HERPETOFAUNAL COMMUNITY CHANGES IN MULTIPLE HABITATS OVER FIFTEEN YEARS IN THE CORKSCREW REGIONAL ECOSYTEM WATERSHED

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ABSTRACT

Herpetofaunal declines have been documented globally, and southern Florida is an especially vulnerable region because of high impacts from hydrological perturbations and nonindigenous species. The hydrological restoration associated with the Comprehensive Everglades Restoration Project may have profound impacts on herpetofaunal communities. To assess the extent of recent change in herpetofauna community composition, we established a baseline inventory during 1995-97 in the Corkscrew Regional Ecosystem Watershed preserve and repeated our sampling methods fifteen years later (2010-11). Nine drift fence arrays were placed in four habitat types: mesic flatwood, mesic hammock, depression marsh, and wet prairie. Trapping occurred daily for one week during 7-8 sampling runs in each period (57 and 49 total sampling days, respectively). Species richness was maintained in mesic hammock habitats but varied in the others. Catch rates of several native species (*Anaxyrus terrestris*, *Lithobates grylio*, *Anolis carolinensis*, *Nerodia fasciata*) declined significantly. Other native species (*Lithobates sphenocephalus*, *Siren lacertina*, and *Notophthalmus viridescens piaropicola*) that were abundant in 1995-97 declined by greater than 50%. Catch rate of only two species (the nonindigenous *Anolis sagrei* and the native *Diadophis punctatus*) increased significantly. Hierarchical cluster analysis indicated similarity within habitat types but significant dissimilarity between sampling periods, confirming shifts in community composition. Analysis of individual species' contributions to overall similarity across habitats shows a shift from dominance of native species in the 1990s to increased importance of nonindigenous species in 2010-11. These results document significant recent changes in the structure and composition of this southwest Florida herpetofaunal community. Although the causes are unknown, hydrological shifts and ecological impacts of nonindigenous species may have contributed.

