Monitoring of high priority bird species at Camp Grayling Joint Maneuver Training Center

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EXECUTIVE SUMMARY

Federal military facilities, such Camp Grayling Joint Maneuver Training Center (CGJMTC), are important to sustaining biodiversity, including threatened and endangered species and numerous migratory bird species. With many bird species continuing to decline, having current information on the status of bird species of conservation concern is vital to facilitating proactive management and minimizing possible conflicts between conservation measures and military training activities. The Michigan Natural Features Inventory (MNFI) partnered with the Michigan Department of Military and Veterans Affairs (DMVA) to design a bird survey program to gather information on bird species of high conservation concern using CGJMTC, such as listed, special concern, and declining species. The program is providing baseline data on these species and the overall bird communities using CGJMTC lands and a mechanism to monitor changes in relative abundance and distributions over time.

The MNFI worked with DMVA to develop a program that would meet their information needs for several bird species/groups: rare raptors, secretive marsh birds, golden-winged warbler (*Vermivora chrysoptera*, State Threatened), red-headed woodpecker (*Melanerpes erythrocephalus*, State Special Concern), grassland birds, and pine barrens birds. For each target species/group, we created a three-year panel design of point-count stations to allow broad spatial coverage of CGJMTC on an annual, rotating basis. We used standardized point count methodologies for the target species/groups consistent with other monitoring efforts within the state and region. In 2023, staff from MNFI and DMVA completed the third year of the three-year sample frame designed to be used as part of a long-term monitoring program.

With help from DMVA staff, we conducted 589 points counts for raptors, marsh birds, and at-risk bird species within CGJMTC in 2023. Across all surveys, 108 bird species were recorded, including one State Endangered, four State Threatened, and six State Special Concern species, nine species of greatest conservation need, 12 statewide featured species of the Michigan Department of Natural Resources (Wildlife Division), and seven focal species of the Upper Mississippi / Great Lakes Joint Venture. In addition, golden-winged warbler is considered a mission-sensitive species by the Department of Defense (DoD) Partners in Flight, and we observed four DoD Tier 2 species. Data gathered on rare species in 2023 resulted in the creation of 20 new element occurrences for 11 bird species and updating of 11 occurrences for six bird species in MNFI's Natural Heritage Database, including new occurrences of American bittern (*Botaurus lentiginosus*, State Special Concern), golden-winged warbler, red-headed woodpecker, eastern whip-poor-will (*Antrostomus vociferus*, State Threatened), and upland sandpiper (*Bartramia longicauda*, State Threatened).

Results from three years of monitoring highlight the value of CGJMTC to a variety of breeding bird species. The data gathered will provide valuable baseline information for evaluating trends in bird distributions and relative abundances as surveys are implemented in the future, as well as creating opportunities to explore questions related to bird habitat use and response to management. We plan to use the data collected over the last three years to assess if the level

of survey effort used to date is necessary to achieve survey objectives moving forward and explore options to reduce labor and costs while still meeting monitoring needs, such as removing points in unsuitable habitat and increasing the minimum spacing of point for some target species.

ACKNOWLEDGEMENTS

Young jack pine (*Pinus banksiana*) in Camp Grayling. Photograph by M.J. Monfils.

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INTRODUCTION

Military installations serve as refuges for several at-risk wildlife species. The intact wildlife habitats found on U.S. Department of Defense (DoD) lands support greater densities of threatened and endangered species than those of any other federal agency (Stein et al. 2008). Migratory bird species, even those once considered common and widespread, have been experiencing demonstrable population declines (Rosenberg et al. 2019), despite protection under the Migratory Bird Treaty Act. As more species become a conservation concern, it is increasingly important for land managers at military facilities to document the species that currently exist on their lands and, through proactive management, avoid potential conflicts between conservation measures and military training. Baseline surveys are a critical first step in making informed management decisions and, if repeated over time, can be used to document population changes. Surveys can also play an important part in helping installations to meet regulatory requirements.

