



Inventory and Monitoring Plan Coldwater River National Wildlife Refuge

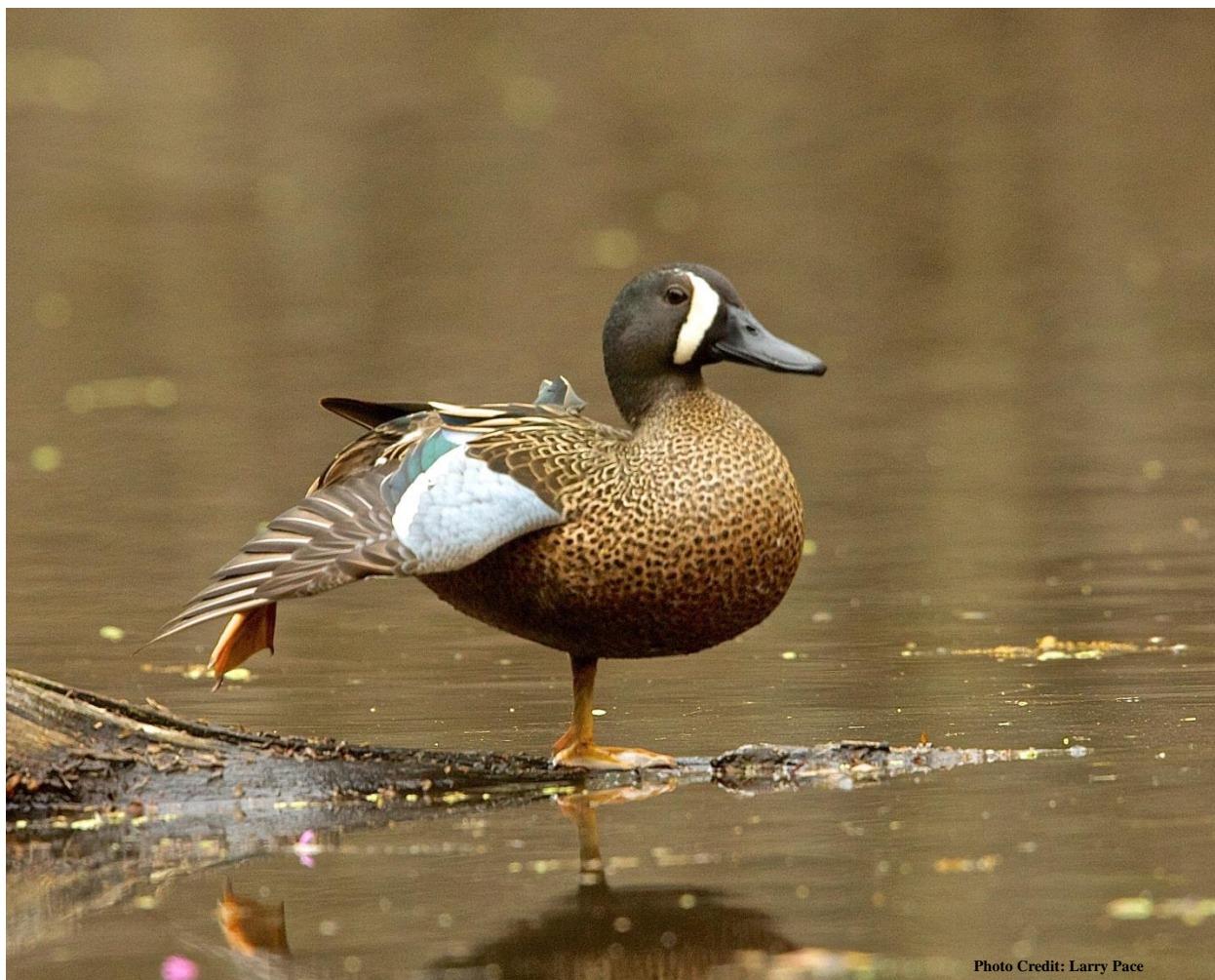


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Coldwater River National Wildlife Refuge

Inventory and Monitoring Plan

Signature Page

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Introduction

This Inventory and Monitoring Plan (IMP) documents natural resource surveys that will be conducted at the Coldwater River National Wildlife Refuge (NWR) from 2016 through 2031, or until the refuge Comprehensive Conservation Plan (CCP), Habitat Management Plan (HMP) or this IMP are revised. The majority of surveys considered in this plan address resource management objectives identified in the Coldwater River NWR HMP (U.S. Fish and Wildlife Service 2015a) and the North Mississippi National Wildlife Refuges Complex CCP (U.S. Fish and Wildlife Service 2005). Many surveys are a continuation of past monitoring conducted for tracking long-term trends of specific resources and understanding ecological interactions. Other surveys are being proposed to establish baseline inventory of the major taxon found on the refuge. Additionally, several surveys feature refuge cooperation in regional (e.g., Landscape Conservation Cooperatives) and national efforts (e.g., Breeding Bird Survey). This plan also includes proposed inventory and monitoring surveys which will rely on future labor, funding, and cooperation with state and other partner programs to fulfill vital information gaps. This IMP was developed according to the Inventory and Monitoring (I&M) policy (701 FW 2) for the National Wildlife Refuge System.

Refuge Purposes

Under legislative provisions of the Migratory Bird Conservation Act (1929) and the Consolidated Farm and Rural Development Act (1961), the land for the Black Bayou unit of Tallahatchie NWR was acquired in 1991. In 2000, the Black Bayou Unit was formally renamed the Coldwater River NWR with the purposes designated:

- i. "...for use as inviolate sanctuary, or for any other management purpose, for migratory birds..."and
- ii. "...for conservation purposes under the Consolidated Farm and Rural Development Act."(U.S. Fish and Wildlife Service 2005).

Refuge Priorities

Additional refuge priorities include 1) incidental fish and wildlife oriented recreational development, 2) protection of natural resources, 3) conservation of endangered or threatened species (16 USC section 460k-1 Refuge Recreation Act), and 4) biodiversity (Public Law 105-57 - National Wildlife Refuge Improvement Act 1997). Coldwater River NWR is considered important to meeting migrant and wintering waterfowl habitat needs as identified in the North American Waterfowl Management Plan (U.S. Fish and Wildlife Service 1986). More specifically, the refuge was proposed "...to preserve and manage wintering and migrating habitat for Canada geese, mallard, pintail, blue-winged teal, and wood duck and to provide production habitat for wood duck..." (U.S. Fish and Wildlife Service 1990).

Vision Statement

Based on sound science, Coldwater River NWR will conserve, protect, enhance, and where possible restore the ecological integrity of bottomland hardwood forests, wetlands, wildlife, fisheries, and other plant communities within upper portions of the Mississippi Alluvial Valley (MAV) for the

benefits of present and future generations of Americans (U.S. Fish and Wildlife Service 2005). This IMP will provide a foundation for measuring the effectiveness of strategies to achieve the goals and objectives of the Coldwater River NWR HMP, the overarching goals and objectives set forth in the North Mississippi Refuges Complex CCP, and ecosystem health and biodiversity (National Wildlife Refuge Improvement Act 1997).

Methods

Prioritizing and Selecting Surveys

Background information for historic and current surveys was obtained from data entered in the Planning and Review of Inventory and Monitoring on Refuges (PRIMR) database. In addition, a comprehensive list of other potential surveys was developed by soliciting input from refuge staff. This list was generated by addressing goals and objectives in the CCP, identifying possible surveys that would evaluate habitat and wildlife response variables associated with objectives in the Coldwater River NWR HMP, and considering priorities within other U.S. Fish and Wildlife Service programs at the local, regional and national levels (i.e., Migratory Birds, Fisheries, and Ecological Services). Also, the list was expanded to include surveys which considered emerging diseases, invasive species, and climate/abiotic resource issues relevant to the Southeast or more specific to the Mississippi Delta. An initial list of 28 surveys was generated from this exercise to consider for inclusion in the Coldwater River NWR IMP. Three surveys were immediately identified as being non-survey activities (Lower Mississippi Valley Joint Venture moist-soil database, wood duck nest box monitoring, and wood duck preseason banding), and dropped from further consideration (Appendix A-Table A.1). One survey was determined to be historic and no longer needed (greater gulf waterbird count). Finally, contaminant assessment was also removed from consideration because it was being prioritized separately for funding through the Contaminants Assessment Process and would not address objectives of the HMP.

The refuge staff was familiar with the IMP survey prioritization and plan process having completed an IMP for Dahomey NWR (U.S. Fish and Wildlife Service 2015b). Therefore, no formal meeting was held to initiate the Coldwater NWR IMP. Steve Gard (Project Leader), Amber Floyd (Dahomey NWR Refuge Manager), Becky Rosamond (Refuge Wildlife Biologist) and David Richardson (Terrestrial Ecologist, Region 4 I&M Branch) began prioritization of the remaining identified 23 surveys in January 2015. Two independent processes were used to evaluate and prioritize the survey list. The two processes served to assist the refuge staff in evaluating surveys based on perceptions of day-to-day operations as well as a more regional, objective-based approach. The first process involved an opinion-based ranking of each survey by each staff member; no set criteria were used to rank the surveys. The second evaluation process was developed by the Natural Resource Program Center, National I&M Initiative, using the Survey Prioritization Tool (U.S. Fish and Wildlife Service 2014a) which provided a standard, structured, and transparent approach to prioritizing surveys. This tool utilizes a simple, multi-attribute ranking technique based on a linear additive model, whereby an overall prioritization score for each survey is calculated from the product of the total sum of a performance score of each selected criterion and the weight of that criterion (Goodwin and Wright 2014). Originally, 24 criteria were developed for the Survey Prioritization Tool to evaluate each survey (U.S. Fish and Wildlife Service 2014a). Of these 24 criteria, the Region 4 I&M Branch chose to remove

eight after careful consideration because they were either redundant with other criteria, or would not add discrimination among surveys. The final selected criteria are provided in Appendix B-Table B.1.

Opinion-based ranking of surveys was done independently by the Refuge Manager, Wildlife Biologist, and the Project Leader. Each survey was assigned a value from 1-23 (with “1” being the most important). If a staff member felt multiple surveys were not worth continuing, they were each assigned a value of 23. Finally, the average rank was calculated for each survey to produce a staff consensus opinion-based rank. Following input from the staff after completing the opinion-based ranking, it was decided that four surveys should be combined into two surveys (shorebird monitoring with waterfowl monitoring) and (moist-soil vegetation monitoring and cereal grain production) because the metric of interest were similar and could be collected using a similar survey design. In addition, three new surveys (emerald ash borer surveillance, secretive marsh bird monitoring, and wood duck brood monitoring) were identified after completing the opinion-based prioritization process and included in the evaluation process using the Survey Prioritization Tool.

The resulting 24 surveys were subsequently evaluated using the Survey Prioritization Tool. Use of the tool began with determining the relative importance weight for each criterion. Importance weights were calculated from rating values (1-100, 100=most important) assigned to each criteria independently from each of the refuge staff members. An additional rating value from the Region 4 I&M Branch was also incorporated into the tool. These four ratings (three refuge staff + one I&M Branch) were then combined in the Survey Prioritization Tool to create a consensus weighting value to be used to score the surveys by the final 16 criteria (Appendix B-Table B.1). Actual scores for each survey were assigned through a collaborative effort between the Refuge Biologist and I&M Terrestrial Ecologist. To ensure consistency, all surveys were scored against a single criterion before moving on to score the next criterion. Once all surveys were scored for each criterion, final values were generated in the Survey Prioritization Tool.

Both the staff opinion-based ranking and Survey Prioritization Tool process yielded relatively similar priorities for the majority of the 15 highest ranking surveys (Appendix C). The final prioritized list of surveys was then categorized into the following status and tier groupings:

1) Selected

a. Current (Tier 1): surveys are ranked as high priority and could be completed based on present station capacity, within the lifespan of the IMP.

b. Expected (Tier 2): surveys are ranked as moderate to high station priority and could be completed over the timespan of the IMP with additional capacity obtained through non-station funding sources (e.g., regional biological funds, partners, grants, etc.).

2) Non-selected

a. Future (Tier 3): surveys that were proposed, were ranked low priority, and/or the chance of obtaining required capacity to conduct them is very low.

Final assignment of surveys to tiers was evaluated based on prioritization scores, refuge capacity (e.g., staff, dollars, etc.), competing time constraints with anticipated surveys to be conducted on other refuges within the refuge complex (i.e., Dahomey and Tallahatchie NWRs), and Regional Office priorities related to work force planning guidance for each refuge. The refuge placed an increased value on surveys that addressed a public use activity or where there was an existing obligation to conduct a survey.

Estimating Capacity

The ability to conduct surveys on the refuge is a function of available staffing and anticipated annual base funding. Coldwater River NWR has very limited staffing resources with only a refuge wildlife biologist assigned to the station. The wildlife biologist also serves two refuges within the North Mississippi Wildlife Refuges Complex and must balance survey efforts and priorities across those stations. No other staff from the refuge complex is available to support survey activities at Coldwater River NWR. During the summer, the refuge expects to hire an intern or other temporary staff to assist with natural resource activities. This IMP attempts to recognize the limitations of staffing and funding while conducting the essential inventory and monitoring needed to fulfill the purposes of the refuge. Estimates of capacity, staff time and costs to complete a survey, were obtained from the PRIMR database for those surveys selected as either Current or Expected Surveys. These estimates should be considered baseline for fiscal year 2016, but may vary greatly as capacity changes from year to year with changes in staffing and budgets.

Results

Selected Surveys

The processes described above identified 18 of 24 prioritized surveys to be conducted over the time span of this IMP (Table 1, Appendix C-Table C.1). Of these, 11 were considered “Current” surveys which the refuge anticipates being able to conduct based on anticipated funding and staffing for the duration of this IMP (2016-2031). Seven additional surveys were deemed “Expected” and are dependent upon increases in overall or targeted annual funding to support staff in conducting the inventories over the time-frame of the IMP. Expected surveys will probably be conducted over the time span of the IMP because they are of moderate to high station priority and there is a reasonable chance that additional capacity will be made available to have them conducted. The remaining six surveys (Future) would require significant increases in funding to conduct over the duration of the plan or were deemed of lower priority because they did not address specific needs of the refuge and were more regional in scale (Table 1, Appendix A-Table A.2).

Assignment of surveys to specific tiers (1-3; Current, Expected, Future) largely followed the prioritization scores from the Survey Prioritization Tool and staff opinion ranking. However, after consideration of capacity, protocol logistics, current survey obligations, and considerations for evaluation of environmental effects from climate change, several surveys were re-prioritized. For example, three surveys assigned to Current status scored relatively low (< 0.229) with the Survey Prioritization Tool. These included groundwater table monitoring (0.229), hunter use

and harvest monitoring (0.209), and stream temperature monitoring (0.176). Groundwater table monitoring was determined important to the refuge and assigned a status of Current due to the reduction of the local groundwater table perceived to be caused by extensive agricultural irrigation surrounding the refuge. This reduction is an emerging issue that cannot be addressed properly without long-term data, and special funding was obtained to acquire specialized tools and monitoring equipment in 2015. Hunter use and harvest monitoring was assigned a Current status because it is a critical monitoring mechanism to evaluate public hunting as it relates to wildlife populations (i.e., waterfowl) on the refuge. Stream temperature monitoring was assigned a Current status because of an existing obligation with Ecological Services to monitor stream temperatures from several sites on the refuge complex. Also, this effort requires minimal annual-time and cost to implement (Table 1).

Non-selected Surveys

Six of the 24 surveys prioritized were not-selected to be conducted during the time span of this IMP (Table 1, Appendix A-Table A.2). The northern long-eared bat inventory, which had a relatively high Survey Prioritization Tool score (0.431), was moved to Future status due to significant challenges of inventorying this species using existing sampling techniques and the relative low probability of occurrence of the species on the refuge due to limited forested habitat. Furthermore, the information needs that this survey would contribute specifically to Coldwater River NWR were considered lower than information needs gathered from other surveys. Three surveys (avian disease surveillance, chytrid amphibian surveillance, and ranavirus herpetofaunal surveillance) would require funding at a regional scale to be most informative. Should special targeted funding become available, these surveys will be reconsidered. Two surveys, the raptor survey and wood duck brood survey were determined to have little effect on management decisions of the refuge and were considered low priority at this time.

National Environmental Policy Act (NEPA) Compliance

After selection of surveys that would be conducted during the period of this IMP, the surveys were evaluated to determine the level of NEPA documentation required. An Environmental Action Statement was prepared indicating the surveys to be conducted under this plan are covered by Departmental categorical exclusion (43 CRF 46.205 and 40 CFR 1508.4) because they would not have significant environmental effects (Appendix D).

Table 1. Surveys selected to conduct at Coldwater River National Wildlife Refuge (FF04RMCW00) from 2016- 2030.

Survey Priority ¹	Survey ID No. ²	Survey Name	Survey Type ³	Survey Status ⁴	Mgmt. Objective ⁵	Survey Area ⁶	Staff Time ⁷	Ann. Cost ⁸	Survey Timing ⁹	Survey Length ¹⁰	Survey Coord. ¹¹	Protocol	
												Citation ¹²	Status ¹³
1.01	FF04RMCW00-026	Migrant and Wintering Waterbird Monitoring	CM	Current	HMP 2.1, 2.2, 2.3, 2.4, 2.5	Multiple Management Units	FWS:0.04	\$400	Annually Biweekly September - March	2015- Indefinite	Becky Rosamond Wildlife Biologist	Loges et al. 2014	National Framework Approved
1.02	FF04RMCW00-008	Mobile Acoustical Bat Monitoring	CM	Current	HMP 1.1, 1.3	Multiple Management Units and Off Refuge Lands	FWS: 0.01	\$364	Annually 2-3 times June-July	2012- Indefinite	Becky Rosamond Refuge Biologist	None	Initial Survey Instructions
1.03	FF04RMCW00-021	Hardwood Reforestation Evaluation	M	Current	HMP 1.1	Multiple Management Units	FWS:0.04	\$1500	Ten year interval Fall/Spring	1998- Indefinite	Becky Rosamond Refuge Biologist	None	Initial Survey Instructions
1.04	FF04RMCW00-014	Moist-soil/ Grain Production	M	Current	HMP 2.1, 2.4	Multiple Management Units	FWS:0.01	\$100	Annually July- October	2005- Indefinite	Becky Rosamond Wildlife Biologist	None	Initial Survey Instructions
1.05	FF04RMCW00-005	Breeding Bird Survey	CM	Current	CCP 1-7, 1-8, 1-9	Multiple Management Units and Off Refuge Lands	FWS:0.01	\$180	Annually - June	2010- Indefinite	Becky Rosamond Refuge Biologist	USGS 2001	National Framework Approved
1.06	FF04RMCW00-028	Secretive Marsh Bird	M	Current	CCP 1-4 HMP 2.1, 2.3	Multiple Management Units	FWS:0.01	\$300	Annually May-July	2015- Indefinite	Becky Rosamond Refuge Biologist	Conway 2015	National Framework In Review
1.07	FF04RMCW00-018	Emerald Ash Borer Surveillance	M	Current	CCP 4-3 HMP 1.1	Multiple Management Units	FWS:0.02	\$600	Annually May - September	2015-TBD	Becky Rosamond Refuge Biologist	None	Initial Survey Instructions
1.08	FF04RMCW00-006	North American Amphibian Monitoring	CM	Current	CCP 2-2	Multiple Management Units and Off refuge lands	FWS:0.01	\$225	Annually 3 times February-June	2001- Indefinite	Becky Rosamond Refuge Biologist	None	Initial Survey Instructions
1.09	FF04RMCW00-024	Groundwater Table Monitoring	BM	Current	HMP 2.5	Multiple Management Units	FWS: 0.01	\$600	Annually – 4 times	2015- Indefinite	Amber Floyd Refuge Manager	None	Initial Survey Instructions

1.10	FF04RMCW00-007	Hunter Use and Harvest Monitoring	M	Current	CCP 2-1	Entire Station	FWS:0.2	\$860	Annually September – February	2000-Indefinite	Becky Rosamond Refuge Biologist	None	Initial Survey Instructions
1.11	FF04RMCW00-017	Stream Temperature Monitoring	CB	Current	None	Multiple Management Units	FWS: 0.01	\$150	Annually 1 time	2014-Indefinite	Becky Rosamond Refuge Biologist	None	Initial Survey Instructions
2.1	FF04RMCW00-032	Plant Inventory	I	Expected	CCP 4-3 HMP 1.1, 2.1	Entire Station	FWS:0.08	\$15,000	May – November Occurs one time only	2016-2031	Becky Rosamond Refuge Biologist	None	Initial Survey Instructions
2.2	FF04RMCW00-019	Fish Inventory	I	Expected	CCP 2-3	Entire Station	FWS:0.04	\$600	Winter - Spring	2016-2031	Becky Rosamond Refuge Biologist	None	Initial Survey Instructions
2.3	FF04RMCW00-025	Herpetofaunal Inventory	I	Expected	CCP 2-2, 3-1	Entire Station	FWS:0.08	\$1500	Throughout the year Occurs one time only	2011-2030	Becky Rosamond Wildlife Biologist	None	Initial Survey Instructions
2.4	FF04RMCW00-022	Mussel Inventory	I	Expected	CCP 2.2, 3-1, 4-3	Entire Station	FWS:0.01	\$200	Summer and Fall Occurs one time	2016-2030	Becky Rosamond Wildlife Biologist	None	Initial Survey Instructions
2.5	FF04RMCW00-026	Crayfish Inventory	I	Expected	CCP/2-2, 3-1	Entire Station	FWS:0.08	\$1000	February- November Occurs one time	2016-2030	Becky Rosamond Wildlife Biologist	None	Initial Survey Instructions
2.6	FF04RMCW00-027	Small Mammal Inventory	I	Expected	CCP 2-2, 3-1	Entire Station	FWS:0.10	\$2000	Fall and Winter Summer for Bats Occurs one time	2016-2030	Becky Rosamond Wildlife Biologist	None	Initial Survey Instructions
2.7	FF04RMCW00-030	Insect Inventory	I	Expected	CCP 2-2, 3-1, 4-3	Entire Station	FWS:0.05	\$50,000	Spring-Fall Occurs one time	2016-2031	Becky Rosamond Wildlife Biologist	None	Initial Survey Instructions

¹ The rank for each survey listed in order of priority.

² A unique identification number assigned by the PRIMR database. This number is prefaced by the station cost-center code FF04RMDH00

³ Type of survey: I = Inventory; BM = Baseline Monitoring; M = Monitoring; CM = Cooperative Monitoring; CB = Cooperative Baseline

⁴ Selected surveys planned for the lifespan of this IMP (i.e., Current, Expected)

⁵ The management plan and objectives that justify the described survey.

⁶ Station management unit names, entire station, or names of other landscape units included in survey.

⁷ Estimates of Service (FWS) and non-Service (Other) staff time needed to complete the survey (1 work year = 2080 hours = 1 FTE).

⁸ Average annual operations costs for conducting the survey (e.g., equipment, contracts, travel) not including staff time, TBD = to be determined.

⁹ Timing and frequency of survey field activities.

¹⁰ The years during which the survey has been or will be conducted.

¹¹ Name and position of the survey coordinator for each survey.

¹² Title, author, and version of the survey protocol (if there is no protocol to cite, enter None).

¹³ Scale of intended use (National Framework, Regional Framework, Site-specific) and stage of approval of the survey protocol (Initial Survey Instructions, Complete Draft, In Review, or Approved).

Survey Narratives

This section of the IMP provides a brief description of the selected surveys, both Current and Expected to be conducted during 2016-2031. The survey narrative provides a justification for the survey; metrics of interest; relationship of the survey to goals and objectives from the North Mississippi National Wildlife Refuges Complex CCP, the Coldwater River NWR HMP and other regional or national plans; partners involved in data collection and analysis; and the protocol to be used to conduct the survey. Initial survey instructions for each Current survey are provided in Appendix E as well as linked to the Region 4, Fishnet Site (<https://fishnet.fws.doi.net/regions/4/nwrs/IM/SitePages/Home.aspx>).

1.01. Migrant and Wintering Waterbird Monitoring; (FF04RMCW00-026)

Overview

This survey involves the biweekly monitoring of waterbird abundance (i.e., waterfowl, coot, grebe, shorebirds, and waders) in managed moist-soil units on the refuge to determine relative abundance and seasonal occurrence throughout the migrant and wintering period (October – March). Historically, the refuge conducted periodic independent monitoring of shorebirds and waterfowl and participated in the mid-winter waterfowl survey. These survey efforts are being consolidated into a single survey design to provide information about the local scale utilization of wetlands by all waterbirds on a recurring biweekly basis. The migrant and wintering waterbird monitoring survey provides a measure for the North Mississippi National Wildlife Refuges Complex CCP goal to promote the conservation and management of waterbirds within northern Mississippi in a manner that supports treaties and national and international plans (U.S. Fish and Wildlife Service 2005) and specifically address information needs identified in the North American Waterfowl Management Plan (U.S. Fish and Wildlife Service 1986) and the Southeastern United States Waterbird Conservation Plan (Hunter et al. 2006). Moreover, the survey is a foundation of biological information for informing local wetland management decisions to address HMP goals and objectives. In addition, data from this survey can be used at the refuge and landscape level to evaluate waterfowl conservation based on goals set by the Lower Mississippi Valley Joint Venture (LMVJV). This survey in combination with the moist-soil/grain production survey provides an overall assessment of the refuge's contribution toward migrating and wintering waterbird conservation which is a foundation for the establishment of the refuge (U.S. Fish and Wildlife Service 1990). Waterfowl and shorebirds have been identified as resources of concern for Coldwater River NWR.

Objectives

This survey will be used to assess the waterbird responses to five habitat objectives from the Coldwater River NWR HMP. The survey will track actual waterbird use of moist-soil units during early fall and winter. Presently, there are no defined triggers for management decisions based on waterbird use. However, a lack of utilization primarily by waterfowl (duck-use-days) in addition to assessment of food resource availability (duck-energy-days, determined by Moist-

soil/Grain Production Monitoring -1.04) will be used to evaluate future wetland management strategies.

HMP Objective 2.1

*On an annual basis within the pond complex (units A – X) and/or the western fields (units 1, 2, 3, 16, 17) provide 190 acres of herbaceous vegetation with a minimum of 75 percent cover of desirable moist-soil plants [e.g., sprangletop (*Leptochloa fusca*), *Panicum* spp., millet (*Echinochloa* spp.), toothcup (*Ammannia auriculata*), smartweed (*Polygonum* spp.), and *Carex* spp.], keeping non-desirables [e.g., coffeeweed (*Sesbania herbacea*) and cocklebur (*Xanthium strumarium*)] to less than 20 percent, and eliminating any invasive species [e.g., parrotfeather (*Myriophyllum aquaticum*) and alligatorweed (*Alternanthera philoxeroides*)] and flooded with 6 to 24 inches of water from October – March to support foraging habitat objectives for wintering waterfowl developed by the LMVJV.*

HMP Objective 2.2

On an annual basis within the pond complex (units A to X) provide 100 acres of mudflat habitat with less than 10 percent cover of vegetation and less than 6 inches of water between mid-July and October to support foraging habitat for fall migrating shorebirds to fulfill in part the habitat objectives for migrating shorebirds.

HMP Objective 2.3

On an annual basis in the western fields (units 1, 2, 3, 16, 17), the drainage ditches (units 20, 22, 23, 24, 28), and/or the pond complex (units N, P, PP, R, X) provide a minimum of 40 acres of emergent wetland habitat in 10 acre (minimum) blocks, characterized by 50 to 70 percent emergent herbaceous vegetation (cattails, soft rush), interspersed with 30 to 50 percent open water habitat, containing less than 10 percent woody vegetation and no invasive aquatic species (e.g., parrotfeather, alligatorweed) to support secretive marsh bird nesting and foraging requirements.

HMP Objective 2.4

On an annual basis, provide a minimum of 75 acres of grain crops (millet, rice, corn, or milo) and flood to a depth of no more than 18 inches, for a minimum of 60 days from November 1 to March 15 to support habitat objectives for migrating and wintering waterfowl developed by the LMVJV.

HMP Objective 2.5

On an annual basis in sloughs and borrow pits (units 8, 21, 29, 30) and/or the pond complex (units N, P, PP, R, X), provide 100 acres of shrub swamp habitat characterized by 30 to 50 percent shrubs, 40 to 70 percent herbaceous emergent, 0 to 10 percent trees, no invasive aquatic species (e.g., parrotfeather, alligatorweed), and 25 percent open

water and containing a minimum of 10 loafing sites (18 inches by 18 inches, 2 to 5 inches above water) per acre in close proximity to nest boxes or natural cavities to provide brood rearing habitat for wood ducks.

Partner Roles

The refuge has the ability to conduct this survey on an annual basis with existing resources. The survey can merge data with the moist-soil/cereal grain production survey and contribute the information to the Integrated Waterbird Monitoring and Management Initiative and support waterbird conservation with the LMVJV. Partnership with these two programs will be explored to determine the level of participation.

Protocol Needs

A national protocol framework developed by Loges et al. (2014) will be used as the basis for this survey. A site-specific protocol is needed. Initial survey instructions are linked to this survey record in PRIMR (<http://tinyurl.com/Waterbird-CLD>).

