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RESTORATION OF REEF ISLANDS PROJECT

Bridled tern survey report – Bajigal and Bimi (Stephens and Sisters islands)

Supplementary island threat assessment report

April 2025

A Great Barrier Reef Joint Field Management Program Priority Project

We acknowledge the Mandubarra Traditional Owners who are the custodians of Bajigal and Bimi and recognise their continuing connection to lands, waters and community.

We pay our respects to their Elders past, present and emerging.

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Version control

Version	Title	Prepared by	Reviewed by	Date prepared
v0.1	Bridled tern survey report – Bajigal and Bimi	Chris Timewell, Isabelle Onley	Andrew Palmer-Brodie, Naomi Maxwell	9/01/2025
v0.2	Bridled tern survey report – Bajigal and Bimi	Aestra	Sam Gibbs (Reef Authority) Naomi Maxwell	30/03/2025
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We acknowledge the Traditional Owners of Bajigal (Stephens Island) and Bimi (Sisters Island), the Mandubarra people, and appreciate the advice and support provided by the Mandubarra Aboriginal Land and Sea Incorporated (MALSI) in undertaking the field surveys and guiding us on Country.

We would like to acknowledge:

- MALSI rangers and associated staff for field support and coordination
- Chris Timewell (The Ecology Office) for leading the sea bird surveys
- Michael Acheson (Kurrimine Beach boat hire and fishing charters)

1 Introduction

This report is a study completed as part of the Restoration of Reef Islands Project (the Project) which aims to facilitate the rehabilitation or enhancement of habitat values for selected islands in the Great Barrier Reef World Heritage Area. The Restoration of Reef Islands Project has been delivered using funding supplied by the Reef Trust administered by the Commonwealth Department of Climate Change, Energy, the Environment and Water.

The Project includes two components, Component 1 which focusses on islands with known threats (such as weeds and pests) and Component 2 which focusses on understanding potential threats to islands with *Pisonia grandis* particularly as a result of soft scale.

The Component 1 assessments for Bajigal is reported in the *Ecological Assessment for Bajigal (Stephens Island)* (Fell et al, 2024). The Component 1 assessment for Bimi is comprised of three reports which are supplementary to the Ecological Assessment for Bajigal and should be read in conjunction with that document. The reports relating to Bimi are:

- Survey for *Pisonia grandis* – Bajigal and Bimi (Stephens and Sisters Island)
- Supplementary report – Bimi vegetation assessment (Fell, 2025).
- Bridled tern survey report – Bajigal and Bimi (Stephens and Sisters islands) (this report)

1.1 Aims and objectives

This study aimed to collect detailed information on the actual and potential bridled tern breeding habitat, and associated relevant information, at Bajigal (Stephens Island) and Bimi (Sisters Island) to assist in the development of the Bajigal Habitat Restoration Plan.

In order of priority (from highest to lowest), the field investigations aimed to:

1. Determine the extent of area(s) being used for nesting by bridled tern on Bajigal and Bimi.
2. Identify the habitat attributes of the area(s) being used for bridled tern nesting on Bajigal and Bimi.
3. Obtain an estimate of nest density and/or population sizes within the bridled tern nesting area(s) at Bajigal and Bimi.

1.2 Survey location

Bajigal (10.6 ha) and Bimi (6.5 ha) are islands situated on the wet tropical coast of north Queensland within the Wet Tropics bioregion (Figure 1). They are located 6.7 km northeast of Kurrimine Beach, which is approximately half-way between Cairns and Townsville. The distance between the two islands is 0.7 km. There is a rocky reef between the islands, which is less than 1 metre deep at low tide (MALSI, pers. comm.)

These two islands lie within the Sea Country of the Mandubarra people. They are part of the Barnard Island Group National Park which is managed by the Queensland Parks and Wildlife Service (QPWS). They are also located within the Marine National Park (Green) Zone (Commonwealth of Australia (Reef Authority), 2016).

Access to Bajigal is restricted to private/chartered vessels for camping and recreation. The number of visitors to the island at any one time is capped, and seasonal access restrictions apply to parts of the island to limit impacts to nesting seabirds (QPWS, 2023). Access to Bimi is limited, there are no camping or recreation facilities on the island and vessel access is constrained by surrounding areas of reef.

1.3 Bridled tern ecology and conservation status

The bridled tern (*Onychoprion anaethetus*) is a seabird found in warm tropical waters throughout the world. Four subspecies are generally recognised, with the ‘Indo-Pacific bridled tern’ (*O. a. anaethetus*) being the subspecies occurring along the Queensland coast (the remainder of the report will refer simply to ‘bridled tern’). The number of bridled tern individuals using Australian waters is uncertain, with the global bridled tern population estimated at between 610,000 to 1,500,000 (Commonwealth of Australia, 2020). Birdlife International considers

that this roughly equates to 400,000 - 1,000,000 mature individuals.[1, 2] As compiled from relevant literature sources, an overview of the bridled tern ecology – including its typical reproductive behaviour – is provided in Attachment A. This overview focuses on aspects that are relevant to this investigation.

Under the Australian *Environment Protection and Biodiversity Conservation Act 1999* (the 'EPBC Act'), the bridled tern is recognised as a Matter of National Environmental Significance, being listed as both a migratory species and as a marine species. The species is not listed as threatened either nationally or in the State of Queensland.

The bridled tern has been recognised as a Key Value for Bajigal by QPWS, as Bajigal supports a significant proportion of the entire bridled tern breeding population within Australian territories and more than 1% of the global breeding population (Birdlife International, 2025).

Figure 1: Overview of Bajigal and Bimi (top), Bimi (Bottom) Images: Mandubarra Aboriginal Land and Sea Inc.

[1] 'Mature individuals' refers to birds that are able to be involved in reproduction (e.g., egg-laying, nesting, chick-raising).
[2] https://datazone.birdlife.org/species/factsheet/bridled-tern-onychoprion-anaethetus/text, accessed 17 January 2025.

2 Methods

2.1 Overview

The investigation of bridled tern breeding activity was conducted over three consecutive days, with the first two days focussed on Bajigal (28-29 November 2024) and the third day focussed on Bimi (30 November 2024).

Access to the islands was influenced by the tidal height, particularly on Bimi where there was only a relatively narrow window for boat access during high tide.

As described below, the investigations at Bajigal involved both ground-based and vessel-based components, while the investigation at Bimi was primarily ground-based. The ground-based survey team comprised Mandubarra Aboriginal Land and Sea Incorporated (MALSI) rangers, and ecologists from Aestra. The vessel-based surveys additionally involved further MALSI staff, and from the boat captain Michael Acheson. Participants in these bridled tern Surveys are listed in Table 1.

Table 1: Bridled tern survey participants, November 2024

Location	**Bajigal**				**Bimi**
Date	**28 Nov**		**29 Nov**		**30 Nov**
Type of survey	Ground	Vessel	Ground	Vessel	Ground
Approximate time (hours)	5	0.75	5	1	3.5
James Epong – MALSI Senior Ranger	X	X	X	X	X
Sean Kyle – MALSI Ranger Coordinator					X
Melissa Ball – MALSI Business Manager		X			
Rohann Sultana – MALSI SCCV Coordinator				X	
Jayden Crump – MALSI Ranger	X	X	X	X	X
Dylan Daughterty – MALSI Ranger	X	X	X	X	X
Larrence O'Donnell – MALSI Ranger			X	X	
Naomi Maxwell – Aestra Project Director and Field Team Leader	X	X	X	X	X
Chris Timewell – Senior Ecologist (The Ecology Office / Aestra)	X	X	X	X	X
Isabelle Onley – Aestra Ecologist	X	X	X	X	X
Michael Acheson – Boat Captain		X		X	

The official weather conditions for the three days of field survey, and the surrounding days, are summarised in Table 2. However, there is some local variation in conditions which differed from the recording station at Cowley Beach, as there was considerable rainfall during the night at Kurrimine Beach between days 2 and 3, and short intense showers when arriving at Bajigal on day 1. There was also no actual rainfall during the time of the visit to Bimi on day 3, despite the high count recorded for the 24 hours encompassing this visit.

Overall, the weather conditions were suitable for undertaking assessments of bridled tern breeding activity and habitat.

Table 2: Weather conditions in the vicinity of Bajigal and Bimi during the field investigations.[3]

Date	Wed 27 Nov	Thurs 28 Nov	Fri 29 Nov	Sat 30 Nov
Minimum temp to 9am (ºC)	21.0	23.1	25.7	24.9
Maximum temp from 9am (ºC)	31.1	31.8	30.0	31.1
Rainfall to 9am (mm)	0.0	0.0	0.2	30.6

2.2 Vessel-based assessments

There are parts of Bajigal and Bimi where it is either difficult, dangerous, inappropriate and/or time-consuming to access on foot, but where it is possible that bridled terns may be nesting. Therefore, by having surveyors on the boat viewing the edge of the islands, surveyors could make observations of adult bridled tern visitations and departures to the islands, and the specific locations where these activities occurred. This information identified likely breeding locations, thereby allowing follow-up on-ground investigations to be more efficient and geographically targeted, and also filling in gaps where on-ground access was not achievable.

Prior to the field survey commencing, there was not a consensus among various parties about whether bridled terns were nesting within areas of non-native Guinea grass (*Megathyrsus maximus*), an invasive tussock-forming grass species. Much of the Guinea grass patches occurred around the fringes of Bajigal. It was deemed undesirable for surveyors to walk within these areas during the bridled tern breeding season, as the surveyors could inadvertently crush underfoot – or otherwise disturb – an unseen bridled tern nest hidden beneath the dense cover of grass tussocks. As such, to assist in determining whether bridled tern breeding activity was occurring within the area dominated by Guinea grass, observations were made by surveyors from the boat of adult bridled terns entering into and/or out of the Guinea grass areas. These observations were considered to be strong evidence that nesting was occurring in these areas at the time of survey.

Vessel-based assessments were not undertaken around Bimi due to the shallow reefs around this island preventing safe access by boat.

As indicated in Table 1, two vessel-based assessments were undertaken around the northern shoreline of Bajigal in the mid-late afternoon of 28 November and early morning of 29 November. The boat moved slowly about 100 metres offshore, with periods where the boat was effectively stationary to allow extended observations of particular areas. The surveyors used binoculars and naked eyes to observe bridled terns arriving or departing from the island (and undertaking other relevant behaviours)[4] in a manner that indicated visitations to attend their nests on the island. Where detected, the relevant observations of bridled tern activity, their locations and associated information were documented using the ArcGIS Field Maps data collection tool (see section 2.4 below for more details). Photographs and video footage were also collected on occasion where possible.

2.3 Terrestrial assessments

The majority of time each day by the team of surveyors was spent on foot traversing the accessible areas of both Bajigal and Bimi to collect relevant detailed information on bridled tern nesting activity. It was collectively agreed during a trial period at the start of day 1 on Bajigal that the most effective approach was to remain together as a single team, with each team member contributing particular skills and undertaking specific tasks.

[3] Information obtained from https://www.weatherzone.com.au/station/SITE/32194/daily-summaries/2024/november, accessed 9 Dec 2024 – based on the weather station at Cowley Beach (Defence)

[4] Relevant behaviours include hovering or repeatedly looping over a Guinea grass patch; perching on an exposed shrub or tree branch before moving into the interior forested habitat; perched on ground or rockface; walking from ground into a tunnel between Guinea grass tussocks.

Three main activities were undertaken as part of the terrestrial assessments:

1. transect counts of active bridled tern nests,
2. documentation of broader bridled tern information, including habitat use, habitat quality, and management threats and opportunities, and
3. incidental sightings of other notable fauna.

Methodologies are described further below. In addition, regular discussions were held between the survey team throughout each day to discuss the various observations being made and their implications, the ecology of the bridled tern, its habitat requirements and possible management options in the context of Bajigal and Bimi. Photos and video footage were also collected regularly throughout.

2.3.1 Transect counts of nests

To obtain an estimate of the density of bridled tern nesting across both islands, and to document the extent of nesting across the islands, a series of counts were collected along transect lines. These do not comprise a complete census of bridled tern nesting across Bajigal and Bimi, but instead were focussed on collecting a sample of data from a range of different habitats and locations using a standardised approach to provide an indication of relative abundance and nest density.

A bridled tern nest activity survey along a transect line involved undertaking the following, in sequential order:

1. All of the survey team would gather together at a designated start point and agree upon a direction of travel. Some team members would be allocated to the role of recording adult birds that were either sitting on nests or observed flying away from a nest. Other team members would be allocated the role of recording nests where the adult had temporarily departed but where an egg[5] or chick[6] was present. One of the Aestra ecologists[7] was allocated to the role of documenting the nest activity data from the allocated data collectors and also documenting the transect pathway.
2. The team would walk along the agreed route at a pace sufficiently slow to allow all nests to be detected.[8] While the route was broadly linear, there were some curves and bends within transects to accommodate safe access paths across the challenging terrain. The designated data collectors would compile sightings of adults and/or eggs using their hand-operated counter units. Although somewhat variable depending on the terrain and vegetation density, sightings were made up to a distance of 5 metres on either side of the transect line.
3. After an appropriate period of walking along the transect, there would be collective agreement to stop. Usually this occurred where there was a notable change in terrain (e.g., from a rocky to non-rocky area) and/or a notable change in vegetation (e.g., from forest to Guinea grass patch; from a forest with a dense understorey cover to an area with a sparse understorey cover). At this time, the Aestra ecologist would use the FieldMaps app to document the counts of bridled terns from the designated data collectors. The FieldMaps app would also be used to document the transect route followed, and other relevant information (e.g., time, date, habitat notes, photos).

[5] Although the scientific literature indicates that bridled terns can sometimes lay two eggs in their nest, every nest detected on Bajigal and Bimi contained only a single egg or single chick.

[6] As discussed further in chapter 3, the vast majority of active bridled tern nests detected during these surveys were at the egg/incubation phase. Only on Bimi were a small number of recently hatched chicks detected within a very restricted geographic area.

[7] Dr Isabelle Onley performed this role on Bajigal. Isabelle Onley and Chris Timewell undertook this role in separate parts of Bimi.

[8] As such, not all transects were walked at a consistent pace. Transects with steep and challenging terrain, and/or dense vegetation, were walked slower than areas with flatter terrain and/or sparse understorey vegetation. Similarly, transects with many nests – or many cracks and crevices where nests could be hidden – were walked at a slower pace – both to ensure accurate counts, and also to avoid accidentally stepping on (or otherwise damaging) an active nest.

