

U.S. Fish and Wildlife Service
U.S. Department of the Interior



National Wildlife Refuge System

Site-Specific Protocol for Monitoring the Red-cockaded Woodpecker Population

Great Dismal Swamp National Wildlife Refuge

Survey ID Number: FF05RDIS00-024 (Red-Cockaded Woodpecker Monitoring)



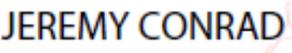
Version 1.0

September 2021

ON THE COVER

Bryan Watts with the William and Mary Center for Conservation Biology climbs a ladder to place a Red-cockaded Woodpecker (*Picoides borealis*) into a cavity for translocation into Great Dismal Swamp National Wildlife Refuge for reintroduction in 2015
Photograph by: Bobby B. Clontz, The Nature Conservancy

Great Dismal Swamp NWRs Survey Protocol Signature Page

Protocol Title: Site-Specific Protocol for Monitoring the Red-cockaded Woodpecker Population on Great Dismal Swamp National Wildlife Refuge Version¹: 1.0				
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Approvals				
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Regional I&M ⁴ Approval:	NA			
National I&M ⁵ Approval:	NA			
Version¹	Date	Author	Change Made	Reason for Change

¹ Version is a decimal number with the number left of decimal place indicating the number of times this protocol has been approved (e.g., first approved version is 1.0.; prior to first approval all versions are 0.x; after first approval, all minor changes are indicated as version 1. x until the second approval and signature, which establishes version 2.0, and so on).

² Signature of station representative designated lead in development of a site-specific survey protocol.

³ Signature signifies approval of a site-specific survey protocol.

⁴ Signature by Regional I&M Coordinator signifies approval of a protocol framework to be used at multiple stations within a Region.

⁵ Signature by National I&M Coordinator signifies approval of a protocol used at multiple stations from two or more Regions.

Survey Protocol Summary

This site-specific protocol (SSP) for Great Dismal Swamp National Wildlife Refuge (NWR) is based on the Regional Protocol Framework for Monitoring of Red-cockaded Woodpecker (RCW) Populations on NWRs (Richardson et al. 2021). The SSP provides specific methods to conduct an RCW population census for cluster activity, breeding season group size, group composition, fecundity, and translocation on Great Dismal Swamp NWR to reach the goal of establishing a second viable breeding population in Virginia and establish a minimum of at least five (5) breeding clusters; working towards a total of 10 breeding clusters.

As a step down from the Regional Protocol Framework, the SSP addresses the same eight elements (introduction, sampling design, field methods, data management and analysis, reporting, personnel requirements and training, operational requirements, and references) and follows the National Wildlife Refuge System Survey Protocol Template Version 1.4 (USFWS 2016). This site-specific document can be used by managers and biologists to annually conduct and assess RCW population monitoring on the refuge while contributing to regional species information and assessment and species recovery actions.

Suggested citation:

Morris, C., Richardson D., Bessler A., and Pittman L. 2021. Site-Specific Protocol for Monitoring the Red-cockaded Woodpecker Population on Great Dismal Swamp National Wildlife Refuge. USFWS, Suffolk, Virginia. 67 pp.

This protocol is available from ServCat <https://ecos.fws.gov/ServCat/Reference/Profile/136525>

Acknowledgments

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Disclaimer: References to commercial products are not endorsements.

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Narrative

Element 1: Introduction

Background

The red-cockaded woodpecker (*Picoides borealis*, Synonym *Leuconotopicus borealis*, *Dryobates Picoides*, RCW) was federally listed in 1970 as an endangered species (35 Federal Register 16047) and subsequently received protection under the Endangered Species Act (1973). This species is endemic to mature pine forests of the southeastern United States. The significant loss and alteration of ecological functioning pine forests and demographic isolation of RCW populations have caused range-wide population declines. RCW are designated as endangered primarily due to dramatic population reductions coinciding with alteration and destruction of the southern pine ecosystems. Species recovery is predicated on maintaining or improving pine habitats through silviculture, prescribed fire, cavity augmentation, and translocation of birds. In 2020, the species was proposed for reclassification from endangered to threatened ([85 Federal Register 63474](#)).

The Virginia population of red-cockaded woodpeckers is the northernmost throughout the species range and has been in eminent danger of extinction for more than 30 years (Watts et al. 2021). The single remaining population within the Piney Grove Preserve (located approximately 44 miles to the NW of GDSNWR) has responded to intensive management and is now approaching capacity but continues to be at risk to stochastic events such as hurricanes, tornadoes and disease (Watts et al. 2021). To offset this risk, a three-phase conservation plan was developed that includes the establishment of additional breeding locations. The Great Dismal Swamp National Wildlife Refuge was identified as a high priority site for the establishment of a second population due to its capacity for habitat management and the similarity of habitat to non-typical red-cockaded woodpecker sites in nearby coastal North Carolina. In an effort to establish a population within the swamp, habitat management was initiated several years ago and translocation of birds into established recruitment clusters began in 2015 (Watts et al. 2021).

Monitoring RCW at Great Dismal Swamp NWR supports the RCW Recovery Plan (2003) goal of having a stable or increasing population of at least 100 potential breeding groups in the Northeast NC/Southeast VA Essential Support Population of the Mid-Atlantic Coastal Plain Recovery Unit (USFWS 2003). Project goals to establish a viable breeding population at Great Dismal Swamp NWR will reinforce the Northern Essential Support Zone, help prevent extirpation of the species in Virginia, and promote recovery of RCW nationwide. In addition, Great Dismal Swamp NWR's habitat work restoring Pond Pine Pocosin and the re-establishment of this species within this habitat will permit the USFWS to determine the viability of these habitats as climate change affects areas prone to sea level rise. Completed project objectives to date include: participation in planning meetings; installation of artificial cavities in established cluster sites using appropriate protocols for cavity type (insert vs drilling); capture, transport, and release of RCW at Great Dismal Swamp NWR; monitoring nest activity; conducting Fall census; and monitoring and managing roost and nest cavities. Objectives that remain to be completed include: establishing a second viable breeding population in Virginia; and establishing a minimum of at least five (5) breeding clusters; working towards a total of 10 breeding clusters.

Great Dismal Swamp NWR is one of twelve refuges that have defined RCW population objectives within either a Comprehensive Conservation Plans (CCP) or Habitat Management Plans (HMP). The population objective for Great Dismal Swamp NWR is a population goal of 10 active clusters (Refuge HMP in Draft). The refuge population designation is Essential Support, with no specific recovery plan goal, a population goal of 10, and a goal of 5 active clusters (USFWS 2003). This SSP was created to have a refuge specific standardized document for RCW monitoring on the refuge that would allow for the assessment of plan objectives, meet legal mandates, and address Recovery Task 1.6: Monitor red-cockaded woodpecker populations using recommended monitoring intensity (USFWS 2003, page 208).

This site-specific protocol is a standardized tool for monitoring RCW populations on Great Dismal Swamp NWR while contributing to regional data attempting to establish or reestablish populations. It includes everything novel staff would need to continue or repeat the survey annually, analyze data, and interpret survey results. Ultimately it will support the RCW recovery plan goal with a population of at least 100 potential breeding groups in the Northeast North Carolina/ Southeast Virginia Essential Support Population.

Objectives

Refuge Habitat Management Plan Goals and Objectives

HMP (in draft) Goal: Preserve, manage, or restore the biological integrity, diversity, and environmental health of forested wetlands that benefit priority resources of concern.

The HMP (draft) objective below is for Pond Pine Pocosin, is a Priority 1 objective, and was derived from CCP Goal 1 Objective “Improve 10,000 acres of pine/pocosin habitat” and Goal 2 Objectives “Re-introduce a viable population of red-cockaded woodpeckers into appropriate refuge habitat and provide basic monitoring” and “survey support for neotropical migratory bird populations to regularly assess status of refuge populations” (CCP: USFWS 2006).

HMP (draft) Objective 1.1: Manage and enhance existing 18,000 acres of Pond Pine Pocosin on Great Dismal Swamp NWR in order to provide habitat (e.g., species composition, regeneration, size class distribution), support migratory bird species (e.g., Brown-headed Nuthatch) and priority resources of concern (e.g. Red-cockaded Woodpecker), and maintain native biological diversity and ecological integrity (e.g., reduce invasive species) with the following attributes (measurement units) and aspirational targets (values):

Maintain at least 5 active clusters of Red-cockaded Woodpeckers, with at least 3 family groups (nests), and 75% of active nests fledge at least 1 chick per year in the Blocks Management Unit. This refuge population within pond pine pocosin habitat is considered experimental by the Service since the typical supportive habitat for this species is longleaf pine savannah (mineral soils) maintained by frequent fire. Pond pine habitat will likely support a stable but small population.

Maintain at least 2,000 acres dominated by open stands of pond pine or loblolly pine (30 - 50 ft² basal area per acre; average tree age 50-90 years) with low densities (< 10 ft² per acre basal area) of hardwood trees, and the presence of red

heart fungus decay in (> 10% of pine trees > 80 years of age) to allow for cavity development.

Survey Objectives

Survey objectives and the rationale regarding how the information will be used to inform management is a local scale decision. These objectives define specifically what will be monitored. Fundamentally, the status and trend of a population is determined based on recurring measurements of the number of active clusters and potential breeding groups (PBR). These two metrics provide the most reliable determination of changes to the population. Other survey objectives support strategies, which could be implemented to maintain or enhance an RCW population.

Survey Objective 1: To determine the status (active, inactive, abandoned) of each cluster on the refuge annually (Priority).

Rationale: The number of active clusters provides a means to determine the trend of the population. This represents a standard metric from which recovery goals and objectives is measured. In addition, changes in the status of clusters from previous years can inform management of decisions regarding where and when to apply strategies to enhance cavity suitability and quantity, or opportunities to promote potential breeding groups through translocations. Furthermore, individual clusters may be demographically isolated and provision of recruitment clusters to bridge the population gaps can maintain or encourage site occupancy.

Survey Objective 2: To determine the group composition of each cluster on the refuge annually (Priority).

Rationale: Group composition provides a second measure of population status and trend. Specifically, the number of potential breeding groups influences the stability of the population and ability to fill breeding vacancies and occupancy of recruitment clusters through dispersal. In addition, the identification of solitary males at clusters provides opportunities to establish potential breeding groups through translocation. In instances where translocation will be used as a strategy, group size in clusters where nestlings will be banded to support the approach should be conducted to meet compliance requirements needed to remove male juveniles.

Survey Objective 3: To determine the number and evaluate the suitability of cavities in each cluster on the refuge annually (Second Level).

Rationale: Cavity limitation and suitability influence cluster status. Maintaining a minimum of 4 suitable cavities per cluster regardless of cluster status is considered a standard threshold. Provisioning artificial cavities to augment clusters with limited suitable cavities has been shown to influence population growth. In addition, monitoring the quality of cavities and recruitment clusters significantly influences the potential occupancy of these sites.

Survey Objective 4: To locate starts or new cavity trees within known clusters on the refuge annually (Second Level).

Rationale: Surveying to locate starts or newly completed cavities in active clusters is important to provide a complete distribution of the administrative boundary of the cluster. Starts often become active cavity trees within a year as birds shift from cavities that are unsuitable or usurped by other species. In addition, new cavity trees developed over the course of the previous year have a high likelihood of being the current nest tree. While a systematic survey of the cluster on an annual basis may not be prudent, when a nest is not documented, efforts to locate undetected cavity trees is warranted. Newly identified trees should subsequently be documented (uniquely numbered and georeferenced).

Survey Objective 5: To determine the reproductive performance of each group annually (Tertiary Level).

Rationale: Monitoring the reproductive performance of groups can be accomplished at several levels of intensity. Identifying nests in early stages of egg laying provides a means to protect nests with snake excluder devices which is important in small populations. Detection of nests also provides a direct indication of the group composition. Finer scale monitoring of reproductive efforts (clutch size, hatching success, sex of nestlings, and fledging rates) are time consuming and have limited value. In cases where translocation will be used as a strategy, determining the sex of nestlings banded should be considered just prior to fledging.

Survey Objective 6: To maintain a uniquely colored banded population (Tertiary Level).

Rationale: The population is small and translocation is still expected. Banding annually provides an opportunity to identify juvenile birds, an effective means to track bird movements to and through clusters, and a means to monitor translocation success. This information may be used to evaluate population dynamics related to adult and nestling survivorship, mean population turn-over, and dispersal.

Survey Objective 7: To identify translocation opportunities annually (Tertiary Level).

Rationale: As the population is small translocation of potential breeding groups (PBG) to the refuge provides genetic diversity and the potential to grow the population. Spring surveys are conducted to provide the most current cluster activity, banded bird locations, and PBG locations. Translocation provides an effective means to establish new territories and PBG through dual bird movements to recruitment clusters. Single bird augmentation of solitary groups also provides an important strategy to maintain cluster occupancy and grow a population. Once carrying capacity has been reached, the goals of translocation will switch to support other efforts throughout the RCW range.

Element 2: Sampling Design

The number of potential breeding groups (PBG) and the number of active clusters will be used to determine population trends and status. Census' are needed for annual variation in productivity and adult survivorship.

In Great Dismal Swamp NWR (population <30 active clusters) monitoring group size and fecundity is warranted on an annual basis (USFWS 2003). The prescribed monitoring intensity is predicated on the current size of the population, risk to population change, risk of stochastic events, and a focused effort on assessing inactive and recruitment clusters on an annual basis.

Target Universe

The target universe is the population of RCWs associated with Great Dismal Swamp NWR.

Sample Frame

The sampling frame is the aggregate of all active, inactive, and recruitment clusters and associated groups on the Great Dismal Swamp NWR.

Sampling Units

The sampling unit associated with this framework is defined as the cluster and the group which occupies the site.