1.02. Mobile Acoustical Bat Monitoring; (FF04RMCW00-008)

Overview

This survey will measure the relative abundance and species richness of bats by using acoustical sampling techniques during early summer along predefined roadside routes. Multiple stressors including habitat fragmentation and degradation, white-nose-syndrome (WNS), and energy development (i.e., wind farms) are primary causes contributing to declines in bats especially across the eastern United States. For many species, the decline is anticipated to accelerate as WNS expands west and south. Rafinesque's big-eared bat (*Corynorhinus rafinesquii*) and the southeastern myotis (*Myotis austroriparius*) are highly reliant on the bottomland hardwood forest ecosystem in Mississippi for roosting (Martin et al. 2011). These two bats and the bottomland hardwood ecosystem are identified as species/habitats of special concern (Bat Conservation International and Southeastern Bat Diversity Network 2013).

Mobile acoustical bat monitoring is designed to evaluate long-term population trends of bats at a regional scale and provide a baseline inventory of species on the refuge. Because the refuge is relatively small with few interior roads, the route will largely be done adjacent to the refuge boundary. The refuge has been conducting this survey since 2012 (U.S. Fish and Wildlife Service 2015c). These data will be geo-referenced to provide information about habitat use for ecological assessments at the landscape scale. Understanding population trends and habitat utilization at multiple scales supports efforts to conserve bats and inform the refuge about present and future forest management. These data combined with other NWRs cooperating in this survey design represent the only data available to evaluate population trends for foliage and cavity roosting bats. In the near future, this survey may be incorporated into the North American Bat Monitoring Program (Loeb et al. 2015).

Objectives

Baseline occurrence information will be used to evaluate response by bats to two habitat management objectives from the HMP within refuge forested and open management units.

HMP Objective 1.1

By 2028 at least 35 percent of the area of the reforestation units (4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 18, 19, 25, 26, 34) should contain a diverse assemblage of both hard mast and soft mast producing hardwood species of at least two age classes and characterized by a minimum of 60 to 70 percent overstory canopy cover, 25 to 40 percent midstory cover, and 60 to 70 square feet per acre basal area (with over 25 percent in older age classes) to provide suitable habitat for the resources of concern.

HMP Objective 1.3

By 2028, evaluate at least 35 percent of all reforestation units (units 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 18, 19, 25, 26, 34) for the potential development of a minimum of one tree greater than 26 inches diameter at breast height per acre with a visible cavity sufficient to provide a nest site for wood ducks or roost for bats or provide an equivalent artificial structure.

Partner Roles

The refuge has annually been conducting this survey since 2012. Data analysis and summary will be done by the Region 4, Inventory and Monitoring Branch. The data will be combined for regional and landscape level analysis in cooperation with other partners including U.S. Geological Survey (USGS) and U.S. Forest Service (USFS) through the North American Bat Monitoring Program (Loeb et. al 2015).

Protocol Needs

A national protocol framework needs to be developed in concert with other state and federal partners. The refuge is currently conducting the MABM survey using the mobile acoustical survey protocol (Richardson 2012). Initial survey instructions are linked to this survey record in PRIMR (<http://tinyurl.com/MABM-CLD>).

1.03. Hardwood Reforestation Evaluation; (FF04RMDH00-021)

Overview

This survey is designed to examine hardwood regeneration, reforestation survivorship and species composition within former agricultural fields on the refuge. Many of the refuges within the MAV acquired in the past 20 years have included large tracts previously used for agricultural production which were historically bottomland hardwood. Most of the hardwood reforestation was done in the late 1990s early 2000 using hardwood seedlings though some fields may have been direct seeded with acorns. This survey was selected because evaluation of hardwood

regeneration, both natural and planted, is critical to addressing the long-term species composition towards final serial stage stand development and evaluating future forest management strategies. The refuge conducted initial seedling survivorship (1-3 year post planting) for many of the reforestation stands but has not made any further assessments. In general, sites will continue to be examined 1-3 years after any initial reforestation planting and then 10-20 years later. The reforestation tracts represent important future areas to support many high priority species of neotropical migratory birds and contribute towards restoration of the natural vegetative community (De Stevenson 2015). Bottomland hardwood forest ecosystems have been identified as a resource of concern in the Coldwater River NWR HMP (U.S. Fish and Wildlife Service 2015a).

Objective

This survey is designed to examine hardwood reforestation and develop management decisions to achieve habitat conditions as outlined in the Coldwater River NWR HMP. This survey addresses the following objective from the HMP.

HMP Objective 1.1

By 2028 at least 35 percent of the area of the reforestation units (4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 18, 19, 25, 26, 34) should contain a diverse assemblage of both hard mast and soft mast producing hardwood species of at least two age classes and characterized by a minimum of 60 to 70 percent overstory canopy cover, 25 to 40 percent midstory cover, and 60 to 70 square feet per acre basal area (with over 25 percent in older age classes) to provide suitable habitat for the resources of concern.

Partner Roles

The refuge does not presently have the capacity to conduct an evaluation of reforested agricultural fields. However, given the importance of this monitoring, the refuge will work to conduct a refuge-wide inventory using a team of foresters and technicians from other refuges to assist with data collection, analysis and reporting.

Protocol Needs

Standard forest inventory sampling techniques are widely used by foresters. However, there are differences in field equipment, analysis software, and reporting. Sampling methods for hardwood reforestation evaluation will be similar to those associated with traditional forest stand monitoring but on a smaller sampling plot (1/100 acre). A regional protocol framework for evaluation of reforested areas needs to be developed by a team of foresters and biologists. A site-specific protocol will be developed from that framework. Initial survey instructions are linked to this survey record in PRIMR (<http://tinyurl.com/HwdRegEval-CLD>).

1.04. Moist-soil/Grain Production; (FF04RMCW00-014)

Overview

This survey monitors the annual floristic composition within individual wetland management units on the refuge and provides a qualitative and/or quantitative estimate of the duck carrying capacity [i.e., duck-energy-days/acre - (1 DED is defined as the energy needed by a mallard size duck for a day)]. Moist-soil plants and supplemental plantings of cereal grains provide important energy for migrant and wintering waterfowl (Reinecke et al. 1989). Coldwater River NWR manages wetland units to support the goals of the North American Waterfowl Management Plan (U.S. Fish and Wildlife Service 1986) and contributes to foraging habitat objectives as outlined by the LMVJV. This survey is designed to be combined with the migrant and wintering waterbird survey to provide an overall assessment of the refuge contribution toward migrant and wintering waterbird conservation at the local and regional scale. Survey data will inform management about the need to conduct treatments to influence desirable annual plant composition and considerations for cereal grain production to meet local and regional waterfowl conservation initiatives. Waterfowl have been identified as resources of concern for the refuge.

Objectives

This survey will estimate the duck-energy-day carrying capacity and percent plant composition on an annual basis within moist-soil management units. Increases in perennial or undesirable annual plants may trigger a need for a management action within identified wetland units. This survey directly assesses target metrics in the following HMP objectives.

HMP Objective 2.1

On an annual basis within the pond complex (units A – X) and/or the western fields (units 1, 2, 3, 16, 17) provide 190 acres of herbaceous vegetation with a minimum of 75 percent cover of desirable moist soil plants (e.g., sprangletop, Panicum spp., millet, toothcup, smartweed, Carex spp.), keeping non-desirables (e.g., coffeeweed and cocklebur) to less than 20 percent, and eliminating any invasive species (e.g., parrotfeather, alligatorweed) and flooded with 6 to 24 inches of water from October – March to support foraging habitat objectives for wintering waterfowl developed by the LMVJV.

HMP Objective 2.4

On an annual basis, provide a minimum of 75 acres of grain crops (millet, rice, corn, or milo) and flood to a depth of no more than 18 inches, for a minimum of 60 days from November 1 to March 15 to support habitat objectives for migrating and wintering waterfowl developed by the LMVJV.

Partner Roles

The refuge has the capacity to conduct this survey on an annual basis. The LMVJV is an important partner in this survey to examine the cumulative contributions of moist-soil/grain production to meet the wintering habitat goal of the North American Waterfowl Plan and more specifically within the Mississippi Alluvial Valley (MAV). The refuge will provide data from this survey to the USGS- LMVJV Impounded Wetlands Managements & Monitoring Application (http://lmvjv.cr.usgs.gov/moist_soils/default.aspx) for analysis at the regional scale.

Protocol Needs

Multiple methods are available to estimate the qualitative and quantitative values for moist-soil and cereal grain production and composition but no standardized approach has been implemented. A regional protocol framework needs to be developed with input from the LMVJV and the Integrated Waterbird Management and Monitoring Program. Initial survey instructions are linked to this survey record in PRIMR (<http://tinyurl.com/MoistSoilGrain-CLD>).

1.05. Breeding Bird Survey; (FF04RMCW00-005)

Overview

This survey assesses distribution and relative abundance of breeding birds for regional and national assessments with the refuge serving as a sampling location. Birds are a national trust resource for the U. S. Fish and Wildlife Service and represent the foundation for establishing most National Wildlife Refuges. Many species of neotropical migratory landbirds and their habitat are of special concern (Hunter et al. 1993). The North American breeding bird survey, established in 1966 (U.S. Geological Survey 2001) monitors bird populations across North America and informs researchers and wildlife managers of significant changes in bird population levels so that if declining species are identified, causes can be examined and corrective actions taken to reverse the trend (Sauer et al. 2013). Though the survey examines trends at regional scales, the data can also be used to establish local breeding bird baseline inventories (i.e., species richness) based on roadside vegetative communities within and adjacent to the refuge. This refuge survey has been conducted since 2009.

Objectives

The information from this survey will be used to evaluate regional scale changes in the relative abundance of breeding birds along roadways. Based on changes in priority bird species associated with the bird conservation area for the MAV (Twedt et al. 1998), the refuge may adaptively manage to improve habitat conditions for these species. The trend analysis of this survey will be used to evaluate the refuge's contribution to meeting the following three bird objectives from the North Mississippi Wildlife Refuges Complex CCP.

CCP Objective 1-7: Forest Birds

Within two years of the plan's approval, survey forest breeding birds with point counts tied to spatially discrete, georeferenced, and habitat-specific locations to assess the

preferred habitat, presence/absence, and relative abundance of all forest breeding species.

CCP Objective 1-8: Scrub/Shrub Birds

Maintain existing early successional habitats along buffer strips and within two years after the plan's approval convert up to 10 percent of acquired agricultural lands throughout the refuge complex to scrub/shrub, supporting priority scrub/shrub breeding species.

CCP Objective 1-9: Grassland Birds

Maintain existing acres of grasslands and within five years of the plan's approval convert up to 10 percent of acquired agricultural lands throughout the refuge complex to grasslands to support priority grassland bird species. Conduct baseline information surveys and continue to monitor bird responses to management and habitat alterations.

Partner Roles

The North American breeding bird survey is a coordinated effort between Patuxent Wildlife Research Center (USGS) and the National Wildlife Research Center (Canadian Wildlife Service) which manages the data and provides long-term trend analysis of the data at geographic, regional, and national scales. The refuge staff will collect data for the associated Coldwater River NWR breeding bird route on a recurring annual basis.

Protocol Needs

A national protocol framework (U.S. Geological Survey 2001) for conducting the North American Breeding Bird Survey will be followed (<https://www.pwrc.usgs.gov/bbs/index.cfm>). A site-specific protocol will be developed from this protocol. In the interim, initial survey instructions are linked to this survey record in PRIMR (<http://tinyurl.com/BreedBird-CLD>).

1.06. Secretive Marsh Bird; (FF04RMCW00-028)

Overview

This survey assesses the occurrence, distribution, and relative abundance of secretive marsh birds utilizing specific moist-soil units and evaluates effectiveness of management strategies to support these species on the refuge. Many marsh birds are of conservation concern due to a lack of general understanding of population size and status (e.g., king rails [*Rallus elegans*], and clapper rails [*R. longirostris*]) (U.S. Fish and Wildlife Service 2002). Emergent wetland systems have undergone widespread decline (Tiner 1984) which provide important habitat for both breeding and non-breeding marsh birds. Many of these wetlands are undergoing significant alterations due to changes in hydrology and invasive plants competing with native vegetation. More traditional survey methods to track changes in bird populations (e.g., Breeding Bird Survey) poorly sample emergent wetlands, and thus provide limited understanding of populations of species which primarily use marsh habitats. The refuge has managed wetland

units with both emergent and scrub/shrub habitat and has identified several species of secretive marsh birds occupying these units. Understanding the contribution of the refuge towards supporting these species is important for long-term conservation planning at the local and regional scales (Hunter et al 2006). Waterbirds are considered a resource of concern for the refuge.

Objectives

The information from this survey will be used to evaluate management strategies within individual moist-soil units to promote the continued utilization by secretive marsh birds. This survey supports the following three objectives.

CCP Objective 1-4: Marsh and Wading Birds

*Within three years of the plan's approval, determine marsh and wading bird use of wetland habitats, with special emphasis on the black rail (*Laterallus jamaicensis*), yellow rail (*Coturnicops noveboracensis*), king rail, American bittern (*Botaurus lentiginosus*), least bittern (*Ixobrychus exilis*), and wood stork (*Mycteria americana*).*

HMP Objective 2.1

*On an annual basis within the pond complex (units A – X) and/or the western fields (units 1, 2, 3, 16, 17) provide 190 acres of herbaceous vegetation with a minimum of 75 percent cover of desirable moist soil plants (e.g., sprangletop, *Panicum* spp., millet, toothcup, smartweed, *Carex* spp.), keeping non-desirables (e.g., coffeeweed and cocklebur) to less than 20 percent, and eliminating any invasive species (e.g., parrotfeather, alligatorweed) and flooded with 6 to 24 inches of water from October – March to support foraging habitat objectives for wintering waterfowl developed by the LMVJV.*

HMP Objective 2.3

On an annual basis in the western fields (units 1, 2, 3, 16, 17), the drainage ditches (units 20, 22, 23, 24, 28), and/or the pond complex (units N, P, PP, R, X) provide a minimum of 40 acres of emergent wetland habitat in 10 acre (minimum) blocks, characterized by 50 to 70 percent emergent herbaceous vegetation (cattails, soft rush), interspersed with 30 to 50 percent open water habitat, containing less than 10 percent woody vegetation and no invasive aquatic species (e.g., parrotfeather, alligatorweed) to support secretive marsh bird nesting and foraging requirements.

Partner Roles

The refuge staff has the ability to conduct this survey on an annual basis. Data from this survey will be contributed to national marsh bird survey efforts through the Eastern Avian Data Center (<http://data.pointblue.org/partners/eadc/index.php?page=resources>) to examine population trends at regional and national scales.

Protocol Needs

Standard monitoring methodology and a data management will follow Conway (2008). A national protocol framework is in review (Conway 2015) from which a site-specific protocol will be developed. Initial survey instructions are linked to this survey record in PRIMR (<http://tinyurl.com/MarshBrd-CLD>).

1.07. Emerald Ash Borer Surveillance; (FF04RMCW00-018)

Overview

This survey provides annual surveillance for the invasive emerald ash borer (*Agrilus planipennis*) within forest stands on the refuge. Survey efforts will focus on the initial detection of the beetle and may subsequently be modified to examine abundance and distribution on the refuge. The larval stage of the beetle feeds on the inner bark and phloem of ash trees (*Fraxinus* spp.) eventually causing the tree to lose the ability to transport food and water, and die. Green ash (*F. pennsylvanica*) is a prominent bottomland hardwood species within the 300 acres of natural regeneration and 1000 acres of planted hardwoods on the refuge and is the preferred ash species for the beetle (McCullough and Siegert 2007). The killing of these trees by the beetle would have a huge effect on the overstory composition within these forest stands. Presently, the beetle can be found in the adjoining states of LA, AR, and TN. It is anticipated the beetle will be found within Mississippi within the next 5 years. This invasive beetle is native to Asia and was first documented in 2002 in North America. The refuge initiated surveillance in 2015. Early detection and rapid response may provide an opportunity to evaluate emerging control measures to slow or eliminate the spread of the beetle.

Objectives

The information from this survey will be used to evaluate local, regional, and national scale distribution of the emerald ash borer. The detection of this invasive species may provide an early means to alter habitat conditions that support this species. Surveillance for this beetle will be used to evaluate the following objectives from the North Mississippi Wildlife Refuges Complex CCP and the Coldwater River NWR HMP.

CCP Objective 4-3: Invasive and Pest Management

For the duration of the plan, inventory, monitor, and control, where possible, invasive plant and animal populations to minimize or eliminate negative effects on native flora and fauna.

HMP Objective 1.1

By 2028 at least 35 percent of the area of the reforestation units (4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 18, 19, 25, 26, 34) should contain a diverse assemblage of both hard mast and soft mast producing hardwood species of at least two age classes and characterized by a minimum of 60 to 70 percent overstory canopy cover, 25 to 40 percent midstory cover,

and 60 to 70 square feet per acre basal area (with over 25 percent in older age classes) to provide suitable habitat for the resources of concern.

Partner Roles

The refuge staff has the ability to conduct this survey on an annual basis. The refuge is cooperating with the Center for Bottomland Hardwood Research (USFS) and Delta State University to review collection of beetles from traps and provide other logistical support. The refuge will provide data from surveillance trapping to the U.S. Department of Agriculture and the Mississippi Forestry Commission for purposes of tracking the spread of the insect.

Protocol Needs

Surveillance for emerald ash borer will be done utilizing baited Lindgren funnel traps, purple panel traps, and girdled trap trees following guidelines provided by McCullough and Siegart (2007). A national protocol framework needs to be developed from which a site-specific protocol will need to be developed. Initial survey instructions are linked to this survey record in PRIMR (<http://tinyurl.com/EmeraldAsh-CLD>).

1.08. North American Amphibian Monitoring; (FF04RMCW00-006)

Overview

This survey will assist in understanding long-term population trends of frogs and toads across regional and national scales as well as provide local baseline inventories. Amphibians are important ecological organisms associated with wetland systems. Worldwide declines in this taxonomic group have prompted the need to undertake multiple survey designs to investigate population trends and understand mechanisms that influence them. Throughout the United States, there is evidence of species-specific and regional declines of amphibians (Adams et al. 2013). The MAV has undergone immense anthropogenic changes through hydrologic alterations of the Mississippi River and 80% reduction in the forested wetlands to foster an agricultural landscape (Tiner 1984). This geographical area continues to undergo significant stressors associated with intense agricultural practices that rely on fertilizers, herbicides, insecticides and irrigation programs to maximize cereal grain production. These stressors, in concert with ongoing climate changes and emerging disease issues are a significant threat for amphibian populations within the MAV.

While baseline inventories of herpetofauna have occurred on the refuge (Mitchell 2011), the North American Amphibian Monitoring Program (U.S. Geological Survey 2012) provides a national survey design to track long-term trends of frogs and toads based on their calling frequency and occupancy at repeated roadside observation sites. Results from this design have recently documented changes in anuran occupancy in the northeastern United States (Weir et al. 2014). This survey was selected because it not only contributes to efforts to monitor this taxon at regional and national scales, but it also provides a better understanding of the biodiversity for the refuge.

Objective

This survey will monitor frog and toad occupancy from roadside wetlands to determine long-term population trends. This information can be used to evaluate the refuge's contribution to the biodiversity of amphibians within the MAV and address the following objective from the CCP.

CCP Objective 2-2: Non-Game Species

Within 10 years of the plan's approval, reestablish historical hydrological and habitat regimes to increase refuge biodiversity to the maximum extent feasible. Biennially monitor non-game species response to restoration activities.

Partner Roles

The refuge will annually collect survey data along the Coldwater River NWR anuran call route and upload the data to the USGS, North American Amphibian Monitoring Program database. USGS will archive data and conduct periodic analysis of the data at regional and national scales. The refuge will also continue to provide data as requested to the Mississippi Museum of Natural Science, Natural Heritage Program to track species occurrence in the state.

Protocol Needs

A national protocol framework and subsequent site-specific protocol needs to be developed. In the interim, procedures for conducting this survey will follow those outlined by the USGS, North American Amphibian Monitoring Program, (<https://www.pwrc.usgs.gov/naamp/index.cfm?fuseaction=app.protocol>) (U.S. Geological Survey 2012). Initial survey instructions are linked to this survey record in PRIMR (<http://tinyurl.com/NAAMP-CLD>).

1.09. Groundwater Table Monitoring; (FF04RMCW00-024)

Overview

This survey will provide baseline information about seasonal and long-term changes in the groundwater table on the refuge. The bottomland hardwood ecosystem of the MAV has been irrevocably altered by flood abatement projects along the Mississippi River, and the main tributaries, as well as the subsequent land clearing of the region for forest products and large-scale agricultural production of cotton and cereal grains. The hydrology of the system continues to be modified as agricultural practices remove small wetlands, improve ditches to facilitate dewatering of fields, and level the landscape for irrigation efficiency. Over the past 20 years, the reliance on groundwater irrigation for corn, milo, rice, and soybean production has grown to immense proportion compared to non-irrigated agriculture. As such, the underlying Mississippi Embayment Aquifer is being pumped at a rate that exceeds the long-term recharge of the basin. Data from the USGS Groundwater Watch (<http://groundwaterwatch.usgs.gov>) shows significant below average levels for large areas of the MAV.

Coldwater River NWR is a fragment of the historic bottomland hardwood ecosystem associated with the MAV. Existing and future flora and fauna are indirectly dependent on the surface soil-moisture gradients which effectively determine local plant communities. Presently, the agricultural-dominated landscape adjacent to the refuge relies intensively on crop irrigation to maximize production. The refuge on a limited scale uses several existing wells to irrigate moist-soil and cereal grain units or flood these impoundments in fall for waterfowl. Continued reductions to the groundwater table could have major negative effects and these may be further influenced by climate change. Understanding the current rate of groundwater removal and the potential for recharge around the refuge is needed to evaluate long-term management of the forested community.

Objective

Water levels will be measured from the confined aquifer being drawn upon for irrigation. This information will be used in conjunction with surveys for herpetofauna, mussels, crayfish, other wetland species, and forest stand composition to understand potential changes influenced by surface and subsurface water conditions. The groundwater table survey will be used to assess the broader CCP goal to maintain a mosaic of wetland habitat types to provide foraging, roosting, nesting, and over-wintering habitat for migratory birds, including waterfowl, shorebirds, wading birds, and secretive marsh birds and State and Federal species of special concern. More specifically this survey is important to understand the influence of groundwater changes as it affects the following HMP objective.

HMP Objective 2.5

On an annual basis in sloughs and borrow pits (units 8, 21, 29, 30) and/or the pond complex (units N, P, PP, R, X), provide 100 acres of shrub swamp habitat characterized by 30 to 50 percent shrubs, 40 to 70 percent herbaceous emergent, 0 to 10 percent trees, no invasive aquatic species (e.g., parrotfeather, alligatorweed), and 25 percent open water and containing a minimum of 10 loafing sites (18 inches by 18 inches, 2 to 5 inches above water) per acre in close proximity to nest boxes or natural cavities to provide brood rearing habitat for wood ducks.

Partner Roles

The refuge has the equipment to construct groundwater monitoring wells and utilize existing irrigation wells for monitoring. The refuge will work with the Mississippi Department of Environmental Quality, Yazoo Water Management District, and the USGS to contribute survey results to the National Ground-Water Monitoring Network (<http://cida.usgs.gov/ngwmn>).

Protocol Needs

Groundwater table survey design and monitoring procedures will follow Lapham et al. (1995). A regional protocol framework and a site-specific protocol need to be developed. Initial survey instructions are linked to this survey record in PRIMR (<http://tinyurl.com/GndWater-CLD>).

1.10. Hunter Use and Harvest Monitoring; (FF04RMCW00-007)

Overview

This survey is designed to estimate the annual harvest of waterfowl and the number of individuals hunting on a daily basis on the refuge. The National Wildlife Refuge Improvement Act of 1997 (Public Law 105-57) provides recognition that wildlife-dependent recreational uses involving hunting, fishing, wildlife observation and photography, and environmental education and interpretation, when determined to be compatible, are legitimate and appropriate public uses of the Refuge System. The refuge has restricted waterfowl hunting to a small portion of the refuge aside from the primary sanctuary. Monitoring hunter participation and animals harvested allows assessment of compatibility so as not to interfere with the establishing purposes for the refuge which are to provide for migrant and wintering waterfowl.

Objective

The survey will be used to ensure public hunting is compatible with the enabling legislation for the refuge. Data from this survey will be used to address the following CCP objective.

CCP Objective 2-1: Game Species

For the duration of the plan, manage game populations to maximize quality hunting opportunities while maintaining habitat for federal trust resources.

Partner Roles

The refuge has the ability to conduct this survey on an annual basis. No partners have been identified.

Protocol Needs

Hunter participation and animals harvested is based on compliance of all hunters filling out a standardized National Wildlife Refuge System/Big Game Harvest Report (FWS Form 3-2359; Office of Management and Budget Control Number 1018-1040). A site-specific protocol is needed. Initial survey instructions are linked to this survey record in PRIMR (<http://tinyurl.com/HuntHarv-CLD>).

1.11. Stream Temperature Monitoring; (FF04RMCW00-017)

Overview

This survey will provide baseline information about seasonal and long-term changes in the water temperature on the refuge and contribute to a broader understanding of surface water temperature variation across the region. Across the Southeast, there is a paucity of information about daily and seasonal stream temperature regimes which influence the biodiversity and potentially relate to land-use practices in the drainage and climate change. Furthermore, significant changes in aquatic biodiversity are influenced by water temperature extremes which limit the species

composition. Building a foundation for a spatially continuous map of waterbody temperatures on refuges and neighboring waters in the southeastern United States is an initiative of FWS, Ecological Services and other federal partners to better understand the effects of abiotic factors on the distribution of aquatic organisms and ecosystem health (U.S. Fish and Wildlife Service 2014b). This survey was selected because it supports a collaborative regional effort with Ecological Services to fill existing stream temperature gaps and provides important information to the refuge regarding aquatic systems.

Objective

The site-specific data will be used to examine the influence of hydrological restoration efforts on the refuge and contribute to regional monitoring efforts. This survey does not directly link to an objective from the CCP or the HMP but supports an evaluation of the CCP goal to: Maintain a mosaic of wetland habitat types to provide foraging, roosting, nesting, and over-wintering habitat for migratory birds, including waterfowl, shorebirds, wading birds, and secretive marsh birds and State and Federal species of special concern.

Partner Roles

Stream temperature monitoring and data collection will be done by the refuge. This is a regional cooperative effort to monitor long-term stream temperatures across the Southeast, and includes participation from National Wildlife Refuges, National Fish Hatcheries and Ecological Services. The Drought Assessment and Response Team (DART) and Ecological Services will oversee the project and work with USGS and USFS to build a broader partnership. The refuge will annually download local temperature data and provide it to DART for regional analysis.

Protocol Needs

Basic temperature monitoring techniques using automated recording data loggers and study design have been developed for this regional initiative (U.S. Fish and Wildlife Service 2014b). A regional protocol framework will need to be developed by DART from which a site-specific protocol will be generated. Initial survey instructions are linked to this survey record in PRIMR (<http://tinyurl.com/StreamTemp-CLD>).

2.1. Plant Inventory; (FF04RMCW00-032)

Overview

The plant inventory will develop a georeferenced source of vascular plant species composition for both aquatic and terrestrial systems throughout the refuge. Prior to 1978, most of the refuge was cleared of hardwoods to promote agriculture. Since acquisition by the Service in 1991, hardwood reforestation (afforestation) and natural regeneration has occurred on approximately 70% (1500 acres) of the refuge (U.S. Fish and Wildlife Service 2015a). The remaining acreage is maintained as moist-soil units which are periodically dewatered and manipulated to set back hardwood succession.

Historically, this bottomland hardwood ecosystem would have had a diverse and dynamic understory and mid-story plant community driven in part by periodic alteration to the canopy and frequent deposition of organic rich sediments from floodwaters associated with the Mississippi River drainage basin. However, the elimination of the overstory and changes in local and regional hydrology has irrevocably changed the seed source, vegetative community structure, and micro-site conditions that would have defined the plant composition on the refuge. As hardwood reforestation areas develop, the understory composition is expected to be much less diverse in species richness compared to forested tracts adjacent to the refuge due to the previous land clearing on the refuge. In some cases, these cleared fields provide an opportunity for colonization by invasive plants that adversely affect resource values. The plant inventory was selected because it provides an understanding of the refuge's plant biodiversity and is an indicator for bottomland hardwood forest restoration (De Steven et al. 2015).

Objectives

The plant inventory will provide a baseline of species diversity and occurrence which is needed to inform refuge management decisions. The survey will provide important information regarding long-term understory restoration within the hardwood reforestation units. The plant inventory assesses these objectives.

CCP Objective 4-3: Invasive and Pest Management

For the duration of the plan, inventory, monitor, and control, where possible, invasive plant and animal populations to minimize or eliminate negative effects on native flora and fauna.

HMP Objective 1.1

By 2028 at least 35 percent of the area of the reforestation units (4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 18, 19, 25, 26, 34) should contain a diverse assemblage of both hard mast and soft mast producing hardwood species of at least two age classes and characterized by a minimum of 60 to 70 percent overstory canopy cover, 25 to 40 percent midstory cover, and 60 to 70 square feet per acre basal area (with over 25 percent in older age classes) to provide suitable habitat for the resources of concern.

