



Photo: Ian Forsyth

2022/23 ANNUAL REPORT

July 2022 – June 2023

Fairy Tern Monitoring on Bird Island, South Australia.

A report for Green Adelaide and Flinders Ports



Photo: Ian Forsyth

Acknowledgements

For the past 5 consecutive years, the former Adelaide and Mount Lofty Ranges Natural Resources Management Board, now Green Adelaide Board have provided funding and support for this project. The work is part of broader conservation work on Bird Island guided by a Biodiversity Action Plan, and regional conservation work with BirdLife Australia on Beach-nesting Birds supported by the Green Adelaide Landscape Board and the previous NRM Board since 2008. This leadership on Fairy Tern conservation in the Gulf St Vincent has provided a more robust and consistent data set to guide on-going conservation. Thank you to Green Adelaide for recognising the importance of continued surveys and engagement by funding the Sharing our Shores with Coastal Wildlife Program.

We acknowledge the ongoing support from Flinders Ports for providing funding for continued research and on ground works and allowing access to Bird Island (Section Bank) for weekly monitoring throughout the breeding season.

Thank you to the many valued volunteers, including members of the Friends of the Adelaide International Bird Sanctuary, for their continued support in undertaking both Fairy Tern monitoring and shorebird surveys on Bird Island.

Dr Greg Johnston has given great insight and support throughout the Programs entirety and his knowledge of Bird Island is invaluable. Thank you, Greg, for your continued support and for providing your boat to access the island for monitoring and to Steve Papp for being our ever reliable and proficient boat captain.

Executive Summary

The South Australian Fairy Tern (*Sternula nereis nereis*) population is in decline and breeding success is threatened. Bird Island, Outer Harbor, South Australia, is one of 16 known Fairy Tern breeding sites in South Australia (DENR 2012). The purpose of the Fairy Tern monitoring project on Bird Island is to monitor breeding success, establish the main threats to breeding success for future prioritisation of recovery actions, and to mitigate threats in real time where possible. Monthly monitoring of colonial breeding birds on Bird Island began in 2015 and included Fairy Terns (Johnston 2018). A finer temporal scale was required for Fairy Terns, so weekly censuses began during the 2018/19 breeding season. Weekly Fairy Tern censuses are coordinated through the Sharing our Shores with Coastal Wildlife Project staff, hosted by BirdLife Australia, and supported by the Green Adelaide Board. In 2021/22, the Australian Government's Department of Agriculture, Water and the Environment became a funding partner to support ongoing monitoring and threat management of Endangered Fairy Terns on Bird Island during that period.

This report is for 2022/23 breeding season monitoring on Bird Island, Outer Harbor. Eleven trained and skilled volunteers assisted the project monitoring team this season. Birdlife Australia staff and volunteers made 23 trips to the Island from October 2022 to April 2023. Monitoring data is recorded into Birddata's Colonial Nesting Birds' Program which is automatically shared with Biological Database of South Australia (BDDBSA).

In 2022/23, seven Fairy Tern colonies were recorded and monitored with a total of 132 adult birds, 90 nests, 178 eggs and 24 chicks. From the 24 chicks, 15 fledged reaching 21-22 days old. The cause of the failure of the 154 eggs and 9 chicks observed is unknown. The introduction of 20 chick shelters placed amongst 2 separate breeding colonies on Bird Island has likely contributed towards the higher number of chicks reaching fledging age as the shelters were regularly observed with varying ages of chicks under or close by. The number of Silver Gulls was less this season compared to last season (Greg Johnston pers comms).

Recommendations for continued Fairy Tern monitoring and species conservation in line with the Recovery Plan are provided at the end of the report.

Introduction

The Australian Fairy Tern (*Sternula nereis nereis*) is a small piscivorous bird, that is generally restricted to shallow water coastal areas and estuaries. In South Australia the population is in decline and breeding success is threatened. The Fairy Tern is listed as Endangered under the SA National Parks and Wildlife Act 1972, and Nationally Vulnerable under the Environment Protection Biodiversity Conservation Act 1999.

Bird Island is one of 16 known Fairy Tern breeding sites in South Australia recorded in a state-wide survey during the 2011-12 breeding season (DENR 2012). It is uncertain if that number remains at 16 today, and whether other sites are still regularly used for breeding. With support from the Australian Government, a state-wide Fairy Tern census coordinated by Birdlife Australia is proposed for the 2023-24 breeding season. This aims to determine the current number of breeding sites across South Australia and Victoria. In 2018 more intensive monitoring of Fairy Terns on Bird Island was initiated by Green Adelaide, formerly the Adelaide and Mount Lofty Natural Resource Management Board (AMLR NRM), delivered via the Sharing our Shores with Coastal Wildlife Project team hosted by BirdLife Australia. The aim was to monitor the breeding success, obtain more information on threats, and mitigate threats where possible. The project has continued over the last 5 consecutive breeding seasons (2018/19 - 2022/23). Monitoring is carried out with assistance from highly trained and skilled volunteers and is in line with the national monitoring framework of BirdLife Australia's National Beach-nesting Birds Program following the BirdLife Australia's guidelines for monitoring nesting success of Fairy Terns. In addition to regional training and mentoring support, volunteers active within the project have access to species-specific inductions, training resources and online workshops from BirdLife's national program.

The rationale for the program is to support actions within the National Recovery Plan for the Australian Fairy Tern. The program is also linked directly to the Bird Island Biodiversity Action Plan (BIBAP) developed by Natural Resources AMLR (Ecological Evaluation Pty Ltd., 2014). The BIBAP guides Green Adelaide's investment in conservation works on the island and provides vegetation baselines to monitor improvement. One of the high priority actions in the BIBAP is to monitor locations and nesting success of Fairy Tern colonies. The BIBAP also uses the Fairy Tern as a flagship species and a means of assessing the effectiveness of management actions on the island. The Fairy Tern Monitoring program is coordinated by BirdLife Australia and Green Adelaide with ongoing monitoring and threat management of endangered Fairy Terns on Bird Island. Flinders Ports also supports the Program by providing funding for on ground weed control, monthly censuses of colony breeding birds, and a Flinders University PhD research project to obtain an overview of the threats and potential threat mitigation strategies for Terns on Bird Island and more broadly across South Australia. Australian Government funding provided to the previous AMLR NRM Board, and now via the Hills and Fleurieu Landscape Board, has provided for the purchase and ongoing maintenance of two 'Felixer' grooming traps, deployed to control cats and foxes on Bird Island and adjacent Torrens Island.

The Bird Island project contributes to the knowledge of the Fairy Tern population and breeding trends across Australia. Fairy Tern monitoring projects are also occurring in the Coorong (SA) undertaken by David and Fiona Paton at University of Adelaide; in the South East (SA) by Friends of Shorebirds SE. Conservation actions and monitoring are undertaken across the species range in Australia by a range of organisations.

These include the Western Australia WA Fairy Tern Network, the Victorian Fairy Tern steering committee and BirdLife Tasmania.



