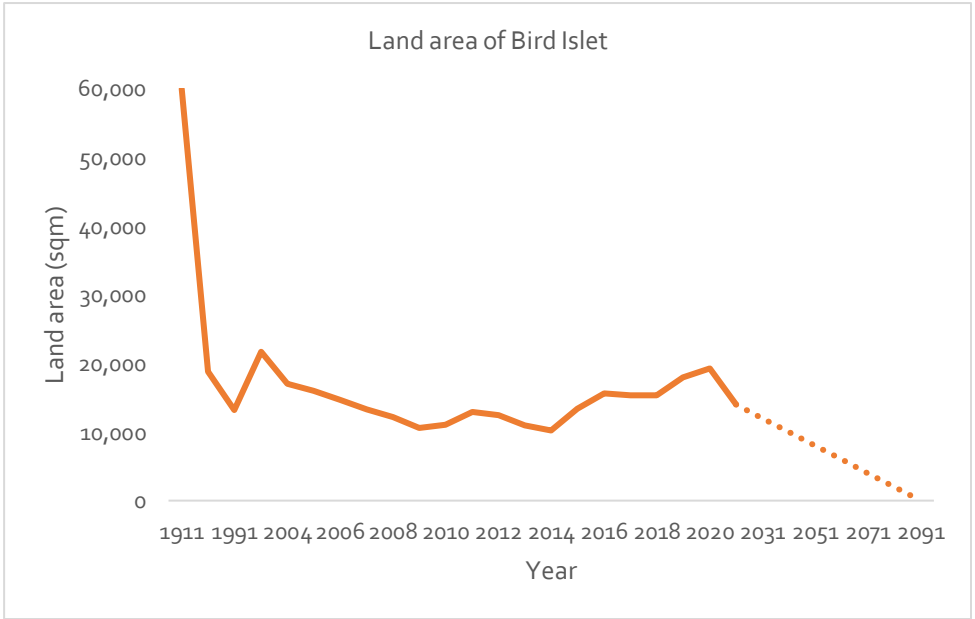

Figure 1. Land area development of Bird Islet from 1911 to 2021, and projected development until 2091.

Figure 3. Landscape of 'Plaza', Bird Islet, May 2021. Photo: Rowell Alarcon

The land area development over 110 years at Bird Islet since Dean C. Worcester's assessment in June 1911 shows a continued decline from approximately 60,000 square meters to 18,760 square meters in 1981, a time span of 70 years (Kennedy 1981). The average decline in land area per year by 589 square meters. Over the past 40 years, from 1981 to 2021, there has been a further loss to 14,000 square meters or about 199 square meters per year. Bird Islet shrunk by 76% and using a linear prognosis, it may take only about 70 years before Bird Islet disappears, Figure 1. A visible sign of the decline are the increased areas of eroded cemented calcite guano sandstone that used to be the core area at the center of the islet ('Plaza').

South Islet: South Islet was originally part of a large sandbar until a circumferential concrete seawall was constructed in the 1980s (Kennedy 1982) to accommodate a lighthouse. In 2019 an embankment and construction of a new seawall and lighthouse changed the size of the islet, Figure 4. The circumference of the islet in 2020 was 307 meters (292.3 meters in 2019) compared to 230 meters in 2018, or an increase by 33.4%. The land area is 5,222 m² (5,585 m² in 2019) compared to 2,884 m² in 2018. The 81% variation represents reclamation of additional marine areas.

Figure 4. Landscape of South Islet, May 2021. Photo: Rowell Alarcon

Monitoring of Changes in Habitats

The total number of beach forest trees at Bird and South Islets from 2006 to 2016 was around 354 trees, classified as being in very good condition (229 trees on Bird Islet and 125 trees on South Islet). Since 2016 all tree vegetation has died.

As part of reforestation efforts, beach forest saplings were planted in small numbers from 2017 to 2019 on Bird Islet. In June 2020, TMO planted a total of 430 saplings, 329 in Bird Islet and 101 in South Islet. By May 2021 the survival rate of the planted saplings on Bird Islet was very low at 7%. On South Islet, the survival rate was around 50%. The reasons for the low survival rates may be the lack of Phosphorus fertilizer and compost soil application in the planting holes, combined with the absence of shade for the saplings during their first week of growth, Annex 3.

The local government of Cagayancillo has established a nursery of Abok-abok *Heliotropium foertherianum* and Anuling *Pisonia grandis* (from stem cuttings) in February 2021. The LGU donated about 312 saplings (199 Abok-abok and 113 Anuling), which were brought to TRNP after the May inventory to be planted from June and onwards, during the rainy season. The new saplings were kept under the shade prior to planting, gradually removing the shade to provide more and more sunlight, and constantly watering them.

Bird Islet: The baseline was 229 beach forest trees recorded in 2006. In June 2019 ,12 saplings of Anuling were planted and 329 saplings in June 2020. In May 2021, only 23 saplings had survived, Annex 2 and 10. Among these some have been protected against Red-Footed Booby by building protective bamboo enclosures around the trees, Figure 6.

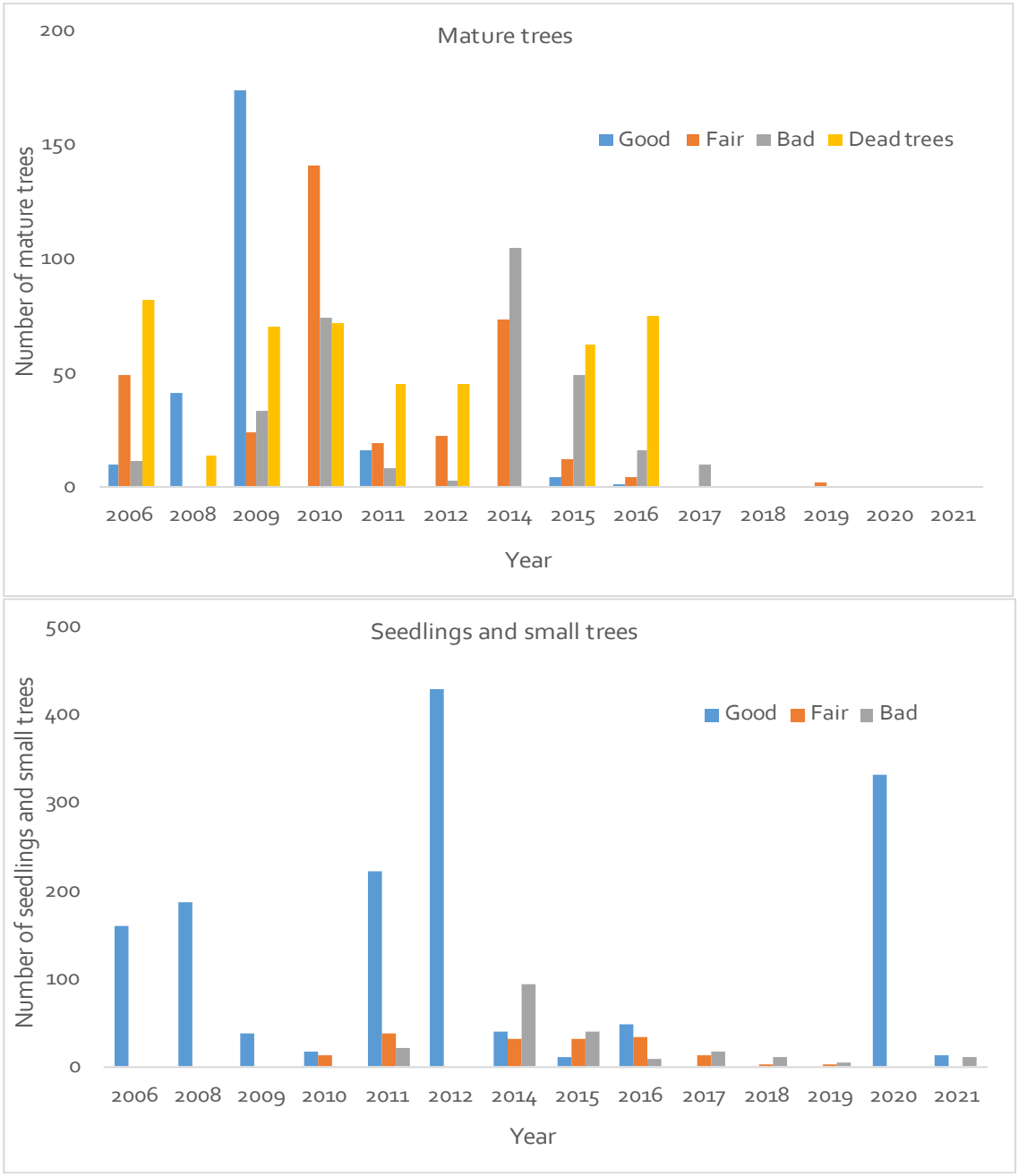

Figure 5. Status of vegetation in Bird Islet from 2006 to 2021.

Figure 6. Planted Anuling protected against Red-footed Booby on Bird Islet by enclosing them in bamboo structures. Photos: Joan Pecson

South Islet: Until 2009, the beach forest comprising of about 125 trees was in optimal condition, with several trees as high as about 30 feet. By 2014, trees in bad condition dominated the vegetative cover of the islet. In 2019, five remaining dying trees were removed during the reconstruction of the islet. In June 2020, 101 Anuling saplings were planted of which 51 saplings were alive in May 2021 (survival rate 50%). In 2021 they represent the vegetation on the islet, together with three stands of Coconut *Cocos nucifera* and patches of grass species (Figure 4, Figure 7, Annex 2, and Annex 10).

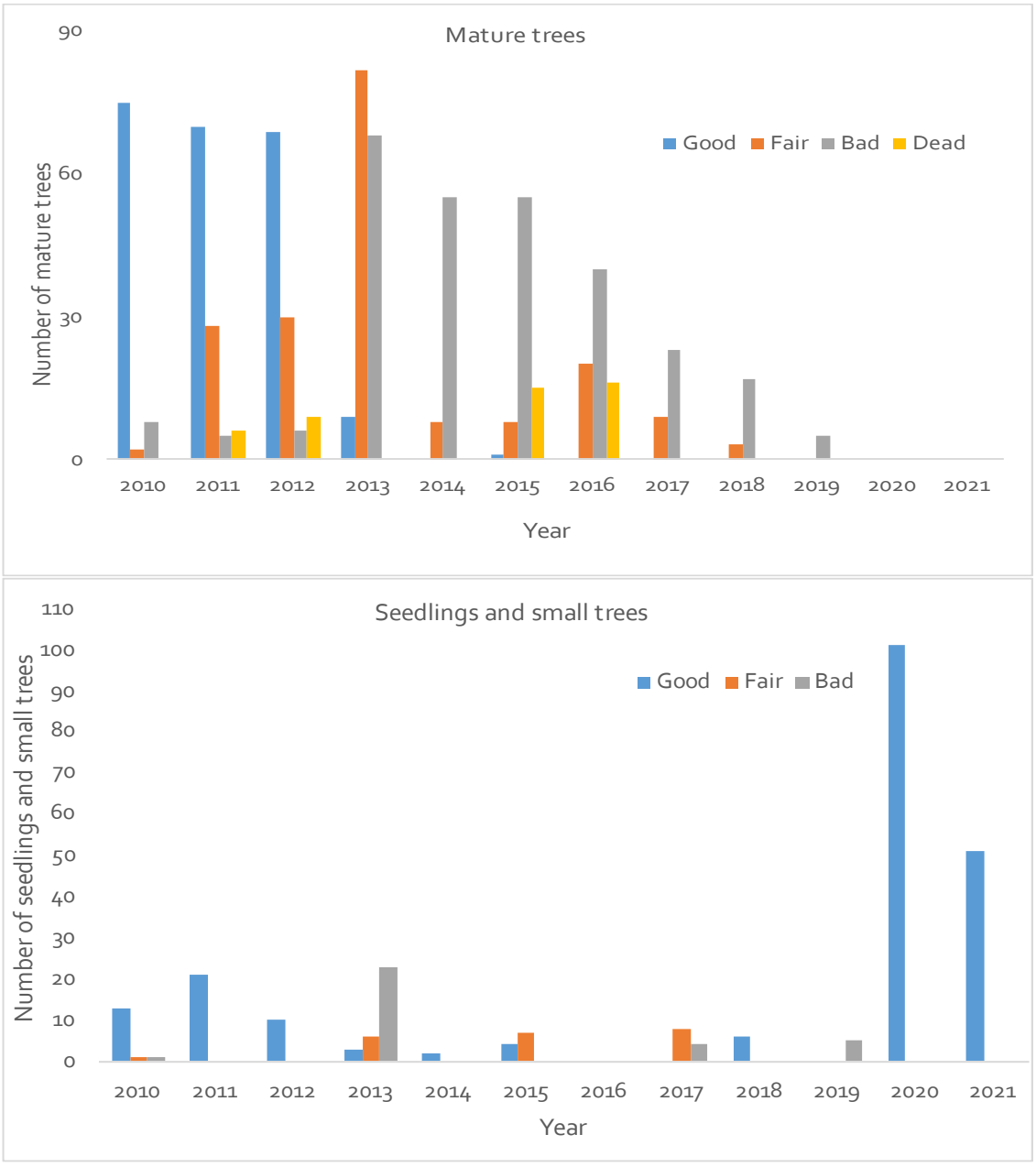

Figure 7. Status of vegetation in South Islet from 2010 to 2021.

