

Changes in shorebird roost preferences following habitat restoration of an established roost site in the Hunter River

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In September 2002, Grey Mangroves (*Avicennia marina*) were removed from the shoreline of Stockton Sandspit, an established shorebird roost in the Hunter River. The mangroves had become established over several years and had formed a visibility barrier between the roost and the waters of the Hunter River. This loss of a clear line-of-sight had devalued the site for a significant proportion of the shorebird species that roosted in the Hunter estuary. Many of these birds had opted to roost on other sites such as the Kooragang Dykes. With the reestablishment of a clear line-of-sight, the sandspit rapidly reverted to a significant shorebird roost site.

An analysis of historical survey data over a three-year period surrounding mangrove removal, showed there was an initial small change in roost preference over three months with some species relocating from Kooragang Dykes. This was followed by a major shift that continued for the remainder of the summer and the following winter. Subsequently, migratory shorebirds settled into a pattern of relatively uniform preference across all roost sites, while endemic shorebirds maintained a strong, all-year-round preference for the sandspit.

INTRODUCTION

The Hunter Estuary near Newcastle is the most important site for migratory and endemic shorebirds in New South Wales (Driessen *et al.* 2025). Within the estuary, the Stockton Sandspit (32.883°S 151.791°E), has been an important day-time shorebird roost site for much of its existence. However, habitat degradation during the 1980s and 1990s eventually led to most shorebirds abandoning the site as a high-tide roost, until restoration works (principally, the removal of a stand of mangroves) were undertaken in 2002.

Daytime roost sites in the estuary

Most of the knowledge about shorebird roost sites in the Hunter Estuary comes from daytime surveys. It is only recently that systematically collected information about night-time roost sites is becoming available (A. Griffin pers. comm.). The estuary has been the target of daytime surveys for many years. Early surveys were conducted by members of the Newcastle Flora and Fauna Society, commencing in 1969 (Kendall & van Gessel 1972; van Gessel & Kendall 1972a, 1972b, 1974, 2015; Stuart 2014). Since April 1999, all known high-tide roost sites in the estuary have been surveyed monthly by members of the Hunter Bird Observers

Club (HBOC) (Stuart & Lindsey 2021). Those surveys have been conducted using BirdLife Australia's shorebird survey protocol (<https://birdlife.org.au/projects/australian-shorebird-monitoring>).

The two main daytime shorebird roost sites in the estuary are Stockton Sandspit and Kooragang Dykes, with some nearby sites regularly hosting lesser numbers of shorebirds. Those latter sites are at Fern Bay, Fullerton Cove Beach and Stockton Channel (**Figure 1**). Collectively, these five roost sites host the majority of shorebirds using the southern part of the Hunter Wetlands National Park. Stockton Sandspit and Kooragang Dykes are almost directly opposite each other on the Hunter River. Usually, the two sites complement each other, providing alternative roosting options for most shorebirds.

History of the site

Stockton Sandspit was formed in the early 1970s from dredge spoil emplaced to support the eastern abutments of the newly constructed Stockton Bridge. It was immediately attractive to shorebirds as a high-tide roost due to its non-vegetated sand and shingle, and a clear line-of-sight for birds to see approaching predators. The sandspit was included into the newly gazetted Kooragang Nature Reserve

in 1983 and into the Hunter Estuary Wetlands Ramsar site in 1984 (NSW Local Land Services 2023).