4. The designated data collectors would then reset their hand-held counter units back to zero. A new transect would be established that commenced from the end of the previous transect, or from a short distance away, and then proceeded into a new area. The process would begin again from step 1 along the new transect.

The transect routes followed on Bajigal and Bimi are displayed respectively in Figures 2 - 5. There were 26 transects completed on Bajigal, ranging in length from 25 metres to 245 metres. There were eight transects completed on Bimi, ranging in length from 30 metres to 80 metres. Of note:

- Multiple shorter transect lines were undertaken in areas with high nest density and/or variability.
- Through two areas of forest in the south-central portion on Bajigal that had a relatively open understorey cover, the team members concurrently undertook three parallel transects - with two surveyors in the upper rocky area, one in the central sparse area, and two surveyors in the lower area that contained a higher cover of low vegetation (transects 7a, 7b, 7c, 9a, 9b and 9c - as displayed in Figure 2 and Figure 3).
- There are parts of both Bajigal and Bimi where no transects could be conducted due to access constraints (e.g., steep rocky areas, impenetrable vegetation) or unacceptable risks to nest damage (e.g., Guinea grass patches). To determine whether breeding activity was occurring in these areas, opportunistic observations were made from adjacent accessible locations wherever possible.[9]

2.3.2 Habitat assessments

Concurrently with the transect surveys, the team members were making broader observations of habitat types, conditions and extents, and their use by bridled terns for breeding and other relevant activities. One of the Aestra ecologists (Chris Timewell) was focussed on the role of using the FieldMaps app to record relevant aspects of this information from either a specific-point location, or from a sub-section of an island ranging in extent from 0.01 ha to 1 ha.[10] The information collected was based partly on the observations of the recorder, and partly on an overview of the discussions with the broader team members either collectively or individually. The types of information being collected for each specific point or designated area included (but was not restricted to):

- Knowledge provided by the MALSI rangers regarding their knowledge of the bridled tern and its nesting activity on Bajigal and Bimi - and elsewhere - from past breeding seasons.
- Perceived bridled tern nesting density across broader areas (i.e., both within and beyond the area covered by the monitoring transects).
- Location of bridled tern nests that were outside of the transect line surveys (e.g., along cliff faces and within Guinea grass patches).
- Features of the broader habitat (e.g., tree height and density, density of vines, understorey vegetation type and density, substrate type, occurrence of weeds) that may be influencing bridled tern nesting density.
- Micro-habitat features that may be influencing nest locations (e.g., density and type of rock cover, logs, tree trunk size and shape, ground-cover vegetation).

[9] This included (a) watching bridled tern activity in the vicinity of a Guinea grass patch while standing in a nearby area outside of the patch, or from the vessel, (b) watching bridled tern activity along the rocky coastline while walking along the rocky intertidal shoreline below the cliffs, or from the vessel, (c) for areas of dense forest that were inaccessible to the survey team, bridled terns were watched entering via a gap in the canopy or through a gap in the vine curtain of invasive morning glory (*Ipomoea* spp.).

[10] Each designated area was referred to as a 'polygon' - which is a standard GIS term used to describe a geographic area that has been mapped because it contains particular values or features that are unique or differ from surrounding areas. There is a function in FieldMaps that allowed polygons to be added to a map, and for a range of information types to be documented for each polygon. This information was critical for the development of the maps presented within this report.

2.3.3 Incidental observations of other notable fauna

The primary purpose of the field investigations was to identify and document bridled tern breeding sites and associated habitat features. However, there has been a relatively low level of past fauna survey effort on Bajigal and Bimi, and therefore the documentation of other interesting, unusual and rare fauna species (i.e., 'notable' fauna) will contribute to the knowledge of these islands and potentially contribute to broader conservation and management considerations. It is also possible that the occurrence and activities of other fauna species on the islands may be directly or indirectly influencing its value for the bridled terns (e.g., presence of species that are known or potential predators upon bridled terns or their nests).

Therefore, to increase knowledge of general fauna usage across the islands, these opportunistic observations of other notable fauna were also documented, whilst ensuring that the time spent on these other fauna species did not significantly reduce the time and effort spent directly on documenting bridled tern nesting activity.

Within the ArcGIS FieldMaps app (as described in section 2.4 below), there was a specific tool developed to collect information on these other notable fauna species at specific locations where and when they were opportunistically detected. In addition, Chris Timewell also used a paper notepad to document all fauna species that he and other team members detected - including common and widespread species that were not necessarily considered to be 'notable' fauna.

Multiple photographs were also taken using a separate camera of both notable and widespread common species, although no attempt was made to obtain a sample photograph of every species. Some of the documented fauna species were not seen at all, but only accurately detected by their characteristic vocalisation (call).

2.4 Data collection using the FieldMaps app

Throughout the field investigations for bridled tern, relevant data was primarily collected using the ArcGIS FieldMaps tool ('FieldMaps'), which was available on two handheld devices – a tablet used for the transect surveys, and a smartphone used for the habitat assessments.[11]

FieldMaps is an app used by researchers to collect data in the field, and which allows the data to be tied to specific geographic locations. It also has the benefit of being able to be used in areas where there is no internet or mobile coverage available. For this project, FieldMaps has been modified to allow the surveyors to collect information that is most relevant to bridled tern breeding sites. The FieldMaps app allowed for the collection of three main types of information:

- Specific geographic points where an isolated bridled tern nesting event is occurring, and where transect lines commence and conclude.
- Broad areas ('polygons') where multiple bridled tern nests are occurring, or where habitat assessments are being conducted.
- Specific geographic points where other 'opportunistic' fauna observations are made (see section 2.3.3. above).

For each of these three main types of information, there is a series of additional data fields where more detailed information was collected on a case-by-case basis, such as:

- Surveyor name(s),
- Time and date,
- Estimated number or density of nests,
- Age of birds detected,
- Broad habitat type,

[11] Both devices were used to record incidental fauna observations.

- Microhabitat at nest site, and
- Any other relevant notes and information that the recorder wishes to document.

This data was then uploaded into a secure cloud-based storage once surveyors returned to an area with internet and/or mobile reception. This made the data available for subsequent analysis and inclusion into this report.

3 Results

3.1 Overview

The main findings from our surveys and assessments of bridled tern breeding activity on Bajigal and Bimi are summarised as follows (in no particular order):

- Reinforcement that Bajigal is an important nesting site for the bridled tern, with a large number of active nests detected (at least 863 from the sample undertaken along the transect lines, and many more beyond the transect lines).
- Confirmation that Bimi is also an important nesting site for the bridled tern, with a large number of active nests detected (at least 220 from the sample undertaken along the transect lines, and many more beyond the transect lines). Bimi also included large numbers of nest for the lesser crested tern (*Thallasseus benghalensis*).
- Virtually all parts of Bajigal and Bimi above the high tide mark are used to some extent for bridled tern nesting activity. While some areas above the high tide mark had a low number of nests, there were no substantial areas that were completely devoid of nests.
- The density of bridled tern nests across both Bajigal and Bimi appear to be somewhat influenced by broad vegetation patterns, and more strongly influenced by the availability of preferred micro-habitat features.
- Discussions with MALSI rangers indicate that some of the bridled tern nesting density patterns seen across Bajigal in November 2024 differs from patterns seen in recent past breeding seasons.
- Bridled terns were nesting within and near areas containing the three main invasive weeds (Guinea grass (*Megathyrsus maximus*, morning glory (*Ipomoea* spp.), and coral berry (*Rivina humilis*)), although there was no strong evidence to indicate that these habitats were favoured breeding locations with higher-than-typical nesting densities compared with more-intact areas where these weeds were sparse or absent. However, as addressed in chapter 4, these weeds are considered likely to have a negative impact on the value of Bajigal and Bimi as important bridled tern nesting locations when viewed over the medium to long term, and almost certainly have a negative impact on other flora and fauna values across the islands.

These findings are described in greater detail within the remainder of chapter 3.

Discussion on the potential implications of these findings for the conservation and management of Bajigal and Bimi are provided for consideration in chapter 4.

3.2 Transect surveys

3.2.1 Bajigal

Surveys were undertaken along 26 transect lines across Bajigal, as displayed in Figure 2 and Figure 3. Along every transect line, at least one active nest was detected, with the lowest count being a single nest detected along a 110 metre transect (#20) that occurred underneath a section of the spectacled flying-fox colony.[12]

[12] See section 3.6.1 for further information about the flying-fox colony.

As a maximum, along a 245 metre section of the central elevated east-west spine on Bajigal, one of the MALSI rangers recorded an estimated 200 adult birds undertaking breeding activity[13] among the cracks and crevices between and on rocks (transect 12). An even higher density of nests was detected along other shorter transects, including at least 50 nests in 40 metres along transect 4 and at least 72 nests in 50 metres along transect 9a. The number of nests with eggs, nests with chicks, and adult birds at nest[14] recorded along each transect is provided in Table B1 of Attachment B.

The minimum count[15] for active nests from along all transect lines combined on Bajigal is 863. The actual number of bridled tern nests would be significantly higher were a complete census feasibly able to be attempted. However, the transect surveys were adequate to gain understanding of nesting density in different parts of the island, and some of the factors influencing this density.

At every bridled tern nest where the adult had temporarily departed, the nests contained a single egg. No nestlings or fledglings were observed along any of the transect lines on Bajigal, although it is feasible that some of the adult birds that remained on their nests (rather than temporarily flying away upon approach of the observers) were sitting on top of nestlings rather than unhatched eggs. No nests were detected containing two or more eggs, even though literature sources indicate that nests with two eggs can occasionally occur (Beruldsen, 2003; Higgins and Davies, 1996).

At the eastern end of Bajigal within a patch of Guinea grass – outside of the transect lines – a single bridled tern nestling was briefly observed before disappearing into the dense cover of grass tussocks. This was the only sighting of a bridled tern chick on Bajigal during these surveys. The presence of a well-developed chick while all other nests on Bajigal were found to be at the egg stage was unexpected, however it is not unprecedented for a small number of birds to undertake nesting at different times to the broader population (Higgins and Davies, 1996).

3.2.2 Bimi

Surveys were undertaken along eight transect lines across the parts of Bimi that were accessible within the limited timeframe available to survey this island, as displayed in Figure 4 and Figure 5. Active bridled tern nests were detected along every transect line. At the lower end, only two active nests were detected along a 55 metre transect line in an area of forest with a relative sparse understorey and ground-cover. In contrast, there were two transects in littoral forest (transect A and D), and another in a rocky area of forest on basalt (transect H) that had more than one nest detected per metre of transect. The number of nests with eggs, nests with chicks, and adult birds at nest[16] from along each transect on Bimi is provided in Table B2 of Attachment B.

The minimum count[17] for active nests on Bimi detected along all transect lines combined is 220. The actual number of bridled tern nests would be significantly higher were a complete census feasibly able to be attempted. However, the transect surveys were adequate to understanding nesting density in different parts of the island, and some of the factors influencing this density.

At most bridled tern nests where the adult had temporarily departed, the nests contained a single egg. Along two of the transect lines in the littoral forest (transects A and D), a total of five recently hatched nestlings[18] were

[13] A mix of adult birds sitting on nests (either incubating an egg or covering a nestling) and adults flying away from nests as a result of the temporary disturbance by the observer.

[14] Either sitting on nests, and/or seen temporarily departing nests upon approach of the observer.

[15] On some occasions, the same nest was recorded by two separate surveyors that were focussed on collecting different types of breeding information. For example, an adult bridled tern was observed departing from a nest by one observer, and then this nest was counted again by another observer focussing on recording eggs and chicks in nests. It is not possible to retrospectively determine how frequently this occurred. Therefore, for a transect where there was a detection of 16 nests with eggs and 28 adults either incubating an egg or flying away from a nesting area, it was considered to contain at least 28 active nests.

[16] Either sitting on nests, and/or seen temporarily departing nests upon approach of the observer.

[17] See footnote 15.

[18] It is considered likely that all had been hatched within the past three days, and at least one within the past 24 hours.

recorded in nests where adults had temporarily departed, with one nestling per nest. As also noted for Bajigal, it is feasible that some of the adult birds that remained on their nests (rather than temporarily flying away upon approach of the observers) were sitting on top of nestlings rather than unhatched eggs. No nests were detected on Bimi containing two eggs, although literature sources indicate that bridled tern nests with two eggs can occur occasionally (Higgins and Davies 1996, Beruldsen 2003).

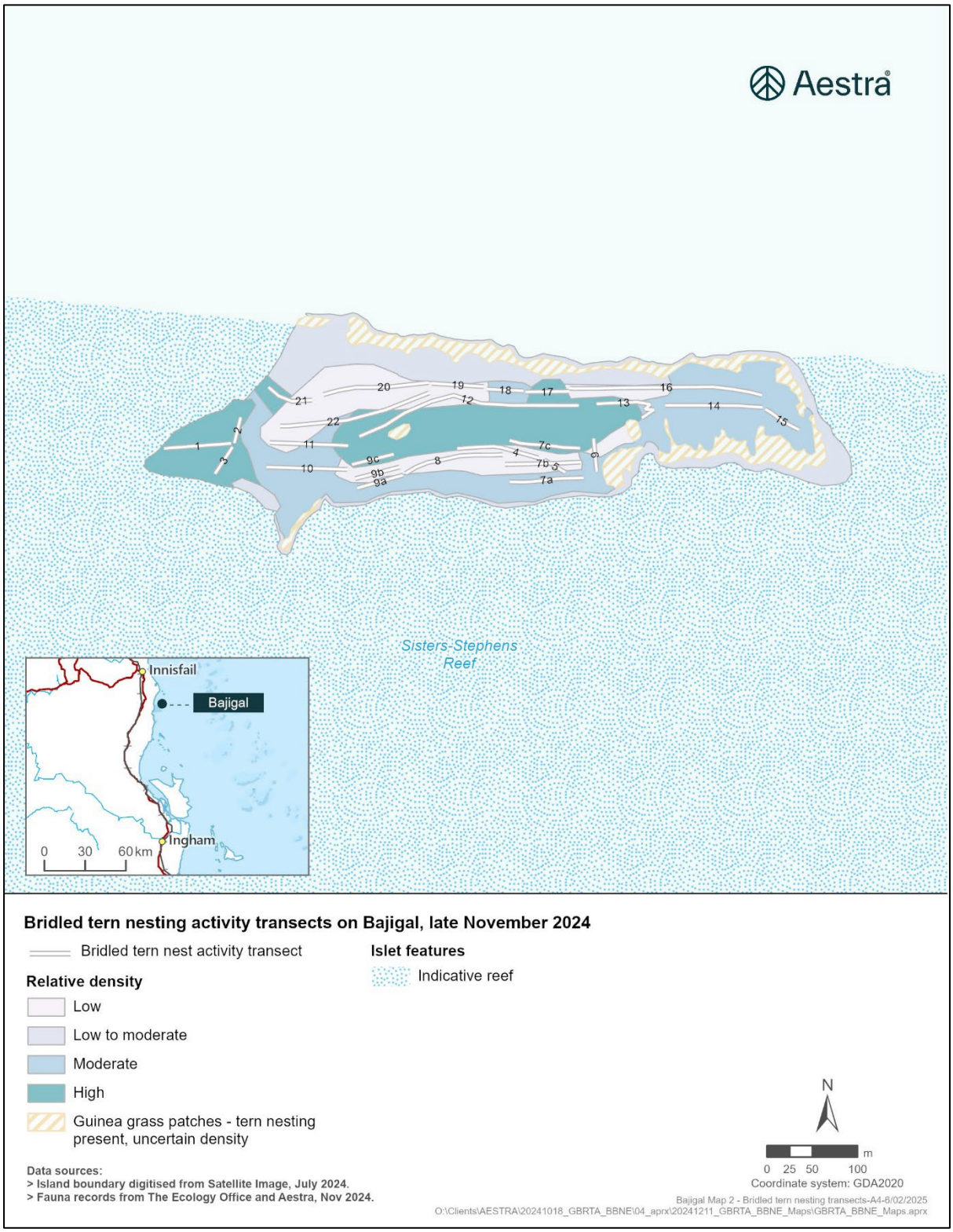

Figure 2 Bridled tern nesting activity transects on Bajigal relative to nest activity, November 2024.