Photo 1: Oblique aerial photograph of the Outer Harbor taken from the north-west in 1993. Bird Island is circled in the foreground. The extent and density of vegetation cover across the island has increased since that time. Image sourced from Johnston 2017 (South Australian Department of Lands).

Project Aims

- To monitor the occurrence of breeding and the success of colonies of Fairy Terns on Bird Island to improve our understanding of breeding at this site (BIBAP).
- To record threats to the colony on each visit made to Bird Island, and to use this data to guide real time threat mitigation to improve breeding success where possible, but also to review this data to guide future, long-term conservation actions (aligns with NRP strategy 3).
- To gather additional ecological data that could further contribute to our understanding of the species and its recovery needs, for example, breeding behavioural observations, banded bird resighting's and prey species information. To share findings with the national Fairy Tern network (NRP Strategy 4).
- To raise awareness amongst community and industry (Flinders Ports) and provide data to key Government Agencies and stakeholders of the significance of Bird Island as a key breeding site for the Endangered Fairy Tern (NRP Strategy 5).

Methods

Monitoring of the island and active Fairy Tern breeding colonies follow BirdLife Australia's national protocols for Fairy Tern monitoring. These are available within the Beach-nesting Birds program participant [hub](#). Volunteers who participate undertake an online induction via the hub, which focuses on the health and safety of volunteers, the aims of the project and on the finer details around monitoring the birds so both volunteers and the sensitive nesting birds are not inadvertently placed at risk.

Since 2019/20 all data collected is recorded in [Birdata](#), an online citizen-science gathered observational database, through the 'Colonial nesting birds' program. Opportunistic digital photo sampling of prey species was undertaken during the 2022/23 season where images of Fairy Terns flying in with prey species to feed mates and chicks were captured and recorded during the monitoring sessions.

A refresher of monitoring methodology and review of the 2021-22 breeding season was undertaken at the start of season training event with volunteers and staff in Port Adelaide on 21st September 2022 and a seasonal monitoring schedule devised. The frequency of monitoring throughout the season was weekly while colonies established. A Fairy Tern breeding colony is defined as a group of adult Fairy Terns nesting within close proximity i.e. 1-3 metres apart. Different colonies can occur throughout the same breeding season on Bird Island if they are separated by geographic location and / or time.

Once a colony is confirmed as establishing, when scrapes/nests are observed, weekly survey trips are undertaken up to a maximum of twice weekly at the peak of breeding. There is a minimum of two people required per monitoring trip from October to the end of March. Monitoring is not undertaken when extreme weather conditions are forecast ie high temperatures and wind.

For each trip, the following was undertaken:

- Travel by boat over to Bird Island.
- Survey the Island (on foot) focusing on known breeding locations for Fairy Terns.
- If nesting birds are suspected, observe the site/colony from a distance that does not cause birds to move from nests (approximately 80m).
- Monitor nesting sites (colonies) for:
 - habitat characteristics i.e. vegetation type, distance to high tide mark, substrate
 - breeding success
 - threats (within 100m radius)
- Use a spotting scope or binoculars to observe and record details of the breeding colony directly on to the Birdata app on a mobile phone.
- Maximum time spent observing colony is 30 minutes if the colony has not been disturbed. Maximum of 20 minutes spent observing colony if birds have been disturbed and move away from their nesting sites.
- All data are entered, inclusive of threat data, while in the field, directly in to Birdata via the app. or using the data sheet and later transferred to Birdata.



Photo 2: Monitoring breeding Fairy Terns on Bird Island February 2023 (Kerri Bartley).



Photo 3: Volunteers travel by boat to access Bird Island (Kerri Bartley).

Results

Monitoring visits to Bird Island

Over the 2022/23 season a total of 23 trips were made from the end of October 2022 to April 2023 (see Table 1) when breeding colonies were active. Weather prevented a number of trips from occurring in November, December and January but the aim was to have weekly trips, particularly when chicks were present. Green Adelaide engages Greg Johnston (with Steve Papp) to undertake ongoing monthly surveys of colony breeding birds of Bird Island and the Northern Revetment Mound, Outer Harbor. BirdLife Australia are alerted if Fairy Terns are observed during their visits. This enabled targeted monitoring to occur from October 2022 when Fairy Terns were first recorded using the island (pers. comm. 2022/23).

Table 1: Number of monitoring trips across the five seasons of the Fairy Tern monitoring project from 2018/19 to 2022/23.

Month	2018/19 Season	2019/20 Season	2020/21 Season	2021/22 Season	2022/23 Season
August	1				
September					
October	2				3
November	2	2	2		4
December	4	2	3	5	1
January	5	4	2	4	5
February	3	3	4	4	5
March	5	4	4	5	4
April	2	3	1		1
Total # trips	24	18	16	18	23
Total Volunteers	7	7	10	12	11

*7 scheduled trips had to be cancelled / postponed in October through January 2023 due to inclement weather (6 due to high winds and 1 due to high temperature).

Once again volunteers contributed enormously to the Fairy Tern project on Bird Island. There were eleven dedicated volunteers throughout the 2022/23 season. Overall volunteers contributed 345 hours. In total, there is an impressive 1,485 volunteer in-kind hours contributed across the five seasons of monitoring for the project to date. This is a fantastic effort and very much appreciated. There was an average of 3 volunteers per trip, and each monitoring trip took approximately 5 hours. This also underestimates volunteer hours as it does not include travel time for volunteers to and from the site and the time spent emailing reports and downloading / editing photographs.

Table 2: Dates of individual volunteer monitoring sessions including Fairy Tern breeding observations on Bird Island for the 2022-2023 season. Unique colony locations are given a separate identifier (A-G).

Colony	A		B		C		D			E			F			G		
DATE	Adults	Nests	Adults	Nests	Adults	Nests	Adults	Nests	Chicks	Adults	Nests	Chicks	Adults	Nests	Chicks	Adults	Nests	Chicks
3-Oct-2022																		
19-Oct-2022																		
29-Oct-2022																		
8-Nov-2022	11	11																
16-Nov-2022	0	0																
22-Nov-2022			50	7														
29-Nov-2022			0	0														
6-Dec-2022					18	1												
4-Jan-2023					0	0	12	4		13	5							
9-Jan-2023							50	20		40	20							
15-Jan-2023							49	20			20							
20-Jan-2023							25	20		65	30							
24-Jan-2023							25	20		42	31		14	12				
1-Feb-2023							36	15	5	74	34	5	22	11				
7-Feb-2023							24	10	6	56	21	8	26	10	2			
14-Feb-2023							5	5	6	-	-	-	3	3		4	4	8
21-Feb-2023							5	5	9	-	-	-	-	-	-			14
28-Feb-2023							17		4	-	-	-	-	-	-			11
6-Mar-2023										-	-	-	-	-	-	3	3	12
14-Mar-2023																3	1	1
21-Mar-2023																2	1	1
28-Mar-2023																		
3-Apr-2023																		

Breeding success

The 2022/23 breeding season resulted in 7 Fairy Tern nesting colonies (A - G). A maximum of 132 adults were recorded on the island near colonies D, E and F on 1st February 2023. Overall, from the seven colonies there were a total of 90 nests, 178 eggs and 24 chicks recorded (Table 3). Colonies A, B and C nesting attempts all failed, with Colony A's nests being washed over by a storm event on 12th November 2022 (photo 4 below). The cause of Colonies B and C's failure is unknown.