Avifauna Inventory Results

A total of 13 species of birds were identified during the inventory (Annex 9). The total number of all avifauna species, including migratory species, recorded in TRNP over time is 119.

Nine of the observed species can be classified as pelagic seabirds. Of these, seven species breed or attempt to breed in TRNP: Brown Noddy *Anous stolidus,* Black Noddy *Anous minutus,* Great Crested Tern *Thalasseus bergii*, Sooty Tern *Onychoprion fuscata*, Masked Booby *Sula dactylatra,* Red-footed Booby *Sula sula*, and Brown Booby *Sula leucogaster.* Of three other breeding species, the Pacific Reef Heron *Egretta sacra* breeds annually; the Barred Rail *Gallirallus torquatus* has become an irregular breeder and was not observed during the inventory; and the Eurasian Tree Sparrow *Passer montanus*, which also was not recorded during the inventory, may have become extinct in TRNP.

Of the breeding seabird species, the Masked Booby is listed as Critically Endangered, the Brown Booby and Black Noddy as Endangered, and the Brown Noddy, Great Crested Tern, and Sooty Tern as Vulnerable species (DENR 2019). Further, the Black Noddy is included in Appendix II of the Convention of Migratory Species as a species that will benefit from international protection and management agreements.

Overall, the booby species of TRNP breed throughout the year and the tern species around nine months annually (Heegaard and Jensen 1992, Manamtam 1996, Kennedy *et al.* 2000, Jensen 2009, Jensen and Songco 2016). The May inventory results therefore represents only the breeding population present during the time of the inventory. The data analysis and conclusions, however, takes into consideration MPR data prior to and after the May 2021 inventory.

In May 2021, a minimum of 28,178 adult individuals of seven breeding seabird species were recorded: 19,889 individuals on Bird Islet and 8,289 individuals on South Islet (Table 2). Bird Islet hosted almost 71% of the breeding population (89 % in 2020) and South Islet 29% of the population (11% in 2020). Compared to the inventory in 2020, the population on Bird Islet decreased by 32%. However, the number of seabirds on South Islet has increased by around 134% compared to the inventory result of May 2020. Since 2020 the population of Black Noddy substantially recovered by around 116%, and Great Crested Tern increased its breeding population by 447%.

Compared to the 2020 inventory, the May 2021 count result is 14% lower (Table 2, Annex 5). The total of adult seabirds in May 2021 is at the same level as the population in 2013 (28,846 individuals) but about 108% higher than in the baseline year of 1981 (Kennedy 1982). If the sub-population breeding numbers of Sooty Tern is added and the number of Brown Noddy in February 2021 is used, the total would be around 31,344 breeding seabirds.

The difference in result for May 2021 compared to 2020 is mainly due to a decrease in the numbers of Brown Noddy by 48%, and of Great Crested Tern by 25%.

Table 2. Total count numbers of adult resident seabirds present on Bird Islet and South Islet from 27 to 31 May 2021 compared to the inventory result of May 2020.

Species / Number	2020			2021			% change 2019-2020	% change 2020 - 2021
	Bird Islet	South Islet	Total	Bird Islet	South Islet	Total		
Brown Noddy	2,134	1,128	**3,262**	>798	904	**>1,702**	+52	- 48

Black Noddy	1,974	676	**2,650**	1,414	1,462	2) **2,876**	+28	+ 8
Great Crested Tern	16,762	1,048	**17,810**	7,644	5,732	**13,376**	+5	- 25
Sooty Tern	>5,272	0	**> 5,272**	6,000	0	3) **6,000**	+21	+13
Masked Booby	2	0	**2**	2	0	**2**	0	0
Red-footed Booby	430	230	**660**	321	101	**422**	-39	-36
Brown Booby	>2,528	449	**> 2,977**	3,710	90	**3,800**	-5	+28
Total	29,102	3,531	**32,633**	19,889	8,289	**>28,178**	+ 18	-14

1) May represent change in phenology. February 2021 count was 2,728 adults

2) Total 3,636 breeding individuals, if 760 actively breeding individuals in February 2021 are added

3) Total 8,063 individuals, if 2,063 individuals actively breeding in February 2021 are added

Review of Marine Park Rangers Data

Since the inventory in May 2020, MPRs made four inventories on Bird Islet and on South Islet in August and November 2020, and in February 2021 and in August 2021. The inventory in November 2020, February 2021 and August 2021 included in-flight counts of booby species.

Until May 2021 the MPRs also conducted 11 monthly distance monitoring counts around Bird Islet and South Islet. No counts were carried out at Jessie Beazley Reef.

The data gathered revealed several important observations (see Table 3 and for details Annex 4).

Table 3. Selected results of MPR distance and direct counts from June 2020 to April 2021.

Species	Bird Islet	South Islet
Brown Noddy	Overwintering, e.g. 1,050 individuals on 16 January 2021. Part of population has been overwintering since 2017. Early start of breeding season with 1,912 adults with 313 eggs and 67 pulli in February 2021.	Absent from November 2020 to February 2021 which is the normal pattern for this species on this islet. 816 adults with 320 eggs already by 14 February 2021.
Black Noddy	Following distance count data, present throughout the year since 2017, e.g. overwintering with 537 individuals in December 2020 and 750 individuals in January 2021. Started breeding season in February 2021: 1,378 adults with 202 eggs and 21 pulli already on 18 February 2021.	Absent from November 2020 to mid-February 2021. 358 adults with 222 nest and 92 eggs counted on 14 February 2021.
Great Crested Tern	Absent from September 2020 to January 2021 with major breeding influx observed	Absent from September 2020 to March 2021

	from mid-February. No active breeding before April/May 2021.	No active breeding before April/May 2021.
Sooty Tern	Absent in July to September 2020 where birds again arrived around 20 September. Major breeding (7,500 individuals) from November 2020 to February 2021 where about 2,100 individuals remained together with 987 pulli. Largely absent in March and April 2021 but a new breeding cycle started in May.	No breeding population.
Masked Booby	Two adults present from June 2020 to May 2021. Eggs in August 2020 which produced one pullus observed in November. It grew to juvenile stage but died around 20 January 2021. Since then, two breeding attempts with courtship observed: March resulting in two eggs first reported in April. On 12 August, no eggs and a second courtship observed. On 17 August with one egg, lost around 1 September 2021.	No breeding population.
Red-footed Booby	Continued low number of adults except in February 2021 (almost 800 adults). Numbers of nest, however, remained low and of these empty nests were removed.	Compared to the period 2020 to 2021, an increased number of adult birds and relative high nesting rate, 50%. Empty nests were removed.
Brown Booby	A high number of 3,388 adults actively breeding in August 2020 (1,813 eggs, pulli and juveniles) Similar to November 2017, 2018, and 2019, more than 3,000 adults in November 2021; with 851 nests of which 58% had either eggs, pulli or juveniles. In February 2021 also relatively high number of around 2,000 adults. These were less active in breeding with just about 50 offspring and eggs.	Six pairs breeding from August to and November 2020 and two pairs in February 2021. Previous documented breeding is from 2016, 2019 and 2020.
Eastern Reef Egret	Reported with maximum of six individuals	Maximum eight individuals which is a significantly lower number than the average from 2004 to 2019. May have been impacted by habitat change with fewer breeding options due to reclamation in 2019

Barred Rail	No birds observed	One bird in February
Eurasian Tree Sparrow	Not observed	Not observed

Species Account of Breeding Birds

The combined results of the adult populations and their development over time at Bird Islet and South Islet are shown in Annex 5. Data on the number of immature, juvenile, and pulli and on the number of eggs and nests recorded since 2004 on the two islets are presented in Annex 6. Percentages of in-flight populations of Brown Noddy, Black Noddy, Red-footed Booby and Brown Booby are shown in Annex 7 (Bird Islet) and Annex 8 (South Islet). A complete list of avifauna records in May 2021 is found in Annex 9.

Brown Noddy (Conservation Status - Philippine Red List: Vulnerable): Declining population. Total estimated annual population: 3,300 to 3,500 individuals (over one year, November 2020 to August 2021, the species produced at least 1,550 eggs equivalent to 3,100 adults, Annex 4).

The breeding population in May, > 1,702 individuals, is 48% lower than in May 2020, and 20% lower than the baseline inventory year in 1981 (Kennedy 1982) (Table 2, Figure 8, and Annex 5.) The population on Bird Islet is declining; on South Islet it is still recovering the man-made habitat changes made in 2019.

Following the data set for Bird Islet where no birds were counted along the shoreline, 798 individuals were recorded in May 2021 compared to 2,134 individuals in 2020 suggesting a substantial decline. It may, however, represent change in phenology with more birds breeding in February (1,912 individuals) than in May (Annex 4). On South Islet where 904 individuals were counted, the population is lower by 20% compared to 2021 (1,128 individuals).

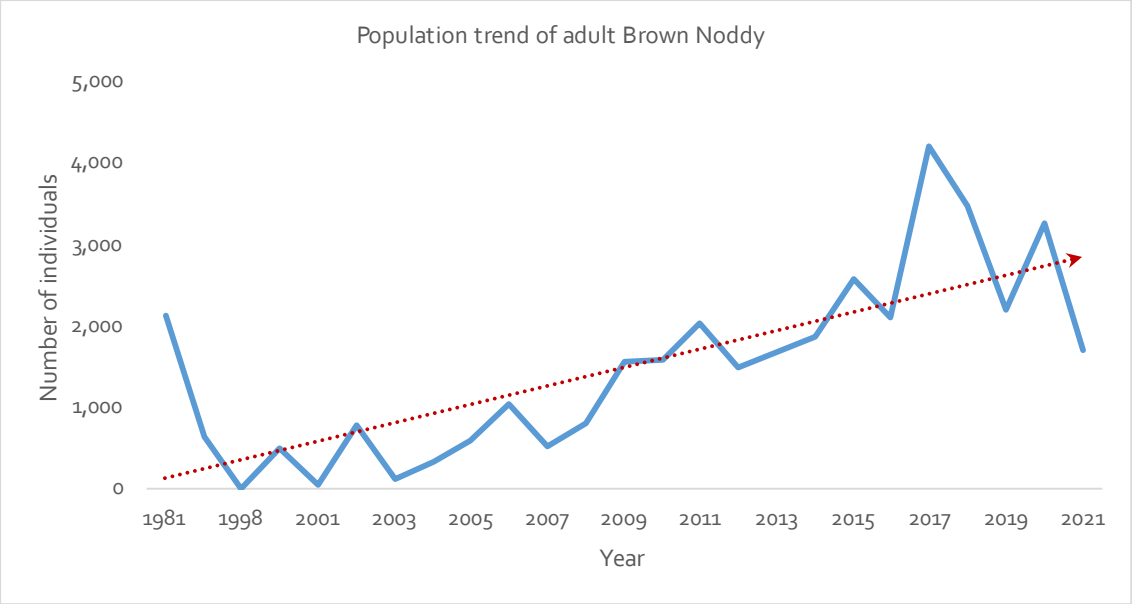

Figure 8. Population trend of adult Brown Noddy from 1981 to 2021.

Similar to February 2018 to 2020, Brown Noddy already bred in February. On 14 February 2021, 2,728 adults had nests containing 633 eggs and 67 pulli. This is an increase by 73% compared to 2020. In May 2021, a low number of 851 nests with 406 pulli and 177 eggs were counted at TRNP (Figure 9, Annex 4 and Annex 6). Of the breeding population on Bird Islet, 58% of the adults had nests, on South Islet 77%.

The species is normally absent from TRNP from November to February, but on Bird Islet it has overwintered since 2017, e.g. 1,050 individuals counted in 16 January 2021. No noddies overwintered at South Islet.