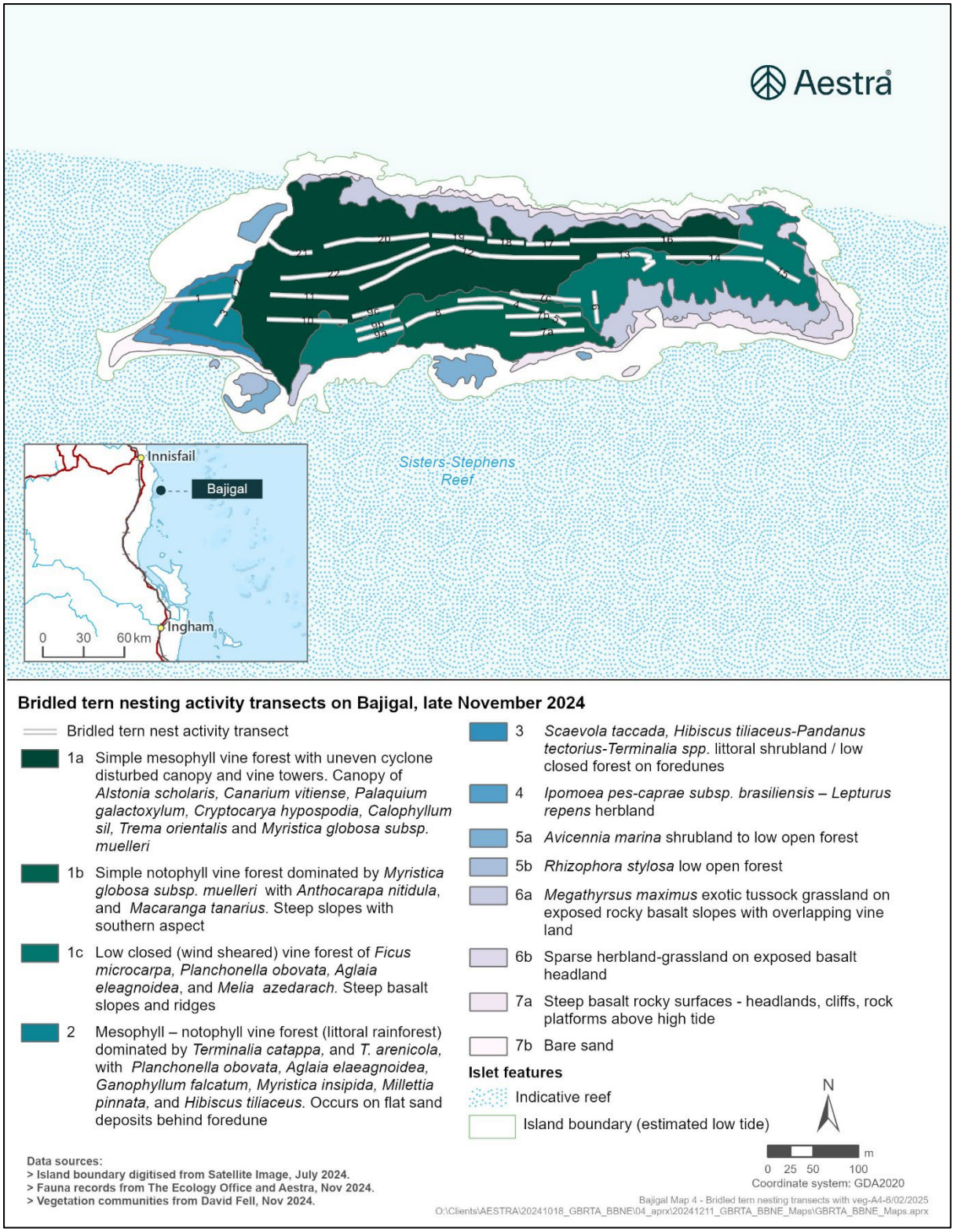

Figure 3: Bridled tern nesting activity transects relative to vegetation on Bajigal, November 2024.

Figure 4: Bridled tern nesting activity transects on Bimi relative to nest activity, November 2024.

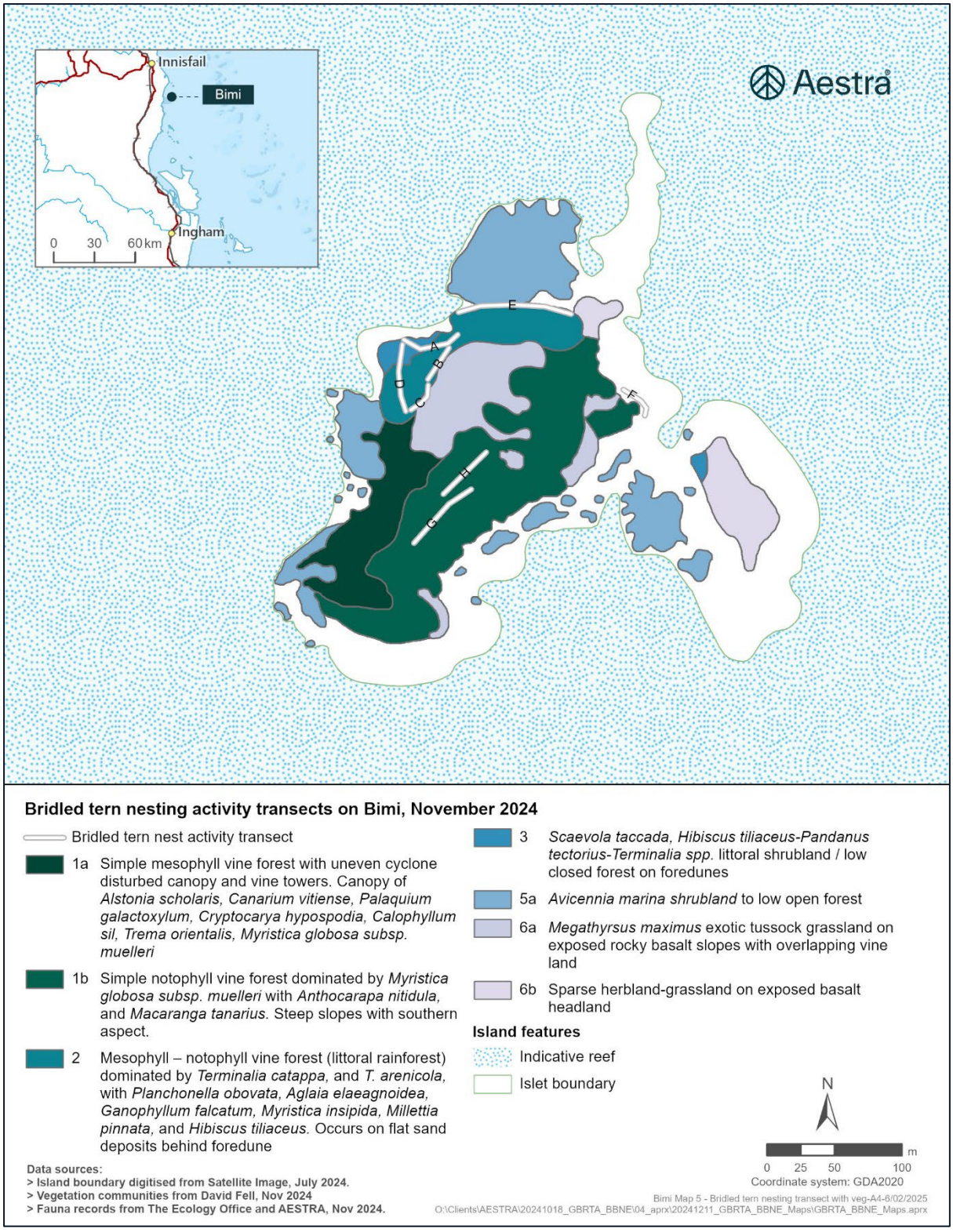

Figure 5: Bridled tern nesting activity transects on Bimi relative to vegetation, November 2024.

3.3 Bridled tern nest density

3.3.1 Bajigal

From the extensive searches undertaken across Bajigal over two days, all parts of the island above the high tide mark were found to contain bridled tern nesting activity. There were no extensive parts where there was no bridled tern nesting activity at all - although there were very few nests directly underneath the noisy spectacled flying-fox colony.[19]

Based on (a) the transect surveys, (b) other observations from the survey team beyond the transect lines, and (c) extrapolation of these findings into those areas where access was not feasible, a map of Bajigal has been prepared to display the relative density of bridled tern nests at the time of assessment in late November 2024 (Figure 6). In summary:

- High nesting density mostly occurred in the littoral rainforest in the far west, and along the elevated east-west spine through the central area which had a forest cover and dense rocky substrate.
- Moderate nesting density mostly occurred in the vine forests (on basalt) that typically either had a somewhat rocky substrate and/or substantial cover of vegetation near ground level and/or relatively abundant logs.
- Low-moderate nesting density mostly occurred either along the rocky cliff faces around the fringe of Bajigal, and also in the vine forests (on basalt) that had a moderate amount of either loose surface rocks, emergent rocks, low vegetation cover, logs and/or tree trunks with buttresses.
- Low nesting density occurred in the vine forests (on basalt) that had very few rocks, low vegetation cover, logs, or tree trunks with buttresses. It is uncertain if the very low number of bridled tern nests directly underneath the flying-fox colony was being influenced mostly by the presence of the flying-foxes (e.g., noise, waste products), or non-preferred habitat features that happened to coincide with this location (sparse cover of rocks and vegetation at ground level; dense lower tree canopy with scattered larger emergent trees[20]).
- From confirmed nests seen on the edges of Guinea grass patches, and strongly suggestive behaviour from adults deeper into the interior of larger patches, it has been verified that bridled terns were using the Guinea grass patches for breeding. And, as a single nestling was also detected within a Guinea grass patch, it seems feasible that bridled terns could theoretically raise their nestlings within the Guinea grass through to fledging and independence.[21] However, as noted earlier, it was not appropriate to undertake detailed transect surveys or searches through the Guinea grass areas. As such, the Guinea grass patches have been mapped as being confirmed sites for bridled tern nesting activity, but where the density of nesting is uncertain. Based on adult bridled tern flight behaviour, perching and overall occurrence around the Guinea grass patches – as observed from adjoining locations and vessel-based assessments – it is considered probable that the patches would be variously ranked as either low-to-moderate or moderate density of bridled tern nesting if transect surveys had been feasible.

[19] Figure 8 in Attachment D displays the location of the spectacled flying-fox colony.

[20] The flying-foxes were roosting mostly in the larger emergent trees above the dense lower tree canopy layer.

[21] Conversely, for the reasons discussed in section 4.2, it is also possible that bridled tern nests within Guinea grass patches have a relatively high failure rate during years when there is rapid growth of Guinea grass after nesting has commenced but before fledging has occurred. Also, in years when Guinea grass is already fully grown and forms a thick cover at the start of the nesting period, bridled tern may avoid commencing their nests within any parts of these weed-dominated areas.