Photo 4: Colony A nesting site washed out by storm event, 12th November 2023 (Kerri Bartley).

Colonies D and E established around the same time and Fairy Terns were observed nesting on the 4th January 2023. The two colonies were separated spatially by ~200 metres distance. Colony D had 4 nests and colony E had 5 nests at this time. Both colonies continued to build over the following week and by the subsequent monitoring session on the 9th January, 20 nests were observed in both colonies. 10 chick shelters were deployed due to the limited vegetation cover to provide the chicks and parents with refuge from the elements. Chick shelters were placed around the perimeter of each colony ~10m apart and a remote camera deployed at each to colony to monitor for threats and shelter uptake. Chick shelters have been used to aid chick fledging success in other beach nesting bird species like the Hooded Plover (Maguire et al. 2011). The use of chick shelters for fairy terns has been adopted in Western Australian guidelines (Dunlop 2018). Provision of monitored chick shelters at priority Fairy Tern breeding areas has been adopted as a National Recovery Plan strategy to reduce threats (Commonwealth of Australia 2020).



Photo 5: Fairy Tern nest in Colony E, 4th January 2023 (Kerri Bartley).



Photo 6: A pair of Fairy Terns mating near Colony E, 1st February 2023 (Kerri Bartley).

Five Fairy Tern chicks were observed in colony D, with 4 chicks using the chick shelters and another 5 chicks observed in colony E on 1st February 2023.



Photo 7: Five day old Fairy Tern chick utilising chick shelter in Colony D, 1st February 2023 (Kerri Bartley).

Colony F had two chicks hatch and were observed on the 7th February 2023, no further chicks hatched in this colony.

Colony G formed on the 14th February with 4 new nests observed and 8 chicks of varying ages (2 @ 9-10 days, 2 @ 16-17 days, 1 @ 21-25 days, 3 @ 21-25 days) which had likely moved over from colonies E and F as no chicks or nests were observed in those colonies during that monitoring session. The remote camera revealed ~40 pelicans moving through colonies E and F on the 10th February (photo 8) which most likely displaced the chicks over to newly formed colony G further west.



Photo 8: Pelicans moving through colonies E and F, 10th February 2023 (remote camera).



Photo 9: Fairy Tern fledgling flying near Colony D, 14th February 2023 (Ian Forsyth).

Table 3: 2022-23 dates of colony formation, suspected cause of colony failure, number of adults, nests, eggs, chicks and breeding comments.

Colony Date	Colony Failed Y / N Suspected cause	Max # Adults	Max # Nests	# Eggs	# Chicks	# Fledglings	Breeding comments
A 08/11/2022 to 16/11/2022	Y - tidal inundation	22	11	22	0	0	Observed fish presenting, incubating and scrape making Colony A (same location as first attempt last season). Storm event 12/11/2023 wipes out nests
B 22/01/2022 to 29/11/2022	Y - unknown	52	7	14	0	0	Fish offering observed, several birds sitting
C 06/12/2022 to 04/01/2023	Y - unknown	15	1	1	0	0	06/12/2022 - One egg in nest observed
D 04/01/2023 to 28/01/2023	Y - Partial Failure - unknown / Fledged chick	50	20	40	9	1	04/01/2023 - 4 nests, colony building 15/01/2023 - 20 nests / 10 chick shelters deployed 01/02/2023 - 5 chicks using shelters 07/02/2023 - 6 chicks - 4 in shelters 14/02/2023 - 6 chicks 21/02/2023 - 9 chicks - 5 in shelters 28/02/2023 - 4 chicks (3 possibly fledged)
E 04/01/2023 to 14/02/2023	Y - Partial Failure - unknown / chicks move to G	74	34	68	8	0	04/01/2023 - 5 nests observed, colony building 15/01/2023 - 20 nests / 10 chick shelters deployed. 7/02/2023 - 8 chicks, 3 inside shelters 10/02/2023 - ~40 pelicans walk through colony 14/02/2023 - No chicks or nests 21/02/2023 - Moved chick shelters to Col G
F 24/01/2023 to 21/02/2023	Y - Partial Failure - unknown / chicks move to G	26	12	24	2	0	24/01/2023 12 incubating adults observed. 07/02/2023 - 2 chicks 10/02/2023 - ~40 pelicans walk through site 14/02/2023 - 3 nests / chicks absent
G 14/02/2023 to 14/03/2023	Y - Partial Failure / Fledged chick	2	5	9	16	14	14/02/2023 - 4 new nests and 8 older chicks 21/02/2023 - 10 chick shelters deployed 06/03/2023 - 15 fledglings 14/03/2023 - One 3 day old chick and 1 egg nest
TOTALS		132	90	178	24	15	

Note: In 2022/23 the total estimated maximum egg count was 178 based on maximum nest count observed, with Fairy Tern's typical clutch size of 2 eggs per nest (Greenwell 2020). However, colonies G and D had nests with only one egg present (personal observation Bartley 2023).