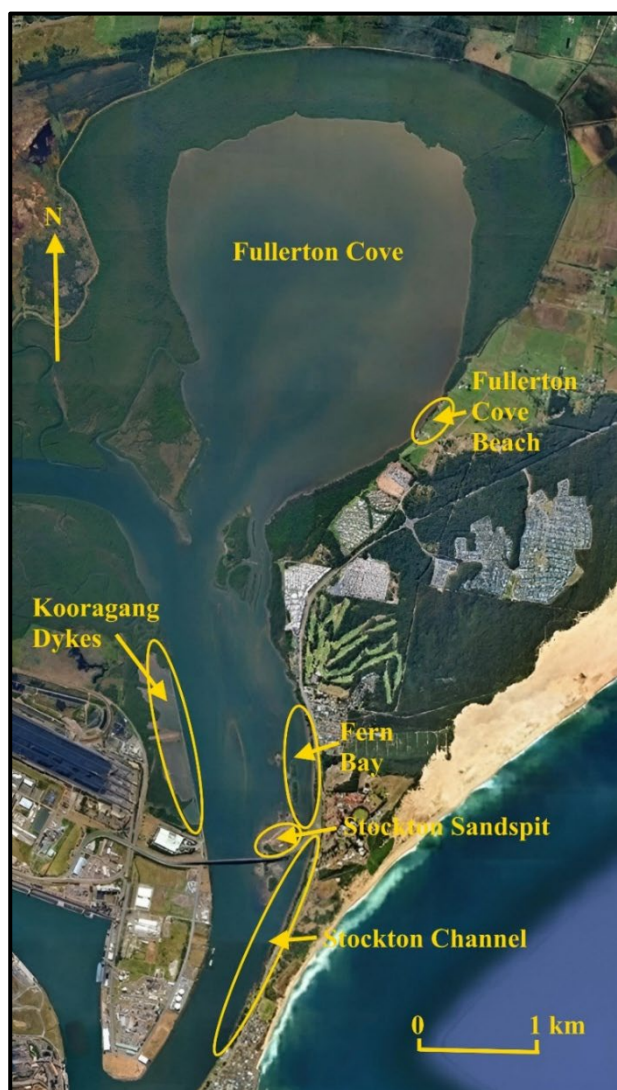


Figure 1. Location of five roost site along the shores of the Hunter River channel and at Fullerton Cove. Image from Google earth <https://www.google.com/search?>

Over time, the sandspit became overgrown with woody weeds and mangroves, and its value to shorebirds was considerably reduced. The Kooragang Wetland Rehabilitation Project was launched in 1993 and the sandspit was identified as a priority area for rehabilitation. This commenced in 1995 with restriction of vehicular access, excavation of a lagoon with a central island, and removal of rubbish (NSW Local Land Services 2023). These measures created foraging and roosting habitat for shorebirds, but the site continued to be ignored by most shorebirds.

The c 0.5 ha fringing stand of Grey Mangroves at the sandspit, which were affecting the line-of-sight for shorebirds, was identified as being the key factor

that discouraged them from roosting there (NSW Local Land Services 2023). Intensive lobbying by HBOC members eventually resulted in the mangroves being removed – this work was carried out over September-October 2002 by contractors supervised by the National Parks and Wildlife Service (**Figure 2**). This led to shorebirds returning to the sandspit, and the site has become reinstated as one of the most important shorebird roosts in NSW (Hunter-Central Rivers Catchment Management Authority 2013; Svoboda 2017).



Figure 2. Aerial photographs of Stockton Sandspit from 1997, prior to mangrove removal, and from 2002, shortly after mangroves were removed from the beach.

Image source: https://www.hboc.org.au/wp-content/uploads/Factsheet_Stockton-SandspitL.pdf

The following year, sand was replenished on the beach and the island in the lagoon, and the weir rock wall was replaced. The weir allows tidal water to enter the lagoon. Also, HBOC volunteers commenced a regular program to control woody weeds and remove mangrove seedlings; that program is ongoing.

Today, the Stockton Sandspit comprises a lagoon, an area of open sand and shingle, and areas of saltmarsh. On its northern side, a sandy beach, mudflats and remnant oyster reef provide additional roosting and foraging areas depending on the tide. The objective of this article is to document the changes in shorebird roosting preference resulting from mangrove removal, by analysing roost site

preference for a 3-year period from one year before mangrove removal to two years afterwards.

METHODS

Historical shorebird records from monthly high-tide surveys of the Hunter Estuary by HBOC were obtained from club records from September 2001 to August 2004. The data were analysed in MS Excel spreadsheets. Records were allocated into three areas: Kooragang Dykes (“Dykes”); Stockton Sandspit (“SSS”) and Other. Data for “Other” comprised all the records from the Fern Bay, Fullerton Cove Beach and Stockton Channel survey sites.

The data were also sorted into “summer” and “winter” periods reflecting the seasonal arrival and departure times of most migratory birds. Summer was defined as the period September through to March and winter as the period April through to August.

Analysis of shorebird roost site preference was carried out. Comparisons were charted in MS Excel for total shorebirds counts, migratory shorebirds counts, endemic shorebirds counts and individual species counts. Roost site preference for each summer and winter period was also charted.

RESULTS

The monthly totals for all shorebirds from September 2001 to August 2004 are shown in **Figure 3**. The chart illustrates the change in roosting preference commencing mainly in December 2002, as large numbers of migratory and endemic shorebirds relocated from the dykes to the sandspit.

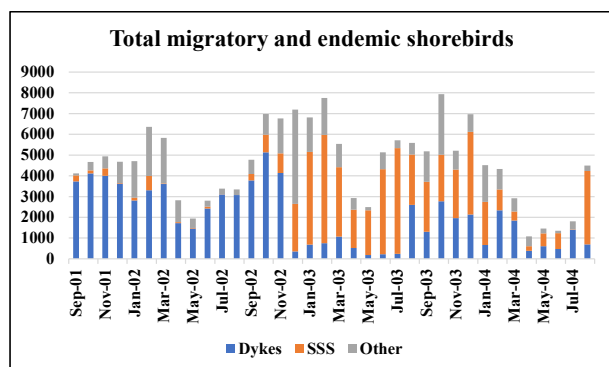


Figure 3. Total migratory and endemic shorebird counts at all three areas, September 2001 – August 2004.