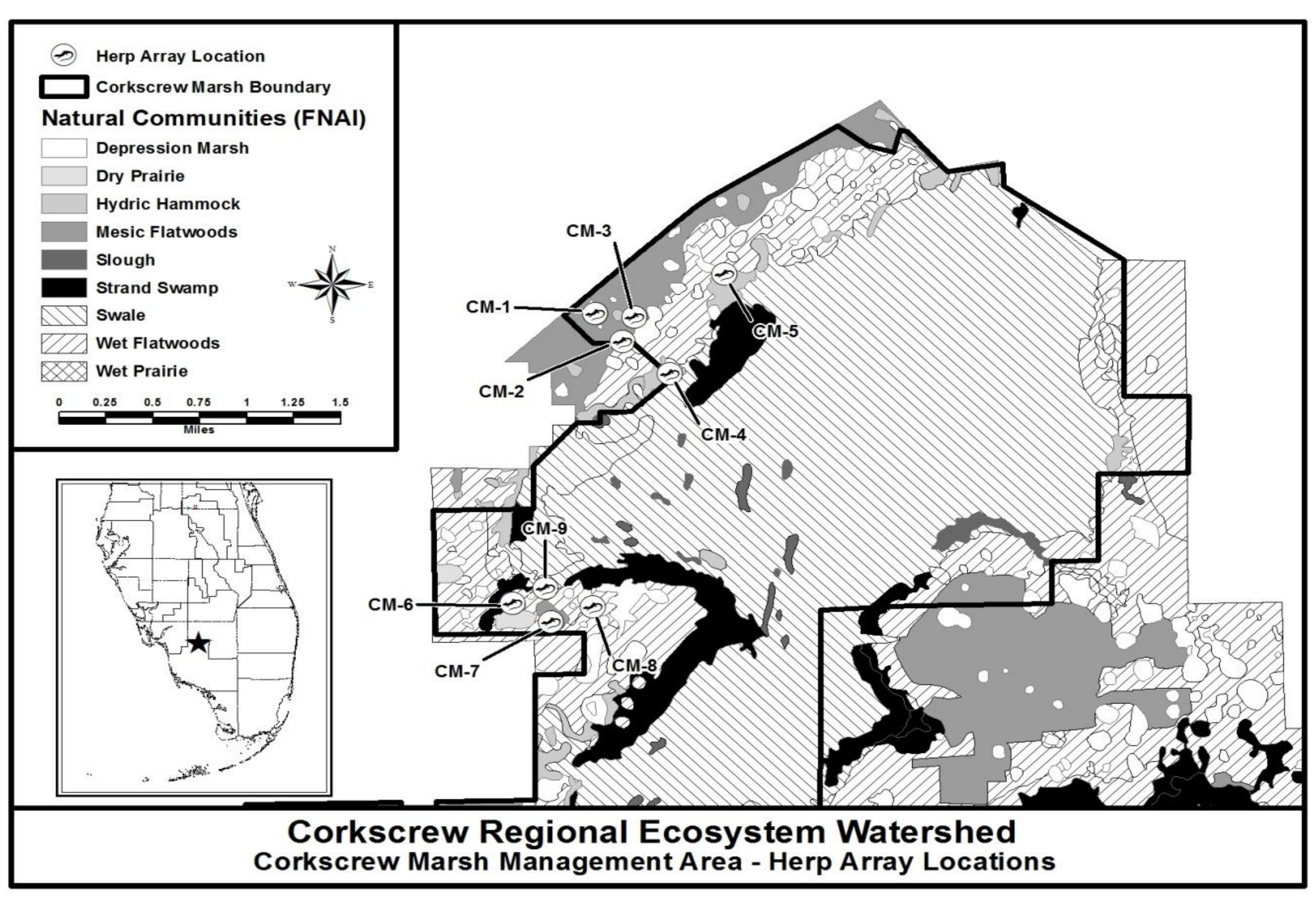

Figure 1 –Map of the Corkscrew Regional Ecosystem Watershed and the array locations.

Introduction

- Global herpetofauna declines, especially among amphibians, have been well documented at various spatial scales and in diverse habitat types (1-8)
- . Gardner et al. [9] and Dodd and Smith [10] suggested that habitat change is the primary cause of population decline of reptiles and amphibians worldwide, although additional factors may contribute: environmental contamination, *UV-B* irradiation, disease, introduced species, exploitation, and climate change are all likely influential [4].
- In Florida, Statewide loss of historic wetlands was estimated at 44% [12], and in southwest Florida, wetlands comprise a major habitat for herpetofauna. Estimates of historic wetland loss in the region approach 50% resulting from the direct impacts of land use conversion and indirectly from altered hydrology [13].
- Synoptic studies of herpetofauna and their associated habitats in south Florida have been lacking since 2000.
- The rarity of such studies is a major concern because Florida, particularly south Florida, has experienced significant development and landscape alterations over the past half century, especially in coastal areas and concentrated agricultural regions south of Lake Okeechobee [11].
- Animal communities in the region are experiencing strong invasion pressure from nonindigenous species, a force likely to exact major changes on native amphibian and reptile populations [3, 15].
- Long-term data sets are critical resources for conservation biologists, and more of these efforts are needed. Indeed, monitoring initiatives spanning at least 7-10 years are required for a reasonable chance to detect population trends that can be separated from natural fluctuations [16-18].
- One strategy is to identify sites that were subject to intense sampling in the past and target them for resampling followed by comparisons of faunal changes (e.g., [14, 19].

Research Objectives

1) establish a current herpetofauna inventory in a large managed preserve of diverse habitats, and
2) examine whether these communities changed over 15 years by comparing species richness and composition at four habitat types using the same methodology in 1995-97 and 2010-11.