HMP Objective 2.1

*On an annual basis within the pond complex (units A – X) and/or the western fields (units 1, 2, 3, 16, 17) provide 190 acres of herbaceous vegetation with a minimum of 75 percent cover of desirable moist soil plants (e.g., sprangletop, *Panicum* spp., millet, toothcup, smartweed, *Carex* spp.), keeping non-desirables (e.g., coffeeweed and cocklebur) to less than 20 percent, and eliminating any invasive species (e.g., parrotfeather, alligatorweed) and flooded with 6 to 24 inches of water from October – March to support foraging habitat objectives for wintering waterfowl developed by the LMVJV.*

Partner Roles

The refuge does not have the capacity to conduct this survey because of the specialized expertise needed to identify plant species in the field and the duration needed to complete a comprehensive plant inventory. The refuge will work to fund this project as a contract survey. The refuge will work with the Mississippi Museum of Natural Science to voucher rare or uncommon botanical specimens.

Protocol Needs

Because plant distributions are rarely homogeneous, it is difficult to conduct baseline inventories using simplified sampling techniques. Instead, sampling requires multiple plot sizes, sampling intensity, and stratification to adequately describe the relative abundance and distribution of plants. This type of sampling design has been outlined by Barnett and Stohlgren (2003), and Elzinga et al. (1998). A national protocol framework and site-specific protocol need to be developed.

2.2. Fish Inventory; (FF04RMCW00-019)

Overview

The survey will provide a baseline inventory of freshwater fish across the entire refuge. The biodiversity and health of aquatic systems is often gauged by the assemblage of fish present. Mississippi is host to 204 native freshwater fish species of which 35% are considered imperiled to some degree (Ross 2001). Many of these fish species are highly specialized and restricted to small drainages. The Mississippi Delta has been poorly sampled (Ross 2001). Coldwater River NWR has very limited, suitable habitat for native fishes with only a few drainage ditches running through the property and permanent shallow impoundments supporting emergent and scrub-shrub habitat. The only inventory of fish occurred opportunistically as captures in minnow traps while a crayfish survey was conducted (unpublished data, 2014). This survey was selected because it provides important baseline information regarding a taxonomic group that is imperiled, reflects on the health of the aquatic system, and furthers the CCP objective to conserve the fish fauna.

Objective

This survey is important to understand the fish assemblage within the wetland system on the refuge and the refuge's contributions to the conservation of native fish within the Mississippi Delta. This survey will provide a diversity index of the fishery and assess the following objective from the CCP.

CCP - Objective 2-3: Fishes

For the duration of the CCP, continue to enhance spawning habitats and improve water quality at Coldwater River, Dahomey and Tallahatchie NWRs to maintain healthy, sustainable fish populations.

Partner Roles

Surveys for fish can be done with existing refuge resources. The refuge will work with the Private John Allen National Fish Hatcher for assistance with specialized sampling equipment (e.g., backpack electrofishing unit). In addition, the refuge will partner with the Center for Bottomland Hardwood Research (USFS); and the Mississippi Museum of Natural Science to verify specimens. Vouchers from the survey will be submitted for inclusion in the Mississippi Museum of Natural Science ichthyology collection.

Protocol Needs

A multitude of sampling techniques is needed to sample for the presence of fish on the refuge. Standard methods for sampling freshwater fish have been identified (Bonar et al. 2009). A national protocol framework and site-specific protocol need to be developed.

2.3. Herpetofaunal Inventory; (FF04RMCW00-025)

Overview

This survey establishes a baseline inventory of herpetofauna (reptiles and amphibians) throughout all habitat types on the refuge. Having baseline information on herpetofauna is important, because many are considered at-risk and this allows long-term monitoring efforts to be established. Unfortunately, there is a lack of population monitoring or species occurrence information at local or regional scales. This taxon is extremely vulnerable to a number of current disease issues including chytrid and ranavirus which have been implicated in local and regional scale species declines and extirpations. The refuge has conducted a fairly extensive inventory of herpetofauna within the moist-soil units (Mitchell 2011) but needs to examine reforestation and drainage system areas of the refuge. This survey was selected because it provides important baseline information regarding a taxon that is poorly understood and reflects on the health of the aquatic system. Also, the survey furthers the CCP objective to conserve biodiversity associated with non-game and threatened and endangered species.

Objectives

The inventory will provide information regarding species occurrence of herpetofauna and will be the basis for long-term monitoring efforts. This survey addresses the need to understand refuge biodiversity and examines the following two objectives from the CCP.

CCP Objective 2-2: Non-Game Species

Within 10 years of the plan's approval, reestablish historical hydrological and habitat regimes to increase refuge biodiversity to the maximum extent feasible. Biennially monitor non-game species response to restoration activities.

CCP Objective 3-1: Inventory

Inventory the distribution and habitat use of all threatened and endangered species on the refuge complex and contribute to their recovery.

Partner Roles

The refuge does not currently have the capacity to conduct this survey given the time involvement it would require. The refuge will work to identify partners and funds to complete the survey during the period of this IMP. The Mississippi Museum of Natural Science will be approached to retained unique voucher specimens in their herpetological collection. No other partnerships have been identified.

Protocol Needs

A multitude of sampling techniques will be utilized to perform a comprehensive inventory due to the diversity of habitats and unique life history of the species which makes many difficult to locate. In general, herpetofaunal surveys will be done following techniques outlined by Graeter et al. (2013). A regional or national protocol framework needs to be developed for the purpose of a baseline inventory of herpetofauna.

2.4. Mussel Inventory; (FF04RMCW00-022)

Overview

The survey will provide a baseline inventory of freshwater mussels (Family Unionidae and Corbiculidae) across the entire refuge. Freshwater mussels represent an extremely diverse taxon and are important indicators of aquatic system health. While some species have wide geographic distribution, many freshwater mussels are restricted to specific drainages. Unfortunately, greater than 30% of them are listed or proposed for listing under the Endangered Species Act. Mississippi has 85 described and 2 undescribed species of freshwater mussels (Jones et al. 2005). Though no field sampling has been done for freshwater mussels on the refuge (Hartfield 2004), the Yazoo River drainage which encompasses the refuge area contains the second greatest number of taxa (46) in the state (Jones et al. 2005). Because there is little permanent water on Coldwater River NWR, the mussel species richness is expected to be very low and restricted to only a few species tolerant of lentic systems [e.g., giant floater, (*Pyganodon grandis*)]. This survey was selected because it provides important baseline information regarding a taxonomic group that is of special concern, includes numerous species in decline and at-risk, and relates to the CCP objective to inventory non-game species.

Objectives

This information is important to understand the freshwater mussel biodiversity within the wetland system on the refuge and the refuge's contribution to the conservation of this taxon within the Mississippi Delta. This survey will serve as a basis to understand the restoration of the hydrology on the refuge, species diversity and the following objectives from the CCP.

CCP Objective 2-2: Non-Game Species

Within 10 years of the plan's approval, reestablish historical hydrological and habitat regimes to increase refuge biodiversity to the maximum extent feasible. Biennially monitor non-game species response to restoration activities.

CCP Objective 3-1: Inventory

Inventory the distribution and habitat use of all threatened and endangered species on the refuge complex and contribute to their recovery.

CCP Objective 4-3: Invasive and Pest Management

For the duration of the plan, inventory, monitor, and control, where possible, invasive plant and animal populations to minimize or eliminate negative effects on native flora and fauna.

Partner Roles

Surveys for freshwater mussels can be done by the refuge. Identification of species can be difficult; therefore, the refuge will partner with the Mississippi Ecological Services Field Office, Center for Bottomland Hardwood Research, and the Mississippi Museum of Natural Science to verify specimens. Vouchers from the freshwater mussel survey will be placed in the Mississippi Museum of Natural Science malacology collection.

Protocol Needs

General inventory guidance on how to determine the presence and potential absence of mollusks would follow Duncan (2008) and Carlson et al. (2008). A national or regional protocol framework needs to be developed.

2.5. Crayfish Inventory; (FF04RMCW00-026)

Overview

The survey will provide a baseline inventory of crayfish across the entire refuge. North America has over 363 species of crayfish with over 33% listed as threatened or endangered (Taylor et al. 2011). In Mississippi, there are at least 63 species though the number may be as high as 78 if undescribed species are included (Fitzpatrick 2000). Due to the vulnerability of this taxon to pesticides, sedimentation, and climate changes, it is important to understand the distribution of crayfish species across the state as indicators of aquatic system health. This survey was also selected because it provides important baseline information regarding a taxonomic group with numerous species listed as threatened, endangered, vulnerable, or at-risk. The refuge has been able to conduct limited surveys for crayfish (USFWS Unpublished data 2014), but has not been able to complete an entire survey across the refuge.

Objectives

This survey provides baseline information to understand the crayfish biodiversity on the refuge and the refuge's contribution to the conservation of this taxon. This survey will serve as a basis to understand the restoration of the hydrology on the refuge, diversity of crayfish, and assess the following objectives from the CCP.

CCP Objective 2-2: Non-Game Species

Within 10 years of the plan's approval, reestablish historical hydrological and habitat regimes to increase refuge biodiversity to the maximum extent feasible. Biennially monitor non-game species response to restoration activities.

CCP Objective 3-1: Inventory

Inventory the distribution and habitat use of all threatened and endangered species on the Complex and contribute to their recovery.

Partner Roles

Surveys for crayfish can be done with existing refuge resources. However, because identification of species can be difficult, the refuge will partner with the Mississippi Ecological Field Services Office, and the Center for Bottomland Hardwood Research (USFS) to verify specimens. Vouchers from the crayfish inventory will be placed in the Mississippi Museum of Natural Science invertebrate collection and other appropriate research collections.

Protocol Needs

A multitude of sampling techniques can be undertaken to sample for the presence of crayfish depending on the habitat and prevalence to burrow. A regional protocol framework needs to be developed.

2.6. Small Mammal Inventory; (FF04RMCW00-027)

Overview

The purpose of the survey is to provide a baseline inventory of the distribution and relative abundance of small mammals throughout the various habitat types on the refuge. Mississippi is host to 68 extant, free-ranging mammals, including 5 species of marine mammals (Jones and Carter 1989). Nearly half of the mammal species in the state are considered terrestrial small mammals (i.e., mice, voles, shrews, rats, and bats). Several species of small mammals are on the state's list of species of concern or are federally listed under the Endangered Species Act [e.g., northern long-eared bat (*Myotis septentrionalis*)]. These species play an important role in the function of the ecosystem by serving as base prey for larger mammals, birds, and snakes; providing a mechanism for plant dispersal; and serving as predators on insects. The diversity of small mammals is a function of present and historic land-use practices which influences the current distribution and relative abundance of certain species. By 1991, the refuge was

completely deforested having been previously cleared of bottomland hardwood forest for agriculture and subsequently aquaculture production. Likewise, most of the land surrounding the refuge was also previously cleared for agriculture. The significant lack of mature forest undoubtedly limits the small mammal composition present on the refuge. This is especially true for bats which are likely to only forage across the refuge due to inadequate roosting habitat within. In addition, dispersal of ground dwelling small mammals with specialized habitat requirements (e.g., shrews) from source populations on adjacent lands, may be precluded from becoming re-established.

An initial inventory of small mammals for the refuge has been assessed by Mitchell (2011) within the moist-soil units. In addition, acoustical detection of bats within and adjacent to the refuge is ongoing during the breeding season (U.S. Fish and Wildlife Service 2015c). However, a comprehensive small mammal inventory has not been completed for the remainder of the refuge. Therefore, understanding the small mammal biodiversity is important to make more informed management decisions and how habitat management strategies are reflecting overall ecosystem restoration.

Objectives

This survey will serve as a basis to understand the diversity of small mammals on the refuge and assess the following objectives from the CCP.

CCP Objective 2-2: Non-Game Species

Within 10 years of the plan's approval, reestablish historical hydrological and habitat regimes to increase refuge biodiversity to the maximum extent feasible. Biennially monitor non-game species response to restoration activities.

CCP Objective 3-1: Inventory

Inventory the distribution and habitat use of all threatened and endangered species on the refuge complex and contribute to their recovery.

CCP Objective 4-3: Invasive and Pest Management

For the duration of the plan, inventory, monitor, and control, where possible, invasive plant and animal populations to minimize or eliminate negative effects on native flora and fauna.

Partner Roles

The refuge has the capability to conduct this survey with existing resources. However, this survey would benefit from the partnership with the Mississippi Museum of Natural Science to verify many of the small mice and voles. Vouchers of collected species will be placed in the mammal collection at the museum.

Protocol Needs

The variability in habitat use and behavior of small mammals requires a multitude of sampling techniques including snap traps, live traps, acoustical detectors, and mist nets to determine the presence of species. A national protocol framework is needed to design appropriate survey methods for the various small mammal species.

2.7. Insect Inventory; (FF04RMCW00-030)

Overview

The primary purpose of the survey is to initiate a baseline inventory of insects throughout the various habitat types on the refuge. No other group of organisms is as diverse both in terms of species richness and overall abundance as insects. The interdependency of the ecological community (plants, animals, fish, fungi, and micro-organisms) with the insect fauna determines the health of the nested biodiversity (composition, structure, ecological processes) (Kim 1993). In many instances, insects can be used as an indicator of habitat integrity across a gradient of conditions (Kutcher and Bried 2014). Thus, conservation of insects is fundamental to larger resource conservation strategies.

No significant efforts have been undertaken to document the insect fauna on the refuge. The only exception has been limited collections made of Odonata (dragonfly and damselfly) in 2003 (USFWS Unpublished data) and periodic sampling done by Delta State University. The understanding of insect biodiversity is important to make more informed management decisions to support insect conservation of rare or uncommon species as well as assessment of ecological restoration.

Objectives

This survey will serve as a basis to understand the diversity of insects on the refuge and assess the following objectives from the CCP.

CCP Objective 2-2: Non-Game Species

Within 10 years of the plan's approval, reestablish historical hydrological and habitat regimes to increase refuge biodiversity to the maximum extent feasible. Biennially monitor non-game species response to restoration activities.

CCP Objective 3-1: Inventory

Inventory the distribution and habitat use of all threatened and endangered species on the refuge complex and contribute to their recovery.

CCP Objective 4-3: Invasive and Pest Management

For the duration of the plan, inventory, monitor, and control, where possible, invasive plant and animal populations to minimize or eliminate negative effects on native flora and fauna.

Partner Roles

The refuge has limited capacity to conduct this survey with existing resources and will continue to engage the Center for Bottomland Hardwood Research (USFS); Delta State University, Entomology Department; and Mississippi State University, Department of Entomology and Plant Pathology in support of this inventory. As funding opportunities become available, the refuge will target specific taxa groups for inventory which are considered rare, uncommon, or species of concern.

Protocol Needs

The diversity of insects, variability of abundance, and habitat association makes this group extremely challenging to inventory. Most inventory surveys will be based on more refined taxa groups (e.g., butterflies, beetles, aquatic invertebrates) and require multiple years of effort and stratified sampling to complete (Fattorini 2013). Each functional group will likely require various sampling designs and collection methods. A national protocol framework is needed to design appropriate survey methods for the various groups of insects.

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Appendix A. Brief Description of Non-survey Activities and “Future- (Tier 3)” Surveys Considered in the Coldwater River NWR IMP Process.

Table A.1. Seven non-survey or redundant activities were identified and excluded from the survey prioritization processes and the reason for not considering them further in the IMP.

Activity Name	Description	Reason for Exclusion
Contaminants Assessment	Determination of contaminants in water, soil, and faunal tissues as part of an overall assessment on the refuge.	Funding and prioritization for this is being directed through the Contaminants Assessment Process.
Greater Gulf Waterbird Count	Count of waterbirds in fall	Project initiated in support of the Gulf BP oil spill to supplement data – survey period has ended and data no longer needed
LMVJV Moist-soil Database	Annual production estimate of moist-soil and cereal grain in managed units.	Cooperative monitoring is being done by the LMVJV but the level of data collection is very qualitative and requires no field effort – data call only.
Midwinter Waterfowl Ground Survey	Annual survey of waterfowl observed on the refuge in the first week of January.	The refuge’s data from this survey are not included in the official Midwinter Waterfowl Survey Summary. Data collection for waterfowl will be incorporated into the IWMM protocol.
Shorebird Monitoring	Biweekly counts of fall shorebird use of impoundments.	Data collection will be incorporated into an all waterbird monitoring effort using IWMM protocol.
Wood Duck Nest Box Monitoring	Annual inspection of wood duck nest boxes to determine egg production and estimate duckling contribution to fledgling	Intensive survey of boxes is not needed to support utilization of box program to enhance local wood duck production – boxes will be maintained without monitoring actual nest production.
Wood Duck Preseason Banding	Annual capture and banding of wood duck from July – September 30	Effort is in support of regional harvest regulations of the species and is not used to generate any management for the species.

Table A.2. Six surveys were identified for consideration in the future if significant new capacity becomes available “Future (Tier 3)”.

Survey Name	Description
Avian Disease Surveillance	Long-term periodic sampling of birds for a host of present and emerging diseases including avian influenza - this would not include targeted sampling during potential avian die-offs
Chytrid Amphibian Surveillance	Surveillance monitoring for chytrid in amphibians on the refuge
Northern Long-eared Bat Inventory	Inventory to determine the presence of northern long-eared bats (<i>Myotis septentrionalis</i>) on the refuge.
Ranavirus Herpetofaunal Surveillance	Surveillance monitoring for Ranavirus in herpetofauna on the refuge
Raptor Survey	Periodic monitoring of breeding and migrant raptors on the refuge
Wood Duck Brood Monitoring	Annual monitoring of wood duck brood use within moist-soil units.

Appendix B. Survey Prioritization Tool Criteria and Weights Used to Prioritize Surveys

Table B.1. Criteria and calculated weights used in the Survey Prioritization Tool.

Criteria Category	Criteria	Weight
Refuge Priorities and Management Needs	<i>1B. CCP or Other Management Plan Objectives</i>	0.11916
	<i>1C. NWRs Objectives</i>	0.11057
	<i>1D. Management Utility (Decision Support) for the Refuge</i>	0.12039
Partner Priorities and Management Needs	<i>2A. FWS Program Need</i>	0.06388
	<i>2B. FWS Partner Need</i>	0.03317
Ecological Application	<i>3A. Surrogate Species</i>	0.00000
	<i>3C. Survey Breadth</i>	0.02948
Additional Legal Mandates	<i>4A. Listed Species or Vegetation Communities</i>	0.10074
Immediacy of Need	<i>5A. Controversy</i>	0.03317
	<i>5B. Threat</i>	0.07002
Scope and Scale	<i>6A. Baseline Data</i>	0.08108
	<i>6B. Survey Scope</i>	0.03563
	<i>6C. Spatial Scale</i>	0.03563
Protocol	<i>7A. Sampling Design Stage</i>	0.05651
	<i>7B. Field Methods Stage</i>	0.05405
	<i>7C. Data Management, Analysis, and Reporting</i>	0.05651

Sixteen of 24 criteria and associated scoring values from the survey prioritization tool were considered to prioritize ongoing and proposed surveys in developing the Inventory and Monitoring Plan for Coldwater River National Wildlife Refuge (Table B.1). Eight criteria were removed after careful consideration and discussion because they were either redundant with other criteria, or would not add discrimination among surveys in the Southeast (Table B.2) Weights for the relative importance of each criteria for evaluating refuge surveys were developed by three refuge staff and a value developed by the Region 4 I&M Branch. These four weights were subsequently used to create an assigned average weight for each criterion (weights used in the survey prioritization tool are reported next to the criteria). Higher value weights represent criteria that were considered more important. For a complete description of all 24 criteria and

the scoring values, see “A User’s Guide for a SMART Survey Prioritization Tool (U.S. Fish and Wildlife Service 2014a)”. **Note:** *The surrogate species criterion (3A) was not evaluated in this IMP due to no designated species for this area at this time.*

Table B.2. Criteria removed from consideration in the Survey Prioritization Tool and justification.

Criteria removed by Region 4 I & M Branch from consideration	Justification
1A. Refuge Purpose	This criterion is covered in 1B. Removed to avoid duplication.
3B. Refuge Processes	Refuge ecological processes can be addressed in 3C.
4B. Other Legal Mandates	Few examples in Region 4 where there are legal mandates other than those covered by ESA, state lists, rankings by Heritage Programs, IUCN global Red List, or NatureServe rankings (these covered in 4A).
6D. Integration with Other Survey	Many surveys are integrated on Region 4 refuges to assess overall management success. However, surveys should not have to be completely dependent on each other to provide useful information.
6E. Attribute Quality and Scope	This criterion is covered in 7A, B, and C.
8A. Monetary	The purpose of prioritizing surveys in Region 4 is based on biological needs and objectives. All cost considerations are dealt with more explicitly by asking the refuge staff to estimate the labor and funding required to complete each survey after the prioritization process.
8B. Personnel	The purpose of prioritizing surveys in Region 4 is based on biological needs and objectives. All cost considerations are dealt with more explicitly by asking the refuge staff to estimate the labor and funding required to complete each survey after the prioritization process.
8C. Security/Source of Funding	The purpose of prioritizing surveys in Region 4 is based on biological needs and objectives. All cost considerations are dealt with more explicitly by asking the refuge staff to estimate the labor and funding required to complete each survey after the prioritization process.

Appendix C. Prioritization Scores and Status of All Ranked Surveys

Values used to prioritize and select the surveys likely to be conducted through 2031 at Coldwater River NWR. Prioritization scores were generated for candidate surveys by refuge staff using 16 criteria for each survey (Appendix B) and by assigning an independent opinion-rank. Scores were then used as a starting reference to assign the surveys into 3 tiers (Current, Expected, Future). Finally, survey status was assigned by considering the capacity available for conducting each survey to completion. Current surveys are those that can be done with station funds alone. Expected surveys will possibly be conducted but at present additional capacity is needed from non-station funding sources to do them and the staff felt it was more likely than not that capacity would be realized during the span of the IMP. Future surveys are those not very likely to be conducted because of low priority or very limited chance in securing the needed capacity to do them. Surveys selected for the IMP (status = Current or Expected) are shown in blue. Non-selected surveys (status = Future) are shown in white and also indicated in Appendix A-Table A.2.

Table C.1. Scores from the Survey Prioritization Tool and an Independent Opinion-based Prioritization Process for 24 surveys.

No.	Survey Name	Survey Tool Score	Opinion ^a Based Rank	Tier ^b	Status	IMP Status	Survey Priority
1	Migrant and Wintering Waterbird Monitoring	0.550	1	1	Current	Selected	1.01
2	Mobile Acoustical Bat Monitoring	0.480	6	1	Current	Selected	1.02
3	Hardwood Reforestation Evaluation	0.462	4	1	Current	Selected	1.03
4	Moist-soil/Grain Production	0.438	2	1	Current	Selected	1.04
5	Breeding Bird Survey	0.385	5	1	Current	Selected	1.05
6	Secretive Marsh Bird	0.376	N/A ^c	1	Current	Selected	1.06
7	Emerald Ash Borer Surveillance	0.372	N/A ^c	1	Current	Selected	1.07
8	N.A. Amphibian Monitoring	0.359	3	1	Current	Selected	1.08
9	Ground Water Table Monitoring	0.229	8	1	Current	Selected	1.09
10	Hunter Use and Harvest Monitoring	0.209	12	1	Current	Selected	1.10
11	Stream Temperature Monitoring	0.176	15	1	Current	Selected	1.11
12	Plant Inventory	0.317	9	2	Expected	Selected	2.1
13	Fish Inventory	0.272	24	2	Expected	Selected	2.2
14	Herpetofaunal Inventory	0.272	17	2	Expected	Selected	2.3
15	Mussel Survey	0.243	19	2	Expected	Selected	2.4
16	Crayfish Inventory	0.240	7	2	Expected	Selected	2.5
17	Small Mammal Inventory	0.224	13	2	Expected	Selected	2.6
18	Insect Inventory	0.220	10	2	Expected	Selected	2.7
19	Northern Long-eared Bat Inventory	0.431	14	3	Future	Non-selected	
20	Wood Duck Brood	0.195	N/A ^c	3	Future	Non-selected	
21	Avian Disease Surveillance	0.188	16	3	Future	Non-selected	
22	Chytrid Amphibian Surveillance	0.188	19	3	Future	Non-selected	

23	Ranavirus Herpetofaunal Surveillance	0.166	20	3	Future	Non-selected	
24	Raptor Survey	0.163	18	3	Future	Non-selected	

^a Opinion rank is the average value or the ranks assigned by the staff using an independent assessment process.

^b Tier 1--The highest priority surveys that the Project Leader estimates can be conducted with existing staffing and funding.

Tier 2--Surveys that the Project Leader sees as second priority for the station, or high priority surveys that would require an increase in operational capacity.

Tier 3--Lower priority surveys that are currently being conducted or are anticipated but would require the major reallocation of staff and capacity.

^c Survey was not ranked using the opinion-based process

Appendix D. Environmental Action Statement for Coldwater River National Wildlife Refuge Inventory and Monitoring Plan

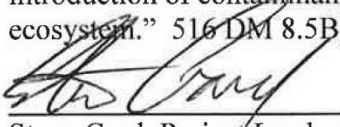
Within the spirit and intent of the Council on Environmental Quality's regulations for implementing the National Environmental Policy Act (NEPA) (40 CFR 1500-1508), and other statutes, orders, and policies that protect fish and wildlife resources, I have established the following administrative record and determined that the following proposed action does not require additional NEPA documentation.

Proposed Action, Alternatives, and NEPA Documentation

The proposed action is to implement an Inventory and Monitoring Plan (IMP) for the Coldwater River National Wildlife Refuge (NWR). This IMP provides specific guidance for surveys of Coldwater River NWR's fish, wildlife, plant, habitat, and abiotic resources to fulfill the Coldwater River NWR's purposes and help achieve Coldwater River NWR's goals and objectives. There are no considered alternatives to the HMP given administrative requirement to complete this step-down plan.

In accordance with 43 CRF 46.205 and 40 CFR 1508.4, surveys within this IMP are covered by the following Departmental categorical exclusion because they would not have significant environmental effects.

"Research, inventory, and information collection activities directly related to the conservation of fish and wildlife resources which involve negligible animal mortality or habitat destruction, no introduction of contaminants, or no introduction of organisms not indigenous to the affected ecosystem." 516 DM 8.5B(1).


Steve Gard, Project Leader

1/12/15
Date

Reference: U.S. Fish and Wildlife Service. 2005. North Mississippi National Wildlife Refuges Complex Comprehensive Conservation Plan, U.S. Dept. of Interior, Fish and Wildlife Service, Atlanta, GA. 231 pp.

Appendix E. Initial Survey Instructions for 11 Current Surveys to be Conducted on Coldwater River National Wildlife Refuge from 2016-2031



1.01 Migrant and Wintering Waterbird Monitoring Survey Instructions – Field Form

Purpose

Documenting survey design and methods maintains the scientific integrity of refuge biological programs and guards against information loss over time. The Survey Instructions field form was developed to assist refuges in recording important biological survey information and will enhance survey integrity by ensuring that survey procedures are clear and consistent. It will provide additional benefits, including: Serve as Initial Survey Instructions (ISI) (701 FW 2), and an initial step in development of formal NWRS survey protocols; Capture information valuable in development of Inventory and Monitoring Plans (IMP); Augment survey information in the Planning and Review of Inventory and Monitoring ([PRIMR](#)) database; Reveal multi-refuge and landscape-level data inference opportunities.

Using the Initial Survey Instructions Field Form

Staff should use this tool for all on-going surveys, particularly those high priority refuge-based surveys where protocols are not available, and followed by cooperative and/or coordinated surveys with important refuge-specific elements of implementation. The information provided in the ISI form should be as thorough and complete as possible; however it is acceptable to leave fields or sections empty if particular survey information is unknown. Provide completed forms to your I&M ecologist, who will archive it on [Fishnet](#) and link it to the survey record in PRIMR for long-term reference. Regional I&M staff ecologists can assist refuge staff with completing the Survey Instructions. If the Survey Instructions are updated over time, we recommend saving updates as versions (e.g., version 2.0).

Survey Name: Migrant and Wintering Waterbird Monitoring

This survey occurs on: ☒ Single refuge only ☐ Multiple refuges

Refuge Name(s): Coldwater River NWR

Background/Survey Justification:

Many refuges rely on traditional mid-winter waterfowl surveys and other periodic sampling to evaluate waterbird (e.g., ducks, geese, coots, and waders) use areas during migration and winter. These data provide information about the local scale utilization of wetlands by waterfowl and other waterbirds on a recurring biweekly basis. The migrant and wintering waterbird monitoring survey provides a measure for the North Mississippi National Wildlife Refuges CCP goal to promote the conservation and management of waterbirds within northern Mississippi in a manner that supports treaties and national and international plans (U.S. Fish and Wildlife Service 2005). Moreover, the survey is a foundation of biological information for informing local wetland management decisions to address HMP goals and objectives. In addition, data from this survey can be used at the refuge and landscape level to evaluate waterfowl conservation based on goals set by the LMVJV. This survey is coupled with the moist-soil/grain

production survey to provide an overall assessment of the refuge contribution toward migrating and wintering waterbird conservation. Waterfowl have been identified as a resource of concern for the refuge.