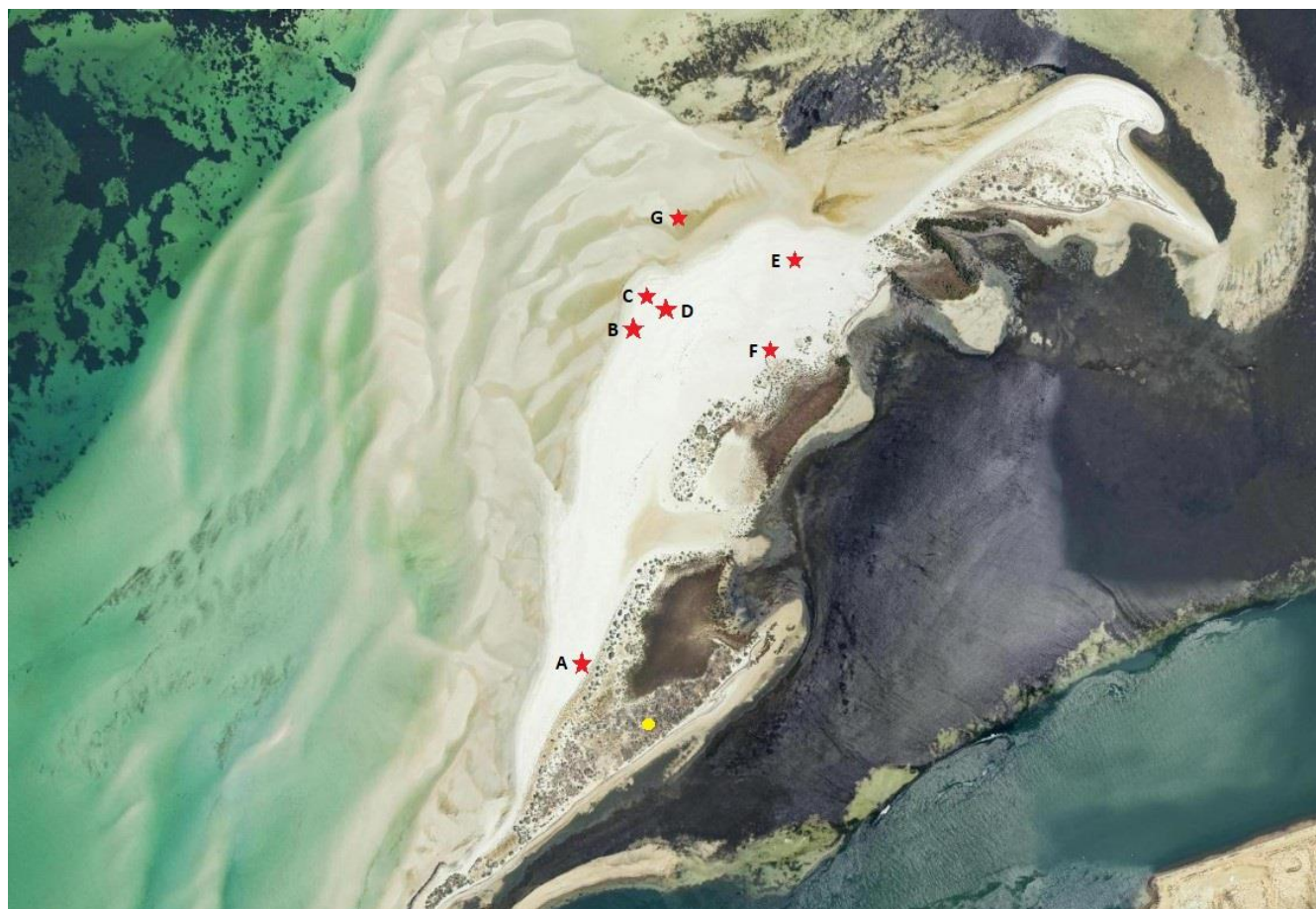


Figure 1: Map of Bird Island Fairy Tern Breeding Colonies A-G in 2022-23.

Nesting success across the season was calculated by the number of fledglings produced per nest attempt, not fledglings produced per pair. Calculating fledglings per pair across the breeding seasons is problematic due to the limitations in determining exactly how many pairs we have in total, due to repeated nesting on the island, and not knowing if they are the same pairs or new pairs coming in. Without banded adults it is impossible to know if colonies had the same birds nesting repeatedly in new (non-overlapping) colonies.

Overall, nesting success (fledglings produced per nest attempt) was nearly 3 times as successful this season with a 0.17 fledgling per nest attempt ratio compared to the poor result of 0.06 in 2021/22 (refer table 4). From a total of 178 eggs, 24 chicks (13%) hatched across the 7 colonies, which is the same percentage result as the previous season but in that season only 4 chicks hatched from a total 31 eggs. The percentage of chicks that then went on to fledge in 2022-23 was 63% which was a great improvement from last season when only 25% (1 of 4 chicks) fledged. Chick shelters were deployed on Bird Island for the first time this season which very likely contributed to the increase in chick survival by offering protection from both the elements and avian predation by species such as Silver Gulls.



Photo 10: Fairy Tern colony E with chick shelters and remote camera, 20th January 2023 (Kerri Bartley).

Table 4: Breeding results for Bird Island five seasons from 2018-2023

Year	Total # pairs	Total # colonies	Total # nests	Total # eggs	Total # chicks	% of chicks to eggs	Total # fledglings	chicks / fledglings	Fledgling/Nest Attempt
18/19	66	7	74	130	71	55%	0	0%	0.00
19/20	26	14	84	159	8	5%	5	63%	0.06
20/21	28	2	38	62	5	8%	3	60%	0.08
21/22	12	7	16	31	4	13%	1	25%	0.06
20/23	66	7	90	178	24	13%	15	63%	0.17



Photo 11: Fairy Tern breeding pair with fish offering, 9th January 2023 (Mary-Ann van Trigt)

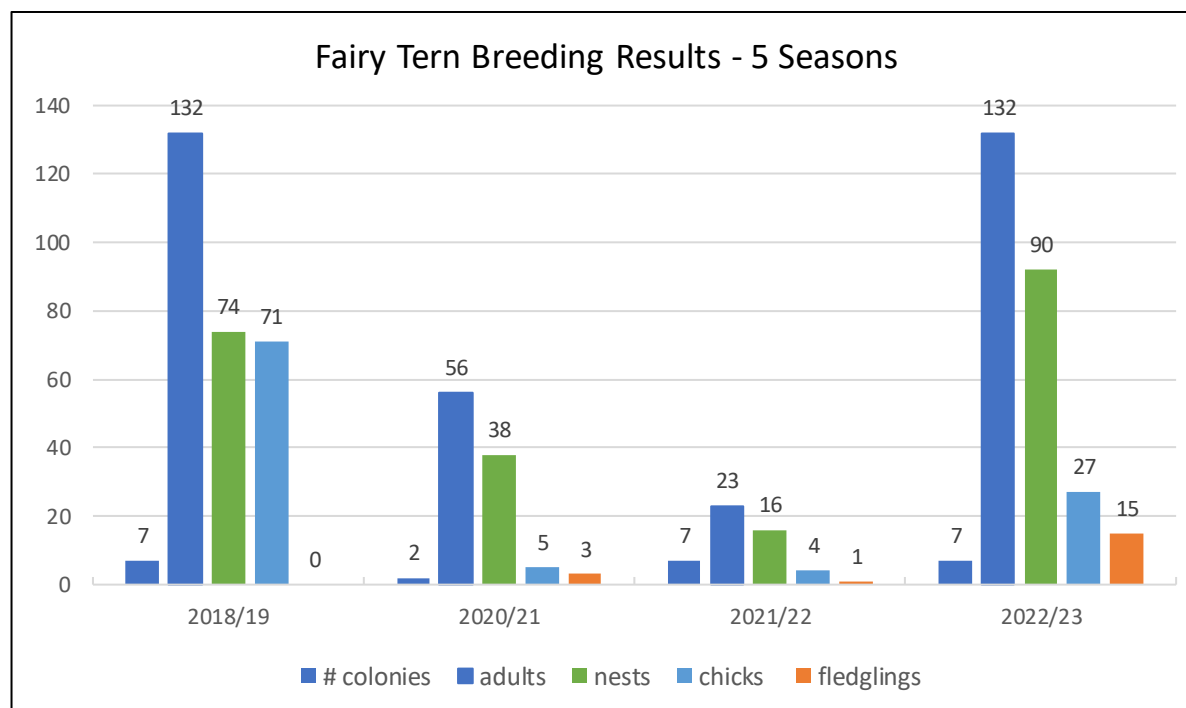


Figure 2: Bird Island breeding success across 5 consecutive seasons, including number of colonies, maximum number of adults, nests, chicks and fledglings from 2018/19 to 2022/23.