Array	No. Species 1995	No. Species 2010	Margalef Richness 1995	Margalef Richness 2010	Shannon Diversity 1995	Shannon Diversity 2010
C1	18	15	5.28	4.72	2.86	2.67
C2	19	14	5.62	4.32	2.90	2.60
C3	14	15	4.36	4.63	2.59	2.67
C4	13	14	3.78	4.33	2.49	2.58
C5	11	15	3.53	4.54	2.31	2.64
C6	12	14	3.77	4.38	2.43	2.56
C7	17	16	4.97	5.01	2.78	2.75
C8	19	14	5.58	4.52	2.93	2.61
C9	17	11	4.95	3.56	2.77	2.33

Table 1 - Changes in univariate measures of the herpetofauna community (species richness, Margalef Richness, and Shannon diversity index) from 1995-97 (1995 in table) and 2010-11 (2010 in table), separated by array site

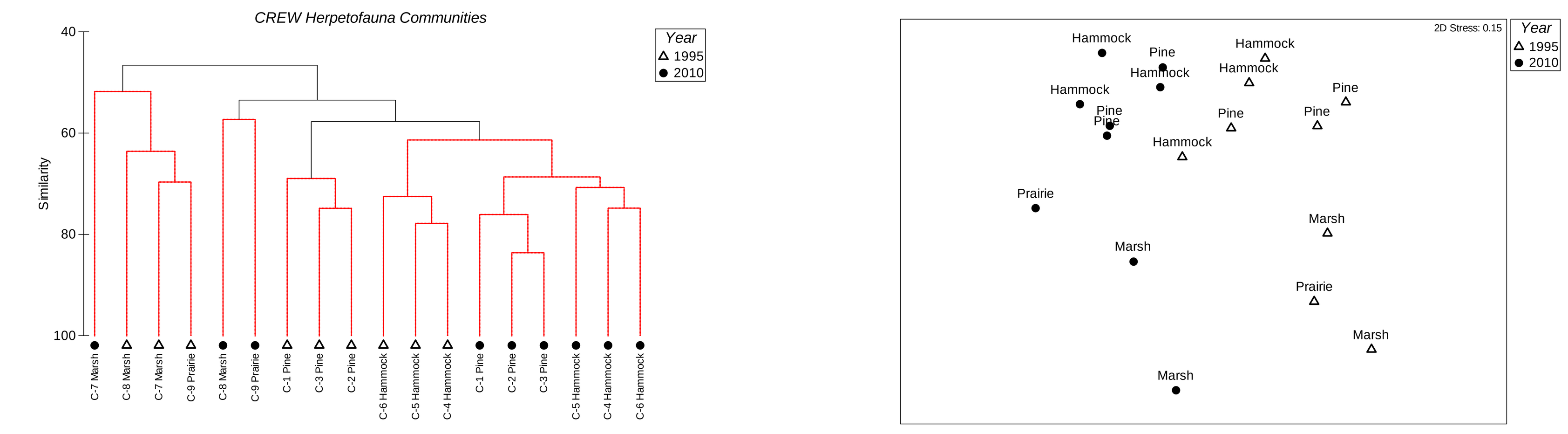

Figure 2 Hierarchical cluster analysis and MDS ordination based on Bray-Curtis similarity. Samples labeled by site number, habitat, and year. In cluster, black lines identify significant groupings while red lines connect samples that are not significantly different at 95% confidence level