Section 1. Survey Targets & Objectives

Target Species/Taxa/Community:

Waterfowl, herons, grebes, coots, herons, egret, shorebirds

Target Habitat(s):

Moist-soil habitat and wetland units planted to cereal grain or other crops for migrating and wintering waterfowl. This could also include more upland fields planted to green crops for grazing by geese.

Survey Objective(s):

1. To estimate the number of waterbirds using each management unit that can be surveyed by a vehicle.
2. Document waterbird use in each unit on a biweekly basis in association with vegetation composition and water conditions throughout the migration and wintering period (i.e., September – March) to inform the refuge if management strategies are supporting actual waterfowl and waterbird usage.

Section 2. Survey Design

For Collaborative Surveys

☒ **This survey is part of a collaborative State, Regional, or National survey:**

Coordinating organization(s) and contact information:

Nationally the data may eventually be incorporated into the Integrated Waterbird Monitoring and Management Initiative

Is there an established protocol for the survey? ☒ Yes ☐ No ☐ In Prep (☐ Not Sure)

Protocol Name, citation and/or link to documentation:

Loges, B. W, B. G. Tavernia, A. M. Wilson, J. D. Stanton, J. H. Herner-Thogmartin, J. Casey, J. M. Coluccy, J. L. Coppen, P. J. Hanan M, Heglund, S. K. Jacobi, T. Jones, M. G. Knutson, K. E. Koch, E. V. Lonsdorf, H. P. Laskowski, S. K. Lor, J. E. Lyons, M. E. Seamans, W. Stanton, B. Winn, and L. C. Ziemba. 2014. National protocol framework for the inventory and monitoring of nonbreeding waterbirds and their habitats, an Integrated Waterbird Management and Monitoring Initiative (IWMM) approach. Natural Resources Program Center, Fort Collins, CO.

Are there refuge-specific elements of implementation? ☒ Yes ☐ No (☐ Not Sure)
(If yes, also specify refuge-specific details in the section below.)

For Surveys with Refuge-specific Details (Collaborative OR unique Refuge Surveys)

☒ This survey has refuge-specific design elements:

Year of survey origin: *(Add year of survey modification after origin if applicable.)*
2014

Are specific sampling units identified? ☒ Yes ☐ No (☐ Not Sure)

Type of sampling unit (sampling geometry):

☒ Route/linear transect ☒ Plot ☐ Point ☐ Other:

Sampling will be done along a route at defined locations to estimate waterbird use within individual wetland management units.

Do sampling units remain fixed (i.e., same location from year to year)?

☒ Yes ☐ No (☐ Not Sure)

Describe sampling design: *(e.g., study area of interest, how sampling units were selected or modified over time, if stratified sampling area, sample size, etc...)*

All wetland management units that can be visually inspected from a vehicle along a refuge or public road will be sampled. This will include units A – X. Fixed focal locations will be developed to insure consistent sampling.

Describe survey timing: *(Examples include # repeat visits each year, months, season, time of day, etc...)*

Annually, Biweekly, September – March. Begin no sooner than 7:00 am and finish by 12:00 pm. No heavy rain during survey period or excessive fog. No surveys on Wednesday (Public Waterfowl Hunt). If a management treatment of units has been done to favor mudflats in April - August, then sampling may also occur during that period.

Section 3. Survey Methods

Primary metrics collected:

- Number of ducks and other waterbirds by species in each wetland management unit.
- Water depth
- Management action since last sampling event.

How are sites marked? *(Examples include GPS waypoints, flagging, etc...)*

Not marked – sites for observation points will be identified on survey data sheet maps and names of individual management units.

Describe preparatory requirements for the survey: *(Examples include permits, training, contracts, other logistics, etc...)*

No permits are needed. Training on data submission to the Integrated Waterbird Management and Monitoring portal will be needed. Initial metadata about each management unit should be uploaded to the site to create unique site unit identifiers. Personnel conducting the survey will need to be trained on shorebird and waterfowl identification. Data entry may require a password.

Describe equipment used during the survey:

- Data sheets
- Binoculars and spotting scope
- 4-wheel drive vehicle
- Map of survey route/area
- Bird Field Guide

Describe detailed methodology (field and lab procedures)

Observer drives along a predefined route during the morning and stops at focal sampling locations to identify waterfowl, shorebirds and other waterbirds roosting and foraging within each unit. The observer, when possible, conducts all counts from within the vehicle to minimize disturbance to the birds and prevent them from leaving the unit. Estimates of birds by species are recorded for each unit. The habitat condition (water level) and type of vegetation will be recorded in the comments section. Counts are not conducted on the day of public waterfowl hunting (Wednesday).

Who conducts the survey: *(Include staff, interns, contractors, etc... if primary surveyors)*

Refuge Biologist, Refuge Manager

Section 4. Data Management

Specify data entry file format(s): *(Examples include MS Excel, MS Access, GIS, web dbs - e.g., SQL), etc..)*

Data are stored in an excel file at the refuge. Data in the future will also be stored in the Integrated Waterbird and Management (IWMM) – MS Access database application or On-line Database

Specify data storage/archive location (hardcopy and electronic): *(Provide file names and locations here if applicable)*

Data sheets retained for a period in the refuge file cabinets, scanned copies of the data sheets on Refuge Server. Primary data storage will be with the National IWMM database.

Describe procedure for verifying/checking/securing the data:

Data sheets will be quality checked after returning from the field to ensure the forms have been properly filled out. Scanned copies of vetted forms will be uploaded to the Refuge Server as security against loss.

Describe methods/software used in data analysis:

Excel is used to create a data summary of species identified, number of detections, based on survey date and management units. Use of IWMM Access database application will provide predefined summary reports. Regional and national data analysis will be done through the IWMM Program.

Section 5. Reporting

Describe reports developed from this survey:

(Include details on reporting schedule/frequency, distribution, archiving, etc... Include links and citations for previous reports if applicable.)

No detailed reports from the survey are being written specific to the data collected on the refuge. Summary information is included in the annual narrative for the N. Mississippi National Wildlife Refuges Complex. Data from the Refuge surveys may be utilized for regional scale analysis and reporting with the Integrated Waterbird Management and Monitoring Program in the future.

Section 6. Other Survey Information

Comment on additional survey elements and issues to consider when implementing the survey:

In the future, this survey may best be undertaken using Unmanned Aircraft Systems as a process to more accurately count waterbirds and reduce error associated with duplicate counting of birds which results from vehicle disturbance.

Description of attachments/supplemental documents/data sets:

(Use the space below to describe supplemental documents - e.g., maps, appendices, etc included with this form)

None

Cite resources: *(Cite the source of the information in the form below, including personal communication and citations for published and gray literature)*

Loges, B. W, B. G. Tavernia, A. M. Wilson, J. D. Stanton, J. H. Herner-Thogmartin, J. Casey, J. M. Coluccy, J. L. Coppen, P. J. Hanan M, Heglund, S. K. Jacobi, T. Jones, M. G. Knutson, K. E. Koch, E. V. Lonsdorf, H. P. Laskowski, S. K. Lor, J. E. Lyons, M. E. Seamans, W. Stanton, B. Winn, and L. C. Ziemba. 2014. National protocol framework for the inventory and monitoring of nonbreeding waterbirds and their habitats, an Integrated Waterbird Management and Monitoring Initiative (IWMM) approach. Natural Resources Program Center, Fort Collins, CO.

U.S. Fish and Wildlife Service. 2005. North Mississippi Wildlife Refuges Complex Comprehensive Conservation Plan. U.S. Fish and Wildlife Service, Southeast Region, Atlanta, GA. 231 pp.

Submitted by and contact information:

David Richardson, Terrestrial Ecologist, David_Richardson@fws.gov, 662 226-8286

Version Tracking *(You can use the table below to track updates to the Survey Instructions Record.)*

Version	Completed by	Date	Comments/material updated
1.0	David Richardson	11/6/2015	Original

Maps, Data Sheets and Appendices: *(You can insert maps and any appendices of information - e.g., progress tables, timelines, budgets, activity logs, etc..., directly into this document (Insert in Word document version or Attach to Adobe version)).*

No Attachments.



1.02 Mobile Acoustical Bat Monitoring Survey Instructions – Field Form

Purpose

Documenting survey design and methods maintains the scientific integrity of refuge biological programs and guards against information loss over time. The Survey Instructions field form was developed to assist refuges in recording important biological survey information and will enhance survey integrity by ensuring that survey procedures are clear and consistent. It will provide additional benefits, including: Serve as Initial Survey Instructions (ISI) (701 FW 2), and an initial step in development of formal NWRS survey protocols; Capture information valuable in development of Inventory and Monitoring Plans (IMP); Augment survey information in the Planning and Review of Inventory and Monitoring ([PRIMR](#)) database; Reveal multi-refuge and landscape-level data inference opportunities.

Using the Initial Survey Instructions Field Form

Staff should use this tool for all on-going surveys, particularly those high priority refuge-based surveys where protocols are not available, and followed by cooperative and/or coordinated surveys with important refuge-specific elements of implementation. The information provided in the ISI form should be as thorough and complete as possible; however it is acceptable to leave fields or sections empty if particular survey information is unknown. Provide completed forms to your I&M ecologist, who will archive it on [Fishnet](#) and link it to the survey record in PRIMR for long-term reference. Regional I&M staff ecologists can assist refuge staff with completing the Survey Instructions. If the Survey Instructions are updated over time, we recommend saving updates as versions (e.g., version 2.0).

Survey Name: Mobile Acoustical Bat Monitoring

This survey occurs on: ☒ Single refuge only ☐ Multiple refuges

Refuge Name(s): Coldwater River NWR

Background/Survey Justification:

This survey will measure the relative abundance of bats by using acoustical sampling techniques during early summer along predefined roadside routes primarily within the existing acquisition boundary. These data will be geo-referenced to provide information about habitat use for ecological assessments for landscape analysis. Mobile acoustical bat monitoring (MABM) is designed to evaluate long-term population trends of bats at a regional scale and provide a baseline inventory of species on the refuge. Multiple stressors including habitat fragmentation and degradation, white-nose-syndrome (WNS), and energy development (i.e., wind farms) are primary causes contributing to declines in bat species especially across the eastern United States. For many species, the decline is anticipated to accelerate as WNS expands west and south. Two species, Rafinesque's big-eared bat and the southeastern myotis, are identified as resources of concern on the refuge and highly reliant on bottomland hardwood ecosystems for roosting and foraging. Understanding population trends and habitat utilization at multiple scales supports efforts to conserve bats and inform the refuge about forest management. These data combined with other NWRS cooperating in this effort represent the only data available to evaluate population changes in foliage roosting bats.

Section 1. Survey Targets & Objectives

Target Species/Taxa/Community:

Bats

Target Habitat(s):

All habitats encountered along road-based survey. However, most of the survey area occurs off refuge through largely open agricultural fields and forest edges.

Survey Objective(s):

1. Provide a baseline inventory of bat species occurrence on NWRs.
2. Institute long-term monitoring of bat population trends at local and landscape scales using a standardized survey protocol.
3. Develop local and landscape-scale species- habitat associations based on bat occurrence along transects.
4. Integrate indices of species abundance and richness with other agencies and partners to support broad-scale Strategic Habitat Conservation Initiatives for bats.

Section 2. Survey Design

For Collaborative Surveys

☒ **This survey is part of a collaborative State, Regional, or National survey:**

Coordinating organization(s) and contact information:

Regional – coordinated by the Region 4, Branch of Inventory and Monitoring. Data may eventually be integrated in the North American Bat Monitoring Plan which is coordinated by USGS.

Is there an established protocol for the survey? ☒ Yes ☐ No ☐ In Prep (☐ Not Sure)

Protocol Name, citation and/or link to documentation:

Richardson D and USFWS. 2012. Mobile Bat Acoustical Survey Protocol, U.S. Fish and Wildlife Service, Region 4, Division of Refuges. Protocol-35782

<https://ecos.fws.gov/ServCat/Reference/Profile/35782>

Are there refuge-specific elements of implementation? ☒ Yes ☐ No (☐ Not Sure)
(If yes, also specify refuge-specific details in the section below.)

For Surveys with Refuge-Specific Details (Collaborative OR unique Refuge Surveys)

☒ This survey has refuge-specific design elements:

Year of survey origin: *(Add year of survey modification after origin if applicable.)*
2012

Are specific sampling units identified? ☒ Yes ☐ No (☐ Not Sure)

Type of sampling unit (sampling geometry):

☒ Route/linear transect ☒ Plot ☐ Point ☐ Other:

Sampling will be done along a discrete, fixed route. GPS points will provide spatial references for call collected along the route. Sampling is done continuously along the route.

Do sampling units remain fixed (i.e., same location from year to year)?

☒ Yes ☐ No (☐ Not Sure)

Describe sampling design: *(e.g., study area of interest, how sampling units were selected or modified over time, if stratified sampling area, sample size, etc...)*

The sampling route is a linear transect that was constructed along public roads that were anticipated to be drivable except for short periods of potential flooding. Route was selected to correspond with the Tallahatchie Breeding Bird Route which overlays with a portion of existing refuge boundary, and extends across portions of the acquisition boundary. The transect does not attempt to sample across habitat types in proportion to availability. The route is fixed and not subject to modification

Describe survey timing: *(Examples include # repeat visits each year, months, season, time of day, etc...)*

The survey is done during June 1 – July 15 with a target survey period of June 30 – July 14. Survey is conducted 2 times separated by a minimum of 4 days, but preferably a 7-14 day interval. Sampling begins 30 minutes after sunset and is completed within 2.5 hours.

Section 3. Survey Methods

Primary metrics collected:

- The primary metric of interest is bat detections per mile of transect, broke down by individual species if possible.
- The georeferenced location of the bat detection is also a primary metric of interest.

How are sites marked? *(Examples include GPS waypoints, flagging, etc...)*

Not marked – sampling is done continuously along the route. A map of the route with turn locations and distances between turns provides driving instructions to conduct the survey

Describe preparatory requirements for the survey: *(Examples include permits, training, contracts, other logistics, etc...)*

- Familiarity with setting up the acoustical detector and roof-mounted GPS unit.
- Need to have a map and driving directions for the route (It helps to drive the route in daylight if surveyor has never driven the route).
- Extra batteries need to be available for the detector.
- CF Card needs to be ERASED and in detector for data collection.
- Test the unit to make sure the microphone and power adaptor for the mouse GPS are both functional.
- Check weather for the evening to minimize chance of rain or excessive winds

Describe equipment used during the survey:

- Data sheet – attached as Appendix
- Vehicle – 2 wheel drive (4-wheel drive may be needed if recent rain event)
- AnaBat Detector with power cords and cables
- 4 spare AA batteries
- Roof mounted GPS unit with Green or Silver Microphone
- Erased-non-programmed CF Card

Describe detailed methodology (field and lab procedures)

Observer sets up GPS roof mount system with green or silver microphone pointing straight up. GPS is plugged into auxiliary power supply in vehicle via a USB/connector. Attach the serial cable of the GPS into the AnaBat Detector.

AnaBat detector is powered on at the beginning of the survey, 30 minutes after sunset. Observer drives the route at a speed of approximately 20 mph. At gates or other points along the route that require a stop of more than 30 seconds, the AnaBat detector is turned off until the vehicle can begin traveling the route.

At the completion of the route, the data sheet is completely filled out, detector is turned off. The CF Card containing the data is downloaded the following day using the CFREAD application. The survey datasheet and data files are uploaded to the mobile acoustical bat monitoring fishnet site (<https://fishnet.fws.doi.net/regions/4/nwrs/IM/bats/default.aspx>). A backup of the data is retained at the field station.

The second survey is conducted preferably 7 -14 days later and no sooner than 4 days.

Who conducts the survey: *(Include staff, interns, contractors, etc... if primary surveyors)*

Refuge Biologist, Refuge Manager, Intern

Section 4. Data Management

Specify data entry file format(s): *(Examples include MS Excel, MS Access, GIS, web dbs - e.g., SQL), etc..)*

Raw acoustical data are stored in a proprietary file format for the AnaBat Detector (SN.....dat). Individual bat calls are stored in a zero-crossing format. Data sheets are stored as a Microsoft Info Form. Processed datasheets and classified call data are imported into an MS Access database.

Specify data storage/archive location (hardcopy and electronic):
(Provide file names and locations here if applicable)

Raw survey data are kept on the refuge server. In addition, an archive copy of all survey data is kept on the I&M Fishnet site under the Mobile Acoustical Bat Monitoring page (<https://fishnet.fws.doi.net/regions/4/nwrs/IM/bats/default.aspx>). Data are organized with each refuge having its own folder for the empirical call data and a separate site for the survey metadata.

Describe procedure for verifying/checking/securing the data:

QA/QC is primarily done by the I&M branch during data processing. However, refuge staff should examine the Log.txt files after downloading the data from the CF Card to look for any error codes and insure that at least 200 call files were generated.

Describe methods/software used in data analysis:

Data are initially filtered using the CFRead application. Call analysis and classification is done using BCID version 2.7 or later. Other call auto-classification software may include EchoClass 3.0. A station level filter is used to only allow certain bat species to be considered in the classification process based on range and habitat delineation. After calls have been classified, they are geo-referenced using a custom R-script that links the GPS data collected concurrently with the calls. Geo-referenced calls are output into a point Shapefile.

Section 5. Reporting

Describe reports developed from this survey:

(Include details on reporting schedule/frequency, distribution, archiving, etc... Include links and citations for previous reports if applicable.)

Field station summary reports are annually developed by the I & M Branch. The reports are archived on the fishnet site (<https://fishnet.fws.doi.net/regions/4/nwrs/IM/bats/default.aspx>).and also uploaded to ServCat for the refuge.

Section 6. Other Survey Information

Comment on additional survey elements and issues to consider when implementing the survey:

It is important to conduct the survey during the same 2-3 week interval each year. Do not shift the survey sampling period.

Description of attachments/supplemental documents/data sets:

(Use the space below to describe supplemental documents - e.g., maps, appendices, etc included with this form)

Survey Meta Data Sheet, Map of Survey Route

Cite resources: *(Cite the source of the information in the form below, including personal communication and citations for published and gray literature)*

Richardson D and USFWS. 2012. Mobile Bat Acoustical Survey Protocol, U.S. Fish and Wildlife Service, Region 4, Division of Refuges. Protocol-35782
<https://ecos.fws.gov/ServCat/Reference/Profile/35782>.

U.S. Fish and Wildlife Service. 2005. North Mississippi Wildlife Refuges Complex Comprehensive Conservation Plan. U.S. Fish and Wildlife Service, Southeast Region, Atlanta, GA. 231 pp.

Submitted by and contact information:

David Richardson, Terrestrial Ecologist, David_Richardson@fws.gov, 662 226-8286

Version Tracking *(You can use the table below to track updates to the Survey Instructions Record.)*

Version	Completed by	Date	Comments/material updated
1.0	David Richardson	11/6/2015	Original

Maps, Data Sheets and Appendices: *(You can insert maps and any appendices of information - e.g., progress tables, timelines, budgets, activity logs, etc..., directly into this document (Insert in Word document version or Attach to Adobe version)).*



Figure – Map of the mobile acoustical bat monitoring route on Coldwater River NWR.

Acoustical Bat Monitoring Survey Data Sheet, Region 4, Refuges

Surveyor Name(s): _____

Contact Number: _____

Survey Route Name (e.g., Carolina Sandhills NWR): _____

State _____ County(s) _____

Date of Survey: _____

Serial Number of AnaBat Detector: _____

GPS Data Collected: Yes No

Survey Route Completed: Yes No

Weather and Time Data

	Time	Temp (F)	Wind (mph)	Moon Visible?	% Cloud Cover	Moon Phase (New, ¼, ½, ¾, Full)
Start						
End						

Comments: (e.g., High insect noise, traffic, problems with AnaBat Detector, GPS Unit, Road hazards, major change in weather pattern – front moved through, recent rains, cold snap, etc.).



1.03 Hardwood Reforestation Evaluation Survey Instructions – Field Form

Purpose

Documenting survey design and methods maintains the scientific integrity of refuge biological programs and guards against information loss over time. The Survey Instructions field form was developed to assist refuges in recording important biological survey information and will enhance survey integrity by ensuring that survey procedures are clear and consistent. It will provide additional benefits, including: Serve as Initial Survey Instructions (ISI) (701 FW 2), and an initial step in development of formal NWRS survey protocols; Capture information valuable in development of Inventory and Monitoring Plans (IMP); Augment survey information in the Planning and Review of Inventory and Monitoring ([PRIMR](#)) database; Reveal multi-refuge and landscape-level data inference opportunities.

Using the Initial Survey Instructions Field Form

Staff should use this tool for all on-going surveys, particularly those high priority refuge-based surveys where protocols are not available, and followed by cooperative and/or coordinated surveys with important refuge-specific elements of implementation. The information provided in the ISI form should be as thorough and complete as possible; however it is acceptable to leave fields or sections empty if particular survey information is unknown. Provide completed forms to your I&M ecologist, who will archive it on [Fishnet](#) and link it to the survey record in PRIMR for long-term reference. Regional I&M staff ecologists can assist refuge staff with completing the Survey Instructions. If the Survey Instructions are updated over time, we recommend saving updates as versions (e.g., version 2.0).

Survey Name: Hardwood Reforestation Evaluation

This survey occurs on: ☒ Single refuge only ☐ Multiple refuges

Refuge Name(s): Coldwater River NWR

Background/Survey Justification:

This survey examines hardwood survivorship and species composition within former agricultural fields on the Coldwater NWR. Almost 1700 acres were planted in the 1990's. In general these sites were examined 2-3 years after initial planting and will be inventoried 10-20 years later when they develop into saplings. Most of these former agricultural fields have been reforested by a standard practice of planting 2-year old hardwood seedlings in winter. A few sites may have been established through natural regeneration and direct acorn planting. This survey was selected because evaluation of seedling survivorship is critical to addressing the long-term species composition towards final serial stage stand development and evaluating future forest management strategies. The reforestation tracts represent important future areas to support many high priority species of neotropical migrant birds which have been identified as resources of concern for the refuge. Bottomland hardwoods are considered a resource of concern.

Section 1. Survey Targets & Objectives

Target Species/Taxa/Community:

Hardwood regeneration tracts (natural and planted).

Target Habitat(s):

Hardwood forest systems.

Survey Objective(s):

1. To estimate the stem density of hardwood regeneration on a unit by unit basis.
2. Determine the species composition of hardwood seedlings and saplings.
3. Utilize the data to determine future management strategies to promote a diverse overstory tree composition to support neotropical migratory birds and other wildlife.

Section 2. Survey Design

For Collaborative Surveys

☐ This survey is part of a collaborative State, Regional, or National survey:

Coordinating organization(s) and contact information:

Is there an established protocol for the survey? ☐ Yes ☐ No ☐ In Prep (☐ Not Sure)

Protocol Name, citation and/or link to documentation:

Are there refuge-specific elements of implementation? ☐ Yes ☐ No (☐ Not Sure)
(If yes, also specify refuge-specific details in the section below.)

For Surveys with Refuge-Specific Details (Collaborative OR unique Refuge Surveys)

☒ This survey has refuge-specific design elements:

Year of survey origin: *(Add year of survey modification after origin if applicable.)*

TBD, previous sampling was done in the late 1990s or early 2000. Data may not be available for comparison.

Are specific sampling units identified? ☒ Yes ☐ No (☐ Not Sure)

Type of sampling unit (sampling geometry):

☐ Route/linear transect ☒ Plot ☐ Point ☐ Other:

Sampling will be allotted with systematic plots in each unique regeneration tract.

Do sampling units remain fixed (i.e., same location from year to year)?

☒ Yes ☐ No (☐ Not Sure)

Describe sampling design: *(e.g., study area of interest, how sampling units were selected or modified over time, if stratified sampling area, sample size, etc...)*

All natural or planted hardwood reforestation units will be sampled. Stand boundaries from shapefiles in the Refuge's GIS system will be used to delineate systematic plot locations using ArcMap extensions for sampling.

Sampling will be done using 1/100 acre (6.8 foot radius) circular plots. Metrics to collect will include species composition, stem survivorship, basal area (6 inch or larger DBH), and qualitative measurement of cane present in the plot. Survey effort will be approximately 1 plot per 2 acre spaced uniformly across the entire tract. If possible, areas of each tract may be stratified based anticipated breaks in species composition associated with wetland gradients. Pilot sampling will be used to refine sampling effort.

If possible, data will be directly input into either Two-Dog or TCruise software on a hand-held data logger. Data management will consist of producing summary means and confidence intervals for collected metrics. Attribute data will be joined with habitat shapefiles in the refuge's GIS system.

Describe survey timing: *(Examples include # repeat visits each year, months, season, time of day, etc...)*

Survey will be done during the growing season after full leaf out or before leaf drop in fall. This will facilitate species identification of oaks. Each unit will be sampled once during the first 3 years post planting and again between 15-25 years of age.

Section 3. Survey Methods

Primary metrics collected:

- Species of hardwood
- Diameter – if over 6 inches
- Stem density/acre
- Qualitative measure of giant cane
- Comment on any invasive plants.

How are sites marked? *(Examples include GPS waypoints, flagging, etc...)*

Not Marked. However, GPS coordinates will be obtained for the center of each sample plot location.

Describe preparatory requirements for the survey: *(Examples include permits, training, contracts, other logistics, etc...)*

Individuals will need to be competent with identification of hardwoods using leaf characteristic. Use of a field data logger running Two-dog or T-cruise software will require some training and initial integration of sampling tract locations

Describe equipment used during the survey:

- Data sheets
- GPS
- Data logger
- Map of survey route/area
- Tree Field Guide
- Extra batteries
- DBH tape

Describe detailed methodology (field and lab procedures)

Observer walks to each sampling plot based on the waypoint coordinates in a GPS unit or information uploaded into a data logger through the Solo Forester program. At each plot center, the number of stems by species and 2-inch diameter class (2) (4) (6)... will be tallied. A qualitative index of giant cane abundance will also be recorded along with any notable issues of invasive plants.

Who conducts the survey: *(Include staff, interns, contractors, etc... if primary surveyors)*

Refuge Biologist, Refuge Manager, Forester

Section 4. Data Management

Specify data entry file format(s): *(Examples include MS Excel, MS Access, GIS, web dbs - e.g., SQL), etc...)*

Data will be stored in t-cruise or two-dog file formats if initially recorded using a data logger in the field. Alternatively, data collected on tally sheets will be transcribed and stored as excel files or in Microsoft Access

Specify data storage/archive location (hardcopy and electronic): *(Provide file names and locations here if applicable)*

Data sheets retained for a period in the refuge file cabinets, scanned copies of the data sheets on Refuge Server. Primary digital data storage will be Excel or Access Database files. Upon completion of the project and development of a final report, the data will be appended as part of the report and uploaded to ServCat.

Describe procedure for verifying/checking/securing the data:

Data sheets will be quality checked after returning from the field to ensure the forms have been properly filled out. Scanned copies of vetted forms will be uploaded to the Refuge Server as security against loss. Data entry into excel or MS Access database will utilize drop-down menus with predefined parameters to prevent data entry errors.

Describe methods/software used in data analysis:

Descriptive statistics for each forest tract or uniquely identifiable forest stand will be generated from T-cruise, Two-dog, or developed directly from Excel or MS Access.

Section 5. Reporting

Describe reports developed from this survey:

(Include details on reporting schedule/frequency, distribution, archiving, etc... Include links and citations for previous reports if applicable.)

No detailed reports of any previous monitoring of hardwood regeneration on Coldwater River NWR have been developed. Upon completion of data collection and summary results, a final report of the findings and recommendations for management strategies will be written. This report will be stored with the empirical data in ServCat

Section 6. Other Survey Information

Comment on additional survey elements and issues to consider when implementing the survey:

Survey data sheet needs to be developed.

Description of attachments/supplemental documents/data sets:

(Use the space below to describe supplemental documents - e.g., maps, appendices, etc included with this form)

None

Cite resources: *(Cite the source of the information in the form below, including personal communication and citations for published and gray literature)*

None

Submitted by and contact information:

David Richardson, Terrestrial Ecologist, David_Richardson@fws.gov, 662 226-8286

Version Tracking *(You can use the table below to track updates to the Survey Instructions Record.)*

Version	Completed by	Date	Comments/material updated
1.0	David Richardson	11/6/2015	Original

Maps, Data Sheets and Appendices: *(You can insert maps and any appendices of information - e.g., progress tables, timelines, budgets, activity logs, etc..., directly into this document (Insert in Word document version or Attach to Adobe version)).*

No Attachments.



1.04 Moist-Soil/Grain Production Survey Instructions – Field Form

Purpose

Documenting survey design and methods maintains the scientific integrity of refuge biological programs and guards against information loss over time. The Survey Instructions field form was developed to assist refuges in recording important biological survey information and will enhance survey integrity by ensuring that survey procedures are clear and consistent. It will provide additional benefits, including: Serve as Initial Survey Instructions (ISI) (701 FW 2), and an initial step in development of formal NWRS survey protocols; Capture information valuable in development of Inventory and Monitoring Plans (IMP); Augment survey information in the Planning and Review of Inventory and Monitoring ([PRIMR](#)) database; Reveal multi-refuge and landscape-level data inference opportunities.

