Inventory of Vernal Pool Fauna on Dahomey National Wildlife Refuge
Bolivar County, Mississippi
FY '12

Dahomey National Wildlife Refuge (NWR) is located in the delta region of Mississippi in Bolivar County, approximately 15 miles southwest of Cleveland on MS Highway 446. The 9,691 acre refuge was established in 1991 and is dominated by bottomland hardwood forests. Much of the acreage shallowly floods each winter, providing habitat for overwintering waterfowl. Additionally, due to the "ridge and swale" topography, numerous temporary pools are formed, providing habitat for a variety of vertebrates and invertebrates.

From January 30 – June 1, 2012 aquatic habitats on Dahomey NWR were sampled for crayfish, fish, amphibians, and reptiles. A total of 20 sites were initially chosen for sampling, with eight sites added later, as original sites dried. Initial site selection was based on water distribution from the previous year, logistical considerations, and ground-truthing to insure areas were flooded sufficiently. The 20 original sites were characterized in January 18 – 24, 2012, and then water chemistry parameters were measured at during each sampling period. Pools were marked at their approximate center with a flag and measurements were taken at that point, when possible. Table 1 below provides a list of the parameters used to characterize the ponds as well as a list of water chemistry variables measured during each sampling period.

Table 1: Summary of characteristics measured on all vernal pools during the four month (January 30 – June 1, 2012) inventory of vernal pools on Dahomey National Wildlife Refuge, Bolivar County, Mississippi.

Parameter	Output	Description	Sampling frequency
Number of pools	Single or multiple	Min. of 4-5 inches of connecting water to classify as single pool	Initial characteristic
Size of pool	Small (< 75 m^2), Medium (76- 140 m^2), or Large(> 300 m^2)	Measured at greatest length and greatest width and calculated area	Initial characteristic
Shape of pool	Circular (natural) or Rectangular (artificial)	pool seems natural or pool follows trail or ditch	Initial characteristic
Forestation	Number of tree in pool	Included trees taken with prism and in pool; diameter taken of 5 random trees	Initial characteristic
Leaf litter	Present or not	Present at bottom of pool	Initial characteristic
Depth	Centimeter	Measured at visual center of pool	Initial characteristic and each sampling period
Temperature	Celsius	Hanna Combo pH & EC waterproof meter (HI98129)	Initial characteristic and each sampling period
pH	pH unit	Hanna Combo pH & EC waterproof meter (HI98129)	Initial characteristic and each sampling period
Conductivity	Micro- Siemens	Hanna Combo pH & EC waterproof meter (HI98129)	Initial characteristic and each sampling period

Total Dissolved Solids	Parts per million	Hanna Combo pH & EC waterproof meter (HI98129)	Initial characteristic and each sampling period
Dissolved Oxygen	Parts per million	Y S I portable dissolved oxygen and temperature instrument (YSI DO200)	Initial characteristic and each sampling period
Percent vegetation	Percent vegetation in pool	In 1 m by 1 m block visual percentage for center, middle (3 paces from center), and edge of pool	Initial characteristic and each sampling period
Percent Canopy	Visual percent of canopy covering pool	From visual center, picture taken of canopy and percent judged by site	Initial characteristic and each sampling period

For logistical purposes, sites were lumped into four areas based on location. Sites were sampled on a rotational basis with one area (5 sites) sampled each week. Once data were collected in all four areas, the cycle began again. As original sites dried, permanent bodies of water were sampled to help expand the species list. Sites were labeled "extra 1 – 8" and were only sampled with minnow traps since the steep banks did not allow for dip netting. Sampling of additional sites occurred from May 8 - June 1, 2012. Table 2 below provides a basic description of each site, dates of first and last sampling and the total number of trap nights per site (measure of sampling effort). Sites were sampled a total of 2,820 trap nights (1 trap night = 1 trap set for 24 hours). Figure 1 (page 6) shows the location of each sampling site on the refuge.

Table 2: Description of site location, number and size category of pools at site, basic description of site habitat, dates of first and last sampling, and number of trap nights for all sites sampled during the four month (January 30 – June 1, 2012) inventory of vernal pools on Dahomey National Wildlife Refuge, Bolivar County, Mississippi.