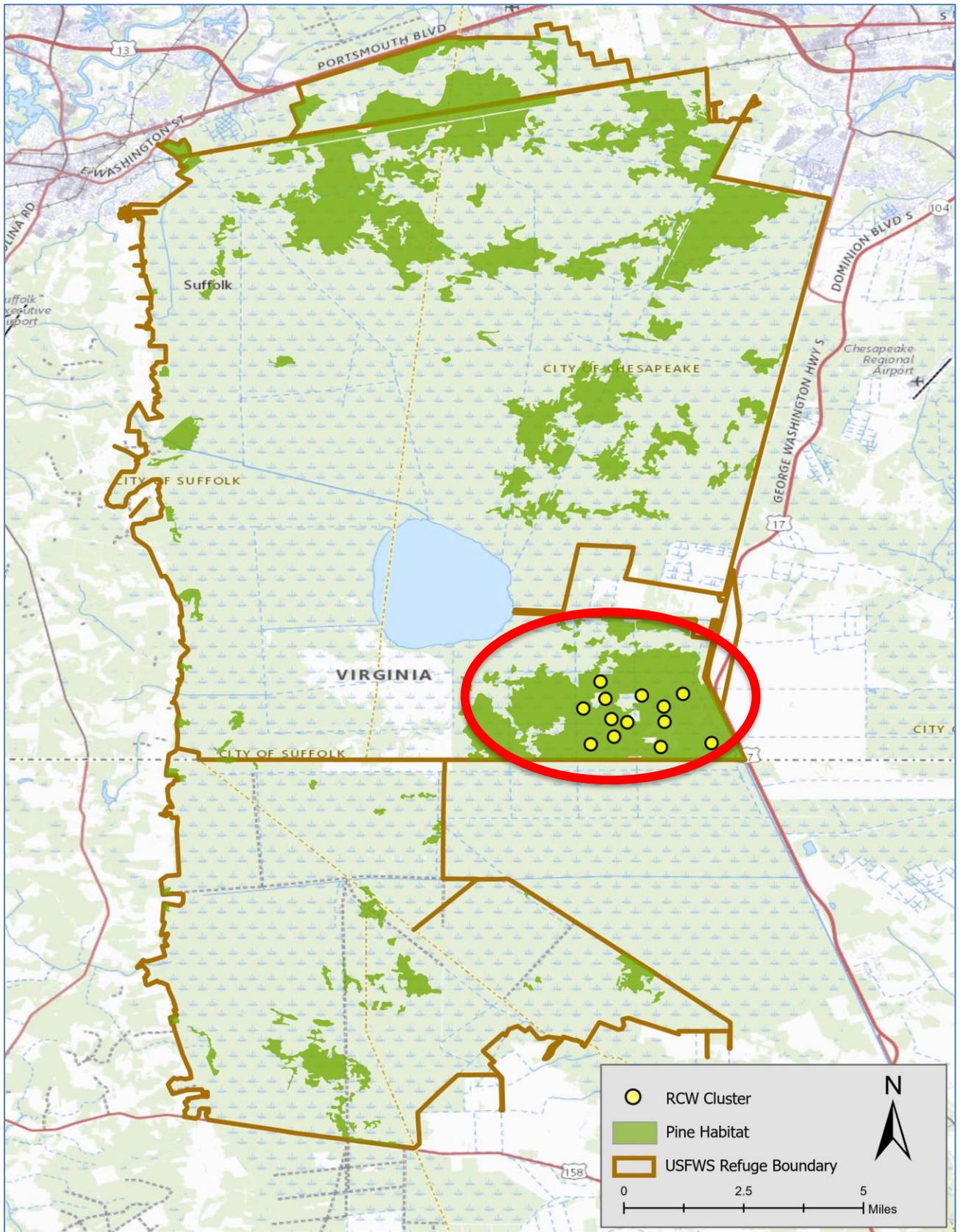


Figure 1. Distribution of RCW clusters on Great Dismal Swamp NWR and associated pine cover type as of June 2021. Most of the other pine habitat shown on the map is not viable as potential habitat for the species, so potential growth is fairly limited.

Sample selection and size

For RCW populations, the matter of determining population size and trend is relatively easy because of the bird's propensity to roost in cavities of mature pines, the long-term stability of the cluster to remain occupied over decades, and the relatively infrequent establishment of new groups by budding or pioneering. Therefore, monitoring the population is based on examining all clusters to determine status and number of PBG rather than more traditional avian monitoring, which requires intensive searches for new territories and nests across all potential suitable habitats.

The refuge will conduct a census for cluster and cavity status and group composition on an annual basis. Great Dismal Swamp NWR is a critically small population (<30 groups) with limited growth potential (10 groups), thus cluster status and group composition should be monitored on an annual basis. The monitoring approach is based on the inherent risk of small populations to deleterious stochastic events and demographic isolation, which can rapidly lead to further declines. Rapid detection of changes to the population or group composition will minimize the annual decline and inform management to mitigate existing conditions.

Survey timing and schedule

Great Dismal Swamp NWR is involved in intensive monitoring to determine group size, fecundity, juvenile and adult annual survivorship and translocation success. This will require more frequent visits to the cluster during the breeding season and post-fledging periods. Cluster status assessments and determination of group size and composition should be done during the breeding season (April - July) following procedures outlined (See SOP 1, SOP 2). This period provides a stable point of reference and a means to understand the demographics within a population on an annual basis. During this same survey period, monitoring cavity status, cavity suitability, and understory and midstory conditions can inform management of needed treatments to maintain or improve habitat conditions. See SOP 3 (Fecundity Determination) for procedures on nest and productivity checks. Return intervals of 4-7 days optimize nest detections and nest fate determinations. In addition, repeated inspections based on hatching (12 days incubations) and expected fledging dates (25-27 days) should be anticipated for banding nestlings (SOP 4 – Capture and Banding RCW) and sex determination of chicks (SOP 3 -Fecundity Determination). Adult group size and composition can be ascertained during nest checks when birds are actively feeding young. While recognizing that enhanced levels of monitoring require a substantial investment of staff time, time in conducting surveys as well as the managing/entering and reporting of the associated data (see SOP 5 – Data Entry and Management) may limit the number of population metrics and sites that can be inspected.

In order to determine if the site is comprised of a solitary bird or has been captured by an adjacent group, early morning or late evening roost counts may be necessary for clusters in which only a single active tree is observed. .

Scheduling translocation opportunities with partners is necessary for continuing to increase the PBGs and the refuge population and to supplement a cluster with a lone bird. Guidance for roosting and cleaning of cavities in translocation clusters is provided in the SOP 3.

Specific guidance on the time of day, month, and weather conditions to conduct specific survey activities is provided in the SOPs.

Sources of error

For census of cluster status and group composition:

Due to the relatively stable nature of cluster occupancy, group composition and ease of making these measurements, there is only a small measure of uncertainty associated with these response variables. The proposed sampling design provides a robust measure of cluster status and group composition to assess population changes with little sources of error.

For fecundity and survivorship measures:

Due to small sample size and timing of survey, there is chance of significant sources of error. In particular, return intervals to determine nesting activity by a group should be relatively short to minimize not detecting a nesting event and subsequent loss.

Element 3: Field Methods and Processing of Collected Materials

Pre-survey logistics and preparation

Preparation for the survey should begin at least 1 month prior to field work, though permitting needs should be evaluated more than 2 months out. Field work generally starts in April. The survey coordinator will lead, oversee, and coordinate all aspects of the survey, including changes to maps and sample units (i.e., clusters) based on annual monitoring schedules.

The survey coordinator will need to organize necessary field gear and initiate appropriate training sessions for new observers (See Element 6; climbing ladders, use of field computers/GPS units, banding, Job Hazard Analysis [JHA]). All persons involved in the survey should be provided a copy of the SSP and expected to fully understand the associated SOPs to ensure standardized data acquisition.

Organizing Supplies, Equipment, and Permits - Organize and prepare all field equipment several weeks before beginning field work. Potential equipment needs are outlined in table 1.1 of SOP 1. Verify that all equipment is in working order before fieldwork begins, as repairs to video inspection equipment, and field computers/GPS units can take many weeks.

For the purpose of handling and banding birds or other activities which may involve “take” of birds (e.g., cavity inspection), appropriate federal and state permits must be acquired prior to conducting those activities. Service employees and identified volunteers are required to be covered by a Virginia Department of Wildlife Resources Threatened and Endangered species permit for endangered species recovery activities in Region 1 by March 1st of that year. If new permit requests are made to the United States Geological Survey, Bird Banding Lab or State wildlife agencies, one should plan for 60 days or more to process applications. Specific

authorization to add color bands to uniquely mark birds should be identified at the time of application or amendments to permits.

Scheduling Field Work - Survey activity will begin in early April and may extend into early July depending on renesting attempts and post-fledging gender determination. Sampling schedules will fluctuate around weather events but are structured with recurring cluster inspection intervals of 4-11 days to identify nest attempts and losses. Under ideal conditions, 2-3 clusters can be inspected to determine cluster status and locate nests on a daily basis. The number of groups where nestlings can be banded in a day is less than 3. Given the short window for banding nestlings (age day 5- 10), work schedules may need to be flexible to allow for efforts over weekends.

Establishment of sampling units

A list of the clusters to be monitored for each successive year (annually) will be generated to reflect the location and status of clusters on the property.

Data collection procedures (field, lab)

The two fundamental metrics to be collected during the survey to address the primary objectives of population size and trend, includes determining the cluster status (Active, Inactive, Unknown, Captured) and the group composition of each active cluster (PBG or solitary bird).

For determining the population trend and size of the RCW population consult:

- Standard Operating Procedure (SOP) 1 for determining cluster status
- Standard Operating Procedure (SOP) 2 for group composition and size
- Standard Operating Procedure (SOP) 3 for fecundity determination
- Standard Operating Procedure (SOP) 4 for capture and Banding Adult and Nestling Red-cockaded Woodpeckers

Metrics will be collected using the supplemental mobile survey forms provided. Refer to the current [RCW Data Management Manual](#) for all aspects of the data collection procedures utilizing the ArcGIS Online Mobile applications.

If not using the mobile app, relevant data sheets (i.e., data forms) for each SOP should be pre-printed on waterproof paper for recording data during wet or misty days or used as backup to the mobile electronic method should it fail (See SM-1, 2, 3, 4, 5).

General guidance on data management and is provided in SOP 5 (Data Entry and Management).

Processing of collected materials

All data should be saved on the refuge drive ([public\(\\ifw5gdsr-fs.fws.doi.net\)\(P:\):\RCW](#)) and uploaded to ServCat (<https://ecos.fws.gov/ServCat/Reference/Profile/133104>) within 3 days of collection.

Hard Copy Form Collection:

All datasheets should be proofread immediately upon completion of each survey event to ensure that they are filled out completely and are legible. A paper and/or digital scanned PDF copy of each datasheet should be made immediately upon return from the field each day. Originals should be stored in a file cabinet in the biologist's office or the biology file cabinet in the server room, with scanned copies being stored in the shared refuge drive mentioned above. Data should be entered into the geodatabase within 3 days of collection and compared with raw datasheets for errors. Any corrections should be marked in pen of a different color than the original data, dated with initials, and the reason for the correction documented (if necessary).

Digital Data Collection using ArcGIS Apps:

Post processing should include reviewing your data entries no later than 1-3 days after the collection date(s). This can be done using the mobile web application, ArcGIS online RCW web map, or the CSV file archived on the SharePoint.

If using the mobile web app, data will be automatically entered into the ArcGIS Online geodatabase. If data was collected offline, data should be uploaded (synced) upon returning from the field in order for the R Markdown script to capture any collected data the next time it is run. If datasheets ever have to be used as backup, ensure to follow the Hard Copy Collection guidance.

Mortality events during banding:

In the event of mortality attributed to banding, regardless of whether the specimen is collected, a report of the incident should occur immediately to the RCW Recovery Coordinator.

End-of-season procedures

At the end of the season:

1. Ensure all data has been entered and proofed.
 - a. Consult SOP 5 for data entry and management. Field data should be entered and proofed into electronic format as soon after each survey event as possible, preferably the same day to clear-up inconsistencies or questions.
2. Collect all equipment that was used and update the inventory list.
 - a. Inventory list is found on the P drive ([public\\ifw5gdsr-fs.fws.doi.net](public:\\ifw5gdsr-fs.fws.doi.net))(P:)\RCW).
 - b. Note and make any needed purchases for next year, then update inventory list.
3. Clean and store all equipment in a climate safe location.
 - a. Equipment for monitoring is stored in the office, maintenance fuel shed, and bio shed.
4. Update Refuge report.
 - a. Consult Element 5 for Reporting (for refuge management as well as any endangered species 10(a)1(A), federal and state bird banding and handling permit reporting needs).
5. Upload Final report into U.S. Fish and Wildlife Service Catalog (ServCat). .CSV files will be loaded by the Database Manager

- a. Consult Servcat record [142968](#) on guidance on how to upload documents to ServCat

Element 4: Data Management and Analysis

Data entry, verification, and editing

A standardized protocol using similar field collection procedures and informed management decisions provides an efficient means to analyze trends of RCW populations on refuges.- The use of a single regional geodatabase by each participating field station provides a mechanism to ensure data consistency and integrity.

Consult SOP 5 for information on how to enter, proof, and manage RCW population and habitat monitoring data into the region's RCW Population Monitoring Geodatabase which is housed on the ArcGIS Online FWS Enterprise Platform as hosted feature services for the Clusters and Cavity Trees. The [RCW Data Management Manual](#) can be found on the RCW Protocol and Data Mgmt SharePoint and archived in ServCat ([Help Documentation 133717](#)).

Metadata, fit to the standards of the protocol framework, are built into the ESRI ArcGIS Online platform. Metadata follows the Digital Geospatial Metadata (CSDGM) endorsed by the Federal Geographic Data Committee (FGDC) as well as following standardized naming of attributes.

Great Dismal Swamp National Wildlife Refuge, through Center for Conservation Biology, has maintained a project record and other historical information about the survey as a companion to the SSP. The annual reports are available upon request.

Data security and archiving

The I&M Database Manager is the assigned Data Custodian and Data Steward within the Data Management Plan. Metadata reporting and updates will all be accomplished via the I&M Data Manager and/or Data Steward. See the Regional RCW Data Management Plan for specifications on archiving and disposition schedule. Annually, the CSV files will be archived independently in ServCat ([Generic Dataset 109561](#)) with its own metadata reference and linked to the Project Reference for station level RCW population monitoring information.

The Survey Coordinator is responsible for ensuring security and backup of the digital data storage of the AGOL files. It should be determined with the Database Manager whether or not shared drive items are being backed up and how frequently. If they are not being backed up, then a manual weekly backup of the geodatabase should occur via a labeled external hard drive. The Survey Coordinator should also ensure regional summary annual reports are archived into ServCat.

Digital and paper copies of data sheets should be made upon returning from the field (locations are mentioned above in Element 3, Processing of collected materials).

Analysis methods

SOP 5 (Data Entry and Management) provides general guidance on data management and analysis to address SSP objectives associated with RCW population monitoring.

The data analysis has multiple functions: (1) provide basic data summaries of cluster status and group composition for use in quality control and annual reporting, (2) derive census or estimates of annual or biennial population size and trend, (3) estimate fecundity, (4) determine long-term trends for the RCW population, (5) cavity status and quantity, and (6) determine translocation clusters.

Software

The mobile app and ArcGIS Field Maps apps on an electronic device (e.g., smart phone or tablet) are used to collect and store data within the ESRI ArcGIS Online platform – [RCW Field Maps](#).

- An excel spreadsheet is stored in a shared refuge drive: [public\(\\ifw5gdsr-fs.fws.doi.net\)\(P:\):\RCW](#)
- And uploaded to ServCat <https://ecos.fws.gov/ServCat/Reference/Profile/133104>

Element 5: Reporting

Implications and application

The management and survey objectives, management decisions, and permit conditions will shape the nature of the report. Reports will restate management and survey objectives and link findings to inform management decisions. Refer to Servcat record <https://ecos.fws.gov/ServCat/Reference/Profile/133104> (or SM) for an example report from a previous year.