Camp Grayling Joint Maneuver Training Center (CGJMTC) is an approximately 147,000-acre military installation used for military training that consists of a mosaic of lands owned by the Michigan Department of Military and Veterans Affairs (DMVA) and Michigan Department of Natural Resources (DNR). The facility provides a variety of habitats for migratory and resident breeding birds. The objective of this ongoing project was to develop and implement a bird monitoring program across CGJMTC to better document the species that occur on the installation and the distributions and relative abundances of at-risk and migratory species. Ultimately, these data will be incorporated into the CGJMTC Integrated Natural Resources Management Plan (INRMP) and used to provide guidelines for species management. In 2021 the Michigan Natural Features Inventory (MNFI), a program of Michigan State University Extension, worked with the DMVA to design and begin implementation of a bird survey program to gather information on bird species of high conservation concern, such as state and federally listed, special concern, and declining species. The program is providing baseline data on these species and the broader bird communities using CGJMTC lands and a mechanism to monitor changes in relative abundance and distributions over time. In 2023, MNFI and DMVA staff completed the third year of bird surveys of what was designed to be an annual, long-term program. In this report, we describe the monitoring program, methods used, and summarize the results of the third year of surveys.

METHODS

Sample Design

We developed bird surveys to evaluate the status (e.g., relative abundance, occupancy, trends) of the following rare or declining species with potential to occur at CGJMTC: 1) rare raptors; 2) secretive marsh birds; 3) golden-winged warbler (*Vermivora chrysoptera*, State Threatened); 4) red-headed woodpecker (*Melanerpes erythrocephalus*, State Special Concern); 5) rare grassland birds; and 6) rare pine barrens species. Michigan Forest Inventory (MiFI) data were used to classify potential habitats for each bird species/group (Table 1). Based on cover type, stand area, and size density class, we identified suitable stands and created spatial layers of potential habitat in ArcMap (ESRI 2017). Next, we created layers of potential survey points by overlaying point grids with appropriate spacing over the stands. We used a 250 m x 250 m point grid for late successional forest areas and a wider spaced, 400 m x 400 m point grid for early successional forest, shrub, and open cover types to reduce the likelihood of double counting (Ralph et al. 1995). Those points falling within the potential survey stands formed the sample frame for each species/group. Except for secretive marsh birds, there were more survey points than could be covered in one year, so we developed a panel sampling approach in which approximately one third of all points are covered in a year and all points are surveyed over three years. This approach could be applied on an ongoing, rotational basis, resulting in each point being surveyed every three years.

To develop our three survey panels while providing a spatially balanced and logistically efficient sample, we created a layer of 100-hectare hexagons to serve as our primary sample units (PSU) for CGJMTC. We used 100 hectares as our PSU size because it represents the approximate maximum area an individual can survey in a day under the various protocols used in this project. Each PSU was assigned a random number and after putting them in numerical order, we created the three survey panels for each bird species/group as follows: Panel 1 – first third of PSUs, Panel 2 – second third of PSUs, and Panel 3 – last third of PSUs. In this sample design, survey points are our secondary sample units, so when a PSU is selected for survey, all secondary sample units, or point count stations, falling within the PSU are to be surveyed (Figure 1). The first panel was surveyed in 2021, the second in 2022, and the third in 2023.

Table 1. Michigan Forest Inventory (MiFI) stand descriptors used to identify potential habitats for bird species or groups targeted in the Camp Grayling monitoring program.

Habitat Descriptor	Rare Raptors	Secretive Marsh Birds	Golden-winged Warbler	Red-headed Woodpecker	Grassland Birds
Cover type					
Aspen	X		X		
Treed bog			X		
Lowland deciduous	X				
Herbaceous openland					X
Hemlock	X				
Lowland shrub			X		
Lowland mixed forest	X			X	
Northern hardwood	X			X	
Natural mixed pines	X				
Mixed upland deciduous	X			X	
Marsh		X			
Oak				X	
Lowland aspen/balsam poplar	X		X	X	
Red pine	X				
Upland mixed forest	X			X	
Low-density trees				X	
Bog		X			
Urban				X	
White pine	X				
Size density class	9	NA	All	All	NA
Minimum patch area (ha)	4.0	4.0	2.0	NA	10.0

Figure 1. Examples of primary sample units (green hexagons) and secondary sample units (point count stations, yellow points) used in designing Camp Grayling bird surveys.

Rare Raptors

Raptor surveys were designed to target red-shouldered hawk (*Buteo lineatus*, State Special Concern) and northern goshawk (*Accipiter gentilis*, State Threatened). Deciduous, mixed, and coniferous forest stands (except for pine plantations) of size-density class 9 and at least 4 hectares (10 acres) were considered potential habitat for these species. We surveyed raptors using a four-minute point count (Mosher et al. 1990, Anderson 2007, Bruggeman et al. 2011) consisting of two, two-minute broadcast periods (one for red-shouldered hawk, one for northern goshawk). Each broadcast period consisted of approximately 10 sec of broadcasted calls followed by 30 sec of silent listening, which was repeated three times for a total of two minutes. Calls were broadcasted using a FoxPro NX4 at a volume that produced a sound pressure of approximately 95 dB at one meter from the unit. The broadcast unit was rotated about 120 degrees for each series of calls to ensure 360-degree coverage.