Using the Initial Survey Instructions Field Form

Staff should use this tool for all on-going surveys, particularly those high priority refuge-based surveys where protocols are not available, and followed by cooperative and/or coordinated surveys with important refuge-specific elements of implementation. The information provided in the ISI form should be as thorough and complete as possible; however it is acceptable to leave fields or sections empty if particular survey information is unknown. Provide completed forms to your I&M ecologist, who will archive it on [Fishnet](#) and link it to the survey record in PRIMR for long-term reference. Regional I&M staff ecologists can assist refuge staff with completing the Survey Instructions. If the Survey Instructions are updated over time, we recommend saving updates as versions (e.g., version 2.0).

Survey Name: Moist Soil/Grain Production

This survey occurs on: ☒ Single refuge only ☐ Multiple refuges

Refuge Name(s): Coldwater River NWR

Background/Survey Justification:

This survey monitors the annual floristic composition within individual wetland management units on the refuge and provides a qualitative and/or quantitative estimate of the duck carrying capacity (i.e., duck-energy days/acre). Moist-soil plants and supplemental plantings of cereal grains provides important energy sources for migrant and wintering waterfowl which have been identified as resources of concern on the refuge. Coldwater River NWR manages wetland units to support the goals of the North American Waterfowl Management Plan and contribute to foraging habitat objectives as outlined by the LMVJV. This survey is coupled with the migrant and wintering waterbird survey to provide an overall assessment of the refuge contribution toward migrant and wintering waterbird conservation. Survey data will inform management about the need to conduct treatments to influence desirable annual plant composition and considerations for cereal grain production to meet local and regional conservation initiatives for waterfowl.

Section 1. Survey Targets & Objectives

Target Species/Taxa/Community:

Plants

Target Habitat(s):

Moist-soil habitat and wetland units planted to cereal grain or other crops for migrating and wintering waterfowl. This could also include more upland fields planted to green crops for grazing by geese.

Survey Objective(s):

1. To provide an estimate of the percent cover of desirable plants.
2. Determine a qualitative estimate (fair, good, excellent) of moist-soil plant composition and derive a corresponding categorical measure of seed abundance (400, 600, 800)
3. Determine an estimate of cereal grain production and derive a corresponding measurement of duck-energy-days/acre for each management unit.

Section 2. Survey Design

For Collaborative Surveys

☐ **This survey is part of a collaborative State, Regional, or National survey:**

Coordinating organization(s) and contact information:

Is there an established protocol for the survey? ☐ Yes ☐ No ☐ In Prep (☐ Not Sure)

Protocol Name, citation and/or link to documentation:

Are there refuge-specific elements of implementation? ☐ Yes ☐ No (☐ Not Sure)
(If yes, also specify refuge-specific details in the section below.)

For Surveys with Refuge-Specific Details (Collaborative OR unique Refuge Surveys)

☒ **This survey has refuge-specific design elements:**

Year of survey origin: *(Add year of survey modification after origin if applicable.)*
2005

Are specific sampling units identified? ☒ Yes ☐ No (☐ Not Sure)

Type of sampling unit (sampling geometry):

☐ Route/linear transect ☒ Plot ☐ Point ☐ Other:

Sampling will be done in impoundments which have water management capabilities.

Do sampling units remain fixed (i.e., same location from year to year)?

☒ Yes ☐ No (☐ Not Sure)

Describe sampling design: *(e.g., study area of interest, how sampling units were selected or modified over time, if stratified sampling area, sample size, etc...)*

Systematic sampling of each unit will be done by establishing plots along transects at a rate of 1 plot per acre. Sampling will be done using 1 meter/squared plots. Metric to collect will include species composition (percent cover) and relative abundance of seeds produced. Survey effort will be approximately 1 plot per acre spaced uniformly across the entire unit. For cereal grain production, seed heads will be counted in each plot and a sample head will be collected from each plot. Average seed weight will be derived and used as a factor to estimate actual seed production. Alternatively, if the unit is being cooperatively farmed, the production yield of the harvested portion based on delivered weight of the grain to the mill can be used to estimate the left portion in the field.

Describe survey timing: *(Examples include # repeat visits each year, months, season, time of day, etc...)*

Annually in September – October

Section 3. Survey Methods

Primary metrics collected:

- Plant Species
- Percent Composition and Stem Density
- Cereal grain production
- Management Treatment in Unit

How are sites marked? *(Examples include GPS waypoints, flagging, etc...)*

Not marked – sample plots will be obtained from sampling grid in ArcMap and coordinates uploaded into a GPS or data logger.

Describe preparatory requirements for the survey: *(Examples include permits, training, contracts, other logistics, etc...)*

No permits are needed. Observer should be familiar with identification of moist-soil plants.

Describe equipment used during the survey:

- Data sheets
- GPS
- 1-meter sampling frame
- Reference moist-soil plant book
- Plastic bags
- Camera

Describe detailed methodology (field and lab procedures)

Sampling will be done using 1 meter/squared plots. Metric to collect will include species composition (percent cover) and relative abundance of seeds produced. Survey effort will be approximately 1 plot per acre spaced uniformly across the entire unit. For cereal grain production, seed heads will be counted in each plot and a sample head will be collected from each plot. Average seed weight will be derived and used as a factor to estimate actual seed production. Alternatively, if the unit is being cooperatively farmed, the production yield of the harvested portion based on delivered weight of the grain to the mill can be used to estimate the left portion in the field. Alternatively, data collection may follow Loges et al. 2014.

Who conducts the survey: *(Include staff, interns, contractors, etc... if primary surveyors)*

Refuge Biologist, Refuge Manager

Section 4. Data Management

Specify data entry file format(s): *(Examples include MS Excel, MS Access, GIS, web dbs - e.g., SQL), etc...)*

Data are stored in an excel file at the refuge

Specify data storage/archive location (hardcopy and electronic): *(Provide file names and locations here if applicable)*

Data sheets retained for a period in the refuge file cabinets, scanned copies of the data sheets on Refuge Server.

Describe procedure for verifying/checking/securing the data:

Data sheets will be quality checked after returning from the field to ensure the forms have been properly filled out. Scanned copies of vetted forms will be uploaded to the Refuge Server as security against loss.

Describe methods/software used in data analysis:

Excel is used to create a data summary of plant species identified and producing summary means and confidence intervals for collected metrics. In addition, a more qualitative estimation of production will be assessed and provided to the USGS- LMVJV Impounded Wetlands Management & Monitoring Application (http://lmvjv.cr.usgs.gov/moist_soils/default.aspx)

Section 5. Reporting

Describe reports developed from this survey:

(Include details on reporting schedule/frequency, distribution, archiving, etc... Include links and citations for previous reports if applicable.)

Summary information is included in the annual narrative for the N. Mississippi National Wildlife Refuges Complex. Data from the Refuge surveys may be utilized for regional scale analysis within the Lower Mississippi Valley Joint Venture.

Section 6. Other Survey Information

Comment on additional survey elements and issues to consider when implementing the survey:

None

Description of attachments/supplemental documents/data sets:

(Use the space below to describe supplemental documents - e.g., maps, appendices, etc included with this form)

None

Cite resources: *(Cite the source of the information in the form below, including personal communication and citations for published and gray literature)*

Loges, B. W, B. G. Tavernia, A. M. Wilson, J. D. Stanton, J. H. Herner-Thogmartin, J. Casey, J. M. Coluccy, J. L. Coppen, P. J. Hanan M, Heglund, S. K. Jacobi, T. Jones, M. G. Knutson, K. E. Koch, E. V. Lonsdorf, H. P. Laskowski, S. K. Lor, J. E. Lyons, M. E. Seamans, W. Stanton, B. Winn, and L. C. Ziemba. 2014. National protocol framework for the inventory and monitoring of nonbreeding waterbirds and their habitats, an Integrated Waterbird Management and Monitoring Initiative (IWMM) approach. Natural Resources Program Center, Fort Collins, CO.

Submitted by and contact information:

David Richardson, Terrestrial Ecologist, David_Richardson@fws.gov, 662 226-8286

Version Tracking *(You can use the table below to track updates to the Survey Instructions Record.)*

Version	Completed by	Date	Comments/material updated
1.0	David Richardson	11/6/2015	Original

Maps, Data Sheets and Appendices: *(You can insert maps and any appendices of information - e.g., progress tables, timelines, budgets, activity logs, etc..., directly into this document (Insert in Word document version or Attach to Adobe version)).*

No Attachments.



1.05 Breeding Bird Survey Survey Instructions – Field Form

Purpose

Documenting survey design and methods maintains the scientific integrity of refuge biological programs and guards against information loss over time. The Survey Instructions field form was developed to assist refuges in recording important biological survey information and will enhance survey integrity by ensuring that survey procedures are clear and consistent. It will provide additional benefits, including: Serve as Initial Survey Instructions (ISI) (701 FW 2), and an initial step in development of formal NWRS survey protocols; Capture information valuable in development of Inventory and Monitoring Plans (IMP); Augment survey information in the Planning and Review of Inventory and Monitoring ([PRIMR](#)) database; Reveal multi-refuge and landscape-level data inference opportunities.

Using the Initial Survey Instructions Field Form

Staff should use this tool for all on-going surveys, particularly those high priority refuge-based surveys where protocols are not available, and followed by cooperative and/or coordinated surveys with important refuge-specific elements of implementation. The information provided in the ISI form should be as thorough and complete as possible; however it is acceptable to leave fields or sections empty if particular survey information is unknown. Provide completed forms to your I&M ecologist, who will archive it on [Fishnet](#) and link it to the survey record in PRIMR for long-term reference. Regional I&M staff ecologists can assist refuge staff with completing the Survey Instructions. If the Survey Instructions are updated over time, we recommend saving updates as versions (e.g., version 2.0).

Survey Name: Breeding Bird Survey

This survey occurs on: ☒ Single refuge only ☐ Multiple refuges

Refuge Name(s): Coldwater River NWR

Background/Survey Justification:

This survey assesses distribution and relative abundance of breeding birds for regional and national assessments with the refuge serving as a sampling location. Birds are a national trust resource for the U. S. Fish and Wildlife Service and represent the foundation for establishing most National Wildlife Refuges. The North American breeding bird survey monitors bird populations across North America and informs researchers and wildlife managers of significant changes in bird population levels so that if declining species are identified, causes can be examined and corrective actions taken to reverse the trend (Sauer et al. 2013). Though the survey examines trends at regional scales, the data can also be used to establish local breeding bird baseline inventories based on roadside vegetative communities. Forest interior birds are considered a resource of concern for the refuge and this survey provides information about their distribution and relative abundance.

Section 1. Survey Targets & Objectives

Target Species/Taxa/Community:

Resident, temperate migrant and neotropical migrant birds

Target Habitat(s):

All habitats along a pre-established roadside route are sampled. However, no specific habitat is being surveyed.

Survey Objective(s):

1. To determine the status and trends of North American bird populations at various scales.
2. Determine local bird species inventory.

Section 2. Survey Design

For Collaborative Surveys

☒ **This survey is part of a collaborative State, Regional, or National survey:**

Coordinating organization(s) and contact information:

U.S. Geological Survey – North American Breeding Bird

Is there an established protocol for the survey? ☒ Yes ☐ No ☐ In Prep (☐ Not Sure)

Protocol Name, citation and/or link to documentation:

Protocol for this survey is provided at: <https://www.pwrc.usgs.gov/bbs/participate/instructions.html>

Are there refuge-specific elements of implementation? ☒ Yes ☐ No (☐ Not Sure)
(If yes, also specify refuge-specific details in the section below.)

For Surveys with Refuge-Specific Details (Collaborative OR unique Refuge Surveys)

☒ **This survey has refuge-specific design elements:**

Year of survey origin: *(Add year of survey modification after origin if applicable.)*
2009

Are specific sampling units identified? ☒ Yes ☐ No (☐ Not Sure)

Type of sampling unit (sampling geometry):

☒ Route/linear transect ☒ Plot ☐ Point ☐ Other:

Fixed route is conducted with sampling points located every ½ mile. Birds identified by sight or sound are recorded around the point (1/4 mile out).

Do sampling units remain fixed (i.e., same location from year to year)?

☒ Yes ☐ No (☐ Not Sure)

Describe sampling design: *(e.g., study area of interest, how sampling units were selected or modified over time, if stratified sampling area, sample size, etc...)*

Routes were created based on an initial starting point and subsequent delineation of sampling points every ½ mile. Sampling was emphasized to pass through as much of the refuge as possible and then moving out to areas identified as part of a proposed expansion to the acquisition boundary.

Describe survey timing: *(Examples include # repeat visits each year, months, season, time of day, etc...)*

Annually, May 15 – June 30, 1 time every year, conducted in the morning to end before 12:00 pm

Section 3. Survey Methods

Primary metrics collected:

- Number of individual birds by species detected at each sampling point.

How are sites marked? *(Examples include GPS waypoints, flagging, etc...)*

Not marked – GPS waypoints, and visual roadside reference points are used to located sample plots.

Describe preparatory requirements for the survey: *(Examples include permits, training, contracts, other logistics, etc...)*

No permits are needed. However, proficiency with call identification should be done using training tapes prior to conducting surveys. Data entry to the USGS web portal may require a password.

Describe equipment used during the survey:

- Data sheets
- Binoculars and spotting scope
- Access to Bird calls for verification if needed.

- Map of survey route/area
- Stop watch
- Bird Field Guide

Describe detailed methodology (field and lab procedures)

Detailed instructions for the methods and survey sheets are attached as an appendix and also available at: <https://www.pwrc.usgs.gov/bbs/participate/instructions.html>. Survey starts ½ hour before sunrise. Observer drives along a predefined route during the morning and stops at predefined locations for 3 minutes; all birds seen or heard within ¼ mile of sampling point are recorded. Survey route is done the same way each year starting at the same point. See map attached.

Who conducts the survey: *(Include staff, interns, contractors, etc... if primary surveyors)*

Refuge Biologist, Refuge Manager, Volunteer

Section 4. Data Management

Specify data entry file format(s): *(Examples include MS Excel, MS Access, GIS, web dbs - e.g., SQL), etc...)*

Data are stored in an excel file at the refuge and entered online with the North American Breeding Bird Survey (<https://www.pwrc.usgs.gov/bbs/dataentry/>)

Specify data storage/archive location (hardcopy and electronic): *(Provide file names and locations here if applicable)*

Data sheets retained for a period in the refuge file cabinets, scanned copies of the data sheets on Refuge Server. Primary data storage is with the USGS – North American Bird Survey – web-platform <https://www.pwrc.usgs.gov/bbs/dataentry/>

Describe procedure for verifying/checking/securing the data:

Data sheets will be quality checked after returning from the field to ensure the forms have been properly filled out. Scanned copies of vetted forms will be uploaded to the Refuge Server as security against loss. USGS -BBS office reviews data before accepting the information.

Describe methods/software used in data analysis:

Excel is used to create a data summary of species identified and number of detections along the individual survey route. No other analysis is done by the refuge. More sophisticated analyses are periodically done by USGS Scientists.

Section 5. Reporting

Describe reports developed from this survey:

(Include details on reporting schedule/frequency, distribution, archiving, etc... Include links and citations for previous reports if applicable.)

No detailed reports from the survey are being written specific to the data collected on the refuge. Summary information is included in the annual narrative for the N. Mississippi National Wildlife Refuges Complex.

Data from the Refuge surveys may be utilized for regional scale analysis and reporting with the USGS – North American Breeding Bird Survey.

Section 6. Other Survey Information

Comment on additional survey elements and issues to consider when implementing the survey:

None

Description of attachments/supplemental documents/data sets:

(Use the space below to describe supplemental documents - e.g., maps, appendices, etc included with this form)

Attached is a map and directions for sampling locations for the Breeding Bird Survey Route (Identified as the Tallahatchie Breeding Bird Route by USGS) conducted at Coldwater River NWR and vicinity. Also attached are the detailed survey instructions and forms provided by USGS.

Cite resources: *(Cite the source of the information in the form below, including personal communication and citations for published and gray literature)*

Sauer, J. R, W. A. Link, J. E. Fallon, K. L. Pardieck, and D. J. Ziolkowsk, Jr. 2013. The North American breeding bird survey 1966-2011: summary analysis and species accounts. North American Fauna. 79:1–32.

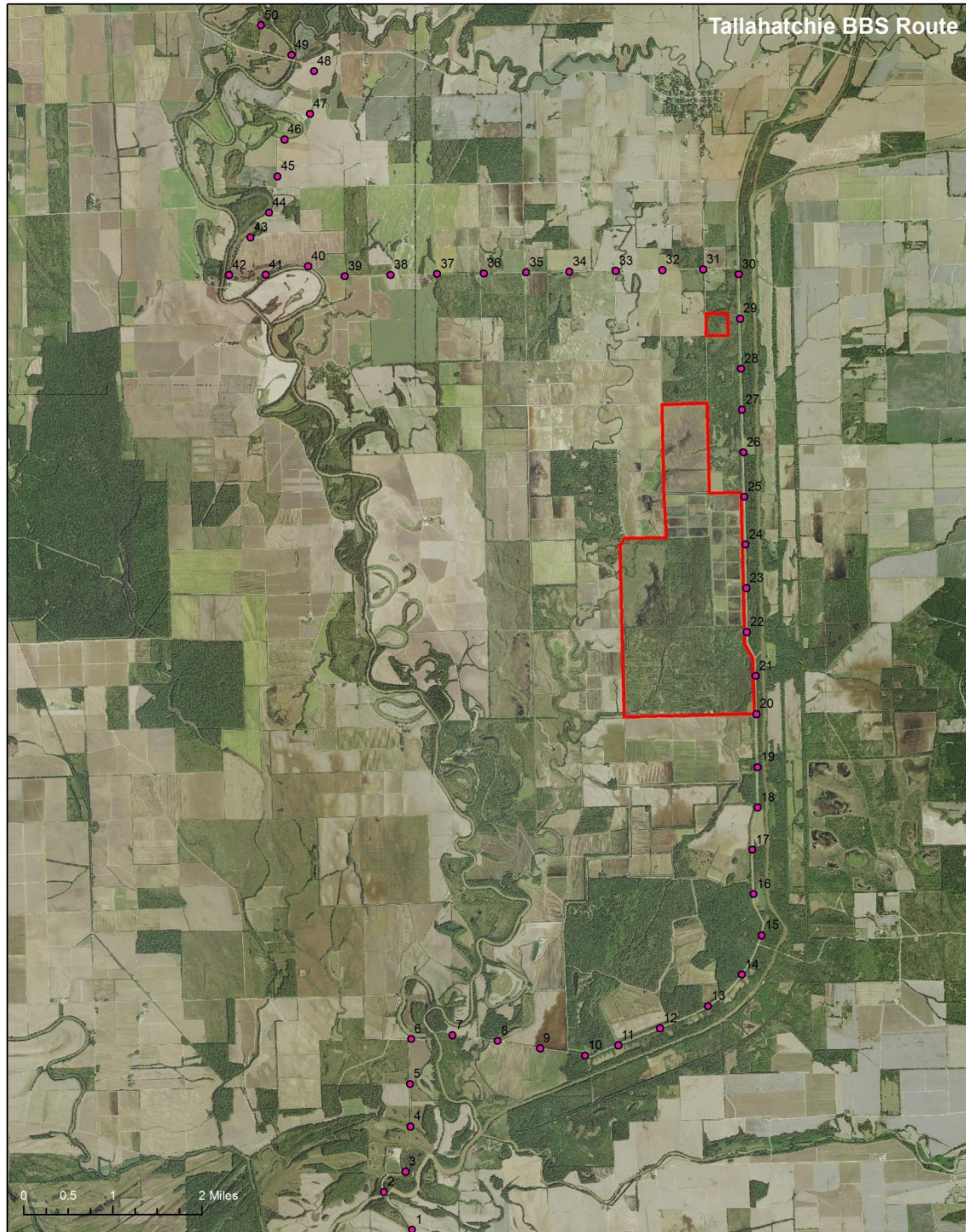
Submitted by and contact information:

David Richardson, Terrestrial Ecologist, David_Richardson@fws.gov, 662 226-8286

Version Tracking *(You can use the table below to track updates to the Survey Instructions Record.)*

Version	Completed by	Date	Comments/material updated
1.0	David Richardson	11/6/2015	Original

Maps, Data Sheets and Appendices: (You can insert maps and any appendices of information - e.g., progress tables, timelines, budgets, activity logs, etc..., directly into this document (Insert in Word document version or Attach to Adobe version)).



BBS STOP DESCRIPTIONS

Tallahatchie Route, Mississippi - 51905

Date collected: 02 June 2009

Printed Date: 30 May 2014

Directions to Start: On Sheley Road, 0.4 miles north of jet of Sheley Road and Hwy 32.

Stop	Description
01	Sheley Road, 0.4 miles north of jet Sheley Road and MS Hwy 32. At tree line (on left).
02	North side of bridge crossing the Tallahatchie River.
03	Willow grove on left ends, road curves to the left.
0.9	
04	Bridge over small bayou.
1.5	
05	Where big ditch comes in on right.
1.9	
06	Turn right onto Levee Road. Between two telephone poles on right, just after turning on to Levee Road.
2.4	
07	In between two telephone poles in farm field on right. Mail box near light poles 0.1 miles ahead.
2.9	
08	Well in farm field on right (south) side of road, just before Barefoot Road.
3.4	
09	Willows on both sides of road in ditch.
3.9	
10	Just before box culvert and "Little Tallahatchie River, ACOE levee" sign.
4.4	
11	180' before ACOE white marker 1280, at gated road to left
4.9	
12	Just before ACOE marker 1240. Dead snag and oak tree on left.
5.4	
13	Midway between ACOE markers 1220 and 1210, large willow oak on left.
5.9	
14	Refuge sign just off east side of levee, just after ACOE white marker 1190.
6.5	
15	Between Paducah Wells Road and ACOE white marker 1160. - at gate
6.9	
16	Large borrow pit on right between ACOE markers 1140 and 1130.
7.4	
17	ACOE white marker 1110 on left
7.9	
18	End of borrow pit on right, turn road just ahead on right, gated road on left.
8.4	
19	Ash trees growing together on left, just past York Woods gate at ACOE marker 1060.
8.9	
20	South boundary levee of Coldwater River NWR.
9.5	
21	300 feet before ACOE white marker 1000.
9.9	
22	10.5 First fence post past ACOE marker 980 at refuge boundary sign.
10.4	
23	11.0 180 feet before ACOE marker 950.
10.9	
24	11.5 Large willow on right, just past ACOE marker 930 at refuge sign.
11.4	
25	12.0 ACOE white marker 900 on left side of levee.
11.9	
26	12.5 South edge of borrow pit on right just before ACOE white marker 870.
12.4	
27	13.0 Just past ACOE marker 850, just before transmission lines cross road.
12.9	

13.4	28	Just before ACOE marker 820. Locust trees on left.
13.9	29	Refuge sign on left, just before ACOE marker 790.
14.4	30	ACOE marker 770 on left side of levee.
14.9	31	Turn left and head west on Terry Road. Cross into Quinman County. At turn row into Savage FmHA property on right (north) just after crossing county line.
15.3	32	Just past telephone pole 129909, just before road intersection.
15.8	33	Past 2 black mail boxes. Driveway on left. Fifteen feet before stop sign.
16.4	34	Two cut off telephone posts on left, ditch goes under road. New building with beige siding and green roof on right. - big gone - just concrete pad
16.8	35	Thirty feet from road intersection, church on right. In line with church wheel chair ramp and bell.
17.3	36	Aspen ditch on left side of road. Just before dirt road on left. <i>Ditch runs along right side of road just before turn (on ditch bank)</i>
17.8	37	Directly over big ditch lined with willows. House number 3025, horse pasture on left.
18.4	38	Before old brown-bricked, wallpapered building on right. Past telephone pole with guide wire going off to the north.
18.9	39	In line with trees sticking out in agricultural field on left. <i>over ditch running under road</i>
19.3	40	Turn right and follow the bayou. Poison ivy covered walnut tree on right.
19.9	41	Pecan grove on left. Metal fence post painted red on top.
20.3	42	Turn right. Old cow pasture on both sides of road. <i>ag field on right</i>
20.8	43	Telephone post 129865 with guide wire on right. Open meadow and wetland on left.
21.3	44	Abandoned house on right, bayou comes close to road on left. Cedar tree painted red on right side of road.
21.8	45	Turn left on gravel road heading north. Approximately 0.15 miles after turning. Farm fields on both sides of road.
22.3	46	Large sycamore tree on left, wood fence post with two wooden supports on left.
22.8	47	Just past turn row north of Emu farm, southern most telephone pole in field to left.
23.3	48	One tenth of a mile south of stop sign for route 322.
23.8	49	Turn left on 322, turn right onto first road after crossing bridge. First telephone pole on left.
24.5	50	Large vine covered snag on right. Yellow-green house on left.

Instructions for Conducting the North American Breeding Bird Survey

USGS Patuxent Wildlife
Research Center
12100 Beech Forest Road
Laurel, Maryland, U.S.A. 20708-4038

Canadian Wildlife Service
(CWS)
National Wildlife Research
Centre
100 Gamelin Blvd.
Hull, Quebec, Canada K1A 0H3

STRICT ADHERENCE TO THE RULES IS ESSENTIAL FOR PROPER ANALYSIS OF RESULTS

IF UNABLE TO CONDUCT SURVEY, CONTACT STATE COORDINATOR IMMEDIATELY

PLEASE READ ALL INSTRUCTIONS PRIOR TO CONDUCTING SURVEY

Quick Reference Guide

Topic	Section(s)
Cars and noise	8, 9
Internet data entry	18
Route problems	13
Using scan sheets	14, 15, 16

Topic	Section(s)
Counting birds	6, 7
Manual data entry	14, 15, 16
Reporting weather	10, 11, 12
Using non-scan sheets	14

- | | | |
|---------------------------------|--------------------------------------|--|
| 1) Requirements | 8) Counting Vehicles | 15) Scannable Field Sheets |
| 2) Scouting | 9) Excessive Noise | 16) Cover Sheet |

- | | | |
|---|---|--|
| 3) When to Run Routes | 10) Acceptable Weather | 17) Reporting Results |
| 4) Starting | 11) Wind Speed Codes | 18) Electronic Data Submission Codes |
| 5) Stop Locations | 12) Sky condition Codes | 19) All Forms Completed by July 15 |
| 6) Counting | 13) Route Problems | 20) Processing of Results |
| 7) Which Birds to Count | 14) Record Keeping | 21) Income Tax Deduction |

1) REQUIREMENTS: It is very important that the observer know the songs, calls, and visual identification of all species likely to be encountered. It is advisable, even for experienced observers to learn the less common species on the available records and tapes. In Canada, cassettes of bird songs for each region are given to all participants. If you did not receive one please contact the CWS office. Since identification by songs and calls is required, acute hearing is extremely important. An observer with a hearing loss should not be running Breeding Bird Surveys.

2) SCOUTING: Much time can be lost due to closed roads, washed out bridges, and wrong turns. The importance of familiarization with the 50 stops and the proper turns before the day of the run cannot be overstressed. A scouting trip can save time and frustration, especially for first-time observers or on new routes. First-time observers should also conduct a test run to get familiar with the technique and the forms. If the route is far away, try 10 or 20 practice stops somewhere closer to home.

3) WHEN TO RUN ROUTES: In most states, routes should be run in early or mid-June. In Canada and most bordering states, any day throughout June and including the very first few days of July are acceptable. In the desert regions of California, Nevada, Arizona, New Mexico, Texas, Utah, and south Florida, routes may be run as early as May, at the discretion of the State Coordinators. In general, a date as near as possible to last year's is most desirable.

4) STARTING: Start at the marked starting point -- do not reverse the route even if the end is closer to home. The starting point is stop number 1. At the proper starting time, which should be printed on the map as well as the first page of the scannable field sheet, begin counting birds at the marked starting point. The times shown are ½

hour before official sunrise. Beware, local papers and TV stations often give incorrect sunrise data. Be at the starting point early to record weather data and odometer readings.

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5) STOP LOCATIONS: Stops are supposedly located at ½ mile (0.8 km) intervals; unfortunately, car odometers vary. The most important issue concerning stops is that all 50 stops should be made in exactly the same location from year to year. If your route map has stops marked on it or a list of stop descriptions attached, use those stops regardless of what your odometer says unless the marked stops are entirely unreasonable -- in which case contact this office. Please make a list of stop descriptions and mark the stops on the map if neither are provided -- this can be done while scouting. Update these stop descriptions each year as necessary. If you have a metric odometer and are running a new or unmarked route, the best approach is to go 0.8 km for every stop. Most importantly -- make a list of stop descriptions and mark their locations on the map, so the stops can be duplicated in the future. Stop descriptions should be updated as necessary whenever major landmarks change along the route. If a route problem arises, see the section 13.

6) COUNTING: One and only one observer should count birds. Counting should be done from outside the car but from a stationary point. Every bird seen within 1/4 mile (400 m) and every bird heard by the one observer should be counted during the 3 minutes at each stop. Do not exceed 3 minutes because you are sure a certain "good bird" is there and not calling -- it will probably be recorded some other year, and valid negative data are as important as positive in this survey. Do not stay less or more than 3 min. **ABSOLUTELY NO METHOD OF COAXING BIRDS SHOULD BE USED** under any circumstances during the 3-minute counting periods. This means no "spishing" or tape playbacks or any other method. It is crucial that all surveys be done consistently, because the goal of the survey is to establish a comparison index not an actual count or census. Birds seen between stops or before and after the three minutes or on scouting runs should not be counted, but may be noted in the margin. Such birds are of some interest, but do not spend extra time pursuing them, as it is important to finish within the time limit, which should be 4 to 5 hours; bird activity changes drastically after this time.

