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Range Expansion of Black Mangroves (*Avicenna germinans*) to the Mississippi Barrier Islands

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SHORT PAPERS AND NOTES

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RANGE EXPANSION OF BLACK MANGROVES (*AVICENNIA GERMINANS*) TO THE MISSISSIPPI BARRIER ISLANDS.—The expansion of the black mangrove (*Avicennia germinans*) into Gulf of Mexico salt marshes is among the many climate-induced poleward range shifts of tropically associated marine plants and animals that have been documented in recent decades (Perry et al., 2005; Lasram and Mouillot, 2009; Fodrie et al., 2010; Comeaux et al., 2012). Gulf of Mexico salt marshes are normally dominated by salt marsh cordgrass (*Spartina alterniflora*) and black needlerush (*Juncus roemerianus*). Some research suggests salt marsh vegetation may actually facilitate black mangrove seedling growth, with the marsh influence becoming neutral as mangrove seedlings mature (Guo et al., 2013). While the distribution of black mangroves is limited by freezing temperatures in the north, in warmer climates competition with mangrove species may limit salt marsh distribution (Kangas and Lugo, 1990). Warmer winter temperatures and infrequent and less extreme frosts are likely causes of the expansion of black mangroves in the Gulf of Mexico (Sherrod and McMillan, 1985; Pickens and Hester, 2010; Cavanaugh et al., 2014), and recent studies suggest there is a temperature threshold for mangrove dominance (Osland et al., 2013; Cavanaugh et al., 2014). In the absence of freezes, mangroves have been shown to channel large amounts of energy into production and outcompete salt marshes by shading them (Stevens et al., 2006). Although some studies in the Gulf of Mexico have examined the effects of black mangroves on nutrient cycling, decomposition rates, and sediment accretion within recently colonized salt marshes (McKee and Rooth, 2008; Perry and Mendelssohn, 2009; Comeaux et al., 2012), there is a lack of information on the broader ecological changes these mangrove expansions may have for species that inhabit salt marshes.

Recently, we have located black mangroves on Horn and Cat Islands, which are part of the Mississippi barrier island chain in the northern Gulf of Mexico and, to the best of our knowledge, are the northernmost populations (Fig. 1). We have located fewer than 10 black mangroves on Horn Island and one tree on the northern shore of Cat Island (Fig. 2). The mangroves on Horn Island are the focus of a study to define the effects that black mangroves have on the abundance and secondary productivity of salt marsh-associated taxa, such as penaeid shrimps, blue crabs, smaller crustaceans, and juvenile fishes. These macrofaunal species typically rely on salt marshes of the northern Gulf as nursery and foraging grounds. Because *Spartina alterniflora* exists lower in the intertidal zone and is flooded more frequently and for longer durations than the black mangrove habitat, faunal

Fig. 1. (Left) Two black mangrove shrubs positioned at the mouth of Ranger Lagoon on Horn Island, Mississippi (30.24171°N, 88.67886°W); (Right) Recently documented *A. germinans* residing in one of the inlets on Cat Island, Mississippi (30.23037°N, 89.08532°W).

