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Site fidelity of American Oystercatcher *Haematopus palliatus* in the Cape Romain Region, South Carolina, United States of America

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Site fidelity of American Oystercatchers *Haematopus palliatus* to both high-tide roosts and nesting habitats remains less-well studied than other aspects of their ecology. During high tides, shorebirds concentrate at roosts primarily to sleep and preen, and the loss of high-quality roost habitat has been linked to population declines in several species. Similarly, high-quality nesting habitat reduces risks from predation, flooding, and intraspecific competition. Strong site fidelity provides additional benefits by allowing individuals to become familiar with local resources and threats. We evaluated intra- and inter-annual fidelity to nonbreeding roosts, fidelity to breeding sites, and natal philopatry in a largely undeveloped coastal landscape, the Cape Romain Region in South Carolina. This region supports one of the largest resident breeding populations of American Oystercatchers along the Atlantic coast of the USA and roughly one third of the nation's wintering population. From 2001–2014, on 713 days, we banded 290 adults and 141 chicks and conducted resighting surveys during spring high tides across beaches and shell rake roosts. Both resident and migrant birds exhibited strong fidelity to nonbreeding sites, while resident birds were even more faithful to their breeding locations. The mean distance between successive nest sites was just over 1 km, compared to an average shift of about 3 km among nonbreeding sites (maximum 43 km). Movements between breeding and nonbreeding sites averaged approximately 4 km. Natal fidelity was also high: birds first observed paired on a breeding site did so on average 5 km from their natal site (maximum 18 km), at a mean age of 5 years. In a region characterized by abundant oyster-reef foraging habitat and low disturbance, these patterns likely reflect the predictability of prey resources and the availability of protected roosts.

Keywords

movement

high-tide roost

shorebird

habitat use

band resighting

nest site

INTRODUCTION

Site fidelity, defined as an individual's repeated return to a previously occupied area, is a widespread behavioral strategy across the animal kingdom (Greenwood 1980). Fidelity can occur across multiple spatial and temporal scales, including breeding sites, nonbreeding roosts, migratory stopovers, and natal areas, and often varies among individuals, populations, and life-history stages (Steenhof & Peterson 2009, Bai & Severinghaus 2012). By repeatedly using familiar locations, animals may benefit from improved knowledge of food availability, predator

distributions, and landscape features, which can enhance survival and reproductive success (Oring & Lank 1984, Fairweather & Coulson 1995, Rogers *et al.* 2006). However, site fidelity is not universally advantageous; its benefits depend on environmental stability and habitat quality, and it may become maladaptive when conditions change rapidly due to natural or anthropogenic disturbances (Merkle *et al.* 2022).

In shorebirds, site fidelity has been documented across both breeding and nonbreeding periods, with individuals often returning to the same nesting territories, foraging areas, and roosts year after year (Mittelhauser *et al.* 2012, Gratto-Trevor *et al.* 2016, Sandercock & Gratto-Trevor 2023, Handmaker *et al.* 2024). In coastal systems, high tides frequently inundate foraging areas, concentrating shorebirds at communal roost sites, particularly during spring tides when tidal heights are greatest (Prater *et al.* 1977, Rosa *et al.* 2006, Milton & Harding 2011). Communal roosting can reduce predation risk through group vigilance, even in species that defend solitary foraging territories (Colwell 2010, Handmaker *et al.* 2024). High-quality roost sites typically offer low disturbance, reduced thermal stress, and protection from wind (Luis *et al.* 2001, Rogers *et al.* 2006, Peters & Otis 2007). Fidelity to such sites may persist even when conditions are suboptimal, if the energetic or survival costs of relocating are high (Rogers *et al.* 2006). Across species, roost selection is often closely linked to the distribution of nearby foraging habitat (Sitters *et al.* 2001, Sanders *et al.* 2013, 2021, Santiago-Quesada *et al.* 2014). For example, Eurasian Oystercatchers *Haematopus ostralegus* form larger roosts where foraging habitat is abundant (Swennen 1984, Belo *et al.* 2022), and Black Oystercatchers *H. bachmani* preferentially roost near feeding areas (Ware *et al.* 2023).

Similarly, site fidelity during the nesting season can confer important fitness benefits. High-quality nesting sites can reduce the risks of predation, flooding, and competition while minimizing travel distances to foraging areas (Lauro & Nol 1995, Jodice *et al.* 2014, Cunningham *et al.* 2016). For example, in American Oystercatchers *H. palliatus*, nest sites located closer to foraging areas are associated with higher parental attendance and improved reproductive outcomes (Thibault *et al.* 2010). Consequently, many avian species exhibit strong breeding site fidelity across years, as returning to familiar nesting territories can facilitate rapid territory establishment, mate retention, and efficient use of foraging areas (Johnson & Walters 2008, Friedrich *et al.* 2015, Patrick & Weimerskirch 2017, van Leeuwen & Jamieson 2018). Conversely, changing breeding sites between seasons can incur energetic costs associated with acquiring new territories and mates, potentially leading to missed breeding opportunities (Danchin & Cam 2002, Bruinzeel 2007).