Site no.	Location	No./size of pools	Description (based on initial characterization	Dates of first and last sample	No. trap nights
1-A	Overflow from Happy Hollow Lake, inside Herbert Trail, sw corner	1 Large	No canopy, flooded grasses, goldenrod, coffeeweed, few planted cypress/oak saplings, leaf litter	1/30/2012 4/19/2012	150
1-B	North of Bear Rd, 0.5 miles west of jct. w/Neblett Road, adjacent to Bear Rd.	3 total Large Small	Hardwood forest, cane present, frog-bit, grasses, leaf litter, saplings as well as larger trees	1/30/2012 4/19/2012	150
1-C	SE corner of moist soil unit 12, north of Bear Road, 0.1 miles west of jct. w/Neblett Road	1 Large	Moist soil unit, grasses, pennywort, frog-bit, naiads	1/30/2012 4/19/2012	135
1-D	1.0 miles from jct. of north end of Christmas Lake Road north side of Hoover Road	8 total Large Small	Hardwood forest, leaf litter, saplings as well as larger trees, grasses	1/30/2012 4/19/2012	135
1-E	1.0 miles from jct. of north end of Christmas Lake Road south side of Hoover Road	9 total Large Medium	Hardwood forest, leaf litter, saplings as well as larger trees, cane, old dump site	1/30/2012 3/22/2012	120
2-A	40 acre tract, 0.25 mi east of main part of refuge, south of hwy 446 (adjacent to hwy)	1 Large	Old canal through site. Hardwood forest, leaf litter, saw palmettos	2/6/2012 4/26/2012	150
2-B	Sawdust Road, 0.3 mi. south of jct. with hwy 446,	1 Large	Hardwood forest, leaf litter, saplings as well as larger	2/6/2012 4/26/2012	150

	northeast side of road.		trees, cane, grasses		
2-C	Well Road, 1.3 mi. south of jct. with hwy 446, west side of road.	1 Large	Hardwood forest, leaf litter, saplings	2/6/2012 5/11/2012	165
2-D	Longshot Road, 0.5 mi. east of jct. with Well Road, north of Longshot	1 Large	Hardwood forest, leaf litter, saplings, vines, grasses, cane	2/6/2012 4/26/2012	135
2-E	Longshot Road, 0.7 mi. east of jct. with Well Road, north of Longshot	2 total Large	Hardwood forest, leaf litter, saplings, rushes, naiad, grasses, pennywort	2/6/2012 4/26/2012	150
3-A	Headquarters Road, south gate, west side of road	1 Large	Hardwood forest, leaf litter, vines, cane (sm. amt.)	2/27/2012 4/6/2012	90
3-B	Headquarters Road, 0.2 mi. north of south gate, east side	1 Large	Hardwood forest, leaf litter, vines	2/27/2012 5/11/2012	135
3-C	Headquarters Road, 0.6 mi. north of south gate, west side	5 total Large Medium	Open site at edge of hardwood forest, vegetation dominated by grasses and sedges	2/27/2012 5/11/2012	120
3-D	Headquarters Road, 1.0 mi. north of south gate, west side of road	2 total Large	Site extends from within hardwood forest out to road. Within forest vegetation dominated by hardwood trees and saplings, leaf litter present. Also road edge, dominated by grasses and sedges	2/27/2012 5/4/2012	105
3-E	East side of Paw Paw trail, just north of hwy 446	1 Large	Hardwood forest, leaf litter, large amount of woody debris	2/27/2012 5/11/2012	150
4-A	Belman Trail, south fork, just south of jct. with Headquarters Road	7 total Large Small	Pools located on trail, hardwood forest surrounds, leaf litter present, dominated by sedges and grasses	3/5/2012 4/12/2012	90
4-B	Belman Trail, north fork, just north of jct. with Headquarters Road	7 total Large Medium Small	Pools located on trail, surrounded by hardwood forest, leaf litter present dominated by grasses	3/5/2012 4/12/2012	90
4-C	North end of Headquarters road, just east along spur trail leading to Belman Trail	6 total Large Medium	Pools located on trail, surrounded by hardwood forest, leaf litter present dominated by grasses	3/5/2012 4/12/2012	90
4-D	Bear Trail, just north of jct. with Bear Road. On trail and in surrounding forest	14 total Large Small	Pools located on trail and in surrounding hardwood forest, leaf litter present, several dominated by grasses	3/5/2012 4/12/2012	90
4-E	Gobbler Trail, just east of jct. with Bear Road	8 total Medium	Pools located on trail, surrounded by hardwood forest, leaf litter present, dominated by grasses	3/5/2012 4/12/2012	90
Extra 1	Sawdust Road, 1.3 miles south of jct. with Hwy 446	N/A	Stillwater Bayou, permanent channelized stream, portions dammed by beaver, surrounded by hardwood forest	5/8/2012 5/11/2012	30

