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Source: Southeastern Naturalist, 15(3) : 431-447

Published By: Eagle Hill Institute

URL: https://doi.org/10.1656/058.015.0305

Herpetofaunal Communities in Ephemeral Wetlands Embedded within Longleaf Pine Flatwoods of the Gulf Coastal Plain

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Abstract - Ephemeral wetlands surrounded by *Pinus palustris* (Longleaf Pine) flatwoods support diverse herpetofaunal communities and provide important breeding habitat for many species. We sampled herpetofauna in 3 pine flatwoods wetlands on Eglin Air Force Base, Okaloosa County, FL, over 2 time periods (1 wetland [1] from 1993 to1995 and 2 wetlands [2 and 3] from 2010 to 2015) using drift fences that completely encircled each wetland. We documented 37, 46, and 43 species of amphibians and reptiles at wetlands 1, 2, and 3, respectively. Herpetofaunal communities were remarkably similar across all 3 wetlands (Sorenson Index values > 0.97) despite sampling that occurred 15–20 years apart on wetlands located approximately 10 km apart. *Ambystoma bishopi* (Reticulated Flatwoods Salamander), *Pseudacris ornata* (Ornate Chorus Frog), and *Eurycea quadridigitata* (Dwarf Salamander), all species of conservation concern, were captured at all 3 wetlands, indicating that these wetlands provide habitat for specialist species. Overall, habitat conservation and management has succeeded in maintaining suitable habitat for herpetofauna in recently surveyed wetlands, despite continued range-wide threats from changes to historic fire regimes and climate change.

Introduction

Ephemeral wetlands often support diverse amphibian and reptile communities (Dodd and Cade 1998, Gibbons et al. 2006, Means et al. 2004). Herpetofaunal diversity, especially breeding amphibians, can be an indicator of overall ecosystem quality (Welsh and Droege 2001, Welsh and Ollivier 1998). Many amphibians migrate from surrounding uplands to ephemeral wetlands to reproduce because ephemeral wetlands provide high-quality breeding habitat (Capps et al. 2015, Duellman and Trueb 1986, Palis 1997). A regular drying phase excludes predatory fishes from ephemeral wetlands, which reduces the predation pressure on larval amphibians when compared to permanent water bodies (Leibowitz 2003, Skelly 1997). Furthermore, the breeding phenology of multiple amphibian species often overlaps, creating a complex aquatic community and an abundant source of prey for other species (e.g., Lawler and Morin 1993). Predators of amphibians include many species of reptiles, which often opportunistically forage in ephemeral wetlands during certain times of the year (Eskew et al. 2009, Preston and Johnson 2012, Russell et

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Manuscript Editor: Karen Francl

al. 2002a). High amphibian reproductive output combined with an influx of outside predators can link ephemeral wetlands to surrounding uplands (e.g., Regester et al. 2006, Schriever et al. 2014, Whiles et al. 2006).

Globally, amphibian and reptile populations have experienced severe declines in recent years because of a variety of factors including habitat alteration, climate change, pollution, and disease (Carey and Alexander 2003, Gibbons et al. 2000, Stuart et al. 2004). Degraded wetland quality can have negative impacts on amphibian (Gorman et al. 2013, McMenamin et al. 2008) and reptile (Aresco 2005, DeCatanzaro and Chow-Fraser 2010) communities. The loss of natural-disturbance regimes can alter wetland habitat (even on managed lands), creating unsuitable habitat patches for some amphibian species (Gorman et al. 2013, Martin and Kirkman 2009). Wetland hydroperiod also plays an important role in determining amphibian breeding success (Semlitsch et al. 1996), and persistent drought can cause reproductive failure for entire populations (Palis et al. 2006, Westervelt et al. 2013). Thus, long-term monitoring of herpetofaunal communities in wetland habitats is important for identifying population trends over time and for describing the communities that utilize these wetlands.

The southeastern United States is characterized by abundant wetland resources and a high diversity of wetland habitats (Sutter and Kral 1994). Included in this diverse wetland assemblage are isolated ephemeral wetlands embedded within *Pinus palustris* Mill. (Longleaf Pine) flatwoods, which are found in low-lying areas of the Coastal Plain (Means 1996). Longleaf Pine forests have been reduced to approximately 3% of their original extent because of widespread anthropogenic disturbance that occurred after European settlement (Means 1996). The decline of Longleaf Pine forests has led to the loss and degradation of wetlands that were historically embedded within these systems (Hefner and Brown 1984). Today, remaining pine flatwoods wetlands are often degraded to varying degrees as a result of continued anthropogenic disturbance, a loss of historic fire regimes in these fire-adapted ecosystems, and climate change (Brooks 2009, Gorman et al. 2013).

We report on herpetofaunal communities surveyed in 3 pine flatwoods wetlands in western Florida. We compare herpetofaunal communities among these 3 wetlands and through time for the 2 wetlands sampled between 2010 and 2015. We also examine the relative abundance of several species, and we focus specifically on 3 species of conservation concern: *Ambystoma bishopi* (Reticulated Flatwoods Salamander), *Pseudacris ornata* (Ornate Chorus Frog), and *Eurycea quadridigitata* (Dwarf Salamander). Reticulated Flatwoods Salamanders breed exclusively in pine flatwoods wetlands and were listed as federally endangered in 2009 (USFWS 2009). The Ornate Chorus Frog is classified as a species of greatest conservation need in Florida because of recent population declines (Florida Fish and Wildlife Conservation Commission 2005). The Dwarf Salamander is also designated as a species of greatest conservation need in Florida (Florida Fish and Wildlife Conservation Commission 2005) and is believed to represent a species complex (Harrison and Guttman 2003).