An annual meeting will be held between station managers, biologists, and the survey coordinator. Meeting will facilitate application of results to management decisions, help managers and staff note report functionality to survey coordinators, and provide a good avenue for interpretation and communication of results. Any needed modifications to survey design, protocol, or an SOP will be discussed and revisions to the SSP subsequently undertaken.

Reporting schedule

For compliance with Section 10(a)1(A) recovery permits, an annual report is due January 31 the following year of conducting permitted activities. An annual report is generally sent no later than (January 31st post field season) to the regional office's permits coordinator (permitsr4es@fws.gov, currently Karen Marlowe) with a cc to the RCW Recovery Coordinator (currently [Lindsey Troutman@fws.gov](mailto:Lindsey_Troutman@fws.gov)) and Interior Region 1 Endangered Species Biologist (currently Sumalee_Hoskin@fws.gov).

Annual reporting of banding information is also sent to the USGS, Bird Banding Lab by the end of the calendar year.

The survey coordinator will plan and budget for a comprehensive analysis and report at least every 5 years.

Report Distribution

The Survey Coordinator will send an email of the final report to the refuge manager(s) and refuge staff, the RCW Recovery Coordinator, regional office's permits coordinator, the Field Supervisor of the Ecological Services Office in the state, the Regional Permit Coordinator, the state wildlife conservation agency, and associated partners.

The Survey Coordinator should ensure that field notes and reports are stored in compliance with Service Enterprise Architecture (270 FW 1), Data Resource Management (274 FW 1), and Electronic Records (282 FW 4) policies. The Survey Coordinator will create accurate metadata and store data documents, metadata, reports, posters, graphs, maps, and any other documentation of results in ServCat under the Project Reference for RCW population monitoring (<https://ecos.fws.gov/ServCat/Reference/Profile/133104>)

Regional reports will be housed in the Service Catalog record (<https://ecos.fws.gov/ServCat/Reference/Profile/115945>)

Element 6: Personnel Requirements, Training, and Permits

Roles and responsibilities

Project Manager – Refuge Manager

The Project Manager is responsible for reviewing monitoring plans, reports, and making the best use of the monitoring information to improve management.

Survey Coordinator – Refuge Biologist

The survey coordinator oversees the implementation of one or more survey protocols that adhere to standards of scientific excellence (701 FW 2). The survey coordinator will ensure that each phase of a survey is conducted properly and completely and addresses the following activities:

- Establishing management and sampling objectives,
- Selecting an appropriate sampling methodology to obtain answers to those objectives (establishing a protocol and articulating how the collected data will be used to inform management decisions),
- Field schedule and sampling (including hiring, training, forms, safety, or necessary purchasing, or permits),
- Data (entry, storage, quality control, to analysis),
- Reporting (documenting results as well as notification to any other relevant or interested entities such as the RCW recovery and permits coordinators).
- Ensure field technicians receive an annual training of revisions to data collection procedures and software applications

The survey coordinator should conduct hiring of any field crew, provide training, supervision, and coordination with all staff, volunteers, or partners. This will include providing field forms, supplies, SOPs, job hazard analyses (JHAs), and assure all qualifications and trainings are complete and up to date for staff involved in the survey. The survey coordinator will delegate some functions to the field technicians such as preparing field gear and data collection equipment, supplies, and data forms for the field season; entering field data into the RCW Population Database (see Element 4); and cleaning, repairing, and storing field equipment. The survey coordinator is also responsible for testing personnel proficiency at assigned tasks, and that all handling of birds is guided by animal use standards of the American Ornithologists Union (Aldrich et al. 1975), Ornithological Council (Fair et al. 2010) and the RCW Recovery Plan (USFWS 2003)

Survey Assistants/Field Crew Members — Biological technician, seasonal technicians, interns, volunteers

Field crew members are responsible for carrying out any assigned duties related to RCW and qualifying on any necessary training. Reading through and understanding the site-specific protocol should be done prior to any field work.

Regional Data Manager and/or Regional Data Steward—

Current contact is Lori Pittman (mailto:lori_pittman@fws.gov). This individual will have responsibilities of:

- Oversight of [Data Management Plan](#) and all National Policy driven needs
- Maintenance of all ArcGIS Online Enterprise datasets
- Maintenance of all ArcGIS Online mobile applications including adding and deleting Clusters and Cavity Trees from within the ArcGIS Online enterprise platform
- Back up and Archiving procedures
- Updating annual training materials including [RCW Data Management Manual](#) and refuge-specific [RCW Field Data Collection Training PowerPoint](#)
- Technical support for all ArcGIS Online web and mobile applications

Qualifications of field crew

Field crew members conducting RCW population monitoring must be competent in numerous field and data management skills. Qualifications will vary depending on the scope of work an observer is performing.

Field crew should be able to:

- Use GPS units or similar devices and orienteer to programmed locations,
- Use binocular and spotting scopes,
- Walk at least a ½ mile stretch while carrying equipment to clusters,
- Work under extremely hot (i.e., above 90⁰F) and buggy field conditions across rough terrain,

- Safely, accurately, and completely implement SOPs,
- Able to operate Swedish climbing ladders and climb cavity trees to heights of 60 feet,
- Band adult or nestlings (or have an agreement with a partner agency to perform),
- Use a pole mounted video probe camera,
- Accurately record, proof , and store data,
- Follow job hazard analyses (JHA)

Training

Due to potential for direct injury or death to RCW from banding, translocating birds and visual inspection of cavities, all field observers involved in any of these activities must be properly trained and certified for each activity before conducting them independently. It should be stressed that climbing trees has severe inherent risk that if proper safety measures are not adhered to could result in serious injury or death to the climber or an assistant on the ground. All field crew members should review the Job Hazard Analysis for climbing cavity trees regardless if they will be actually climbing (SM-7). In addition, crew members must also be trained to conduct bird observations, use the database, use a chainsaw, climb cavity trees with Swedish ladders, and personnel protective equipment. Preferred, but not necessary, training includes use of specialized vehicles (i.e. ATV/UTV, marsh master).

Listed below are the training and skills that any individual should have if working in the field, at a level to where the individual is comfortable to perform with ease by their self:

Safety Training – There will be a safety training at the start of the project season. During training sessions, safety procedures, first aid and CPR, what to do in case of an accident or injury, and how to check in with a responsible party at the end of each day, etc. will be reviewed. There will be daily and weekly safety reminders during the field season. Specialized vehicles (i.e., ATV/UTV) will require additional safety training.

In case there is a need to contact emergency services, there should be a minimum of two cellular phones with survey crews at all times. If possible, all surveyors should carry a work or personal cellular phone. Sampling occurs in a damp environment, so care should be taken to keep cell phones dry and in working order. The survey coordinator should establish accountability processes for phones before entering the field. Safety instructions should include where to go (or travel to) to reach the nearest likely cellular service if working in an area without cellular coverage.

Contact Numbers for Emergencies: 911

Office, 757-986-3907

LEO, 757-630-4001

Refuge Manager, 757-376-2841

Fire Shop, 757-986-3249

Maintenance, 757-986-2266

Suffolk PD non-emergency, 757, 923-2350

Suffolk Fire Dept., 757-925-1439

Suffolk Animal Control, 757-923-2350 or 757-514-7855

Virginia DWR, 757-367-1000
Virginia State Police, 757-382-4998
NC Dismal Swamp State Park, 252-771-6593

Radios/frequencies if substituted.

Office, 627
LEO, 30
Refuge Manager, 1
Fire Shop, 6
Maintenance, 10

Appropriate Check in/out procedures for staff/volunteers will be reviewed and followed, in particular for after hour activities.

Technical Equipment - The survey coordinator will ensure that field crew members understand and are trained to use all the equipment needed while they are in the field including: motorized vehicles, GPS navigation equipment, video probe cameras, and emergency communication equipment (e.g., radios or cell phones)

Duties for all aspects of population monitoring require the skills and training identified below for each SOP.

- Cluster and Cavity Tree Status Determination (SOP 1)
- Group Composition, Size and Individual Bird Identification (SOP 2)
- Fecundity Determination: Nest Checks and Cavity Inspections (SOP 3)
- Capture and Banding Adult and Nestling Red-cockaded Woodpeckers (SOP 4)
- Data Entry and Management (SOP 5)

Under the supervision of a qualified trainer (USFWS 2003, page 277), a field crew member will need to successfully perform the requirements below before they conduct each activity independently.

- 50 cavities correctly assessed for stage and activity,
- 15 cavity trees climbed and cavity contents checked,
- 10 adult red-cockaded woodpeckers captured and banded (with appropriate data taken) without injury to the birds,
- 20 nestlings captured, and banded (with appropriate data taken) without injury to the birds,
- 20 red-cockaded woodpeckers correctly identified by color-bands,

Questions about training requirements relating to authorized activities of the endangered species sub-permit should be addressed to the RCW Recovery Coordinator or the regional ESA permit coordinator.

Software and Data Management Training –

I&M Branch will provide annual software and data management training for all data collector by the Regional Data Manager and/or Regional Data Steward. An [RCW Data Collection Training manual](#) and an [RCW Data Collection Training PowerPoint](#) will be updated annually and stored on the RCW Protocol and Data Mgmt SharePoint for those individuals that are unable to attend the provided regional I&M training session.

Permitting Requirements

A federal Endangered Species Act Section 10(a)(1)(A) recovery permit is required for conducting authorized activities including banding, examining RCW cavities, installation of artificial cavities, and translocation of birds. The Region 4 Ecological Service Division has issued permit TE 697819-4, which covers all Service personnel in Region 4 to conduct these activities in accordance with, appropriate training (see ***Training*** above) and as approved by the RCW Coordinator (see Element 5).

If banding, a federal migratory bird banding and marking permit must be obtained from the U.S. Geological Survey, Biological Resources Division, [Bird Banding Lab](#).

Great Dismal Swamp NWR obtains an annual threatened and endangered species permit from the Virginia Department of Wildlife Resources to conduct these activities in the State of Virginia.

Element 7: Operational Requirements

The annual estimates for conducting RCW population monitoring, including operational costs, staffing, and the frequency of the monitoring and administrative activities, is listed in Table 7.

Budget

Table 7. Estimated annual costs for RCW population monitoring for Great Dismal Swamp NWR. Labor costs are based on actual pay grades of staff involved in monitoring. Equipment costs are conservative estimates for expected repairs and replacement of equipment averaged across multiple years.

Personnel - Activity	Staff (Days)	Estimated Annual Cost¹
Planning	10	\$5340
Training	5	\$1700
Cluster & Tree Status Assessment*	10	\$1462
Artificial Insert Cleaning	5	\$731
Group Composition and Size, including bird identification	8	\$1170
Nest Monitoring and Banding	20	\$2924
Translocation Monitoring per event	1	\$146
Data Entry & QA/QC	5	\$731
Data Summary and Reporting	10	\$5340
Operational Costs		
Fuel – Vehicle and Marsh Master		\$500.00
Banding/Translocation – CCB or other contractor		\$3000.00
Equipment – e.g.: Video inspection camera, data sheets, climbing gear, ladders, waders, spray paint, putty, inserts, flagging tape, Tree tags, nails, contractors, helicopter etc.		\$1500.00

¹Cost should be estimated based on combined salary of staff involved in activity or through contract service.

* Includes installing and replacing lost artificial cavities.

Staff time

As shown in Table 7, it is estimated to take a total of 74 staff days to annually conduct this survey. Most field activities and data entry are conducted by a GS-05 biological technician, with periodic assistance from a GS-12 wildlife biologist. Planning and reporting primarily conducted by a GS-12 wildlife biologist.

Schedule

Figure 7. General red-cockaded woodpecker activity schedule for Great Dismal Swamp NWR. Most activity for RCW activities occur between (April through June & September-November).

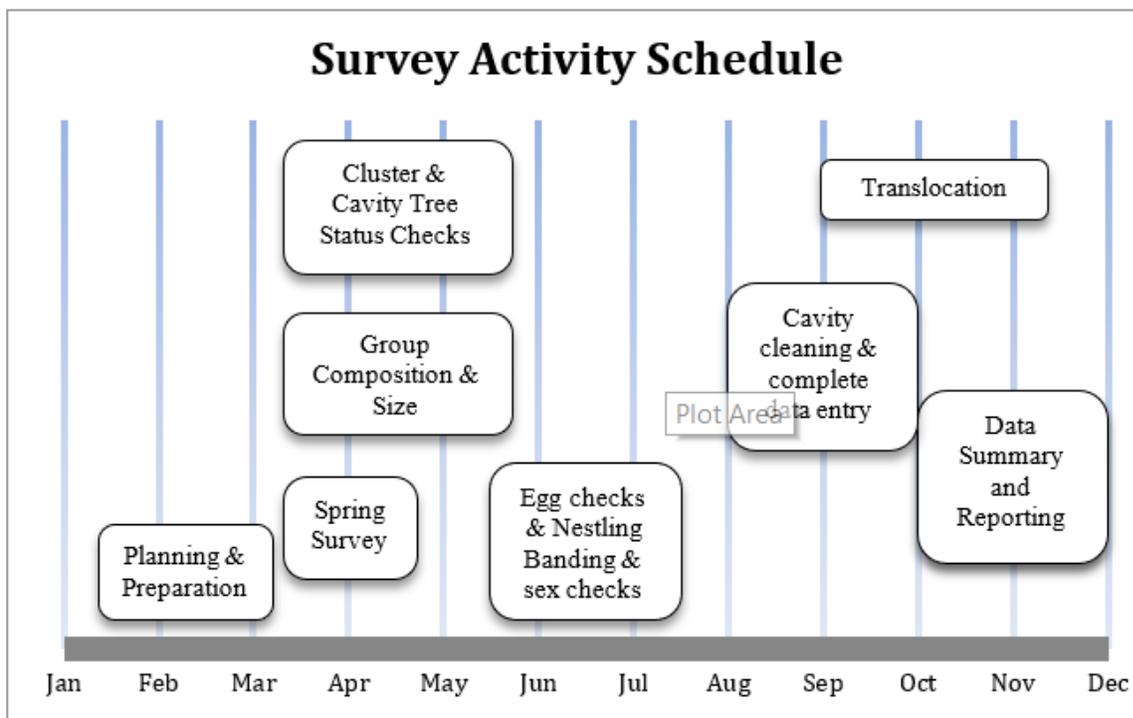


Figure 7. A generalized schedule is depicted for implementing annual red-cockaded woodpecker population monitoring, data entry, analysis, and reporting.

Planning and Preparation includes:

- Training and education of new staff (from safety to refuge orientation to Project details);
- Inspect and insure all necessary equipment is ready;
- Print maps of clusters and cavity tree locations for the year;
- Weed-wack or use the Marsh Master to mow trails;
- Reflag trails as necessary;
- Respray paint and retag trees as necessary.

