

Reconciling mangrove restoration with shorebird conservation

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Received: July 7, 2026; Accepted: September 9, 2026; Published Online: September 10, 2026; <https://doi.org/10.59717/j.xinn-life.2026.100253>

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Citation: Wen K. and Jiang A. (2027). Reconciling mangrove restoration with shorebird conservation. *The Innovation Life* 5:100253.

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China's mangroves declined sharply as a result of land reclamation, aquaculture and coastal development. Over the past two decades, however, they have entered a phase of rapid recovery, supported by protected-area expansion, conversion of aquaculture ponds to mangroves and targeted restoration programs. The study by Yang et al.¹ therefore provides timely and important national-scale evidence for assessing the ecological consequences of this recovery. The study shows that mangrove area in China increased substantially during the study period, alongside increases in recorded avian richness and occurrences of IUCN-listed threatened species. It further suggests that increased mangrove area may influence avian diversity by improving environmental conditions and food-web structure. However, the reported avian patterns require cautious interpretation because the citizen-science records were not adequately calibrated or corrected for sampling bias. The patterns reported by Yang et al.¹ might be mainly associated with increased survey effort, which can result in more species, including threatened species, being detected even without ecological change. Population trends of migratory birds are influenced by habitat suitability at both breeding and non-breeding sites. Increased records of threatened species such as the Oriental Stork (*Ciconia boyciana*) and Chinese Crested Tern (*Thalasseus bernsteini*) may therefore reflect improved habitat suitability at breeding sites, rather than mangrove recovery in non-breeding areas alone. The reported patterns should therefore not be taken as evidence that mangrove recovery benefited all avian guilds equally.

Mangroves are unquestionably high-value intertidal habitats. A previous

synthesis has shown that mangroves provide shelter, foraging grounds and nursery areas for diverse terrestrial and marine animals through their vegetation structure, root architecture and food-web processes.² For birds, mangroves are commonly used by several families, including Ardeidae (especially herons and egrets), Alcedinidae (kingfishers) and Rallidae (rails). Some ardeids also nest in mangrove stands. Yet birds that strictly depend on mangroves are not the majority. For many species, mangrove use occurs within a broader habitat mosaic formed by mangroves and adjacent wetlands.² Mangroves therefore cannot replace the distinct ecological functions of other intertidal habitats. For migratory shorebirds, apparently empty tidal flats are not ecological voids, but core spaces for foraging, refueling and completing the migratory cycle.

Shorebirds can be understood as integrators and indicators of ecological processes on tidal flats.³ These birds are specialized for highly dynamic intertidal environments, with bill morphology, leg length, sensory capacity, digestive physiology and foraging mode corresponding to tidal stage, sediment type and benthic prey availability. Their distribution, feeding intensity and residence time on tidal flats can therefore reflect habitat suitability, shaped by factors such as foraging conditions, exposure to disturbance and predation, and tidal connectivity to high-tide roosts. Across the East Asian-Australasian Flyway, many migratory shorebird populations have declined rapidly, with annual declines of up to 8% reported among taxa that rely on Yellow Sea tidal flats as stopover habitat.⁴ More broadly, the 2024 IUCN Red List update moved 16 migratory shorebird species to higher threat categories. Thus, an overall increase in recorded avian diversity cannot replace a separate assessment of open tidal flats and the species that depend on them, especially