Field-site Description

We sampled 3 pine flatwoods wetlands located on Eglin Air Force Base (AFB) in Okaloosa County, FL. One wetland (1) was sampled for 2 seasons (1993–1995), and the other 2 wetlands (2 and 3) were sampled for 5 seasons (2010–2015). Wetland 1 had a wetted area of approximately 0.8 ha, and wetlands 2 and 3 had a wetted area of approximately 0.4 ha each. Eglin AFB, a large military installation, contains over 187,000 ha of various habitat types, including over 145,000 ha of actively managed Longleaf Pine forests. Wetland 1 was located in East Bay flatwoods, and wetlands 2 and 3 in Oglesby's Flatwoods, approximately 10 km from wetland 1 (Fig. 1). These wetlands are typically filled by winter rains (November–February) and then experience a dry period during late spring or early summer (Chandler et al. 2016). They are characterized by open canopies composed mostly of *Pinus elliottii* Engelm. (Slash Pine), Longleaf Pine, and *Taxodium ascendens* Brongn. (Pond Cypress). Wetland midstories are dominated by shrub species including *Ilex myrtifolia* Walter (Myrtle Dahoon) and *Hypericum chapmanii* W.P. Adams (Apalachicola St. Johnswort). Wetland basins are dominated by thick herbaceous vegetation including

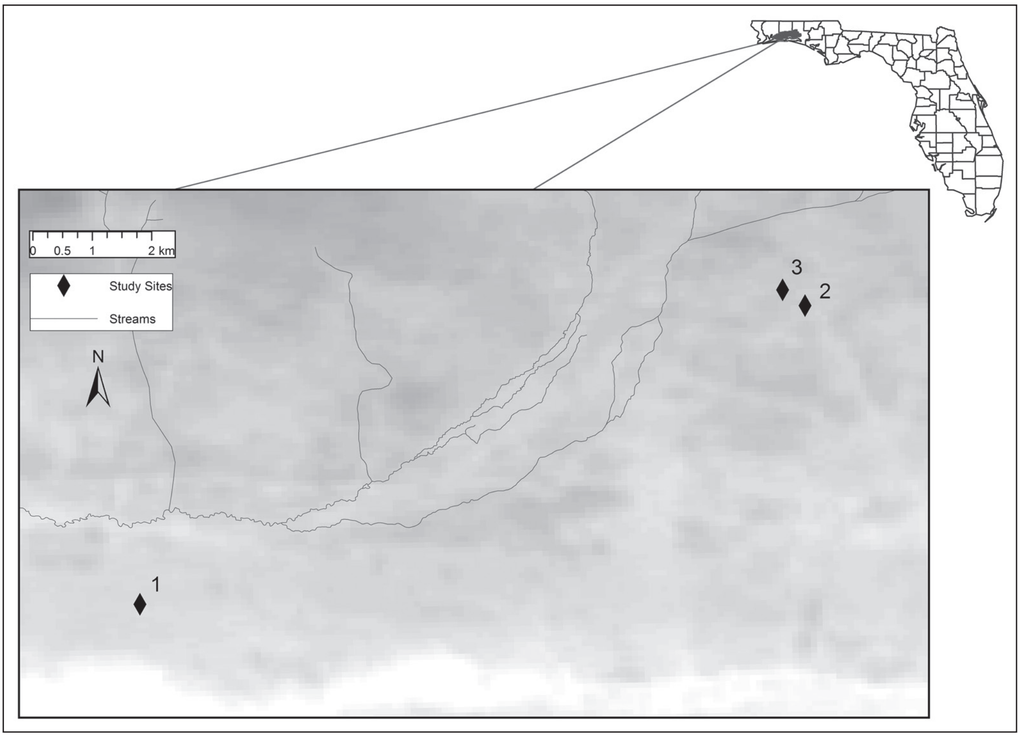

Figure 1. Three pine flatwoods wetlands on Eglin Air Force Base, Okaloosa County, FL, that were each completely encircled by a drift fence shown on a digital elevation model (darker areas represent higher elevations). The boundary between shaded and unshaded areas is the coastline (shaded area is land and the white area is water). Wetland 1 was monitored from 1993 to 1995 (2 seasons) and was located in East Bay Flatwoods. Wetlands 2 and 3 were sampled from 2010 to 2015 (5 seasons) and were located in Oglesby's Flatwoods (~10 km from wetland 1).

Aristida stricta Michx. (Pineland Threeawn), *Eriocaulon compressum* Lam. (Flattened Pipewort), and *Andropogon* spp. (bluestems) (Chandler 2015; Gorman et al. 2013, 2014).

Methods

We constructed drift fences that completely encircled each wetland. Palis (1997) described the drift-fence installation methods used for the surveys conducted at wetland 1 from 1993 to 1995, and we used similar methods for the surveys at wetlands 2 and 3 from October 2010 to May 2015. At wetlands 2 and 3, we installed drift fences using 60-cm high rolls of galvanized steel flashing, and we buried approximately 15–20 cm of the flashing to reduce the chances of incidental trespass under the fences. Each drift fence had a different number of funnel traps that, depending on the size of the wetland and the length of the fence, were spaced approximately 10 m apart and placed in pairs along both sides of the fence (i.e., for each pair, one trap was placed on the inside of the fence and a second on the outside). Wetlands 1, 2, and 3 had 31, 31, and 28 pairs of funnel traps, respectively. We constructed all of the funnel traps using aluminum window screening. Funnel traps were approximately 85 cm x 20 cm with a funnel on each end that had a 5-cm opening. We used two wooden stakes to hold each trap in place along the drift fence so that traps were pressed firmly against the ground and the fence. Finally, we placed a wet sponge in each trap (to reduce the chances of desiccation of amphibians) and covered all traps with a 61 cm x 61 cm shade board to further reduce the chance of mortality.