Coordination

Virginia Department of Wildlife Resources (Primary Contacts)

- Sergio Harding sergio.harding@dgif.virginia.gov
- Becky Gwynn, Becky.Gwynn@dgif.virginia.gov

The Nature Conservatory - Piney Grove

- Bobby Clontz, bclontz@tnc.org

Center for Conservation Biology – Williams and Mary College

- Bryan Watt, bdwatt@wm.edu
- Chance Hines, chhines@wm.edu

Regional Ecological Services Office

- Sumalee Hoskin, sumalee_hoskin@fws.gov
- Rachel Case, rachel_case@fws.gov

RCW Species Recovery Coordinator

- Lindsey Troutman, lindsey_troutman@fws.gov

Element 8: References

- Aldrich JW, Banks RC, Cade TC, Calder WA, Cooch FC, Emlen ST, Greenwell GA, Howell TR, Hubbard JP, Johnston DW, Johnston RF, and Mewaldt LR. 1975. Report of the American Ornithologist; Union and ad hoc Committee on Scientific and Educational Use of Birds. *Auk* 92 (3, Supplemental): 1A-27A.
- Allen DH. 1991. Constructing artificial red-cockaded woodpecker cavities. USDA Forest Service General Technical Report SE-73.
- Allen DH, Franzreb KE, and Escano RF. 1993. Efficacy of translocation strategies for red-cockaded woodpeckers. *Wildlife Society Bulletin* 21:155-159.
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- Fair J, Paul E, and Jones J. Eds. 2010. *Guidelines to the Use of Wild Birds in Research*. Washington, D.C.: Ornithological Council.
- Jackson JA. 1978. Pine bark redness as an indicator of red-cockaded woodpecker activity. *Wildlife Society Bulletin* 6:171-172.
- Jackson, JA. 1982. Capturing red-cockaded woodpecker nestlings with a noose—a technique and its limitations. *North American Bird Bander* 7:90-92.
- Ligon, JD. 1970. Behavior and breeding biology of the red-cockaded woodpecker. *Auk* 87:255-278.
- Richardson, DM, Costa R, and Boykin R. 1998. Strategy and guidelines for the recovery and management of the red-cockaded woodpecker and its habitats on National Wildlife Refuges. U.S. Fish and Wildlife Service, Atlanta, GA.
- US Fish and Wildlife Service. 2003. Recovery plan for the red-cockaded woodpecker (*Picoides borealis*): second revision. U.S. Fish and Wildlife Service, Atlanta, GA.
- U.S. Fish and Wildlife Service. 2006. Great Dismal Swamp National Wildlife Refuge and Nansemond National Wildlife Refuge: Final Comprehensive Conservation Plan. Hadley, MA. 258 pp.
- US Fish and Wildlife Service. 2013. How to develop survey protocols, a handbook (Version 1.0). National Wildlife Refuge System, Natural Resource Program Center, Fort Collins, CO.

- US Fish and Wildlife Service. *In draft*. Great Dismal Swamp National Wildlife Refuge Habitat Management Plan. Hadley, MA. pp.
- US Fish and Wildlife Service. *In draft*. Great Dismal Swamp National Wildlife Refuge Inventory and Monitoring Plan. Hadley, MA. pp.
- US Fish and Wildlife Service, National Wildlife Refuge System, Inventory and Monitoring. 2016. National Wildlife Refuge System Survey Protocol Template. Natural Resources Program Center, Fort Collins, CO.
- Watts, B. D., C. Hines, L. Duval, B. J. Paxton, and J. Wright. 2021. Investigation of red-cockaded woodpeckers within the Great Dismal Swamp National Wildlife Refuge: 2020 report. Center for Conservation Biology Technical Report Series, CCBTR-21-02. William & Mary, Williamsburg, VA. 19 pp.
- Wright, J., C., Lowie, and F., Wurster. 2021. Great Dismal Swamp National Wildlife Refuge Inventory and Monitoring Plan. National Wildlife Refuge System, U.S. Fish and Wildlife Service, Department of Interior Region 1. Suffolk, VA.
[HTTPS://ECOS.FWS.GOV/SERVCAT/REFERENCE/PROFILE/131341](https://ecos.fws.gov/servcat/reference/profile/131341).
- Wurster, Fred and Jennifer Wright. 2021. Great Dismal Swamp National Wildlife Refuge Habitat Management Plan. National Wildlife Refuge System, U.S. Fish and Wildlife Service, Department of Interior Region 1. Suffolk, VA

Standard Operating Procedures (SOP)

SOP 1: Cluster and Cavity Tree Status Determination

This SOP details how to determine the current status of RCW clusters and associated cavity trees on an annual basis. The procedures outlined below are consistent with guidance from the RCW Recovery Plan (US Fish and Wildlife Service 2003, pages 71-72). Determining the population trend and size of the RCW population is best evaluated by monitoring the number of active clusters (SOP 1) and potential breeding groups (PBG) (see SOP 2). Monitoring cavity tree status and assessment of cavity condition provides an additional index of group occupancy at a cluster if actual group demographics are not monitored. Moreover, the availability of suitable cavities in a cluster is of particular importance, because cavity limitation has been identified as a critical factor in maintaining occupancy by a group and individual bird survivorship. Thus, management decisions regarding habitat treatments in a cluster or augmentation of artificial cavities is dependent on this assessment.

Preplanning Field Logistics

Prior to conducting cluster and cavity tree status assessments, the survey coordinator should ensure that field crew members have been properly trained and are qualified to judge cavity tree status (see Element 6). Maps of clusters and cavity tree locations should be updated annually and printed in advance. A list of the target clusters should be generated for refuges that have a large population (>100 active clusters) and are conducting a 50% annual sample of clusters (see Element 2). At least one week before and prior to leaving the station for a status assessment, the field crew should verify all equipment and supplies are available (Table SOP-1.1). The survey coordinator or other refuge staff members should be aware of the anticipated work area for each day as well as the expected return periods as a safety procedure. The crew should also review any other safety precautions and review work assignments for the day. To save time and effort, other monitoring activities including fecundity and group composition can often be done concurrently.

Equipment and Supplies

Table SOP-1.1 Equipment and supplies needed for annual cluster and cavity tree status determination.

Quantity	Item Description	Purpose
1	Video inspection camera with extendable pole	Determine cavity contents
1	Knee boots and/or waders	To traverse trails
1	Cluster and Tree Status Rite-In-The-Rain® notebook (SM-1: Cluster and Cavity Tree Status Determination)	Record field data
1	IPad with mobile apps	Record and report field data digitally
2	Pens or pencils – Blue color preferred	Data recording
1	Cluster and Cavity Tree Maps	Orient to site

Quantity	Item Description	Purpose
1	GPS with extra batteries – Latitude and Longitude, Decimal Degrees, NAD83 or WGS84	Geo-reference trees
1	Binoculars and/or spotting scope	Visualize cavities
1	Numbered Tags and nails	Monument Trees
1	Flagging	Temporarily mark new trees and flag trails
1	White Paint	Mark new cavity trees and fix old ones
1	Curved Spoke Shave (Bark Scraper) or Machete	Scrap loose bark
1	Aluminum foil 36 inch wide	Protect active cavities from snakes
1	Duct tape	To hold foil in place

Cluster and Cavity Tree Status Determination

The status of all active, inactive, and recruitment clusters are checked for evidence of red-cockaded woodpecker activity until an active cavity is located or the cluster is determined to be inactive. However, abandoned clusters (inactive for a period of greater than five years and no management is being undertaken to reactivate the clusters – e.g., artificial cavity augmentation) are not surveyed. Presence of a bird in the cluster should not be used to assign the cluster as active since birds from adjacent groups may cross inactive or abandoned clusters. Cluster status determination is done prior to or during the breeding season (April – July). In addition, the status of each cavity tree may be assessed to determine if cavity augmentation is needed to maintain four suitable cavities per cluster and as an indirect measure of the number of RCW in the group.

A cluster is an aggregation of cavity trees currently or previously used for nesting and roosting by a group of red-cockaded woodpeckers (Walters et al. 1988a). Cluster status is defined below as:

- **ACTIVE** - Cluster containing one or more active cavity trees
- **INACTIVE** - Cluster with no cavity trees are active
- **CAPTURED** - Cluster that does not support its own group of red-cockaded woodpeckers, but contains active cavity trees in use or kept active by a neighboring group
- **ABANDONED** – Cluster inactive for five consecutive years and not managed to recruit a group back to the site
- **UNKNOWN** – Definitive status could not be determined based on visual inspection.
- **NOT SURVEYED** – Cluster not inspected during that year

Cavity tree status will be based on the following:

- **Active** – Contains one or more active cavities
- **Inactive** – No active cavities or starts
- **Dead** – Tree is dead and is no longer tracked on an annual basis

- **Start** – Partially completed cavity not being used by a bird for roosting
- **UNKNOWN** – Definitive status could not be determined based on visual inspection

Cavity type will be based on the following:

- **Start** – Partially completed cavity
- **Natural** – Completed cavity by RCW
- **Insert** – Artificial cavity box design (Allen 1991)
- **Drilled** – Artificial cavity using the drilled technique (Copeyon 1990)
- **Restricted** – Cavity has received a restrictor plate

Cavity condition should be determined based on the external characteristics of the cavity entrance. However, visual inspection of the internal cavity chamber can also be used to refine the suitability determination. Condition class of a cavity can be changed if a management action is done to correct a defect. The presence of flying squirrels or another bird species should not be used to determine the condition class.

Cavity condition will be based on the following:

- **Suitable** – External cavity entrance is not overly enlarged, or has a restrictor plate applied.
- **Non-suitable** – External cavity entrance has been greatly enlarged, the side of an insert has been pecked or decayed to expose the cavity chamber, a drilled cavity has been temporarily or permanently screened due to a sap leak, or the cavity chamber contains water.

Cluster Status Procedure:

1. Field crew member examines cavity trees within the cluster for evidence of fresh resin flow or bark redness on cavity trees as outlined by Jackson 1978. Use of binoculars or a spotting scope is advised for higher cavities.
2. If one or more cavity trees show indication of activity, cluster status should be assigned ACTIVE and no further assessment is needed.
3. In rare instances in which there is uncertainty of cavity trees being active, the status of the cluster should be assigned UNKNOWN. A crew member should conduct a morning or evening roost of the cluster to determine presence or absence of RCW and then assign the appropriate status.
4. In general the status of all cavity trees and detection and monument of new cavities should be done concurrently during the Cluster Status procedure to facilitate locating nests and determining group composition /size based on number of active cavities (*see Cavity Tree Status Procedure* below).
5. If all cavities are determined to be inactive in a cluster that was active the previous year a thorough search for new cavity trees should be conducted in suitable habitat within 0.4

km (0.25 mi) of the cluster center. If no active cavities are located, assign the cluster status as INACTIVE.

6. Primary variables to record are included on the Cluster and Cavity Tree Status Form (SM-1): Date, Cluster ID Number, Cluster Status. Secondary variables may include management treatments within the clusters – burned, herbicide, thinned.
7. The crew member should verify all required data fields on the form have been completed before leaving the cluster.

Cavity Tree Status Procedure

1. One or more crew members use the cluster map with identified cavity trees to locate and inspect each cavity tree. Use of binoculars may be necessary for higher cavities to examine for recently worked resin well or redness of bark near cavities.
2. Observer records the following primary variables for each trees: (Date, Cluster ID Number, Cavity Tree Number, Number of Cavities, Type of Cavity, Status of Cavity, and Suitability/Condition of Cavity) on the Cluster and Cavity Tree Status Form (SM-1).
3. Information about the need to restrict enlarged natural cavities or replace inserts should be indicated in the comments section.
4. Dead cavity trees should be noted but no further information is collected.
5. Any unmarked tree with a completed cavity should also be checked.
6. A metal tag with a unique alpha/numeric code should be placed on the new cavity trees at chest height.
7. A GPS should be used to collect the coordinates of the new tree location. Geographic coordinates should be recorded as Latitude (nn.nnnnnn) and Longitude (-nn.nnnnnn) in decimal degrees with a geodetic datum of WGS84 or NAD83.
8. If a start tree is located, refuges may choose to formally monitor these trees and tag the tree or delay annual monitoring until a cavity is completed.
9. Characteristics of the new cavity tree including the following variables: (Date Located, Cluster ID, Cavity Tree Number, and Tree Species). This information should be placed on the Cluster and Cavity tree Status Form (SM-1).
10. Upon returning from the field, a hard copy and digital scan of the status information should be stored in a file cabinet and/or in the identified path on a Shared Drive. Actual data entry of the information should be done immediately following the breeding season.

References

- Allen, DH. 1991. Constructing artificial red-cockaded woodpecker cavities. USDA Forest Service General Technical Report SE-73.
- Copyeon, CK. 1990. A technique for constructing cavities for the red-cockaded woodpecker. *Wildlife Society Bulletin* 18:303-311.
- Jackson, JA. 1978. Pine bark redness as an indicator of red-cockaded woodpecker activity. *Wildlife Society Bulletin* 6:171-172.
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SOP 2: Group Composition, Size, and Individual Bird Identification

Overview

This SOP details how to determine the group composition, group size, and the identity of individuals in the group on an annual basis. Group composition (i.e., potential breeding group, solitary bird, captured) is an essential metric to determining population trend and size of the RCW population. In particular, accurately determining changes in the number of potential breeding groups from all clusters is needed to monitor the population. In addition, observations of color-banded individuals can be used to measure group size, evaluate survivorship, map dispersal of birds, and identify individual birds for translocation. However, these additional metrics can be extremely time consuming and should only be considered for targeted groups, critically small populations (<30 groups). The procedures outlined below are consistent with guidance from the RCW Recovery Plan (US Fish and Wildlife Service 2003, pages 74, 284).

Preplanning Field Logistics

Prior to conducting group composition, size or individual bird determination, the survey coordinator should ensure that field crew members have been properly trained to conduct this assessment and identify color band combinations (see Element 6). Maps of clusters and cavity tree locations should be updated annually and printed in advance. A list of the target clusters should be generated for refuges that have a large population (>100 active clusters) and are conducting a 50% annual sample of active clusters (see Element 2) or a subsample of those for individual bird observations. If only a sample of the population is being monitored on an annual basis, all groups from the last survey year containing a solitary bird should be included in the current survey. In addition, any cluster in which single or multiple bird translocations were conducted, should be monitored during the current year. At least one week before and prior to leaving the station for a status assessment, the field crew should verify all equipment and supplies are available (Table SOP- 2.1). The survey coordinator or other refuge staff members should be aware of the anticipated work area that day and expected return period as a safety procedure. The crew should also review any other safety precautions and review work assignments for the day. To save time and effort, other monitoring activities including fecundity checks and nestling banding can often be done concurrently.

Table SOP- 2.1 Equipment and supplies needed for group composition, size, and bird identification.