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7) WHICH BIRDS TO COUNT: Count individuals (except dependent young including downy chicks of water and shorebirds) of all species seen or heard during each 3-minute period. Estimates should be used only for flocks too large to count in

the brief time they are seen. Do not use check marks (i.e. marking presence of bird rather than actual number of individuals) even for abundant species. No one will detect all birds within hearing or seeing distance. Hundreds of birds present will not be active during each 3-minute count, and you must not try to guess how many you are missing. Report only those birds actually seen or heard during the prescribed 3-minute stops. Be careful not to count any individuals known or strongly suspected to have been counted at a previous stop. Any bird known to be a non-breeder (late migrant, injured bird, or summer vagrant) should be included but marked on the data sheet as such. Easily identifiable subspecies of birds, such as Northern Flicker, Dark-Eyed Junco, and Yellow-rumped Warbler should be identified. Species recorded that are not found on the form should be added at the bottom. Do not fill in AOU numbers; we will do that for you. Any species unusual in the area, whether it appears on the form or not, should be supported by including some details of the observation.

8) COUNTING VEHICLES: At the bottom of the field sheets, record the number of vehicles that pass by during each 3-min stop. Treat all motorized conveyances equally; motorcycles, cars, buses, trucks, semi-tractor trailers, etc., would each count as one vehicle if they were to pass by the point while the count was in progress. Count only those vehicles that are on the road where the count is taking place. Do not count vehicles passing by on nearby thoroughfares even if their noise is interfering with your ability to detect birds. If a stop is located at an intersection, count the vehicles traversing both roads during the count. It is acceptable for assistants to count and record the number of vehicles. We suggest using a mechanical hand-counter or tallying device to count vehicles. If a stop is on a heavily traveled road, it is acceptable to estimate the number of vehicles that passed by during the 3-min stop since counting birds is the primary objective of the survey. In addition, if you feel counting vehicles distracts too much of your attention from the bird survey, forego this step and indicate on the Cover Sheet that you did not count vehicles.

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9) EXCESSIVE NOISE: At the bottom of each field sheet are five bubbles, one for each stop. Fill in a circle completely if you feel constant excessive noise, other than that produced by counted vehicles, is significantly interfering with your ability to hear birds at that stop. Possible sources of excessive noise include, but are not limited to: lawn mowers, oil well pumps, trains, crop dusters, tractors, vehicles on nearby roads, numerous barking dogs, and rushing river water. Do not fill in the circle if the disturbance is temporary (lasts < 45 sec) or if you temporarily suspend the count until the offending noise has ceased or moved on.

10) **ACCEPTABLE WEATHER:** To be comparable, routes must be run under satisfactory weather conditions: good visibility, little or no precipitation, light winds. Occasional light drizzle or a very brief shower may not affect bird activity but fog, steady drizzle, or prolonged rain should be avoided. Except in those prairie States and Provinces where winds normally exceed Beaufort 3, counts preferably should be made on mornings when the wind is less than 8 m.p.h. (13 kph) and not taken if the wind exceeds 12 mph. (19 kph). If you can walk faster than the wind is blowing, wind conditions are very satisfactory (See sections 11 and 12 for wind and sky codes).

11) **WIND SPEED CODES:** (Enter Beaufort Numbers on Cover Sheet, not m.p.h. or km.p.h.)

Beaufort Number	Wind Speed Indicators	Wind Speed in mph / kmph
0	Smoke rises vertically	< 1 / < 2
1	Wind direction shown by smoke drift	1-3 / 2-5
2	Wind felt on face; leaves rustle	4-7 / 6-12
3	Leaves, small twigs in constant motion; light flag extended	8-12 / 13-19
4	Raises dust and loose paper; small branches are moved	13-18 / 20-29
5	Small trees in leaf sway; crested wave lets on inland waters	19-24 / 30-38

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12) **SKY CONDITION CODES:** (Enter these U.S. Weather Bureau code numbers on Cover Sheet.)

0 - Clear or a few clouds 4 - Fog or smoke 7 - Snow
 1 - Partly cloudy (scattered) or variable sky 5 - Drizzle 8 - Showers
 2 - Cloudy (broken) or overcast

13) **ROUTE PROBLEMS:** Scouting of routes should eliminate most last-minute adjustments. If any problems arise, notify this office as soon as possible. For maximum consistency, it is best that an alternative be worked out here that pleases

both you and us. If it is not possible to scout a route and a problem arises while running it, remember that it is most important to use the same stops in the same order as in previous years. If a detour is necessary, go around and resume on the other side of the obstruction, attempting to preserve as many stops as possible. Do not make new stops along the detour unless necessitated by inaccessible sections of road or if detouring around will take in excess of an hour. There are numerous local traffic regulations dealing with the proper and safe parking of vehicles along roadsides. Please observe these regulations while conducting the Breeding Bird Survey and remember to use caution in selecting an appropriate stopping place and when getting into and out of your vehicle. If a stop is in a dangerous location, it is acceptable to move it as much as 0.1 mile (forward or backward) or put it on a side road. If this does not resolve the safety problem, skip the stop and contact us. Never stop at a location you consider to be dangerous in any way. Counting may be extended by 1 minute at stops with excessive traffic noise. This should be restricted to only a few stops; if many stops have excessive traffic, notify this office. In some cases a replacement route will have to be developed.

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14) RECORD KEEPING: You can submit your data by Internet (see section 18) or you can mail us the data. Sections 15, 16, and 17 describe procedures for those wishing to send us their data by mail. Two types of data forms are available for collecting BBS data -- Scan forms and Standard forms. The Scan forms are double-sided and have the words "SCAN FORM" printed on them; the Standard forms are single-sided and have a form number printed in the lower right corner. The Standard forms were used regularly before 1997. Unless you indicate otherwise, only the Scan form will be sent to you. Use either set of data sheets to collect the field data. You can also use a field data sheet of your own design. However the type of field sheet chosen will affect the process used to record and report data since all BBS data must now be scanned or electronically entered via the Internet. If you are going to enter your data via the Internet you may use either type of BBS data sheet, or your own data sheets, and record data using any method you desire since the form will not be scanned (see section 18). If you choose to mail your completed data forms to the BBS office for entry, remember that all data must either be transcribed to the Scan form from the original data sheets or recorded directly to the original Scan form in the field. If using hash marks, dots or other methods to count individuals, use the Standard field sheets, your own field sheets, or make a photocopy of the Scan form for use in the field, then transfer the species data to the original Scan form; if you use Arabic numerals (i.e., 1, 2, 3, . . .) to record the number of individuals per stop directly to the original Scan forms, there is no need to transcribe species data. Do not wait to record birds after the 3 minutes have been completed. This leads to errors of

omission and significantly delays the completion of the survey. If you transcribed data, always send both sets of data sheets to our office. Also keep a photocopy of the original data sheets for your records; you will need the photocopy to check against the results we will send you at the end of the year and as insurance against lost mail. A word of caution concerning dictating observations to a tape recorder: it is risky because the data can easily be lost by one manner of malfunction or another. Transferring the taped data is tedious and also subject to error. Another problem is that the tape is technically the original field sheet and it would be unreasonable for people to send us tapes. If you must use a tape recorder, indicate so on the assistant line and please be careful. With practice, an observer can count and record birds alone. Remember to record weather data at start and finish. Record the start and finish time for the route. Use a dark pencil or pen on field sheets, Scan Forms and Cover Sheet. We must photocopy or microfilm these records, which is impossible with light images. Do not use a felt-tip pen; the ink is not waterproof; hence, it smudges, washes out easily and makes corrections difficult.

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15) SCANNABLE FIELD SHEETS: If using the original scan sheets in the field or when transcribing your data to them, remember: count data must be written in Arabic numbers (1, 2, 3, . . . , 15, 16, etc.) in order to be scanned, print firmly with dark pencil or ink pen, write legibly avoiding contact with edges of entry boxes, do not obscure or mar black cornerstones or identification box at top left corner of pages, do not fill in missing AOU numbers, missing species may be written in lower case letters and abbreviated, and do not staple these data sheets together.

16) COVER SHEET: Always complete and return the Cover Sheet regardless of the method used to record and report survey data. Before submitting the Cover Sheet and data, always verify the address on the Cover Sheet, complete the route summary information, and answer the brief questions listed by filling in the data entry bubble corresponding to the correct response (Y = yes and N = no). When updating the address always use CAPITAL letters and place one character per entry box. If surveying multiple routes, it is only necessary to update the address on one cover sheet.

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17) REPORTING RESULTS: Upon completion of the route, address data should be verified and date and weather data should be transferred from the Field Sheets to the Cover Sheet; again, use a dark pencil or pen, but not a felt-tip marker. If you did not use the original Scan forms in the field, transfer the data from your own field sheets to the Scan forms. Please double check the transfer of data; we have found that many

observers inadvertently omit information when transferring. For this and other reasons we need your original field sheets. Copied field sheets tend to be less accurate than originals. Be sure to furnish all the summary information requested on the front of the Cover Sheet; please enter only 1 number or letter per block (start the date and starting time entries with a "0"). Please print plainly because all information must be scanned or keypunched. Don't forget to include your middle initial. We need your initials and last name to keep our address and route assignment files accurate. The observer should be the name entered here, not the driver or the recorder. Married women should use their own initials, not those of their husband. Two people should not observe together and take turns putting each others name in the observer block from year to year. The Field Sheets (representing 50 stops), the 5 scannable Data Sheets, 1 Cover Sheet, the route map, and these instructions should be sent in the envelope provided to the USGS Patuxent Wildlife Research Center or, in Canada, these items should be sent to the Canadian Wildlife Service as soon as possible after completion of the count. You will want to keep a copy of your data so that you can check the computer printout that will be sent at a later date.

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18) INTERNET DATA SUBMISSION: Instructions for Internet data submission are posted on the Internet at: <http://www.pwrc.usgs.gov/bbs/>. Once at the site, select the **BBS Data** link then choose the **Data Entry** link. Prior to running your route, test the compatibility of your computer with the data entry program. If they are incompatible, you will need to mail your data on the original Scan forms. If you use electronic data submission, please remember that you still need to return the original data sheets (i.e. those used in the field) including the completed Cover Sheet to the BBS office.

19) ALL FORMS MUST BE COMPLETED AND RETURNED BY JULY 15: If you choose to submit your data via the Internet, the data sheets need not be returned until **August 31**. If you cannot run your route, RETURN THE PACKET AS SOON AS POSSIBLE. If for any reason it should be impossible for you to cover your route during the prescribed period, inform the State/Provincial Coordinator or this office immediately. Current contact information for the State and Provincial/Territorial Coordinators is available on the BBS web site: <http://www.pwrc.usgs.gov/bbs/>

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20) PROCESSING OF RESULTS: Upon receipt of the forms, the Cover and Field Sheets are checked for completion, addresses are checked, and AOU numbers of write-ins are inserted. Data from the Cover and Field Sheets are then scanned into the computer and run through a computer edit program. A machine listing will be

mailed, or e-mailed, to each observer and a state/provincial/territorial tabulation will be mailed to each regional Coordinator. Individuals who submitted their data via the Internet will also receive a final machine listing of the data via email once it has completed the editing process within approximately one week of submission. Data on distribution trends and comparative abundance of individual species are available upon request.

21) INCOME TAX DEDUCTION/RECEIPTS: U.S. citizens who itemize deductions on their Income Tax Returns may make a deduction for mileage necessary for the counting and running of official Breeding Bird Survey routes. Cost of motels, campgrounds, etc. involved with the scouting and running of routes are also deductible. Please check your 1040 instructions each year; it could change. In Canada, it is not possible for the CWS to reimburse expenses or to issue tax receipts for participation in the BBS. However, out-of-pocket expenses incurred while running a BBS route can be treated as a charitable donation through the non-governmental organization Bird Studies Canada (BSC) and participants can thereby receive income tax receipts. Please note: this system provides a tax receipt only and is not a reimbursement of expenses. Participants submit a record of their expenses directly to BSC, along with a check payable to BSC, of an amount equaling the expenses. BSC then treats the check as a donation and issues the participant a tax receipt. Along with the tax receipt, BSC sends the participant a check equaling the amount of the donation. Cost of motels, campgrounds, meals, mileage, etc. involved with scouting and running the official Breeding Bird Survey routes can be included in these costs. For details, see the BSC Tax Relief Form enclosed in your package. The address for BSC is: P.O. Box 160, Port Rowan, Ontario, N0E 1M0.

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THANK YOU VERY MUCH FOR PARTICIPATING IN THE BREEDING BIRD SURVEY.

EQUIPMENT CHECKLIST

BBS Route Name _____

Wind	0 smoke rises vertically	3 leaves, small twigs in motion	Sky	0 clear	3 rain
	1 wind direction shown by smoke drift	4 raises dust, sm. branches move		1 partly cloudy	4 fog
	2 wind felt on face, leaves rustle	5 small trees sway		2 cloudy	5 drizzle

Date _____ Observer _____ Start Time _____ Temp _____ Wind _____ Sky _____

	Species	Minute 1		Minute 2		Minute 3	
		<50 m	>50 m	<50 m	>50 m	<50 m	>50 m
Stop # _____ # cars _____							
Stop # _____ # cars _____							
Stop # _____ # cars _____							



1.06 Secretive Marsh Bird Survey Instructions – Field Form

Purpose

Documenting survey design and methods maintains the scientific integrity of refuge biological programs and guards against information loss over time. The Survey Instructions field form was developed to assist refuges in recording important biological survey information and will enhance survey integrity by ensuring that survey procedures are clear and consistent. It will provide additional benefits, including: Serve as Initial Survey Instructions (ISI) (701 FW 2), and an initial step in development of formal NWRS survey protocols; Capture information valuable in development of Inventory and Monitoring Plans (IMP); Augment survey information in the Planning and Review of Inventory and Monitoring ([PRIMR](#)) database; Reveal multi-refuge and landscape-level data inference opportunities.

Using the Initial Survey Instructions Field Form

Staff should use this tool for all on-going surveys, particularly those high priority refuge-based surveys where protocols are not available, and followed by cooperative and/or coordinated surveys with important refuge-specific elements of implementation. The information provided in the ISI form should be as thorough and complete as possible; however it is acceptable to leave fields or sections empty if particular survey information is unknown. Provide completed forms to your I&M ecologist, who will archive it on [Fishnet](#) and link it to the survey record in PRIMR for long-term reference. Regional I&M staff ecologists can assist refuge staff with completing the Survey Instructions. If the Survey Instructions are updated over time, we recommend saving updates as versions (e.g., version 2.0).

Survey Name: Secretive Marsh Bird

This survey occurs on: ☒ Single refuge only ☐ Multiple refuges

Refuge Name(s): Coldwater River NWR

Background/Survey Justification:

This survey assesses the occurrence and distribution of secretive marsh birds utilizing specific moist-soil units on the refuge and evaluates effectiveness of management strategies to support these species. Many marsh birds are of conservation concern due to a lack of general understanding of population size and status (e.g., king rails [*Rallus elegans*], and clapper rails [*R. longirostris*]). More traditional survey methods to track changes in bird populations (i.e., Breeding Bird Survey) poorly samples emergent wetlands, and thus provides limited understanding of populations of species which primarily use marsh habitats. The refuge has managed wetland units with both emergent and scrub/shrub habitat and has identified several species of secretive marsh birds occupying them but has no measure of abundance. Understanding the contribution a refuge has to supporting these species is important for long-term conservation planning at the local and regional scales. Waterbirds have been identified as a resource of concern for the refuge.

Section 1. Survey Targets & Objectives

Target Species/Taxa/Community:

Rails, grebes, coots and other secretive marsh birds. Secondary birds observed at the plot may also be recorded.

Target Habitat(s):

Moist-soil habitat and other managed emergent wetland units on the refuge (Units I-X).

Survey Objective(s):

1. Determine which species of marsh birds are using the refuge during the breeding season.
2. To estimate the number of secretive marsh birds within specific moist-soil and emergent wetland units.
3. Determine which units marsh birds are using and determine management strategies to promote favorable habitat conditions.

Section 2. Survey Design

For Collaborative Surveys

☒ **This survey is part of a collaborative State, Regional, or National survey:**

Coordinating organization(s) and contact information:

Nationally these data are being compiled by the Avian Knowledge Network.

Is there an established protocol for the survey? ☒ Yes ☐ No ☒ In Prep (☐ Not Sure)

Protocol Name, citation and/or link to documentation:

Conway, C. J. 2015. National protocol framework for the inventory and monitoring of secretive marsh birds. Version 0.5. Inventory and Monitoring, National Wildlife Refuge System, U.S. Fish and Wildlife Service, Fort Collins, Colorado.

Are there refuge-specific elements of implementation? ☒ Yes ☐ No (☐ Not Sure)
(If yes, also specify refuge-specific details in the section below.)

For Surveys with Refuge-Specific Details (Collaborative OR unique Refuge Surveys)

☒ This survey has refuge-specific design elements:

Year of survey origin: *(Add year of survey modification after origin if applicable.)*
2015

Are specific sampling units identified? ☒ Yes ☐ No (☐ Not Sure)

Type of sampling unit (sampling geometry):

☐ Route/linear transect ☒ Plot ☐ Point ☐ Other:

Sampling has initially been conducted on a subset of the eastern units (I-X.).

Do sampling units remain fixed (i.e., same location from year to year)?

☒ Yes ☐ No (☐ Not Sure)

Describe sampling design: *(e.g., study area of interest, how sampling units were selected or modified over time, if stratified sampling area, sample size, etc...)*

Fixed sampling points approximately 400 yards or greater are located on the levee adjacent to permanent or semi-permanent wetland units which contain emergent or scrub-shrub habitat conditions.

Describe survey timing: *(Examples include # repeat visits each year, months, season, time of day, etc...)*

Annually, Sampling will be done at least 3 times during 10-day windows. Each window will be separated by a 7 day period from May – July. Survey begins 30 minutes before sunrise and is completed by 10:00 am.

Section 3. Survey Methods

Primary metrics collected:

- Number of detected marsh birds by survey unit.
- Number of secondary birds of interest (e.g., northern harrier, herons)
- Management action since last sampling event.

How are sites marked? *(Examples include GPS waypoints, flagging, etc...)*

Not marked – sites for observation points will be identified on survey data sheet maps and names of individual management units.

Describe preparatory requirements for the survey: *(Examples include permits, training, contracts, other logistics, etc...)*

No permits are needed. Training on the identification of the vocalization of marsh birds is needed as well as visual identification. Conducting a trial run by new observers is advised to facilitate familiarization with the data sheet and calling process. Submission of the data to the Eastern Avian Data Center may require a password and initial setup by the Center.

Describe equipment used during the survey:

- Data sheets
- Tape player with external speaker or similar device to broadcast calls of targeted marsh birds.
- Map of survey route/area with designated sampling location
- Bird Field Guide

Describe detailed methodology (field and lab procedures)

At each survey point, observers will record all primary species (rails, bitterns, and pied-billed grebe) detected during both a 5-minute passive period prior to broadcasting recorded calls, and during a period in which pre-recorded vocalizations are broadcast into the marsh. The broadcast sequence includes calls of the primary marsh bird species that are expected breeders in that area and is broadcast using a portable cassette tape player, CD player, or MP3 player. Observer will estimate the distance to the individual call. Each unique calling bird is counted only once regardless of the calling period. See Conway 2009 for more detailed methods.

Who conducts the survey: *(Include staff, interns, contractors, etc... if primary surveyors)*

Refuge Biologist, Refuge Manager, Interns

Section 4. Data Management

Specify data entry file format(s): *(Examples include MS Excel, MS Access, GIS, web dbs - e.g., SQL), etc...)*

Data are stored in an excel file at the refuge. Subsequently, data will be transferred to the Eastern Avian Data Center.

Specify data storage/archive location (hardcopy and electronic): *(Provide file names and locations here if applicable)*

Data sheets retained for a period in the refuge file cabinets, scanned copies of the data sheets are kept on the Refuge Server. Primary data storage will be with the Avian Knowledge Network through the Eastern Avian Data Center.

Describe procedure for verifying/checking/securing the data:

Data sheets will be quality checked after returning from the field to ensure the forms have been properly filled out. Scanned copies of vetted forms will be uploaded to the Refuge Server as security against loss.

Describe methods/software used in data analysis:

Excel is used to create a data summary of species identified, number of detections, based on survey date and management units. Data analysis will not be done specifically with the refuge data. Instead, analysis may be done by others at a regional scale utilized these data.

Section 5. Reporting

Describe reports developed from this survey:

(Include details on reporting schedule/frequency, distribution, archiving, etc... Include links and citations for previous reports if applicable.)

No detailed reports from the survey are being written specific to the data collected on the refuge. Summary information is included in the annual narrative for the N. Mississippi National Wildlife Refuges Complex. Data from the Refuge surveys may be utilized for regional scale analysis and reported through other sources.

Section 6. Other Survey Information

Comment on additional survey elements and issues to consider when implementing the survey:

None

Description of attachments/supplemental documents/data sets:

(Use the space below to describe supplemental documents - e.g., maps, appendices, etc included with this form)

Attachment includes data sheets for recording detections of birds.

Cite resources: *(Cite the source of the information in the form below, including personal communication and citations for published and gray literature)*

Conway, C. J. 2009. Standardized North American Marsh Bird Monitoring Protocols, version 2009-2. Wildlife Research Report #2009-02. U.S. Geological Survey, Arizona Cooperative Fish and Wildlife Research Unit, Tucson, AZ.

Submitted by and contact information:

David Richardson, Terrestrial Ecologist, David_Richardson@fws.gov, 662 226-8286

Version Tracking *(You can use the table below to track updates to the Survey Instructions Record.)*

Version	Completed by	Date	Comments/material updated
1.0	David Richardson	11/6/2015	Original

Pg ____ of ____

Date (eg 10-May-04):

Name of marsh or route

Observer(s) (list all)*[illegible]

Pg_1__of__1__

Before	After
--------	-------

Temperature ($^{\circ}\text{F}$):	10	21
---	----	----

Wind speed (mph):	0	1
-------------------	---	---

Cloud cover (%) :	15	60
--------------------------	----	----

Precipitation (see below): none | none

put an "S" in the appropriate column if the bird was seen, a "1" if the bird was heard, and "1S" if both heard and seen

[illegible]

If the call type is not one of the above listed types, describe the call in the comments column

Background noise: 0 *no noise* 1 *faint noise* 2 *moderate noise (probably can't hear some birds beyond 100m)*

3 loud noise (probably can't hear some birds beyond 50m) 4 intense noise (probably can't hear some birds beyond 25m)

List of AOU 4-letter species acronyms for primary marsh birds in North America.

Primary species

SORA	sora
VIRA	Virginia rail
CLRA	clapper rail
KIRA	king rail
BLRA	black rail
YERA	yellow rail
AMCO	American coot
COMO	common moorhen
PUGA	purple gallinule
LIMP	limpkin
PBGR	pied-billed grebe
AMBI	American bittern
LEBI	least bittern

Examples of Secondary Species (these are just some examples - there are other wetland birds that a participant may want to include; each cooperator should decide which secondary species to include in their surveys in advance and list these species on their datasheet so that all participants in future years will know the list of species recorded in prior years)

LEGR	least grebe (1 cooperator has included LEGR in their call-broadcast sequence)
EAGR	eared grebe (1 cooperator has included EAGR in their call-broadcast sequence)
GRHE	green heron (1 cooperator has included GRHE in their call-broadcast sequence)
GBHE	great blue heron
GLIB	glossy ibis
WFIB	white-faced ibis
WHIB	white ibis
NOHA	northern harrier
SACR	sandhill crane
WILL	willet
WISN	Wilson's snipe (1 cooperator has included WISN in their call-broadcast sequence)
FOTE	Forster's tern
BLTE	black tern
BEKI	belted kingfisher
ALFL	alder flycatcher
WIFL	willow flycatcher
SEWR	sedge wren
MAWR	marsh wren
COYE	common yellowthroat
YEWA	yellow warbler
SSTS	saltmarsh sharp-tailed sparrow
NSTS	Nelson's sharp-tailed sparrow
LCSP	LeConte's sparrow
SWSP	swamp sparrow
SAVS	Savannah sparrow
SESP	seaside sparrow (1 cooperator has included SESP in their call-broadcast sequence)
RWBL	red-winged blackbird
YHBL	yellow-headed blackbird
BTGR	boat-tailed grackle

List of the most common calls for the primary target species of marsh birds

Black Rail: *kickee-doo* (primary breeding call), *grr-grr-grr*, *churt*, *ticuck*

Least Bittern: *coo-coo* (male advertisement), *kak-kak-kak*, *gack-gack* (given from nest), *ank-ank* (given when flushed)

Yellow Rail: *click-click*, *wheese* (female call), *descending cackle* (pair maintenance), *squeak* (given by retreating bird)

Sora: *whinny* (territorial defense and mate contact), *per-weep*, *kee* (may be given to attract mates)

Virginia Rail: *grunt* (pair contact, territorial call), *tick-it* (male advertisement call), *kicker* (female advertisement call), *kiu* (sharp, piercing call)

King Rail: *chac-chac* (pair communication), *kik-kik-kik* (mating call)

Clapper Rail: *clatter* (pair contact, territorial call), *kek* (male advertisement call), *kek-burr* (female advertisement call), *kek-hurrah*, *hoo*, *squawk* (chase squeal), *purr*

American Bittern: *pump-er-lunk* (territorial/advertisement call), *chu-peep* (given during copulation ceremony), *kok-kok-kok* (given when flushed)

Common Moorhen: *cackle* (primary advertising call), *squawk*, *yelp*, *chuck*, *purr*

Purple Gallinule: *cackle* (primary advertising call), *squawk*, *grunt*

American Coot: *pow-ur* (crowing for territorial defense), *puhk-ut* (warning), *puhk-kuh-kuk* (crowing for territorial challenge), *puhlk*, *tack-tack* (cackling), *kerk* (sharp cough)

Pied-billed Grebe: 3-part gurgling song, *quaa-aaa-aaa* (wavering, guttural copulation call), *kwah* (alarm call), *ek-ek-ek* (rapid, staccato greeting call), *tshick-tshick*

Limpkin: *krr-oww*



1.07 Emerald Ash Borer Survey Survey Instructions – Field Form

Purpose

Documenting survey design and methods maintains the scientific integrity of refuge biological programs and guards against information loss over time. The Survey Instructions field form was developed to assist refuges in recording important biological survey information and will enhance survey integrity by ensuring that survey procedures are clear and consistent. It will provide additional benefits, including: Serve as Initial Survey Instructions (ISI) (701 FW 2), and an initial step in development of formal NWRS survey protocols; Capture information valuable in development of Inventory and Monitoring Plans (IMP); Augment survey information in the Planning and Review of Inventory and Monitoring ([PRIMR](#)) database; Reveal multi-refuge and landscape-level data inference opportunities.

Using the Initial Survey Instructions Field Form

Staff should use this tool for all on-going surveys, particularly those high priority refuge-based surveys where protocols are not available, and followed by cooperative and/or coordinated surveys with important refuge-specific elements of implementation. The information provided in the ISI form should be as thorough and complete as possible; however it is acceptable to leave fields or sections empty if particular survey information is unknown. Provide completed forms to your I&M ecologist, who will archive it on [Fishnet](#) and link it to the survey record in PRIMR for long-term reference. Regional I&M staff ecologists can assist refuge staff with completing the Survey Instructions. If the Survey Instructions are updated over time, we recommend saving updates as versions (e.g., version 2.0).

Survey Name: Emerald Ash Borer Survey

This survey occurs on: ☒ Single refuge only ☐ Multiple refuges

Refuge Name(s): Coldwater River NWR

Background/Survey Justification:

This survey provides annual surveillance for the emerald ash borer (*Agrilus planipennis*) within forest stands on the refuge. The invasive beetle is native to Asia and was first documented in 2002 in North America. The larval stage feeds on the inner bark and phloem of ash trees (*Fraxinus* spp.) eventually causing the tree to lose the ability to transport food and water and die. Green ash (*F. pennsylvanica*) is a prominent bottomland hardwood species within the 300 acres of natural regeneration and 1000 acres of planted hardwoods on the refuge and is the preferred ash species for the beetle (McCullough and Siegert 2007). The killing of these trees by the beetle would have a huge effect the overstory composition within these forest stands. Presently, the beetle can be found in the adjoining states of LA, AR, and TN. It is anticipated the beetle will be found within Mississippi within the next 5 years. Early detection and rapid response may provide an opportunity to evaluate emerging control measures to slow or eliminate the spread of the beetle. This work is being funded by a SE Region Invasive Species Management with Volunteers grant and supported by the assistance of the USFS, Center for Bottomland Hardwood Research and Delta State University.

Section 1. Survey Targets & Objectives

Target Species/Taxa/Community:

Emerald Ash Borer – Bottomland Hardwood Communities

Target Habitat(s):

Habitats to be evaluated will be all forest stands of natural and planted hardwood regeneration. These stands were established since the 1990's

Survey Objective(s):

1. To provide a basis for early surveillance detection of the emerald ash borer on the refuge.
2. Provide a measure of the level of infestation of this invasive beetle across the refuge forested units.