Extra 2	East Boundary of refuge, 0.4 miles north of jct. with Hwy 446, north of refuge sign	N/A	Belman's Bayou, permanent channelized stream, reforestation area to west, ag field to east	5/14/2012 6/1/2012	60
Extra 3	Stillwater Trail, just south of jct. with pipeline	N/A	Stillwater Bayou, permanent channelized stream, surrounded by hardwood forest	5/14/2012 6/1/2012	60
Extra 4	Neblett Road, 0.5 mi. north of jct. with 446, west side	N/A	Christmas Lake Branch, permanent old meander bend, now used to drain ag land to the north, gravel road to east, forest to west	5/14/2012 6/1/2012	30
Extra 5	Herbert Trail, east end, near viewing tower	N/A	Eastern tributary leading out of Happy Hollow Lake, surrounded by reforestation areas	5/14/2012 5/17/2012	30
Extra 6	Headquarters Road, 2.0 mi north of south gate, east side	N/A	Belman's Bayou, permanent channelized stream, surrounded by hardwood forest	5/21/2012 5/24/2012	30
Extra 7	Bear Road, 0.5 mi. west of jct. with Headquarters Road	N/A	Stokes Bayou, permanent dredged stream, surrounded by hardwood forest	5/21/2012 6/1/2012	60
Extra 8	Sawdust Road, 1.4 mi. south of jct. with hwy 446, west side of road	N/A	Stillwater Bayou, permanent channelized stream, portions dammed by beaver, surrounded by hardwood forest	5/21/2012 5/24/2012	30

At each site, 20 minnow traps were set at the beginning of the week and baited with commercial crayfish bait. Traps were checked daily and were removed at the end of the week. Traps were placed near existing structures, such as against a log, near vegetation, or in a depression, to maximize the possibility of captures. As the water receded, the number of traps set at each site was reduced, with five as the minimum number of traps set at a site. Trapping continued until the water became too shallow to use the minnow traps. Table 3 below summarizes the dates of each trapping period, the sites trapped during each period, the number of traps used, and the number of trap nights. In addition to trapping, water chemistry information was collected and a time-constrained search using dip nets was conducted at each site during each sampling period. Appendix A contains water quality results for all sampling periods for each site.

Table 3: Summary of trapping periods, sites trapped, and number of traps used during each sampling period during the four month (January 30 – June 1, 2012) inventory of vernal pools on Dahomey National Wildlife Refuge, Bolivar County, Mississippi.

Trapping period	Dates	Area (Sites) trapped	Number of traps [total trap nights]
1	Jan. 30 - Feb. 2, 2012	1 (A-E)	20 traps/site [300 tn]
	Feb. 6- Feb. 9, 2012	2 (A-E)	20 traps/site [300 tn]

	Feb. 27- Mar. 1, 2012	3(A-E)	20 traps/site [300 tn]
	Mar. 5- Mar. 8, 2012	4 (A-E)	20 traps/site [300 tn]
2	Mar. 19- Mar. 22, 2012	1 (A-E)	20 traps/site [300 tn]
	Mar. 26- Mar.29, 2012	2 (A-E)	20 traps/site [300 tn]
	Apr. 3- Apr. 6, 2012	3(A-E)	10 traps/site [150 tn]
	Apr. 9- Apr. 12, 2012	4 (A-E)	10 traps/site [150 tn]
3	Apr. 16- Apr. 19, 2012	1 (A-D)	10 traps/site (A,B), 5 traps/site (C,D) [90 tn]
	Apr. 23-Apr. 26, 2012	2 (A-E)	10 traps/site (A,B,C,E), 5 traps/site (D) [135 tn]
	May 1- May 4, 20123(B-E)	3(B-E)	10 traps/site(B,E), 5 traps/site (C,D) [90 tn]
4	May 8- May 11, 2012	3 (B,C,E), 2 (C,), and Extra 1	10 traps/site (3-E, Extra1) 5 traps/site (2-C,3-B,3-C) [105 tn]
5	May 14- May 17, 2012	Extra (2-5)	10 traps/site (Extra 2,3,5) 5 traps/site (Extra 4) [105 tn]
6	May 21- May 24, 2012	Extra (6-8)	10 traps/site [90 tn]
7	May 29- Jun. 1, 2012	Extra (2-4, 7)	10 traps/site (Extra 2,3,7) 5 traps/site (Extra 4) [105 tn]

All individuals captured were identified to genus and most were identified to species. Where possible, individuals were sexed and assigned an age class (juvenile or adult), and total number of individuals was recorded. All amphibians and reptiles were then released near the point of capture. Crayfish were identified in the field and preserved in 70% ethanol. Captured fish were preserved in 5% formalin. All crayfish and fish samples were sent to the U.S. Forest Service, Southern Research Station, in Oxford, Mississippi to have the identification verified. Beginning April 17, crayfish that could be confidently identified in the field were processed and released near the point of capture. Additional reptile and amphibian species were detected through chance encounters and call recognition (frogs).