The roost preference for all shorebirds over six seasonal periods is shown in **Figure 4**. In summer 2001/2002 and winter 2002, the greatest proportion were present on the dykes (71% and 82% respectively). Over that same period just 5% and 1% respectively were roosting on the sandspit. In the two following summers there was a relatively even distribution of birds over the three areas with 38% present on the sandspit in 2002/2003 and 39% in 2003/2004. In winter, birds exhibited a much higher preference for the sandspit with 71% present in 2003 and 50% in 2004.

The change in the roosting preference of six migratory species is presented in **Figure 5**. The change for Black-tailed Godwit *Limosa limosa*, Bar-tailed Godwit *Limosa lapponica*, Great Knot *Calidris tenuirostris*, Red Knot *Calidris canutus* and Curlew Sandpiper *Calidris ferruginea* occurred in November and December 2002, almost immediately after the mangrove removal. The change for Far Eastern Curlew *Numenius madagascariensis* was less dramatic as some birds had continued to use the sandspit despite the growth of mangroves, although no birds were present in July and August 2002. While the majority of Black-tailed Godwit, Bar-tailed Godwit, Great Knot and Far Eastern Curlew roosted on the sandspit in summer 2002/2003, this did not continue in summer 2003/2004. Other shorebird species that were present in smaller numbers and which also changed their preference in a similar timeframe were Ruddy Turnstone *Tringa interpres*, Sharp-tailed Sandpiper *Calidris acuminata* and Red-necked Stint *Calidris ruficollis*. Species that did not change their preference were Eurasian Whimbrel *Numenius phaeopus* (which prefer to roost in mangroves), Common Greenshank *Tringa nebularia*, and Marsh Sandpiper *Tringa stagnatilis* (which prefer roosting on the dykes) and Pacific Golden Plover *Pluvialis fulva*.

The change in the roosting preference of four endemic species over the 36 months is presented in **Figure 6**. The change for Red-necked Avocet *Recurvirostra novaehollandiae* and Pied Oystercatcher *Haematopus longirostris* occurred as soon as the mangroves were removed. Pied Stilt *Himantopus leucocephalus* numbers increased after mangrove removal but the majority of birds continued to roost elsewhere. Numbers of Red-capped Plover *Charadrius ruficapillus*, which do not roost on the dykes increased slightly on the sandspit after mangrove removal, but the majority of birds continued to be found on the other areas. Masked Lapwing *Vanellus miles*, did not exhibit any change in site preference.