Section 2. Survey Design

For Collaborative Surveys

☒ **This survey is part of a collaborative State, Regional, or National survey:**

Coordinating organization(s) and contact information:

Data are being collected by many organizations. However, no “coordinated” survey efforts are being done. The refuge is working with the USFS, Center for Bottomland Hardwood Research and Delta State University to identify collected insects and establish girdled trap trees.

Is there an established protocol for the survey? ☐ Yes ☒ No ☐ In Prep (☐ Not Sure)

Protocol Name, citation and/or link to documentation:

A formalized protocol for detecting this beetle has not been developed. However, most surveys are based on funnel traps, prism traps, or girdled trap trees (McCullough and Siegert 2007.)

Are there refuge-specific elements of implementation? ☒ Yes ☐ No (☐ Not Sure)
(If yes, also specify refuge-specific details in the section below.)

For Surveys with Refuge-Specific Details (Collaborative OR unique Refuge Surveys)

☒ **This survey has refuge-specific design elements:**

Year of survey origin: *(Add year of survey modification after origin if applicable.)*
2015

Are specific sampling units identified? ☒ Yes ☐ No (☐ Not Sure)

Type of sampling unit (sampling geometry):

☐ Route/linear transect ☒ Plot ☐ Point ☐ Other:

Do sampling units remain fixed (i.e., same location from year to year)?

☒ Yes ☐ No (☐ Not Sure)

Describe sampling design: *(e.g., study area of interest, how sampling units were selected or modified over time, if stratified sampling area, sample size, etc...)*

Hardwood regeneration units >15 years of age were evaluated for the presence of green ash along their edges. Two units with ash were selected that had easy road access.

Describe survey timing: *(Examples include # repeat visits each year, months, season, time of day, etc...)*

Sampling will be done annually from May to September on an every other week basis. Each year, new girdled trap trees will also be created to induce attacks by adult beetles.

Section 3. Survey Methods

Primary metrics collected:

- Number of emerald ash borer beetles per sampling interval in each funnel trap
- Presence of emerald ash borer larval galleries in girdled trap trees in spring
- Number and identification of ancillary insects in the traps

How are sites marked? *(Examples include GPS waypoints, flagging, etc...)*

Trap locations will be initially marked with flagging tape along the road. Individual trees that have been girdled will also be marked with flagging tape. Plot location will be recorded using a GPS..

Describe preparatory requirements for the survey: *(Examples include permits, training, contracts, other logistics, etc...)*

No permits are needed. No major preparatory requirements are needed to conduct this survey. However, annual coordination with the Center for Bottomland Hardwood Research (USFS) should be done to facilitate identification of collected beetles and inspection of girdled trap trees.

Describe equipment used during the survey:

- Data sheets
- Collection jars

- Funnel traps and purple prism traps
- 70% Ethanol
- 3/8 inch rope
- Draw knife
- Marking tape/flagging
- GPS
- Chemical attractant

Describe detailed methodology (field and lab procedures)

Two multi-funnel traps and purple prism traps will be hung on green ash trees in May – September and treated with a chemical attractant (Manuka oil or Leaf Alcohol lure). Each sampling event will occur for 5-7 consecutive days. All collected insects will be stored in labeled jars in 70% ethanol. Initial identification and pinning of insects will be done by student and faculty at Delta State University, Department of Entomology. Verification of any detection of emerald ash borer will be done by USFS entomologist. Three girdled trap trees will also be created annually and inspected on year later for the presence of larval galleries. Voucher specimens of all insects will become the domain of Delta State University.

Who conducts the survey: *(Include staff, interns, contractors, etc... if primary surveyors)*

Refuge Biologist, Refuge Manager, Interns, Volunteers, (USFS, Delta State University – insect identification)

Section 4. Data Management

Specify data entry file format(s): *(Examples include MS Excel, MS Access, GIS, web dbs - e.g., SQL, etc..)*

Data are stored in an excel file.

Specify data storage/archive location (hardcopy and electronic): *(Provide file names and locations here if applicable)*

Data sheets will be kept in the refuge files and scanned copies held on the refuge server.

Describe procedure for verifying/checking/securing the data:

Data sheets will be quality checked after returning from the field to ensure the forms have been properly filled out. Scanned copies of vetted forms will be uploaded to the Refuge Server as security against loss.

Describe methods/software used in data analysis:

No data analysis.

Section 5. Reporting

Describe reports developed from this survey:

(Include details on reporting schedule/frequency, distribution, archiving, etc... Include links and citations for previous reports if applicable.)

No detailed reports from the survey are expected to be written. A list of other beetles and insects captured in the funnel traps will be developed by the USFS and Delta State University.

Section 6. Other Survey Information

Comment on additional survey elements and issues to consider when implementing the survey:

If a positive detection of emerald ash borer occurs, more intensive sampling for the beetle may be undertake at other stands on the refuge containing significant composition of green ash. In addition, a survey may be developed to examine survivorship of green ash saplings and trees.

Description of attachments/supplemental documents/data sets:

(Use the space below to describe supplemental documents - e.g., maps, appendices, etc included with this form)

Cite resources: *(Cite the source of the information in the form below, including personal communication and citations for published and gray literature)*

McCullough, D. G. and N. W. Siegert. 2007. Using girdled trap trees effectively for emerald ash borer detection, delimitation and survey. Michigan State University, East Lansing, MI. 8 pp.

Submitted by and contact information:

David Richardson, Terrestrial Ecologist, David_Richardson@fws.gov, 662 226-8286

Version Tracking *(You can use the table below to track updates to the Survey Instructions Record.)*

Version	Completed by	Date	Comments/material updated
1.0	David Richardson	11/6/2015	Original

Maps, Data Sheets and Appendices: *(You can insert maps and any appendices of information - e.g., progress tables, timelines, budgets, activity logs, etc..., directly into this document (Insert in Word document version or Attach to Adobe version)).*

No Attachments.



1.08 North American Amphibian Monitoring Survey Instructions – Field Form

Purpose

Documenting survey design and methods maintains the scientific integrity of refuge biological programs and guards against information loss over time. The Survey Instructions field form was developed to assist refuges in recording important biological survey information and will enhance survey integrity by ensuring that survey procedures are clear and consistent. It will provide additional benefits, including: Serve as Initial Survey Instructions (ISI) (701 FW 2), and an initial step in development of formal NWRS survey protocols; Capture information valuable in development of Inventory and Monitoring Plans (IMP); Augment survey information in the Planning and Review of Inventory and Monitoring ([PRIMR](#)) database; Reveal multi-refuge and landscape-level data inference opportunities.

Using the Initial Survey Instructions Field Form

Staff should use this tool for all on-going surveys, particularly those high priority refuge-based surveys where protocols are not available, and followed by cooperative and/or coordinated surveys with important refuge-specific elements of implementation. The information provided in the ISI form should be as thorough and complete as possible; however it is acceptable to leave fields or sections empty if particular survey information is unknown. Provide completed forms to your I&M ecologist, who will archive it on [Fishnet](#) and link it to the survey record in PRIMR for long-term reference. Regional I&M staff ecologists can assist refuge staff with completing the Survey Instructions. If the Survey Instructions are updated over time, we recommend saving updates as versions (e.g., version 2.0).

Survey Name: North American Amphibian Monitoring

This survey occurs on: ☒ Single refuge only ☐ Multiple refuges

Refuge Name(s): Coldwater River NWR

Background/Survey Justification:

This survey will assist in understanding long-term trends of frogs and toads across regional and national scales as well as provide local baseline inventories. Amphibians are important ecological organisms associated with wetland systems. Worldwide declines in this taxon have prompted the need to undertake multiple survey designs to investigate population trends and understand mechanisms that influence them. The MAV has undergone immense anthropogenic changes through hydrologic alterations of the Mississippi River and 80% reduction in the forested wetlands to foster an agricultural landscape. This geographical area continues to undergo significant stressors associated with intense agricultural practices that rely on fertilizers, herbicides, insecticides and irrigation programs to maximize cereal grain production. These stressors, in concert with ongoing climate changes and emerging disease issues are a significant threat for amphibian populations. While baseline inventories of herpetofauna have occurred on the refuge (Mitchell 2011), the North American Amphibian Monitoring Program provides a national survey design to track long-term trends of frogs and toads based on their calling frequency and occupancy at repeated roadside observation sites. This survey was selected because it contributes to efforts to monitor this taxon at regional and national scales and provides a better understanding of the biodiversity for the refuge.

Section 1. Survey Targets & Objectives

Target Species/Taxa/Community:

Frogs and Toads

Target Habitat(s):

No specific habitats are targeted for monitoring. Sampling locations are based on ½ mile distances between permanent and semi -permanent wetlands located along the survey route.

Survey Objective(s):

1. Determine the status and trends in species richness and diversity of frogs and toads of North America.

Section 2. Survey Design

For Collaborative Surveys

☒ **This survey is part of a collaborative State, Regional, or National survey:**

Coordinating organization(s) and contact information:

USGS- Patuxent Wildlife Research Center (<https://www.pwrc.usgs.gov/naamp/index.cfm>)

Is there an established protocol for the survey? ☐ Yes ☒ No ☐ In Prep (☐ Not Sure)

Protocol Name, citation and/or link to documentation:

Field methodology follows the Mississippi Amphibian Monitoring Protocol (see below) which is based on the more complete protocol of the North American Amphibian Monitoring Program (<https://www.pwrc.usgs.gov/naamp/index.cfm?fuseaction=app.protocol>)

Are there refuge-specific elements of implementation? ☒ Yes ☐ No (☐ Not Sure)
(If yes, also specify refuge-specific details in the section below.)

For Surveys with Refuge-Specific Details (Collaborative OR unique Refuge Surveys)

☒ **This survey has refuge-specific design elements:**

Year of survey origin: *(Add year of survey modification after origin if applicable.)*
2003

Are specific sampling units identified? ☒ Yes ☐ No (☐ Not Sure)

Type of sampling unit (sampling geometry):

☐ Route/linear transect ☒ Plot ☐ Point ☐ Other:

Do sampling units remain fixed (i.e., same location from year to year)?

☒ Yes ☐ No (☐ Not Sure)

Describe sampling design: *(e.g., study area of interest, how sampling units were selected or modified over time, if stratified sampling area, sample size, etc...)*

Sampling is based on a stratified random block design at a regional level conducted by USGS. Specific sampling locations along the route are based on habitat conditions at the local scale with an attempt to place 10 plots approximately ½ mile apart.

Describe survey timing: *(Examples include # repeat visits each year, months, season, time of day, etc...)*

Surveys are conducted during 3 sampling periods. February 20-March 31, April 15-May 15, and June 1 – July 1 Each survey period is sampled 1 time.

Section 3. Survey Methods

Primary metrics collected:

- Categorical calling index of detected frog and toad species at each sampling plot.

How are sites marked? *(Examples include GPS waypoints, flagging, etc...)*

Sampling locations are not marked in the field. Plot locations are defined by waypoints and physical description of each site and identified on a map with driving intervals between plots.

Describe preparatory requirements for the survey: *(Examples include permits, training, contracts, other logistics, etc...)*

No permits are needed. Observer must be able to recognize frog calls to species and pass the NAAMP quiz each year to participate:
<https://www.pwrc.usgs.gov/Frogquiz/index.cfm?fuseaction=privateQuiz.StartPARKSQuiz>. Individual conducting the route should examine the sampling location during the daytime to facilitate ease of locating them. Weather conditions should be evaluated in advance of the survey to ensure there is not expectation of high winds or excessively low temperatures which would invalidate the survey.

Describe equipment used during the survey:

- Data sheets
- Map

- Wind gauge
- GPS

Describe detailed methodology (field and lab procedures)

Observer starts the survey 30 minutes after sunset. At each sampling location, the observer listens for a period of 5 minutes and records a calling index for each species of frog or toad heard. The route is run 1 time during each of 3 sampling periods. The survey route is conducted in the same order each time. The route is not surveyed if the temperature is too low or excessive winds (see MS Amphibian Monitoring Protocol – Appendix) for specific temperature and wind parameters.

Who conducts the survey: *(Include staff, interns, contractors, etc... if primary surveyors)*

Refuge Biologist, Refuge Manager, and Interns,

Section 4. Data Management

Specify data entry file format(s): *(Examples include MS Excel, MS Access, GIS, web dbs - e.g., SQL), etc...)*

Data are stored in an excel file. Data are uploaded to web-based portal of USGS-NAAMP

Specify data storage/archive location (hardcopy and electronic): *(Provide file names and locations here if applicable)*

Data sheets will be kept in the refuge files and scanned copies held on the refuge server.

Describe procedure for verifying/checking/securing the data:

Data sheets will be quality checked after returning from the field to ensure the forms have been properly filled out. Scanned copies of vetted forms will be uploaded to the Refuge Server as security against loss. Data are also vetted by the MS Amphibian Monitoring Program.

Describe methods/software used in data analysis:

No data analysis.

Section 5. Reporting

Describe reports developed from this survey:

(Include details on reporting schedule/frequency, distribution, archiving, etc... Include links and citations for previous reports if applicable.)

No detailed reports from the survey are expected to be written. Data are summarized and included in the N. MS National Wildlife Refuges Complex Annual Report.

Section 6. Other Survey Information

Comment on additional survey elements and issues to consider when implementing the survey:

None

Description of attachments/supplemental documents/data sets:

(Use the space below to describe supplemental documents - e.g., maps, appendices, etc included with this form)

Field data sheet for recording site observations is attached along with the MS Amphibian Monitoring Protocol. A map and coordinates of 10 sampling locations along the route is also attached.

Cite resources: *(Cite the source of the information in the form below, including personal communication and citations for published and gray literature)*

Mitchell, J. C. 2011. Amphibian and reptile research on Coldwater River National Wildlife Refuge, Mississippi. Unpublished Report, Mitchell Ecological Research Service, LCC, High Springs, FL. 66 pp.

<https://www.pwrc.usgs.gov/naamp/index.cfm?fuseaction=app.protocol>

https://www.mdwfp.com/media/129119/mamp_protocol.pdf

Submitted by and contact information:

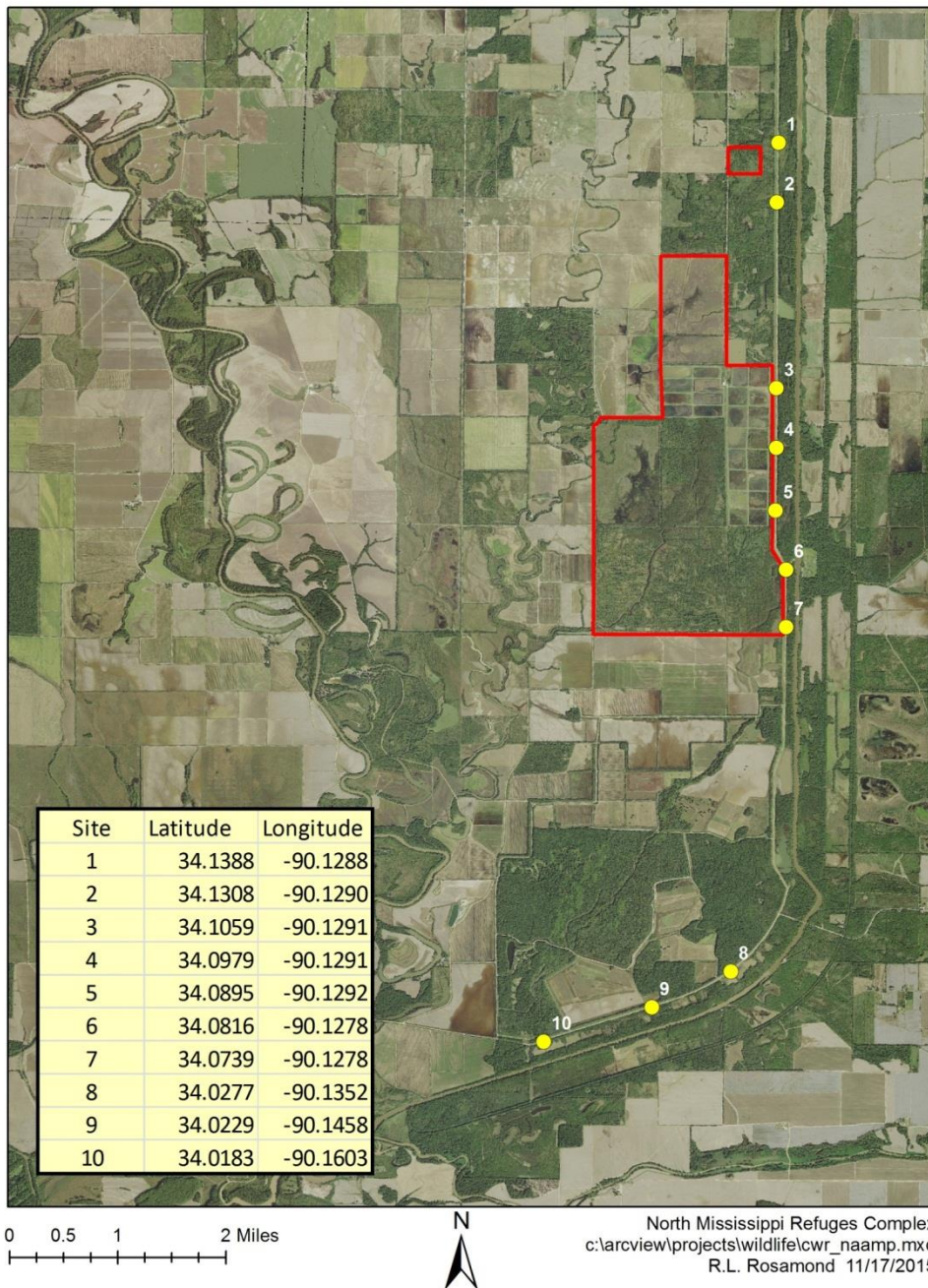
David Richardson, Terrestrial Ecologist, David_Richardson@fws.gov, 662 226-8286

Version Tracking *(You can use the table below to track updates to the Survey Instructions Record.)*

Version	Completed by	Date	Comments/material updated
1.0	David Richardson	11/6/2015	Original

Maps, Data Sheets and Appendices: *(You can insert maps and any appendices of information - e.g., progress tables, timelines, budgets, activity logs, etc..., directly into this document (Insert in Word document version or Attach to Adobe version)).*

Coldwater River National Wildlife Refuge NAAMP Route



Mississippi Amphibian Monitoring Program Protocol

Sampling periods

There are three seasonal sampling periods designed to cover the calling periods of all species. These sampling periods vary slightly depending on whether your route is located in the northern or southern part of the state. Each sampling window is 30 - 45 days long with a 2-week interval between sampling periods. Our sampling windows are as follows:

Region	1 st	2 nd	3 rd
Northern MS (north of 33°N):	Feb. 20 – Mar. 31	Apr. 15 – May 15	June 1 – July 1
Southern MS (south of 33°N):	Jan. 23 – Feb. 28	Apr. 1 – May 6	June 1 – July 1

Surveys should be conducted on the first available night when conditions are right (see below for survey conditions).

Nightly sampling conditions

A survey should begin 30 minutes or more after sunset and be completed no later than 1 a.m. Appropriate sampling conditions are based on wind, sky, and air temperature conditions. Wind should be at level 3 or less and surveys should not be conducted during heavy rainfall or during a thunderstorm. (Frogs frequently call less when it's windy and heavy rains/thunderstorms may prevent you from hearing the frogs.)

The air temperature criteria are the minimum allowable temperatures, varying for each sampling period. If you begin a survey and the temperature falls below the minimum required at more than 2 stops, abort the survey and redo it on a different night. (The entire survey must be run in a single night in order to submit data.) Those temperatures are as follows:

	Minimum Temperature
First period	5.6 °C (42 °F)
Second period	10 °C (50 °F)
Third period	12.8 °C (55 °F)

In general, humid nights and nights following a period of rain are the best nights to survey frogs.

Data collection

Stops are conducted in numerical order, in one night by one observer. Because survey ability varies between observers, it is encouraged (though not required) that the same observer conducts all surveys of a route in a given year. If friends accompany you on a survey and would like to collect data also, they should fill out a separate datasheet and should not contribute to your observations. This allows each survey conducted to be of

equal effort. All datasheets should be returned to the state coordinator as soon as possible. Please keep a copy in case it is lost in the mail.

Many of the wetlands we are surveying are located on private property. Please remain at the roadside during the survey and don't venture out to the wetland. If the wetland is located on public land that is accessible, feel free to return once you have completed the survey. However, the surveys themselves should be conducted from the roadside and not from the bank of the wetland.

Below is the basic protocol for conducting a survey.

1. Prior to starting your survey, fill out the front of the datasheet (route information and observer information).
2. When you arrive at your first survey point, record the time and check the appropriate boxes for sky and wind codes.
3. Walk a short distance from your vehicle (along the road) then listen for 5 minutes. After the 5 minute survey period is over, record the species heard and a calling index value for each species. Record the time you started listening, the number of cars that passed during the listening period, the temperature, whether or not moonlight was visible, and the noise index value.
4. Proceed to your next stop and repeat step 3 until you have completed all 10 stops.
5. After you finish your survey at site 10, record the time and check the appropriate boxes for sky and wind codes at the top of the sheet under "Finish". Double-check your datasheet to be certain that all data are in the appropriate row and column.

Amphibian Calling Index

- 1 – Individuals can be counted; there is space between calls
- 2 – Calls of individuals can be distinguished but there is some overlapping of calls
- 3 – Full chorus, calls are constant, continuous and overlapping

Note: Frequently individuals will stop and start calling during the listening period. Record the maximum calling index heard during the listening period. (i.e. if the frogs were chorusing at one point during the listening period, record it as a "3", even if they were silent by the end.)

Beauford Wind Codes

- 0 – Calm (< 1 mph) smoke rises vertically
- 1 – Light Air (1 – 3 mph) smoke drifts, weather vane inactive
- 2 – Light Breeze (4 – 7 mph) leaves rustle, can feel wind on face
- 3 – Gentle Breeze (8 – 12 mph) leaves and twigs move around, small flags extend
- 4* - Moderate Breeze (13 – 18 mph) moves thin branches, raises loose papers

* Do not conduct a survey at level 4 or greater.



North American Amphibian Monitoring Program



Observer Number:			
Route Information			
Route Number:	Route Name:	State:	Survey Date:
			Window Number:
Observer Information			
First Name:	MI:	Last Name:	
Please complete address or contact information in boxes below, only if it has changed.			
Street Address 1:	Street Address 2:		
City:	State:	Zip:	
Phone:	e-mail:		
Directions			
<p>Please be sure to complete the whole datasheet; don't forget the Date and Window Number above. At the start and finish of each run record the time, windspeed, and sky code. At each stop listen for 5 minutes, then record the amphibian calling index for each species heard and the additional requested information.</p> <p>We are asking all participants to record whether the moon or moonlight was visible at each stop. Please write Yes or No for each stop. In addition, it is now requested that all participants include a car count for each stop. If you have an assistant, he or she can count cars for you. All other data should be collected by one observer.</p> <p>There are two kinds of noise disturbance questions: "Noise index" is a numerical ranking of the level of disturbance encountered. The index descriptions are listed below. "Did you take a time out?" is for an unexpected noise disturbance that happens (such as a train) that lasts a minute or more, you may interrupt the 5 minute listening period to ignore the sudden disturbance, finish up the listening time after the disturbance has passed. Do not include this type of noise in the "was noise a factor" question.</p> <p>Index and Code Definitions Amphibian Calling Index 1 = Individuals can be counted; there is space between calls 2 = Calls of individuals can be distinguished but there is some overlapping of calls 3 = Full chorus, calls are constant, continuous and overlapping</p> <p>Sky Codes 0 = Few clouds 1 = Partly cloudy (scattered) or variable sky 2 = Cloudy or overcast 4 = Fog or smoke 5 = Drizzle or light rain (not affecting hearing ability) 7 = Snow 8 = Showers (is affecting hearing ability) do not conduct survey</p> <p>Beaufort Wind Codes 0 = Calm (<1mph) smoke rises vertically 1 = Light Air (1-3 mph) smoke drifts, weather vane inactive 2 = Light Breeze (4-7 mph) leaves rustle, can feel wind on face 3 = Gentle Breeze (8-12 mph) leaves and twigs move around, small flag extends 4* = Moderate Breeze (13-18 mph) moves thin branches, raises loose papers *do not conduct survey at Level 4, unless in Great Plains region 5** = Fresh Breeze (19 mph or greater) small trees begin to sway **do not conduct survey at Level 5, ALL REGIONS</p> <p>Noise Index 0 = No appreciable effect (e.g. owl calling) 1 = Slightly affecting sampling (e.g. distant traffic, dog barking, 1 car passing) 2 = Moderately affecting sampling (e.g. nearby traffic, 2-5 cars passing) 3 = Seriously affecting sampling (e.g. continuous traffic nearby, 6-10 cars) 4 = Profoundly affecting sampling (e.g. continuous traffic passing, construction noise)</p>			
Additional Notes:			
<p>PAPERWORK REDUCTION ACT STATEMENT: A Federal agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a currently valid OMB control number. Public burden for the collection of this information is estimated to average 7 hours per response. Comments regarding this collection of information should be directed to the Bureau Clearance Officer, U.S. Geological Survey, 807 National Center, Reston, Virginia 20192. OMB NO. 1028-0078 Expiration Date: 3 / 31 / 2008</p>			

--Please turn over to continue filling in survey form --



1.09 Groundwater Table Monitoring Survey Instructions – Field Form

Purpose

Documenting survey design and methods maintains the scientific integrity of refuge biological programs and guards against information loss over time. The Survey Instructions field form was developed to assist refuges in recording important biological survey information and will enhance survey integrity by ensuring that survey procedures are clear and consistent. It will provide additional benefits, including: Serve as Initial Survey Instructions (ISI) (701 FW 2), and an initial step in development of formal NWRS survey protocols; Capture information valuable in development of Inventory and Monitoring Plans (IMP); Augment survey information in the Planning and Review of Inventory and Monitoring ([PRIMR](#)) database; Reveal multi-refuge and landscape-level data inference opportunities.

Using the Initial Survey Instructions Field Form

Staff should use this tool for all on-going surveys, particularly those high priority refuge-based surveys where protocols are not available, and followed by cooperative and/or coordinated surveys with important refuge-specific elements of implementation. The information provided in the ISI form should be as thorough and complete as possible; however it is acceptable to leave fields or sections empty if particular survey information is unknown. Provide completed forms to your I&M ecologist, who will archive it on [Fishnet](#) and link it to the survey record in PRIMR for long-term reference. Regional I&M staff ecologists can assist refuge staff with completing the Survey Instructions. If the Survey Instructions are updated over time, we recommend saving updates as versions (e.g., version 2.0).

Survey Name: Ground Water Table Monitoring

This survey occurs on: ☒ Single refuge only ☐ Multiple refuges

Refuge Name(s): Coldwater River NWR

Background/Survey Justification:

This survey will provide baseline information about seasonal and long-term changes in the groundwater table on the refuge. The bottomland hardwood ecosystem of the MAV has been irrevocably altered by flood abatement projects along the Mississippi River, the main tributaries, and the subsequent land clearing of the region for forest products and large-scale agricultural production of cotton and cereal grains. The hydrology of the system continues to be modified as agricultural practices remove small wetlands, improve ditches to facilitate dewatering of fields, and level the landscape for irrigation efficiency. Over the past 20 years, the reliance on groundwater irrigation for corn, milo, rice, and soybeans production has grown to immense proportion compared to non-irrigated agriculture. Coldwater River NWR is a habitat fragment of bottomland hardwood and moist-soil units within this agricultural-dominated landscape that extensively uses irrigation. The plant community and associated fauna is a function of this forested wetland system. In addition, the refuge on a limited scale uses several existing wells to irrigate moist-soil and cereal grain units or flood these impoundments in fall for waterfowl. Data from the USGS Groundwater Watch shows significant below average levels for large areas of the MAV. These wetlands provide critical support to herpetofauna and many invertebrate species. Also, soil-moisture gradients provide the basis for the existing and future plant communities. Continued alterations to the groundwater table could have major negative effects. The changes in the groundwater table may be further influenced by climate change.

Understanding the current rate of groundwater removal and the potential for recharge around the refuge is needed to evaluate long-term management of the forested community.

Section 1. Survey Targets & Objectives

Target Species/Taxa/Community:

Groundwater

Target Habitat(s):

Not Applicable.

Survey Objective(s):

1. This survey will provide baseline information about seasonal and long-term changes in the groundwater table on the refuge

Section 2. Survey Design

For Collaborative Surveys

☒ **This survey is part of a collaborative State, Regional, or National survey:**

Coordinating organization(s) and contact information:

USGS Groundwater Table Network and Yazoo Water Management Board.

Is there an established protocol for the survey? ☒ Yes ☐ No ☐ In Prep (☐ Not Sure)

Protocol Name, citation and/or link to documentation:

Detailed methods for conducting manual well monitoring is provided at:
http://www.ecy.wa.gov/PROGRAMS/eap/qa/docs/ECY_EAP_SOP_ManualWellDepth&DepthtoWaterMeasures_v_1_1EAP052.pdf

Are there refuge-specific elements of implementation? ☒ Yes ☐ No (☐ Not Sure)
(If yes, also specify refuge-specific details in the section below.)