Natal site fidelity refers specifically to fidelity to the area where an individual was born rather than to breeding or nonbreeding sites occupied later in life (Greenwood & Harvey 1982). It operates over longer temporal scales, influencing population structure, gene flow, and recolonization potential, and can be influenced by a species' mating system and an individual's sex (Greenwood 1980, Clobert *et al.* 2001).

Despite these advantages, site fidelity may also incur costs, e.g. due to variation in habitat quality, resulting in variation across species or individuals. Some shorebirds exhibit low site fidelity in response to variable environmental conditions, such as fluctuating predation risk or snow cover on breeding grounds (Kwon & Kempenaers 2023). Within species, fidelity often depends on prior reproductive success, with unsuccessful breeders more likely to relocate in subsequent years (Hoover 2003), and in some cases, changing sites following mate loss can improve reproductive success (Culina *et al.* 2015). During the nonbreeding season, fidelity to roost sites may likewise vary in response to disturbance, predator distribution, and food availability (Conklin & Colwell 2007, Lilleyman *et al.* 2024). As coastal habitats are increasingly altered or lost, individuals with lower site fidelity may be better able to adjust to changing conditions by shifting to higher-quality sites (Chan *et al.* 2023, Donnez *et al.* 2023).

In South Carolina, the American Oystercatcher is a 'species of greatest conservation need' (South Carolina Department of Natural Resources 2025). Therefore, understanding its spatial use patterns, including site fidelity across multiple spatial and temporal scales, is essential for designing effective surveys, interpreting population trends, and guiding habitat management (Brown *et al.* 2001). South Carolina is a key component of the species' migratory strategy, supporting approximately one-third of the USA's Atlantic and Gulf coast populations during the nonbreeding season (Sanders *et al.* 2004, 2008, Brown *et al.* 2005). In South Carolina, during the nonbreeding season at high tides, American Oystercatchers roost primarily on linear shell rakes, narrow mounds of shell, largely composed of Eastern Oyster *Crassostrea virginica*, that form along shorelines through wind and wave action (Sanders *et al.* 2004), dispersing at low tide to forage individually on live oyster reefs and adjacent habitats (Hand *et al.* 2010, Sanders *et al.* 2013). They maintain relatively consistent foraging areas within a nonbreeding season, with distances between roost and foraging sites averaging approximately 1.5 km (Sanders *et al.* 2013). Even in areas with extensive foraging habitat, declines in high-tide roost availability due to anthropogenic factors may limit population size (Brush *et al.* 2017), raising concern given links between roost loss and shorebird population declines elsewhere (Belo *et al.* 2022). Despite this, fidelity to nonbreeding roost sites in American Oystercatchers remains poorly quantified.

South Carolina supports one of the largest breeding populations in the USA (Sanders *et al.* 2008). During the breeding season, American Oystercatchers nest across multiple habitat types, including shell rakes (45%), barrier island beaches (28%), and estuarine islands (27%; Sanders

et al. 2008). Within a breeding season, pairs may renest multiple times at the same location following failure (Jodice *et al.* 2014), but the degree to which individuals reuse nesting territories across years remains unknown (AMOYWG *et al.* 2020).

In this study, we examined site fidelity in American Oystercatchers within the Cape Romain Region of South Carolina, a largely undeveloped 50 km stretch of coastal landscape with minimal human disturbance, that hosts both resident and nonbreeding individuals. Using observations of banded individuals, we quantified intra- and inter-annual movements among nonbreeding roost locations and breeding territories and assessed spatial relationships between roost and nest locations. We predicted that individuals would show fidelity to roost sites and that resident American Oystercatchers would exhibit higher fidelity to nonbreeding roosts than migratory individuals, facilitating regular access to breeding territories throughout the year (Sanders *et al.* 2004). Although our assessment is inherently biased toward individuals that remain faithful to the study area, movements of adults beyond the Cape Romain Region are likely limited. Previous research along the Atlantic coast of the USA found the probability of breeding American Oystercatchers returning to the same region in the following year is high (91%), with only 9% emigrating from a given study area. Among those emigrants, the annual probability of returning is 24% (Murphy *et al.* 2017). Similarly, a 21-year study of 10,918 adult Eurasian Oystercatchers during the nonbreeding season reported the maximum intra-annual movements of 30 km and inter-annual movements of 24 km (Rehfisch *et al.* 2003).

Finally, we assessed natal philopatry by examining band resightings of chicks fledged in the Cape Romain Region that returned to breed. We predicted that individuals hatched in this region would exhibit fidelity to their natal area, consistent with previous studies of oystercatcher species (McGowan *et al.* 2005, Scott *et al.* 2011). Given the high proportion of the USA's population supported by the Cape Romain Region, understanding fidelity across roosting, nesting, and natal scales should inform effective conservation planning at both regional and species-wide levels (Schulte *et al.* 2010).