We conducted surveys from 12 to 28 April 2023 during daylight hours (sunrise to sunset). Weather conditions that can reduce the detectability of raptors were avoided (e.g., strong winds, moderate to heavy precipitation). Although red-shouldered hawk and northern goshawk were the focus of surveys, we recorded all raptor observations. For each raptor observation, we recorded the species, approximate distance when first detected (using distance bins of 0-50 m, 51-100 m, 101-250 m, 251-500 m, and > 500 m), and direction (i.e., N, NW, NE, S, SW, SE). When red-shouldered hawks or northern goshawks were observed, we searched the vicinity

surrounding the survey point and location of the detection for potential nests. Trees were also visually inspected for stick nests while walking and driving between survey stations. We documented nest locations using tablet computers along with information on the species detected, activity observed (e.g., territorial behavior, incubation), nest status (e.g., decorated, feathers, whitewash), tree species, and approximate nest height. When an active nest was confirmed (e.g., bird seen incubating or flushed from nest), we discontinued surveys at nearby points (i.e., within the same contiguous forest stand or nearest on the 250-meter point grid) to minimize disturbance to the nesting pair.

Secretive Marsh Birds

Open wetlands, such as marshes and wet meadows, of at least four hectares (10 acres) were surveyed for a suite of rare, declining, and secretive marsh bird species. We followed the North American Marsh Bird Monitoring Protocols (Conway 2011), which were further refined for the Michigan Marsh Bird Survey (Michigan Bird Conservation Initiative [MiBCI] 2015). The survey methods target 10 primary species (e.g., rails, bitterns, grebes) and eight secondary species (e.g., selected songbirds, marsh-nesting terns) that occur in marshes and other wetlands dominated by emergent vegetation.

We conducted three visits during the breeding season (mid-May to late June) at points separated by at least 400 m (Conway 2011). Surveys were done in the morning between 30 minutes before to three hours after sunrise. During each visit, we completed a 10-minute point count consisting of a five-minute passive listening period followed by one-minute broadcast periods for the following five species: least bittern (*Ixobrychus exilis*, State Threatened), yellow rail (*Coturnicops noveboracensis*, State Threatened), sora (*Porzana carolina*), Virginia rail (*Rallus limicola*), and American bittern (*Botaurus lentiginosus*, State Special Concern). Calls were broadcasted using an MP3 player (Oakton MP100) and portable wireless speaker (Ultimate Ears Wonderboom 2) at the recommended sound pressure of 80-90 dB at one meter from the speaker. Observations of primary target species were recorded by individual bird across each minute of the 10-min survey and the distance at first detection was estimated to the nearest five meters with aid of a laser rangefinder. Secondary species were tracked at the species level, with only the period of first observation of the species noted and the total number of individuals were recorded within three distance bins (0-50 m, 51-100 m, and > 100 m). Please refer to the Michigan Marsh Bird Survey Protocol (MiBCI 2015) for detailed survey methods.

At-risk Bird Surveys

We used the same point-count methodology for surveys targeting golden-winged warbler, red-headed woodpecker, grassland birds, and pine barrens birds. Areas of early successional aspen (*Populus* spp.) and balsam poplar (*Populus balsamifera*), shrub wetlands, and treed bogs at least 2 hectares (5 acres) in size were the focus of golden-winged warbler surveys. Stands of deciduous, mixed, and oak-dominated forests, and areas with low tree densities within the Hanson Forest and Cantonment were surveyed for red-headed woodpeckers. We identified grasslands (herbaceous openlands in MiFI) of at least 10 hectares (25 acres) as potential

grassland bird habitats where surveys were conducted. Surveys for rare pine barrens species were conducted within the Pine Barrens Management Area.