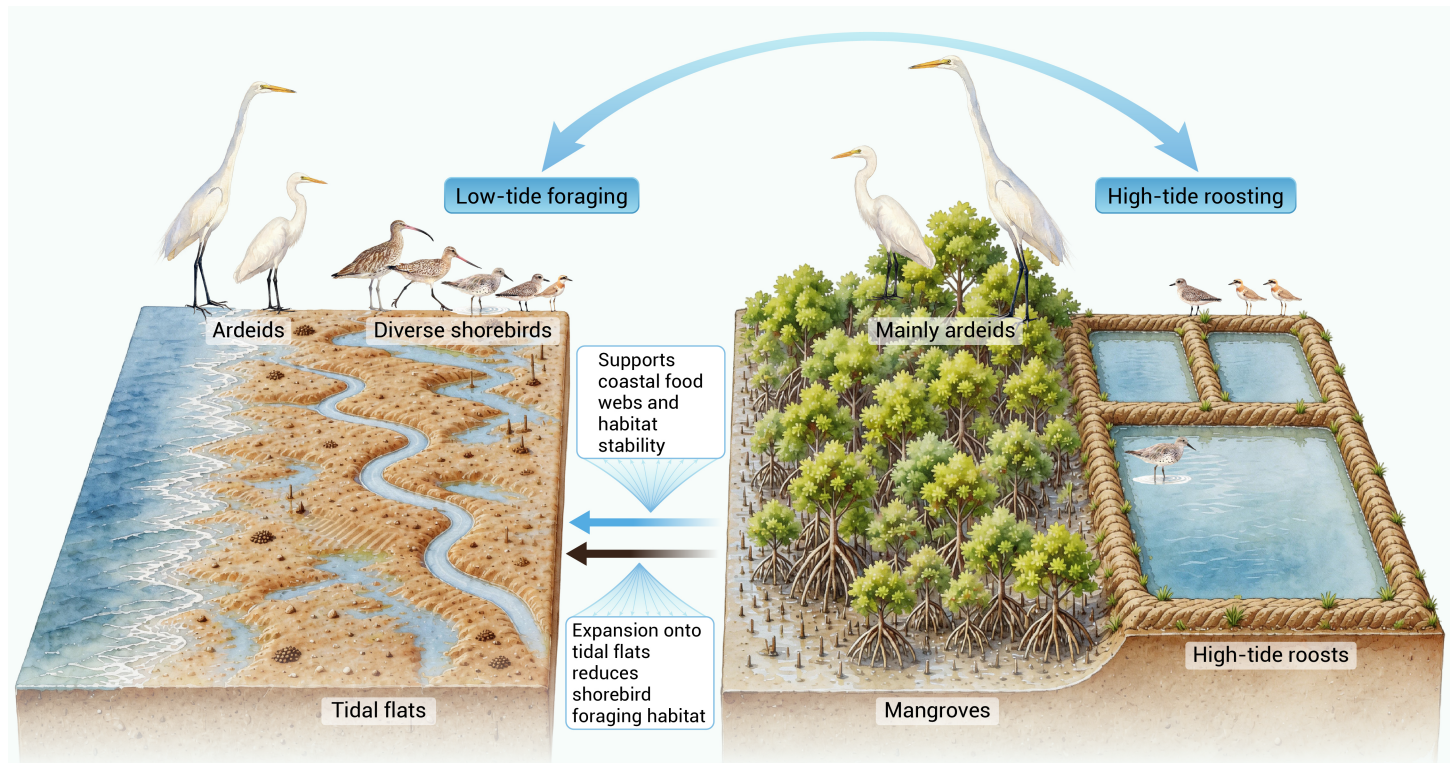


Figure 1. Context-dependent effects of mangrove expansion on shorebird conservation Mangroves, open tidal flats and nearby high-tide roosts form an interconnected coastal habitat mosaic. Mangroves support coastal food webs, help stabilize coastal habitats, and can provide roosting sites for some birds, including ardeids. Open tidal flats provide low-tide foraging habitat for shorebirds and other birds, whereas high-tide roosts provide resting habitat when tidal flats are submerged. When mangroves expand onto functionally important open tidal flats, they can reduce the foraging habitat available to shorebirds.

shorebirds.

This points to an emerging challenge in coastal wetland management: mangrove expansion and shorebird conservation may not always be spatially aligned (Figure 1). Migratory shorebirds rely on open tidal flats for feeding at low tide and on nearby high-tide roosts for resting and digestion after tidal inundation. Together, these feeding and roosting sites form a linked habitat network. Shorebirds seldom use densely vegetated habitats such as mangroves. If mangrove planting programs prioritize short-term area gains without adequate assessment of site selection, species suitability and long-term ecological function, important shorebird habitat may be treated as available space for planting. In parts of southern China, mangroves have expanded onto functionally important open tidal flats through natural spread or deliberate planting, reducing shorebird foraging habitat.⁵ An overall increase in recorded avian diversity should therefore not be interpreted as evidence that increasing mangrove area will generally improve bird conservation outcomes. Management decisions should consider where mangrove expansion occurs, which habitats it replaces and which avian guilds are affected.

The decision framework proposed by Choi et al.⁵ provides a useful basis for applying these considerations within a coastal wetland restoration approach that accounts for habitat mosaics and ecological functions. Before a mangrove restoration project is implemented, the functional importance of the target area for shorebirds should be assessed. Where key open tidal flats are involved, restoration planning should evaluate how proposed mangrove planting would affect tidal flat extent, benthic food resources and roosting space. Restoration sites should preferentially include degraded mangroves, abandoned aquaculture ponds, damaged shorelines or areas with historical mangrove occurrence. Functionally important open tidal flats should not be treated as vacant space for planting.

From this perspective, the study by Yang et al.¹ documents China's mangrove recovery at a national scale but should not be understood as a general justification for mangrove planting in all coastal settings. High-quality

restoration should not be equated with maximizing the area of a single habitat type. It should maintain an appropriate configuration of mangroves, open tidal flats, salt marshes, tidal channels and other functionally important coastal wetlands. In other words, the goal of mangrove restoration should not simply be to plant more trees, but to plant them in the right places while protecting the different wetland-dependent avian guilds.

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FUNDING AND ACKNOWLEDGMENTS

This work was supported by the Guangxi Science and Technology Base and Talent Special Project (AD25069066) and the Innovation Project of Guangxi Graduate Education (YCBZ2025012). The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

AUTHOR CONTRIBUTIONS

All authors contributed to the manuscript and approved the final version.

DECLARATION OF INTERESTS

The authors declare no competing interests.