Threats

Threats to breeding Fairy Terns during the 2022/23 season were made via direct observation from volunteers during the scheduled monitoring sessions and recorded on the Birddata app. Silver Gull (*Chroicocephalus novaehollandiae*) presence was consistently observed and recorded at each Fairy Tern breeding colony and in 2022/23 season appeared to be again the major threat to Fairy Tern breeding on Bird Island. Silver Gulls were observed breeding adjacent to Colony E and 2 chicks were seen utilising one of the chick shelters deployed for Fairy Terns. A Silver Gull was photographed by a remote camera installed in colony E taking a young Fairy Tern chick on 9th February 2023 (photo 12).



Photo 12: Remote camera image of Silver Gull with Fairy Tern chick, Colony E - 9th February 2023.

Monthly colonial bird counts are conducted on Bird Island by Dr Greg Johnston for the Green Adelaide Board. The method used to calculate Silver Gull numbers across the island is by calculating the number of Silver Gulls observed at each photo point location across the island and then multiplied by the area of the island to give an estimate of total birds. There continues to be large numbers of breeding Silver Gulls recorded on the island (Figure 3) which is not surprising given the distance of the island (~8km flight path) from the Wingfield Waste and Recycling Centre. From the monthly counts, Silver Gull numbers peaked in July at almost 4,367 individuals and numbers stayed above 900 until December. Although Silver Gull counts were down on previous years, there were still numerous Silver Gulls observed within each breeding fairy

tern colony by Birdlife Australia volunteers throughout the breeding season. Fairy Tern breeding failure continued throughout the season with 178 Fairy Terns eggs recorded and only 24 chicks observed. Whether the eggs are being predated by Silver Gulls before hatching or once the chicks hatch cannot be determined from the weekly site monitoring visits as volunteers are not entering inside the recommended 80m from the breeding colonies and remote cameras are the only insight to what predation is occurring on individual nests.

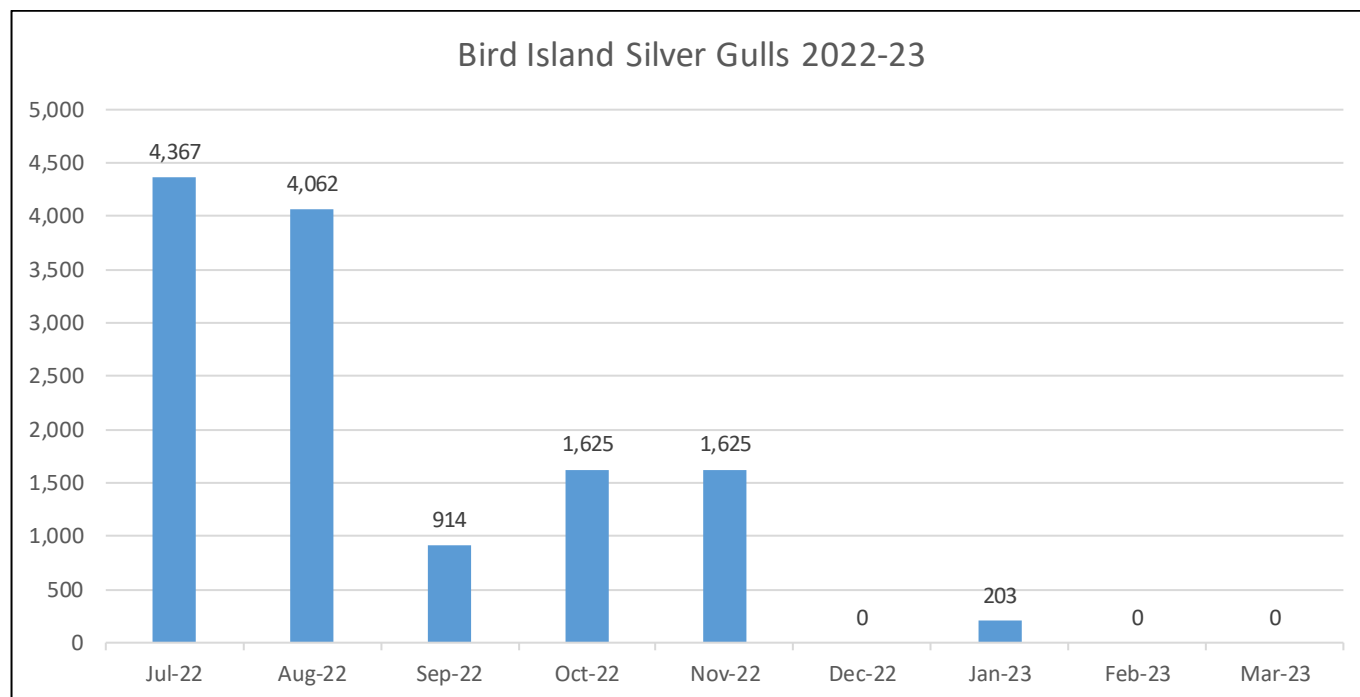


Figure 3: Silver Gull population counts on Bird Island July 2022 to March 2023 (data source: Greg Johnston)

As mentioned above, Silver Gull predation continues to be the major known threat to breeding Fairy Terns on Bird Island. However, the installation of chick shelters this season may have contributed towards the success of at least 15 Fairy Tern chicks making it through to fledging. The chick shelters provide a physical shelter, reducing visibility and potentially accessibility of Fairy Tern chicks to avian predators and in turn increase chances of survival through to the fledging stage.

The island is a very busy place with numerous other colonial birds nesting across the island. During the 2022/23 breeding season other threats were recorded by volunteers during monitoring trips to the island and others are captured on the remote cameras deployed at Colonies D, E and G. A large Australian Pelican rookery occurred not far from the breeding Fairy Terns, and Silver Gulls were also nesting very close to the Fairy Tern breeding areas.

Three Little Ravens (*Corvus mellori*) were observed near Colony B on the 22nd November 2022 but no predation events were recorded.

A Black Rat (*Rattus rattus*) was observed inside colony D and appeared to be leaving one of the chick shelters (photo 13). Numerous black rat tracks were also recorded further away from the Fairy Tern breeding areas, in and around dense vegetation, towards the eastern side of the island.



Photo 13: Black Rat inside Fairy Tern breeding colony 13th March 2023 (remote camera)



Photo 14: Pelicans of varying ages and Silver Gulls near the Fairy Tern breeding area 9th Jan 2023 (Ian Forsyth)

Prey Photo Sampling

In the 2022-23 breeding season, volunteers captured several photographs of Fairy Terns returning to Bird Island from foraging with various prey items (photos 15 – 17). The need for further information on diet is noted in the National Recovery Plan and understanding diet is important for many reasons including, how prey abundance and diversity influence nesting site choice and how prey availability can impact on breeding success. Whether other co-occurring species of terns compete with Fairy Tern for the same prey may influence the Fairy Tern breeding activity and success. At least 2 fish species were recorded from the photographs taken by Birdlife Australia volunteer Ian Forsyth, being Southern Garfish (*Hyporhamphus melanochir*) and a species from the Clupeidae family (herrings, pilchards, sardines and sprats). Fairy Terns are central-place foragers and prefer to nest close to available food resources and are known to travel up to 2km from breeding sites to forage (Paton & Rogers, 2009).