METHODS

Site description

The study was conducted from 2001 to 2014 in the Cape Romain Region, defined as the coastal area of South Carolina from Cape Romain National Wildlife Refuge south to Isle of Palms (33°05'N, 79°20'W – 32°49'N, 79°45'W; Fig. 1). This coastal region consists of barrier islands, estuarine islands, shell rakes, saltwater marshes, creeks and shallow bays. Intertidal oyster reefs, primarily consisting of Eastern Oysters, Ribbed Mussels *Geukensia demissa* and Hard Clams *Mercenaria mercenaria*, occur along edges of creeks and in bays on mudflats and the Atlantic Intracoastal Waterway passes through this region (Parkman 1983). The Cape Romain Region is accessible only by boat and is relatively pristine and undisturbed by humans, especially during the winter. This area is part of the Cape Romain-Santee Delta Western Hemisphere Shorebird Reserve Network Site, designated as a site of International Importance (WHSRN 2025).

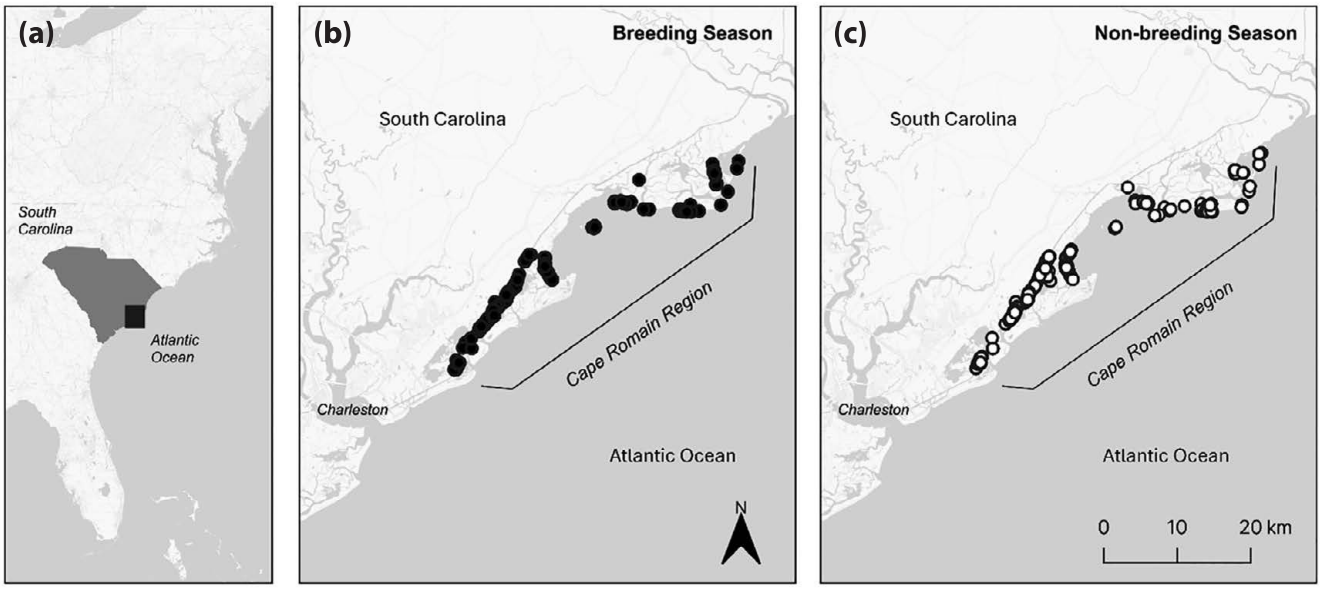


Fig. 1. Cape Romain Region, on the coast of South Carolina, USA. This 50 km stretch consists of barrier islands, estuarine islands, saltwater marshes, creeks and shallow bays. **(a)** Cape Romain Region's location along the coast of South Carolina; **(b)** locations (n = 492; filled circles) of nesting American Oystercatchers in the Region, and **(c)** locations (n = 183; open circles) of roosting American Oystercatchers during the nonbreeding season.

The Cape Romain Region supports about one-fifth (approximately 1,900 individuals) of USA's American Oystercatcher population wintering on the Atlantic and Gulf coasts (Sanders *et al.* 2004, Brown *et al.* 2005) and approximately 230 breeding pairs (Sanders *et al.* 2008). Migratory individuals arrive in the region in late August and leave as late as early April, with peak numbers occurring from December to February (Sanders *et al.* 2004). Birds that breed in Atlantic Coast states north of South Carolina, including marked populations monitored as far north as Massachusetts, are observed in the Cape Romain Region during the nonbreeding season. This highlights the region's critical importance as nonbreeding habitat for the entire USA Atlantic coast breeding population (AMOYWG *et al.* 2020). During the nonbreeding season, residents and migrants mix within the same flocks (AMOYWG 2025). Annual survival rates of adult American Oystercatchers are high (90%) with no difference in survival rates between resident and migratory populations (Murphy *et al.* 2017).