Quantity	Item Description	Purpose
1	Group Composition, Size and Bird ID (SM-2) Rite-In-The-Rain® notebook	Record field data
2	Pens or pencils – Blue color preferred	Data recording
1	Cluster and Cavity Tree Maps	Orient to site
1	Binoculars (10 x 50x) and/or camera	Visualize birds and Identify color bands
1	Spotting scope variable power (20-60x)	Visualize birds and Identify color bands
1	Tripod or monopod	Support spotting scope
1	Portable folding stool/chair	Observation platform

Quantity	Item Description	Purpose
1	Copy of Field Data: used color bands combinations and recent observations	Facilitate: QA/QC of observations and identification
1	Color band samples of each used color/shade	Improve color identification
1	Knee boots and/or waders	To traverse trails
1	IPad with mobile apps	Record and report field data digitally
1	GPS with extra batteries – Latitude and Longitude, Decimal Degrees, NAD83 or WGS84	Georeference trees
1	Tree Flagging	Temporarily mark new trees

Group Composition

The group composition of an active cluster is evaluated immediately prior to or during the breeding season (April – July) and only accounts for adult birds. Group composition is generally determined by conducting checks in active cluster until nesting is verified (see SOP 3), identifying the number and sex of individual birds, or doing a morning follow or evening roost of birds from a cluster.

Group composition is assigned based on the following:

- **Potential breeding group (PBG)** – An adult female and adult male occupying the same cluster, with or without helpers, regardless if they attempt nesting.
- **Solitary Male** – An adult male occupying a cluster without a mate
- **Solitary Female** – An adult female occupying a cluster without a mate
- **Captured** – An active cluster that does not support its own group and typically bird(s) from an adjacent group occupy one or more cavities.

Field Procedure for Group Composition

1. Field crew member examines each active cluster during the breeding season.
2. As the field crew member approaches each active tree, they should be looking up at the cavity for a flushing bird and listening for birds in the cluster. Particular effort should focus on the previous year's nest tree as it is likely to be reused.
3. Nesting is confirmed by flushing an incubating bird by scrapping lightly on active cavities, documenting a cavity with an egg or nestling with a video camera, hearing nestling begging, or an adult is seen carrying food to a cavity. Nest checks should continue on a 4-11 days interval should until a nest detected. If a nesting is determined, composition is assigned as a **PBG**.
4. If during a cluster inspection, two or more birds are observed interacting without aggression, the group can be assigned as a **PBG** and no further nest inspection is required (unless reproductive success and banding of nestling is being monitored, see SOP 3). Hearing one or more birds in a cluster is insufficient to assign group composition.

5. If by mid-breeding season a nest has not been determined, multiple birds observed, or the site contains a single active cavity, then group composition is best determined by conducting a morning follow.
6. *Morning Follow*: One or more field crew members should arrive at the cluster 10 minutes before sunrise and be positioned such that active cavity trees can be observed. Use of binoculars or a spotting scope may be needed. The target group is observed for up to an hour after bird(s) exit.
7. Group status is assigned to: a) **PBG** if two or more birds are observed interacting without aggression, b) **Solitary** – a bird that remains solitary throughout the follow, or c) **Captured** – no birds are observed or the bird joins up with a neighboring group.
8. Record data on the Group Composition and Size Form (SM-2).

Group Size

Group size may be used to derive an estimate based on a sample in large populations, generate average size from a census of all groups in critically small populations (<30 active clusters), or assess translocations success at clusters undertaken the previous 6-8 months. For refuges undertaking translocation [intra- or inter-population (recipient or source)], documenting PBG with helpers is very important to focus nestling banding efforts and obtain juveniles birds in fall. Group size can be most readily determined via observations of color-band and unbanded birds. Most observations can be made during regularly scheduled nest determination or nestling banding. In some instances, a morning follow or evening roost count at a cluster may be needed to ascertain group size.

Field Procedure for Group Size Determination

1. During fecundity checks or nestling banding, field crew member(s) observes adults tending to the nest. Field crew member should observe a cluster for 30-60 minutes at a distance that does not interfere with feeding bouts. Binoculars or a spotting scope should be carried to look for any banded birds. If the number of active cavities in a cluster is 2, the amount of time observing a cluster can be substantially less given the likelihood of their being a helper is minimal (see 5 below).
2. For clusters with no documented nesting, field crew member should conduct either a morning follow, or an evening roost inspection (see 3 and 4 below).
3. *Morning Follow*: One or more field crew members should arrive at the cluster 10 minutes before sunrise and be positioned such that active cavity trees can be observed. A spotting scope or binoculars should be used. The target group is observed for up to an hour after bird(s) exit to determine group size and possible interaction with a neighboring group. If a single bird is followed and joins up with a neighboring group, the cluster is considered Captured and this bird should be accounted for in the size of the neighboring group. Otherwise, the group size of the cluster is assigned the number of birds detected exiting cavities or interacting in the area.
4. *Evening Roost Inspection*: Field crew member should arrive 30-45 minutes before sunset and position themselves a minimum of 50 yards from known active cavity trees. Typically birds will work resin wells and interact with other group members before going to roost. Birds are noted as they go to roost. Because the call location from an RCW can be difficult to discern, number of birds in a group should be based on visual detection. If individual bird identification is required for monitoring objectives based on color-

banding, attempt to record the leg (left or right), color of band, shade (light or dark) and position on the tarsus (top, middle, and bottom). Note: band position is referenced from the tarsus-tibia joint. On a perched RCW with the toes pointed up, the band position should be interpreted as inverted. See *Field Procedure for Individual Bird Identification* below for additional guidance.

5. Record and validate all data on the Group Composition, Size and Bird ID Form (SM-2).

Individual Bird Identification

Individual bird identification is based on visual observations of uniquely color marked birds. This monitoring will generally be restricted to refuges that are conducting intensive RCW monitoring of small populations or detecting birds pre- and post-translocation. These data can be used to estimate annual juvenile and adult survivorship if collected over multiple years. Annual coordinated efforts to identify adult birds should be done during the breeding season. In situations where nesting is unsuccessful or a group consists of a solitary bird, observations of adults should be done during evening roost counts. Locating juvenile birds for translocation should be scheduled for August and early September before birds potential disperse within the population. In rare circumstances, recapture of adult birds may be necessary to identify individuals for which color bands have been lost, are excessively covered with pine resin, or the observed color band combination is not one used in that population.

Field Procedure for Individual Bird Identification

1. For groups with known nesting, schedule observations of adult birds based on nests with young that are ≥ 5 days of age. Identification can occur on the same day chicks are banded or scheduled when adults are more actively feeding older chicks (see 6). It is recommended to avoid mid-day observations when the sun is overhead as excessive backlighting can make reading color bands difficult especially on higher cavities.
2. For solitary bird clusters or groups with failed nesting attempt, conduct an evening roost inspection (see 15: *Evening Roost Inspection*)
3. Field crew member should observe the nest cavity tree at a distance (~30 yards) that does not interfere with feeding bouts.
4. If two crew members are present, position one on each side of the nest cavity to facilitate reading banding color combinations on each leg.
5. Erect a spotting scope on a tripod and point at the nest cavity.
6. Use of a folding chair by the observer will reduce fatigue and often settles adults into more normal feeding activity.
7. Feeding bouts by adults to tend younger chicks (<8 days) or nests with few chicks (1-2) may be less frequent and the return interval of each adult may take 0.5 – 2 hours.
8. Partial reading of bands should be anticipated and repeated observations of the same bird tending the nest may be needed to read record all band colors and positions.
9. The leg nearest the observer is most readily observed. If the opposing leg cannot be read, the observer should reposition to the other side of the cavity.

10. The field crew member should examine color band examples to verify observed colors and shade. Colors can potentially fade, be partially covered by blackened pine resin or are easily confused with similar colors (e.g., mauve, pink, purple).
11. For birds that are banded, record the leg (left or right), color of band, shade of band (light or dark) and position on the tarsus (top, middle, and bottom).
 - a. Note: band position is referenced from the tarsus-tibia joint. On a perched RCW with the toes pointed up, the band position should be interpreted as inverted.
12. Once a color combination has been identified, the field crew member should cross-validate the information against the historic banding and observation table. If the band combination is not confirmed, the crew member should make additional observations of the unknown bird and attempt to resolve either the color or band location confusion. The history of banding observations at this cluster may provide information that allows even partially read bands to be reasonably assumed to be a particular bird.
13. Observations of any unbanded birds should be noted.
14. Record and validate all data on the Group Composition, Size, and Banding and Recapture Forms (SM-2 and SM-3).
15. Evening Roost Inspection Reading color band combinations during evening roost inspections is more difficult due to multiple birds interacting, birds are more prone to move among trees, and birds may go to roost before a band combinations are read. Multiple crew members are recommended at a cluster with more than 2 adults.
16. Field crew member(s) should arrive 30-45 minutes before sunset and position their chair and spotting scope approximately 30 yards from an active cavity tree. Select a vantage point that affords a view of multiple active cavity trees.
17. Observe bird as it pecks on resin wells at the roost tree.
18. If the bird goes to roost before the combination is read, approach the cavity to flush the bird. Do not flush a bird that goes to roost 15 minutes after sunset. If need return another evening to document unread band combinations.
19. Follow Steps 8-14 above to complete data collection and validation process.

Group Composition, Size and Bird Identity Data Management

Management of group composition, size and bird identification data is addressed in Element 4 and specific details are outlined in SOP 5 (Data Entry and Management) for recording the information within the RCW Population Database.

SOP 3: Fecundity Determination: Nest Checks and Cavity Inspection

Overview

This SOP provides detailed instructions to document RCW fecundity and cavity contents. Nest checks are periodic visits to active clusters during the breeding season. Nest checks provide information on fecundity (eggs and nestling produced), timing for nestling banding, sex of nestlings, and fledgling rates. In addition, nest activity can be used as a proxy for group composition of a PBG. It is important that frequency of nest visits and the date of their initiation are consistent across years to allow accurate determination of population trend. Cavity inspections are primarily done to locate nests but also may be used to determine the suitability and contents of cavities. These inspections may coincide with efforts to remove flying squirrels just prior to or during the breeding season, or a prerequisite to translocate birds to a recruitment cluster. The procedures outlined below are consistent with the RCW Recovery Plan (US Fish and Wildlife Service 2003, pages 280-284).

Preplanning Field Logistics

Prior to conducting nest inspections and cavity contents, the survey coordinator should ensure that field crew members have been properly trained to use the peeper scope and climb with Swedish sectional ladders. Maps of clusters and cavity tree locations should be updated annually and printed in advance. A list of the target clusters should be generated for refuges that have a large population (>100 active clusters) and are conducting a 50% annual sample of active clusters (see Element 2). If only a sample of the population is being monitored on an annual basis, all groups from the last survey year containing a solitary bird should be included in the current survey. In addition, any cluster in which single or multiple bird translocations were conducted, should be monitored during the current year. At least one week before and before leaving the station for a status assessment, the field crew should verify all equipment and supplies are available (Table SOP- 3.1). The survey coordinator or other refuge staff members should be aware of the anticipated work area that day and expected return period as a safety procedure. The crew should also review any other safety precautions and review work assignments for the day. To save time and effort, other monitoring activities including cluster and cavity tree status, group composition and size can be completed concurrently.

Equipment and Supplies

Every refuge may have a unique technique for operations, so this equipment list should be adjusted per the needs of the refuge.

Table SOP- 3.1 Equipment and supplies needed to determine nesting and cavity contents.

Quantity	Item Description	Purpose
1	Cavity Inspection and Nesting Form (SM-4) preprinted on Rite-In-The-Rain [®] paper	Record field data
1	Nestling Aging Sheet (SM-6)	Standardize Aging Criteria
2	Pens or pencils – Blue color preferred	Data recording

Quantity	Item Description	Purpose
1	Peeper Scope and extra battery	Inspect cavity contents
1	Cluster and Cavity Tree Maps	Orient to site
1	Binocular (10 x 50x) and/or camera	Visualize birds and Identify color bands
1	Spotting scope variable power (20-60x)	Visualize birds and Identify color bands
1	Insect Repellant	Prevent tick, mosquito, chiggers
1	GPS	Record new cavity trees
1	Swedish Climbing Ladders	Direct visual inspection
1	Cavity Cleaning Bucket – vacuum, cleaning tools, drill, carabiner, rope	Remove trash material
1	Climbing Safety Belt and Lanyard	Climbing with ladders

Nest Checks

Nest checks are repeated inspections of active clusters to determine if the cluster contains a PBG as well as reproductive effort and nest fates. Nest checks consist of (1) lightly scraping active cavity trees in an effort to flush incubating birds, (2) listening for nestlings begging for food, (3) inspecting potential nest cavities using a video probe or climbing equipment, and/or (4) watching for adults carrying food to a cavity, or observing adults doing a cavity exchange during the day. The timing of nesting inspections should begin in early April and continue to July as needed to document late or second nest attempts. Nest checks are conducted every 4 to 11 days until a nest is detected. If nesting is documented, the cluster supports a PBG and no further nest checks are required (unless reproductive success is being monitored or nestlings are scheduled to be banded).

Field Procedure for Nest Checks

1. Before going into the field ensure all equipment and supplies (Table SOP 3.1) have been prepared and are available.
2. Upon arrival to an active cluster, look and listen for RCW activity. Watch for RCW flying from cavities and listen for chicks begging for food. Typically, the nest will be in the same cavity as last year or a newly completed active cavity. If you hear chicks begging, see adults do an incubation exchange, or observe an adult bring food to a cavity, you can assume nesting. Simply observing a bird flushing from a cavity is insufficient to document nesting as adults often times will be constructing or cleaning cavities.
3. For each active cavity tree within the cluster, use a video peeper scope or a Swedish climbing ladders to check the cavity contents. Once a nest is located, no further monitoring is necessary unless more specific reproductive and cavity content information is being gathered. In such cases, record number of eggs or nestlings and

nestling age, or other cavity contents on the Fecundity Determination Form (SM-4), as well as other relevant information such as date, cavity ID and relevant comments

4. If a nest contains eggs, return to the cluster in 4-7 days to determine total production and hatching rates. Thereafter schedule a subsequent visit based on nestling age (see SM- – Nestling Aging Chart) if checks are to be banded. Otherwise, it is not necessary to return to the cluster until the late/nestling checks are performed to determine sex of checks.
5. If no nesting activity in the cluster is documented continue to monitor the cluster on a 7 to 11 day interval throughout the breeding season. A morning follow of adults may be advised to survey for unknown cavity trees further from the cluster center.

Productivity: Fledgling or Late Nestling Checks

Fledgling checks or late nestling checks are performed to determine how many nestlings survived to fledging, and the sex of those individuals. Though fledgling checks provide more accurate nestling survival estimates, it requires a much higher investment of time to locate fledged chicks. Late nestling checks (approximate day 18-21 post hatching) provides an alternative approach when checks are still in the nest cavity. However, band color combinations rarely can be determined in the cavity and thus sex of chicks cannot be assigned to known individuals. Do not conduct a visual inspection of the cavity after this date with chicks in the cavity as it may cause them to fledge prematurely.