Photo 15: Fairy Tern with Southern Garfish (Ian Forsyth)



Photo 16: Fairy Tern with Clupeidae (herrings, pilchards, sardines and sprats) (Ian Forsyth)



Photo 17: Fairy Tern with Southern Garfish (Ian Forsyth)

Threats Discussion

Foxes:

There was no suspected predation from European Foxes during the 2022/23 season. A Felixer unit (photo 18) was installed on Bird Island in February 2021, and one European Fox was controlled in March 2021. The Felixer unit is kept in place as a precautionary measure in case of future Fox colonisation on Bird Island because of the considerable diversity of shorebird species breeding, foraging, and roosting on the island. Throughout the 2022/23 season the unit did not 'fire' but numerous photographs of 'non target' prey species were captured. Another Felixer unit has been deployed on adjacent Torrens Island, from which foxes are able to swim to Bird Island. This unit has recorded confirmed targeting of 4 foxes and one cat. (Steve Papp pers comm, March 2022). Hills and Fleurieu Landscape Board staff maintain the Felixer devices on the two islands.

Canid pest ejectors are available for deployment on Torrens and Bird Island should Fox activity be detected. These have previously been deployed on both islands. On-going liaison with National Parks and Wildlife to undertake Fox baiting and / or shooting operations on Torrens Island Conservation Park should be undertaken regularly to implement control prior to and during key nesting seasons of birds of conservation concern, to prevent interference with the breeding season. In 2022-23 Green Adelaide instigated a conservation detection dog project to detect Fox dens adjacent to beach-nesting bird territories. This aims to disrupt Foxes foraging on beaches. Den detection and fumigation with carbon monoxide is proposed to be undertaken on Torrens Island in future seasons.



Photo 18: Felixer unit deployed February 2021 for Fox control on Bird Island (Kerri Bartley)

King Tides:

No management actions were undertaken to mitigate against king tides inundating colonies in 2022/23. On the 12th November 2022, Colony A was washed over during a storm event which coincided with a high tide and all nests were lost. Over the previous 4 seasons of monitoring, there has been no tidal inundation events recorded (Lamanna & Stephens, 2022). However tidal inundation did occur on Bird Island in 2015, 2016 and 2017 causing significant Fairy Tern nesting failures (Johnston, 2018) and is a major consideration for future success of Fairy Tern breeding on Bird Island.

Opportunities to increase island width using suitable dredge spoil from port activities has been proposed to assist in limiting these impacts, but this would have to be fully investigated. Following early season High tide events many Fairy Terns re-nest after the inundation in more suitable locations. Another potential mitigation option is to deploy tern decoys (possibly with acoustic call devices) to encourage Fairy Terns to establish first nests in less tidally susceptible areas. Currently, suitable tern nesting habitat does not appear limited on Bird Island. Should tidal or other impacts increase, floating nesting islands in other areas of the Barker Inlet could be considered. These have been successfully deployed for other tern species internationally.

Climate change:

Other factors like Climate Change that may affect Fairy Tern prey species requires further research and modelling. Greenwell et al (2021c) notes that climate-driven threats add further pressure to already challenging conditions for breeding success. Managed (engineered) sites can provide an opportunity when facing high levels of human disturbance, lack of habitat, or inundation through sea-level rise (Greenwell et al., 2020). Currently the accumulation of sediments forming the island has outpaced sea-level rise. One future risk is the expansion of mangroves at Bird Island, however, mangrove encroachment on Bird Island is not yet a threat, and occurs primarily on the leeward side of the island away from current sea bird colonies. On adjacent Torrens Island mangroves have encroached on tidal flats significantly impacting upon shorebird feeding and roost sites.

Black Rats:

There were regular sightings of heavy numbers of Black Rat tracks adjacent to vegetation during monitoring sessions more broadly across Bird Island, and a Black Rat observed leaving one of the chick shelters on 13th March 2023 which suggests that Rats could pose a direct threat to the breeding success of the Fairy Terns during the 2022/23 breeding season. It is possible that Rat numbers could increase to levels that would cause significant predation on Fairy Tern eggs. If predation is thought to be occurring, or tracks sighted amongst colonies, then either an intensive Rat control program using baiting stations (as was done in 2017/18) (AMLRNRM 2017) or other less intensive programs like depot pest control where monthly monitored bait stations could be implemented dependant on infestation densities.

The intensive Rat control program had previously been undertaken on Bird Island in 2017 -2018 as part of vertebrate pest management plan for the island. Rat control using an extensive protected bait station tubes was resource intensive but significantly reduced observed abundance. Mice activity was still noticeable after

Rat numbers decreased. There were limited observable benefits for Fairy Tern fledgling success following Rat control, with tidal inundation that season being a key cause of early nest failure. Predation interactions and dynamics between Black Rats and Silver Gull egg and chick predation are not well understood, and these other abundant birds may provide additional food resources for rats other than Fairy Tern. With an international port adjacent to the island, Rats can readily repopulate the island from the mainland.



Photo 19: Rat-baiting stations previously deployed in 2017-18 (Green Adelaide).

Silver Gulls:

Low hatching success in Fairy Tern colonies adjacent to Silver Gull breeding areas (see figure 2) suggest that gulls may be limiting breeding success of Fairy Terns on Bird Island.

Silver Gull numbers continue to be an issue for breeding Fairy Terns on the island, and this is suspected to be due to the abundant, readily available, artificial food sources like open waste recovery sites, poor management of waste at food processing factories, eateries, and the FOGO (Food Organics & Garden Organics) waste stream implemented nearby at the Wingfield Waste & Recycling Centre. FOGO is a relatively new initiative rolled out across Adelaide suburbia in 2020, whereby diversion of food waste from land fill (from the 'waste' bin to the 'green' bin) is now processed into a mulch product and resold to the public by a landscaping company. The FOGO waste comprises of dairy, meat, bones, seafood, fruit and vegetable scraps and is stored outside in large open-air mounds to compost for approximately 8 to 10 weeks (www.eastwaste.com.au). Increases in anthropogenic food sources in general has allowed Silver Gull populations to increase historically in many parts of Australia (Johnston 2018 and references there in).