The dates that drift fences were run varied across wetlands and through time, but, in general (except for 2010), we set all traps prior to the first heavy rainfall event in October (Table 1). We ran drift fences until mid- to late spring before closing all traps. In the figure and tables presented herein, a "drift fence season" is defined as the start of data collection in the fall of one year and ending with late spring sampling in the following year, with each season referenced by the year in which the sampling period ended (e.g., 1994 = data collected fall 1993 to spring 1994, a complete drift-fencing season). Where possible in the text, we indicate timing of events by prefacing the year with F (fall) or S (spring).

Table 1. Dates of operation for 3 drift fences encircling pine flatwoods wetlands on Eglin Air Force Base, Okaloosa County, FL. The number of trap nights (i.e., one trap set for one night) for each season is indicated in parentheses.

Season	Wetland 1	Wetland 2	Wetland 3
1993–1994	10/9–3/31 (9060)	-	-
1994–1995	10/27–5/19 (9462)	-	-
2010–2011	-	11/2–2/27 (2771)	12/12–2/27 (1960)
2011–2012	-	10/31–3/23 (8928)	10/31–3/23 (8064)
2012–2013	-	10/29–3/12 (7498)	10/29–3/12 (6762)
2013–2014	-	10/6–5/31 (13,212)	10/6–5/31 (11,928)
2014–2015	-	9/13–3/29 (10,553)	9/13–3/29 (9536)

At wetlands 2 and 3, we checked traps every evening beginning just after sunset. To minimize potential trap mortality from *Solenopsis invicta* Buren (Red Fire Ant) predation, we monitored soil temperatures at 2 cm depth to determine the likelihood of foraging activity (Porter and Tschinkel 1987). On dry nights (low likelihood of salamander movement) with soil temperatures above 15 °C (high likelihood of fire ant foraging), we checked traps continuously until approximately midnight and once after dawn. On dry nights when soil temperatures were <15 °C, we performed an initial check in the evening and once after dawn. On rainy nights when soil temperatures were >15 °C, we checked drift fences every 2 hours for the entire night until dawn. At all 3 wetlands, we identified all captured amphibians and reptiles to species and recorded each individual's stage and sex class (adult male, adult female, or juvenile) and whether females were gravid or not, when possible. We also were able to age some Reticulated Flatwoods Salamanders as yearlings based on the retention of a lateral line (following Palis 1997). All animals were released on the opposite side of the fence from where they were captured.

We used the abundance-based Sorenson index (S_s) to calculate similarity indices among the 3 wetlands (Krebs 1998). The Sorenson index uses species lists and the relative abundance of each species to calculate a similarity value for 2 sites. Values range from 0 to 1 with values closer to 1 indicating more-similar communities. We calculated relative abundances separately for each wetland and reported those metrics as the percentage of the total captures (pooled across years) of a given species.

Results

Herpetofaunal diversity was high across all 3 wetlands and in a majority of sampling seasons (though fewer trap nights [i.e., 1 trap set for 1 night] were conducted from F2010 to S2011; Table 1, Fig. 2). From F1993 to S1995, we captured 37 species of amphibians and reptiles in wetland 1, and from F2010 to S2015, we captured 46 and 43 species in wetlands 2 and 3, respectively (Appendix 1). Species richness did vary across years from F2010 to S2015, and F2013–S2014 had the highest species richness of any season, which coincided with above average precipitation during that year. Furthermore, all 3 wetlands had similar communities when captures were pooled for each site (S_s for wetlands 1 and 2 = 0.98, S_s for wetlands 1 and 3 = 0.98, and S_s for wetlands 2 and 3 = 0.99).

Even though community composition was similar among all sites, there were differences in the relative abundance of the most common species in each wetland (Fig. 3). In wetland 1, Dwarf Salamanders were by far the most abundant species (56.7% of total captures), and the next most abundant species was Reticulated Flatwoods Salamanders, which accounted for only 7.1% of total captures. *Acris gryllus* (Southern Cricket Frog) and *Lithobates sphenocephalus* (Southern Leopard Frog) were the 2 most abundant species in wetlands 2 and 3 (Fig. 3). Dwarf Salamanders accounted for only 3.8% and 6.1% of total captures in wetlands 2 and 3, respectively. *Kinosternon subrubrum* (Eastern Mud Turtle) was the only reptile species included in the 8 most abundant species for any wetland (only in wetland 1). Other commonly encountered reptile species included *Agkistrodon piscivorus*

(Cottonmouth), *Regina rigida* (Glossy Crayfish Snake), and *Scincella lateralis* (Ground Skink). From F2010 to S2015, Cottonmouths were most abundant during F2013–S2014 (76% of all Cottonmouths captured). Sixty-two percent of total Cottonmouth captures from F2010 to S2015 occurred from March to May 2014. F2013–S2014 had highest rainfall and therefore a large emergence of metamorphic amphibians, and was the only successful Reticulated Flatwoods Salamander breeding year from F2010 to S2015.