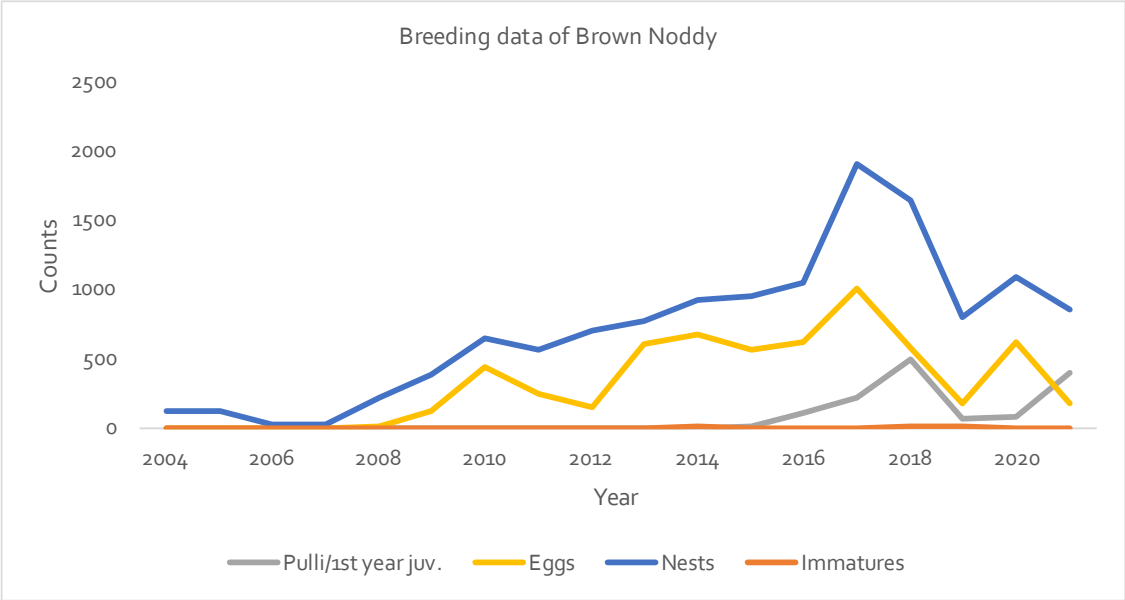

Figure 9. Breeding data of Brown Noddy from 2004 to 2021.

Black Noddy (Conservation Status – Philippine Red List: Endangered): Declining population. Total estimated population: 3,700 adult individuals.

Black Noddy is classified as Endangered by the Department of Environment and Natural Resources (DENR, DAO 2019-09) and is included as a conservation management-dependent species under the Convention for Migratory Species (Appendix II).

Of the original population of 10,656 adult birds (2013), only about 35% remain, Annex 4 and Annex 5. Its population decline is correlated with the loss of its natural breeding habitat over time.

A total of 2,876 adult birds were counted in May 2021 compared to 2,650 individuals in 2020, Table 3. The result suggests an overall population increase by 8% but still representing a decline by 28% on Bird Islet. The population in South Islet increased by 116% . However, it is still lower by 28% compared to 2018, the year before the islet was reconstructed.

The species was present at Bird Islet every month since the May 2020 inventory and overwintering with 537 individuals in December 2020 and 750 individuals in January 2021. At South Islet it was absent from November 2020 to February 2021. Early breeding, similar to 2017 to 2020, was noted on 14 February 2021 when 1,822 adults had 917 nests (Annex 4).

Of 1,438 nests found in May 2021, 37% or 530 contained eggs or pulli (27% in 2020). It represents a considerable increase in nest numbers compared to the May 2020 inventory (1,135 nests). The number of breeding birds increased by 8% compared to the inventory in May 2020 (Table 2, Figure 10, Annex 5). On Bird Islet only about half of the population had nests. Of these only 23% were nests with eggs or offspring.

Together, the February and May 2021 inventory data represents at least about 3,636 adults with 2,355 nests of which 845 nests or 36% had eggs (617 nests), and pulli or juveniles (228 nests).

In comparison, from 2013 to 2017, the species was found to have produced a very low number of eggs and offspring equivalent to an average of 6.6% compared to the adult population present, Table 4, Figure 11 and Annex 6. The average percentage was substantially higher from 2018 to 2021, 22.8 %, in 2021 even as high as 33.6%.

Table 4. Comparison of numbers of adult Black Noddy and numbers of their eggs, pulli and juveniles found from February to November 2013 to 2020, and February to August 2021 at Bird Islet and South Islet

Year/Numbers	2013	2014	2015	2016	2017	2018	2019	2020	2021
Adult population	10,656	7,556	8,226	8,716	5,191	4,473	2,072	3,128	3,636
Eggs, pulli and juveniles	>700	>351	>329	>384	>412	623	534	568	1,223
Percentage of population	6.6	4.6	4.4	9.5	7.9	13.9	25.8	18.2	33.6

Note: Egg data not collected in 2004 and in 2007, 2009, and 2010. 2011 data are limited to presence or absence of eggs.

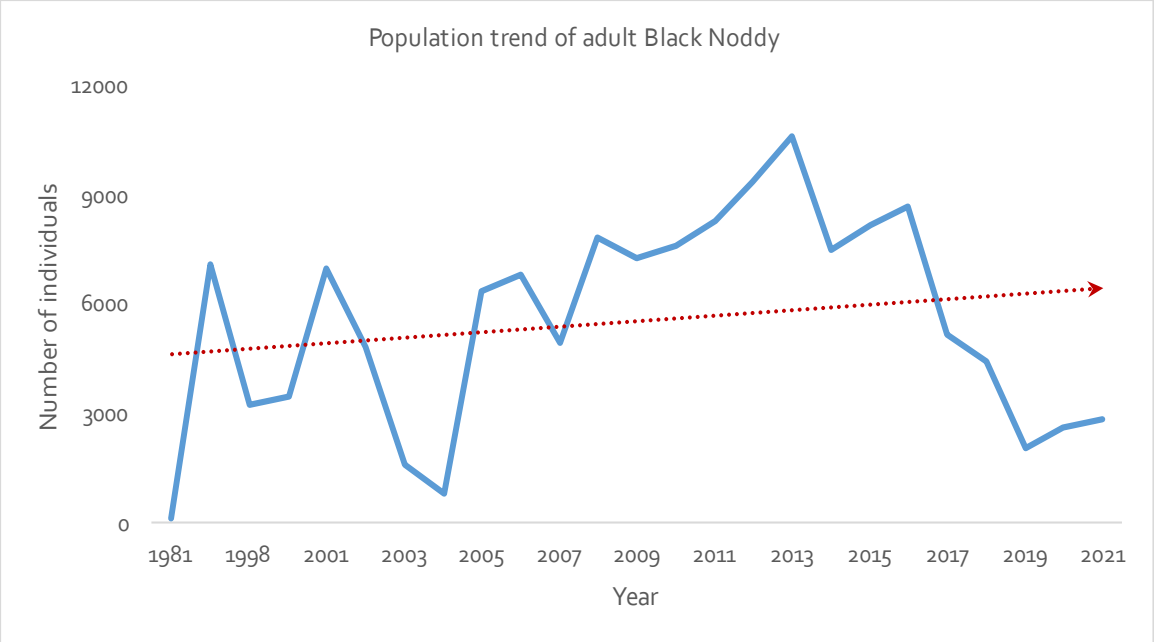

Figure 10. Population trend of adult Black Noddy from 1981 to 2021.

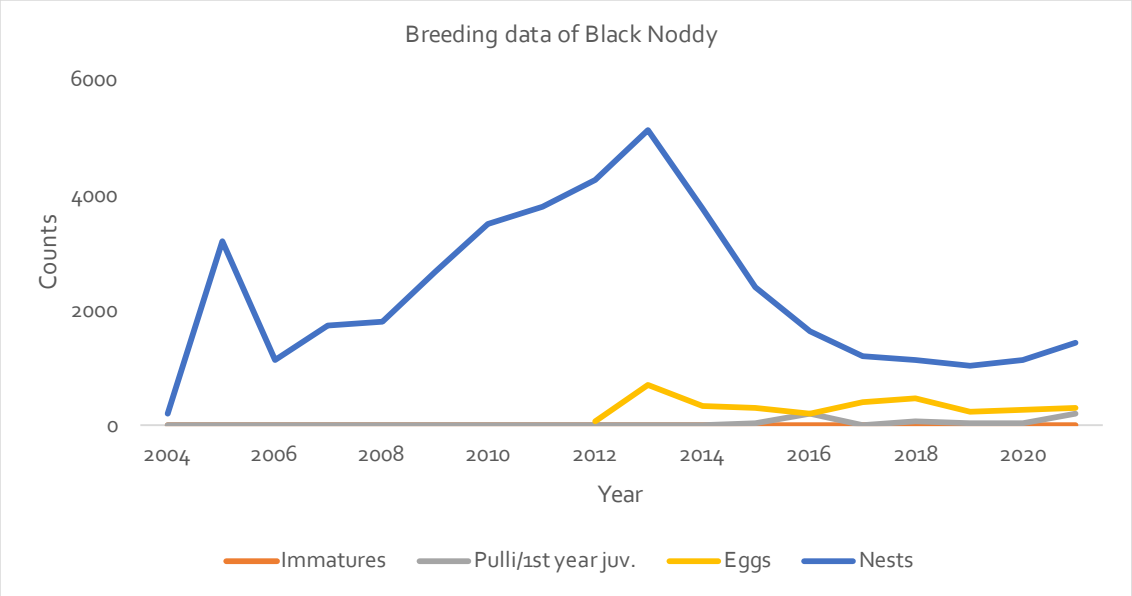

Figure 11. Breeding data of Black Noddy from 2004 to 2021.

Breeding Structurers

Except for a maximum of 80 individuals on South Islet attempting to breed on the ground and two successful breedings, and in the absence of its natural breeding habitat, Black Noddy is only breeding on artificial nesting structures; 10 structures on Bird Islet and seven on South Islet. Of these, seven structures are made of PVC plastic nest platforms held together by steel frames, Figure 12. Ten are made of bamboo.

The experimental PVC structures were installed in September 2020 and February 2021. Three designs were used, and two structures were provided with a covering as protection against the northeast monsoon. One protection sheet made of Bamboo, however, blew away shortly after its installation.

In Bird Islet, of nine bamboo structures in May 2020, only 5 remained. In September 2020 and in February 2021, five PVC structures were added. In South Islet, five bamboo structures established in May 2020, still stands in May 2021. In September 2020, two PVC structures were added.

Breeding materials (mainly cut grasses, leaves, and seaweeds) were provided in June and August 2020, and in 2021 in May, June, and August.

Given the continued decline in the population of the endemic Black Noddy subspecies, TMO has collected detailed monthly data on the breeding population since June 2020. These data are particularly important in order to understand reproduction rates and the species' preference between the types of artificial breeding structures (bamboo and PVC plastic). The dataset still has to be analyzed in detail but there are some initial trends that are very important to have in mind in improving the conservation management.

On South Islet, from September 2020 to August 2021, there was a very significant difference in the use of the PVC structures and the bamboo structures with a clear preference by the birds for structures made of bamboo, Table 5. As an average per structure, only 5.5% of the birds used the PVC structures. The highest

average number was 57 individuals in August 2021 compared to 600 individuals found at bamboo structures. There are only datasets for three months from Bird Islet but they show the same trend, a minority or 28.5% of the birds showed preference for the PVC structures. However, it must be considered that the first PVC structures were introduced only in 2019 while the bamboo structures were installed in 2016.

The noddies had 107 nests at South Islet and 479 nests at Bird Islet placed in the PVC structures. In these nests, they only produced a total of 103 eggs and 31 pulli and juveniles equivalent to 22.8% of reproductive nests. The eggs per structure averaged 15 eggs, highest at Bird Islet. The average of pulli and juveniles was below five birds per structure (22.8%).

Figure 12. PVC breeding structure for Black Noddy in Bird Islet, May 2021. Photo: Rowell Alarcon

In terms of preferences of structurers, among the bamboo structures at Bird Islet, Structure number 3 and 4 had the highest attendance by the adult birds followed by Structure number 2. Out of the five PVC structures, the hexagon-designed structure (N-NS5) appeared to be the most preferred. At South Islet, there was no preference among the two PVC structures installed. Among the bamboo structures, however, Structure number 5 appeared to be highly preferred by the birds.

Table 5. Average numbers of adult Black Noddy per nest structures at South Islet and Bird Islet from September 2020 to August 2021.

South Islet												
Adults	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Aug**	**Average**
PVC	0	19	0	0	2	18	42	7	25	51	57	20
Bamboo	246	386	0	0	230	380	393	479	492	549	600	341
Total	246	40	0	0	232	398	435	486	517	600	657	
Bird Islet												

PVC			19			?			43		83	48
Bamboo			116			197			121		124	120
Total			125						164		207	

Despite the initial success of the artificial breeding structures in increasing the reproduction rate, the rate is still too low to maintain the breeding population as it needs to produce enough offspring to replenish the population over time. The 2021 population of 3,636 adults, from February to August 2021, only produced 1,223 eggs, pulli and juveniles. As mortalities of eggs and hatchlings are known to occur, especially during periods with strong winds or when exposed to cold or heat in the nest, not all of these may have survived to fledging stage (Gauger 1999). Furthermore, mortality rates among juvenile terns may also be high. Although it is unknown for Black Noddy, mortality rates, e.g. of juvenile Roseate Tern *Sterna dougallii* is about 44% (Montecelli *et al*.)