Pondberry search

Informal area searches for pondberry were conducted at all sites by walking through the sites during late February and early March. Based on a nearby population of pondberry (Hester FSA Conservation Easement) any pondberry present should have been in bloom and easily detected.

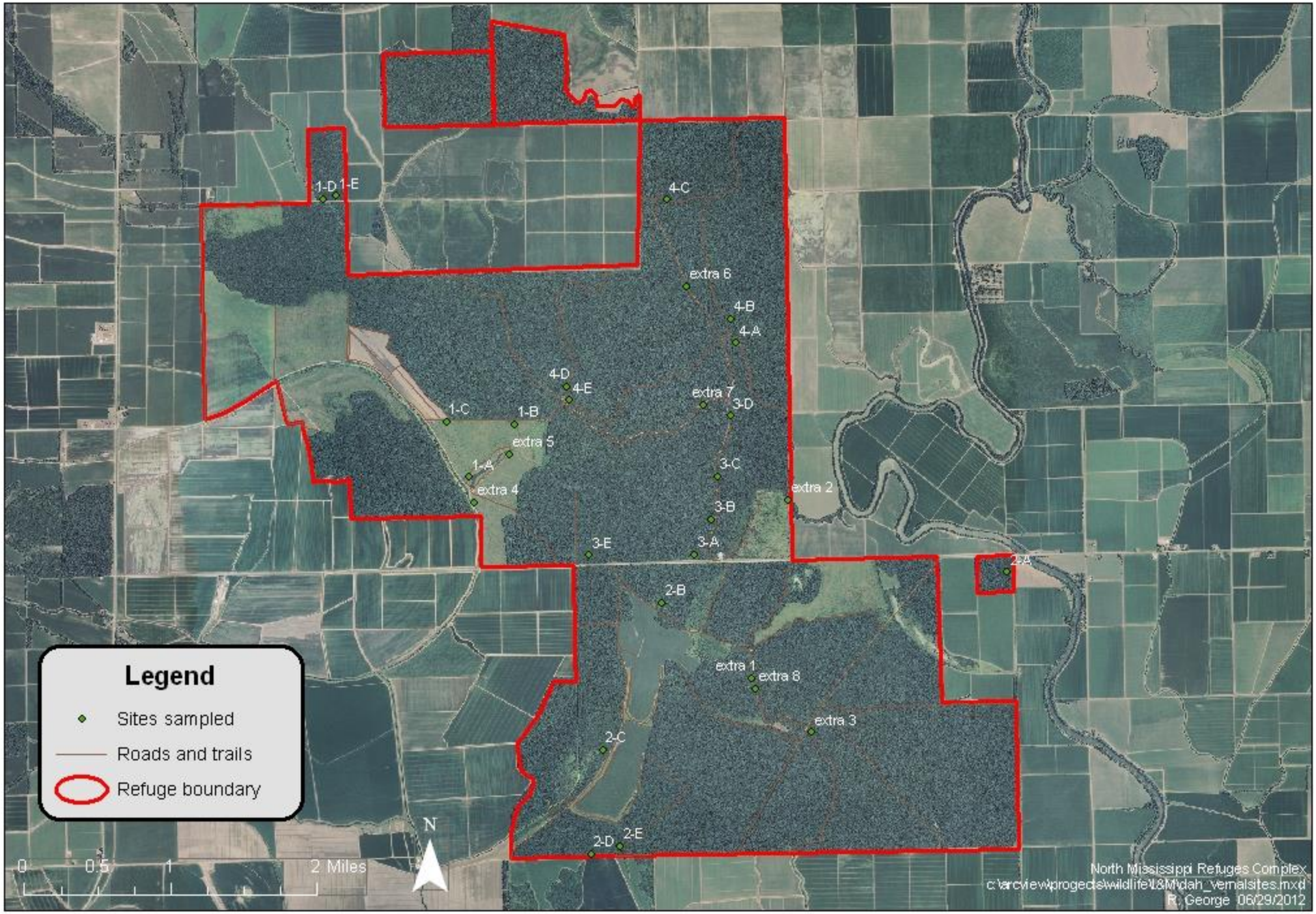

Figure 1: Location of vernal pool sites sampled during the four month (January 30 – June 1, 2012) inventory of vernal pools on Dahomey National Wildlife Refuge, Bolivar County, Mississippi.