Data collection

Over the 13 years of the study, we captured birds using different methods and in a variety of locations as a function of their seasonal use of habitats. During the nonbreeding season at spring high tides, roosting flocks of American Oystercatchers were captured on beaches and shell rakes with cannon nets. During the breeding season, paired adults were captured on territory using a box trap over a nest or a decoy and leg-hold noose mats (McGowan & Simons 2005). Pre-fledging juveniles were captured by hand on nesting territories when they were between 10 and 25 days old. On each individual, one U.S. Geological Survey metal leg band was placed on the tarsus, along with one or two identical unique engraved color leg bands placed on the tibia or with a unique combination of color wrap-around bands placed on the tarsus or tibia. When American Oystercatchers were captured during the nonbreeding season, they were classed as adults if they had an orange bill and bright yellow iris, or as immatures if the bill was orange and brown and the iris was dull yellow brown (AMOYWG *et al.* 2020).

Our visits to sites and observations of birds were scheduled according to seasons that we identified based on aspects of the ecology and behavior of American Oystercatchers. American Oystercatchers begin nesting late March / early April although most pairs are territorial from early March (Jodice *et al.* 2014). Both parents incubate eggs and raise young (AMOYWG *et al.* 2020). Post-breeding birds form flocks in early August (Sanders *et al.* 2004), thus we divided the annual cycle into breeding season (March 1 to July 31) and nonbreeding season (August 1 to end of February). Observation data from January and February were assigned to the previous year to keep all nonbreeding data in one season. Each year we visited breeding territories twice from March through July to band and/or search for banded birds. During the nonbreeding season, opportunistic surveys were conducted throughout the Cape Romain Region with all possible roosting habitat visited at least once a year. Year round, only observations of adults (determined through coloration and or nesting observations) during daylight hours and during high tides were used.

American Oystercatchers were categorized as either resident or migrant for analysis purposes. If an individual was observed paired during the breeding season in the study area, it was considered a resident. If a bird observed in the nonbreeding season in our study area was either observed north of the study area in the breeding season (none were observed south) or not observed in our study area during the breeding season, then it was categorized as a migrant. Efforts to find banded American Oystercatchers occurred between approximately 1,400 km north and 300 km south of our study site through a reliable network of reported observations (AMOYWG *et al.* 2020).

All capture and resighting locations were recorded with a handheld Global Positioning System unit. Marked individuals in large roosting flocks (up to 700 individuals) often shifted positions within the flock during a survey, and thus nonbreeding roost locations were only accurate to ± 50 m. If an individual was observed during nonbreeding season surveys more than once in a given week, one location was randomly selected for the analysis.

Data analysis

To examine intra-annual movement, we measured each individual's movement within a season by calculating the Euclidean distance between each observed location and its previous location using the *st_distance* function in the 'sf' package in R (Pebesma 2018). Single observations of an individual during a season were excluded. Intra-annual movement was only calculated for the nonbreeding season. In the breeding season, movements are likely minimal, because banded adults generally remain in the same territory throughout the season (Jodice *et al.* 2014).

To examine inter-annual movement, we first calculated the centroid of all locations in each season and year for each individual American Oystercatcher using the *centroid* function in the 'amt' package (Signer *et al.* 2019). We then used these centroids to calculate the Euclidean distance between breeding and nonbreeding locations, subsequent breeding locations, and subsequent nonbreeding locations, using the *st_distance* function in the 'sf' package (Pebesma 2018). This measure – 'centroid shift' – provides an index of movement from one season to the next.

We compared migrant and resident site fidelity to nonbreeding sites between years and compared their movements within a single nonbreeding season. We used Wilcoxon signed-rank tests for these comparisons, as data were non-normally distributed. All analyses were performed using R Statistical Software (v4.4.2; R Core Team 2024).

Natal site fidelity was examined by measuring the Euclidean distance from where a chick was banded to where it was observed paired on a likely nesting territory during a subsequent breeding season. Once a bird was observed paired on a nesting territory and in adult coloration it was categorized as an adult. Data are presented as mean ± standard deviation.

RESULTS

From 2001 to 2011, we banded 290 adults (85 and 205 during the breeding and nonbreeding seasons respectively) and 141 chicks. Banding and resighting efforts from 2002 to 2014 produced observations at 675 unique locations on 713 survey days (288 in the breeding season, 425 in the nonbreeding season). In total, 3,466 records of uniquely marked American Oystercatchers were obtained. We excluded observations of immature birds and multiple observations of the same individual within a breeding season. We further removed 362 records in which individuals were observed more than once per week during the nonbreeding season (mean records removed per individual = 1.1 ± 2.3). After applying these filtering criteria, 2,417 observations remained for analysis.