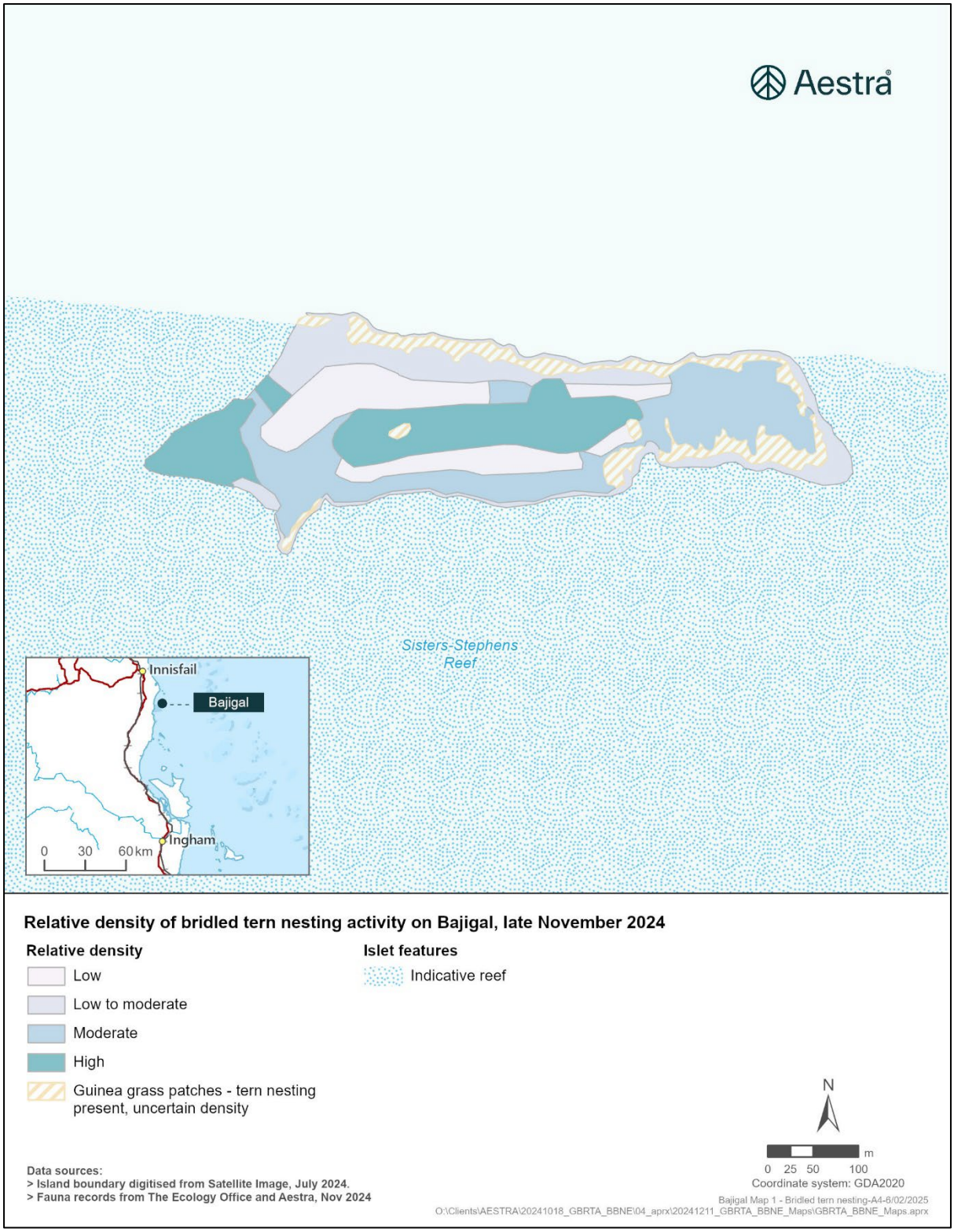

Figure 6: Relative density of bridled tern nesting activity on Bajigal, November 2024

3.3.2 Bimi

From the search undertaken across Bimi, and from observations of bridled tern flights and occurrence in the vicinity of areas not able to be accessed by the observers, it is considered highly likely that all parts of the island above the high tide mark contained bridled tern nesting activity. Undeniably, all parts of the island that were able to be directly accessed by the survey team contained breeding activity.

Based on (a) the transect surveys, (b) other observations from the survey team beyond the transect lines, and (c) extrapolation of these findings into those areas where access was not feasible, a map of Bimi has been prepared to display the relative density of bridled tern nests at the time of assessment on 30 November 2024 (Figure 7). In summary:

- High nesting density mostly occurred in the littoral rainforest in the far north, and within a section of vine forest (on basalt) containing a dense rocky substrate.
- Moderate nesting density occurred on the rocky platform to the east of the main island - which is separated from the main island during high tide.
- Low-moderate nesting density mostly occurred either along the rocky cliff faces around the fringe of Bimi, or in the vine forests (on basalt) in the centre of the island that had a moderate amount of either loose surface rocks or emergent rocks, with a low vegetation cover.
- Low nesting density occurred in the vine forests (on basalt) that had very few rocks, low vegetation cover, logs, or tree trunks with buttresses.
- Within the various Guinea grass patches on Bajigal, some bridled tern nesting activity was either confirmed or considered highly likely. For the same reasons outlined above for Bajigal, bridled tern nesting within these patches has been mapped as ‘Present; Uncertain density”. Also as per Bajigal, it is considered probable that the patches would be variously ranked as either low-to-moderate or moderate density of bridled tern nesting if transect surveys had been feasible.
- As described in section 2.1, a substantial portion of forested areas on Bimi were not directly accessed by the survey team due to a combination of limited time availability (due to tides) and challenging access. For a range of reasons,[22] it is considered highly likely that bridled terns are nesting through most or all of these areas to some extent. Largely depending on the microhabitats occurring in these areas, the nesting densities within these non-accessed areas could vary from low to high. As such, these areas have been mapped as “Present; Uncertain density” regarding their relative level of bridled tern nesting activity.

[22] For example, based on bridled tern activity, flight activity and movements around these non-accessed areas as observed from adjoining locations, and also based on our experience in similar habitats on Bajigal in the preceding days.

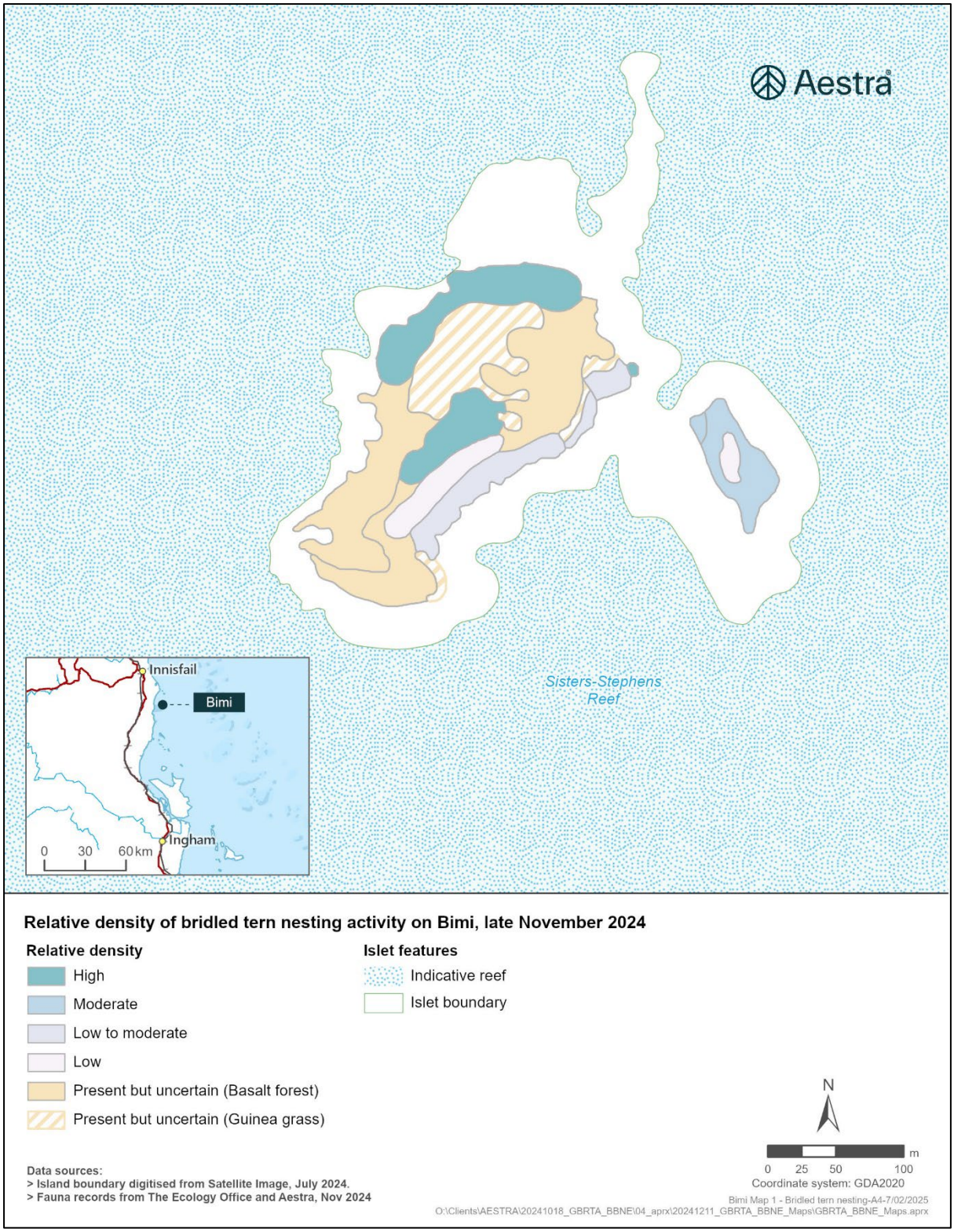

Figure 7: Relative density of bridled tern nesting activity on Bimi, November 2024

3.4 Broad habitats used by bridled tern for nesting

Across Bajigal and Bimi, effectively all areas that are above the high tide mark contained at least some active bridled tern nests.

The main broad habitat areas identified across the two islands during the survey were:

- Vine forest (on basalt).
- Littoral forest.
- Rocky basalt surfaces without forest.
- Exotic tussock grassland.
- Other – non-breeding habitats.

An overview of each of the four broad breeding habitats that occurred above the high tide mark is provided below. Each overview includes an indicative photo of the environment type and a summary of how the environment was typically used by bridled terns for nesting.

Additional field photos of habitat are provided at Attachment E.

3.4.1 Vine forest (on basalt)

Plate 1: Examples of vine forest occurring on basalt with high density bridled tern nesting activity on Bajigal

An overview of the vine forest habitat type is provided in Table 3.

Table 3: Summary of vine forest as bridled tern nesting habitat on Bajigal and Bimi

Vine forest (on basalt)	Description
Vegetation Type described in Bajigal Ecological Assessment (Fell et al, 2024)	1a – Simple mesophyll vine forest, 1b – Simple notophyll vine forest (nutmeg forest), 1c – Low closed (wind sheared) vine forest
Presence	Bajigal, Bimi
Photograph	Plate 1, Plate 6, Plate 7, Plate 11
Relative density of bridled tern nesting activity	Ranging from low to high

This rainforest was the most extensive vegetation type found across both Bajigal and Bimi. It is variable in structure and composition across the islands with the main consistent theme being tropical lowland rainforest species growing on the elevated basaltic base, which is usually sloped and/or uneven ground (Plate 1). The tree size, species and spacing differed across the islands, as did the level of canopy cover, and the presence and abundance of vines, mid-storey shrubs, lower ground layer vegetation, logs and leaf litter. The level of exposed rock ranged from almost none (e.g., where a soil layer had established) to almost complete cover of rocks (e.g., along the east-west spine through the centre of Bajigal).

Bridled terns were found nesting throughout this habitat. However, the relative density of nests varied throughout, and appeared to be correlated most closely with the availability of suitable micro-habitat features (see section 3.5 below). However, it is also probable that other factors such as past damage from cyclones, the canopy density, aspect, and the abundance of weeds within this habitat type also influence bridled tern nesting density to some extent.

3.4.2 Littoral forest

Plate 2: Littoral rainforest areas with high density bridled tern nesting activity on Bimi

An overview of the littoral forest habitat type is provided in Table 4.

Table 4: Summary of littoral forest as bridled tern nesting habitat on Bajigal and Bimi

Littoral forest	Description
Vegetation Type described in Bajigal Ecological Assessment (Fell et al, 2024)	2 – Low closed (wind-sheared) vine forest
Presence	Bajigal, Bimi
Photograph	Plate 2, Plate 5
Relative density of bridled tern nesting activity	Mostly high, with small areas of low-to-moderate on Bajigal.

This rainforest type occurs in low-lying areas near the coastline in relatively small areas on both Bajigal and Bimi, and grows on coastal sand deposits. The trees form a dense canopy cover, which becomes lower in height closer to the shoreline (Plate 2). There is a relatively low level of mid-storey and ground storey vegetation, however, it is still somewhat dense due to the abundance of tree trunks and winding woody vine stems that reach up into the canopy. There are no rocks at ground level, a moderate volume of logs and woody debris, and a relatively thick layer of leaf litter.

With a few small exceptions, this habitat type consistently had a high density of bridled tern nests. While the nests were preferentially placed in areas protected by vine tangles, in buttresses around the base of trees, or next to logs, there were also numerous nests placed in open areas. Nests in open areas involved a scrape in the sand within a gap in the leaf litter.

Nesting appears to have commenced on Bimi in this habitat earlier than other locations, as it was the only location with multiple hatched chicks, rather than eggs only.

3.4.3 Rocky basalt surfaces without forest

Plate 3: Example of cliff faces occurring around the fringes of both Bajigal and Bimi, with a generally low-moderate density of bridled tern nesting activity

An overview of the rocky basalt surfaces without forest habitat type is provided in Table 5.

Table 5: Summary of rocky basalt surfaces without forest as bridled tern nesting habitat on Bajigal and Bimi

Rocky basalt surfaces without forest	Description
Vegetation Type described in Bajigal Ecological Assessment (Fell et al, 2024)	6b – Sparse herbland- grassland on exposed basalt headland, 7a – Steep basalt rocky surfaces – headlands, cliffs, rock platforms above high tide
Presence	Bajigal, Bimi
Photograph	Plate 3, Plate 8
Relative density of bridled tern nesting activity	Ranging from low to moderate

On both Bajigal and Bimi there are rocky cliffs around the coastline that are vertical or steeply sloped. These areas contain only sparse grass tussocks, and sometimes creeping roots from a nearby fig tree (Plate 3). These cliff faces often have narrow platforms or small caves underneath overhangs. As viewed from walking around the shoreline below, or from the vessel-based assessments, bridled tern nesting activity was detected on most of these rock faces, although the density of nests typically appeared to be low in these narrow, exposed locations.

At the eastern end of Bimi, there is a rock platform that is isolated by ~20 metres from the main island during high tide, and connected during low tides. At its highest point, the rock platform rises to approximately 3 metres above the high tide mark. There are no trees, only a few scattered shrubs, a partial cover of grasses and other low vegetation (less than 50 cm high), rocky areas without vegetation and some scattered rock pools (likely to contain fresh or brackish water, based on the presence of frog tadpoles in some of them). Bridled terns were nesting across most of this area in an overall moderate density, but largely avoided nesting within the small area being used by hundreds of lesser crested terns as a breeding colony.

3.4.4 Exotic tussock grassland

Plate 4: Example of Guinea grass patches being used for nesting activity by bridled tern in an extensive area on the coastal border of Bajigal

An overview of the exotic tussock grassland habitat type is provided in Table 6

Table 6: Summary of exotic tussock grassland as bridled tern nesting habitat on Bajigal and Bimi

Exotic tussock grassland	Description
Vegetation Type described in Bajigal Ecological Assessment (Fell et al, 2024)	6a – *Megathyrsus maximus* exotic tussock grassland.
Presence	Bajigal, Bimi
Photograph	Plate 4, Plate 9
Relative density of bridled tern nesting activity	Nesting present, but uncertain density

Both Bajigal and Bimi have large areas that are entirely dominated by the invasive tussock-forming Guinea grass (*Megathyrsus maximus)*, as well as scattered smaller patches dominated by this weed (Plate 4). There are generally no trees, shrubs or other plants within patches where Guinea grass has established.