An estimate of the survival rate of the 2021 eggs and pulli at around 70%, will mean only 856 juveniles. If the survival rate of these after two years is only 60%, it would mean that by 2023 there would only be about 514 individuals that have reached breeding maturity. Hence, the population will continue to decline.

Great Crested Tern (Conservation Status - Philippine Red List: Vulnerable): Deceasing population. Total estimated population: 14,000 adult individuals. For the first time since 2014 there is a population decrease. Compared to May 2020 and 2021 by 25% to 13,376 individuals or around the same numbers as in 2016 (Table 2, Figure 13, Annex 5). The result for May 2021 is, however, about six times higher than the baseline count of 2,264 individuals in 1981 (Kennedy 1982).

Adult birds were present at Bird Islet from mid-February 2021 and at South Islet from mid-March 2021 (Annex 4). At the end of May 2021, 4,447 eggs and 2,292 eggs were counted (Figure 14, Annex 6). On South Islet, the species had increased its breeding numbers by 450% to 5,732 individuals since May 2020 (Table 6).

Table 6. Breeding data from 1981 to 2021 of Great Crested Tern at South Islet

Number/Year	**1981**	**1985**	**2000**	**2002**	**2003**	**2020**	**2021**
Adults	2,264	135	50	560	64	1,026	5,732
Eggs	1,132	+	12	145	7	512	1,790
Pulli	0	0	0	25	19	2	872
Juveniles	0	0	0	0	0	0	256

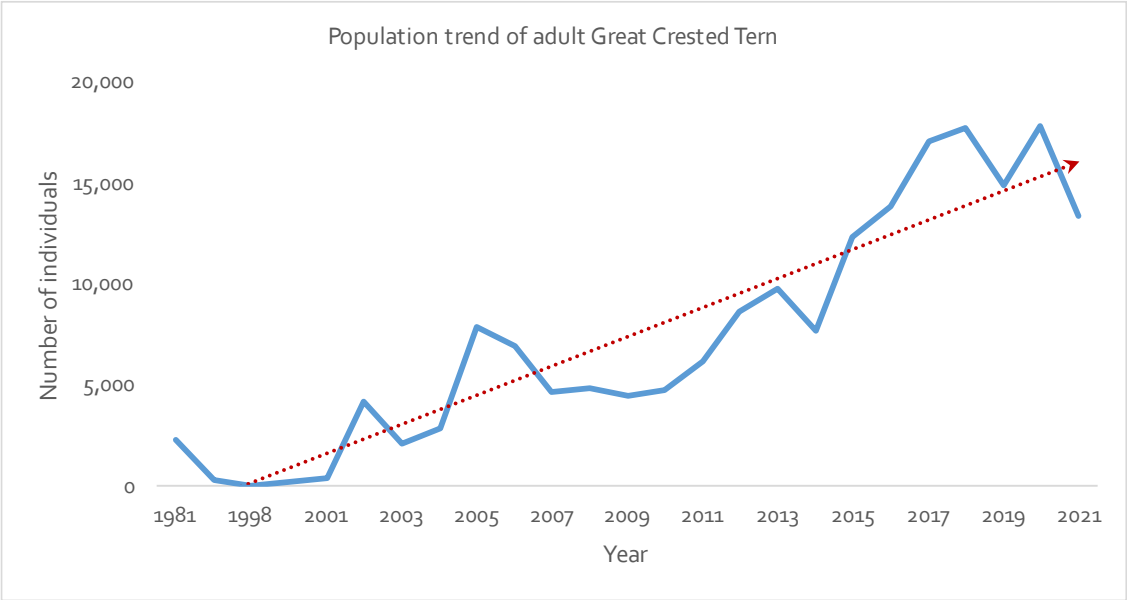

Figure 13. Population trend of adult Great Crested Tern from 1981 to 2021

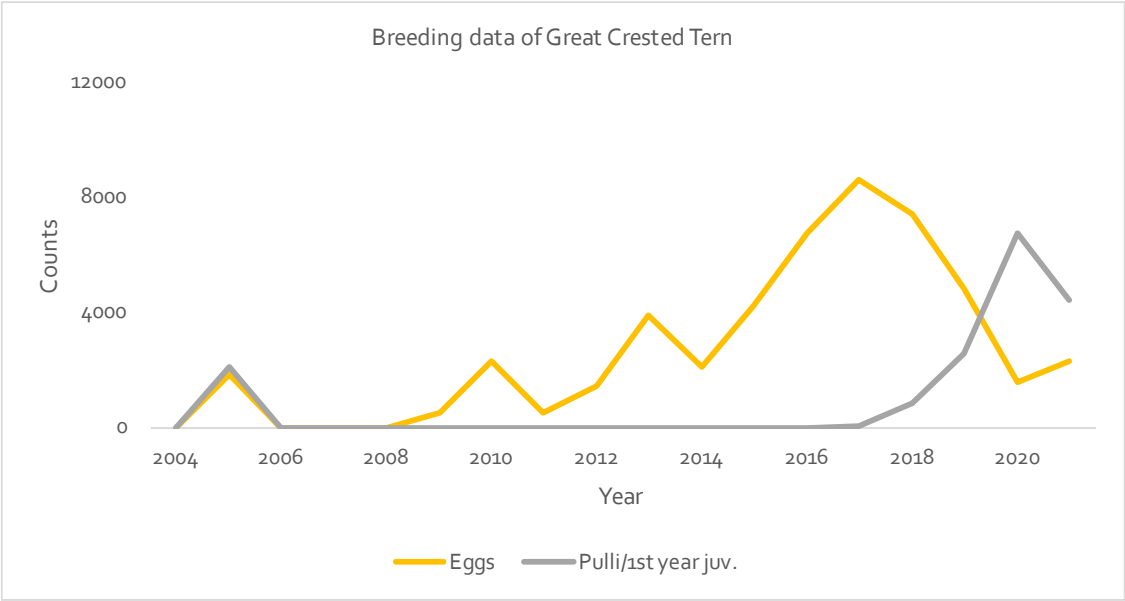

Figure 14. Breeding data of Great Crested Tern from 2004 to 2021

Sooty Tern (Conservation Status – Philippine Red List: Vulnerable): Stable population. Total estimated population: 12,000 adults.

The breeding population at Bird Islet, estimated at night in May 2021, to be 6,000 individuals, is 18% higher than in the baseline inventory year of 1981, and higher by 14% compared to the May 2020, Table 2, Figure 15 and Annex 5. The species does not breed on South Islet.

Sooty Terns were present from the end September 2020 to February 2021, absent in March and April 2021 and again present from May to August 2021.

MPR data shows that at least 9,000 adults were breeding in January 2021 (16 Feb: 4,243 eggs and 288 pulli). The May inventory revealed that all February offspring had left and the population was in the early stage of breeding as indicated by predominantly night presence and just 593 eggs laid. It suggests that the population was in early stage of the egg-laying which can extend to more than one month.

The total adult May population could not be accurately counted as they were in the night courtship phase known as 'night clubbing' (Reynolds *et al.* 2014). MPR data from 12 August, however, shows that 9,460 birds had around 4,110 pulli and juveniles indicating egg-laying may have started late in May and ended in July 2021.

Although if the species breeds in successive periods is not documented from the Philippines, TMO data from 2017 to 2021 indicate that the Sooty Tern either has a sub-annual breeding cycle. There may also be two separate sub-populations with breeding cycles that tend to shift over time, e.g., one population bred from November 2020 to February 2021 and another population from May to August 2021, Table 7. The shift in the breeding cycles may perhaps be impacted by irregular periodic variation in winds and sea surface temperatures caused by El Niño–Southern Oscillation (Pagliawan 2013).

If the terns breed twice a year, then sub-annual breeding intervals may translate to breeding peaks at different months of the year as suggested in Table 7. Sub-population breeding cycles could also translate into shortened courtship periods of around two months, e.g., in 2017, 2020 and 2021, when it matched the different breeding intervals of the birds. MPR distance counts and inventory datasets since 2004, though, needs to be analyzed to reach conclusions on intervals of breeding and the numbers of birds per breeding cycle over time.

Table 7. Breeding months of Sooty Tern 2017 to 2021. Egg laying periods indicate a sub-annual breeding cycle or breeding cycles composed of two sub-populations (yellow and red fond).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2017				EGGS	Pulli			EGGS			Juv/P	
2018					EGGS			Juv/P			EGGS	
2019		Juv/P						EGGS				
2020		EGGS			Juv/P	?					EGGS	
2021		Juv/P		?	EGGS			Juv/P				

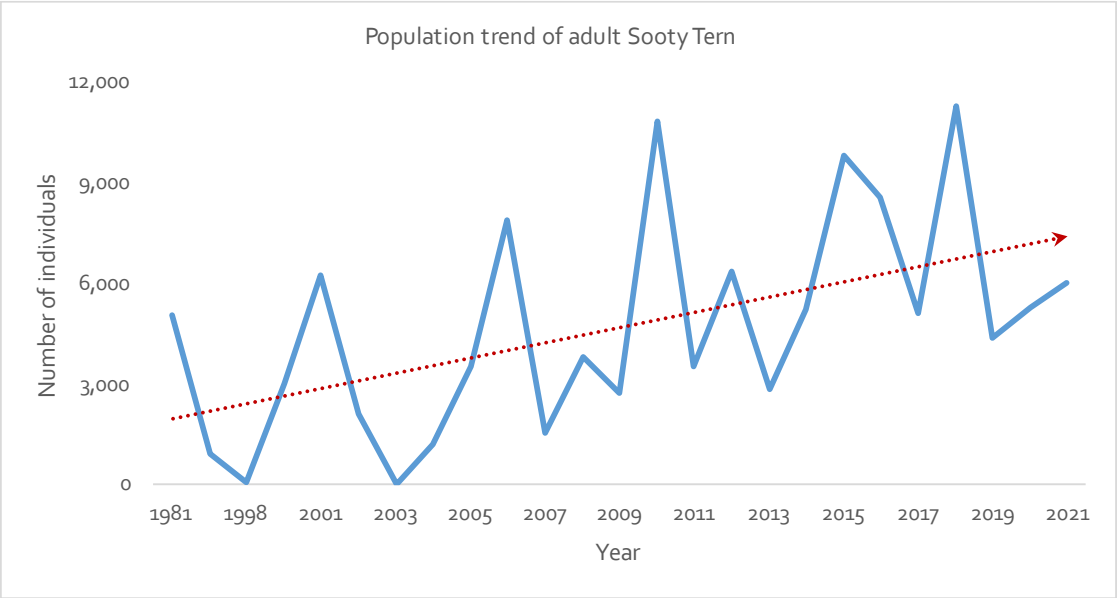

Figure 15. Population trend of adult Sooty Tern from 1981 to 2021.

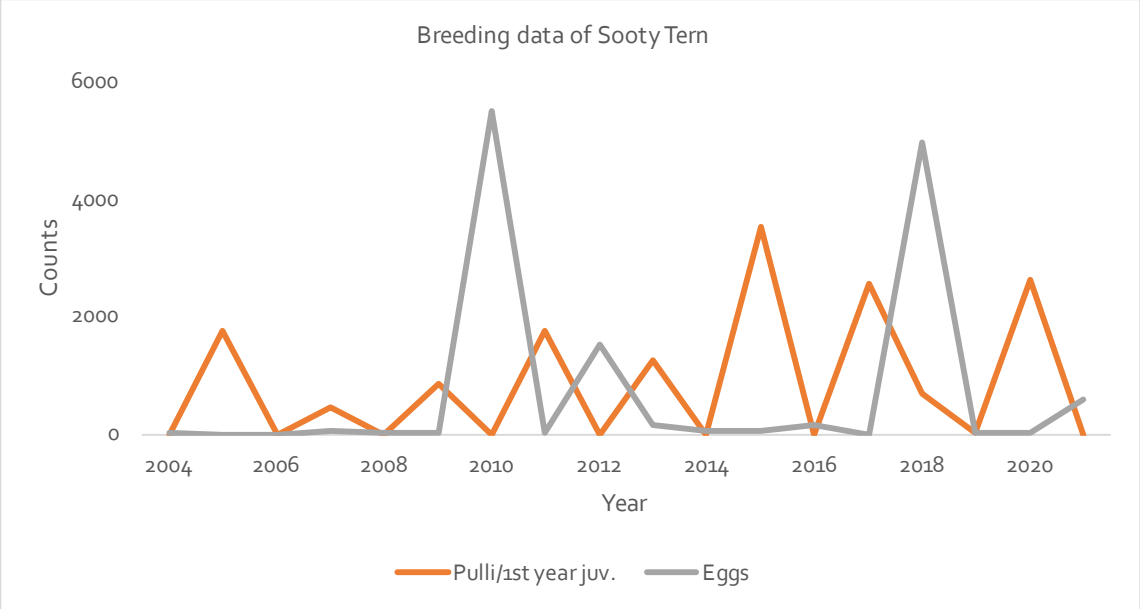

Figure 16. Breeding data of Sooty Tern from 2004 to 2021

Masked Booby (Conservation Status - Philippine Red List: Critically Endangered): MPR records show the species was present with two adults at Bird Islet within the colony of Brown Booby at the 'Plaza" from June 2020 to August 2021. Noted with eggs in August 2020 which produced one pullus observed in November. It grew to juvenile stage (6 months) but was found dead on 20 January 2021. Since then, two breeding attempts with courtship were observed: The first in March resulting in two eggs reported in April and in June 2021. On 12 August, however, the pair had no eggs and a second courtship was observed. On 17 August they had one egg. This is the fifth time that the pair laid eggs.

