2013

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

Whitney A. Scheffel
University of South Alabama

Kenneth L. Heck Jr.
Dauphin Island Sea Lab

Just Cebrian
Dauphin Island Sea Lab

Matthew Johnson
National Park Service

Dorothy Byron
Dauphin Island Sea Lab

Follow this and additional works at: <https://aquila.usm.edu/goms>

DOI: 10.18785/goms.3101.08

Recommended Citation

Scheffel, W. A., K. L. Heck Jr., J. Cebrian, M. Johnson and D. Byron. 2013. Range Expansion of Black Mangroves (*Avicenna germinans*) to the Mississippi Barrier Islands. Gulf of Mexico Science 31 (1). Retrieved from <https://aquila.usm.edu/goms/vol31/iss1/8>

This Article is brought to you for free and open access by The Aquila Digital Community. It has been accepted for inclusion in Gulf of Mexico Science by an authorized editor of The Aquila Digital Community. For more information, please contact Joshua.Cromwell@usm.edu.

SHORT PAPERS AND NOTES

Gulf of Mexico Science, 2013(1–2), pp. 79–82
 © 2013 by the Marine Environmental Sciences
 Consortium of Alabama

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 Mendelsohn, 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.

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.

Acknowledgments.—We thank the Marine Ecology and Ecosystems labs at the Dauphin Island Sea Lab (DISL) for their field and laboratory assistance. We also thank the U.S. Fish and Wildlife Service, the National Park Service Gulf Islands National Seashore, and the DISL for funding this project.

LITERATURE CITED

- CAUDILL, M. C. 2005. Nekton utilization of black mangrove (*Avicennia germinans*) and smooth cordgrass (*Spartina alterniflora*) sites in southwestern Caminada Bay, Louisiana. Master's thesis, Louisiana State University and Agricultural and Mechanical College, Department of Oceanography and Coastal Sciences.
- CAVANAUGH, K. C., J. R. KELLNER, A. J. FORDE, D. S. GRUNER, J. D. PARKER, W. RODRIGUEZ, AND I. C. FELLER. 2014. Poleward expansion of mangroves is a threshold response to decreased frequency of extreme cold events. *Proc. Natl. Acad. Sci.* 111(2):723–727.
- COMEAX, R. S., M. A. ALLISON, AND T. S. BIANCHI. 2012. Mangrove expansion in the Gulf of Mexico with climate change: Implications for wetland health and resistance to rising sea levels. *Estuar. Coast. Shelf Sci.* 96:81–95.
- FODRIE, F. J., K. L. HECK, S. P. POWERS, W. M. GRAHAM, AND K. ROBINSON. 2010. Climate-related, decadal-scale assemblage changes of seagrass-associated fishes in the northern Gulf of Mexico. *Glob. Change Biol.* 16(1):48–59.
- GUO, H., Y. ZHANG, Z. LAN, AND S. C. PENNING. 2013. Biotic interactions mediate the expansion of black mangrove (*Avicennia germinans*) into salt marshes under climate change. *Glob. Change Biol.* 19:2765–2774.
- KANGAS, P. C., AND A. E. LUGO. 1990. The distribution of mangroves and salt marsh in Florida. *Trop. Ecol.* 31:32–39.
- LASRAM, F. B. R., AND D. MOUILLOT. 2009. Increasing southern invasion enhances congruence between endemic and exotic Mediterranean fish fauna. *Biol. Invasions* 11(3):697–711.
- McKEE, K. L., AND J. E. ROOTH. 2008. Where temperature meets tropical: Multi-factorial effects of elevated CO₂, nitrogen enrichment, and competition on a mangrove-salt marsh community. *Glob. Change Biol.* 14(5):971–984.
- OSLAND, M. J., N. ENWRIGHT, R. H. DAY, AND T. W. DOYLE. 2013. Winter climate change and coastal wetland foundation species: Salt marshes vs. mangrove forests in the southeastern United States. *Glob. Change Biol.* 19(5):1482–1494.
- PATTERSON, C. S., I. A. MENDELSSOHN, AND E. M. SWENSON. 1993. Growth and survival of *Avicennia germinans* seedlings in a mangal/salt marsh community in Louisiana, USA. *J. Coast. Res.* 9(3):801–810.
- PERRY, A. L., P. J. LOW, J. R. ELLIS, AND J. D. REYNOLDS. 2005. Climate change and distribution shifts in marine fishes. *Science* 308(5730):1912–1915.
- PERRY, C. L., AND I. A. MENDELSSOHN. 2009. Ecosystem effects of expanding populations of *Avicennia germinans* in a Louisiana salt marsh. *Wetlands* 29(1):396–406.
- PICKENS, C. N., AND M. W. HESTER. 2011. Temperature tolerance of early life history stages of black mangrove *Avicennia germinans*: Implications for range expansion. *Estuar. Coasts* 34:824–830.
- ROZAS, L. P., AND T. J. MINELLO. 1998. Nekton use of salt marsh, seagrass, and non-vegetated habitats in a south Texas (USA) estuary. *Bull. Mar. Sci.* 63(3):481–501.
- SHERROD, C. L., AND C. McMILLAN. 1985. The distributional history and ecology of mangrove vegetation along the northern Gulf of Mexico coastal region. *Contrib. Mar. Sci.* 28:129–140.
- STEVENS, P. W., S. L. FOX, AND C. L. MONTAGUE. 2006. The interplay between mangroves and salt marshes at the transition between temperate and subtropical climate in Florida. *Wetlands Ecol. Manag.* 14:435–444.
- WHITNEY A. SCHEFFEL, KENNETH L. HECK, JR., JUST CEBRIAN, MATTHEW JOHNSON, AND DOROTHY BYRON, (WAS) University of South Alabama, Department of Marine Sciences, 101 Bienville Boulevard, Dauphin

Island, Alabama 36528, wscheffel@disl.org; (KLH and JC) Dauphin Island Sea Lab, University of South Alabama, Department of Marine Sciences, 101 Bienville Boulevard, Dauphin Island, Alabama 36528; (MJ) National Park Service, Present address: Bureau of Ocean Energy Management, 1201

Elmwood Park Boulevard, New Orleans, Louisiana 70123; (DB) Dauphin Island Sea Lab, Marine Environmental Science Consortium, 101 Bienville Boulevard, Dauphin Island, Alabama 36528. Send reprint requests to WAS. Date accepted: February 12, 2014.