During the nonbreeding season, individuals were observed a mean of 1.7 ± 1.3 times within a single year (range 1–11). When analyses were restricted to years in which individuals were seen more than once, the mean increased to 2.9 ± 1.4 (2–11) observations of an individual per year. Individuals were observed during the nonbreeding season in a mean of 3.4 ± 2.1 (1–10) years; restricting analyses to birds observed more than one nonbreeding season increased this value to 4.0 ± 1.2 (2 – 10) years. During the breeding season, individuals were observed in a mean of 3.1 ± 1.7 (1–9) years. When analyses were restricted to individuals observed in more than one breeding season, individuals were detected in a mean of 3.4 ± 1.6 (2–9) years. A total of 597 observations of breeding individuals were included in the analysis. Of these, 65 observations were of individuals in a pair where both were banded (9 pairs).

Overall, the mean shift in centroids between nonbreeding seasons was 3.0 ± 4.7 km, while the mean distance within a nonbreeding season was 2.9 ± 4.8 km (Table 1). Residents and migrants did not show significant differences in distances, either between nonbreeding seasons (Wilcoxon's $W = 66920$, $p = 0.1$; Fig. 2a) or within a single nonbreeding season ($W = 64420$, $p = 0.285$; Fig. 2b).

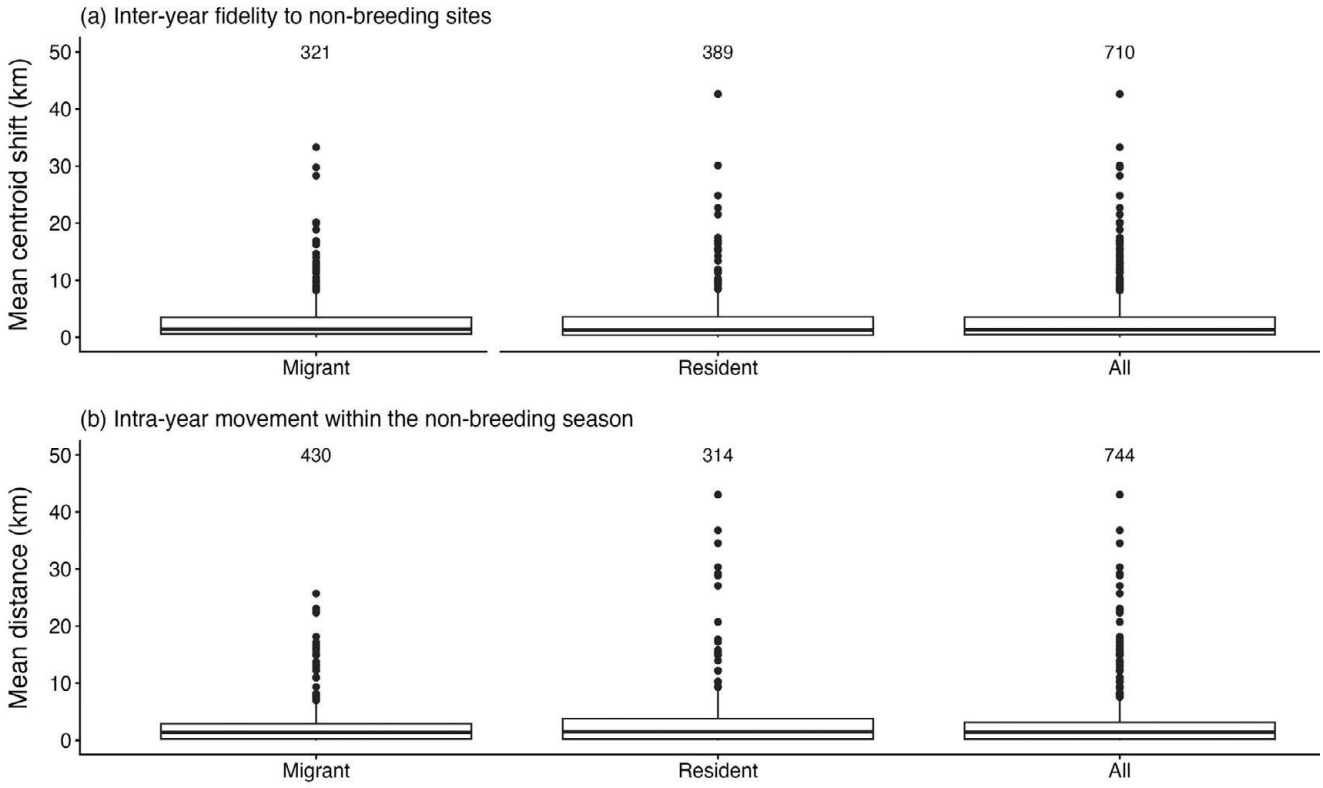


Fig. 2. American Oystercatcher resident and migrant inter- and intra-annual fidelity to nonbreeding sites, in the Cape Romain Region of South Carolina. **(a)** Movement from one season to the subsequent season as centroid shift, the distance from the center of the locations of one individual bird in one season (the centroid) to the centroid in a successive year. **(b)** Movement during one season as the mean of the distances between successive observations of individual American Oystercatchers. Boxplots show the spread of movement distance across individuals, with points indicating individuals that moved more than 1.5 times the interquartile range over the 75th percentile. Numbers at the top of the plot indicate the number of movements included in the analysis.