We captured Reticulated Flatwoods Salamanders, Ornate Chorus Frogs, and Dwarf Salamanders in every sampling season at all 3 wetlands. From F2010 to S2015, Reticulated Flatwoods Salamanders migrated to wetlands in October, November, or December, which typically coincided with the first rains of the season (Fig. 4). In February 2013, we observed a large movement out of wetland 2 following a large rain event that filled the previously dry site. In spring 2014, large numbers of Reticulated Flatwoods Salamander metamorphs were captured leaving the wetlands during April and May (Fig. 4). We have documented yearlings in 4

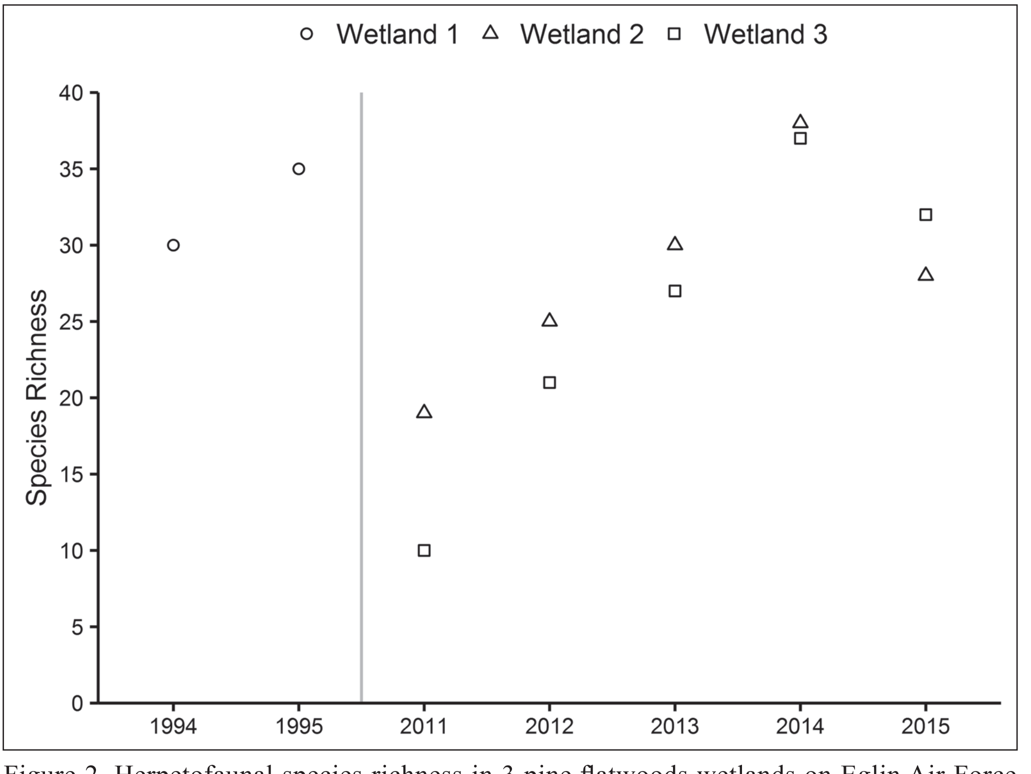

Figure 2. Herpetofaunal species richness in 3 pine flatwoods wetlands on Eglin Air Force Base, Okaloosa County, FL, sampled using a drift fence that completely encircled each wetland. Wetland 1 was sampled for 2 seasons (1993–1995), and wetlands 2 and 3 were sampled for 5 seasons (2010–2015). Sampling seasons usually started in October, and fences were usually closed in either March or May, depending on the conditions in the wetlands. Years are referenced by the January through close portion of the sampling season. See Table 1 for the dates of sampling and number of trap nights in each year. The low species richness in 2011 is likely an artifact of a short sampling season in that year.