At the time of assessment in late November 2024, the Guinea grass was transitioning from a dormant phase – where most tussocks mostly comprised dried grass stems no more than 1 metre tall – to an actively growing phase, with new green shoots sprouting vigorously, probably following recent increased rainfall (James Epong, pers. comm.). It is understood that the Guinea grass can rapidly grow to 2 metres height or more in suitable conditions, and form thickets that are effectively impenetrable to humans attempting to walk through them.

As discussed in greater detail in section 3.5 below, the bridled terns appear to be nesting on the ground between bases of the grass tussocks. When the tussocks are in a dormant phase, the nest may be in an open exposed area between the dried tussocks among decomposing old stem material.

When the tussocks are still intact, the nests are sheltered in a space underneath overhanging stems from adjoining plants. Within a larger patch, there seems to be a network of tunnels between tussocks that are protected by these dense overhanging stems. There are openings from the edge of the patches that allow bridled terns to walk in from the ground level to access this tunnel network (see Plate 24).

It is uncertain whether these tunnels and protected areas under tussocks are only present when the Guinea grass tussocks are dormant, and early in the growing phase. That is, it is possible that some or all of the tunnels and spaces between tussocks are no longer present and/or accessible when the Guinea grass is at full growth – which then reduces or removes its suitability as a bridled tern nesting area.

For the variety of reasons outlined earlier in this report, it was not possible to obtain accurate measurements of nesting density with the Guinea grass areas. As such, it is concluded that nesting was occurring within these areas, however the density of nest activity was uncertain. Based on the limited observations able to be made, it seems probable that the nesting within these areas is either low-moderate or moderate. As the ground layer between tussocks is often only accessible via tunnel entrances at the edge of a patch, it is speculated that bridled tern nesting density would be higher towards the edges of these large Guinea grass patches.

3.4.5 Other – non-breeding habitats

There were another four broad habitats detected on and around Bajigal and Bimi that were not directly used by bridled terns for constructing nests. However, these areas were still being used by bridled terns for other activities that were indirectly related to nesting activity.

- Both Bajigal and Bimi contained small areas of mangroves (Plate 10a), 'sandy' shoreline[23] (Plate 10c), and relatively extensive areas of rocky intertidal shoreline around most of the fringes of the islands (Plate 10b). Bridled terns were observed perching (resting/loafing) on these three habitat types between their foraging bouts and/or between visits to their nests. Although not observed due to the timing of the surveys, these areas may feasibly be also used by bridled terns during courtship displays and pair bonding, and also for fledglings that have left the nest but not yet reached independence.
- The available literature indicates that most bridled tern foraging occurs in ocean waters between two and 16 km of their nest during the breeding season. This includes foraging to satisfy their own nutritional and energy needs, and also that of their chick once it is hatched. During the field assessments, there was one main foraging event opportunistically observed over a period of minutes, with approximately 60-80 terns dipping and surface-diving into a relatively small patch of water approximately 250 metres west of Bajigal (Plate 12).

3.5 Micro-habitats used by bridled terns for nesting

Across the broad habitat types identified, bridled terns appeared to select nest sites based on a range of different micro-habitat features. The following describes the various niches (micro-habitats) across Bajigal and Bimi where the ground-based bridled tern nests were found.

While nests were detected in almost all niches at ground level, there were certainly some that were favoured over others. As a consistent trend, wherever there was a high availability of favoured niches there was also a higher density of bridled tern nests. Conversely, where the ground layer had little cover or variation in the types of micro-habitat available (e.g., areas dominated by soil and leaf litter, with no rocks, logs or shelters around tree trunks), then the nesting density was generally low.

Rock – overhangs (see Plate 13)

This was a highly favoured bridled tern nesting site. On sloped areas of both islands among the rainforest areas, but particularly on Bajigal, medium-to-large sized emergent basalt rocks formed small overhangs on the lower side of the slope, with a space of around 10-20cm height between the ground layer and the rocky roof. While some of the overhangs could be up to 1 metre deep, most nests that were detected were within the first 20 cm of the entrance.

[23] Largely composed of small pieces of dead broken coral and marine invertebrate shells.

Rock – loose at surface and emergent (see Plate 14 and Plate 18)

In the rainforests where there was a moderate-to-high abundance of rocks at the surface, there also tended to be a moderate or high abundance of bridled tern nests. Sometimes these nests were on the rocks themselves, but usually they were placed in a narrow strip of soil that had accumulated between adjoining rocks. On occasion, there were deeper crevices between rocks (up to 1 metre) where nests were also regularly placed.

Rock – cliff faces (see Plate 15)

Excluding the sandy littoral areas, the majority of the outer boundaries of Bajigal and Bimi comprised rocky cliff faces that were either vertical or with a steep slope. In a couple of locations on both islands, wave and wind action had cut into the lower sections of the cliffs to create large overhands and small caves. Weathering also created uneven surfaces across these cliff faces and steep slopes, creating small platforms, crevices and other areas that bridled terns used for perching regularly, and for establishing nests at a relatively low to moderate density. As viewed from adjoining areas, these areas may have had relatively few suitable spots along the cliff faces for nest establishment, and would also be relatively exposed to the direct sun, rainfall and other challenging weather conditions, and therefore may be less preferred.

Rock – platform (see Plate 16)

The relatively extensive rock platform on the eastern side of Bimi, connected directly to the main island by a sandy base at low tide, was used by at least two seabirds for nesting (bridled tern, lesser crested tern). At least one other seabird species (black-naped tern) was suspected to be nesting here at the time of assessment. The bridled terns were nesting on the rocks among the sparse grasses and shrubs (less 50 cm tall) on this rocky platform at a moderate density.

Tree base (see Plate 19)

Bridled terns were regularly detected breeding at the bases of trees, immediately next to the trunks at their point of emergence from the ground. However, there were also areas containing many trees that had little nesting activity around their bases. Nesting at the base of a tree tended to be most prevalent when either (a) it was a medium-to-large sized tree that had buttresses at its base (see Plate 19b), (b) when the soil around the base of the tree was partially washed away, leaving a small protective overhang, or (c) in areas of overall high nesting density where the preferred micro-habitats (e.g., rocky areas; vine tangles in littoral forests) were all taken by other nesting terns.

Vine tangles and other low-lying vegetation (see Plate 20)

There are parts of Bajigal and Bimi, particularly in the littoral rainforest areas, where there are multiple native woody vine stems curling up from the ground towards the canopy. Where these occur, there is usually a moderate or high density of bridled terns with nests among the protective cover provided by these stems.

Although direct access was generally not possible, it seemed likely that bridled terns were also nesting at a low-to-moderate or moderate density where there were invasive vines emerging from the ground (i.e., morning glory *Ipomoea* spp.)

Under the forest canopy, and usually in the lower slopes, there are areas with a cover of low-lying plants. It was typical to find a low-to-moderate or moderate density of bridled tern nests in these areas, presumably attracted by the protection from the vegetation.

Coral berry (see Plate 23)

Coral berry is an invasive shrub species that was seen to grow up to 1 metre tall in a few areas across both islands. Where it is present, the abundance of this plant is quite variable. In the few small areas with a thick cover of coral berry, almost no bridled tern nests were detected. In areas with a low-to-moderate thickness of coral berry plants, a number of bridled tern nests were detected underneath or on the edge – particularly when there was also loose surface rocks or emergent rocks present.

Guinea grass (see Plate 24 and Plate 25)

Bridled terns were confirmed to be nesting on the ground between the tussocks of adjacent Guinea grass plants.

On the edges of the Guinea grass patches (i.e., the only place where access was possible), the centrepoint of the tussock bases were typically spaced 40 – 60 cm apart, which translated to a gap of 20 – 30 cm when including the grass stems on each tussock. When not dormant and dried out, the overhanging stems from adjoining tussocks provided a grass canopy between the tussocks which was 15 – 30 cm high. On numerous occasions,

bridled terns were observed entering openings between tussocks, which they were then using to access nest sites inside the outer edge of the Guinea grass patch. While two nests were observed that were more than 1 metre in from the edge of a Guinea grass patch, it is feasible that some bridled terns are following these tunnels for multiple metres into the patch to access their nests. The bridled terns were nesting on the bare ground and dead stems between Guinea grass tussocks.

A two-picture sequence of a bridled tern walking into a tunnel is provided in Plate 24, and some video footage was also collected.

Where the tussocks were substantially dried off, and without regrowth or tunnels, the nesting between tussocks did not include a grass canopy or other protective cover overhead.

As noted earlier, it was not possible to determine the relatively density of bridled tern nesting activity within the Guinea grass patches.

Logs (see Plate 21)

To varying extents across both islands, there are fallen branches, dead trunk stems and other detached woody debris (collectively 'logs') across the ground underneath the forest canopy. It was a regular occurrence to detect a bridled tern nest placed either immediately next to a log, or in the spaces formed underneath when there was not a tight connection between the log and ground beneath it. Where log abundance was higher, the density of bridled tern nests also usually increased.

Open ground (see Plate 22)

Within the forested areas, it was not a common occurrence to detect a bridled tern nest on the open ground, (i.e., without rocks, logs, tree trunks, low vegetation or other protective cover nearby). Most areas of open ground had no nests at all. However, nests in the open were detected more frequently in parts of the littoral rainforest and other areas of higher nesting density – where available niches that provided an increased level of natural protection for nesting (e.g., under a rock overhang) were already taken by other birds. The increased level of collective vigilance in areas of higher nesting density may also have reduced the risks of nest failure for those birds attempting to nest in open areas. A photo of a nest with relatively little nearby protective cover is provided in Plate 22, and there were also examples detected (but not photographed) of birds in the littoral rainforest areas that had nests within a scrape in the sand after the leaf litter had been pushed aside, with no other nearby protective cover.

Around the eastern boundary of Bimi, a couple of relatively small rocky outcrops that were largely devoid of native vegetation (with the exception of a sparse patchy cover of native and non-native grasses and herbs) were being used by bridled terns for nesting at a moderate and high density. This was somewhat surprising to find these nests in this exposed area, particularly in areas with almost no vegetation cover, given their preference within the forested areas for micro-habitats that provided some nearby protective cover (e.g., rocks, logs, tree trunks) and also in the absence of a tree canopy cover to provide shade and some protection from inclement weather.

3.6 Other fauna

Beyond the bridled tern, detailed surveys were not conducted for fauna across the islands. However, opportunistic observations of other fauna species were documented. Records of other fauna species observed during the field surveys are summarised below.

Photographs of many of the fauna species detected on Bajigal and Bimi, as taken during this three-day site visit, are provided in Plate 26 to Plate 38.

3.6.1 Bajigal

Fourteen vertebrate fauna species (one mammal, 12 birds, one reptile) were opportunistically detected during the bridled tern breeding surveys on Bajigal and immediately surrounding waters on 28-29 November 2024. These species are listed in Table D1 of Attachment D, along with annotations that provide an overview of their observed occurrence. It is also noted that the flora/invertebrate survey team sighted a slaty grey snake during their visit to this island on 29 November 2024 (David Fell, pers. comm). The slaty grey snake was also detected during previous ecological assessment of the island in 2024 (Fell et al, 2024).

As expected based on earlier discussions with MALSI, a spectacled flying-fox colony was present on Bajigal at the time of assessment. No attempt was made to estimate the number of individuals within this colony, nor its current breeding status. However, the extent of the colony was mapped, which was within the vine forests on underlying basalt towards the western end of Bajigal. This is displayed in Figure 8 in Attachment D.

Figure 8 also displays the location where other notable species were detected on Bajigal during the visits over these two days. Common and widespread fauna were not mapped.

3.6.2 Bimi

Seventeen vertebrate fauna species (15 birds, two reptiles) were opportunistically detected during the bridled tern breeding surveys on Bimi and immediately surrounding waters on 30 November 2024. These species are listed in Table D2 of Attachment D, along with annotations that provide an overview of their observed occurrence. It is also noted that the flora/invertebrate survey team found abundant amphibian tadpoles in a freshwater pool during their visits to this island on 28-29 November 2024 (David Fell, pers. comm). It is suspected that these may be cane toad (*Rhinella marina*) tadpoles.

Of note, an active lesser crested tern breeding colony comprising more than 150 nests was detected on the rock platform to the east of the main Bimi island (see Figure 9 in Attachment D, and Plate 30). It is also suspected that a small number of black-naped tern pairs may have been nesting on this rock platform at the time of assessment, but no attempt was made to seek confirmation so that any nesting attempt was not disrupted.

Figure 9 also displays the location where other notable species were detected on Bimi and immediately surrounding waters during the one-day visit. Common and widespread fauna were not mapped.

4 Management considerations

The following section provide a snapshot of items to consider for the future management of Bajigal and Bimi that are directly and indirectly related to the bridled tern. Except where stated otherwise, the following content applies to both islands.

4.1 General

As outlined above, all parts of both islands (above the high tide mark) are used for nesting to varying degrees. Utilisation of habitat areas by bridled tern should be considered when implementing management activities and the potential effects of management activities on bridled terns (both positive and negative).

Conversely, it also means that if dramatic management activities need to be undertaken in parts of the island (e.g., major control operations for weed removal), there will remain many other parts of the island available to nesting while these control operations are underway. When considering management activities it is recommended that:

- broader management activities across the island would ideally be undertaken outside of the bridled tern breeding season. If it is not possible to avoid the breeding season entirely, then management should aim to avoid impacts on the terns (or, if avoidance is not possible, then minimise impacts).
- the best areas for bridled tern nesting (high) should be a priority for protection, maintenance and management of threats.
- thought is given to the development of tern-friendly guidelines for weed management activities that seek to avoid or minimise potential impacts on their breeding to support implementation of control activities across the island.

Although bridled terns were detected nesting in areas that contained moderate to high levels of invasive weeds, there was no evidence to indicate that these modified areas were preferred or critical to the persistence of the bridled tern nesting on the islands. As such, efforts to reduce the cover of invasive weed cover on the islands, increase native vegetation cover and quality, and increase their health/capacity to repel future weed incursions, will ultimately be of a neutral or positive impact for bridled terns, and positive impact for most or all other flora and fauna values on the islands.

4.1.1 Bridled tern nesting population

The Barnards Island National Park Management Plan indicates that the two South Barnard islands - Bajigal and Bimi[24] - have indicated population levels in the region of 10,000 bridled terns based on recorded numbers (QPWS and DES, 2023).

These two islands were recognised as internationally important for bird conservation in 2009, as they were known to collectively support more than 1% of the global population for bridled tern and lesser crested tern. In particular for the bridled tern, there was data indicating 3,000 to 10,000 breeding pairs using these islands during the period from 1987 to 1998 (BirdLife International, 2025).