Surveys occurred during late May through early July and from sunrise to four hours after sunrise (Ralph et al. 1995). We avoided conducting surveys during weather conditions that can reduce bird detectability (e.g., winds ≥ 20 km/hour [13 mph], moderate to heavy precipitation). All birds seen or heard were recorded during 10-minute point counts. The 10-minute point count consisted of three periods: 1) first three minutes (minutes 1 – 3); 2) next two minutes (minutes 4 and 5); and 3) last five minutes (minutes 6 – 10; Ralph et al. 1995). Use of the three survey periods provides flexibility in making comparisons with other surveys and studies of varying time lengths, such as the North American Breeding Bird Survey. During each time period, we assigned each bird observation to one of four distance categories at the time of first observation (0 – 25 m, 26 – 50 m, 51 – 100 m, and > 100 m) based on the estimated distance of the bird from the observer. Having observations assigned to distance bins facilitates analyses to estimate density and population size.

RESULTS

In 2023, we observed 108 bird species during 589 point counts conducted across surveys targeting rare raptors, secretive marsh birds, and several at-risk species. Data gathered under this project resulted in MNFI creating 20 new element occurrences (EOs) of 11 bird species and updating 11 EOs of six bird species. Note that the Michigan Department of Natural Resources (DNR) updated the State list of threatened and endangered species in March 2023 and concurrently the MNFI updated the list of special concern species based on feedback from the Bird Technical Committee. These changes resulted in new species being listed (e.g., golden-winged warbler and northern goshawk listed as Threatened), species being delisted (e.g., red-shouldered hawk moved from Threatened to Special Concern), and additions to the special concern list (e.g., wood thrush, sedge wren). Below we provide detailed summaries of our 2023 survey results according to the target bird species or group. A complete list of the bird species detected with scientific names is provided in Table A1 (Appendix A).

Rare Raptors

We surveyed 112 (85%) of the 131 survey points identified in our Year 3 raptor survey panel for northern goshawk and red-shouldered hawk. Nineteen points were dropped because they fell within clearcuts or active logging operations. In addition, we surveyed four points from the Year 2 panel and one point from the Year 1 panel that had northern goshawk/red-shouldered hawk activity, as well as an existing red-shouldered hawk element occurrence (EO) located within CGJMTC from 2004. We also checked the two active northern goshawk nests documented in 2021 and an active red-shouldered hawk nest documented in 2022.