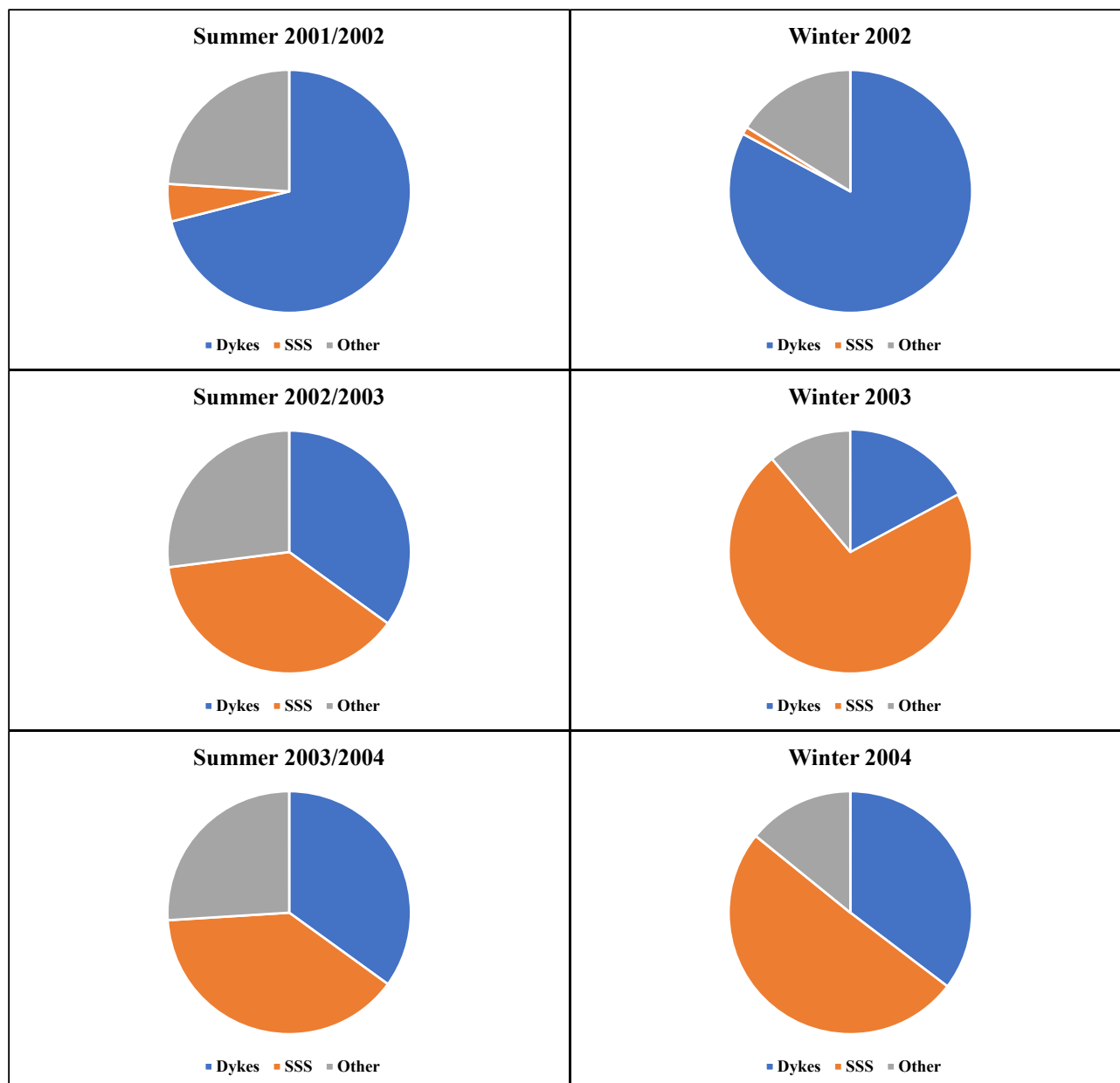


Figure 4. Roost site preference for migratory and endemic shorebirds over six seasonal periods 2001-2004.

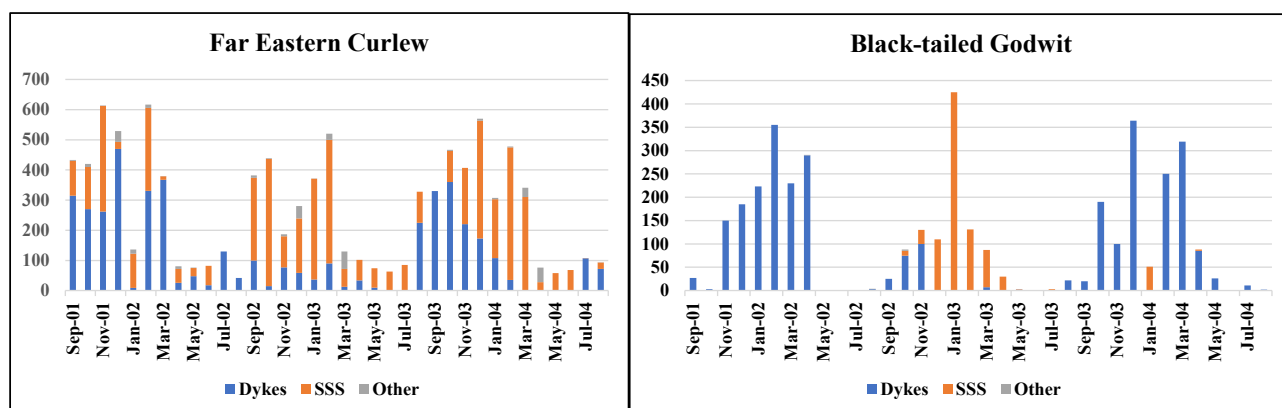


Figure 5. Migratory shorebird counts at three areas, September 2001 – August 2004.