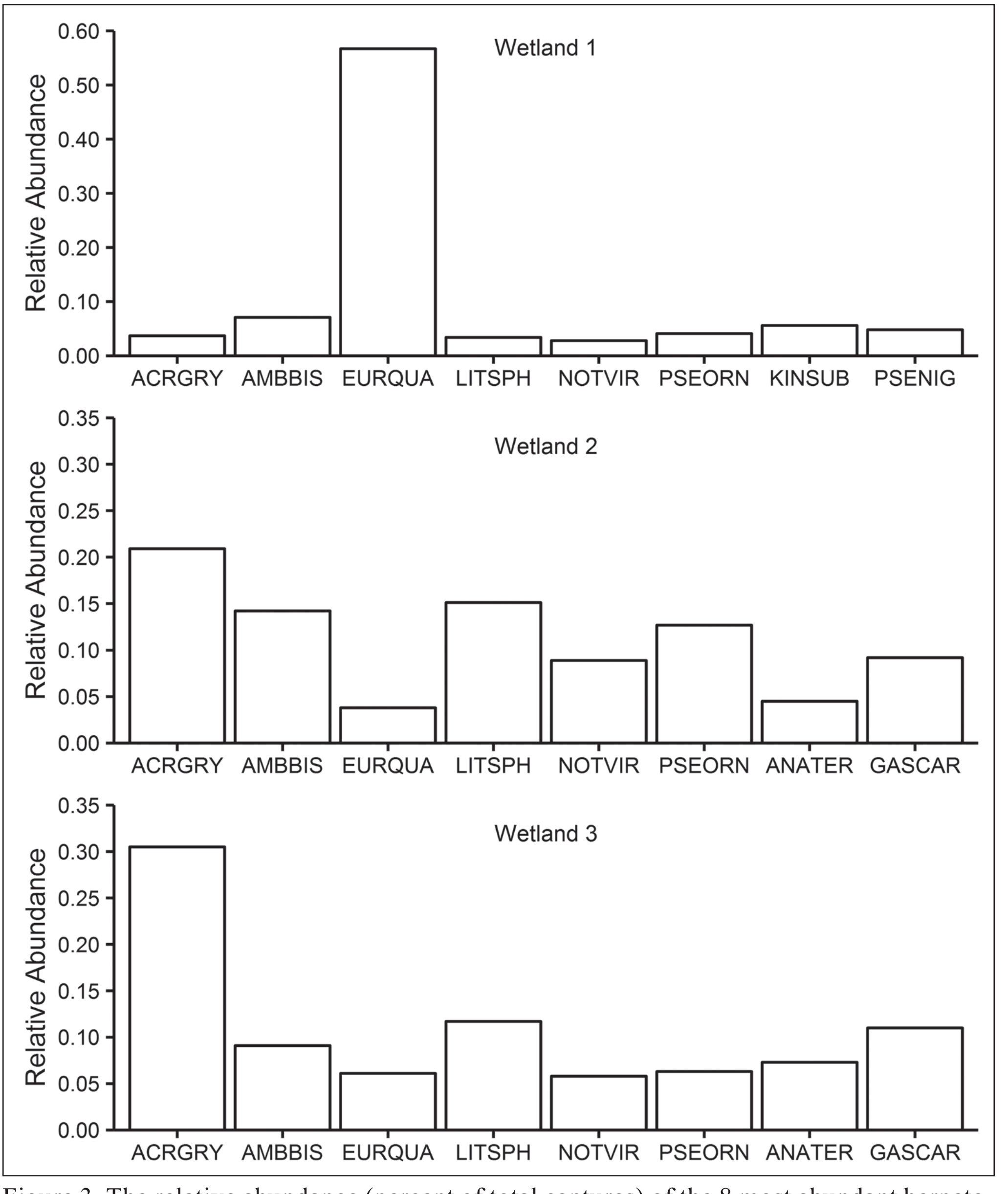

Figure 3. The relative abundance (percent of total captures) of the 8 most abundant herpetofauna captured in drift fences encircling 3 pine flatwoods wetlands (~90% of total captures in all 3 wetlands). Wetland 1 was sampled October–March (1993–1994) and October–May (1994–1995), and wetlands 2 and 3 were sampled for 5 seasons (2010–2015) over approximately the same months. All 3 wetlands were located on Eglin Air Force Base, Okaloosa County, FL. Species codes represent the first three letters of the genus followed by the first three letters of the species name (ACRGRY = *Acris gryllus*; AMBBIS = *Ambystoma bishopi*; ANATER = *Anaxyrus terrestris*; EURQUA = *Eurycea quadridigitata*; GASCAR = *Gastrophryne carolinensis*; KINSUB = *Kinosternon subrubrum*; LITSPH = *Lithobates sphenocephalus*; NOTVIR = *Notophthalmus viridescens*; PSENIG = *Pseudacris nigrita*; PSEORN = *Pseudacris ornata*).