Field Procedure for Fledgling or Late Nestling Checks

1. *Fledge Check:* Field crew member should arrive at a cluster during the morning to facilitate locating fledglings.
2. Schedule checks 2-14 days after expected fledge date of the nest.
3. Observer should listen for adults as they return with food to feed chicks. Observe the fledglings with a spotting scope or binoculars to observe band color combination if chicks were banded and examine the crown to determine the sex of chicks. Record number of fledglings, their color band combinations, and their sex (females have a black crown and males have a central red crown patch). Data should be recorded on the Cavity Inspection/Nesting Form (SM-4) and the Banding and Resight Form (SM-3).
4. If a banded nestling is not detected as a fledgling during the one-hour fledgling check, conduct a second check within ten days to locate any unaccounted bird.
5. *Late Nestling Checks:* Field crew member conducts a traditional nest inspection using a video peeper scope or direct visual inspection of the cavity with Swedish Ladders.
6. Schedule checks between 18-21 days estimated hatching date of the nest.
7. Observer should be careful when inserting the camera into the cavity entrance as the chicks tend to hang in the entrance tunnel.

8. Record the number of chicks and their sex (females have a black crown and males have a central red crown patch).

References

US Fish and Wildlife Service. 2003. Recovery plan for the red-cockaded woodpecker (*Picoides borealis*): second revision. U.S. Fish and Wildlife Service, Atlanta, GA.

SOP 4: Capture and Banding Adult and Nestling Red-cockaded Woodpeckers

Overview

This SOP details how to capture and band adult and nestling red-cockaded woodpeckers from roost and nest cavities. The procedures outlined below are consistent with guidance from the RCW Recovery Plan (US Fish and Wildlife Service 2003, pages 280-283). Placement of USGS - numbered aluminum bands and a unique combination of auxiliary markers (colored leg bands) is used as a method to assist in identification of specific individuals in the population based on capture-mark-recapture (or resighting of free flying birds). Banding data are used in part to estimate annual survivorship, group composition and size, and identify individuals for translocation.

Banding of adult or nestling birds is at the discretion of the survey coordinator based on annual or long-term monitoring objectives and population metrics of interest as outlined in each refuge site-specific protocol. In many cases, only a portion of the population may need to be banded to estimate population variables of interest or facilitate translocation activities. For refuges interested in understanding annual juvenile and adult survivorship, significant effort will be needed to establish a base of the population being banded and maintaining annual banding of nestlings over a minimum of 5 years in conjunction with extensive field observation of birds. As such, banding only should be undertaken to meet well-defined objectives.

Preplanning Field Logistics

Prior to conducting banding operations, the survey coordinator should ensure that field crew members have been properly trained to conduct banding and capture activities or will be directly supervised by a qualified individual and that appropriate permits to conduct banding and auxiliary mark birds has been approved (see Element 6). A schedule for anticipated banding dates and cluster locations for nestlings should be developed based on nest inspections (SOP 3) and approximate age of banding of 5-10 days. The appropriate banding schema should also be prepared to prevent accidental duplication of color band sequences. A copy of this scheme is stored in a shared refuge drive: public(\\ifw5gdsr-fs.fws.doi.net)(P:):\RCW. Well in advance ensure your station has sufficient bands for the season. On days of banding, the field crew should verify all equipment and supplies are available (Table SOP-2.1). In addition, the field crew should check weather conditions to be certain ambient temperatures will be above 50⁰F and no precipitation; banding operations should be delayed or suspended as necessary. The survey coordinator or other refuge staff members should be aware of the anticipated work area that day and expected return period as a safety procedure. The crew should also review any other safety precautions and review work assignment for the day. Ideally banding operations should be carried out by two members to increase safety and efficiency of banding.

Equipment and Supplies

Every refuge may have a unique situation for banding operations, so this equipment and supplies list should be adjusted per the needs of the refuge (Table SOP-2.1). Banding equipment supplies and color bands can be obtained from [Avinet Research Supplies](#), [Red Bird Products](#), and [Avian ID](#). Sequentially number aluminum butt-end bands (size 1A) should be ordered directly from the U.S. Geological Service, Bird Banding Lab ([Order Form](#)).

Table SOP-4.1 Equipment and supplies needed to band adult and nesting red-cockaded woodpecker.

Quantity	Item Description	Purpose
2-6	Swedish sectional ladders 10-foot	Climb cavity tree
1	Safety belt and lanyard	Safety equipment
1/person	Climbing Helmet	Safety equipment
1 pair	Leather gloves	Safety
30-70 ft	Rope – 3/8 – 1/2 inch braided polyester	Lower or raise equipment
1	Rope bag	Store rope to prevent tangling
2	Fine flat metal file or finger nail emery board	File down plastic bands
18 in	3/8 inch - Flexible plastic or rubber hose	Capture nestlings
1 spool	25 – 50 lb monofilament line or nylon coated steel wire fishing leader	Noose material for capturing nestlings
1	Extendible Net Capture Pole – fitted with mist net, plastic bag, or mosquito net	Capture adults from cavities
2	8-inch pieces of fine steel wire	Assist in removing butt-end bands from injured bird
1	Video inspection camera with extendible pole	Determine nest contents
1	Extra 12-volt battery	Video camera
1	6-volt Drop light and mirror or peeper	Inspect cavities from ladders
3	Cloth banding bags with rope tie or synch	Temporary holding& weighing
1	Dial Calipers (0.5 mm accuracy)	Morphological measurements
1	Spring scale (0.5 gram accuracy)	Weigh adults
2	Pen or pencils	Data recording
1	Aluminum and color banding combination table	Determine band combination
1	Spotting Scope or Binoculars	Examine birds for bands
1	USGS numbered aluminum bands – Size 1A	Banding birds
1	Colored leg bands – multiple colors; solid, striped, or numbered (Inside Diameter- 4.0mm)	Banding birds
1	Clip Board – metal with inside storage compartment	Hold forms and pens
1	Banding and Recapture Data Form (SM-3) preprinted on Rite-In-The-Rain® paper)	Record field banding data
1	Nestling Aging Chart (SM-6)	Reference for aging chicks
1	Corn Starch	Prevents sap sticking to noose
8 oz	Baby Oil	Lubricant for noose
16 oz	Isopropyl alcohol	Sap cleaner for bands and hands
1	Rags or paper towel	Clean sap bands and hands
1 tube	Antibiotic cream	Wound care
1 roll	Cellophane tape	Splint leg or wing injuries
1 tube	Pet bond	Stops bleeding
1	Tarp	Ground cloth to work over

Banding Nestlings

Nestlings have to be kept warm, dry and out of direct sun during all procedures. They are banded between the ages of 5 to 10 days old. Banding nestlings older than 10 days of age is prohibited because of the increased risk of injury to a limb or the developing feathers. Banding nestlings younger than 5 days old is not possible because they cannot accommodate three-color bands on one leg and often the leg is too fat to accept the aluminum band.

Nestling banding procedure:

1. Prepare and stage all banding equipment and supplies in an open place 15-20 feet away from the nest tree.
2. Based on previous nest checks (SOP 3) or via inspecting the nest cavity with a video camera system (Richardson et al, 1999), determine the nestlings are of proper age to band (~5-10 days; SM-6 Nestling Age Chart) and the number chicks in the cavity.
3. Field crew members put on safety climbing equipment (climbing belt, gloves, and helmets).
4. Secure safety lanyard around tree and clip other end of lanyard clip into lockable carbineer.
5. Have second crew member check carbineer and safety belt before climbing begins.
6. Attach rope to belt – use to raise Swedish ladders, other equipment, and lower nestlings in cloth bag.
7. Crew member ascend ladders and secures safety chain as each section is added.
8. Clip rope to additional ladders as needed. Ensure ground crew member is clear beneath tree before raising ladders.
9. Raise the banding cloth bag and capture noose.
10. Coat the noose and loops with corn starch or baby oil to reduce friction and prevent sap sticking.
11. Slowly insert the noose into the nest cavity and reduce light at the entrance with your other hand to induce a begging response from the chicks. Slowly pull the monofilament line to close the loops until the chicks quit chirping, the line becomes taught, or the stop gauge knot is observed as described by Jackson (1982).
12. Slowly withdraw the noose and any nestlings from the cavity and immediately remove the noose from around each nestling – place in clean cloth bag.

13. Repeat the procedure until all nestlings have been captured. Verify the nest is empty by using a small 6-volt drop light and mirror. If one or more nestlings cannot be noosed over a period of 10 minutes, then cease any further attempts.
14. If working with a crew member, lower the chicks in the cloth bag on the rope. A crew member working alone should carry the bag in such a manner that it is over their back and does not become crushed between the climber and the ladders or lower the bag on the rope and then proceed down.
15. Place chicks in location that is out of direct sun.
16. Remove the sequential numbered USGS bands needed to band the nestlings from the wire string holding them and then secure the wire through the remaining bands to prevent them from sliding off. Bands should be used in sequential order. Place loose bandings in storage compartment of banding box to prevent loss.
17. Nestlings and adults are banded based on a unique combination of three colored bands on one leg and the USGS-aluminum band with an additional color-band on the other leg. Birds are not to be banded with one or two color-bands alone on a leg, because color-bands that move excessively can cause injury to toes. Birds are not to be banded with more than a single color-band on the leg carrying the aluminum band. Occasionally, the tarsus of younger chicks will not easily fit a third color band. In such circumstances the height of one or more of the color bands can be filed down slightly to accommodate the leg. Color bands are applied using a split tool to open and slide the bands onto the leg. Unique banding combinations are always based the location of each band in relation to the top of the tarsus of the bird, the USGS-aluminum band, and leg. This provides thousands of unique combinations depending on the number of colors being used.

Example of a band combination: note the middle position is always left blank for the leg with the USGS-numbered aluminum band. Combination would be denoted as Red/Red/Orange – Left Leg, Orange/Al – Right Leg.

Band Location Relative to the Top of the Tarsus	Left Leg	Right Leg
Top	Red	Orange
Middle	Red	-
Bottom	Orange	USGS-Al

18. The nestling should be first banded with a USGS, numbered band using size 1A banding pliers based on the predetermined banding color combination. If the aluminum band is incorrectly placed on the wrong leg, the band is not to be removed and an alternative color band combination determined. Immediately check the band number against that recorded on the datasheet for verification. If data are being recorded by a second field crew member, the individual should call back the band number and all other associated variables being collected to the bander as each is recorded. This will provide a mechanism to minimize errors and insure all information is collected prior to releasing

the bird. Primary variables to record include: (Date, Cluster ID Number, Cavity Tree Number, USGS Band Number, Color Bands Used and Location, and [Sex: M – Male, F – Female, U – Unknown], and Number of Unhatched Eggs). Secondary variables may include: Age and Weight. All data should be recorded on the Banding and Recapture Data Form (SM-3)

19. After banding all the nestlings and verifying all data has been collected, return the nestlings to the cavity by folding wings and legs in and push the nestling in head first through the entrance until it rolls down into the central cavity.
20. Upon returning from the field, a hard copy and digital scan of the banding form should be stored in a file cabinet and/or in the identified path on a Shared Drive. Actual data entry of the information should be done immediately following the nestling banding season (see SOP 5: Data Entry and Management)

Banding Adults

Adults are captured for banding or color-band replacement outside the breeding season, unless the bird in question cannot be caught except during breeding (e.g., a female without a roost cavity). Aluminum bands are never replaced and are only removed if the band is causing a foot injury (see below: *Band Removal Procedure*). Color bands may sometimes need replacement, but capture of adults should be minimized to the fullest possible extent. Capture of adults will be done using an extendable fiberglass pole net following general procedures of Jackson and Parris (1991) using either a plastic bag or a net bag made from fine-meshed mosquito netting.

Adult banding procedure:

1. Determine location (cluster and cavity tree) of unbanded birds or birds needing color band replacement based on evening or morning roost inspections.
2. Prepare a central location away from active roost cavities to lay out banding equipment and supplies and equipment.
3. Arrive in the evening 30 minutes before birds are expected to roost or 1 hour before sunrise. This allows time to locate cavity trees from which to capture birds.
4. After the target bird has gone to roost for a period of 5 minutes, approach the tree with the net pole. Some birds can be extremely skittish and may readily flush upon approach. In such cases, a longer period waiting may be needed or one can capture the bird in the morning before sunrise.
5. The net is slowly raised and centered over the cavity. For extremely tall cavities, a second observer may be needed to insure the net is placed accurately over the cavity.
6. If the bird does not exit the cavity, tapping on the bole, scrapping the bark with a stick, or shining a strong light at the cavity may help.

7. After the bird enters into the net, it is quickly lowered to decrease chances of the bird flying out. The bird is removed and placed into a cloth holding bag.
8. If multiple birds are being captured from a cluster, all captures can be completed in the same manner before beginning banding operations.
9. Adults will not be caught at night, except those captured for translocation that evening and for specific research needs. Adults will also not be caught during wet weather.
10. Adults are banded in the same way as nestlings with three color-bands on one leg, and the USGS numbered aluminum band with an additional color band on the other leg based on predetermined unique band combinations.
11. For adult birds having been previously banded, examine the color bands and remove any excessive pine sap using isopropyl alcohol or replace excessively faded color bands by splitting the bands apart with the banding tool and then placing new color bands.
12. If the captured bird has an injury to the foot, removal of the bands from that leg may be advised. Extra precautions should be undertaken to remove the USGS-aluminum band following procedures outlined below under *Band Removal Procedure*.
13. Record and verify the accuracy of the band combination and band serial number after recording them on Banding and Recapture Data Form (SM-3).
14. Primary variables to record include: (Date, Cluster ID Number, Cavity Tree Number, USGS Band Number, Color Bands Used and Locations, and [Sex: M – Male, F – Female, U – Unknown], and Age [HY – Hatch Year, AHY – After Hatch Year]. Secondary variables may include: Weight and Wing-chord Length.
15. Birds are immediately released by letting them cling to the bole of tree within the cluster.
16. Upon returning from the field, a hard copy and digital scan of the banding information should be stored in a file cabinet and/or in identified path on a Shared Drive. Actual data entry of the information should be done immediately following the nestling banding season.

Banding Data Management

Management of banding data is addressed in Element 4. Capture and recaptures of birds should be recorded in the RCW Population Monitoring ArcGIS Online GeoDatabase (SOP 5) as well as Program [Bandit](#) to report used bands to the U.S. Geological Survey, Bird Banding Lab.

Bird Injury or Mortality

Though procedures for capture and banding are designed to minimize injury or mortality to birds, it is recognized that such outcomes may occur. General guidance is provided below on how to handle injuries to birds and reporting requirements.

During removal of nestlings from the cavity, wing or leg injuries including deep abrasions, fracture of the leg or wing, and bruising of the neck and skull have been reported. Field crew members should use their best judgement to provide first aid to treat the bird. Light compression on any bleed and application of an antibiotic ointment should resolve most abrasions or cuts. If a broken leg or wing is suspected, cellophane tape can be used to stabilize the fracture by making several light wraps – the tape typically falls off on its own after several days but provides enough time for the fractures to stabilize. It is advised that birds with fractures not be banded. However if the injury was noted after banding, do not remove the bands as this may cause further injury. When reporting the status of birds with an injury, the condition code will be **5** (see below: *Banding Codes*).