Table 1. Adult American Oystercatcher movement, mean ± SD, within one year (intra-annual) and between years (inter-annual) in the Cape Romain Region, South Carolina from 2001 to 2014. Nonbreeding season is August 1 to end of February and breeding season is March 1 to July 31. Resident American Oystercatchers remain in the study area all year and migrant American Oystercatchers nest north of the study area and spend the nonbreeding season in the Cape Romain Region.

	Mean distance ± SD (km)	Range (km)	# of movements
Intra-annual non-breeding season			
All	2.9 ± 4.8	0–43.0	744
Migrant	2.6 ± 3.9	0–25.7	430
Resident	3.4 ± 5.7	0–43.0	314
Inter-annual non-breeding season			
All	3.0 ± 4.7	0–42.7	710
Migrant	3.1 ± 4.4	0–33.3	321
Resident	3.0 ± 5.0	0–42.7	389
Inter-annual breeding season			
Resident	1.0 ± 3.0	0–23.2	472
Breeding season to non-breeding season			
Resident	4.2 ± 6.3	31–43.2	151

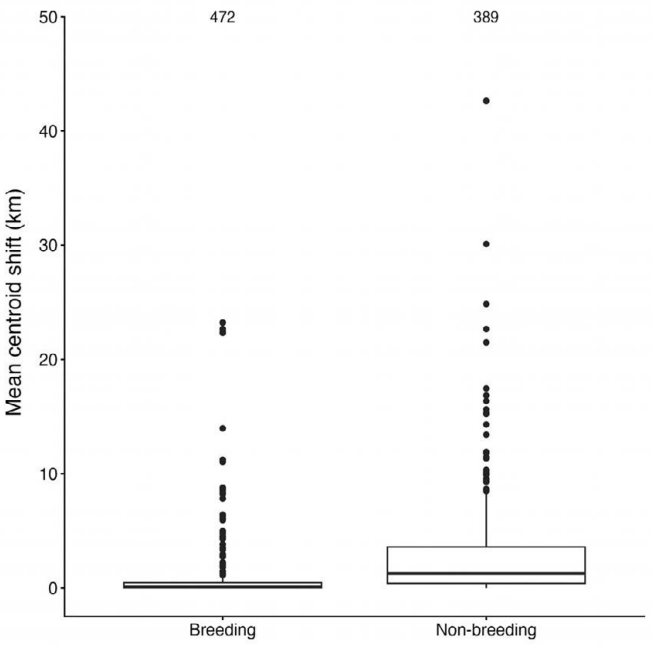


Fig. 3. Resident American Oystercatchers in the Cape Romain Region of South Carolina inter-annual fidelity to breeding sites and nonbreeding sites. Boxplots show the mean centroid shift (the distance between the centroid of one individual bird's locations in successive seasons) as an index of movement from one season to the subsequent season. Boxplots show the spread of movement distance across individuals, with points indicating individuals that moved more than 1.5 times the interquartile range over the 75th percentile. Numbers at the top of the plot indicate the number of movements included in the analysis.

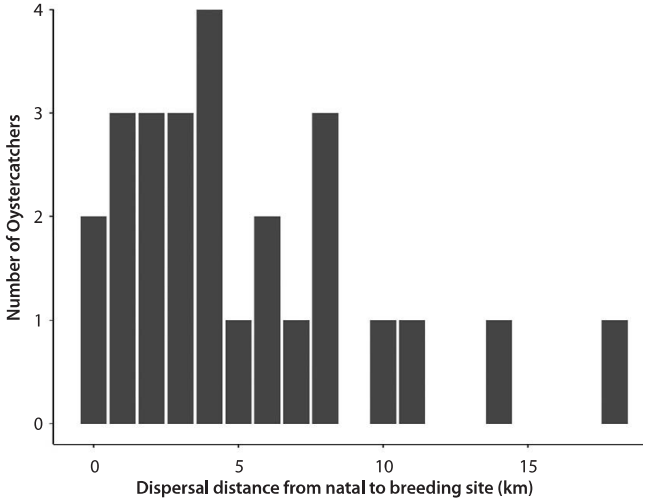


Fig. 4. Distance from natal site to location where American Oystercatchers (n = 26) were first seen paired on a breeding territory in the Cape Romain Region of South Carolina. Nesting was not always confirmed.

For resident American Oystercatchers, the mean distance between nest sites in successive years was significantly shorter (1.0 ± 3.0 km) than the mean distance between nonbreeding sites (3.0 ± 5.0 km; W = 40196, $p < 0.001$; Table 1; Fig.3). Residents moved an average of 4.2 ± 6.3 km between breeding and nonbreeding sites (Table 1).