Although the intention of the survey was not to obtain a reliable bridled tern breeding population count for Bajigal, it is possible to extrapolate the transect counts and habitat densities to a rough estimate of the overall nesting population using the following calculations:

- High bridled tern nesting density has an estimated average of >10 nests per 100 square metres (noting that some of the high density areas contained well above 10 nests per 100 square metres, possibly upwards of 25-30 nests).
- Moderate nesting density has an estimated average of >5 to 10 nests per 100 square metres.

[24] Referred to as Stephens Island and Sisters Island respectively in this plan.

- Low-moderate nesting density has an estimated average of >1 to 5 nests per 100 square metres.
- Low nesting density has an estimated average of 1 or fewer nests per 100 square metres.

See Table C 1 in Attachment C for bridled tern nesting density calculations for Bimi and Bajigal.

Using this method, the bridled tern breeding population on Bajigal is estimated to be 8,522 – 17,534 (based on an estimated number of nests of 4,261 – 8,767), noting that density remains uncertain for significant parts of the island (particularly Guinea grass patches). The breeding population of bridled terns nesting on Bimi is estimated to be 1,651 – 3,408 (based on an estimated number of nests of 825 – 1,704). These estimates are within the range of previous measurements (described above). Using the upper and lower global population estimates, and the upper and lower counts of adult birds for Bajigal and Bimi combined from the 2024 surveys, these two islands are predicted to have been supporting between 0.70% and 3.50% of the world's bridled tern population at this time.[25, 26] These values are also in the same range as available previous breeding population estimates for the islands.

While a rough population estimate was able to be generated based on the findings of this survey, the following should be noted in interpreting these findings:

- The transect surveys and other searches across the island were primarily intended to obtain an understanding of nesting extent and relative density across the island, and the habitat characteristics of the nesting areas. Modified survey methods would be required to obtain more accurate bridled tern breeding population estimates. However, there is a moderate-to-high level of confidence that the actual adult breeding population is within the range of the upper and lower values obtained using the current methods.
- As addressed in section 3.4.4. and 3.5. of this report, there is some uncertainty with regards to the bridled tern nesting density within patches of Guinea Grass, even though evidence of nesting was observed. For the purposes of estimating the overall bridled tern population for Bajigal and Bimi, these areas have been excluded.
- Similarly, as addressed in section 3.3.2. of this report, there are also some parts of Bimi that were not able to be accessed. For the purposes of estimating the overall bridled tern breeding population for Bajigal and Bimi, non-accessed areas of Bimi were excluded.
- The breeding population values have been obtained by estimating the number of active nests across the island, and then allocating a female and male adult bird to each nest. Based on the known breeding biology of the species, it is a reasonable assumption to allocate two adult birds to each active nest.
- Any non-breeding birds that are present in the vicinity of Bajigal or Bimi – and birds that had not commenced egg-laying – would not be included in the estimated breeding population. Similarly, the eggs and chicks detected on the islands were not included in the breeding population estimate.
- The breeding population estimates are based on the data collected during late November 2024, and should be used carefully when attributed to on-site habitat characteristics and threats. There are likely to be other external factors influencing bridled tern breeding activity on Bajigal and Bimi, and which are likely to vary from year-to-year and also within years (e.g., food availability in surrounding waters during breeding period, survival rates during non-breeding period, weather conditions during breeding period).

Gaining a more robust estimate of the population size through targeted sampling of accessible areas of Bajigal and Bimi would be a valuable monitoring activity in the future and would complement the knowledge gained in the present survey. This is discussed further in section 4.7 below.

[25] The lower bridled tern estimate for Bajigal and Bimi combined is 5,272 breeding pairs (or 10,544 adults), which is 0.70% of the upper estimate for the world population of 1,500,000. The upper bridled tern estimate for Bajigal and Bimi combined is 10,827 breeding pairs (or 21,654 adults), which is 3.50% of the lower estimate for the world population of 610,000. Given the limitations of these surveys (e.g., inaccessible areas), these estimates are likely to be conservatively low.

4.2 Guinea grass

Although Guinea grass patches were being used for nesting at the time of assessment, this may be because nesting commenced at a time when most/all of the Guinea grass was in a dormant phase, and therefore the spaces/tunnels between tussocks may have been more accessible compared to an alternative scenario whereby the Guinea grass was in an active growth phase prior to the commencement of nesting.

In years when heavy rains commence before egg-laying, it is possible that little or no bridled tern nesting occurs across most of the Guinea grass patches due to the impenetrable nature of the vegetation, except perhaps around the edges (within the first 2-5 metres).

It is possible that some of the nests that commenced in Guinea grass patches in early-mid November 2024 may fail as 2024-25 breeding season progresses. The rapid and thick growth of Guinea grass following heavy rain in late November - early December 2024 may hinder or prevent adult bridled terns from accessing their existing nests, and/or hatched chicks may not be able to extract themselves from a dense Guinea grass patch in order to fledge and reach independence. This is speculative, but a consideration.

Although bridled tern will nest within Guinea grass, they are also nesting within all habitats across the islands occurring above the high-tide mark, and Guinea grass does not appear to be a preferred habitat.

Guinea grass threatens to encompass more of each island. When there is a major gap in the forest that is created following a major storm or cyclone, Guinea grass has a high likelihood of colonising this gap, and preventing the reestablishment of the forest. An increased cover of Guinea grass across the islands is likely to have a neutral effect on bridled tern nesting activity at best, and a significantly negative effect at worst.

An expansion of Guinea grass across the islands will undoubtedly have an adverse impact on most other flora and fauna values. As such, preventing the further spread of Guinea grass across the islands – and ideally reduced its existing extent – and then replacing the Guinea grass with a native vegetation cover, is consistent with bridled tern conservation and management for the islands.

4.3 Morning glory

At the time of assessment, bridled terns were able to access the interior of the rainforests on both islands by flying through gaps in the thick curtain morning glory (*Ipomoea* spp.) that cover the outside of much of the forested component of the islands. As such, the vine curtains were acting as a hindrance, but ultimately not a barrier, to nesting activity in the interior of the forest. However, in past years, the vine curtains have been much thicker and healthier, leaving substantially fewer gaps for the bridled terns to enter into the forests for nesting (James Epong, pers. comm.), and therefore would have been likely to have a negative impact on nesting success.

Over time, widespread coverage of vines reduces the health of the rainforest trees that they are covering (e.g., reduced photosynthesis and seed production of the host tree). In a windy storm or cyclone, trees covered in vines are also more likely to be blown down completely or lose major branches, facilitating further invasion by vines, Guinea grass or other weeds in the bare space created and also preventing the growth of new native trees. This process would negatively impact on the suitability of breeding habitat for the bridled tern, almost certainly in the medium to long term, and possibly also in the short term.

As such, although the vines did not appear to be a major impediment to the bridled tern nesting during the limited window of the 2024 survey, over time they will have a negative impact on bridled tern nesting.[27] Therefore, the reduction or removal of morning glory from the islands is considered to be consistent with appropriate management for bridled terns.

[27] As well as a major impact on most other forest-dependent flora and fauna on the island.

4.4 Coral berry

Like Guinea grass and morning glory, bridled terns will nest in areas that have a cover of coral berry, although they appeared to largely avoid the few small areas with a dense coral berry cover. Unlike the two other invasive weeds described above, coral berry is unlikely to change the overall structure of the forest (e.g., it is unlikely to trigger conversion from a treed forest to exotic tussock grassland), acknowledging that coral berry does have negative impacts on the diversity of understorey vegetation. If undertaken using a suitable approach, the complete removal of coral berry from the islands would be expected to have a neutral impact on bridled tern nesting at worst, and a positive effect at best particularly the removal of dense areas of infestation.

For dense infestations of coral berry, their complete removal or control down to a low-moderate level of cover would probably increase bridled tern nesting opportunities.

4.5 Cane toads

Evidence of the presence of a reproducing population of cane toads was detected on Bajigal in early 2024 (two juvenile frogs – as reported in Fell et al, 2024). During the November 2024 surveys, tadpoles were observed in pools on Bimi. It is unknown when cane toads first arrived on these islands. While it may have been an accidental human introduction from visiting boats, it is also feasible that they rafted to the island via woody material washed over from the mainland following a flooding event.

A paper published in 2012 about the risk to Australian ground-nesting birds from the cane toad concluded:

> *Our literature survey suggests that although cane toads eat birds[28] they do so only infrequently. However, predation rates may be greater in some circumstances, such as among colonial nesting birds (where a small number of toads could have a substantial impact), birds whose nests also provide a refuge for toads (such as burrow-nesting species), and birds that nest in areas with a high density of toads. A combination of these factors is likely to be required for toads to be a serious threat to local populations of ground-nesting birds.* (Beckman and Shine, 2012).[29]

Some of these criteria for cane toads to have an impact on the ground-nesting birds potentially apply to the bridled tern breeding colony on Bajigal and Bimi (and they certainly apply to the dense lesser crested tern breeding colony on Bimi, which is immediately adjoining the freshwater pools where the possible cane toad tadpoles were detected). Further information would be required on the extent of the cane toad population and distribution across the islands to be more certain. As a precautionary approach, it should be concluded that cane toads are a potential threat to bridled tern nesting success rates on the islands, and measures to reduce or remove them from the islands should be investigated.

4.6 Snakes and other predators

The slaty grey snake has been detected sporadically on other islands on the Great Barrier Reef and Torres Strait, and its confirmed occurrence on Bajigal during 2024 could potentially be natural (i.e., not an accidental introduction). Like the cane toad, it may also have feasibly arrived on the island from the mainland recently via woody debris following a flooding event. It is not certain whether its detection on Bajigal represents a single isolated individual, or a self-sustaining population. It is also unknown whether it occurs on Bimi.

[28] Which also includes their eggs and nestlings.

[29] Unfortunately, the species-by-species assessment undertaken by Beckman and Shine (2012) did not include the bridled tern – nor many of the other ground-nesting seabirds, such as the lesser crested tern - possibly because it was not envisaged that cane toads would be occurring on offshore breeding islands such as Bajigal and Bimi.

The Atlas of Living Australia states that the slaty grey snake is a predator of mammals, birds, frogs and reptiles, including other snakes. It also preys on lizard eggs.[30] As such, it is considered probable that the slaty grey snake does consume a small number of bridled tern eggs and young nestlings when they are available during the breeding season. Although it's considered to be a relatively low likelihood that the slaty grey snake is having an adverse impact on bridled tern nesting success rates on Bajigal and Bimi, this could be considered further.

Although the major skink (*Bellatorias frerei*) is considered to be an omnivore, and potentially large enough to break into a bridled tern egg, no references to the species eating bird's eggs or nestlings were found in the literature. It mostly eats small fruits and invertebrates, and sometimes small reptiles. It is considered highly unlikely to be a major threat to bridled tern nesting success on Bajigal or Bimi.

Prior to their removal, black rats would have been a significant predator upon the eggs and nestlings of bridled terns and other ground-nesting birds on Bajigal and Bimi. Recent monitoring efforts have shown no evidence that black rats or other rodents have re-established on Bajigal or Bimi. Regular monitoring for rodents should continue on both islands. If one is not already available, then a ready-to-go rodent eradication plan should be pre-emptively developed for immediate implementation should they be detected on either island in the future. Strong biosecurity measures must be maintained for all visitors to these islands to minimise the likelihood of accidental re-introductions.

There are likely to be a number of native raptors and other birds that will opportunistically take a bridled tern egg, nestling or fledgling. This is a natural process, and is unlikely to be having a major impact on bridled tern nesting success rates, unless there is some other process occurring concurrently that has artificially increased the numbers of these predators. As such, no action needs to be taken at the present time.

At most times, there will be one of a breeding pair of bridled terns at the nest, either incubating the egg or sitting over the young nestlings. During these current surveys, many of these adult birds temporarily departed their nests when the human surveyors were nearby, and then returned once the observers had moved on. If humans were to spend extended periods on the islands during the breeding season, or if there were to be an increase in visitation rates, then there is a risk that there would be increased time-periods when nests are left unattended by the adults, and therefore there would be a greater risk of predation upon the eggs and chicks.

4.7 Monitoring

The development of a monitoring program for bridled terns on Bajigal and Bimi could be considered through the Project and would support greater understanding of the efficacy of management actions implemented on the island. Some considerations for the development of a monitoring program would include:

- Development of a detailed monitoring plan with specific aims and objectives, and with a repeatable scientifically-rigorous methodology and incorporating traditional ecological knowledge of MALSI Rangers. This plan should be realistic, relevant and utilise local knowledge about access constraints and limitations (e.g., tidal range, weather, costs, expertise and equipment required, access tracks and safety).
- Opportunities to utilise the surveys to monitor changes in nesting success rates across the islands as a whole, or in particular locations, and in the context of weather conditions, cyclone damage, habitat management, weed control, and predator management (e.g., cane toads).
- Determining how frequently and intensively monitoring should be undertaken to obtain meaningful results.
- Ensuring that the monitoring activities themselves do not become a risk to nesting success of bridled terns (e.g., minimise the time and frequency of adult birds temporarily departing their nests as a result of disturbance from the observers).

[30] https://bie.ala.org.au/species/https://biodiversity.org.au/afd/taxa/650af7dc-9004-456a-9cb0-24082c83dcba, accessed 17 December 2024

4.8 Other

Even though there was a low level of bridled tern nesting activity beneath the spectacled flying-fox colony on Bajigal, this is not considered to be significant concern for the bridled tern values on the island for the following reasons:

- The flying-fox colony is valuable in its own right.
- The extent of the flying-fox colony is relatively small compared to the broader area used for nesting by the bridled tern on these islands.
- It is possible that the bridled tern may naturally have a low density of nesting in the locality where the flying-fox colony is present due to factors such as (a) the dense lower canopy cover, possibly reducing the access to the ground layer by adult bridled terns, (b) the sparse cover of preferred micro-habitat breeding habitats on the ground, with few rocks or logs present, and sparse low vegetation.

The small rock platform on the eastern side of Bimi is part of the broader bridled tern breeding area, but also valuable for a breeding colony of lesser crested terns, and probable breeding by black-naped tern and other seabirds. It is also understood to be an important vegetation community. Any management of this area should consider the full range of values, including but not limited to the bridled tern.

5 Bibliography

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[31] Since this article was first published, this journal's name has been expanded to Emu – Austral Ornithology.

Attachment A – Overview of the ecology and reproductive strategy of the bridled tern

The following is a summary of aspects of the ecology for the bridled tern considered relevant to the field assessment that was undertaken on Bajigal and Bimi in late November 2024. This was compiled prior to the commencement of the surveys from relevant literature sources.