Results

Habitat Characteristics

To maximize the number of species captured, sampling areas were selected to represent the range of vernal pool habitat available. Areas were selected that were isolated pools, as well as pools that were connected or had been connected to larger permanent bodies of water. Some sites contained single pools, while others were a series of connecting pools. All 20 initial sites were dry by the end of May, and many dried a month or more earlier.

The majority of sites sampled were within or immediately adjacent to mature bottomland hardwood forest. However, several sites were sampled that were in open habitat or adjacent to agricultural lands, reforestation areas, or roads. Since the goal of the project was to inventory species present, an effort was made to sample a variety of potential aquatic habitats.

Species Inventory

A total of 6 crayfish species, 17 fish species, 12 amphibian species, and 12 reptile species were captured or otherwise recorded. Tables 4 – 7 provide a list of species detected and locations where they were found. Species identifications for crayfish and fish were verified by the U.S. Forest Service, Southern Research Station.

Pondberry results

Pondberry was not found at Dahomey NWR during this study. A similar species, spicebush (*Lindera benzoin*) was found near the entrance of Paw Paw Trail (near site 3-E). Because of the specialized habitat requirements of pondberry, and the short window of opportunity for detecting it in bloom, it's still possible that it is on the refuge. Future plans include continuing periodic spring surveys for this species.

Table 4: Distribution of crayfish species throughout all sites during the four month (January 30 – June 1, 2012) inventory of vernal pools on Dahomey National Wildlife Refuge, Bolivar County, Mississippi.

Crayfish	**Sites**																			**Extra**							
Species	1-A	1-B	1-C	1-D	1-E	2-A	2-B	2-C	2-D	2-E	3-A	3-B	3-C	3-D	3-E	4-A	4-B	4-C	4-D	4-E	1	2	3	4	5	6	7	8
Vernal Crayfish *Procambarus viaeviridis*		X		X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X								
Red Swamp Crayfish *P. clarkii*	X					X	X	X	X	X		*			*						*		*	*	*			*
White River Crayfish *P. acutus*		X	X		X	X	X	X	X	X	X	X	X	X	X	X		X	X		*		*		*			*
Swamp Dwarf Crayfish *Cambarellus puer*		X					X				X	X	X	X	X													*
Digger Crayfish *Fallicambarus fodiens*															X													
Grey- speckled Crayfish *Orconectes palmeri*																						X					X	

*identified and released, not verified

Table 5: Distribution of fish species throughout all sites during the four month (January 30 – June 1, 2012) inventory of vernal pools on Dahomey National Wildlife Refuge, Bolivar County, Mississippi.

Fish		**Sites**																										
		1					**2**					**3**					**4**					**Extra**							
Species		A	B	C	D	E	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E	1	2	3	4	5	6	7	8
Amiidae	Bowfin, *Amia calva*								X																				
Cyprinidae	Blacktail shiner, *Cyprinella venusta*																						X					X	
	Redfin shiner, *Lythrurus umbratilis*																						X						
	Golden shiner, *Notemigonus crysoleucas*													X									X				X	X	
	Bullhead minnow, *Pimephales vigilax*																						X						
Ictaluridae	Yellow bullhead, *Ameiurus natalis*																						X					X	
	Tadpole madtom, *Noturus gyrinus*																						X				X	X	
Aphredoderidae	Pirate perch, *Aphredoderus sayanus*												X												X		X		X
Fundulidae	Golden topminnow, *Fundulus chrysotus*																						X		X		X		
Poeciidae	Western mosquitofish, *Gambusia affinis*	X	X	X				X	X	X	X		X					X				X	X	X	X	X	X	X	X
Centrarchidae	Green sunfish, *Lepomis cyanellus*	X	X	X				X	X		X		X	X	X		X					X	X	X	X	X	X	X	X
	Warmouth, *L. gulosus*	X	X										X									X	X	X	X		X		X
	Orange-spotted sunfish, *L. humilis*																						X						
	Bluegill, *L. macrochirus*	X	X																				X				X		X
	Longear sunfish, *L. megalotis*																						X						
	Bantam sunfish, *L. symetricus*	X	X						X													X		X	X				X

Table 6: Distribution of amphibian species throughout all sites during the four month (January 30 – June 1, 2012) inventory of vernal pools on Dahomey National Wildlife Refuge, Bolivar County, Mississippi.

