Status of freshwater resources and future management implications of sea level rise in the Lower Florida Keys

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Introduction

Freshwater wetlands are important habitat for many wildlife species, including those considered endangered, threatened or of special concern by federal and state resource agencies. Birds, mammals, amphibians, reptiles, fish, and insects are dependent on the existence of these non-tidal wetlands for feeding, drinking and habitat in the National Key Deer Refuge located in the Lower Florida Keys (USFWS 2009).

The location, quality (salinity), and permanence of surface fresh water in the Florida Keys is critical to maintaining, and managing the endangered Key deer as well as other species. Folk (1992) mapped more than 1,000 wetlands on 19 islands. A variety of data has been collected in subsets of these wetlands between 1987 and the present.

The Miami oolite limestone formation found in the Lower Keys allows for the development of subterranean fresh water lenses as well as extensive surface fresh water wetlands. Rainwater collects in the shallow, impermeable limestone basins and solution holes that are distributed throughout the Lower Keys, supporting a diversity of endemic flora and fauna. Fresh water wetlands reach their greatest extent and distribution on Big Pine Key, primarily as isolated features occurring in shallow basins or lowlands either surrounded by higher upland forests or between upland areas and transition zones. The average elevation freshwater marshes is 3 to 6.5 feet above mean sea level, with size varying up to 247 acres (Folk 1992).

The purpose of our study was to reassess the salinity and general condition at a subset of the wetlands, with emphasis on whether suitability for native wildlife and plant species has changed. Our target subset was 277 that had been sampled in previous efforts. Analyses of these data will help inform strategies to monitor effects of sea level rise, and affect restoration and protection.

Figure 1. Typical freshwater solution hole

Materials and Methods

We resurveyed 200 freshwater wetlands on nine islands from January to September 2010. Water chemistry data was collected with a YSI 85 handheld oxygen, conductivity, salinity and temperature meter.

Evidence of wildlife was recorded for each solution hole and included waterbirds, fish, mammals, reptiles, amphibians and insects. Presence of invasive exotic flora and fauna were also documented. These data were compared to baseline inventories by Folk (1992) and others to identify changes in habitat, water quality, and suitability for wildlife.

Results

Most of the originally mapped wetland sites persist; however, 10 are now unavailable to wildlife because they are filled or fenced in (5% decline since 1991).

Data from all years were examined for trends in average salinity by habitat. Figure 2 (below) illustrates maximum salinity recorded among sites. As expected, salinity levels were inversely correlated with the elevation of given cover types. In increasing order of elevation, these were mangrove (16 ppt), scrub mangrove (10), saltmarsh (10), hammock (9), buttonwood (7), developed land (4), and pine rockland (3).

For the 200 wetlands assessed, there were no significant long-term trends in salinity. However, inequities in sampling effort (year X season X specific locations) preclude drawing definitive conclusions. Additionally, 1989 was a “severe” drought year (Folk 1992).

The more permanent freshwater wetlands are particularly critical to wildlife during the dry season (November-May). During the dry season, wildlife concentrate at fewer, more permanent locations. During the wet season, wildlife apparently increase use of overflow and ephemeral wetlands, and are more dispersed (Figure 3).