An opportunity to progress a series of 'Wildlife and Waste' Workshops for waste industry management is encouraged to discuss possible solutions to house the FOGO waste as to not be readily accessible by avian scavengers. A similar scenario occurred back in the early 2000's when the Wingfield Dump provided a ready

source of food for Silver Gulls breeding on Bird Island until operations at the dump were largely enclosed by buildings in late 2005 (Johnston 2018). The number of breeding Gulls on Bird Island declined notably from 50,000 in 1987 to about 15,000 in 2006, and only 150 nests were attempted in the particularly dry year of 2007 (Johnston unpublished data 1990-2007). The numbers of Silver Gulls breeding on Bird Island increased again between 2008-2010 to about 15,000 individuals (Johnston unpublished data). Silver Gulls have not returned to the high numbers as previously recorded when Wingfield dump offered a ready source of food (Harrison 2010).

Investigating management activities which could lessen the breeding period of Silver Gulls when Fairy Tern chicks are emerging ie January / February by ways of Silver Gull nest destruction. Interrupting Silver Gull breeding at this time by mitigating hatching success could assist with reduction of Fairy Tern egg and chick predation, with benefits more likely to be seen in future seasons.

Little Ravens:

Three Little Ravens (*Corvus mellori*) were observed on one occasion during the 2022/23 monitoring sessions on Bird Island. There were no Ravens captured on the remote camera images this season and no evidence of predation, however, it is important to continue to monitor presence and abundance of Ravens as they are known predators of breeding beach nesting birds and may be attracted to introduced novel equipment like cameras and chick shelters.

Raptors:

White Bellied Sea Eagles and Osprey are regularly recorded flying over Bird Island and are a known predator of beach-nesting birds. There is a current re-wilding project underway where artificial nesting platforms are being deployed along the coast in South Australia. It is therefore recommended that nesting platforms not be installed within the vicinity of Bird Island or Torrens Island.

Weeds:

Earlier assessment of Birds of the Section Bank (Carpenter 2008) notes that more open sites are favoured for nesting by Terns, whereas areas where weedy ground cover is high, is favoured by Silver Gulls. As such, decrease in weed ground cover is seen as a positive outcome to favour more desirable seabird species nesting.

Habitat condition re-assessment of sites originally established in 2014 was undertaken on 16th March 2022. There has been a decrease in high threat woody weeds (African Boxthorn) cover of weed species was observed to have generally declined as a result of weed control. Decrease in weedy ground covers such as Galenia and Marshmallow on the south of the island, is a positive outcome which favours the nesting of seabird species. A key consideration in managing this island as a significant seabird and shorebird area is maintaining open spaces for nesting and roosting. In the Atriplex / Nitroaria Open Shrubland (Management Zone 3), there was a notable increase in Beach Rocket (*Cakile maritima*). This increase in cover is not considered a high threat at this stage, although vigilance should be maintained to ensure that it does not impact on key seabird breeding habitat (such as open beach areas used by Fairy Terns).

Samphire communities remain weed free, however Grey Mangrove cover continues to increase. Expansion of mangroves can limit the availability of the open spaces for shorebird and seabird habitat. Ongoing monitoring of Grey Mangrove expansion will be needed to assess if shorebird roosting and feeding habitat is being compromised.

Sea Wheat-grass is present on the island and is controlled through Green Adelaide's coastal conservation program to remove this threat. Follow up planting using the native dune species, Rolling Spinifex (*Spinifex hirsutus*) is completed each winter to replace the weedy sea-wheat grass which threatens the integrity of the dunes. Native Spinifex grass stabilises the sand and encourages a gentle sloped dune mound to develop and capture sand to mitigate erosion.

Disturbance:

Visitation to the island by boaters, fishers and members of the general public can cause direct disturbance to breeding beach nesting birds, not only causing them to leave their nests but also by direct crushing of eggs. Human and dog footprints adjacent to the breeding colony have been recorded during site monitoring sessions over the past 5 breeding seasons. A series of 'Fairy Tern Breeding Area – Keep Out' signs were developed for Bird Island and installed for this breeding season. The signs aim to raise awareness and protect the breeding Fairy Tern colonies on Bird Island by highlighting when breeding is occurring on the island. A total of six interpretive A1 sized corflute signs were installed at various access points across the island in November 2022 (see photo 20). Additional signage at other seabird colonies is proposed and aim to be installed prior to the 2023-24 breeding season.



Photo 20: Installation of 6 x 'Fairy Tern Breeding – Keep Out' signs across Bird Island, 16th November 2022 (Jay Johnston).