Amphibians	**Sites**																				**Extra**							
Species	1-A	1-B	1-C	1-D	1-E	2-A	2-B	2-C	2-D	2-E	3-A	3-B	3-C	3-D	3-E	4-A	4-B	4-C	4-D	4-E	1	2	3	4	5	6	7	8
Bullfrog *Rana catesbeiana*	X		X	X	X	X		X		X	X	X	X	X	X	X		X	X	X	X	X					X	
Bronze frog *Rana clamitans*		X		X	X			X		X		X	X	X				X					X			X		X
Southern Leopard frog *Rana utricularaia*		X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X									
Cricket frog *Acris gryllus*		X		X	X	X			X	X						X				X								
Green Treefrog *Hyla cinerea*														X	X													
Pickerel Frog *Rana palustris*			X																									
Spring Peeper *Pseudacris crucifer*			X												X													
Mole Salamanders *Ambystoma talpoideum*														X	X													
Marbled Salamander *A. opacum*		X		X			X		X	X	X	X	X	X	X	X	X	X	X	X								
Central Newt, *Notophthalmus viridescens*										X			X															
Lesser Siren *Siren intermedia*						X		X	X	X	X	X			X													
Amphiuma *Amphiuma tridactylum*																							X					
Tadpoles	X	X	X	X		X	X	X	X	X		X	X	X	X	X	X	X	X	X	X		X					X

Table 7: Distribution of reptile species throughout all sites during the four month (January 30 – June 1, 2012) inventory of vernal pools on Dahomey National Wildlife Refuge, Bolivar County, Mississippi.

Reptiles	**Sites**																				**Extra**							
Species	1-A	1-B	1-C	1-D	1-E	2-A	2-B	2-C	2-D	2-E	3-A	3-B	3-C	3-D	3-E	4-A	4-B	4-C	4-D	4-E	1	2	3	4	5	6	7	8
Ground skink *Scincella lateralis*												X		X														
Rough Green Snake *Opheodrys aestivus*		X		X																								
Broad banded water snake *Nerodia fasciata*	X			X				X	X									X			X	X	X		X			X
Yellow bellied water snake *Nerodia flavigaster*		X	X							X						X							X		X			
Eastern garter snake *Thamnophis sirtalis*																		X										
Cottonmouth *Agkistrodon piscivorus*								X						X				X		X					X			
Ribbon snake *Thamnophis sp.*									X	X																		
Diamondback water snake *Nerodia rhombifer*	X																				X	X						X
Mud snake *Farancia abacura*												X													X			
Common mud turtle *Kinosternon subrubrum*							X					X																
3-toed box turtle *Terrapene carolina triunguis*									X																			
Red eared slider *Trachemys scripta elegans*								X												X								

Appendix A

Water quality parameters measured at each site sampled during the four month (January 30 – June 1, 2012) inventory of vernal pools on Dahomey National Wildlife Refuge, Bolivar County, Mississippi. At sites with multiple pools, 3 pools were randomly selected for water quality measurements and were used throughout the study. The designations S, M, and L refer to pool size (small, medium, and large, respectively) and were used to differentiate pools within the same site. An asterisk (*) designates a sampling period in which that pool was dry at the center point, but water quality parameters (other than depth) were still measured.

Site 1	Depth at Center (cm)				Water Temp. (°C)				pH				Conductivity (µS)				Total Dissolved Solids (ppm)				Dissolved Oxygen (ppm)			
Date sampled (week of)	1/18/12	1/30/12	3/19/12	4/16/12	1/18/12	1/30/12	3/19/12	4/16/12	1/18/12	1/30/12	3/19/12	4/16/12	1/18/12	1/30/12	3/19/12	4/16/12	1/18/12	1/30/12	3/19/12	4/16/12	1/18/12	1/30/12	3/19/12	4/16/12
1-A	21	18	16	4	6.7	7.9	20.2	17.0	7.21	7.58	7.45	7.09	128	170	200	143	66	130	106	68	2.20	3.66	0.45	1.35
1-B_{L1}	12	17	8	4	7	13	20.7	16.0	7.46	7.52	7.50	7.30	166	190	201	145	82	100	108	70	2.97	4.24	1.60	2.05
1-B_S	13	14	5.5	0	7.3	12.1	21	---	7.27	7.98	7.60	---	155	187	175	---	75	100	89	---	2.97	3.70	3.30	---
1-B_{L2}	16	11	6	3.5	8.4	13.2	20.7	16.1	7.32	7.95	7.68	7.56	137	164	140	130	110	81	71	65	2.97	4.83	5.55	1.62
1-C	17	20	12	*	11.9	12.9	20.2	16.9	7.5	8.45	7.72	7.25	129	155	295	132	65	85	135	65	7.76	11.5	3.30	3.78
1-D_S	22	18	10.5	13.5	12.2	18.1	20.7	17.7	7.37	7.76	7.64	7.38	232	250	305	215	115	120	154	82	6.40	5.05	2.50	1.97
1-D_L	---	17	---	---	12.5	15.4	22.1	---	7.44	7.87	7.74	---	219	238	290	---	121	125	150	---	3.16	5.41	3.70	---
1-E_{M1}	20	13	6	0	6.6	12.2	24.8	---	7.17	7.71	7.56	---	190	190	230	---	95	101	115	---	4.36	3.91	3.2	---
1-E_{M2}	19	18	13	0	6.5	12.9	23.4	---	8.00	7.67	7.83	---	259	240	315	---	136	119	152	---	2.91	3.03	8.5	---
1-E_L	23	17	12	---	7.1	13.6	23.7	---	8.17	7.86	7.82	---	220	255	283	---	117	130	156	---	3.06	2.36	5.2	---