Capture and handling of adult birds from cavities rarely results in any injury. If an adult bird is suspected of having a broken limb, the field crew should consider holding the bird overnight in ventilated enclosed box and consult with the RCW Coordinator and a local veterinary or wildlife rehabilitation group to determine the best course of treatment. An injury associated with the bands on the legs of adults is occasionally observed and removal of the bands is necessary (see *Banding Removal Procedure*). Upon removal of the bands, application of an antibiotic cream is advised. During net captures of adults, some birds may occasionally get large globs of pine resin on their primaries or retrices that impair their function. Before releasing these birds, wiping the feathers with a cloth soaked in isopropyl alcohol to remove most of the resin is appropriate.

If any unintended injury or mortality should occur, all authorized activities must stop and the survey coordinator or designee shall contact the RCW Recovery Coordinator and the Permit Coordinator on the next working day., . Based upon discussions between these offices, a decision will be made as to whether or not the banding activities will be allowed to continue. A decision will also be made regarding the disposition of any killed individuals.

Band Removal Procedure

The removal of the USGS-aluminum band should only be done in the event the leg with the band has developed an injury in which retention of the band on the leg would further hinder survivorship of the bird. Two methods are discussed to allow the removal of the band.

The first method involves the use of a leg band opener (see [Avinet Research Supplies](#)) or split ring pliers. Though typically used to open the closed band from a string, these pliers can also be used to remove a band on a bird. While holding the bird in one hand with the leg restrained between the thumb and fore finger, insert the sharpened tips of the pliers on either side of the leg and squeeze the handles which will open the butt ends. Care must be taken not to inadvertently prick the leg with the tips or force the tips too far in between the leg and the band.

The second method for removing the bands is to insert two strands of fine single-strand wire (e.g., wire used to string bands) between the band and the tarsus on each side of the tarsus. Subsequently twist the wires' ends tightly to form two separate loops, insert a rod or tips of a pair of partly opened needle-nosed pliers or small scissors into each loop, and then pull the loops in opposite directions. The loops should be placed 90⁰ angle from the butt-ends of the band and therefore opposite each other. The butt end of the band should open which will allow the band to be removed. Assistance from a crew member to hold the bird is strongly advised. If the bander

is working alone, the bird can be held over to the morning in a ventilated enclosed box to get assistance in removing the band.

Banding Codes

When reporting the condition status of newly banded bird (see Element 4 and SOP-5), refer to the USGS, Bird Band Lab for correct condition code and additional information code ([Status Codes](#)). In most instances, a normal, wild bird, released in same 10-minute block as captured, held 24 hours or less would be coded (300); with colored leg bands (301). Injured birds will be condition coded 5 with appropriate additional information code and supplementary comments.

References

- Jackson JA. 1978. Capturing woodpecker nestlings with a noose – a technique and its limitations. *North American Bird Bander* 7:90-92
- Jackson JA and SD Parris. 1991. A simple effective net for capturing cavity roosting birds. *North American Bird Bander* 16:30-31.
- Richardson DM, JW Bradford, PG Ranch, and J Christensen. 1999. A video probe system to inspect red-cockaded woodpecker cavities.
- US Fish and Wildlife Service. 2003. Recovery plan for the red-cockaded woodpecker (*Picoides borealis*): second revision. U.S. Fish and Wildlife Service, Atlanta, GA.

SOP 5: Data Entry and Management

The RCW protocol framework provides an efficient means to analyze trends of RCW populations on refuges. The use of a standardized data management process ensures data consistency and integrity across all field stations. SOP 5 provides guidance for data management, including data entry, verification, archiving, metadata, and database administration for the RCW Population Monitoring Protocol. The Survey Coordinator will be responsible for oversight of field data collection procedures. Detailed information on how to enter, proof, and manage RCW population and habitat monitoring data within the region's RCW Population Monitoring datasets are housed on the ArcGIS Online FWS Enterprise Platform provided in the [RCW Data Management Manual](#). This documentation is updated annually, retained on the RCW Protocol and Data Mgmt SharePoint, and archived in ServCat ([Help Documentation 133717](#)). This SOP assumes that all data collected in the field are immediately or eventually entered into the ArcGIS Online RCW Population Monitoring data platform (see Supplemental Materials if using paper form data sheets). The USFWS Regional I&M Data Manager can assist the Survey Coordinator with all aspects of data management upon request. *For all data collected on paper data sheets, data will still need to be entered to the AGOL RCW Population Monitoring data platform.*

Metadata

The metadata requirements for the RCW Population Monitoring Protocol include a Site-specific Protocol (SSP) and a [Data Management Plan](#). The SSP includes important details about the survey, among other information, that will serve as part of the metadata for the survey. The Data Management Plan, maintained annually by the Data Steward, describes the data acquired or produced; how the data will be managed, described, and stored; what standards will be used; and how the data will be handled and protected during and after the completion of the activity where the data is involved. The Data Management Plan and SSP comprise the full metadata for the survey needed for reporting and tracking progress.

Regional RCW Population Monitoring Geodatabase

Data collected using this protocol framework will be entered into the RCW Population Monitoring geodatabase using a series of forms via the ArcGIS Mobile, ArcCollector or mobile application. This application relies on the ArcGIS Online Enterprise platform via hosted feature datasets. Survey data are hosted as a regional dataset and archived daily during the collection season on the [RCW Protocol and Data Mgmt SharePoint](#).

Data entry should be entered while in the field or as soon as possible after the data are collected. Full guidance for entering data into the mobile and/or web-based application and how to utilize the ArcGIS Online Enterprise data platform can be found in the [RCW Data Management Manual](#) and is available on the RCW Protocol and Data Mgmt SharePoint or from the Service Catalog record (ServCat) (<https://ecos.fws.gov/ServCat/Reference/Profile/115946>). The process consists of using the ArcGIS Online and mobile applications. Data entry using the online platform utilizes built in quality control standards and quality assurance methods in order to ensure accuracy and minimize errors during the collection process.

If using paper datasheets, field crew members should make a paper copy of each original field data sheet upon returning from the field. Review each copied data sheet for clarity as the copied data sheets will be used for data entry.

Proof the data sheets—While all data sheets should have undergone an initial review for completeness in the field, it is important to proofread the copied datasheets, ensuring they are filled out completely. This serves as a final check prior to data entry and if deficiencies are identified, they must be reviewed with the survey coordinator and/or crew member who filled them out the data sheet.

The following steps should be used to reduce errors in the database and make original data recording materials available for future reference, back-up or checking.

1. Organize data sheets by RCW cluster. Review the data sheets, ensuring that all required fields have been filled out completely. Ideally, if more than one person is collecting data, have someone that did not collect the data conduct the review.
2. Mark corrections on copied data sheets with a red pen. Any corrected errors, or changes made by the data “proofer” (that are entered differently into the database than they appear on the data sheet) should be circled, initialed, and corrected. Notes should be written in the margins or in the comments section to document the reason for the corrections.

Entering data into the RCW Population Monitoring Geodatabase

1. The field crew member will enter the data into the mobile application. Using your Microsoft Authenticator login information, connect to the mobile application using a mobile device or the web-based data collection application.
2. Enter cluster and cavity tree status, banding and resight encounters, group composition and size, and fecundity using the respective mobile app forms.

Geodatabase File Backup

The Regional I&M Data Manager is responsible for performing periodic backups of all RCW monitoring data residing in the ArcGIS Online database platform. The regional geodatabase will be backed up to the Microsoft OneDrive platform via the RCW Protocol and Data Mgmt SharePoint. All ArcGIS online datasets (Feature Classes) are backed up daily as csv files using an R-Markdown script. Individual Refuge directories will be compiled on a weekly basis during collection period for ease of access and stored by year at [RCW Protocol and Data Mgmt/Data Management/Refuges/](#).

Other File Backup

Refuge-specific backup files are located at on the field station server (public(\\ifw5gdsr-fs.fws.doi.net)(P:):\RCW).

Data Security and Archiving

The Regional Data Steward is responsible for archiving all regional data. Data will be backed up in the ArcGIS Online platform as well as to ServCat on an annual basis. Data includes annual csv files for all 6 surveys collected, annual data management manual, annual supplemental materials, and the regional Data Management Plan.

The survey coordinator will archive survey data, field notes/forms, in compliance with relevant Service data standards (<http://www.fws.gov/stand/>) and pursuant to the Inventory and Monitoring Policy (701 FW2). Data will be added to the Project Reference in ServCat for this survey (ServCat <https://ecos.fws.gov/ServCat/Reference/Profile/133104>). The Project Reference will store relevant survey documents (e.g., scanned data sheets, reports).

1. Scan the original data sheets and field notes to create a digital archive. PDF is the preferred file type.
2. Archive the scanned data sheets along with survey reports and other digital survey files in ServCat as appropriate reference types (e.g., generic data, unpublished reports), and link as products to the Project Reference.

Supplemental Materials

SM-1: Cluster and Cavity Tree Status Determination Form.

Cluster and Cavity Tree Status Determination Form
 (page 1 of 2)

Date Entered into DATABASE _____
 Data QA/QC'd in DATABASE _____

Station _____ Observer(s) _____ / _____ Date ____/____/____

Cluster ID _____ Cluster Status (*circle one*) A I C Ab U NS

Recommended Management Actions:

Additional Cavities Needed <input type="checkbox"/>	Midstory Hardwood Removal Needed <input type="checkbox"/>	Cluster Needs Prescribed Burning <input type="checkbox"/>	Repaint Cavity Trees <input type="checkbox"/>	None at this time <input type="checkbox"/>
--	--	--	--	---

Comments _____

Cavity Tree Status (for each natural or artificial cavity info column, record the number observed on each tree)

Tree ID* (For new trees add metadata below)	Tree Status*	Naturals	Naturals Suitable	Naturals Active	Inserts	Inserts Suitable	Inserts Active	Drilled	Drilled Suitable	Drilled Active	Starts	Natural Cavities Restricted	Snake Excluder (Existing/New/None)	Comments

SM-2: Group Composition and Size Form.

Group Composition and Size Form	Date Entered into DATABASE _____ Data QAQC'd in DATABASE _____
Station Name: _____	
Observer Names: (1) _____ (2) _____ Date: _____ Cluster: _____ Group Composition (<i>circle one</i>): Captured Potential Breeding Group Solitary Group Size: _____ Comments: _____	
Observer Names: (1) _____ (2) _____ Date: _____ Cluster: _____ Group Composition (<i>circle one</i>): Captured Potential Breeding Group Solitary Group Size: _____ Comments: _____	
Observer Names: (1) _____ (2) _____ Date: _____ Cluster: _____ Group Composition (<i>circle one</i>): Captured Potential Breeding Group Solitary Group Size: _____ Comments: _____	
Observer Names: (1) _____ (2) _____ Date: _____ Cluster: _____ Group Composition (<i>circle one</i>): Captured Potential Breeding Group Solitary Group Size: _____ Comment _____	
Observer Names: (1) _____ (2) _____ Date: _____ Cluster: _____ Group Composition (<i>circle one</i>): Captured Potential Breeding Group Solitary Group Size: _____ Comment _____	

SM-5: Translocation Form

Translocation Form (Optional)

Date Entered into DATABASE _____
Data QAQC'd in DATABASE _____

Station Name: _____ Observer (s) _____

Capture Date _____ USGS Band Number _____ - _____

Sex (M F) Age (Adult Hatch Year)

Left Leg Band Combination			Right Leg Band Combination		
Top	Middle	Bottom	Top	Middle	Bottom

Translocation Type
 Donor Interpopulation Augmentation Donor
 Interpopulation Duel Bird Intrapopulation
 Augmentation Intrapopulation Duel Bird
 Recipient Interpopulation Augmentation
 Recipient Interpopulation Duel Bird
 (Circle One)

Source Population _____ Capture Tree ID _____ _____ Capture Cluster ID

Release Population _____ Release Cluster ID _____ Release Tree ID _____

Release Date _____

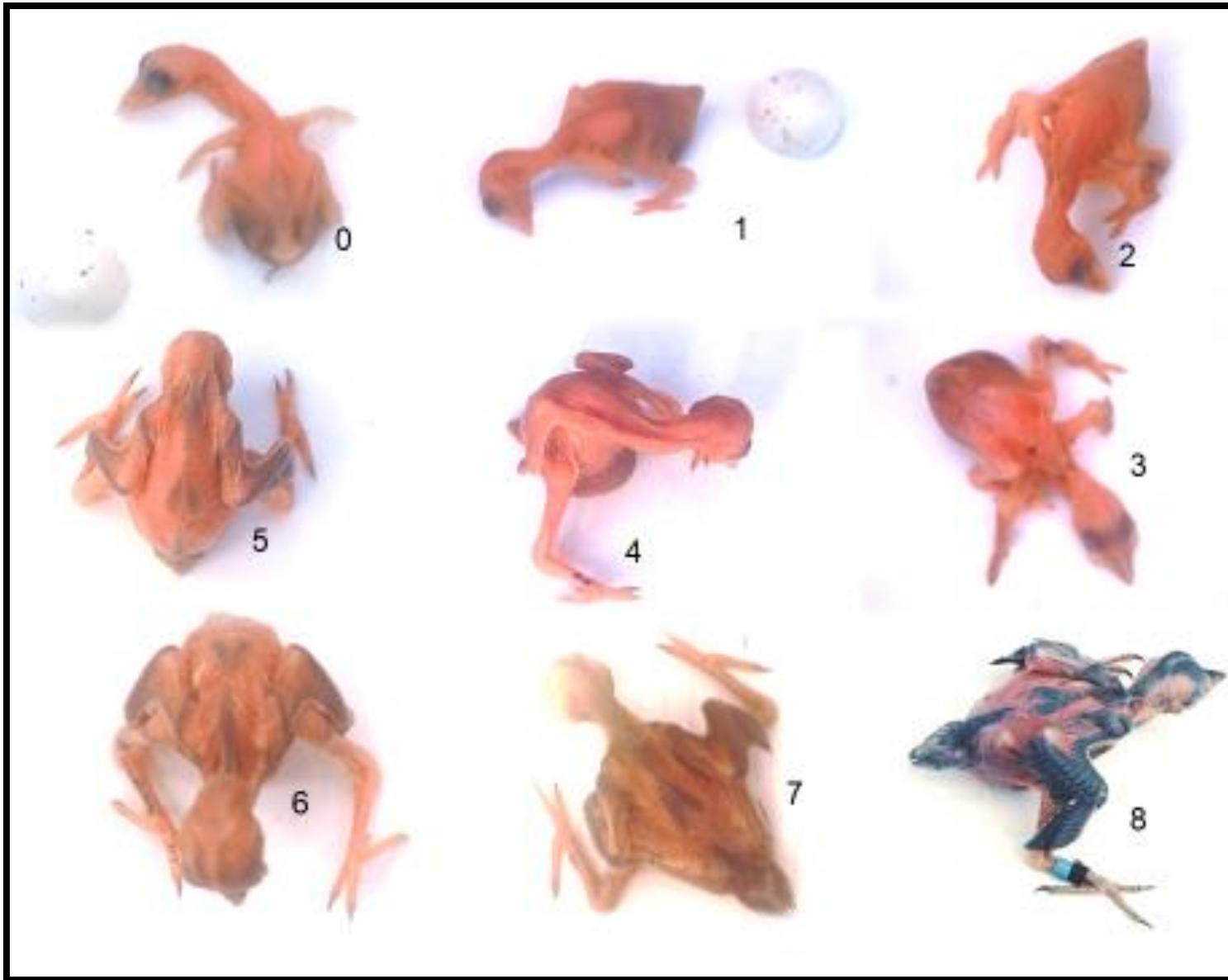
Comments _____

SM-6: Nestling Age Chart

Nestling characteristics and images indicative of nestling age (days), modified from Ligdon (1970)