For Surveys with Refuge-Specific Details (Collaborative OR unique Refuge Surveys)

☒ **This survey has refuge-specific design elements:**

Year of survey origin: *(Add year of survey modification after origin if applicable.)*
2016

Are specific sampling units identified? ☒ Yes ☐ No (☐ Not Sure)

Type of sampling unit (sampling geometry):

☐ Route/linear transect ☒ Plot ☐ Point ☐ Other:

Do sampling units remain fixed (i.e., same location from year to year)?

☒ Yes ☐ No (☐ Not Sure)

Describe sampling design: *(e.g., study area of interest, how sampling units were selected or modified over time, if stratified sampling area, sample size, etc...)*

Existing irrigation wells will be the principal sampling locations. These are scattered across the refuge. If additional sampling wells are needed, they will be based on strategically placing them across the refuge. Shallow wells will be located near existing roads to facilitate installation but a minimum of 100 yards from permanent water.

Describe survey timing: *(Examples include # repeat visits each year, months, season, time of day, etc...)*

Wells will be monitored a minimum of 2 times annually, in April and September. This will capture groundwater levels following peak irrigation times for agriculture (September) and the peak water table recharge prior to the irrigation of agricultural fields following the wet season (April). Additional surveys may occur in July and August when extensive irrigation occurs regionally.

Section 3. Survey Methods

Primary metrics collected:

- Depth to ground water – measurements will be converted to an elevation based on mean sea level.

How are sites marked? *(Examples include GPS waypoints, flagging, etc...)*

Wells are marked by prominent well heads or posts. The coordinates for each well have been obtained by GPS and mapped..

Describe preparatory requirements for the survey: *(Examples include permits, training, contracts, other logistics, etc...)*

No permits are needed for drilling new wells less than 6 inches in diameter.

Describe equipment used during the survey:

- Data sheets
- Well boring machine and associated piping to construct new wells
- Map of survey route/area
- High-end survey equipment to derive a x-y horizontal and z-vertical reference point at each well.
- Water level sounder, solonist, or tape device to measure depth to water in the well.

Describe detailed methodology (field and lab procedures)

Detailed methods for conducting manual well monitoring is provided at:

http://www.ecy.wa.gov/PROGRAMS/eap/qa/docs/ECY_EAP_SOP_ManualWellDepth&DepthtoWaterMeasurements_v_1_1EAP052.pdf

Deviation from this procedure will occur if using a water level sounder or similar electronic monitoring device. Use of these devices should be evaluated based on the owner's manuals.

Well measurements will be based on established reference points for each well. This is critical as all changes in static water level are based against this defined point. Also at each well, this measuring point should be cross referenced to the land surface datum at the well head.

Though the wells to be evaluated are not public drinking water sources, there is the possibility that during measurements of the well contaminants could be introduced into the aquifer. Water level measuring equipment must be cleaned, disinfected or decontaminated prior to and after use in each well.

Well measurements will be recorded to the nearest inch and ambient temperature recorded. Ancillary comments regarding recent irrigation activities near the well head should be recorded.

Who conducts the survey: *(Include staff, interns, contractors, etc... if primary surveyors)*

Refuge Biologist, Refuge Manager

Section 4. Data Management

Specify data entry file format(s): *(Examples include MS Excel, MS Access, GIS, web dbs - e.g., SQL), etc..)*

Data are stored in an excel file at the refuge

Specify data storage/archive location (hardcopy and electronic): *(Provide file names and locations here if applicable)*

Data sheets retained for a period in the refuge file cabinets, scanned copies of the data sheets on Refuge Server. Data may eventually be placed with the USFS Groundwater Table Network.

Describe procedure for verifying/checking/securing the data:

Data sheets will be quality checked after returning from the field to ensure the forms have been properly filled out and that changes in water levels from previous measurements are within anticipated levels of change (< 5 feet). Scanned copies of vetted forms will be uploaded to the Refuge Server as security against loss.

Describe methods/software used in data analysis:

No data analysis anticipated though changes in well measurements may be graphically displayed.

Section 5. Reporting

Describe reports developed from this survey:

(Include details on reporting schedule/frequency, distribution, archiving, etc... Include links and citations for previous reports if applicable.)

No detailed reports from the survey are being written specific to the data collected on the refuge. Regional changes in groundwater table may be developed from the USGS Groundwater Table Network. Summary graph of changes in well measurements may be included in the Annual Report for N. MS. Refuges Complex.

Section 6. Other Survey Information

Comment on additional survey elements and issues to consider when implementing the survey:

None

Description of attachments/supplemental documents/data sets:

(Use the space below to describe supplemental documents - e.g., maps, appendices, etc included with this form)

None

Cite resources: *(Cite the source of the information in the form below, including personal communication and citations for published and gray literature)*

http://www.ecy.wa.gov/PROGRAMS/eap/qa/docs/ECY_EAP_SOP_ManualWellDepth&DepthtoWaterMeasures_v_1_1EAP052.pdf

Submitted by and contact information:

David Richardson, Terrestrial Ecologist, David_Richardson@fws.gov, 662 226-8286

Version Tracking *(You can use the table below to track updates to the Survey Instructions Record.)*

Version	Completed by	Date	Comments/material updated
1.0	David Richardson	11/6/2015	Original

Maps, Data Sheets and Appendices: *(You can insert maps and any appendices of information - e.g., progress tables, timelines, budgets, activity logs, etc..., directly into this document (Insert in Word document version or Attach to Adobe version)).*

No Attachments.



1.10 Hunter Use and Harvest Monitoring Survey Instructions – Field Form

Purpose

Documenting survey design and methods maintains the scientific integrity of refuge biological programs and guards against information loss over time. The Survey Instructions field form was developed to assist refuges in recording important biological survey information and will enhance survey integrity by ensuring that survey procedures are clear and consistent. It will provide additional benefits, including: Serve as Initial Survey Instructions (ISI) (701 FW 2), and an initial step in development of formal NWRS survey protocols; Capture information valuable in development of Inventory and Monitoring Plans (IMP); Augment survey information in the Planning and Review of Inventory and Monitoring ([PRIMR](#)) database; Reveal multi-refuge and landscape-level data inference opportunities.

Using the Initial Survey Instructions Field Form

Staff should use this tool for all on-going surveys, particularly those high priority refuge-based surveys where protocols are not available, and followed by cooperative and/or coordinated surveys with important refuge-specific elements of implementation. The information provided in the ISI form should be as thorough and complete as possible; however it is acceptable to leave fields or sections empty if particular survey information is unknown. Provide completed forms to your I&M ecologist, who will archive it on [Fishnet](#) and link it to the survey record in PRIMR for long-term reference. Regional I&M staff ecologists can assist refuge staff with completing the Survey Instructions. If the Survey Instructions are updated over time, we recommend saving updates as versions (e.g., version 2.0).

Survey Name: Hunter Use and Harvest Monitoring

This survey occurs on: ☒ Single refuge only ☐ Multiple refuges

Refuge Name(s): Coldwater River NWR

Background/Survey Justification:

This survey is designed to estimate the annual harvest of waterfowl on the refuge and the number of individuals hunting on a daily basis. The National Wildlife Refuge Improvement Act of 1997, Public Law 105-57 provides recognition that wildlife-dependent recreational uses involving hunting, fishing, wildlife observation and photography, and environmental education and interpretation, when determined to be compatible, are legitimate and appropriate public uses of the Refuge System. Coldwater River NWR has very limited hunting opportunities given the relatively small size (<2500 acres) and the focus on providing contiguous areas of sanctuary. Monitoring hunter participation and waterfowl harvested allows assessment of compatibility so as not to interfere with the establishing purposes for the refuge (U.S. Fish and Wildlife Service 2005). Waterfowl have been identified as a resource of concern for the refuge.

Section 1. Survey Targets & Objectives

Target Species/Taxa/Community:

Waterfowl harvested and number of daily hunters.

Target Habitat(s):

Areas open to public hunting for waterfowl

Survey Objective(s):

1. Census the annual harvest of waterfowl taken on Coldwater River NWR
2. Census the number of individuals hunting on Coldwater River NWR on a daily basis.

Section 2. Survey Design

For Collaborative Surveys

☐ This survey is part of a collaborative State, Regional, or National survey:

Coordinating organization(s) and contact information:

Nationally the data may eventually be incorporated into the Integrated Waterbird Monitoring and Management Initiative

Is there an established protocol for the survey? ☐ Yes ☐ No ☐ In Prep (☐ Not Sure)

Protocol Name, citation and/or link to documentation:

Are there refuge-specific elements of implementation? ☒ Yes ☐ No (☐ Not Sure)
(If yes, also specify refuge-specific details in the section below.)

For Surveys with Refuge-Specific Details (Collaborative OR unique Refuge Surveys)

☒ This survey has refuge-specific design elements:

Year of survey origin: (Add year of survey modification after origin if applicable.)
1992

Are specific sampling units identified? ☒ Yes ☐ No (☐ Not Sure)

Type of sampling unit (sampling geometry):

☐ Route/linear transect ☒ Plot ☐ Point ☒ Other:

Census of all harvested waterfowl and hunter participation is obtained for the area designated as open to the public for hunting.

Do sampling units remain fixed (i.e., same location from year to year)?

☒ Yes ☐ No (☐ Not Sure)

Describe sampling design: *(e.g., study area of interest, how sampling units were selected or modified over time, if stratified sampling area, sample size, etc...)*

None – monitoring data is a census of the total harvest of waterfowl and numbers of hunter participating in the hunt on a daily basis.

Describe survey timing: *(Examples include # repeat visits each year, months, season, time of day, etc...)*

Data are collected for the entire waterfowl hunting season on the refuge (September - March)

Section 3. Survey Methods

Primary metrics collected:

- Number of waterfowl by species harvested per day
- Number of hunters per day.

How are sites marked? *(Examples include GPS waypoints, flagging, etc...)*

Waterfowl hunting zone is clearly signed around the perimeter – public use access points and harvest use data card collection locations are delineated on refuge brochures.

Describe preparatory requirements for the survey: *(Examples include permits, training, contracts, other logistics, etc...)*

Daily use cards need to be provisioned on a regular basis.

Describe equipment used during the survey:

- Daily use cards – see attachment

Describe detailed methodology (field and lab procedures)

Daily use cards are filled out by each hunter as part of a mandatory compliance component of the refuge hunt permit. The hunter returns the card to the check station at the end of each day of hunting regardless if he successfully takes any waterfowl.

Who conducts the survey: *(Include staff, interns, contractors, etc... if primary surveyors)*

Refuge Biologist, Refuge Manager

Section 4. Data Management

Specify data entry file format(s): *(Examples include MS Excel, MS Access, GIS, web dbs - e.g., SQL), etc..)*

Data are stored in an Access Database file at the refuge.

Specify data storage/archive location (hardcopy and electronic):
(Provide file names and locations here if applicable)

Data are stored on the refuge server and uploaded to ServCat on an annual basis.

Describe procedure for verifying/checking/securing the data:

Data cards are self-populated by the public. No means of verifying data entered on the form.

Describe methods/software used in data analysis:

Summary counts of daily harvest and hunter participation as well as overall census information are obtained using Access.

Section 5. Reporting

Describe reports developed from this survey:

(Include details on reporting schedule/frequency, distribution, archiving, etc... Include links and citations for previous reports if applicable.)

Summary information is included in the annual narrative for the N. Mississippi National Wildlife Refuges Complex and reported in the Refuge Annual Performance Plan.

Section 6. Other Survey Information

Comment on additional survey elements and issues to consider when implementing the survey:

Description of attachments/supplemental documents/data sets:

(Use the space below to describe supplemental documents - e.g., maps, appendices, etc included with this form)

Copy of the uniform Daily Use Card used to obtain harvest and hunter use information.

Cite resources: *(Cite the source of the information in the form below, including personal communication and citations for published and gray literature)*

U.S. Fish and Wildlife Service. 2005. North Mississippi Wildlife Refuges Complex Comprehensive Conservation Plan. U.S. Fish and Wildlife Service, Southeast Region, Atlanta, GA. 231 pp.

Submitted by and contact information:

David Richardson, Terrestrial Ecologist, David_Richardson@fws.gov, 662 226-8286

Version Tracking *(You can use the table below to track updates to the Survey Instructions Record.)*

Version	Completed by	Date	Comments/material updated
1.0	David Richardson	11/6/2015	Original

Maps, Data Sheets and Appendices: *(You can insert maps and any appendices of information - e.g., progress tables, timelines, budgets, activity logs, etc..., directly into this document (Insert in Word document version or Attach to Adobe version)).*

Daily use card:

U.S. Fish & Wildlife Service		OMB Control Numbr 1018-0140 Expires 01/31/2012	
National Wildlife Refuge System / Big Game Harvest Report			
Name of Refuge: _____		Hunt area (unit, zone, description): N/A	
Hunter name: _____		City, State, ZIP: _____	
Date of hunt: _____		Time: N/A Total hours hunted: N/A Number in party: N/A	
Species	Number Harvested	Male/Female	Size*
<small>Note: Not all species are hunted on this refuge. Check refuge regulations for details.</small>			
Deer			
Feral Hog			
Turkey			
Other (specify):			
<small>*points, approximate weight, beard length or other appropriate measure.</small>			



1.11 Stream Temperature Monitoring Survey Instructions – Field Form

Purpose

Documenting survey design and methods maintains the scientific integrity of refuge biological programs and guards against information loss over time. The Survey Instructions field form was developed to assist refuges in recording important biological survey information and will enhance survey integrity by ensuring that survey procedures are clear and consistent. It will provide additional benefits, including: Serve as Initial Survey Instructions (ISI) (701 FW 2), and an initial step in development of formal NWRS survey protocols; Capture information valuable in development of Inventory and Monitoring Plans (IMP); Augment survey information in the Planning and Review of Inventory and Monitoring ([PRIMR](#)) database; Reveal multi-refuge and landscape-level data inference opportunities.

Using the Initial Survey Instructions Field Form

Staff should use this tool for all on-going surveys, particularly those high priority refuge-based surveys where protocols are not available, and followed by cooperative and/or coordinated surveys with important refuge-specific elements of implementation. The information provided in the ISI form should be as thorough and complete as possible; however it is acceptable to leave fields or sections empty if particular survey information is unknown. Provide completed forms to your I&M ecologist, who will archive it on [Fishnet](#) and link it to the survey record in PRIMR for long-term reference. Regional I&M staff ecologists can assist refuge staff with completing the Survey Instructions. If the Survey Instructions are updated over time, we recommend saving updates as versions (e.g., version 2.0).

Survey Name: Stream Temperature Monitoring

This survey occurs on: ☒ Single refuge only ☐ Multiple refuges

Refuge Name(s): Coldwater River NWR

Background/Survey Justification:

This survey will provide baseline information about seasonal and long-term changes in the water temperature on the refuge and contribute to a broader understanding of stream temperature variation across the region. Building a foundation for a spatially continuous map of waterbody temperatures on refuges and neighboring waters in the southeastern United States is an initiative to better understand the effects of abiotic factors on the distribution of aquatic organisms and ecosystem health (U.S. Fish and Wildlife Service 2014). Significant changes in aquatic biodiversity are influenced by water temperature extremes. Across the Southeast, there is a paucity of information about daily and seasonal stream temperature regimes which influence the biodiversity and potentially relate to land-use practices in the drainage and climate change. This survey was selected because it supports a collaborative regional effort to fill existing stream temperature gaps and provides important information to the refuge regarding aquatic systems

Section 1. Survey Targets & Objectives

Target Species/Taxa/Community:

Aquatic Community

Target Habitat(s):

Survey targets moving aquatic systems. However, the 2 sites on the refuge are intermittent and have long periods of stagnation or may dewater completely during late summer and fall

Survey Objective(s):

1. Determine seasonal and annual changes in stream temperatures across the southeast U.S.
2. Correlate stream temperature changes with respect to aquatic organism(s estimate the number of waterbirds using each management unit that can be surveyed by a vehicle.
3. Evaluate changes in stream temperature with regards to surrounding land-use practices and changes in ambient air temperature.

Section 2. Survey Design

For Collaborative Surveys

☒ **This survey is part of a collaborative State, Regional, or National survey:**

Coordinating organization(s) and contact information:

Ecological Services, Drought Assessment and Response Team (DART), Region 4. Data may also support a larger eastern North America initiative collecting similar information.

Is there an established protocol for the survey? ☐ Yes ☒ No ☐ In Prep (☐ Not Sure)

Protocol Name, citation and/or link to documentation:

None

Are there refuge-specific elements of implementation? ☒ Yes ☐ No (☐ Not Sure)
(If yes, also specify refuge-specific details in the section below.)

For Surveys with Refuge-Specific Details (Collaborative OR unique Refuge Surveys)

☒ **This survey has refuge-specific design elements:**

Year of survey origin: *(Add year of survey modification after origin if applicable.)*
2014

Are specific sampling units identified? ☒ Yes ☐ No (☐ Not Sure)

Type of sampling unit (sampling geometry):

☐ Route/linear transect ☒ Plot ☐ Point ☐ Other:

Do sampling units remain fixed (i.e., same location from year to year)?

☒ Yes ☐ No (☐ Not Sure)

Describe sampling design: *(e.g., study area of interest, how sampling units were selected or modified over time, if stratified sampling area, sample size, etc...)*

Sampling sites were selected based on limited availability of aquatic drainages on the refuge. No effort was made to randomize the selection process. (See maps for specific sampling locations)

Describe survey timing: *(Examples include # repeat visits each year, months, season, time of day, etc...)*

Annually – download data in late August – October.

Section 3. Survey Methods

Primary metrics collected:

- Hourly water temperature.

How are sites marked? *(Examples include GPS waypoints, flagging, etc...)*

A metal t-post identifies the location of the data logger in the water. Waypoints have been taken to locate the sites and the coordinates have been placed on the survey forms with a map.

Describe preparatory requirements for the survey: *(Examples include permits, training, contracts, other logistics, etc...)*

The observer must be familiar with the process to use the Hobo Shuttle to download the data from each Tidbit data logger.

Describe equipment used during the survey:

- Data sheets
- Hobo Shuttle – used to download data.
- Zip ties
- Knife or Pliers
- Map of sampling locations
- Hip boots or Chest Waders.
- Precision thermometer

Describe detailed methodology (field and lab procedures)

Stream temperature data loggers have already been deployed to the field for long-term recording. Annually, the data from these units will be down loaded using a Hobo Shuttle. A data sheet is filled out to indicate the unique ID of the data logger and the date and time of the download. A corresponding water temperature is taken 1 minute before the hour, on the hour, and 1 minute after the hour in direct proximity to the data logger using a precision thermometer. This provides a cross-comparison of the temperature data logger to be certain it working correctly. Data are downloaded by holding the data logger against the electronic light reader of the shuttle. One needs to be certain the light sensor on the data logger is clean and free of debris or else the data transfer will fail. Batteries in the data logger are not replaceable but the unit is capable of collecting data for 5 years.

Who conducts the survey: *(Include staff, interns, contractors, etc... if primary surveyors)*

Refuge Biologist, Refuge Manager

Section 4. Data Management

Specify data entry file format(s): *(Examples include MS Excel, MS Access, GIS, web dbs - e.g., SQL), etc...)*

Data are stored in a proprietary format of the manufacturer of the Hobo Tidbit Temperature data logger. Metadata for each survey year are maintained in an MS Access Database by the Drought Assistance Response Team (DART) in Ecological Services Office, Cookeville, TN.

Specify data storage/archive location (hardcopy and electronic): *(Provide file names and locations here if applicable)*

Data sheets retained for a period in the refuge file cabinets, scanned copies of the data sheets and the downloaded temperature data are kept on the Refuge Server under the folder [\\ifw4fo-msnmc1-](#) Stream_Temperature_Data

Describe procedure for verifying/checking/securing the data:

Data sheets will be quality checked after returning from the field to ensure the forms have been properly filled out. Scanned copies of vetted forms and the downloaded data will be uploaded to the Refuge Server as security against loss and also submitted to the DART for permanent retention of the data.

Describe methods/software used in data analysis:

Data summary will be graphically displayed from the Hobo Shuttle Software.

Section 5. Reporting

Describe reports developed from this survey:

(Include details on reporting schedule/frequency, distribution, archiving, etc... Include links and citations for previous reports if applicable.)

No detailed reports from the survey are being written specific to the data collected on the refuge. Summary information is included in the annual narrative for the N. Mississippi National Wildlife Refuges Complex. Data from the Refuge surveys may be utilized for regional scale analysis and reporting Drought Response Assessment Team, Region 4.

Section 6. Other Survey Information

Comment on additional survey elements and issues to consider when implementing the survey:

None.

Description of attachments/supplemental documents/data sets:

(Use the space below to describe supplemental documents - e.g., maps, appendices, etc included with this form)

Initial survey field forms describing the location of the 2 temperature data loggers. Blank field forms for subsequently downloading data on an annual basis are also attached.

Cite resources: *(Cite the source of the information in the form below, including personal communication and citations for published and gray literature)*

U.S. Fish and Wildlife Service. 2014. Building a foundation for spatially continuous map of waterbody temperatures on refuges and neighboring waters in the southeastern United States. Region 4, Atlanta, GA. 2 pp.

Submitted by and contact information:

David Richardson, Terrestrial Ecologist, David_Richardson@fws.gov, 662 226-8286

Version Tracking *(You can use the table below to track updates to the Survey Instructions Record.)*

Version	Completed by	Date	Comments/material updated
1.0	David Richardson	11/6/2015	Original

Maps, Data Sheets and Appendices: (You can insert maps and any appendices of information - e.g., progress tables, timelines, budgets, activity logs, etc..., directly into this document (Insert in Word document version or Attach to Adobe version)).

USFWS Southeast Region Temperature Monitoring Network – Logger Deployment Datasheet

Header/Station Information

Date: 8/27/2014

Station ID: CLD 01 Station Name: Hurricane Bayou North

Facility Name: Coldwater River NWR State: MS County: Quitman

Site Coordinates (planned) Latitude: 34.10163 Longitude: -90.13857

Recorder: Becky Rasmund Add'l Crewmembers: Will Duncan

Logger Information (water)

Logger Information (air)

Type (check one): ☒ TidbiT ☐ Water Temp Pro v2 ☐ TidbiT ☐ Water Temp Pro v2
☐ Pendant ☐ Level Logger (U24) ☐ Pendant ☐ Level Logger (U24)

Serial No.: 10416351 Samp. Interval (min.): 30 min Serial No.: _____ Samp. Interval (min.): _____

Programmed Start Date: 8/27/14 Time: 1800 CT Programmed Start Date: _____ Time: _____

Deployment Information

Units (m and °C preferred) Distance: ___ m ___ ft Temperature: ___ °C ___ °F

Water Temperature Logger WP 157

GPS lat.: N 34.10163 Datum: NAD 84

GPS long.: W 090.13857

Water Depth: 18" Logger Depth: 16"

Ht above streambed: 2" Time installed: 17:51

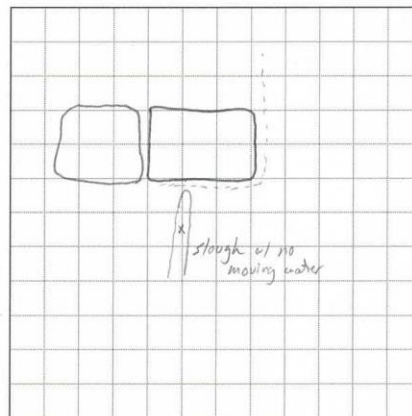
Air Temperature Logger

GPS lat.: _____ Time installed: _____

GPS long.: _____

Ht above stream: _____ Ht above ground: _____

Site Sketch



Time	Air Temp	Water Temp
17:50	33.5	27.5

Weather/Comments

Water Temperature Logger Location:

Air Temperature Logger Location:

Photos

No. or Filename	Description	No. or Filename	Description
0365	Deployment location		
0366	" "		
0367	Deployment method - f-post		

USFWS Southeast Region Temperature Monitoring Network – Logger Deployment Datasheet

Header/Station Information

Date: 8/27/2014

Station ID: CLD 02 Station Name: Hurricane Bayou @ S. Levee
 Facility Name: Coldwater NWR State: MS County: Quitman
 Site Coordinates (planned) Latitude: 34.07397 Longitude: -90.15211
 Recorder: Bill Duncan Add'l Crewmembers: Becky Rosemond

Logger Information (water)

Logger Information (air)

Type (check one): ☒ TidbiT ☐ Water Temp Pro v2
☐ Pendant ☐ Level Logger (U24)
 Serial No.: 10416350 Samp. Interval (min.): 30
 Programmed Start Date: 8/27/2014 Time: 1700 CT

Type (check one): ☐ TidbiT ☐ Water Temp Pro v2
☐ Pendant ☐ Level Logger (U24)
 Serial No.: _____ Samp. Interval (min.): _____
 Programmed Start Date: _____ Time: _____

Deployment Information

Units (m and °C preferred) Distance: _____ m _____ ft Temperature: ☒ °C _____ °F

Water Temperature Logger WP156

GPS lat.: N 34.07397 Datum: WGS-84
 GPS long.: W 090.15211
 Water Depth: 10" Logger Depth: 9"
 Ht above streambed: 1" Time installed: 16:55

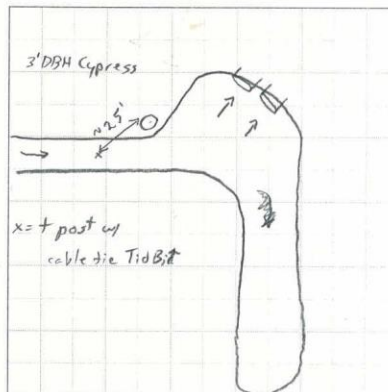
Air Temperature Logger

GPS lat.: _____ Time installed: _____
 GPS long.: _____
 Ht above stream: _____ Ht above ground: _____

Time	Air Temp	Water Temp
4:55	34.5	35.5

Weather/Comments

Site Sketch



Water Temperature Logger Location:

Air Temperature Logger Location:

Photos

No. or Filename	Description	No. or Filename	Description
IMG_0363	Deployment method - t-post		
0364	" " " " " location		
0365			

USFWS Southeast Region Temperature Monitoring Network – Logger Deployment Datasheet

Header/Station Information

Date: _____

Station ID: _____ Station Name: _____

Facility Name: _____ State: _____ County: _____

Site Coordinates (planned) Latitude: _____ Longitude: _____

Index Gage (station name): _____ Station No.: _____

(Nearby gaging station to monitor when flow conditions are suitable for a site visit)

Visit Information

Visit Type: ☐ Initial deployment ☐ Re-visit (download data) ☐ Re-visit (replace logger)
☐ Decommissioning (remove logger)

Recorder: _____ Add'l Crewmembers: _____

Index Gage Reading (☐ Discharge ☐ Stage)

Value: _____ Units: _____ Date: _____ Time: _____

Logger Information (logger that will be collecting data)

Type (check one): ☐ TidbiT ☐ Water Temp Pro v2 ☐ Pendant ☐ Level Logger (U24)

Serial No.: _____ Samp. Interval (min.): _____ Programmed Start Date: _____ Time: _____

Logger Information (logger replaced or removed on this visit, if applicable)

Type (check one): ☐ TidbiT ☐ Water Temp Pro v2 ☐ Pendant ☐ Level Logger (U24)

Serial No.: _____ Samp. Interval (min.): _____ Programmed Start Date: _____ Time: _____

Field Thermometer Information

Type: _____ Serial No.: _____

Deployment Information

Units (m and °C preferred) Distance: _____ m _____ ft Temperature: _____ °C _____ °F

Water Temperature Cross-Section Measurement

(If site conditions allow, measure water temp at approx. midpoint of water column at midpoints of 5 equal width increments—e.g., at 0.1, 0.3, 0.5, 0.7 and 0.9 x the wetted width. Left and right banks are defined facing downstream.)

Wetted width: _____ Increment width: _____

Bank from which distance is measured: ☐ L ☐ R

Dist.	Time	Temp	Comments

Validation Check of Existing Logger Deployment

(If a logger is currently deployed, measure temperature at the logger location at approx. 1-min. intervals starting 2 min. before the scheduled logging time.)

	1	2	3	Avg.
Time				
Temp.				

Time logger removed from water: _____

Logger status when removed: ☐ Active ☐ Inactive

Logger Condition:

USFWS Southeast Region Temperature Monitoring Network – Logger Deployment Datasheet (p. 2)

Station ID: _____

Date: _____

Logger Deployment/Redeployment

Time installed: _____ GPS Datum: _____

GPS lat.: _____

GPS long.: _____

Water depth: _____ Wetted width: _____

Logger depth: _____ Ht above streambed: _____

Logger Temperature Validation Check

(After logger has been in place at least 5-10 min., measure temperature at the logger location at approx. 1-min. intervals starting 2 min. before the next scheduled logging time.)

	1	2	3	Avg.
Time				
Temp.				

Logger Location Description:

Photos

Time	No. or Filename	Description

Site Sketch

Additional Comments

IMP Revision Signature Page

IMP Revisions Coldwater River National Wildlife Refuge

<i>Action</i>	<i>Signature /Printed Name</i>	<i>Date</i>
Survey list and priority changed:		
Submitted By:	Refuge Manager/Project Leader	
Reviewed By:	Regional I&M Coordinator	
Approved By:	Refuge Supervisor	