Figure 17. Masked Booby with dead offspring, January 2021. Photo: Segundo Conales

Red-footed Booby (Conservation Status - Philippine Red List: Least Concern): Declining population. Total estimated population: 980 adult individuals. The adult population in May 2021 was 422 individuals, lower by 36% compared to the inventory in May 2020 (660 adult individuals), or by 58% compared to 2019 (Table 2, Figure 18 and Annex 5). Compared to the baseline inventory year in 2004 (2,435 adult individuals), the population is lower by 83%. Except for February 2021 when about 980 birds were present, MPR data shows that since June 2020 the number of adults has consistently been falling from around 750 individuals to around 500 in August 2021. Correspondingly, the number of nests is also relatively low although nest numbers in May 2021 was higher than in 2020 (Figure 19 and Annex 6). The declining population is a result of the reduced breeding habitat.

Only 26% of the population at Bird Islet had nests while 61% of the birds at South Islet were breeding. In reproductive terms, within one year from August 2020 to 2021 the species produced just 36 pulli and juveniles and laid around 190 eggs. A total of 65 pairs, however, were prevented from egg laying by nest removal in May 2021.

Of the adult population recorded in May 2021, 76% were found on Bird Islet, an increase by 11% compared to May 2020 (Table 2). On South Islet, the population was 56% lower than in May 2020.

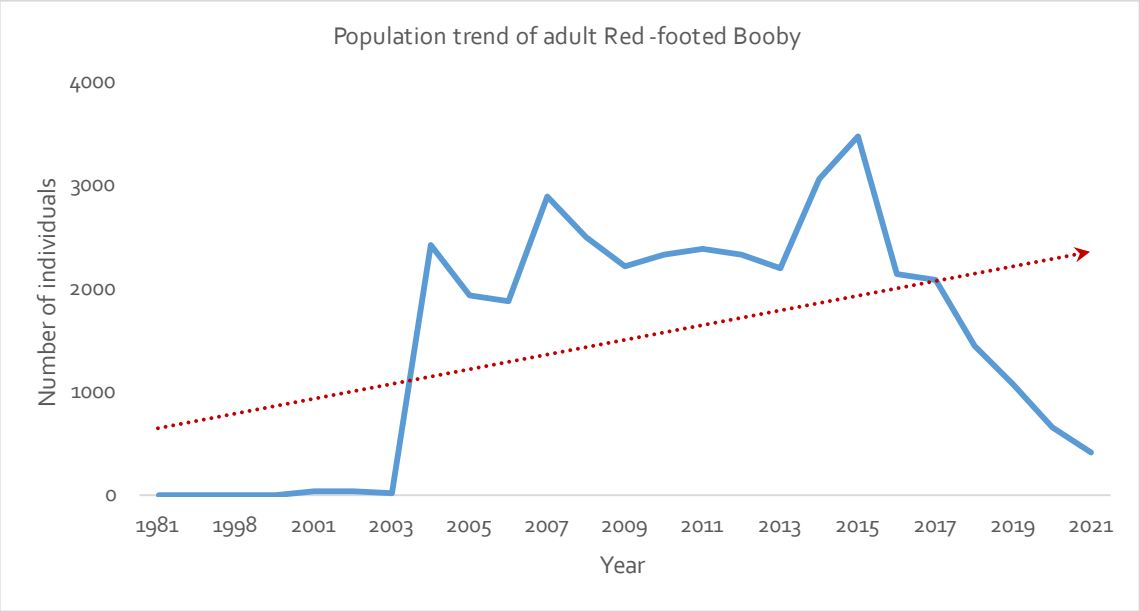

Figure 18. Population trend of adult Red-footed Booby from 1981 to 2021.

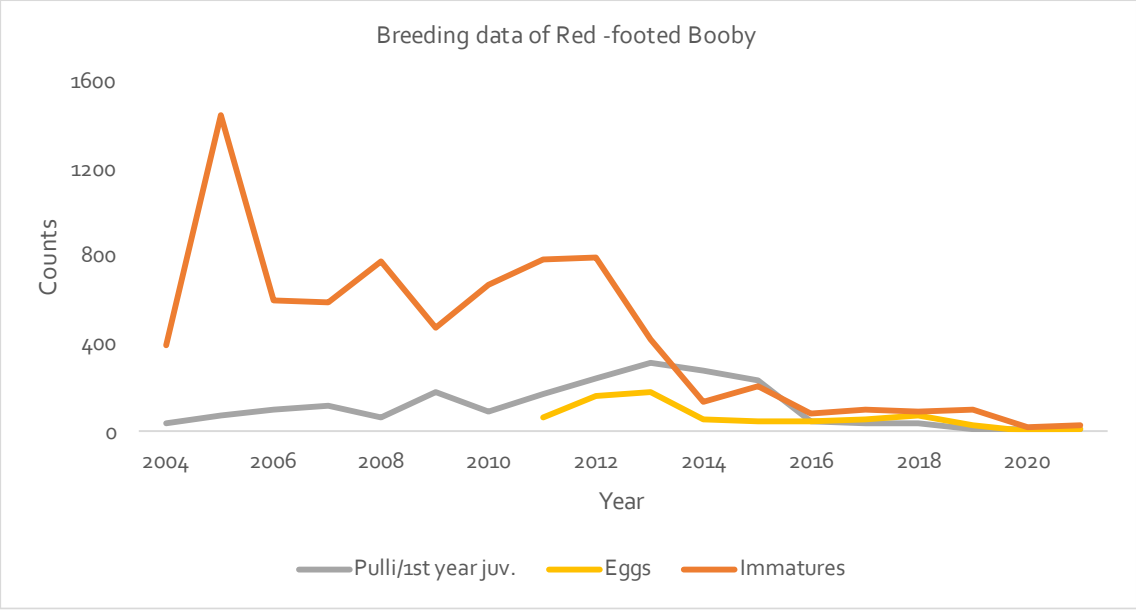

Figure 19. Breeding data of Red-footed Booby from 2004 to 2021.

Brown Booby (Conservation Status - Philippine Red List: Endangered): Increasing population. Total estimated population: 4,500 adult individuals. Based on direct counts, the population is now at same level as in the baseline inventory year of 1981 (3,768 adults), Annex 5. However, MPR data from 12 August 2021, shows 4,484 adults which is 19% higher than in 1981.

In 1911 Dean C. Worcester, the first avian explorer to visit the Tubbataha Atolls, found the Brown Booby breeding in "enormous numbers", Figure 20. He also passed by South Islet and landed on the now submerged Black Rock Islet and found both islets "covered" by breeding boobies (Worcester 1911).

High number of adults, > 3,000, were observed by the MPRs during their inventories in August and November 2020, and as high as 4,484 adults on 12 August 2021. The total counted in May 2021, 3,800 individuals represent an increase by 28% compared to the May inventory in 2020 (Table 2, Figure 21 and Annex 5).

Figure 20. Segment of the breeding population of Brown Booby on Bird islet 24 June 1911. Photo: D.C.Worcester.

The 1,855 nests found in May 2021 represents an extraordinary increase by 75% compared to the result in May 2020 (Figure 21, Annex 6). Of these nests, 1,492 contained eggs and 172 pulli and juveniles representing an active breeding rate of about 60%. In comparison, in August 2021, MPRs noted 2,192 nests of which 75% had either eggs or offspring.

On South Islet, of 90 adult birds six pairs had nests. Nesting was also observed by the MPRs in 2020 (August and November) and in 2021 in February and August.

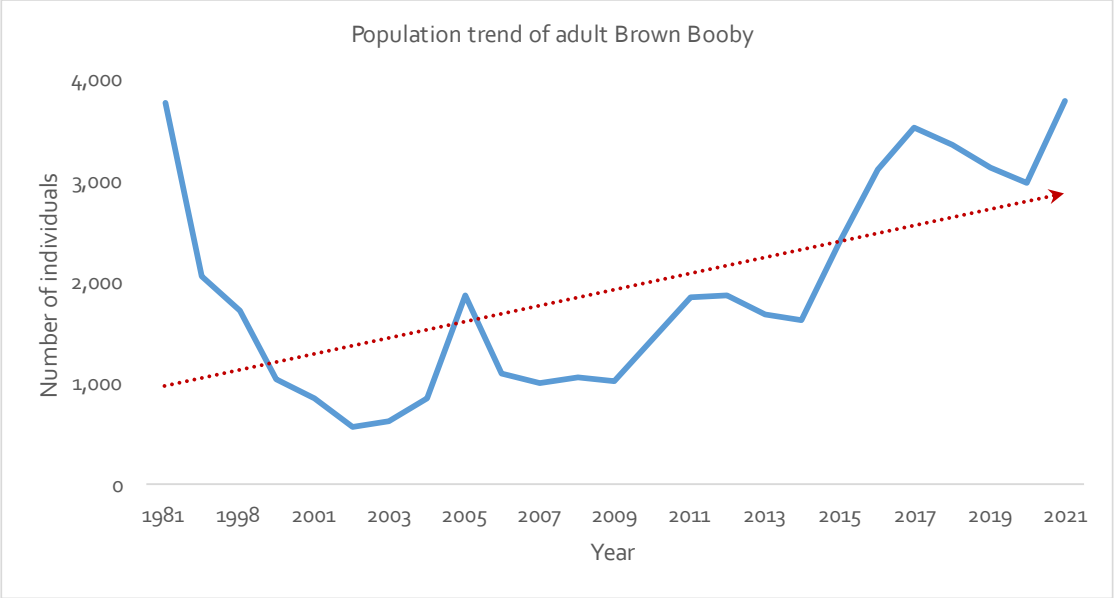

Figure 21. Population trend of adult Brown Booby from 1981 to 2021.

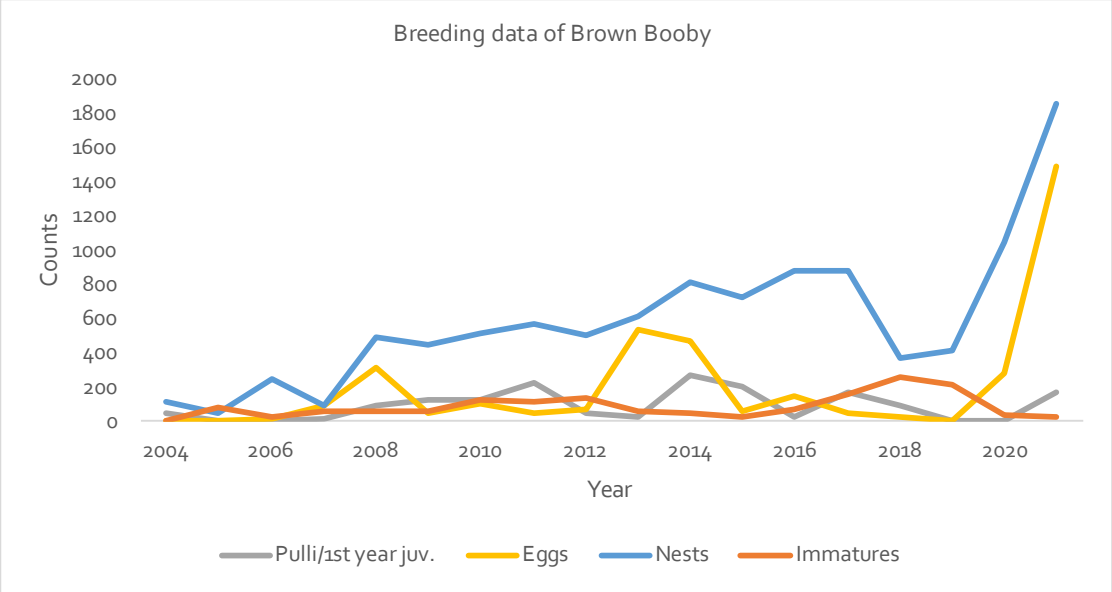

Figure 22. Breeding data of Brown Booby from 2004 to 2021.

Banded birds: In November 2020 and in May and August 2021, a total of 107 Brown Boobies, color banded and steel ringed between 2006 to 2009 on Bird Islet, had their bands and rings read. Of these birds, 57 were banded as adults and 50 individuals as pulli, Table 8. The birds banded as pulli are now from 12 to 15 years old, or on average about half the lifespan of the species, which can reach the age of 25 years. Adults banded in 2006 are at least 19 years old and have lived about 75% of their lifespan (Hennicke *et al.* 2012).