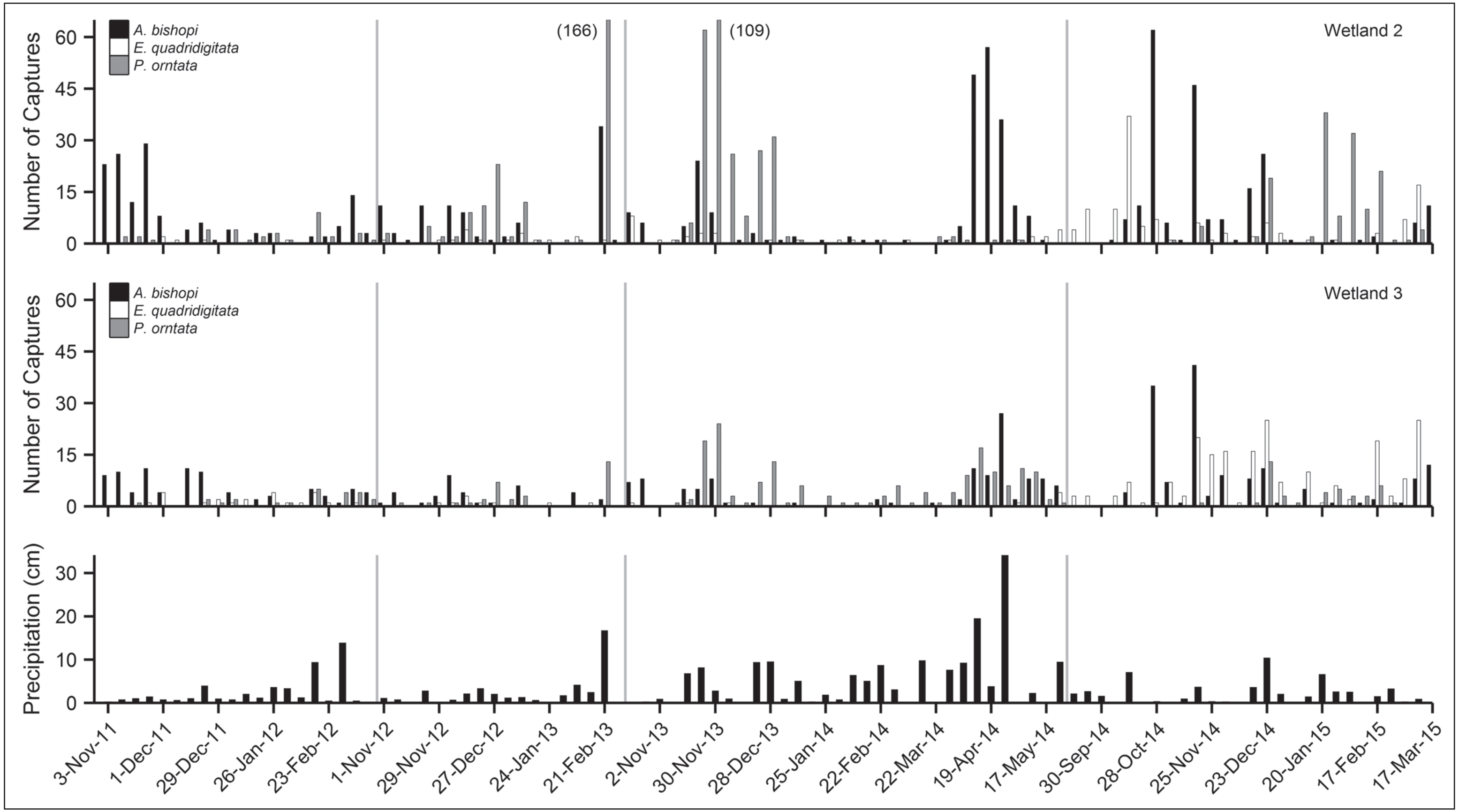

Figure 4. Total weekly captures from 2011 to 2015 for *Ambystoma bishopi* (Reticulated Flatwoods Salamander), *Eurycea quadridigitata* (Dwarf Salamander), and *Pseudacris ornata* (Ornate Chorus Frog) at drift fences encircling 2 pine flatwoods wetlands on Eglin Air Force Base, Okaloosa County, FL. Two weeks for wetland 2 had greater than 75 *P. ornata* captures, and the actual number of captures is indicated in parentheses on the graph. Captures for *E. quadradigitata* were low until the 2014–2015 season. Weekly precipitation totals are plotted over the same time period. Grey bars separate sampling seasons.

seasons, suggesting that the prior year was a successful breeding season (i.e., detection of yearlings occurred in F1993, F1994, F2010, and F2014). Ornate Chorus Frogs displayed similar movement patterns to Reticulated Flatwoods Salamanders, with large movements generally coinciding with the first heavy autumn rains of the season. Finally, Dwarf Salamander captures varied over time and among wetlands. In wetlands 2 and 3, only small numbers of Dwarf Salamanders were captured from F2010 to S2014 (F2010–S2011: 58, F2011–S2012: 28, F2012–S2013: 26, F2013–S2014: 43), but there were 363 captures in F2014–S2015 for the 2 wetlands combined (Fig. 4). In wetland 1, there were 2055 Dwarf Salamander captures in F1993–S1994 and 1341 captures in F1994–S1995.

Discussion

We documented diverse herpetofaunal communities in 3 pine flatwoods wetlands over multiple sampling seasons. Other drift-fence surveys have documented similar herpetofaunal diversity in Coastal Plain wetlands of the southeastern US (e.g., Dodd [1992]: 42 species in a northeast Florida wetland, Russell et al. [2002b]: 56 species combined in 5 wetlands in South Carolina). Furthermore, drift-fence surveys of steephead ravines on and around Eglin AFB documented 44 species of reptiles and amphibians (Enge 2005), and drift-fence surveys in flatwoods and hammocks of western Florida captured 53 species of reptiles and amphibians from 2002 to 2005 (Dodd et al. 2007). We observed remarkably similar herpetofaunal communities between all wetlands (all $S_s > 0.97$) despite the 15–20-year gap in sampling events and the different locations of wetlands included in this study. This result indicates that these wetlands supported a general pool of species that accounted for the vast majority of captures in this study (8 species accounted for >85% of all captures). Species that were not captured at all sites were only captured a few times and likely do not depend on these wetlands during the times of year in which we sampled, if at all. For example, *Apalone ferox* (Florida Softshell), captured a total of just 9 times and at only 1 wetland, usually prefer more permanent water bodies, and *Plethodon grobmani* (Southeastern Slimy Salamander), captured a total of 3 times at 2 wetlands, is an upland species that does not migrate to ephemeral wetlands to breed (Conant and Collins 1998). High community similarity among wetlands combined with high species richness during a majority of years demonstrates that pine flatwoods wetlands reliably support highly diverse herpetofaunal communities that can contribute to regional diversity (Means et al. 2004, Russell et al. 2002b).

High herpetofaunal diversity at sites surveyed in recent years indicates that habitat management on Eglin AFB has been successful for maintaining wetland resources, despite changes to historic fire regimes. Eglin AFB has one of the most active prescribed burning programs in the country (Eglin Air Force Base 2010), which creates and maintains high-quality upland habitat. However, there are challenges associated with prescribed burning in wetlands (e.g., prescribed fires are frequently set during the dormant season when wetlands are inundated; Bishop and Haas 2005). The inability of dormant-season fires to burn through wetland basins has resulted in some wetlands becoming so degraded that a more-active management strategy is required to restore high-quality vegetation communities (e.g., Gorman et al. 2009, 2013; Martin and Kirkman 2009). Recent active management may have contributed to the high species richness seen in wetlands 2 and 3. Despite the degradation that can occur with dormant-season fires, it is not uncommon for wetlands to retain some characteristic vegetation structure (i.e., some edge habitat usually burns even during dormant-season fires), and it is unlikely that wetlands 2 and 3 would support the diverse herpetofauna that we documented if not for the habitat management that has occurred on Eglin AFB.