The bridled tern forages in the open ocean mostly upon fish, but also crustaceans and aquatic insects to a lesser extent. It catches fish by 'dipping' its beak into the ocean surface, and also by making shallow plunges.

In Australian waters, the bridled tern breeds on small islands. In the region encompassing Bajigal and Bimi, bridled terns are mostly migratory. They typically arrive in large numbers around mid-spring, with nest site selection and egg laying occurring about 4 weeks after arrival. The phases of incubation, nestling care, and then fledging through to independence, typically continue through to mid-late summer. Most individuals then leave their breeding sites at the end of the breeding season to overwinter at sea (Commonwealth of Australia, 2020). However, small numbers of individuals may remain in the region throughout the year, and on occasions, an active bridled tern nest is detected at a range of atypical times throughout the year (Higgins and Davies, 1996).

Their nests are well concealed, and are usually in either (a) crevices or caves that are between or under rocks (up to 1.5 metres deep), (b) on cliff edges, or (c) in a scrape on the ground beneath low shrubs or bushes, and occasionally among tussocky grass areas (Higgins and Davies, 1996). A single egg is laid (occasionally two), which is incubated for 28-30 days before hatching. After hatching, there is about 60 days where the chick is dependent upon its parents for food and protection, and where the chick spends most of its time in or near the nest. From food they have collected in the nearby ocean (typically 2 – 16 km from the nesting area), the parents feed the chick regularly throughout the day, with an average of four daily feeding events (ranging from one to nine). After this ~60 day period of growth and development, the chick is large enough to leave the nest permanently, and fly independently ('fledging') (Higgins and Davies, 1996).

Although, using precise definitions from western science, the bridled tern is not a 'colonial nesting bird' [32], it is typical that large numbers of bridled terns pairs will congregate in suitable habitats for breeding (Commonwealth of Australia, 2020). For the purposes of management of Bajigal and Bimi, this technical distinction around the definition of 'colonial nesting' is largely irrelevant.

[32] A true colonial nesting bird species has multiple clustered nests in very close proximity, with each bird owning and defending a small territory around its nest – usually corresponding to the reach of the owner's beak or wings. One of the key benefits of colonial nesting is joint defence against predators. As described in section 3.4 of this report, the dense cluster of lesser crested terns detected nesting on the rock platform at Bimi is an example of true colonial nesting – with each nest typically less than 50cm from the next nearest. Also as described later, the density of bridled terns nesting on Bajigal and Bimi was high overall - but ranged from high to very low at the micro-scale – with some nests being up to 5 metres or more from the next nearest. That is, the choice of nesting sites by bridled tern was not primarily influenced by a behavioural urge to nest close to others – but by habitat availability and suitability. In good quality habitats, they will nest abundantly and close to each other. In poorer quality habitats, their nests will be more spaced out, and possibly even isolated from others. Therefore, the bridled tern is generally not considered to be a true colonial nesting bird.

Attachment B: Transect survey data

Table B 1: Counts of bridled tern (BT) nesting activity recorded on transects at Bajigal, November 2024. NR = not recorded (i.e., some information not collected for this particular transect)

Transect # (see Map 1)	Date of Survey	Approx Length (m)	Eggs / Nests	Chicks	Adults on or near nests	Notes about bridled terns and their nesting habitat
1	28 Nov 2024	70	24	0	60	High density of bridled tern nests in low-lying littoral rainforest. Nests situated among vines, around tree bases and on open ground. As a general rule, reduced bridled tern nest density in littoral rainforests with increased distance from the shoreline – possibly associated with lesser cover from vines and other low vegetation.
2	28 Nov 2024	30	29	0	20	
3	28 Nov 2024	35	11	0	20	
4	28 Nov 2024	40	NR	0	50	Many bridled tern adults taking off from – and returning to – nests within this rocky steep slopes along this transect.
5	28 Nov 2024	25	7	0	0	No notes.
6	28 Nov 2024	25	4	0	15	A relatively narrow rocky strip (~10 m wide) running from near the ridge downslope towards the shoreline. A mix of sparse vegetation, areas of coral berry and a patch of Guinea grass.
7a	28 Nov 2024	70	9	0	46	These three transects were parallel to each other (approx. 15-20 m apart) and also parallel to the southern shoreline, and undertaken concurrently. Transect 7a was on the lower slopes within rainforest containing understorey vegetation that is transitioning from very sparse on the northern (upper) side of the transect to moderate levels and increased rocks on the southern (lower) side – with most bridled tern nests on the southern side. Transect 7b generally had a sparsely vegetated understorey and relatively few rocks at the surface – with a very low level of nests throughout (except at the western end of transect, where an increase in rock cover coincided with almost all bridled tern nest records). Transect 7c was along the southern side of the main east-west rocky spine that extends across much of Bajigal – with many nests among the abundant emergent rocks along the transect.
7b	28 Nov 2024	70	4	0	5	
7c	28 Nov 2024	60	11	0	13	
8	28 Nov 2024	105	1	0	40	One active nest detected along transect. The adult bridled tern detected were mostly flying into and out of the thicker mid- and lower-storey vegetation occurring along the northern fringe of this transect. Highly likely they were attending nests concealed within this area.
9a	28 Nov 2024	50	NR	0	72	These three transects were parallel to each other (approx. 15-20 m apart) and also parallel to the southern shoreline, and undertaken concurrently. Transect 9a was on the lower slopes within rainforest containing understorey vegetation that is

Transect # (see Map 1)	Date of Survey	Approx Length (m)	Eggs / Nests	Chicks	Adults on or near nests	Notes about bridled terns and their nesting habitat
9b	28 Nov 2024	50	1	0	3	transitioning from very sparse on the northern (upper) side of the transect to moderate levels and increased rocks on the southern (lower) side – with most bridled tern nests on the southern side. Transect 9b generally had a sparsely vegetated understorey, a dense canopy cover and relatively few rocks at the surface – with a low level of bridled tern nests throughout. Transect 9c was along the southern side of the main east-west rocky spine that extends across much of Bajigal – with many nests among the abundant emergent rocks along the transect.
9c	28 Nov 2024	45	NR	0	36	
10	28 Nov 2024	85	NR	0	26	Transect runs from the upper slopes of the rocky ridge at its eastern end, downslope through rocky areas towards (but not including) the littoral rainforest at its western end.
11	29 Nov 2024	85	17	0	40	Bridled tern nesting activity occurring in rock crevices and outcrops on the north, west and top side of the main spine/ridge. Bridled tern nests are densest at the top of the ridge (at the eastern end of transect).
12	29 Nov 2024	245	20	0	200	Two surveyors traversing the ridge and northern edge of the ridge over an extended transect. Bridled tern nests are pre-dominantly either in rocky crevices
13	29 Nov 2024	90	22	0	NR	Nests in rock crevices and on ground among low density stems of coral berry. Some nests also present in moderate density stems of coral berry and on the edge of a patch of Guinea grass at the eastern end of the transect.
14	29 Nov 2024	105	32	0	NR	Rainforest with an understorey that is mostly sparse with few rocks or logs, but with a cover of coral berry at the eastern end of the transect. Bridled tern nests are in the open mostly, but also within areas of low-moderate density coral berry and under rocks and logs where available.
15	29 Nov 2024	40	15	0	NR	Bridled tern nests are mostly protected by rock crevices, rock overhangs or tangled vines near the ground, but some nests also in shallow scrapes in the ground away from immediate protective cover.
16	29 Nov 2024	205	36	0	80	Transect within a section of rainforest containing a sparse cover of low vegetation. Bridled tern nests are mostly beneath rocks and logs, or are beside or underneath rocks.
17	29 Nov 2024	45	26	0	48	
18	29 Nov 2024	40	2	0	23	Transect within a section of rainforest containing a sparse cover of low vegetation. The detected bridled tern eggs within scrapes in open areas.

Transect # (see Map 1)	Date of Survey	Approx Length (m)	Eggs / Nests	Chicks	Adults on or near nests	Notes about bridled terns and their nesting habitat
19	29 Nov 2024	55	2	0	NR	Transect within a section of rainforest containing a sparse cover of low vegetation. The detected bridled tern nests within scrapes near the base of trees.
20	29 Nov 2024	110	NR	0	1	This transect passes through the northern portion of the flying-fox colony. Only one bridled tern nest detected, towards the eastern end of transect, within an area with a dense sub-canopy (NB: the flying-foxes are in emergent upper canopy trees).
21	29 Nov 2024	55	26	0	NR	The 26 nests were clustered in a narrow rocky-lined depression / steep gully that extends approximately from the northern boundary of the flying-fox colony down to the shoreline.
22	29 Nov 2024	160	14	0	52	Many nests detected when walking along the southern portion of the flying fox colony. Bridled tern nests were around exposed tree roots/buttresses, in scrapes under logs and below rocky outcrops.

Table B 2: Counts of bridled tern nesting activity recorded on transects at Bimi, November 2024. NR = not recorded (i.e., some information not collected for this particular transect)

Transect # (see Map 2)	Date of Survey	Approx Length (m)	Eggs / Nests	Chicks	Adults on or near nests	Notes about bridled terns and their nesting habitat
A	30 Nov 2024	45	28	4	57	High density of birds nesting within littoral rainforest. Nests on ground within gaps between tree roots, low tangles of vines or in open among leaf litter. Included a small number of chicks estimated to all be less than 3 days old – and at least one likely to be less than 24 hours old.
B	30 Nov 2024	30	11	0	9	
C	30 Nov 2024	25	8	0	NR	
D	30 Nov 2024	50	65	1	29	
E	30 Nov 2024	80	11	0	NR	A sample of the bridled tern nests – only those within the first 2-4 metres of the littoral rainforest. As recorded by a single observer walking along the sand (i.e., broken coral debris) shoreline, looking into the adjoining rainforest. Undoubtedly many more nests further in from shoreline.
F	30 Nov 2024	30	9	0	16	Raised rock area that is connected to main part of Bimi by a narrow area of littoral rainforest. The rock area is without trees and shrubs, and has scattered low vegetation including Guinea grass. Nests are in the open or under crevice on bare rock, and/or close to the scattered plants.
G	30 Nov 2024	55	2	0	0	Area of rainforest with a dense canopy, and open surface on the forest floor. No rocks or vines near ground level, and few logs. Tree bases largely without buttresses or other protective cover. Immediately adjoining downslope areas with higher vegetation cover in the understorey appears to have greater bridled tern activity.
H	30 Nov 2024	45	20+	0	57	Area of rainforest with rocks at surface (loose surface rocks and emergent rocks). Also mod-high density of tangling vine near to the ground level providing further protective cover for bridled terns.

Attachment C: Relative density of bridled tern nest activity

Table C 1: Estimated nest density on Bajigal and Bimi

Bajigal					
Density	Area (m^2)	Estimated density class (low)	Estimated density class (high)	Estimated nests (Set 1)	Estimated nests (Set 2)
High	24,039	10	20	2,404	4,808
Moderate	29,423	5	10	1,471	2,942
Low to moderate	20,339	1	5	203	1,017
Low	18,285	1	0	183	0
Present but uncertain (Guinea grass)	11,370	Not estimated	Not estimated	Not estimated	Not estimated
Total	103,456	-	-	4,261	8,767
Bimi					
Density	Area (m^2)	Estimated density class (low)	Estimated density class (high)	Estimated nests (Set 1)	Estimated nests (Set 2)
High	6,515	10	20	652	1,303
Moderate	2,402	5	10	120	240
Low to moderate	3,215	1	5	32	161
Low	2,167	1	0	22	0
Present but uncertain (basalt forest)	12,963	Not estimated	Not estimated	Not estimated	Not estimated
Present but uncertain (Guinea grass)	5,525	Not estimated	Not estimated	Not estimated	Not estimated
Total	32,787	-	-	825	1,704

Attachment D: Other fauna detected

Table D 1: Incidental sightings on fauna on Bajigal, 28-29 November 2024

Common Name	Scientific Name	Notes
Mammals		
Spectacled flying-fox	*Pteropus conspicillatus*	Colony detected in western third of island. Roosting in high canopy.
Birds		
Orange-footed scrubfowl	*Megapodius reinwardt*	At least four individuals seen and heard on island. Nesting mounds present.
Bar-shouldered dove	*Geopelia humeralis*	Heard occasionally in forested areas.
Torresian imperial-pigeon	*Ducula spilorrhoa*	Large numbers nesting in canopy. Chicks, eggs and nests detected.
Large-tailed nightjar	*Caprimulgus macrurus*	Single bird observed at east end of island.
Bridled tern	*Onychoprion anaethetus*	Large numbers of birds nesting across island, perched in vegetation and on-ground, and foraging in surrounding waters.
Black-naped tern	*Sterna sumatrana*	Single bird observed in flight over water near island during vessel-based assessments.
Lesser frigatebird	*Fregata ariel*	Single bird observed in flight over water near island during vessel-based assessments.
White-bellied sea-eagle	*Haliaeetus leucogaster*	Observed in flight over island during vessel-based assessments.
Sacred kingfisher	*Todiramphus sanctus*	Heard occasionally in forested areas.
Varied honeyeater	*Gavicalis versicolor*	Heard across parts of island. Common around littoral rainforest.
White-breasted woodswallow	*Artamus leucorynchus*	Small numbers seen in flight near shoreline.
Silvereye	*Zosterops lateralis*	Heard regularly in forested areas.
Reptiles		
Major skink	*Bellatorias frerei*	Two individuals seen and photographed in littoral rainforest.
Slatey grey snake	*Stegonotus australis*	One individual reported.