Red-shouldered hawks were detected at thirteen (12%) of the Year 3 panel points surveyed, one out of four of the Year 2 points revisited, at the existing EO from 2004, and incidentally at two additional locations while traveling between points. We also heard red-shouldered hawks at seven points surveyed for golden-winged warbler and at two points surveyed for red-headed woodpecker. After searching for nests near locations with responses, we found one active red-shouldered hawk nest. The nest was located near the existing EO from 2004 (EO ID 14333) in NTA 26 approximately 180 m to the south of Krause Rd (Figure 2). The nest was in a 46 cm (18 in) DBH red oak (*Quercus rubra*) about 12 m (40 ft) above the ground (Figure 3). A female was on the nest incubating and eventually flushed from the nest, calling aggressively. The male was within the vicinity of the nest and was heard calling in response to the female. This nest record data was used to update the occurrence created in 2004. We observed potential red-shouldered hawk nesting activity near a nest found in 2022 located just west of Old US-27 in STA 7 (Figure 2). We did not see or hear red-shouldered hawks in the area during our visit; however, there was possible new nest construction in two red pines (*Pinus resinosa*), but they lacked decoration, whitewash, and down. This information was used to update the existing EO from 2022 (EO ID 26111) and we suggest surveying the area again in 2024.
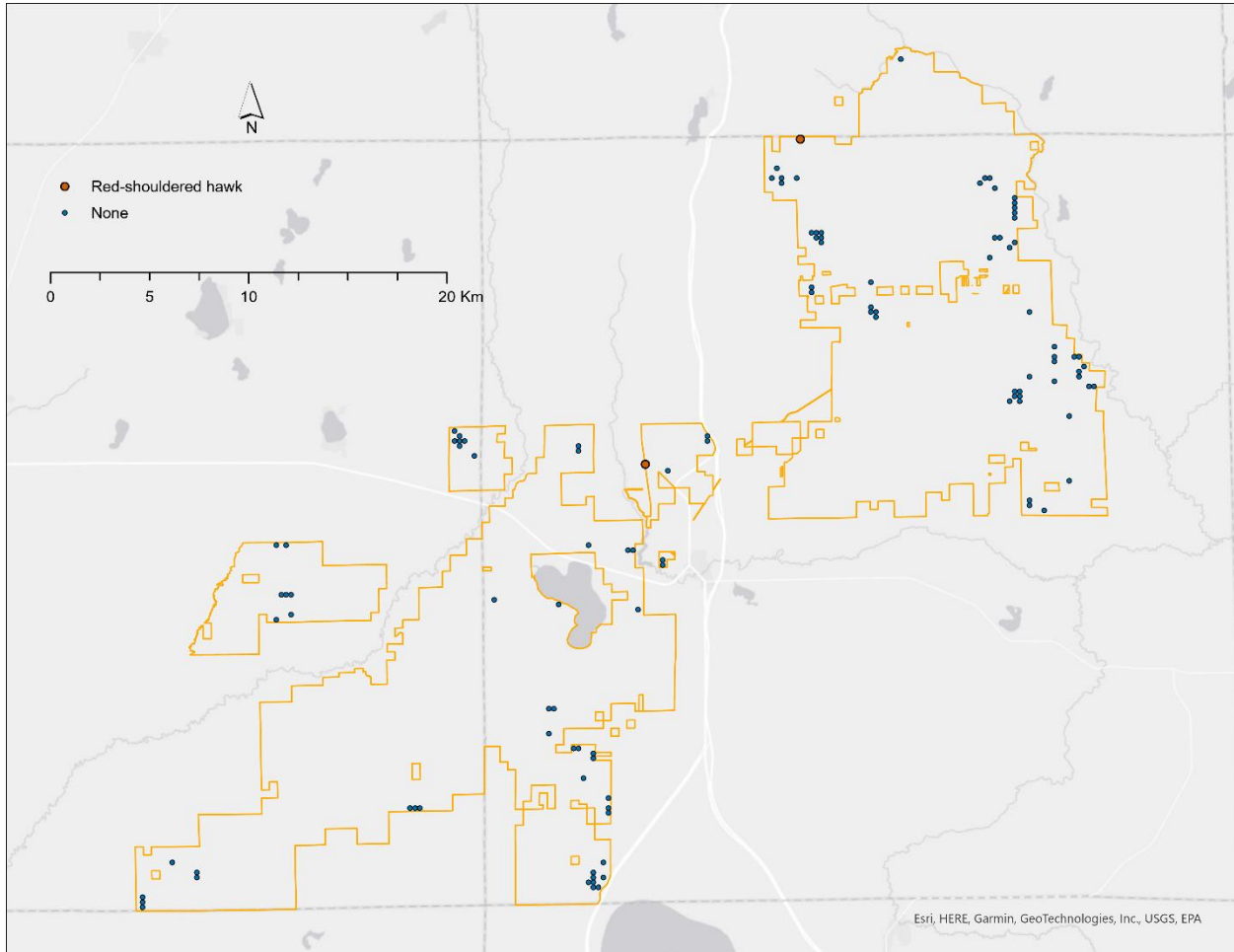
Figure 2. Rare raptor point-count stations where surveys were conducted within Camp Grayling in 2023. Red points indicate locations where red-shouldered hawk nesting activity was observed.

Figure 3. An active red-shouldered hawk nest found in 2023 in a red oak near an existing element occurrence in Camp Grayling last observed in 2004. Photograph by A.A. Cole-Wick.

Northern goshawks were not detected at any of the points surveyed this year, and no new nests were found. We incidentally observed a pair while traveling between golden-winged warbler survey points. The pair was detected in STA 8 to the east of Sunset Trail near Muskrat Road SE. We visited the two areas with active northern goshawk nests in 2021 to check for nesting activity. The first nest from 2021, located northwest of Lake Margrethe near McIntyre landing just south of STA 5, was destroyed during a timber harvest operation prior to 2022 surveys. The territory was no longer active in 2022 and remained inactive in 2023. The second nest was located in STA 18 within a red pine stand north of Six Point Road and west of Pine Road. This nest was active in 2022 but the territory was inactive this year. Two visits were made to this area and no northern goshawk activity was observed. Additionally, we found no evidence of new construction or decoration within the territory.