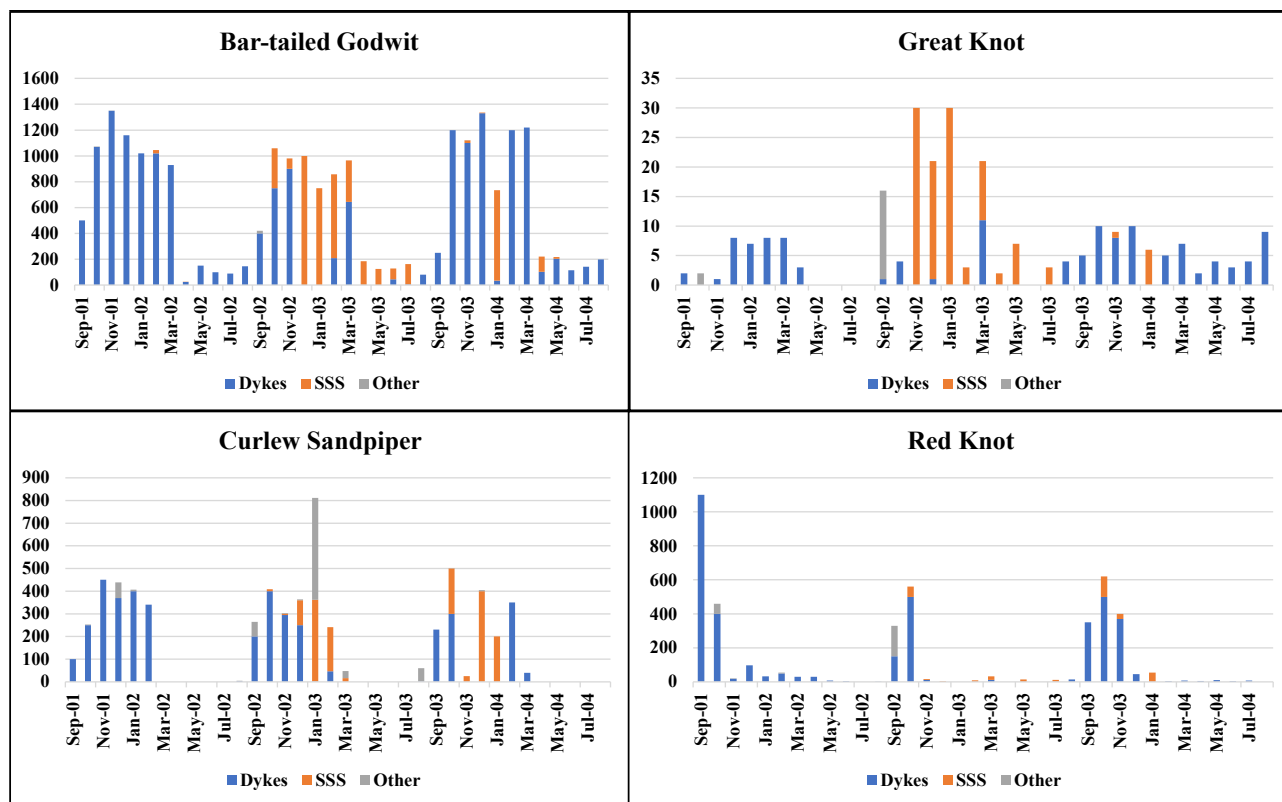


Figure 5 cont. Migratory shorebird counts at three areas, September 2001 – August 2004.