Table D 2: Incidental sightings on fauna on Bimi, 30 November 2024

Common Name	Scientific Name	Notes
Birds		
Orange-footed scrubfowl	*Megapodius reinwardt*	At least one bird heard in forest on island.
Bar-shouldered dove	*Geopelia humeralis*	Small numbers heard in forest on island.
Torresian imperial-pigeon	*Ducula spilorrhoa*	Large numbers breeding in canopy of forest.
Buff-banded rail	*Hypotaenidia philippensis*	Unconfirmed, but highly likely. Grass-lined nest with three eggs detected on ground. Size, shape and coloration of eggs, and the nest style, match available information on nesting by this species.
Sooty oystercatcher	*Haematopus fuliginosus*	Two adults and one juvenile/sub-adult perched on rock platform.
Black-naped tern	*Sterna sumatrana*	Approximately eight birds perching across the rock platform. Nesting here by this species is possibly occurring.
Lesser crested tern	*Thalasseus bengalensis*	At least 300 birds detected on rock platform, with a large breeding colony at the 'egg' stage.
Bridled tern	*Onychoprion anaethetus*	Large numbers of birds nesting across island, perched in vegetation and on-ground, and foraging in surrounding waters.
Australian pelican	*Pelecanus conspicillatus*	Two birds perched on rocks short distance offshore of main island.
Great pied cormorant	*Phalacrocorax varius*	Three birds perched on rocks short distance offshore of main island.
Osprey	*Pandion haliaetus*	Single bird seen in flight over water adjacent to island.
White-bellied sea-eagle	*Haliaeetus leucogaster*	Single bird seen in flight over water adjacent to island.
Sacred kingfisher	*Todiramphus sanctus*	Single bird seen along shoreline, perched in mangroves.
Varied honeyeater	*Gavicalis versicolor*	Small numbers of birds seen and heard in forested areas.
White-breasted woodswallow	*Artamus leucorynchus*	Small numbers seen in flight near shoreline.
Reptiles		
Striped snake-eyed skink	*Cryptoblepharus virgatus*	Single individual seen and photographed in littoral rainforest.
Coast snake-eyed skink	*Cryptoblepharus litoralis*	Unconfirmed. Sub-optimal photo of individual along rocky shoreline, on exposed basalt rock. Right size, shape, habitat - and with nearby records at Kurrimine Beach and other nearby islands. However, would need to hand-capture animal to view scales and other key identification features to be certain.

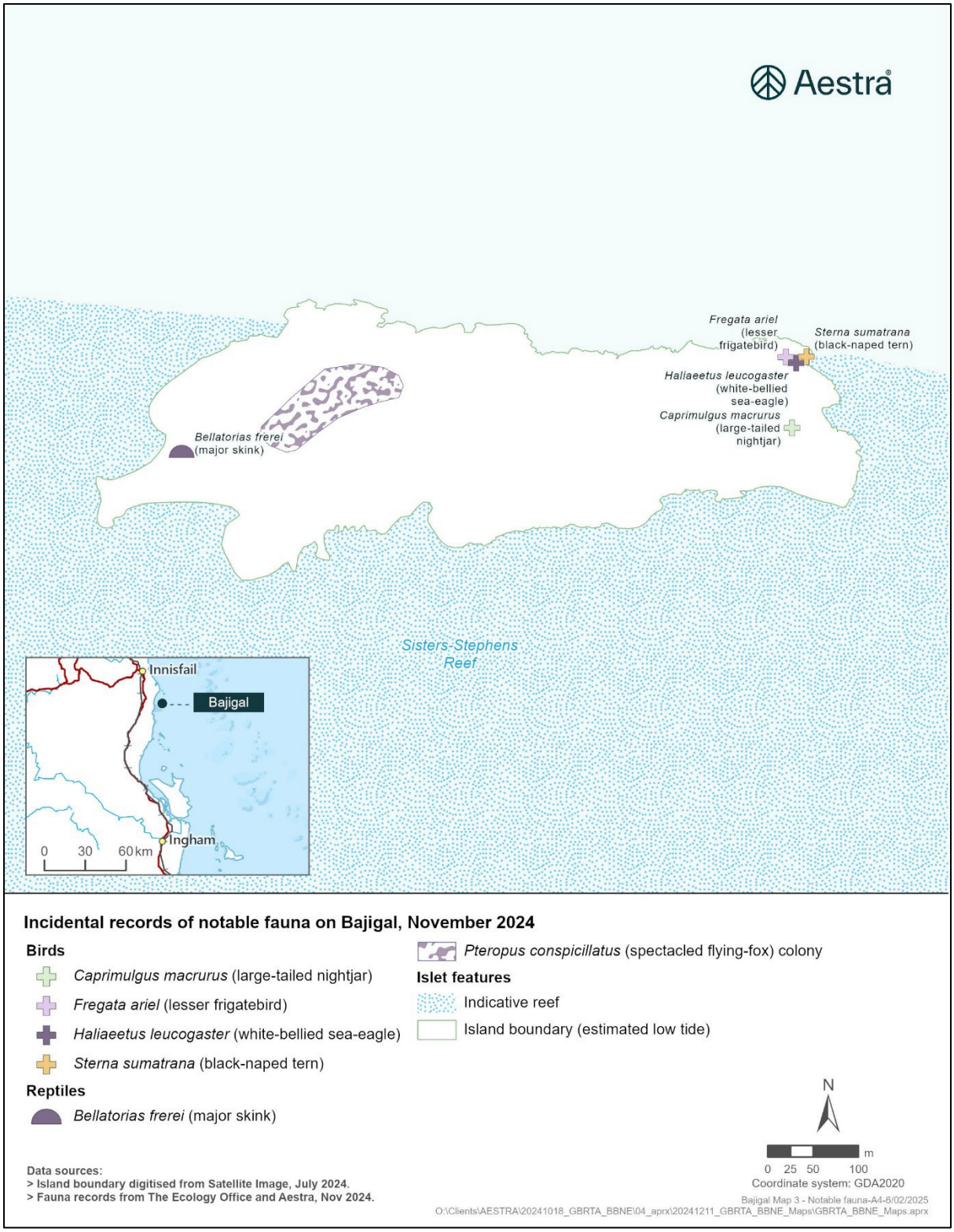

Figure 8: Incidental fauna sightings on Bajigal, November 2024

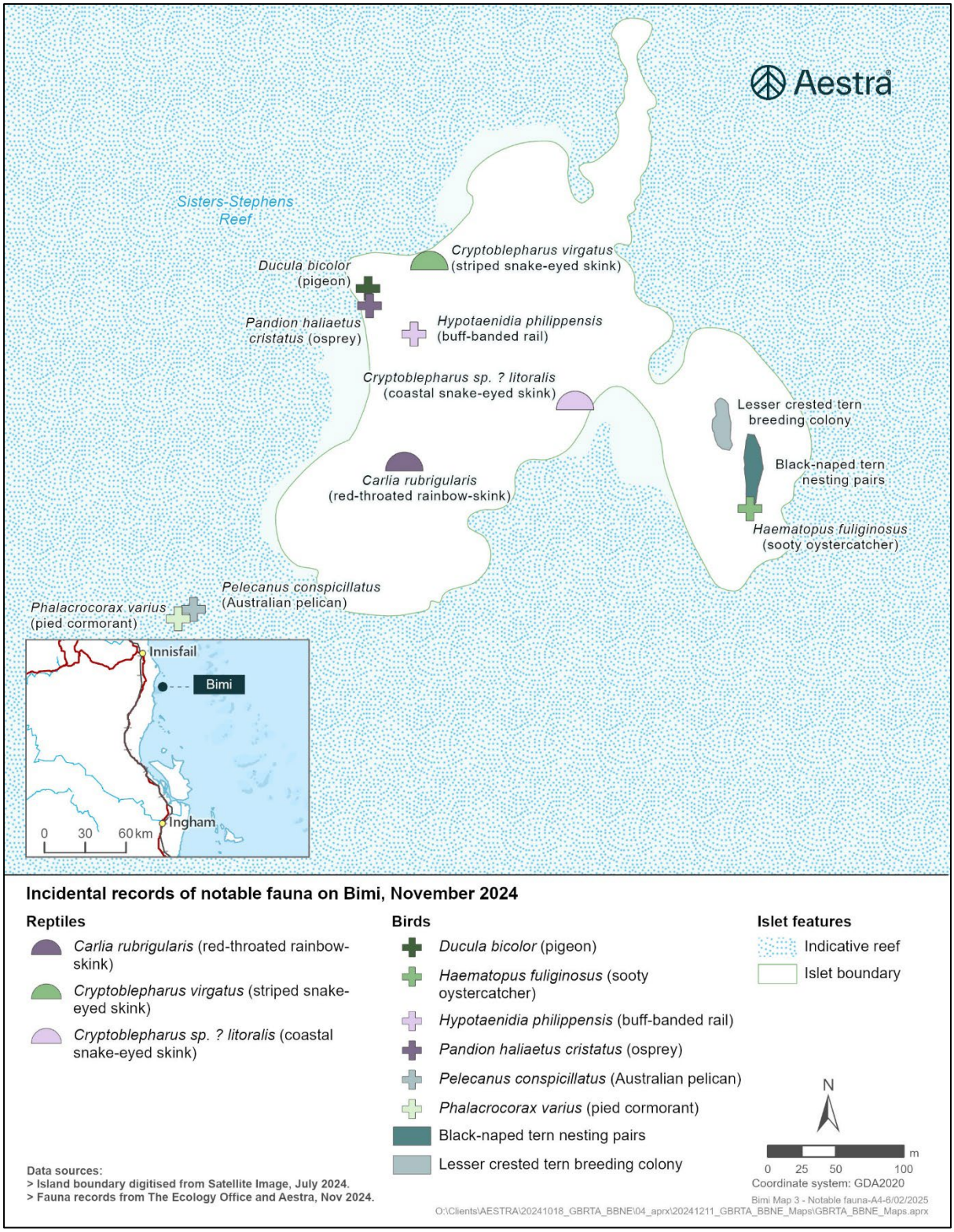

Figure 9 Incidental fauna sightings, Bimi, November 2024

Attachment E – Field photos

Taken by Chris Timewell at Bajigal (28-29 November 2024) and Bimi (30 November 2024), unless otherwise indicated.

The following field photos are indicative of the broad and microhabitat types utilised by bridled tern on Bajigal and Bimi (E1 and E2). Photos of other fauna species recorded during the field survey are also presented in E3.

E1. Broad Habitats

Plate 5: Littoral rainforest areas with high density bridled tern nesting activity on Bimi

Plate 6: Examples of vine forest occurring on basalt with high density bridled tern nesting activity on Bimi

(a)

(b)

Plate 7: Examples of vine forest occurring on basalt with low density bridled tern nesting activity on (a) Bajigal and (b) Bimi

Plate 8: Rock platform occurring on Bimi only, with native grasses and other low vegetation, with a generally moderate density of nesting activity by bridled terns.

Plate 9: Example of Guinea grass patches being used for nesting activity by bridled tern in the interior of Bimi surrounded by rainforest habitats.

Plate 10: Habitats around the island that are below the high tide mark were, unsurprisingly, not used directly by the ground-nesting bridled terns for breeding, but were being used by adults for resting between bouts of foraging, incubation and other activities related to nearby nesting. This includes (a)rocky outcrops, (b) mangroves, and (c) sandy shoreline.

Plate 11: Bridled terns perched regularly on the edge of invasive morning glory vine curtains, periodically flying in and out of small gaps in the curtain.

Plate 12: Bridled terns were detected foraging in waters approximately 200 metres from the nearest shoreline on Bajigal on 29 November 2024.

E2. Microhabitats

Plate 13: Examples of a rock overhang being used as a bridled tern nesting site, which was a regularly observed occurrence where this habitat occurs.

Plate 14: Example of a crevice between rocks being used as a bridled tern nesting site, which was a regularly observed occurrence where this habitat occurs. Photo by Naomi Maxwell.

Plate 15: Example of a bridled tern nest on a cliff face along the shoreline of Bajigal. Photo by Isabelle Onley

Plate 16: Example of a bridled tern nest in the low sparse vegetation occurring on the rock platform on Bimi.

Plate 17: Example of a bridled tern nest among a cluster of rock – which is a mix of loose surface rock and rock partially emerged from the ground.

Plate 18: Example of a bridled tern nest on bare rock in the open (i.e., not within rainforest)

Plate 19: Examples of a bridled tern nest at the base of a tree (a) next to the main trunk, and (b) in the buttresses at base of trunk.

Plate 20: Example of a bridled tern nest among the tangles of relatively dense vine stems occurring near ground level. A common micro-habitat in littoral rainforest, particularly near the shoreline edge, but also occurs in parts of the vine forest on basalt.

Plate 21: Example of bridled tern nests located where there are logs on the ground, including (a) nests in the space underneath logs, and (b) nests immediately adjacent to a log.

Plate 22: Relatively uncommon occurrence of a bridled tern nest in a scrape on open ground (e.g., among leaf litter) without larger protective micro-habitat features in the immediate surrounds.

Plate 23: Bridled tern nests were detected on the edge of patches of the invasive coral berry, and within the patches where the coral berry was of a low or moderate density. Nests were not detected within dense areas of coral berry.

Plate 24: A two-picture sequence showing a bridled tern walking into a tunnel formed between two Guinea grass tussocks amongst a larger patch of this invasive grass. (Plus a third photo in this sequence, not provided here, of the same bird further progressed into this tunnel with tiny tip of tail showing).

Plate 25: Examples of a bridled tern nest detected between tussocks within 2 metres of the edge of a large patch of invasive Guinea grass.

E3. Other Fauna

*Plate 26: Part of the spectacled flying-fox (*Pteropus conspicillatus*) colony occurring at Bajigal.*

*Plate 27: Two Australian pelicans (*Pelecanus conspicillatus*) perching on a small rocky outcrop just offshore at Bimi.*

*Plate 28: Three pied cormorants (*Phalacrocorax varius*) perching on a small rocky outcrop just offshore at Bimi.*

*Plate 29: Two adults and a sub-adult sooty oystercatchers (*Haematopus fuliginosus*) on the rock platform at Bimi.*

*Plate 30: Abundant lesser crested terns (*Thallasseus benghalensis*) at Bimi, including an active colonial nest site.*

*Plate 31: Up to eight black-naped terns (*Sterna sumatrana*) detected perching on the rock platform at Bimi, potentially with active nests.*

*Plate 32: A grass-lined nest detected in littoral rainforest on Bimi, considered highly probable to belong to a buff-banded rail (*Gallirallus philippensis*).*

*Plate 33: Torresian (pied) imperial pigeons (*Ducula spilorrhoa*) were present throughout most of the forested areas on both Bajigal and Bimi, with active nests in the canopy. Chicks and broken egg shells were detected regularly.*

*Plate 34: Varied honeyeaters (*Gavicalis versicolor*) were regularly heard calling from the canopy of the forested areas on both Bajigal and Bimi.*

*Plate 35: A major skink (*Bellatorias frerei*) was detected moving through the leaf litter of the littoral forest on Bajigal.*

*Plate 36: A red-throated rainbow skink (*Carlia rubrigularis*) was detected in the litter at Bimi, and is considered likely to be relatively widespread on both islands.*

*Plate 37: A striped snake-eyed skink (*Cryptoblepharus virgatus*) was detected in the ground litter in littoral rainforest at Bimi.*

*Plate 38: A skink (considered likely to be the coast snake-eyed skink (*Cryptoblepharus litoralis*)) was detected on bare basalt rocks along the shoreline at Bimi.*

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