Over the course of the study, 18% (n = 26) of the chicks banded were subsequently documented as being paired with a mate on a nesting site in our study area. Prior to being observed on a nesting site in the Cape Romain Region, four birds were observed south of the area, two in Georgia and two in Florida. The remaining 22 were observed only in South Carolina. The mean distance between the natal site and subsequent breeding location where an American Oystercatcher was first seen paired was 5.2 ± 4.4 km (Fig. 4). The mean age when these birds were first observed as part of a pair was 4.6 ± 1.8 years (range: 2–8).

DISCUSSION

American Oystercatchers in the Cape Romain Region exhibited strong site fidelity to both breeding and nonbreeding sites. Resident birds moved a mean of 1 km between the breeding sites they used from one year to the next, while mean distance moved between non-breeding sites used in different seasons was 3 km. This could indicate that American Oystercatchers show higher fidelity to their breeding sites than non-breeding sites, or that individuals have smaller home ranges during the breeding season. Individuals that returned to the study area to breed also showed high natal site fidelity. Residents and migrants were equally faithful to nonbreeding sites, both within and between years. Movement within the nonbreeding season was limited: although the maximum distance moved was approximately 43 km, the mean distance was only 3 km.

Our estimates of site fidelity include only individuals that returned to the region and are therefore biased towards site faithful individuals. Furthermore, surveys during the nonbreeding season were opportunistic and not equally distributed because high winds often prevented access to outer beaches, whereas protected creek edges remained accessible under most weather conditions. Consequently, the temporal spacing and number of observations (2–25) varied among individuals. Although such variation in observation intervals could influence calculated movement distances, the high fidelity observed in this study is consistent with findings from other shorebird research. Strong fidelity to nonbreeding sites is typical of shorebird species that defend foraging territories, including oystercatchers and curlews (Hand *et al.* 2010, Handmaker *et al.* 2024) and may reduce intraspecific competition for prey (Donnez *et al.* 2023). The abundance and stability of oyster reefs in the Cape Romain Region (Tibbetts 2013) likely contributes to the predictability of prey availability and the fidelity we observed to roosting areas. Such a relationship between predictable food resources and high site fidelity has also been documented in other shorebird species. For example, Ruddy Turnstones *Arenaria interpres* and Purple Sandpipers *Calidris maritima* wintering on rocky shores with consistent prey show higher site fidelity than species using soft-sediment habitats where prey distribution is less predictable (Burton & Evans 1997). Ruddy Turnstones foraging along rocky shorelines rarely move more than 3 km between roosts during winter (Pearce-Higgins 2001). Similarly, Hudsonian Whimbrel *Numenius hudsonicus* at a South Carolina stopover site exhibited high fidelity to feeding and roosting areas, likely reflecting reliable prey availability (Handmaker *et al.* 2024). Black and Eurasian Oystercatchers also demonstrate strong fidelity to nonbreeding areas (Rehfisch *et al.* 1996, Johnson *et al.* 2010). For example, more than 82% of adult Eurasian Oystercatchers in the Wash, England stayed within a 10–30 km wide region, both within and across years (Rehfisch *et al.* 1996).

Site fidelity in the nonbreeding season did not differ between migrant and resident American Oystercatchers, suggesting high roost site fidelity in the nonbreeding season is not solely driven by the benefits of resident individuals roosting year-round near their nest sites. Roost sites during the nonbreeding season were close to breeding areas, a mean of approximately 4 km from nesting sites. Nesting and nonbreeding roost sites were distributed throughout the Cape Romain Region (Fig. 1). Nonbreeding roost site availability may thus be adequate to accommodate both resident and migrant birds and fidelity may potentially be linked to territoriality or reduced intraspecific competition on foraging grounds. Comparable strategies occur in other shorebirds: Killdeer *Charadrius vociferus* often remain near nest sites year-round (Plissner *et al.* 2000), and Black Oystercatchers maintain home ranges as small as 5 km^2 but may range over 1,000 km^2 when suitable habitat is limited (Ware *et al.* 2023). Black Oystercatcher home range size is smaller during the breeding than nonbreeding season (Ware *et al.* 2023). Because American Oystercatchers roost close to breeding areas year-round, conserving nonbreeding roost habitat would benefit resident and migratory birds.