Site 2	Depth at Center (cm)					Water Temp. (°C)					pH				
Date sampled (week of)	1/23/12	2/6/12	3/26/12	4/23/12	5/7/12	1/23/12	2/6/12	3/26/12	4/23/12	5/7/12	1/23/12	2/6/12	3/26/12	4/23/12	5/7/12
2-A	34	30	21.5	14.5	---	15	9.2	17.6	13.0	---	7.11	7.40	7.20	7.23	---
2-B	18	20	8.5	*	---	13.6	8.4	16.7	12.9	---	6.76	7.40	7.23	6.68	---
2-C	15	28	36	*	*	14.9	10.3	18.4	12.6	27.5	7.02	7.80	7.42	7.18	7.53
2-D	35	39	21	9	---	10.6	10	19.7	15.5	---	7.60	7.80	7.60	7.45	---
2-E_{L1}	23	24	16	4	---	10.5	9.3	27	14.3	---	7.42	7.55	7.62	7.58	---
2-E_{L2}	22	25	15	13	---	9.0	10.1	21.6	14.6	---	7.87	8.03	7.56	7.60	---

Site 2 (cont.)	Conductivity (µS)					Total Dissolved Solids (ppm)					Dissolved Oxygen (ppm)				
Date sampled (week of)	1/23/12	2/6/12	3/26/12	4/23/12	5/7/12	1/23/12	2/6/12	3/26/12	4/23/12	5/7/12	1/23/12	2/6/12	3/26/12	4/23/12	5/7/12
2-A	118	240	175	152	---	58	110	100	75	---	5.80	4.50	4.22	3.02	---
2-B	64	150	157	140	---	33	67	80	55	---	2.60	1.75	0.90	0.77	---
2-C	86	155	200	225	190	43	76	110	108	152	2.4	1.70	0.85	1.03	0.27
2-D	127	167	210	185	---	64	80	92	97	---	2.12	2.34	2.90	1.04	---
2-E_{L1}	125	200	190	233	---	65	99	97	111	---	4.64	4.30	9.00	1.00	---
2-E_{L2}	138	150	192	167	---	69	80	110	74	---	3.38	7.76	6.10	1.11	---

Site 3	Depth at Center (cm)					Water Temp. (°C)					pH				
Date sampled (week of)	1/18/12	2/27/12	4/2/12	4/30/12	5/7/12	1/18/12	2/27/12	4/2/12	4/30/12	5/7/12	1/18/12	2/27/12	4/2/12	4/30/12	5/7/12
3-A	18	8	*	---	---	8.9	10.4	18.7	---	---	6.91	7.15	7.32	---	---
3-B	23	13	6.5	*	*	9.3	11.9	19.3	22.8	19.6	6.80	7.17	7.33	7.04	7.03
3-C_L	41	30	27	19	14	8.2	15.4	20.6	26.1	21.5	7	7.25	7.50	6.99	7.07
3-C_{M1}	16	11	---	---	---	9.8	14.9	---	---	---	6.83	7.15	---	---	---
3-C_{M2}	18	4.5	---	---	---	9.5	12.9	---	---	---	6.97	7.11	---	---	---
3-D_{L1}	19	15	12.5	*	---	12.1	18.5	23.9	28.7	---	6.78	7.18	7.35	6.93	---
3-D_{L2}	14	10.5	6	---	---	12.8	17.6	19.8	---	---	6.80	7.08	7.30	---	---
3-E	20	22.5	18.5	13	13.5	12.5	17.1	21.2	22.7	20.7	7.01	7.34	7.42	7.07	7.34