Even though the overall herpetofaunal assemblages were similar among wetlands, we did observe differences in the relative abundances of certain species. Dwarf Salamanders were an order of magnitude more abundant in wetland 1 compared to wetlands 2 and 3. We cannot determine whether the large difference in abundance reflects differences in locations surveyed or changes over time or both. Other surveys (larval dipnetting) from F2010 to S2015 at both locations indicate that East Bay Flatwoods (wetland 1) does support a higher abundance of Dwarf Salamander when compared to Oglesby's Flatwoods (wetlands 2 and 3; T. Gorman and C. Haas, Virginia Tech, Blacksburg, unpubl. data). The substantial increase in Dwarf Salamander captures in wetlands 2 and 3 after a single year with above average precipitation does suggest that more successful reproduction occurred during F2013–S2014 than F2010–S2013. We observed a similar trend in the Reticulated Flatwoods Salamander populations at wetlands 2 and 3. The number of adult salamanders declined from F2010 to S2015 to a low of just 23 and 14 (wetlands 2 and 3, respectively) during F2014–S2015, likely because of multiple reproductive failures during drought years (Chandler et al. 2016, Palis et al. 2006, Westervelt et al. 2013). We did observe one successful breeding season (metamorphs leaving wetlands 2 and 3 in S2014), which increased the total number of Reticulated Flatwoods Salamander captures to 116 and 89 (wetlands 2 and 3, respectively) F2014–S2015 (adults and yearlings combined). However, it is likely that populations in these 2 wetlands may be almost completely composed of a single cohort in subsequent years. These examples highlight the challenges for amphibians breeding in ephemeral wetlands (Dodd 1992, Gibbons et al. 2006, Semlitsch et al. 1996), especially as climate change continues to affect wetland hydrology (Chandler et al. 2016).

An increased frequency of drought and shortened or more unpredictable hydroperiods are likely to be primary stressors for these wetland communities in the future, especially in landscapes where anthropogenic degradation is minimal (Chandler et al. 2016, Walls et al. 2013, Westervelt et al. 2013). Palis et al. (2006) documented how severe drought can lead to complete reproductive failure (no metamorphosis) in flatwoods salamander populations, and the effects of drought are likely similar for other habitat specialists that breed in ephemeral wetlands. During our surveys, we sampled during multiple years that were characterized by drought and short hydroperiods (e.g., F2012–S2013 and F2014–S2015). Drought years did have a species richness similar to other non-drought years, and wetlands did fill for at least a short time during all sampling seasons (although years with no standing water in these wetlands have been documented; Gorman et al. 2009). Observing only 1 successful breeding event by Reticulated Flatwoods Salamanders during the period F2010–S2015 and the increase in Dwarf Salamander captures after a year with above average rainfall indicate that, for drift-fence studies to be effective in these systems, they need to span enough years to capture the temporal variation of ephemeral-wetland breeding species (Palis and Aresco 2007, Semlitsch et al. 1996).

Effectively monitoring herpetofaunal communities in pine flatwoods wetlands is important for several reasons. In ephemeral wetlands, larval amphibians play an important role in aquatic food webs, serving as prey sources for predatory invertebrates and vertebrates and directly competing with both herbivorous (Beard et al. 2003, Morin et al. 1988) and predaceous invertebrates (Caldwell et al. 1980). Larval amphibians can also affect nutrient cycling within a wetland and alter decomposition rates (Capps et al. 2015, Hocking and Babbitt 2014, Whiles et al. 2006). Furthermore, amphibian breeding events serve as one of the primary links between wetland energy sources and surrounding upland forests (Schriever et al. 2014, Whiles et al. 2006), and these breeding events provide resources for numerous other species, including many reptiles (Wilbur 1997). Given the extensive loss of wetland resources across the southeastern United States (Hefner and Brown 1984), the importance of wetlands within pine flatwoods to herpetofaunal diversity, and the current threats to these ecosystems, supporting high-quality vegetation structure through regular fires should be a management priority for the remaining pine flatwoods wetlands (Bishop and Haas 2005; Chandler et al. 2015; Gorman et al. 2009, 2013). Finally, detailed research (e.g., Chandler et al. 2016, McLaughlin and Cohen 2014) is needed in these and other ephemeral wetlands to better understand the drivers and threats to wetland hydrologic processes.

Acknowledgments

We thank the many people who have assisted with this work, especially C. Abeles, D. Atencio, A. Austermann, J. Bell, A. Daniels, M. Dziadzio, L. Gamble, K. Gault, P. Gault, S. Goodman, B. Hagedorn, J. Hefner, A. Hillman, J. Jensen, J. Johnson, K. Jones, L. LaClaire, C. Mahmood, T. Mammone, A. Minor, H. Mitchell, B. Moore, J. Newman, C. Nordman, E. Nordman, B. O'Hanlon, E. Ohr, J. Parker, A. Perez-Umphrey, C. Petrick, J. Preston, A. Saenger, S. Powell, B. Rincon, S. Ritchie, J. Da Silva Neto, and T. Williams. We thank Karen Powers, Susan Walls, and 1 anonymous reviewer for their helpful comments on an earlier draft of this manuscript. Also, we thank the Natural Resources Branch of Eglin Air Force Base (Jackson Guard), Department of Defense Legacy Resource Management Program, Hurlburt Field, US Fish and Wildlife Service, Aquatic Habitat Restoration/Enhancement Program of Florida Fish and Wildlife Conservation Commission, and the Department of Fish and Wildlife Conservation at Virginia Tech for financial and logistical support of this project. Sampling protocols were approved by the Virginia Tech Institutional Animal Care and Use Committee (IACUC), Protocol no. 13-129-FIW.

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Appendix 1. Herpetofauna captured in drift fences that encircled 3 pine flatwoods ponds on Eglin Air Force Base, Okaloosa County, FL. Wetland 1 was sampled for 2 seasons (1993–1995), and wetlands 2 and 3 were sampled for 5 seasons (2010–2015). Drift fences were usually opened in October and run through March or May of the following year (the spring portion of the year is used to reference seasons).