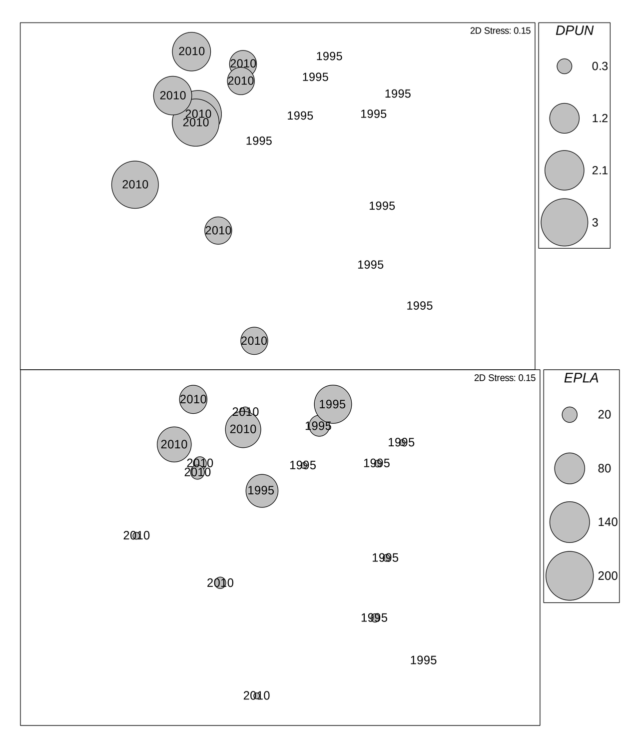

Figure 3 – Average abundance of southern ringneck snake (DPUN) and the exotic greenhouse frog (EPLA) as bubble overlays on the MDS ordination

Species	Mean Abundance 1995-97	Mean Abundance 2010-11	Contribution % 1995-97	Cumulative % 2010-11
Anolis sagrei[2]	0.22	1.68	7.03	7.03
Diadophis punctatus punctatus[2]	0	1.15	5.64	12.67
Lithobates grylio [1]	1.79	0.78	5.06	17.73
Eleutherodactylus planirostris[1,2]	1.77	2.17	4.84	22.57
Siren lacertina	0.97	0.32	4.78	27.35
Anolis carolinensis	0.88	0	4.26	31.62
Nerodia fasciata pictiventris	0.96	0.29	4.14	35.76
Anaxyrus quercicus	0.27	0.85	4.06	39.81
Lithobates sphenocephalus [1,2]	2.4	1.76	3.6	43.41
Plestiodon inexpectatus	0.92	0.77	3.48	46.89
Kinosternon baurii	0.82	0.62	3.23	50.13
Notophthalmus viridescens piaropicola	0.66	0	3.03	53.16
Pseudacris ocularis	0.56	0.24	2.87	56.03
Anaxyrus terrestris	0.61	0.35	2.87	58.9
Thamnophis sauritus sackenii	1.19	1.02	2.86	61.76
Thamnophis sirtalis sirtalis	0.55	0.22	2.76	64.53
Scincella lateralis	0.51	0.22	2.65	67.18
Hyla cinerea	0.54	0.11	2.59	69.77
Coluber constrictor priapus	1.34	1.15	2.57	72.34
Gastrophryne carolinensis[1,2]	1.68	1.8	2.48	74.82
Cemophora coccinea cocccinea	0.38	0.33	2.38	77.21
Pantherophis alleghaniensis	0.41	0.22	2.34	79.54
Acris gryllus [1]	1.44	1.26	2.15	81.7
Hyla squirella	0	0.33	1.6	83.3
Pantherophis guttatus	0.11	0.26	1.58	84.88
Seminatrix pygaea cyclas	0.11	0.24	1.54	86.42
Nerodia floridana	0.26	0.11	1.5	87.93
Sternotherus odoratus	0.11	0.24	1.48	89.41
Amphiuma means	0.13	0.17	1.28	90.7

Table 2 - SIMPER results comparing mean abundance of herpetofauna collected between 1995-97 and 2010-11 and species contributions to the dissimilarity between habitat types (total average dissimilarity = 48.44%). Species accounting for similarity between habitat types within each sampling period are indicated by superscript

DISCUSSION

- This study documents statistically significant changes in amphibian and reptile populations at this study site in southwest Florida, USA.
- Nonindigenous species (*E. planirostris* and *A. sagrei*) increased in importance over a relatively short study period (1995-2011) and several native species (*Anaxyrus terrestris*, *Lithobates grylio*, *Anolis carolinensis*, *Nerodia fasciata*) declined precipitously.
- Species that were present in 1995-97 but appeared to decline greatly in the latter study period may offer priorities for species conservation management or protection.
- Despite these shifts in community structure, overall biodiversity as defined by species richness appears to have been partially maintained at CREW over the 15-year study period.
- . These results indicate that the CREW management plan implementation, along with minimal human disturbance, has resulted in one of the few remaining areas of relatively high biodiversity in the southwest Florida region.
- . Our results also suggest the possibility that biological diversity could be compromised eventually at this and other highly invaded communities in the region.

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