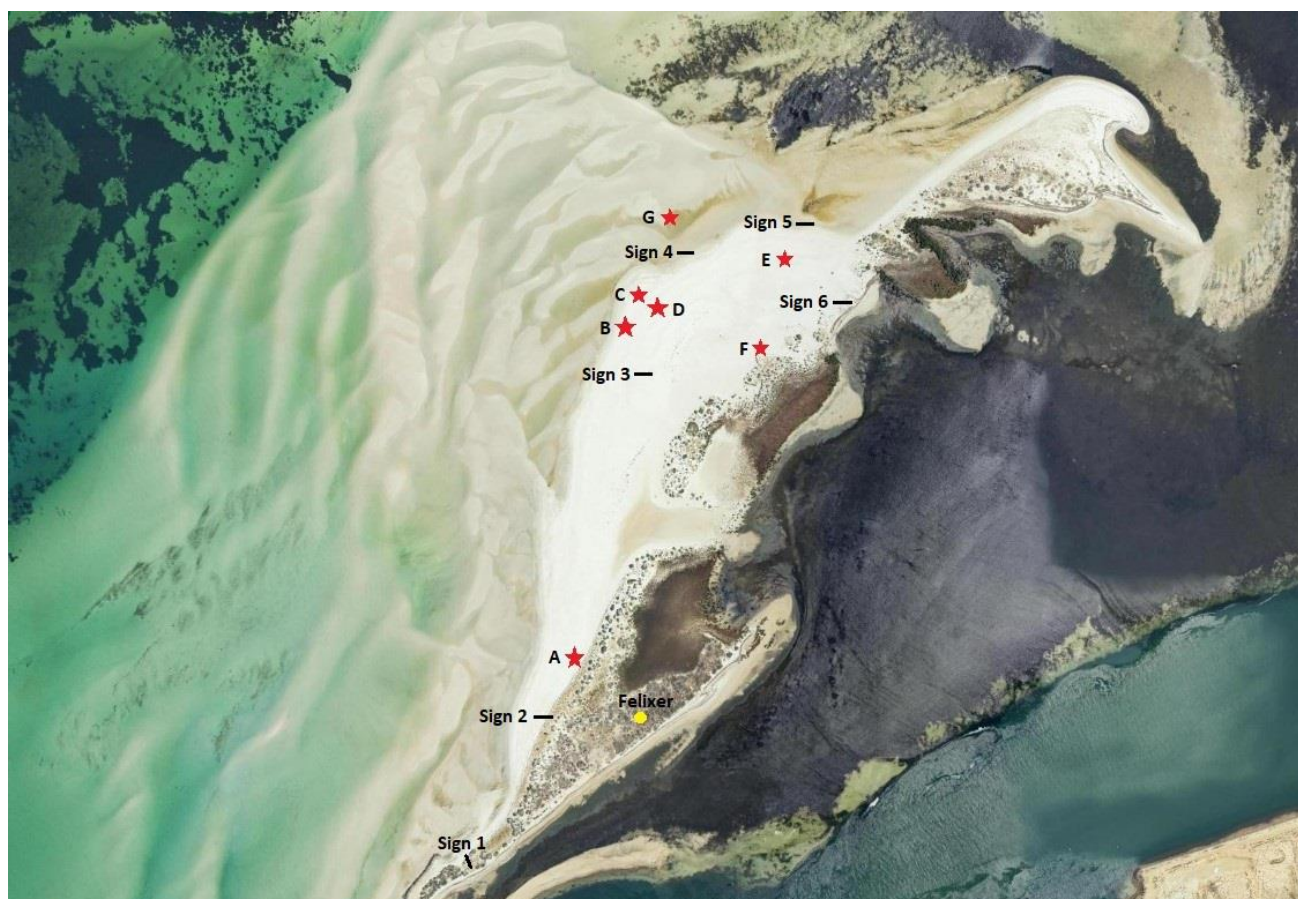


Figure 4: Location of 6 'Fairy Tern Breeding – Keep Out' signs on Bird Island.

Community Engagement

A 'Beach Nesting Birds Workshop' was held at Henley Beach Sailing Club on Saturday 3rd December 2022 where members of the community were invited to attend to learn about beach nesting birds and specifically Fairy Terns, Red-capped Plovers and Hooded Plovers. A presentation on the Bird Island Monitoring Program was given and a 'flock' of life size model Fairy Terns were on display. The Fairy Tern models were created for education purposes and includes 3 phases of plumage; juvenile, non-breeding and breeding plumage (see photo 21).



Photo 21: Fairy Tern models on display at the Beach Nesting Birds Information Workshop, Henley Beach December 2022 (Kerri Bartley).

A presentation was also given at the ‘Beach Nesting Birds End of Season Celebration’ at the Sellicks Beach Community Hall with an update of the Bird Island Fairy Tern monitoring program and the breeding success for the 2022-23 season. The South Australia Deputy Premier was in attendance as well as Elected Members and Mayors from Councils, Land Managers, Green Adelaide staff and Birdlife Australia volunteers.

A ‘Seabirds / Shorebirds Information Presentation’ was given at the Whyalla Yacht Club to launch the Eyre Peninsula Boating, Fishing and Birding guides on 23rd June 2023 as part of the Cuttlefest Festival. The Bird Island, Outer Harbor Fairy Tern monitoring program case study was shared with the group with great interest from participants. 48 people registered and attended the event including representatives from the Whyalla Sports Fishing club, Whyalla Yacht club, interested community members and staff from NPWS and Eyre Peninsula Landscape Board.



Photo 22: Seabirds and Shorebirds Presentation at the Whyalla Yacht Club, June 2023 (Barb Murphy).

Bird Island 'site specific' chick shelters have been made by two local community groups, the Mallala Men's Shed and the Port Adelaide Defence Shed with support from Northern Coastal Conservation officer for use on Bird Island next season (photos 23 & 24).



Photos 23 & 24: Volunteers from the Defence Shed at Port Adelaide and Mallala & District Men's Shed with chick shelters made for the Bird Island Fairy Tern Project.

Recommendations

Recommended actions for 2022/23 season

- Continue to monitor Fairy Tern breeding success and threats on Bird Island, and to enter all monitoring data into Birddata's colonial nesting birds program which automatically is shared with Biological Database of South Australia (BDBSA).
- Continue Cat and Fox control using the Felixer device already installed on Bird Island and Torrens Island and liaise with National Parks and Wildlife to undertake fox baiting and / or shooting operations on Torrens Island Conservation Park. Develop an Emergency Response Plan for when/if a cat or fox is sighted on Bird Island.
- Maintain vegetation restoration actions recommended in the Bird Island Biodiversity Action Plan to maintain open habitat for fairy tern nesting. Monitor potential occurrence or increase in weeds such as Beach Rocket, Sea Wheat-grass and Marram Grass and control.
- Continue the use of 'chick shelters' which should be deployed soon after nests are observed and preferably prior to eggs hatching to minimise disturbance to the breeding colony, to offer a place of refuge away from the elements, as well as Silver Gulls, Ravens, and other avian predators. Continue to monitor chick shelters and adapt use of shelters if any learning occurs within local predator populations.
- Continue to install remote cameras to monitor uptake of chick shelters and other threats adjacent to breeding colonies.
- Engage with Communities including the nearby Royal South Australian Yacht Squadron and scope for increased awareness and collaborations.
- Monitor the sand movement and weeds on Bird Island to compare to previous years' mapping to ensure there is enough suitable habitat available for breeding prior to season start.
- Investigate options for Silver Gull control and/or deterrent from nesting on Bird Island. Liaise with the Port Lincoln Silver Gull project to explore the best means of managing Silver Gulls.
- Continue to use digital photo sampling to collect information on prey and use in diet analysis.
- Encourage the existing Waste & Wildlife project to broaden its focus to include Silver Gulls in their applied research and management goals of available sources of anthropogenic sources of food.
- Pending national protocols for Fairy Tern colour banding, instigate a leg banding program to mark individual Fairy Terns to establish whether colonies are of the same individuals over the course of the season; to detect movements between sites; and to assist with tracking survival of chicks from colonies. Work with National Fairy Tern Recovery Team for advice on coloured bands across the state.

- When scheduling the monitoring trip roster, consider high tide trips when chicks are close to fledging age. High tide trips allow for closer observations and less chance of 'missing' chicks when the tidal flats are not exposed.
- Devise a plan for Fairy Tern abundance and movements on the Samphire Coast and within the Adelaide International Bird Sanctuary (AIBS) to look for any possible juvenile birds after they leave Bird Island. The benefit of this area search would be enhanced by flagging of chicks.
- Further our understanding of Fairy Tern ecology through collaboration with other researchers. Attend and contribute to National Fairy Tern meetings coordinated through BirdLife Australia and contribute to National Recovery Team once established. Support the Statewide Fairy Tern census during the 2023-24 breeding season.
- Consider the landscape scale dispersion of Fairy Terns and whether declines in number of breeding pairs using the island over time are indicative of population decline or differential site use.
- Raise the profile of Fairy Terns in South Australia with the community, key project partners and stakeholders (kayak, sport fishing and boating clubs) around Bird Island including Flinders Ports. Do this through media articles, e-mails, social media and develop a Boating, Fishing and Birding guide relevant for the region to educate the public about the need to protect threatened species and their habitats.
- Investigate opportunities for funding to continue monitoring through grants. Leverage the Island's inclusion as part of Adelaide International Bird Sanctuary to assist with grant opportunities.
- Undertake on-going awareness of the project to the Green Adelaide Landscape Board and Flinders Ports to ensure ongoing resourcing of wildlife and habitat conservation work on Bird Island.

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Photo: Fairy Tern fledgling on Bird Island March 2023 (Kerri Bartley)

Thank you

Kerri Bartley

Sharing our Shores with Coastal Wildlife Coordinator

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