Small plovers cooling off in human footprints

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The Manning Estuary is located on the north coast of NSW, 34 km north-east of the township of Taree. The estuary is unusual as it has two natural ocean entrances: one at Harrington and the other 12 km to the south, known as the Farquhar Inlet at Old Bar (**Figure 1**). Both entrances are characterised by large sandbars intersected by channels, and islands surrounded by mudflats covered with saltmarsh, mangroves and coastal floodplain forest (Weller *et al.* 2020).

The Manning Estuary is nationally significant for four threatened migratory shorebird species: Far Eastern Curlew *Numenius madagascariensis*, Sanderling *Calidris alba*, Pacific Golden Plover *Pluvialis fulva*, and Double-banded Plover *Anarhynchus bicinctus* (Handreck & Weller 2017; Weller *et al.* 2020, Driessen *et al.* 2025). It supports one of the largest breeding colonies of Little Tern *Sternula albifrons* in NSW (Darnell 2020) and boasts the only Australian records of Aleutian Tern *Onychoprion aleuticus* (Callaghan *et al.* 2020). The area is also important as a breeding site for resident threatened species like the Beach Stone-curlew *Esacus magnirostris* and the Pied Oystercatcher *Haematopus longirostris* (Darnell 2020; BirdLife Australia 2021).

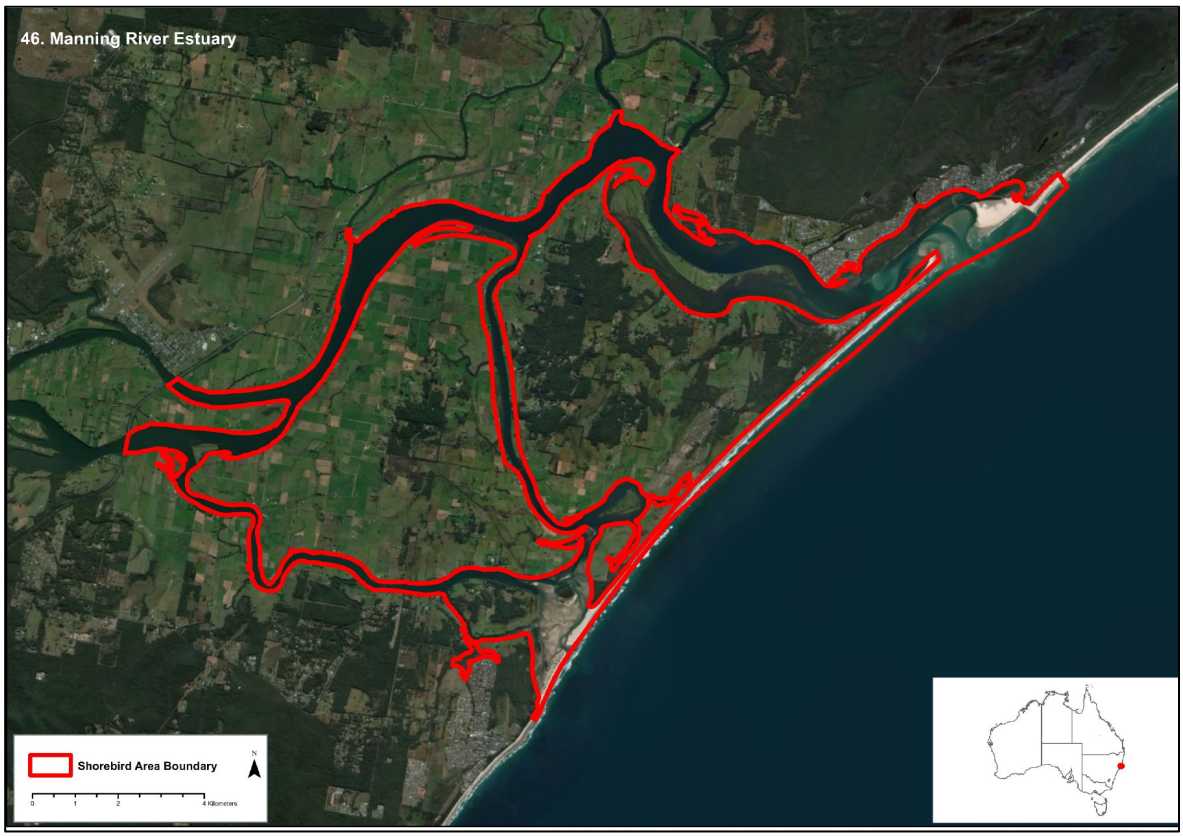

Figure 1. Manning Estuary (site #46 of the BirdLife Australia's Directory of Important Migratory Shorebird Habitat (extracted from Weller *et al.* 2020).

Figure 2. Shorebird survey transects (yellow line: breakwater and red line: sand bar) at Harrington, Manning Estuary, with the red star indicating where the observation took place.