Site 3 (cont.)	Conductivity (µS)					Total Dissolved Solids (ppm)					Dissolved Oxygen (ppm)				
Date sampled (week of)	1/18/12	2/27/12	4/2/12	4/30/12	5/7/12	1/18/12	2/27/12	4/2/12	4/30/12	5/7/12	1/18/12	2/27/12	4/2/12	4/30/12	5/7/12
3-A	96	123	259	---	---	44	64	137	---	---	1.40	3.41	0.44	---	---
3-B	94	97	157	187	480	40	52	75	138	159	3.75	1.50	1.74	0.63	2.59
3-C_L	78	107	180	151	118	39	50	97	65	63	3.78	5.4	1.45	2.92	1.10
3-C_{M1}	86	115	---	---	---	43	52	---	---	---	3.11	3.60	---	---	---
3-C_{M2}	36	110	---	---	---	36	54	---	---	---	2.60	3.05	---	---	---
3-D_{L1}	124	95	162	248	---	74	49	141	123	---	6.47	4.50	2.10	0.38	---
3-D_{L2}	132	120	172	---	---	98	58	77	---	---	4.64	3.63	0.78	---	---
3-E	110	118	195	138	158	53	59	85	73	72	1.23	3.50	1.93	0.35	0.80

Site 4	Depth at Center (cm)			Water Temp. (°C)			pH			Conductivity (µS)			Total Dissolved Solids (ppm)			Dissolved Oxygen (ppm)		
Date sampled (week of)	1/18/12	3/5/12	4/9/12	1/18/12	3/5/12	4/9/12	1/18/12	3/5/12	4/9/12	1/18/12	3/5/12	4/9/12	1/18/12	3/5/12	4/9/12	1/18/12	3/5/12	4/9/12
4-A_S	15	---	---	8.1	---	---	6.90	---	---	205	---	---	111	---	---	3.75	---	---
4-A_{L1}	8	2.5	3.5	8.7	11.5	15.3	6.82	7.33	7.29	140	120	153	67	60	70	3.20	5.05	1.81
4-A_{L2}	---	20	11	---	12.5	16.3	---	7.40	7.54	---	91	150	---	45	62	---	5.75	3.27
4-B_M	23	10	12.5	8.2	14.4	15.8	6.87	7.40	7.32	101	93	138	83	41	70	4.37	6.06	1.10
4-B_S	16	---	---	9.7	---	---	7.04	---	---	120	---	---	57	---	---	3.20	---	---
4-B_L	19.5	8.5	9	8.7	15.4	16.4	6.90	7.35	7.29	95	89	124	47	49	62	2.76	5.75	2.55
4-C_S	17	---	---	7.3	---	---	6.96	---	---	109	---	---	65	---	---	2.08	---	---
4-C_L	20	15.5	12	6.6	10.6	15.2	7.18	7.20	7.17	74	225	200	40	105	90	2.63	7.50	3.75
4-D_S	16	---	---	13.2	---	---	6.75	---	---	112	---	---	55	---	---	4.84	---	---
4-D_{L1}	24	18.5	8.5	12.8	17.6	18.8	7.07	7.28	7.27	127	132	206	62	65	83	6.04	2.2	1.44
4-D_{L2}	---	10.5	18	---	16.8	17.0	---	7.39	7.21	---	100	136	---	52	77	---	3.6	1.09
4-E_{M1}	17	11.5	12.5	12.6	21.7	19.8	6.89	7.24	7.22	93	113	147	50	58	72	7.54	3.70	1.78
4-E_{M3}	19	---	---	12.2	---	---	6.84	---	---	94	---	---	49	---	---	4.52	---	---
4-E_{M2}	7	9	10	15	19.8	17.9	6.77	7.46	7.41	87	97	127	43	49	60	4.8	6.0	1.97

Extra	Depth at Center (cm)			Water Temp. (°C)			pH			Conductivity (µS)			Total Dissolved Solids (ppm)			Dissolved Oxygen (ppm)		
Date sampled (week of)	5/7/12	5/14/12	5/21/12	5/7/12	5/14/12	5/21/12	5/7/12	5/14/12	5/21/12	5/7/12	5/14/12	5/21/12	5/7/12	5/14/12	5/21/12	5/7/12	5/14/12	5/21/12
Extra 1	16.5	---	---	21.7	---	---	7.27	---	---	176	---	---	76	---	---	0.52	---	---
Extra 2	---	---	---	---	20.6	---	---	8.66	---	---	769	---	---	357	---	---	8.39	---
Extra 3	---	---	---	---	20.7	---	---	7.50	---	---	204	---	---	100	---	---	0.72	---
Extra 4	---	---	---	---	22.5	---	---	8.03	---	---	605	---	---	240	---	---	0.36	---
Extra 5	---	---	---	---	28.3	---	---	7.86	---	---	---	---	---	165	---	---	2.43	---
Extra 6	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Extra 7	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Extra 8	---	---	---	---	---	22.3	---	---	7.50	---	---	193	---	---	92	---	---	0.50