Age	Characteristic	Description
0	Skin Wings Size	Loose and Pink Permanently extended – used to remain upright Appears small enough to fit back into shell
1	Size	Body could fit into shell, but not the head
3	Remiges	Dots visible on wings
5	Skin Tracts	Darkening – losing pink color Crown, lower neck and most of spine, femoral and ventral tracts visible
6	Bill Retrices	Maxilla almost as long as mandible Bristles visible on tail
7	Tracts	Thigh and leg tracts visible
8	Bill Remiges	Maxilla and mandible equal in length Quills protruding from skin on wing
9	Eye Retrices	Open Exposed short distance
10	Remiges Tracts	Quills visible Well developed, quills exposed on most tracts
11	Bill Tracts	Maxilla slightly longer than mandible, culmen 11-12 mm Feather tips of spinal, scapular, anterior ventral and leg tracts showing
13	Retrices Remiges	Tail quills – 6.5-7.5 mm Outer primary quills about 25 mm
15	Retrices Tracts	Tail quills 16-18 mm Feathers still largely sheathed across body
17	Tracts	Feather sheaths on head broken away except red crown patch in males

19	Retrices	Longest tail feather 29 mm, quills breaking away
	Remiges	Longest primary feather 45 mm, quill breaking away





SM-7: Job Hazardous Analysis for Climbing Trees with Swedish Ladders.

<p>SM-7: Job Hazard Analysis for Climbing Trees with Swedish Ladders.</p>  <p>JOB HAZARD ANALYSIS (CERTIFICATION OF HAZARD ASSESSMENT - 29 CFR 1910.133)</p> <p>U.S. FISH AND WILDLIFE SERVICE</p>		<p>JOB ACTIVITY: Tree Climbing (Red-cockaded woodpecker work)</p> <p>DATE: 13 June 2017</p> <p>PREPARED BY: Allyne Askins</p> <p>CERTIFIED BY: Allyne Askins</p>
<p>PERSONAL PROTECTIVE EQUIPMENT REQUIRED: appropriate clothing and footwear, UIAA approved helmet; harness, gloves, sun or safety glasses</p>		<p>QUALIFICATIONS, EXPERIENCE, OR TRAINING REQUIRED: All personnel, volunteers trained by qualified personnel</p>
BASIC JOB STEPS	HAZARDS	SAFE JOB PROCEDURE
Break work down to basic elements (such as remove, lift, carry, stop, start, apply, return, squeeze, weld, saw, walk, hold, grind, place, etc.). Describe what is done, not how it is done.	For each job step, state what accident could occur and/or what hazard is present. To determine this, ask yourself <u>Can</u> the person fall; overexert; be exposed to burns, fumes, rays, gas, etc.; hit against; be struck by; in contact with; be caught in, on, or <u>between?</u>	State how each element of work should be performed to prevent the accident or avoid the hazard. What should the person do or not do? Be specific. What precautions should be taken? Ask yourself <u>what</u> can I do to eliminate, modify, guard, identify, or protect against the potential hazard or accident, including such things as how the worker stands, holds, uses, carries, dresses, <u>etc.?</u>
Preparations for Climbing	Unprepared Personnel	Must be in good physical condition, mentally prepared to climb. Have any necessary medications for allergies <u>available</u> . Have appropriate clothing and footwear, UIAA approved <u>helmet</u> ; harness, gloves, sun or safety glasses. Plan for adequate food and water; prepare first aid kit; include wasp or bee killer. Secure and check <u>hand held</u> radio for contact with HQ. Sign out with work leader and provide location of climbing activities. Do not climb alone.
Driving to climbing site	Vehicle and Traffic	Check gas, oil, water, tires, seat belts, lights, brakes, horn and general condition of body and undercarriage. Clean windshield and mirrors. Be aware of other activities in project area.
Moving around at climbing site	Injury due to poor footing, plants, animals, <u>insects</u> and equipment.	Be certain of secure footing and maintain safe walking distance between people, especially when carrying equipment. Watch for stepping in loops formed by lanyards. Be aware of <u>poisonous plants</u> , animal hazards,

		and insects in area. Place equipment out of the way until ready to use.
Checking the environment	Adverse weather conditions	Do not climb when winds exceed 25 mph or strong gusts are predicted. Climb with adequate daylight. Monitor temperature and heat index. Do not climb if thunderstorms are predicted to avoid lightning and heavy rain.
Checking the tree	Unsafe tree	Check every tree for hazards before and during climbing, and while working in the tree. Avoid trees with hornet or wasp nests, large nesting birds, animals, or any indication of rot. Never climb a tree with power lines close enough to come in contact with the tree. Be aware of dead branches hanging in the tree and other dead trees leaning against tree to be climbed. Never climb above a fork in a conifer if the fork represents a weak point or has been caused by injury.
Equipment check	Unsafe equipment	Inspect equipment before each climb; ensure that it meets or exceeds National Safety Standards Check for stress, cracks, wear, abrasion, splices and stitching. Never allow equipment to be used for anything other than climbing. Keep equipment stored away from chemicals, sunlight and protect from mice and mildew.
Climbing on branches	Falls or injury due to breaking, dead or small diameter limbs	Always climb with a ground person with the ability assist or communicate with someone if additional help is needed. Always maintain 3-point climbing technique using secure surfaces able to support <u>climbers</u> weight. Keep feet, hands, and body as close to the bole as possible. Keep ground person informed of your activities in the tree. Limit free climbing to portion of the crown below 4" diameter. Always use lanyard to secure self when stopping to work or rest in tree, and visually check attachment points for proper security. Never move in a hurried fashion.
Climbing/working in tree	Abrasions, <u>cuts</u> and eye injury	Always wear appropriate climbing gear, including a <u>long sleeved</u> shirt (optional for summer climbing), and gloves when necessary. Do not turn head rapidly; eye protection is recommended. Keep lanyard above waist level and properly adjusted while climbing; take small steps to avoid slipping.

Climbing/working in tree	Injury due to falling limbs, <u>debris</u> and equipment	Ground person should stay away from the base of the tree as much as possible. Equipment should not be placed directly overhead while climbing. Keep climbing helmet adjusted and chin strap fastened. Stay alert to direction of fall when pruning limbs. Never use ladders to knock off limbs.
Equipment use	Damage to rope and equipment, or injury from rapid or improper rappel	Be familiar with equipment use and history. Keep equipment free of pitch and dirt; clean up regularly. Check ropes frequently for abrasion and fraying. Secure rappel rope and system well below 4" diameter. Angle tree crotch lanyard or rope over 1 or 2 sturdy limbs, not entire whorl. Check any system before removing lanyard and transferring weight to system.
Equipment removal from tree	Injury from rappel system being removed from tree	Climber and ground person should <u>wear head protection at all times</u> . Warn others of intent to remove system from tree. Plan an escape route; watch carefully and stand away from base of tree.
Continuous climbing	Fatigue	Climber and ground person (if properly trained) should alternate jobs to prevent fatigue. Do not climb when overly tired. Complete tree top work first and move downward. Use haul line rather than carry heavy equipment.
General climbing activities	Strained muscles	Perform stretching exercises prior to starting a climbing assignment; work especially on flexibility. Do not have heavy equipment hanging from harness; transfer this weight to limbs. Use pulley system to raise and lower equipment; have ground person do the work of raising and lowering. Minimize the time spent in one position, especially when leaning out. Drink ample water to prevent dehydration and muscle cramps. Use legs to push upward rather than pulling with arms whenever possible.
	Strangulation, lacerations	Never wear anything around the neck, including jewelry, <u>cameras</u> or lanyards. Remove other jewelry such as rings and earrings.
Chainsaw use	Cuts, Lacerations, Falls	Follow procedures outlined in Chainsaw Use JHA including proper PPE (substitute climbing helmet for hardhat). All climbers will be certified for chainsaw use in trees on their climbing card. A steel cord lanyard is required for chainsaw use in trees.

SM-8: Glossary

Active Cavity. A completed cavity exhibiting fresh pine resin associated with cavity maintenance, cavity construction, or resin well excavation by red-cockaded woodpeckers and being used for roosting

Start. The beginning stages of cavity creation, before a cavity is completed or considered a cavity.

Active Cluster. Any cluster containing one or more active cavity trees.

Accuracy. Measures precision and bias of estimators. A sample-based estimator is considered accurate when multiple sampling trials give a very similar answer that on average is the same as the true value for the parameter of interest (Williams et al. 2002).

Adaptive management. A structured process that promotes flexible, informed decisions that allow us to make adjustments as we better understand outcomes from management actions and other events. Careful monitoring of these outcomes both advances scientific understanding and helps adjust policies or operations as part of an iterative learning process (Williams et al. 2012).

Attribute or Parameter. A feature or process of the environment that can be measured or estimated and that provides insights into the state of a resource or related ecological indicator.

ATV. All-terrain vehicle, travel on low-pressure tires (3-4), seat straddled by the operator, and steered with handlebars.

Bias. The difference between the expected value of an estimator and the parameter it is meant to estimate. Biased statistics either overestimate or underestimate the true value.

Captured Cluster. A cluster that does not support its own group of red-cockaded woodpecker, but contains active cavity trees in use or kept active by a neighboring cluster.

Cluster. The aggregation of cavity trees previously and currently used and defended by a group of red-cockaded woodpeckers.

Group. The social unit in red-cockaded woodpeckers, consisting of a breeding pair with or without helpers, or a solitary bird.

Inventory. A survey that estimates the presence, abundance, or distribution of species, habitats, ecological communities, or abiotic features at a particular time.

Inventory and Monitoring Plan. A plan required by Service policy (701 FW 2) documenting the surveys that a refuge selects to implement.

Metadata. Description of the content, quality, history, condition, and other characteristics of recorded information. Federal agencies must create metadata that meets specific standards for newly collected or produced geospatial and biological data (see Executive Order 12906 as amended by Executive Order 13286, Federal Geographic Data Committee 2000).

Monitoring. A survey repeated through time to document changes in select attributes of wildlife, plants, habitats, ecological communities, or abiotic resources (701 FW 2.6).

Objective, management. A concise statement of desired outcomes that specifies what we want to achieve, how much we want to achieve, when and where we want to achieve it, and who is responsible for achieving it.

Objective, sampling. Specifies target levels of accuracy required to reliably interpret the data collected in a survey. These targets determine the level of rigor needed to meet the objectives.

Population, target. The set of individuals or species that are the focus of inquiry in a survey.

Precision. Variability of measurements within or among samples. The standard error and the coefficient of variation often are used to quantify precision of a parameter. Precision contrasts with bias, which focuses on how the average sample estimate differs from the true value.

PRIMR. A database for Planning and Review of Inventory and Monitoring at Refuges (PRIMR). This database describes and archives the surveys conducted on the refuges, and can be a tool to generate summaries for an Inventory and Monitoring Plan.

Protocol. Detailed instructions for conducting a survey. This includes information on sampling procedures, data collection, management and analysis, and reporting of results. In this handbook, the term protocol refers to either a survey protocol framework or a site-specific survey protocol (701 FW 2.6).

Refuge. Any unit of the National Wildlife Refuge System, including refuges, wetland management districts, tracts transferred to the Service from USDA, and associated waterfowl production areas.

Resin Well. A wound in a pine tree's cambium, created and maintained by red-cockaded woodpeckers, for the purpose of resin production.

Restrictor. A metal plate used to protect existing cavities (natural or artificial) from being enlarged by competing woodpecker and to repair cavities that have been enlarged by competing cavity nesters.

Sample frame. The list from which units are drawn for the sample. These units closely approximate the target population that is the focus of inquiry.

Sampling unit. The units that are selected for collecting data in survey; these units may include individual organisms, quadrats, transects or points on a map. For this protocol, it refers to clusters and groups.

Sample size. The number of units within the sample frame selected for sampling.

Secondary core. A population identified in recovery criteria that will hold at least 250 potential breeding groups at the time of and after delisting. Defined by biological boundaries.

ServCat. (Service Catalog) The U.S. Fish and Wildlife Service document catalog is an online repository designed to centralize and preserve Service information. This includes reports, annual narratives, management plans, geospatial data, Inventory and Monitoring Plans and survey protocols.

Site-specific survey protocol (SSP). A complete set of instructions used to conduct a survey at a specific refuge. SSPs are developed by adding site-specific instructions to a generalized protocol framework or by modifying a site-specific protocol that was developed for a similar survey at another refuge.

Standard Operating Procedure (SOP). A written document or instruction detailing all relevant steps and activities of a process or procedure.

Survey. A specific data-collection effort to complete an inventory or conduct monitoring of biotic or abiotic resources (701 FW 2).

Survey Coordinator. A Service employee, usually the Refuge Biologist, who oversees the implementation of one or more surveys selected in an IMP. This includes selection of survey protocols that adhere to standards of scientific excellence. The survey coordinator also ensures that survey data are managed, analyzed and reported, and results are archived in ServCat. When surveys involve implementation by cooperators or partners, the survey coordinator ensures I&M policy requirements for surveys are met. (701 FW 2).

Survey protocol framework. A survey protocol that was written for application at many locations, but lacks the site-specific information necessary to implement the protocol at an individual refuge.

Survey Objective. A concise statement of what is to be measured, and reference to spatial and temporal considerations.

Target Universe. The population about which you want to make an inference.

Translocation. The capture and movement of red-cockaded woodpeckers from one location to another.

Uncertainty. The extent to which we cannot reliably predict the outcome or result of an action or event, or prove that something is true. In a monitoring context, it generally refers to the accuracy of conclusions drawn from survey data or models, or the correctness of our predictions as to how a species or habitat will respond to a management action. Sources of uncertainty about management effectiveness include ecological (structural) uncertainty, environmental variation, partial controllability, and partial observability.

UTV. Utility Task Vehicle that seats 2 or more in a side-by-side configuration and has a steering wheel.