Table 8. Results of ring readings of Brown Booby on Bird Islet in November 2020 and May and August 2021.

Year of Banding	Pulli	Adult	Total
2006	1	5	6
2007	21	27	48
2008	24	12	36
2009	4	13	17
Total	50	57	107

Pacific Reef Heron: The total adult population in May 2020 may have been overlooked since the TMO team only noted three individuals at Bird Islet and four birds at South Islet. This is below the average numbers 15 individuals counted from 2016 to 2019. In March 2021, though, MPRs observed 14 individuals. No nests were reported until September 2021.

Mortalities

The total number of carcasses were not recorded but was estimated to be around 10 pulli of either Red-footed Booby or Brown Booby. The condition of the specimens was in advanced decomposition. Other than these, a wounded Black Noddy, banded at Bird Islet in 2008, landed on the research vessel on 3 June. It had an infected abdominal wound which exposed its liver, as well as a fractured foot. The part of the liver at the wound was whitish to yellowish in color. The other organs were intact, and no other discoloration was observed. The stomach showed no traces of food items.

MANAGEMENT RECOMMENDATIONS FOR TRNP 2021 AND BEYOND

Habitats

1. Restoration of Beach Forest: Despite considerable effort, the reforestation is facing substantial problems in the form of very low survival rate of planted saplings, on Bird Islet as low as 7%. As success is vital for the long-term survival of the declining and threatened population of Black Noddy, it is recommended not to continue reforestation unless advice from experienced forest experts is taken into consideration. Annex 3 outlines a set of recommendations to be piloted. It is further recommended to monitor the survival rate of saplings per species planted and that planting continue to be limited to areas where the former beach forest was located on both islets.

2. Habitat restoration of South Islet: Ensure a wide enough sandy beach habitat free of vegetation enabling Great Crested Tern and Brown Booby to breed on the islet.

Land area at Bird Islet

3. As erosion continues to be a serious long-term problem, it is advised that areas in Bird Islet that are eroding be mapped out. If erosion continues in the next two years, by 2024 start securing and even expanding the land area using best practice nature-based solutions including beach sand nourishment. Sand deposits may have to be pumped in from sandbars elsewhere along the coral crest.

Species

4. Black Noddy: To play safe, and as the pilot using PVC plastic breeding option so far have had very limited success, continue to install bamboo structures until it is documented that the species is breeding successfully and in sufficient numbers at the PVC plastic structurers. Overall, there is a need to maintain about 10 structures per islet with sufficient breeding materials to provide at least 4,000 noddies with breeding opportunities.

5. Contrary to beach forest, the artificial structurers do not protect the species from exposure to strong winds and rainfall. It is recommended that protective shields be installed for the structures. This may increase the reproduction rate, which is still too low to secure the population.

6. Satellite tracking devices have become very light weight. Use of these devices cause the least disturbance on the population and can provide important information for the management of the species. It is recommended to include in fund-raising activities a budget for the purchase of satellite tracking devices, including the cost of capacity-building of TMO, installation, data analysis, and results dissemination.

7. It is further recommended that previously banded Black Noddy be recaptured and ring numbers read for analysis.

8. Red-footed Booby: Where the species places nests in the artificial breeding structures or on plant protection devices, it is advised that MPRs remove these nest regularly. Data on the number of nests removed should be made part of the MPRs reporting to TMO.

9. Brown Booby. There are substantial data on the readings of the color and steel bands applied on the Brown Booby from 2006 to 2009. It is recommended that these data be analyzed.

Methodology

10. Recommended improvements on data collection and reporting includes:

a) Data on empty nests to be separated from data on nests with eggs, pulli and juveniles;

b) Data on pulli to be separated from data on juveniles, which are birds living in their first calendar year;

c) Immatures (birds on their second calendar year or more) of Sooty Tern, Great Crested Tern and the two noddy species cannot be easily distinguished from adult birds, or at all. Hence, there is no need to try to report them.

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ANNEXES

Annex 1. 2021 Seabird Monitoring Team

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Annex 2. Condition of vegetation on Bird Islet and South Islet

Condition of vegetation on Bird Islet, May 2006 (baseline year), and 2019 to 2021

Trees/ Condition	Good (optimal)				Fair (moderately deteriorating)				Bad (severely deteriorating)				Total (live trees)				Dead trees			
	2006	2019	2020	2021	2006	2019	2020	2021	2006	2019	2020	2021	2006	2019	2020	2021	2006	2016	2018	2019
Dead trees																	82	75	ND	ND
Mature, live trees (> 3 feet)	10	0	0	**0**	49	2	0	**0**	11	0	0	**0**	70	2	0	**0**				
Small, live trees (2- 3 feet)	109	0	3	**13**	0	3	0	**0**	0	0	0	**10**	109	0	332	**23**				
Seedlings (< 1 feet)	50	12 *)	0	**0**	0	0	0	**0**	0	0	0	**0**	50	12	0	**0**				
Total	**169**	**12**	**3**	**13**	**49**	**5**	**0**	**0**	**11**	**0**	**0**	**10**	**229**	**14**	**332**	**23**	**82**	**75**	ND	ND

Notes Seedlings/small trees 2019 were planted saplings > 1 foot tall, taken from Cagayancillo Municipality. In June 2020, 329 Anuling saplings planted. In 2021 planting took place only after the May inventory, e.g., 16 mostly Anuling as of August

Coco Palms: 2018: 3, 2019: 2, 2020: 0, 2021: 0

Condition of vegetation on South Islet May 2011 (baseline year), and 2019 to 2021

Trees/ Condition	Good (optimal)				Fair (moderately deteriorating)				Bad (severely deteriorating)				Total (live trees)			Dead				
	2011	2019	2020	2021	2011	2019	2020	2021	2011	2019	2020	2021	2011	2019	2020	2011	2016	2018	2019	2021
Dead trees																6	16	ND	ND	
Mature, live trees (> 3 feet)	70	0	0	**0**	28	0	0	**0**	5	5	0	**0**	103	5	0					**0**
Small, live trees (2- 3 feet)	2	0	0	**51**	0	0	101	**0**	0	0	0	**0**	2	0	101					**51**
Seedlings (< 1 feet)	19	0	0	**0**	0	0	0	**0**	0	0	0	**0**	19	0	0					**0**
Total	**91**	**0**	**0**	**51**	**28**	**0**	**101**	**0**	**5**	**5**	**0**	**0**	**124**	**5**	**101**	**6**	**16**	ND	ND	**51**
Notes:	In June 2020, 101 Anuling saplings > 1 feet tall were planted. In 2021 planting took place only after the May inventory, e.g. 35 mostly Anuling as of August. Coco Palms 2011: 13, 2016: 6, 2017:6, 2018:10, 2019:6, 2020:7, 2021: 3																			

Annex 3. Advice on enhancing survival rate of Beach forest seedlings and saplings

(Dr. Agustin R. Mercado, Jr. PhD in Agricultural Sciences (specialized in agroforestry and, nutrient cycling, World Agroforestry Centre, Research Manager for ICRAF Mindanao)

Beach cabbage *Scaevola taccada* and Anuling *Pisonia grandis* can be planted/propagated using cuttings as they are softwood. Plant them during the start of the rainy season. Use 30-40 inches cuttings.

Heliotrope tree *Heliotropium arboreum* is a hardwood and grows very slowly. It is difficult to propagate it through cuttings, but it produces lots of seeds. You can improve seed germination by soaking the seeds with Giberrellic acid. This can be propagated using plastic bags in a nursery.

A. Cuttings

1. To dramatically increase the percentage of survival, dip cuttings with root hormone using ANAA or IBA or both, e.g., Dip N Grow.

B. In nursery, prior to planting

1. Allow the seedling/sapling to recover for two weeks under shade up to 80%.

2. While under shade, irrigate with water diluted with root hormone auxins, e.g. Hormex (it contains ANAA, IBA and Vitamin B1) at the rate of 40 ml for a drum of water (200 liters). Dose precisely as recommended by the manufacturer.

3. After two weeks, reduce shade up 40% for a week and 20% for the following week.

4. 3 days before planting, do not irrigate the seedlings to keep the soil and root intact. When transporting the seedlings do not hold the stem, but at brim of the plastic bags or the root container.

C. Planting

1. Planting holes should be large: 30-40cm3. At planting, apply Dofus (0-20-0) or any fertilizer containing high Phosphorus (P), about 50 grams for root development. Avoid Nitrogen (N) fertilizer at basal because it burns the roots.

2. Cover the fertilizer with soil. Apply 1 kg compost and cover with soil. At planting, cut 1 cm at the bag bottom of the bag to cut curling roots. Slit the side of the bag up to 3/4. Bring the seedling with the plastic bag to the hole without breaking the seedling ball. Fill the side of the seedling bag up to the slit (3/4).

3. Hold the stem upright while pulling gently the plastic bag. Fill the planting hole completely and compact the soil lightly around the seedling making sure no air circulation happening. Water the plants after planting.

4. Put shade or coconut fronds at the east side of the seedlings. Remove shade after 2-3 weeks.

Annex 4. Results of Park Rangers' inventory counts, August and November 2020 and January, February and Aug 2021 at Bird Islet and South Islet

Bird Islet	**2020**				**2021**								
Species/Date	**13 Aug**	**12 Nov**			**18 Feb**			**27-28 May**			**12 Aug**		
Brown Noddy	Day Count	Day Count	In-flight	Total	Day Count	In-flight	Total	Day Count	In-flight	Total	Day Count	In-flight	Total
Adult	616	1325	no count	1,325	1912	no count	1,912	798	No count	>798	405		405
Juveniles	85	31		31	0		0	137		137	3		3
Pullus	4	3		3	67		67	28		28	12		12
Eggs	9	61		61	313		313	68		68	2		2
Nests, empty	98	305		305	0		0	166		166	235		235
Nests, Total	139	475		475	380		380	399		399	249		249
Black Noddy													
Adult	631	774	no count	774	1,378	No count	1,378	1,414	No count	1,414	1) 1,118		1,118
Juveniles	10	12		12	15		15	31		31	20		20
Pullus	20	23		23	6		6	35		35	9		9
Eggs	46	113		113	202		202	95		95	100		100
Nests, empty	102	196		196	472		472	546		546	710		710
Nests, Total	178	344		344	695		695	707		707	839		839
Great Crested Tern													
Adult	43	8		8	2,356		2,356	7,644		7,644	1,228		1,228
Juveniles	8	0		0	0		0	0		0	24		24
Pullus/ Juvenile	0	0		0	0		0	3,319		3,319	3		3
Eggs	0	0		0	0		0	503		503	0		0
Sooty Tern													
Adult	0	8,902		8,902	2,063		2,063	6,000		2)6,000	3) 5,583		5,583
Juveniles	0	0		0	0		0	0		0	3,844		3,844
Pullus/juvenile	0	288		288	987		987	1		1	250		250

Eggs	0	4243		4,243	1		1	593		593	636		636
Masked Booby													
Adult	2	2		2	0		0	2		2	2		2
Pullus	0	1		1	0		0	0		0	0		0
Eggs	1	0		0	0		0	1		1	1		1
Red-footed Booby													
Adult	139	155	173	328	761	32	793	97	224	321	210	69	279
Sub-adult	10	2	8	10	3	3	6	5	20	25	8	13	21
Juvenile	0	2		2	0		0	5		5	0		0
Pullus	0	0		0	2		2	6		6	10		10
Eggs	3	3		3	26		26	6		6	47		47
Nests, empty	21	4		4	32		32	25		25	42		42
Nests, Total	24	8		8	58		58	42		42	89		89
Brown Booby													
Adult	3,388	1,210	1,908	3,118	1,373	576	1,949	2,358	1,352	3,710	1,125	1,137	2,262
Sub-adult	25	352	30	382	6	82	88	3	18	21	61	18	79
Juvenile	3	63		63	13		13	4		4	82		82
Pullus	610	388		381	10		10	168		168	1,054		1,054
Eggs	1,210	71		71	25		25	1,492		1,492	1,039		1,039
Nests, empty	414	357		357	623		623	750		750	550		550
Nests, Total	1,694	851		851	664		664	1,855		1,855	2,192		2192

Bird Islet: Note 1) 1,678 adults based on nests. Note 2) Night estimate Note 3) 9,460 adults based on numbers of offspring and eggs