For resident American Oystercatchers, the mean interannual movement during the breeding season (1 km) was less than the movement during the nonbreeding season, with many birds reusing the same nest site across multiple years. In South Carolina, American Oystercatchers nest in dynamic habitat (sandy beaches, estuarine islands, and shell rakes; Sanders *et al.* 2008), and erosion or habitat reconfiguration likely drives some observed year to year nest site shifts. Our breeding season movement data exhibited some non-independence between individuals because both members of a banded pair were included in 11% of our observations. Although this introduces the potential for pseudo-replication, similar patterns have been reported in Eurasian Oystercatchers, which exhibit stronger fidelity to breeding sites than to nonbreeding sites (Safriel *et al.* 1984). Breeding dispersal in oystercatchers is rare: 88% of Black Oystercatchers reuse the same territory in consecutive years, and Eurasian Oystercatchers typically re-nest within approximately 128 m even after mate loss or breeding failure (Hazlitt & Butler 2001, Bruinzeel 2007, Andres & Falxa 2020). Pairs that successfully fledge chicks exhibit stronger site fidelity than unsuccessful pairs (Ens *et al.* 1992, Hazlitt & Butler 2001). Incorporating reproductive success into future studies of breeding site fidelity in American Oystercatchers would help clarify whether dispersal reflects habitat change, breeding failure, or adaptive flexibility.

This study provides the first examination of American Oystercatchers that were banded as chicks and were later observed in a pair on a nesting territory. Natal site fidelity was variable but high, with individuals returning to breed a mean distance of approximately 5 km from natal sites and a maximum distance of only 18 km. The only previous study examining natal site fidelity in American Oystercatchers reported second- and third-year birds (n = 8) seen 3 to over 25 km from natal sites, although these birds were presumed not yet breeding (McGowan *et al.* 2005). While our findings provide insight into natal site fidelity, there are limitations. We cannot confirm whether some birds nested outside of our study area, which would increase estimated natal dispersal distances, nor do we know how long observed pairs occupied breeding territories. Several immature birds in our study moved south before eventually returning, a pattern constant with Eurasian Oystercatchers, that spend immature years far from future breeding areas (Hulscher *et al.* 1996). Our estimate of age of first breeding (mean 5 years, maximum 8 years) is likely conservative as individuals banded late in the study that first bred after its conclusion were not included. African Black Oystercatchers *H. moquini* breed primarily at 3–4 years, with earlier breeding on mainland than island sites (Hockey 1996, Scott *et al.* 2011). Variable Oystercatchers *H. unicolor* typically breed at 4–8 years (Dowding & Chamberlin 2025) and Black Oystercatchers a minimum of 5 years (Hazlitt & Gaston 2002).

Conservation

Though site fidelity is typically an adaptive strategy that aligns with habitat predictability, it may become maladaptive under conditions of sustained human disturbance or rapid and/or substantial changes in resource availability (Merkle *et al.* 2022). For example, Piping Plovers *Charadrius melodus* that maintained fidelity to disturbed nonbreeding habitats experienced lower survival than those that relocated (Gibson *et al.* 2018), and Eurasian Oystercatchers in the Dutch Wadden Sea continued using prey-depleted sites instead of shifting to food-rich areas, contributing to population declines (Verhulst *et al.* 2004). Similarly, adult Eurasian Oystercatchers in a protected area showed strong nonbreeding site fidelity between years, whereas immatures were more likely to move, even to sites with less prey (Morten *et al.* 2022). Although our sample size was insufficient to test age-specific patterns, immature American Oystercatchers may also display lower site fidelity, which could provide some resilience against increasing habitat unpredictability. This highlights the importance of understanding how behavioral flexibility varies across life stages and whether high fidelity might constrain adaptation to future habitat shifts.

Human disturbance is a well-documented cause of roost abandonment, particularly in shorebirds compared to terns, gulls, and raptors (Pfister *et al.* 1992, Milton & Harding 2011). Disturbance increases energy expenditure through repeated flushing, underscoring the importance of undisturbed roosts in conservation planning (Rogers *et al.* 2006). The Cape Romain Region currently supports abundant American Oystercatchers and relatively intact habitat, suggesting it may serve as a baseline for understanding site fidelity under minimal disturbance. For instance, Eurasian Oystercatchers in the German Wadden Sea preferentially roost in areas remote from human activity and exhibit higher fidelity at undisturbed sites (Scheiffarth & Becker 2008). Birds that relocated due to habitat loss have shown lower survival (Duriez *et al.* 2009), underscoring the potential costs of forced relocation. The strong site fidelity observed in our population suggests that many individuals may not yet have needed to respond to habitat changes by shifting use areas. The Cape Romain Region lies within a rapidly urbanizing stretch of the Atlantic coast. For example, the human population of Mount Pleasant, the 39 km length of coast between the city of Charleston and the Cape Romain Region grew by 7% between 2020 and 2025 (World Population Review 2025). Thus, future changes could challenge this stability.

Sea level rise and increased storm activity have reduced the amount of marsh in our study area and are expected to increase erosion throughout coastal South Carolina, thus reducing habitat available to American Oystercatchers (Hughes *et al.* 2009, von Holle *et al.* 2019). Conservation strategies could therefore extend beyond the immediate protection of current nesting and roosting sites to include the preservation of broader coastal ecosystem integrity, ensuring that birds retain the spatial flexibility to respond as habitats change.

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