	Wetland 1		Wetland 2					Wetland 3				
Species	1994	1995	2011	2012	2013	2014	2015	2011	2012	2013	2014	2015
Frogs and Toads												
Acris gryllus (LeConte) (Southern Cricket Frog)	69	153	53	24	369	706	136	13	20	274	783	312
Anaxyrus quercicus (Holbrook) (Oak Toad)	14	40		2	7	20	3			3	51	1
Anaxyrus terrestris (Bonnaterre) (Southern Toad)	65	17	10	167	15	75	12	3	55	18	226	34
Eleutherodactylus planirostris (Cope) (Greenhouse Frog)		1	1		11	25	8			1	18	5
Gastrophryne carolinensis (Holbrook) (Eastern Narrow-mouthed Toad)	47	94	11	55	138	257	104		32	67	346	61
Hyla cinerea (Schneider) (Green Treefrog)						2					1	
Hyla femoralis Bosc in Daudin (Pine Woods Treefrog)	3	43	1	2	3	15	11			8	26	8
Hyla gratiosa (LeConte) (Barking Treefrog)												1
Hyla squirella Bosc in Daudin (Squirrel Treefrog)					4		1			2		
Lithobates capito (LeConte) (Gopher Frog)						2					3	
Lithobates clamitans (Latreille in Sonnini de Manoncourt and Latreille) (Green Frog)		2				12					20	
Lithobates grylio (Stejneger) (Pig Frog)					4	8				4	15	6
Lithobates sphenocephalus (Cope) (Southern Leopard Frog)	91	111	9	32	106	713	69	10	17	52	417	39
Pseudacris nigrita (LeConte) (Southern Chorus Frog)	149	137	2	3	3	9	3			1	3	
Pseudacris ornata (Holbrook) (Ornate Chorus Frog)	173	75	79	37	241	282	145	24	23	32	169	41
Scaphiopus holbrookii (Harlan) (Eastern Spadefoot)				12	6	2		2	6	1	1	8
Salamanders												
Ambystoma bishopi Goin (Reticulated Flatwoods Salamander)	349	93	188	145	92	235	217	29	86	36	114	151
Amphiuma means (Garden in Smith) (Two-toed Amphiuma)		1				1					1	
Eurycea quadridigitata (Holbrook) (Dwarf Salamander)	2055	1341	42	5	17	34	138	16	23	9	9	225
Notophthalmus viridescens (Rafinesque) (Eastern Newt)	101	66	35	82	58	101	271	18	20	36	62	130
Plethodon grobmani Allen and Neill (Southeastern Slimy Salamander)			2									1

Species	Wetland 1		Wetland 2					Wetland 3				
	1994	1995	2011	2012	2013	2014	2015	2011	2012	2013	2014	2015
Lizards												
Anolis carolinensis Voigt (Green Anole)				12	6	2	2			2	8	2
Cnemidophorus sexlineatus (L.) (Six-lined Racerunner)	6	1							2			
Ophisaurus attenuatus Cope (Slender Glass Lizard)	3											
Ophisaurus ventralis (L.) (Eastern Glass Lizard)	2	3			3	9			5	5	16	5
Plestiodon anthracinus Baird (Coal Skink)	2	1										
Plestiodon laticeps (Schneider) (Broad-headed Skink)				1		2	3				1	3
Sceloporus undulatus Bosc and Daudin in Sonnini and Latreille (Eastern Fence Lizard)	1	4										
Scincella lateralis (Say) (Ground Skink)	70	19	1	4	2	6	1		12	1	10	1
Snakes												
Agkistrodon piscivorus (Lacépède) (Eastern Cottonmouth)				5	10	40	7				40	3
Cemophora coccinea (Blumenbach) (Scarlet Snake)	1				1						2	2
Coluber constrictor L. (Black Racer)	32	15	1	2		1	5		1	1	2	3
Diadophis punctatus (L.) (Ring-necked Snake)	8	1		4	7	1			1		2	
Farancia abacura (Holbrook) (Mud Snake)		7				2					1	1
Heterodon platirhinos Latreille in Sonnini and Latreille (Eastern Hog-nosed Snake)	3	3					2				1	
Lampropeltis elapsoides (Holbrook) (Scarlet Kingsnake)			1						2			
Lampropeltis getula (L.) (Eastern Kingsnake)		4										
Nerodia fasciata (L.) (Banded Water Snake)	13	21		3	8	44	2	1	4	5	22	6
Opheodrys aestivus (L.) (Rough Green Snake)		1					1			1	1	2
Pantherophis guttatus (L.) (Corn Snake)	1	2	1		3	9	7		4	2	2	5
Regina rigida (Say) (Glossy Crayfish Snake)	16	9				19	47		2	2	27	46
Sistrurus miliarius (L.) (Pygmy Rattlesnake)		1										
Storeria occipitomaculata (Storer) (Red-bellied Snake)						1			2			1
Tantilla coronate Baird and Girard (Southeastern Crowned Snake)	1				1		1				3	4
Thamnophis sauritus (L.) (Eastern Ribbon Snake)	27	44	4	1	5	36	20		2	4	19	14
Thamnophis sirtalis (L.) (Common Garter Snake)	19	10	4	3	2	6	9			2	4	10
Virginia valeriae Baird and Girard (Smooth Earth Snake)				1		1	2					

	Wetland 1		Wetland 2					Wet				
Species	1994	1995	2011	2012	2013	2014	2015	2011	2012	2013	2014	2015
Turtles												
Apalone ferox (Schneider) (Florida Softshell)					2	7						
Deirochelys reticularia (Latreille in Sonnini and Latreille) (Chicken Turtle)	5	7				5						
Kinosternon subrubrum (Bonnaterre) (Eastern Mud Turtle)	94	243	3	5	12	10	12	1	8	7	7	6
Pseudemys floridana (LeConte) (Coastal Plain Cooter)						13						
Terrapene carolina (L.) (Eastern Box Turtle)	6	9		2	1					1	1	
Trachemys scripta (Thunberg in Schoepff) (Pond Slider)				5	2	14						