South Islet	2020				2021								
Species/Date	**14 Aug**	**14 Nov**			**14 Feb**			**31 May**			**11 Aug**		
	Day Count	Day Count	In-flight	Total	Day Count	In-flight	Total	Day Count	In-flight	Total	Day Count	In-flight	Total
Brown Noddy													
Adult	1488	2	No count	2	816	No count	816	904	No count	904	734		734
Juvenile	1080	0		0	0		0	152		152	18		18
Pullus	57	0		0	0		0	89		89	18		18
Eggs	61	0		0	320		320	109		109	114		114
Nests, empty	598	0		0	88		88	102		102	341		341
Nests, Total	744	0		0	408		408	452		452	491		491
Black Noddy													
Adult	631	12	No count	1	444	No count	444	1462	No count	1462	1331		1331
Juvenile	10	0		0	0		0	79		79	78		78
Pullus	20	0		0	0		0	62		62	70		70
Eggs	46	1		1	92		92	228		228	324		324
Nests, empty	102	102		102	130		130			362	763		763
Nests, Total	178	103		103	222		222	731		731	1235		1235
Great Crested Tern													
Adult	232	0		0	0		0	5,732		5,732	949		949
Juvenile	115	0		0	0		0	256		256	60		60
Pullus	1	0		0	0		0	872		872	7		7
Eggs	0	0		0	0		0	1,790		1,790	0		0
Sooty Tern													
Adult	0	0		0	0		0	0		0	1		1
Juvenil	0	0		0	0		0	0		0	0		0
Pullus	0	0		0	0		0	0		0	0		0
Eggs	0	0		0	0		0	0		0	0		0

Red-footed Booby													
Adult	117	84	189	273	128	(no count)	128	81	20	101	126	110	236
Sub-adult	1	3	62	65	3	(no count)	3	3	2	5	1	28	29
Juvenile/Pullus	0	4		4	1		1	3		3	3		3
Eggs	10	0		0	32		32	8		8	52		52
Nests, empty	39	5		5	31		31	20		20	16		16
Nests, Total	49	9		9	64		64	31		31	71		71
Brown Booby													
Adult	166	120	67	187	289	(no count)	289	6	84	90	69	31	100
Sub-adult	3	3	2	5	11	(no count)	11	3	3	6	3	3	4
Juvenile	0	0		0	0		0	0		0	0		0
Pullus	0	2		2	0		0	0		0	3		3
Eggs	3	0		0	0		0	4		4	5		5
Nests, empty	4	2		2	2		2	2		2	1		1
Nests, Total	6	4		4	2		2	6		6	8		8

Annex 5. Population results and population trend of breeding seabirds in TRNP April to June 1981 – 2021

Inventory baseline years are underlined. Source: Kennedy 1982, Manamtam 1996, WWF Philippines 1998-2004 and TMO 2004-2021

Species/ Numbers	1981	1995	1998	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Ground-breeders Sub-total	**13,388**	**3,949**	**1,744**	**4,695**	**7,529**	**7,635**	**2,804**	**5,200**	**13,825**	**16,957**	**7,746**	**10,534**	**9,721**
Masked Booby	150	1	0	0	0	0	0	0	0	0	0	0	0
Brown Booby	3,768	**1)** 2,060	1,716	1,045	850	577	623	856	1,877	1,108	1,016	1,059	1,018
Brown Noddy	2,136	643	0	500	37	775	115	336	590	1,035	530	800	1,570
Great Crested Tern	2,264	335	0	150	414	4,160	2,064	2,808	7,858	6,894	4,700	4,875	4,433
Sooty Tern	5,070	**1)** 910	28	3,000	6,228	2,123	2	1,200	3,500	7,920	>1,500	3,800	2,700
Tree-breeders Sub-total	**156**	**7,128**	**3,250**	**3,502**	**7,042**	**5,003**	**1,630**	**3,240**	**8,353**	**8,727**	**7,902**	**10,403**	**9,525**
Red-Footed Booby	9	0	0	2	44	43	20	2,435	1,947	1,877	2,902	2,513	2,220
Black Noddy	147	7,128	3,250	3,500	6,998	4,860	1,610	805	6,406	6,850	> 5,000	7,890	> 7,305
TOTAL	**13,544**	**11,077**	**4,994**	**8,197**	**14,571**	**12,638**	**4,434**	**8,440**	**22,178**	**25,684**	**15,648**	**20,937**	**19,246**

Notes: 1) End of March data.

2) Based on Park Rangers distance count 1 June 2014.

3) Based on Park Rangers count 9 August 2014.

4) Based on Park Rangers egg count 14 Feb 2015.

5) 7,258 individuals based on Park Rangers egg count 16 Feb 2020

Species/ Numbers	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Trend (%)
Ground-breeders													
Sub-total	**18,669**	**13,592**	**18,383**	**15,988**	**16,448**	**27,193**	**27,654**	**29,940**	**35,878**	**24,569**	**29,323**	**24,880**	**- 15**
Masked Booby	0	0	0	0	0	0	1	1	1	1	2	2	
Brown Booby	1,438	1,846	1,879	1,690	1,632	2,403	3,122	3,535	3,367	3,138	>2,977	3,800	**+ 28**
Brown Noddy	1,575	2,042	1,492	1,688	1,862	2,583	2,096	4,209	3,470	2,208	3,262	**6)** 1,702	**- 48**
Great Crested Tern	4,790	6,160	8,653	9,794	**2)** 7,730	<12,387	13,880	17,097	17,752	14,880	17,810	13,376	**- 25**
Sooty Tern	10,866	3,544	6,359	2,816	**3)** 5,224	**4)** 9,820	8,555	>5,098	11,288	4,342	**5)**> 5,272	**7)** 6,000	**+ 13**
Tree-breeders													
Sub-total	**9,975**	**10,746**	**11,776**	**12,858**	**10,630**	**11,718**	**11,101**	**7,278**	**5,916**	**3,152**	**3,310**	**3,298**	**- 1**
Red-Footed Booby	2,331	2,395	2,340	2,202	3,074	3,492	2,141	2,087	1,443	1,080	660	422	**- 36**
Black Noddy	7,644	8,351	9,436	10,656	7,556	8,226	8,716	5,191	4,473	2,072	**8)** 2,650	**9)** 2,876	**+ 8**
TOTAL	**28,644**	**24,338**	**30,159**	**28,846**	**27,078**	**38,911**	**38,549**	**37,218**	**41,794**	**27,721**	**32,633**	**28,178**	**- 14**

Notes:

1) End of March data.

2) Based on MPR distance count 1 June 2014.

3) Based on MPR count 9 August 2014.

4) Based on MPR Rangers egg count 14 Feb 2015.

5) Annual total 12,530, if 7,258 breeding individuals counted by MPR Feb 2020 is added.

6) May represent change in breeding phenology. February 2021 count was 2,728

7) Annual total 8,063, if 2,063 breeding individuals counted by MPR Feb 2020 is added.

8) Annual total 3,128 breeding individuals, if 478 actively breeding individuals counted by MPR Feb 2020 is added.

9) Annual total 3,636 breeding individuals, if 760 actively breeding individuals counted by MPR Feb 2021 is added.

Annex 6. Seabird breeding data from Bird Islet and from South Islet, 2nd Quarter (mainly May) 2004-2021

Species/Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Red-footed Booby																		
Immatures	398	1,455	606	597	780	477	677	795	799	426	134	206	80	97	89	104	24	30
Pulli/1st year juv.	> 35	71	105	116	69	180	88	171	243	312	277	240	49	43	39	14	8	8
Eggs	+	+	+	+	+	+	+	68	>166	>185	>57	>46	> 49	55	74	26	>7	14
Nests	279	217	225	404	361	367	451	369	739	848	431	379	315	177	223	72	43	73
Brown Booby																	Note 1	
Immatures	0	81	26	55	55	61	126	110	140	62	51	28	66	157	264	218	35	27
Pulli/1st year juv.	43	2	7	12	91	126	125	225	46	28	266	200	22	175	95	8	8	172
Eggs	1	0	18	95	317	48	106	52	69	532	466	55	144	43	25	6	286	1,496
Nests	117	43	250	89	497	453	513	575	507	618	816	726	887	886	376	412	1,054	1,861
Brown Noddy																	Note 2	Note 6
Immatures	0	2	0	0	0	4	1	1	2	3	5	2	0	2	14	9	0	0
Pulli/1st year juv.	0	0	0	0	0	0	0	0	0	0	0	6	109	223	493	68	79	406
Eggs	0	0	0	3	17	126	438	253	>147	>607	679	571	620	1,005	581	183	615	177
Nests	115	124	20+	25+	218	384	653	571	709	771	931	960	1,048	1,917	1,644	805	1092	851
Black Noddy																	Note 3	Note 7
Immatures	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulli/1st year juv.	0	0	0	0	0	0	0	0	0	0	0	30	193	8	74	d39	40	207
Eggs	ND	+	0	+	+	430	+	+	>80	>700	>351	>299	>191	406	468	254	269	323
Nests	208	3,203	1,131	1,734	1,824	2,680	3,525	3,827	4,282	5,156	3,778	2,397	1,634	1,205	1131	1036	1,135	1,438
Great Crested Tern																	Note 4	
Immatures	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulli/1st year juv.	0	2,100	0	0	0	0	0	0	0	0	0	0	0	29	832	2610	6,813	4,447
Eggs	0	1,829	0	0	0	515	2,341	498	1,456	3,939	2,120	4,280	6,800	8,620	7,461	4830	1,568	2,292
Sooty Tern																	Note 5	
Immatures	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Pulli/1st year juv.	0	1,750	0	458	0	846	0	1,764	0	1,258	0	3,538	0	2,549	680	11	2,622	1
Eggs	9	0	0	63	2	3	5,515	2	1,534	146	37	52	166	0	4,964	3	14	593

Source: WWF Philippines 2004 and TMO 2004 to 2021

Note 1: MPR counted 16 Feb 2020 40 pulli/juv, 17 eggs and 257 nests; on 13 Aug 3 juveniles, 630 pulli, 1,213 eggs and 1,1,700 nest
Note 2: MPR counted 16 Feb 2020 51 pulli/juv, 188 eggs and 302 nests; on 13 Aug 254 pulli/juv, 70 eggs and 1020 nests
Note 3: MPR counted 16 Feb 2020 46 pulli/juv, 196 eggs and 367 nests; on 13 Aug 60 pulli/juv, 82 eggs and 356 nests
Note 4: MPR counted on 13 Aug 124 pulli/juv
Note 5: a) MPR counted 16 Feb 2019 3,627 eggs; on 13 Aug 0 pulli/juv and 0 eggs
Note 5: b) 19 -20 May, juveniles and pulli with feathers, c) Many airborne juveniles could not be counted
Note 6: MPR counted on 14 Feb 2021 633 eggs, 67 pulli and 788 nests
Note 7: MPR counted on 14 Feb 2021 92 eggs

Annex 7. In-flight to roost statistics of boobies and noddies on Bird Islet May 2005 to May 2021

Species/ Numbers	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	May 10: 17.00-18.15	Apr 28: 16.30-18.25	May 8: 16.30-18.20	May 7: 16.00-18.00	May 7: 16.30-18.30	May 13: 16.30-18.30	May 9: 16.30-18.30	May 10: 16.30-18.30	May 10: 16.30-18.30	May 9: 16.30-18.30	May 9: 16.30-18.30	May 11: 16:30 – 18.30	May 10: 16.30 – 18.30	May 14: 16.30 – 18.30	May15: 16.30 – 18.30	May19: 16.30 – 18.30	May27: 16.30 – 18.30
	Red-footed Booby																
Adult: Daytime	823	655	631	1,241	686	982	1,011	382	830	950	1,499	248	343	470	362	131	97
In-flight	960	1,171	2,082	1,272	1,534	1,259	1,259	1,680	779	813	602	367	527	356	282	309	224
Adjusted to 2-hour period	1,012	1,222	2,271	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	1,835	1,877	2,902	2,513	2,220	2,241	2,270	2,062	1,609	1,763	2,101	615	870	826	644	430	321
%-in-flight population	55%	65%	78%	51%	69%	56%	55%	81%	48%	46%	29%	25%	25%	43%	44%	72%	70%
Average In-flight (%)	**53.6%**																
Immature: Daytime	514	>205	275	239	179	194	106	174	125	61	111	8	29	24	27	5	5
In-flight	588	401	295	541	298	483	483	249	149	5	37	17	40	20	34	16	20
Adjusted to 2-hour period	941	419	322	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	1,455	>606	597	780	477	677	589	423	274	66	148	25	69	44	61	21	25

%-in-flight population	65%	69%	54%	69%	63%	71%	82%	59%	54%	8%	25%	25%	25%	45%	56%	76%	80%
Average In-flight (%)	**54.5%**																
	Brown Booby																
Adult: Daytime	629	405	660	691	650	930	1,338	1,060	968	834	1,505	1,920	2,257	1,295	2,212	888	1,556
In-flight	360	225	326	368	368	508	508	819	722	798	848	1,202	1,278	2,072	727	1,640	1,352
Adjusted to 2-hour period	576	235	356	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	1,205	640	1,016	1,059	1,018	1,438	1,846	1,879	1,690	1,632	2,353	3,122	3,535	3,367	2,939	2,528	2,908
%-in-flight population	48%	37%	35%	35%	36%	35%	28%	44%	43%	49**%**	36%	25%	25%	62%	25%	65%	47%
Average In-flight (%)	**39.7%**																
Immature: Daytime	22	20	21	20+?	22	30+	96	81	30	13	1	25	74	127	187	16	3
In-flight	37	6	31	34	39	96	14	59	32	39	25	41	78	105	30	19	18
Adjusted to 2-hour period	59	6	34	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	81	26	55	54	61	126	110	140	64	51	26	66	152	232	217	35	21
%-in-flight population	73%	23%	62%	63%	64%	76%	13%	42%	50%	76%	96%	62%	51**%**	45%	14%	26%	86%