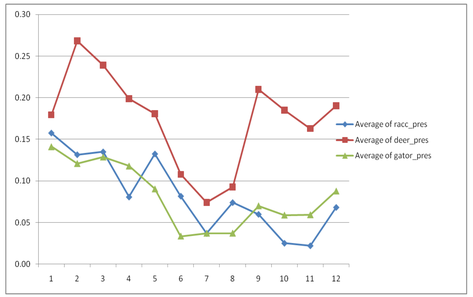
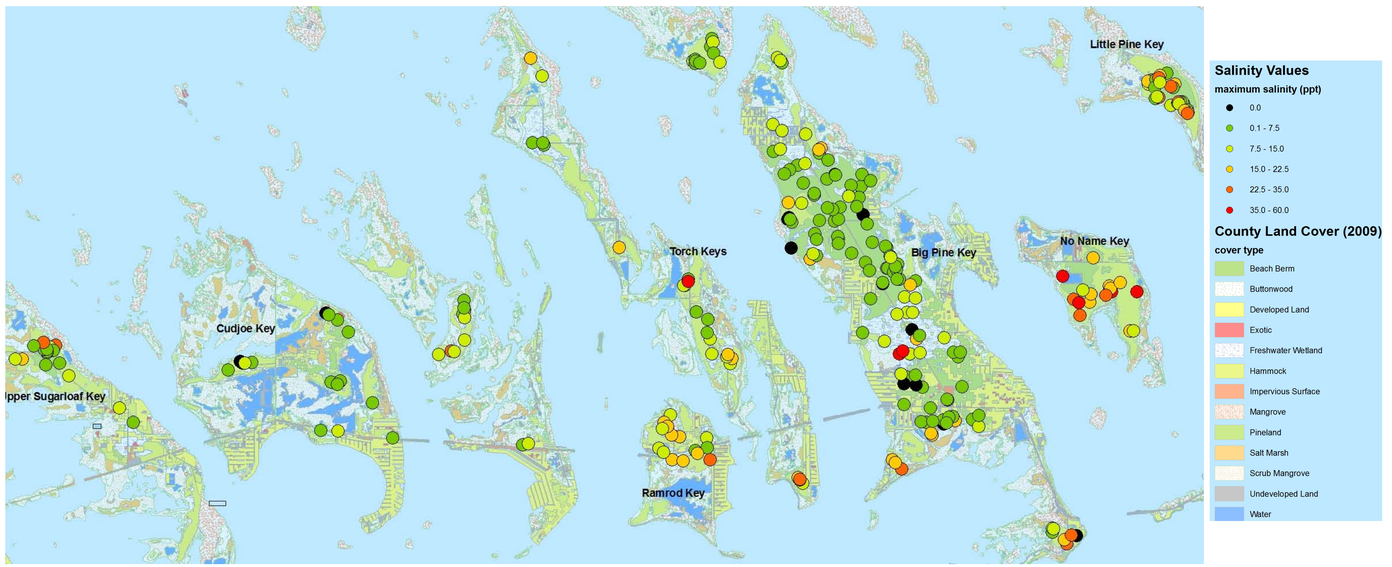


Figure 3. Proportion of wetlands by month that had Key deer, raccoons, and alligators or recent sign.

American alligators were observed on 8 islands with the largest numbers on Little Pine and No Name Keys. Salinities where alligators were observed averaged 7.6 ppt and ranged from 1-17.2 ppt. They were observed most frequently in buttonwood swamps in hardwood hammock cover. Alligators may serve as a useful indicator species for monitoring impacts of sea level rise due to their salinity and habitat requirements.



Conclusions

Freshwater resources in the Lower Keys provide critical habitat for a variety of fish and wildlife species. Salinity changes that may result as a consequence of sea level rise could have significant impacts on wetland habitat suitability for many species. Consider the following:

➢Key deer (Federally Endangered) require freshwater solution holes, wetlands and ponds for drinking (<15ppt)

➢Lower Keys marsh rabbit (Federally Endangered) distribution on Big Pine Key is strongly correlated with freshwater surface sloughs

➢White-crowned pigeons (State Threatened) were observed drinking from freshwater ponds on several islands during this study. Similarly, Wiley and Wiley (1979) observed this behavior in Puerto Rico.

➢White ibis (State Species of Special Concern) often fly long distances to freshwater marshes to secure prey for nestlings, which are unable to develop normally when fed brackish-water prey (Bildstein 1993) .

➢American alligator (State Species of Special Concern) were observed in fresh to mildly brackish (1-17ppt) freshwater ponds but they are intolerant of salt water over extended periods.

The Florida Keys National Wildlife Refuges Complex plans to initiate long-term monitoring of freshwater wetlands in the Lower Keys. These data will guide future management decisions for the protection and enhancement of these critical habitats.

Literature cited

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Acknowledgments

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