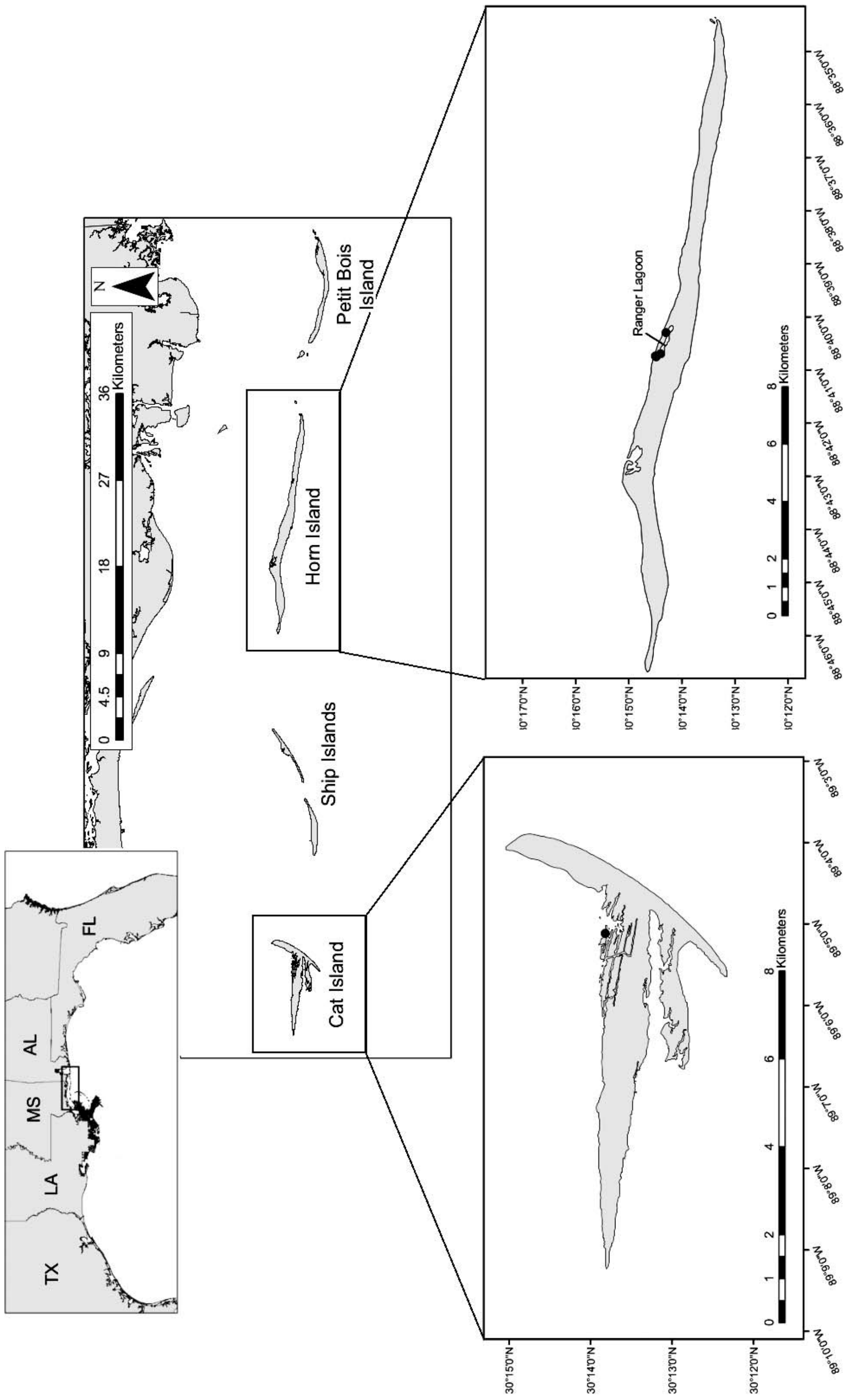

Fig. 2. Presence of black mangroves along the Mississippi barrier island chain. Black dots indicate current known locations.

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species are able to use the salt marsh when adjacent mangroves are dry (Patterson et al., 1993; Rozas and Minello, 1998). Major alterations in habitat complexity through the expansion of black mangroves, therefore, could have far reaching effects on economically important fish and crustacean species (e.g., blue crab and gray snapper), potentially altering both their absolute and relative abundances. It is also possible, however, that a combination of salt marsh and mangrove habitats could prove to be beneficial to organisms using these habitats during alternating tidal stages (Caudill, 2005).

To begin to address these important ecological questions, we are investigating the effects that emergent black mangroves in the northern Gulf of Mexico may have on salt marsh herbivory, decomposition rates, plant morphometry, and nutrient cycling. We will make comparisons to faunal usage patterns at three sites within the Chandeleur Islands, Louisiana, that have higher abundances of black mangroves in the salt marshes in relation to Horn Island. Since the Chandeleur Islands have supported black mangroves for much longer, we can use a space-for-time substitution to predict changes likely to occur as mangroves increase in abundance. Our work will document community and ecosystem alterations due to climate change–induced colonization of salt marshes by black mangroves, especially concerning the ''nursery role'' that marshes play for economically important species. We plan to continue surveying the barrier islands along the northern Gulf coast to document future black mangrove colonizations. These data will be crucial for predicting the effects of mangrove expansion on the harvest of finfish and crustaceans along with changes in ecosystem structure and function that are likely to occur as the conversion of marsh to mangrove domination takes place.

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