Migratory and resident shorebird data in the estuary have been collected through periodic, and opportunistic surveys by land and boat conducted by different groups and individuals between 1993 and 2016 (Stuart 2008, Stuart 2014; BirdLife Australia 2021). Since 2020, with the support of BirdLife Australia and the NSW Saving our Species program, surveys have been carried out monthly by Hastings Birdwatchers and partner organisations at high tide using a standard procedure, involving multiple teams by boat and on land (BirdLife Australia 2021) (**Figure 2**).

On 11 March 2024 (at 11:00 am), on the return path of the survey route for the Harrington entrance of the Manning River, we observed a group of 12 Double-banded Plovers and 6 Red-capped Plovers *Anarhynchus ruficapillus* resting inside depressions created by recent human footprints in the muddy sand (**Figure 3**); one plover per footprint. At our approach, the plovers moved to the water's edge but they returned to rest inside the footprints after we passed.

The Double-banded Plover is a small plover which breeds in New Zealand and migrates to coastal areas of eastern and southern Australia, exhibiting a high site-fidelity on wintering grounds from February until August, with individuals occupying and defending the same intertidal feeding space in different years (Marchant & Higgins 1993). The Manning Estuary is one of the six main non-breeding Double-banded Plover sites in the Hunter Region along with Worimi Conservation Lands, Port Stephens, Hunter Estuary, Lake Macquarie and Wallis Lake (Williams 2020; Lindsey & Fraser 2022). Although usually segregating from most other shorebird species while sojourning on our shores, Double-banded Plovers are often seen roosting and feeding with Red-capped Plovers and Red-necked Stints *Calidris ruficollis* (Stuart 2020; Lindsey & Fraser 2022; authors' pers. obs.).

The Red-capped Plover is a small, widespread, resident plover in Australia, found along the coastline and less frequently inland around lakes, lagoons and on river shores (Marchant & Higgins 1993). On the coast, the breeding season extends from August to January, whereas inland breeding occurs in response to rainfall and flooding (Marchant & Higgins 1993). Mostly a gregarious species mixing with other similar-sized shorebirds during the non-breeding season, pairs can nest with other waders and terns but can exhibit aggressive

Figure 3. Human footprints on muddy sandflat where Double-banded Plovers and Red-capped Plovers were resting on 11 March 2024. The plovers using the footprints can be seen on the shoreline. (Photo by Christophe Tourenq.)

territorial behaviour against conspecifics during the nesting period (Marchant & Higgins 1993; N. Fraser & C. Tourenq pers. obs.). In the Hunter Region, the Manning Estuary is one of the main nesting and post-breeding aggregation sites along with Port Stephens, Worimi Conservation Lands and the Hunter Estuary (Stuart 2008; Stuart 2014; Stuart 2020; Williams 2020; Stuart & Lindsey 2021; Fraser *et al.* 2024).

To avoid heat stress in tropical areas, shorebirds are known to often roost around sites where a damp substrate lowers the local temperature (Battley *et al.* 2003; Rogers *et al.* 2006). In the Hunter Estuary, Alaskan Bar-tailed Godwits (*Limosa lapponica baueri*) are regularly observed choosing to roost with their feet in water during their summer stay on Kooragang Dykes where there is also opportunity to roost on a dry part of the rock wall (A. Lindsey pers. com.).

On the day of the survey, the weather conditions were sunny and hot with a maximum temperature of 28.9°C, and a relative humidity of 100% at 9:00 am (Taree Airport AWS station; http://www.bom.gov.au/climate/dwo/202403/html/IDCJDW2129.202403.shtml). The high tide was at 9:54 am, about an hour before our observation, which was made during an ebbing tide (http://www.bom.gov.au/ntc/IDO59001/IDO59001_2024_NSW_TP019.pdf). Red-capped Plovers, Sanderlings and Pied Oystercatchers have regularly been observed sheltering in vehicle tracks on Worimi Conservation Lands beach particularly during hot and windy days (N. Fraser & C. Tourenq pers. obs.). However, wind conditions during the period of observation were mild with light WNW winds averaging 13 km/hr (*c* 7 knots; https://www.timeanddate.com/weather/@8347831/historic?month=3&year=2024). Therefore, we inferred that the plovers were benefitting from the cooler damp conditions inside the footprints to lower their body temperatures, rather than using them to get protection from the wind. A similar behaviour by a Common Greenshank *Tringa nebularia* was observed by one of us in February 2025; the bird was in a depression in the mud at The Perch Hole, Innes Nature Reserve near Lake Cathie (P. West pers. obs.).

Many NSW coastal sites, including the Manning Estuary, experience high levels of human disturbance particularly during the summer holidays that coincide with the presence of migratory and nesting resident shorebirds. Disturbance can have non-lethal effects, such as heightened vigilance leading to missed opportunities to feed, loss of

critical rest time, energy expenditure associated with fleeing, and temporary-to-permanent feeding or roosting site abandonment, jeopardizing the need to put on weight in preparation for migration (Spencer 2010; Williams *et al*. 2024). Our observation joins previous observations (e.g. Lunardi & Macedo 2014) that in some instances, shorebirds can adopt strategies to take advantage of human presence.

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