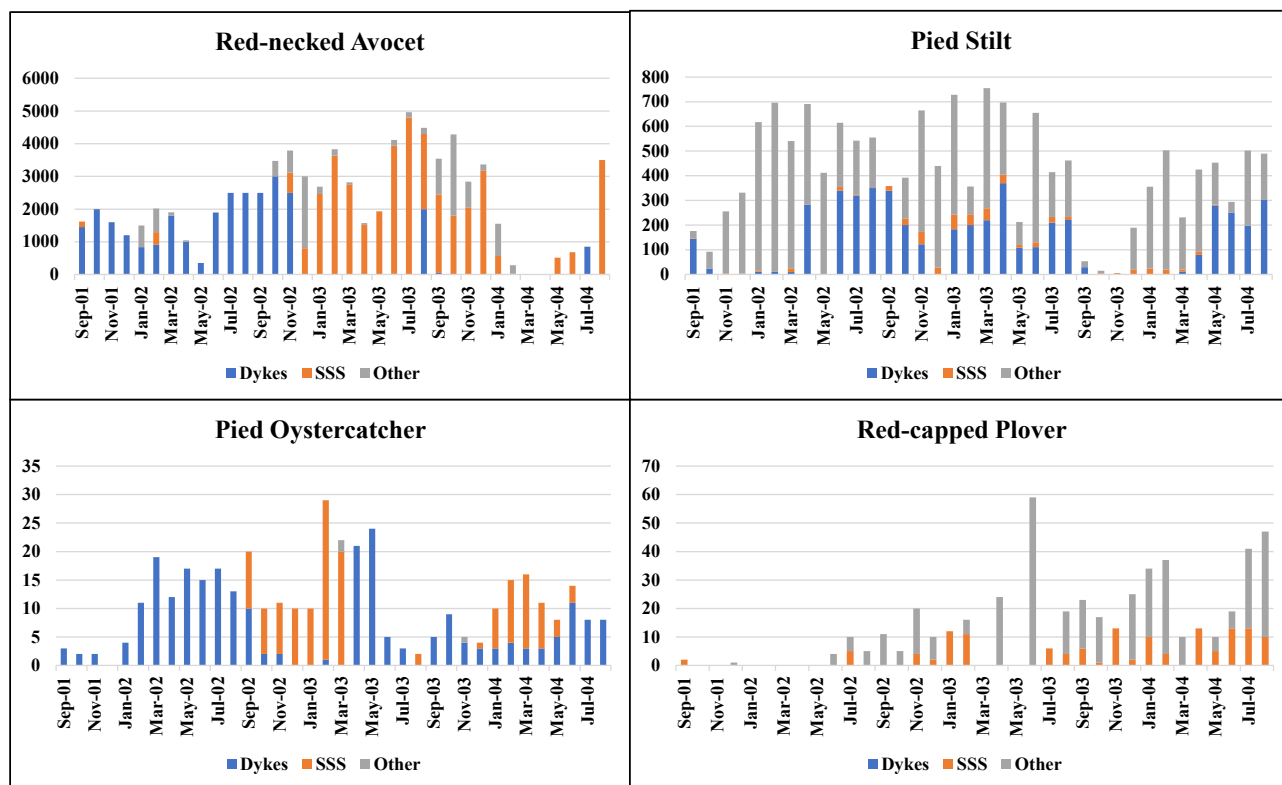


Figure 6. Endemic shorebird counts at three areas, September 2001 – August 2004.

The site preference of migratory shorebirds over the six seasonal periods is shown in **Figure 7**. In summer 2001/2002 and winter 2002, the greatest proportion were present on the dykes (74% and 73% respectively). Over the same two periods just 5% were present on the sandspit. In the summer immediately following mangrove removal, 35% were present on the sandspit in 2002/2003 and 23% in 2003/2004. In winter 2003, 54% of birds preferred the sandspit and in winter 2005 17% were present. In summer 2003/2004 and winter 2004, a majority of migratory shorebirds, still preferred to roost on the dykes (66% and 77% respectively).

The site preference of endemic shorebirds over the six seasonal periods is shown in **Figure 8**. In summer 2001/2002 and winter 2002, the greatest proportion were present on the dykes (68% and 85% respectively). Over the same periods just 4% were present on the sandspit in summer 2001/2002 and none in winter 2002. In the following summers 40% were present on the sandspit in 2002/2003 and 57% in 2003/2004. In winter 2003, 73% of birds preferred the sandspit and in winter 2004, 58% were present. From winter 2003 onwards, the majority of endemic shorebirds preferred to roost on the sandspit.