Average In-flight (%)	**54.2%**																
	Brown Noddy																
Adult: Daytime							618	607	1,004	1,045	1,031	992	2,953				
In-flight							1,124	525	142	239	378	358	51				
Total							1,742	1,132	1,146	1,284	1,409	1,350	3,004				
%-in-flight population							65%	46%	12%	19%	27%	27%	2%				
Average In-flight (%)	**28.3%**																
	Black Noddy																
Adult: Daytime							421	1,098	2,243	1,506	2,412	711	800				
In-flight							1,334	1,124	272	318	132	84	9				
Total							1,755	2,222	2,515	1,824	2,544	795	809				
%-in-flight population							76%	51%	11%	17%	5%	11%	1%				
Average In-flight (%)	**24.6%**																

Annex 8. In-flight to roost statistics of boobies and noddies on South Islet May 2014 to 2021

Species/ Numbers	2014	2015	2016	2017	2018	2019	2020	2014	2015	2016	2017	2018	2019	2020	2021
	Red-footed Booby							Brown Booby							
	May 8: 16.30 - 17.30	May 8: 16.30 - 18.30	May 13: 16.30 - 18.30	May 9: 16.30 - 18.30	May 12: 16.30 - 18.30	May 15: 16.30 - 18.30	May 21: 16.30 - 18.30	May 8: 16.30 - 17.30	May 8: 16.30 - 18.30	May 13: 16.30 - 18.30	May 9: 16.30 - 18.30	May 12: 16.30 - 18.30	May 15: 16.30 - 18.30	May 21: 16.30 - 18.30	May 31: 16.30 - 18.30
Adult: Daytime	401	366	508	584	262	154	32	7	22	40	31	160	41	73	81
In-flight	910	1,020	1,018	633	355	282	198	2	28	24	11	144	158	376	20
Adjusted to 2-hour period	1,820	-	-	-	-	-	-	4	-	-	-	-	-	-	-
Total	2,221	1,386	1,526	1,217	617	436	230	11	50	64	42	304	199	449	101
% in-flight population	82.0	73.6	66.7	52.0	57.5	64.7	86.1	18.2	56.0	37.5	26.2	47.4	79.4	83.7	19.8
Average	46.0							46.1							
Immature: Daytime	68	58	32	27	22	43	5	0	2	0	4	32	1	16	3
In-flight	1	No count	21	1	23	27	4	0	No count	No count	1	0	4	16	2
Adjusted to 2-hour period	2	-	-	-	-	-	-	0	-	-	-	-	-	-	-
Total	70	> 58	63	28	45	70	9	0	>2	0	5	32	5	32	5
% in-flight population	2.9%	-	33.3%	3.6%	51.1%	38.6	44.4	0	-	-	20.0	0	80.0	50.0	40.0
Average	29.0							38.0							

Species	Black and Brown Noddy					
	Year	2015	2016	2017	2018	2019
	(Note 1)	(Note2)	(Note 3)		(Note 4)	(Note 5)
	May 8: 16.30 - 18.30	May 13: 16.30 - 18.30	May 9: 16.30 - 18.30	May 12 16.30 - 18.30	May 15: 16.30 - 18.30	May 21: 16.30 - 18.30
Adult: Daytime	6,856	> 4,421	4,126	2,179	0	-
In-flight	4,678	> 3,500	< 2,066	1,335	0	-
Adjusted to 2-hour period	4,678	-	-	-	-	-
Total	11,534	7,921	6,192	3,514	0	-
% in-flight population	40.6	44.2	33.4	38.0	-	-
Average	**39.0**					
	Brown Noddy					
Adult: Daytime			2,921	1,347	0	427
In-flight			1,461	681	0	249
Adjusted to 2-hour period			-	-	-	-
Total			4,382	2,028	0	676
% in-flight population			33.3	33.6	0	36.8
Average	**25.9**					
	Black Noddy					
Adult: Daytime			1,205	832	60	948
In-flight			605	654	19	171
Adjusted 2-hour period			-	-	-	-
Total			1,810	1,486	79	1,119
% in-flight population			33.4	44.0	24.0	15.3
Average	**29.2**					

Note 1: Predominantly Black Noddy
Note 2: From 16.30 to 17.30 more birds left the islet compared to the number of birds arriving. From 17.30 to 18.00 more birds arrived than left the islet
Note 3: 578 individuals left the islet while 2,644 flew in = 2,066 in-flight
Note 4: 101 birds did not settle for landing as a results of ongoing construction and reclamation works
Note 5: Black Noddy: flying in to islet 421, flying out 172. Brown Noddy: flying in to islet 464, flying out 293

Annex 9. Systematic list of avifaunal records from South Islet, Bird Islet, and Ranger Station, Tubbataha Reefs Natural Park from 26 to 31 May 2021

Breeding species are indicated in bold letters. Taxonomic treatment and sequence follows IOC/Wild Bird Club of the Philippines 2021. Threat status follows DENR Administrative Order No 2019 – 09: Updated National List of Threatened Philippine Fauna and Their Categories

CR – Critically Endangered, EN – Endangered, VU – Vulnerable, OTS – Other Threatened Species (Near Threatened, LC – Least Concern

Status and Abundance (within Sulu Sea) Threat Status (IUCN and National Red List)	**Species name**	**Number of individuals**	**Locality**	**Notes**
Resident Common LC	Barred Rail *Gallirallus torquatus*	0 0	Bird Islet South Islet	One bird counted during inventory on Bird Islet 18 February 2021
Migrant U common LC	Sanderling *Calidris alba*	2	Bird Islet	
Migrant Fairly common LC	Ruddy Turnstone *Arenaria interpres*	0 0	Bird Islet South Islet	Outside of the May 2021 inventory period, in 2020 3 individuals were counted on 13 August, 8 birds on 18 September, 5 individuals on 14 October and 20 birds on 12 November 2020. In 2021, 10 birds observed on 18 February,10 individuals on 15 March and 11 individuals on 11 -12 Aug 2021
Resident Locally Rare	**Brown Noddy** *Anous stolidus*	Adults: 798 Juveniles: 137	Bird Islet	1,912 adults with 380 nest on 18 Feb 2021. Empty nests likely

VU		Pullus: 68 Nests: 399 Eggs: 68		undercounted as they are difficult to identify
		Adults: 904 Juveniles: 152 Pullus: 89 Nests: 452 Eggs: 109	South Islet	On 14 February 2021, 816 adults with 408 nests containing 320 eggs
Resident Locally Rare EN	**Black Noddy** *Anous minutus*	Adults: 1,414 Juveniles: 31 Pullus: 35 Nests: 707 Eggs: 95	Bird Islet	Adults per nest count. All breeding birds were found on the artificial breeding structures On 18 Feb 2021, 1,378 adults with 695 nests
		Adults: 1,462 Juveniles: 79 Pullus: 62 Nests: 731 Eggs: 228	South Islet	All breeding birds were found on the artificial breeding structures On 14 Feb 2021, 444 adults with 222 nests. In addition 80 adults on the ground without nests
Resident Fairly Common VU	**Great Crested Tern** *Thalasseus bergii*	Adults: 7,644 Pullus: 3,319 Eggs: 503	Bird Islet	A substantial decline compared to May count in 2020
		Adults: 5,732 Juveniles: 256 Pullus: 872 Eggs: 1,790	South Islet	Adult numbers based on nest count. Actually counted = 868 adults. First breeding since 2003. New larger sand habitat makes breeding more possible
Resident Locally Rare VU	**Sooty Tern** *Onychoprion fuscata*	Adults: 6,000 Pullus: 1 Juv: 0 Eggs: 593	Bird Islet	Nigh estimate. On 12 Aug 2021 9,460 adults based on numbers of offsprings and eggs.

		Adults: 0	South Islet	
Migrant Locally uncommon LC	Great Frigatebird *Fregata minor*	Adults: 0 Juvenile: 1	Bird Islet	
		Adults: 0 Juvenile: 1-2	South Islet	
Migrant Locally uncommon LC	Lesser Frigatebird *Fregata ariel*	Adults: 0 Juvenile: 3	South Islet	
	Unidentified Frigatebirds *Fregata sp*	3	Bird Islet	In 2021, 2 birds on 14 March 2021 and 3 on 11 August 2021
		29	South Islet	Highest counts since the May 2020 inventory includes 29 individuals on 14 August 2020 and 21 on 13 August 2021
Rare CE	**Masked Booby** *Sula dactylatra*	Adult: 2	Bird Islet	Noted with eggs in August 2020 which produced one pullus observed in November. It grew to juvenile stage but was found dead on 20 January 2021. Since then, two breeding attempts with courtship observed: The first in March resulting in two eggs in April and in June 2021. On 12 August, no eggs and a second courtship was observed, and on 17 August they had one egg which was lost around 1 September 2021.
Resident Locally uncommon LC	**Red-footed Booby** *Sula sula*	Adults: 321 Immatures: 25 Pulli/juv.: 11	Bird Islet	Nests of 33 pairs breeding on the structures for Black Noddy were removed

		Nests: 42 Eggs: 6		On 18 Feb 2021, 793 adults with 58 nests
		Adults: 101 Immatures: 5 Pulli/juv.: 3 Nests: 31 Eggs: 8	South Islet	Nests of 32 pairs breeding on the structures for Black Noddy were removed On 14 Feb 2021 128 adults with 64 nests
Resident Rare EN	**Brown Booby** *Sula leucogaster*	Adults: 3,710 Immatures: 21 Pulli/juv.: 4 Nests: 1,855 Eggs: 1,492	Bird Islet	Only average of 2,190 adults estimated at dawn. MPR data shows > 3,000 adults in the months of August and November 2020, and 4,384 adults in August 2021
		Adults: 90 Immatures: 6 Nests: 6 Eggs: 4	South Islet	
Resident Uncommon LC	**Pacific Reef Heron** *Egretta sacra*	Adults: 3 Nests: 0	Bird Islet	Up to 6 birds on 14 March 2021
		Adults: 4 Nests: 0	South Islet	Outside of the May 2021 inventory period, up to 8 dark phased birds on 16 October 2020 and 8 on 15 March 2021
Resident Common LC	**Eurasian Tree Sparrow** *Passer montanus*	0	Bird Islet	
		0	South Islet	

Annex 10. Comparison of the landscape and habitats seen from the Permanent Photo Documentation Sites on Bird Islet and South Islet, May 2004 and May 2021

Bird Islet:

Viewing angle for photo: facing NW 180°
Date: May 7, 2004

Comments: panoramic view
Photo no (camera): 4 shots

Photo Doc Site NI No. 01 - 2004

Photo name code: B1 01
Photo nos.: DSC_ DSC_0721-0727

Comments: 7 shots (Stitched by Microsoft ICE)
Photo credit: Retch Alaba

Date: 28 May, 2021

Photo Doc Site NI No. 01 - 2021

Viewing angle for photo: facing NE 038°

Film no: 27, 28 Photo no (camera):

Photo name code: BI 02 Photo no (negative):

Comments: 2 shots good angle Date: May 7, 2004

Photo name code: BI 02 Comments: 6 shots Photo Doc Site NI No. 02 – 20201

Photo nos.: DSC_ 0635-0640 Date: 28 May 2021

Viewing angle for photo: facing S 165°

Comments: 3 shots panoramic view

Photo name code: BI 03

Film no: 22, 23, 24

Date: May 7, 2004

Photo no (camera):

Photo name code: BI 03

Comments: 7 shots stitched (Microsoft ICE)

Date: 28 May 2021

Photo no (camera): DSC_ 0669-0675

Photo Doc Site NI No. 04 - 2004

Viewing angle for photo: facing E 067°

Film no: 14 Photo no (negative):

Photo name code: BI 04 Photo no (camera):

Comments: 1 shot Plaza Date: May 7, 2004

Photo name code: BI 04 Comments: 8 shots Plaza Date: 28 May, 2021 Photo nos.: DSC_0654-0661

Photo Doc Site NI No. 04 – 2021 Photo credit: Retch Alaba

South Islet:

Viewing angle for photo: facing S 060°

Comments: shot includes view of the old lighthouse at the background
Photo taken behind the old nipa hut

Photo name code: SI 01

Photo name code: SI 01

Date: 31 May 2021

Comments: single shot including new lighthouse at the background
Coordinates for new photoc doc site was taken in 2019

Photo no (camera): IMG_2705