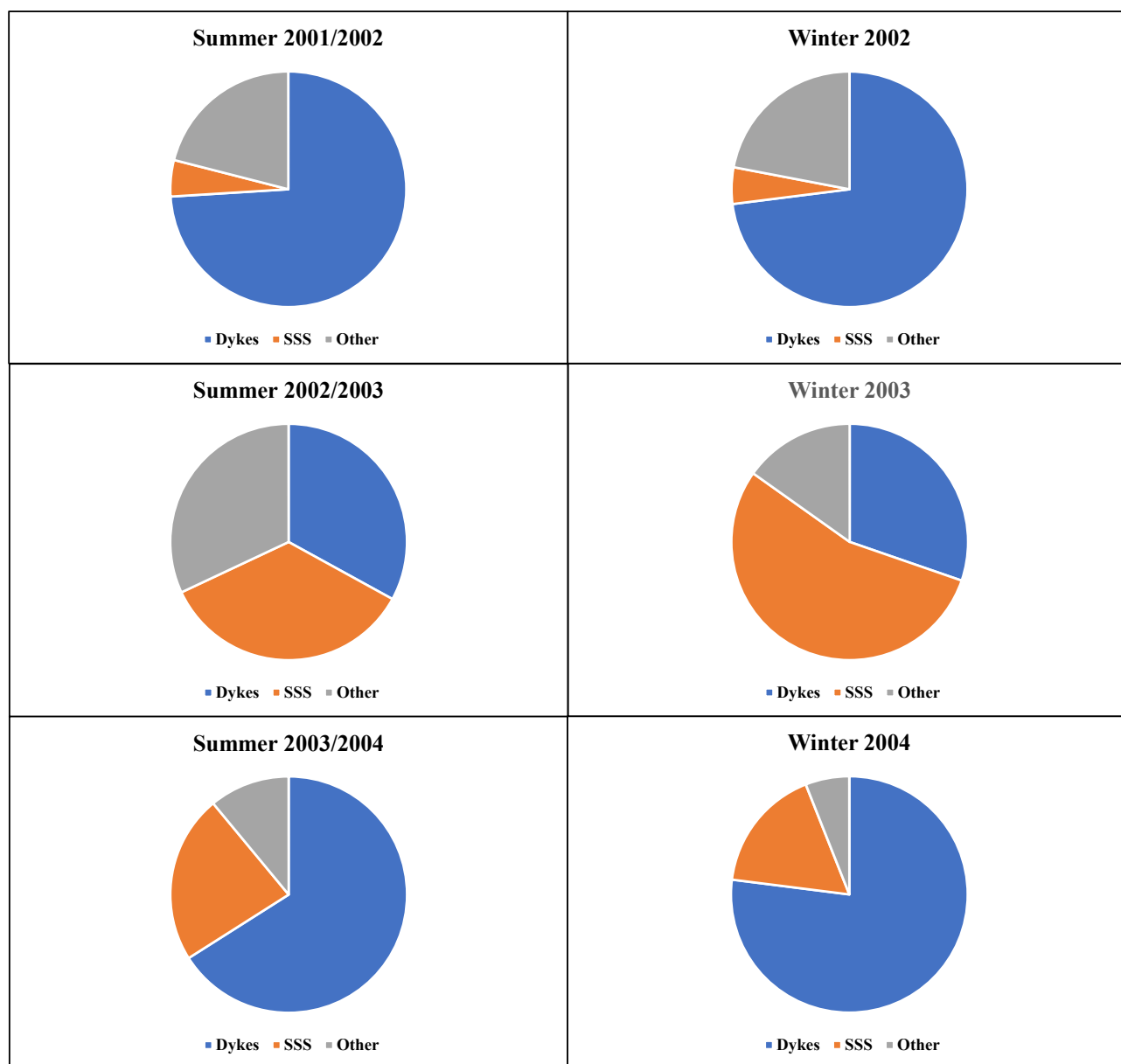


Figure 7. Roosting site preference for migratory shorebirds over six seasonal periods 2001-2004.

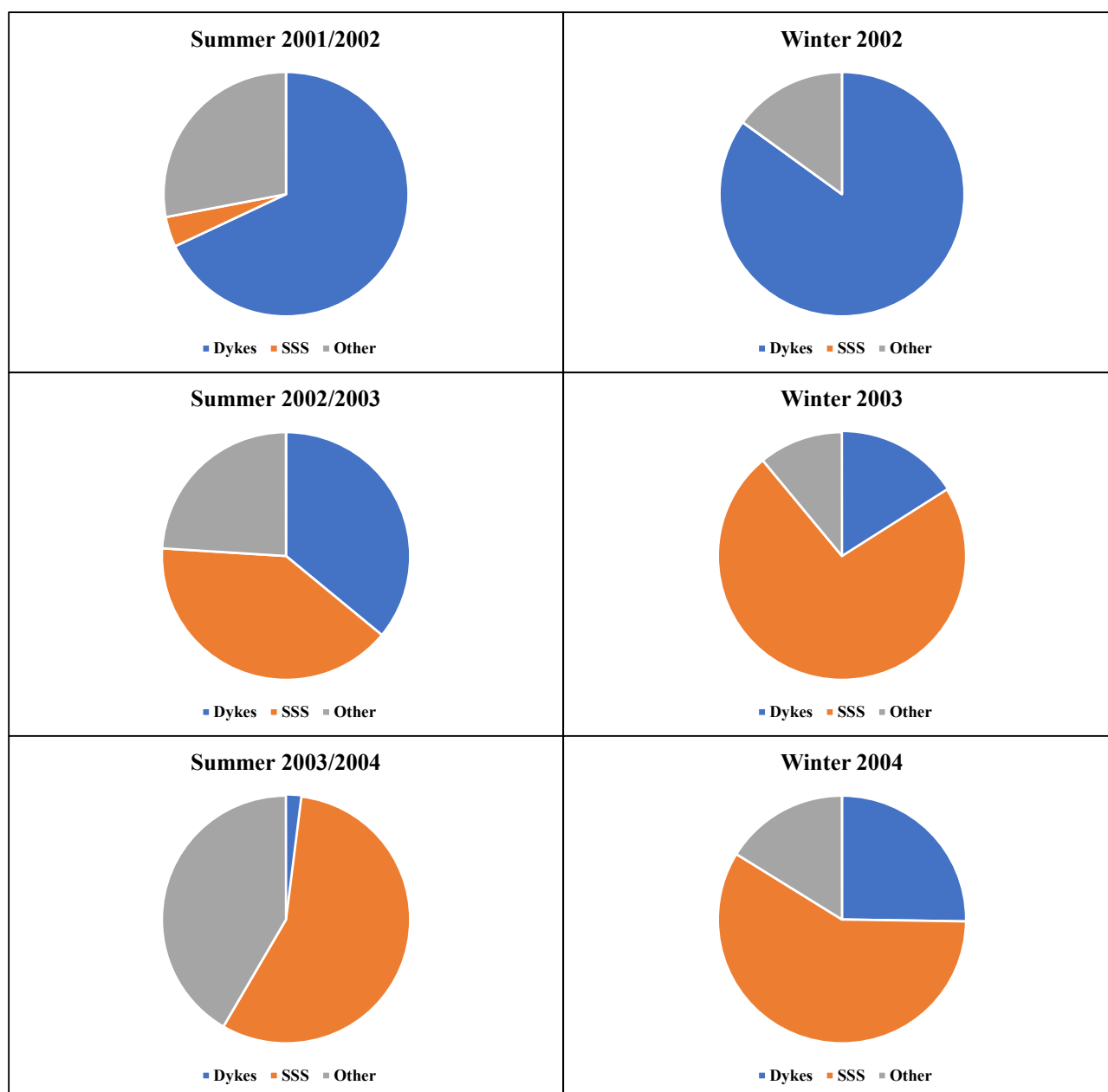


Figure 8. Roosting site preference for endemic shorebirds over six seasonal periods 2001-2004.

DISCUSSION

Due to resource constraints, the monthly surveys of the sites were restricted to Saturday mornings at high tides. Only easily accessible areas were surveyed. Variables such as tide height, river height and the prevailing weather on the day of the survey could potentially influence the number and distribution of birds present. Over the long term these variables would tend to cancel each other out, but the short-term duration of this analysis could potentially result in the inclusion of data anomalies. The results do however tell a very clear story of change, covering a short period of time within a dynamic estuarine environment.

Because only 36 months of data were used for this study the long-term declining population trends for many migratory shorebird species will not have affected the results.

Across the study period, the observed changes in roost preference can be divided into four main stages. Up until August 2002 the dykes were the preferred roost for most species. Then, over a three-month period (September to November 2002), there was incremental change as the sandspit became the preferred roost for some shorebirds. In the following eight months, December 2002 to July 2003, the sandspit became the preferred roost for the greatest number of shorebirds. Subsequently, roosting

preference changed to a more even distribution across the three areas.

The migratory shorebirds that changed their preference in the summer of 2002/2003 were Far Eastern Curlew, Black-tailed Godwit, Bar-tailed Godwit, Great Knot, Red Knot and Curlew Sandpiper. In the following summer of 2003/2004, Far Eastern Curlew continued to use both the sandspit and the dykes for roosting. At the same time, the other four species reverted to the majority of birds preferring to roost on the dykes.

For endemic shorebirds, Pied Oystercatcher changed their roost preference to the sandspit immediately the mangroves were cleared, while the majority of Red-necked Avocet did not adopt the sandspit until January 2003. Small numbers of Pied Stilt roosted on the sandspit after mangrove removal, but the majority of birds continued to roost on the dykes and the other areas. Red-capped Plover never roosted on the dykes. A small number were occasionally present on the sandspit prior to mangrove removal. Subsequently their number increased in November 2002, but the majority of birds preferred to roost at the Other locations.

Red-capped Plover commenced breeding on the sandspit following the removal of mangroves in summer 2002. While the mangrove removal may have partially contributed to this, the major factor was the shingling of the island in the lagoon. This provided a preferred nesting substrate for this species.

It is evident that the removal of the mangroves promoted considerable change in roosting preference of many shorebird species over a period of only four months and re-established Stockton Sandspit as the preferred roost site for many migratory and endemic shorebirds. The changes observed represented a redistribution of existing numbers of shorebirds already using this section of the Hunter Estuary, and did not represent an influx of additional birds from elsewhere.

CONCLUSIONS

Following the removal of mangroves from the northern edge of Stockton Sandspit during September-October 2002, an initial small change in roost preference commenced with some species relocating from Kooragang Dykes to the sandspit at slightly different times over the period September, October and November. This was followed by a major shift that continued for the remainder of the

summer season (2002/2003) and the following winter. While migratory shorebirds subsequently settled into a pattern of relatively uniform preference across the sandspit, dykes and other areas in summer, endemic shorebirds adopted a pattern of strong preference for the sandspit all year round. Ultimately, endemic shorebirds were the major beneficiary of the mangrove removal. Overwintering shorebirds showed a strong preference for diurnal roosting on the dykes. Accounts for individual species describe a more complex story with the timing and extent of the change of roosting preference varying considerably.

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