Secretive Marsh Birds

In 2023, we surveyed the same nine points visited in 2022. Seven target species, American bittern, pied-billed grebe, Wilson's snipe, sandhill crane, Virginia rail, sedge wren, and swamp sparrow, were recorded during surveys. Pied-billed grebe and Virginia rail were not observed during 2021 or 2022 surveys. We reconfirmed the presence of American bittern at the known EO along Black Creek (Figure 4), which was detected at the site in 2021 but not 2022. American bittern was also confirmed in the Barker Creek wetland complex, with a calling bird observed during two of the three visits (Figures 4 and 5). A breeding pair was later observed by an MNFI ecologist working in the wetland for another project. The Barker Creek observations represent a new EO for the species within Camp Grayling.
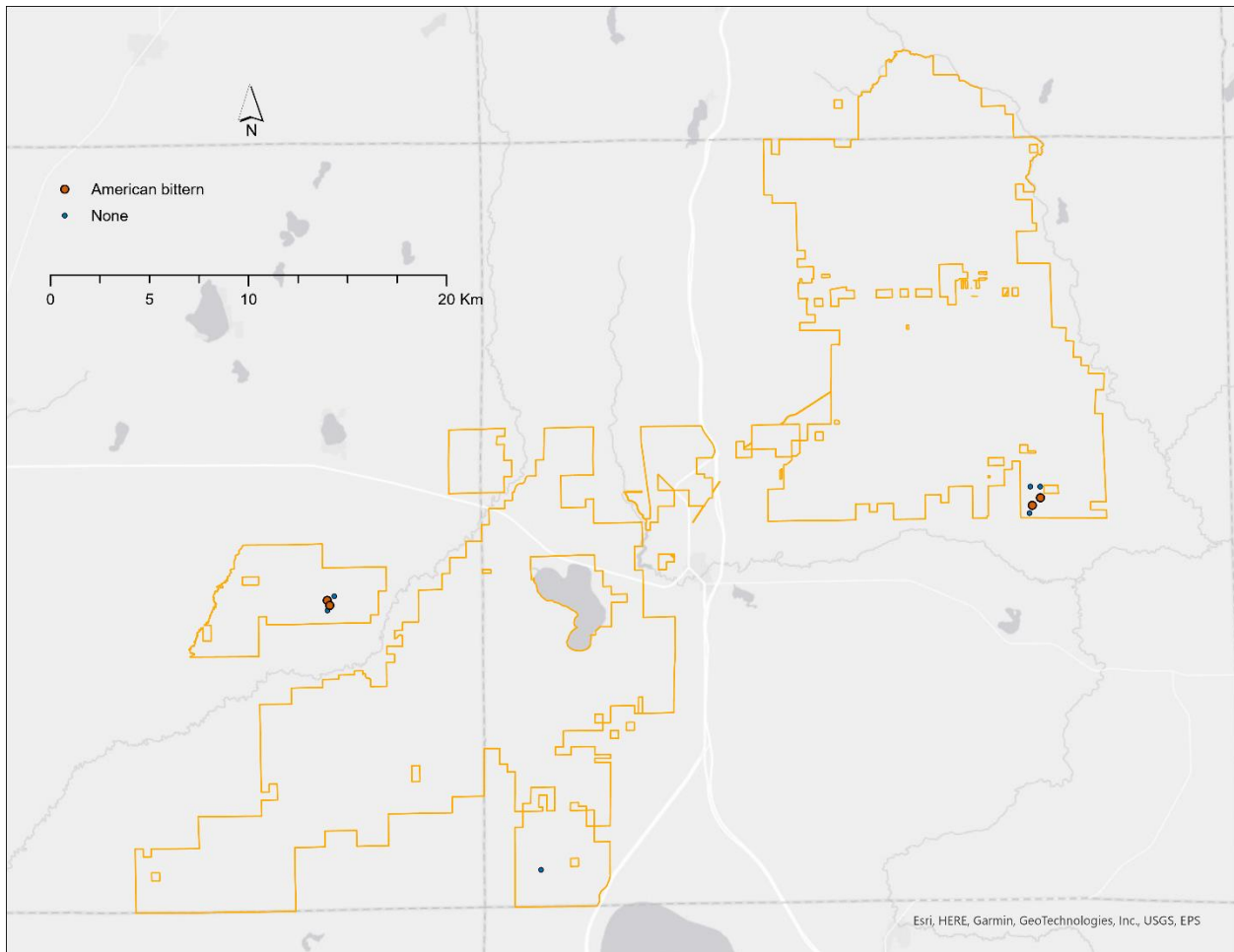

Figure 4. Secretive marsh bird point count stations (blue points) where surveys were conducted within Camp Grayling in 2023. Red points indicate locations where American bittern was detected.

Figure 5. Barker Creek wetland complex where American bittern was detected during 2023 surveys. Photograph by M.J. Monfils.

At-risk Bird Species

We completed 452 point counts for all targeted at-risk bird species or groups in 2023, consisting of 249 golden-winged warbler points, 146 red-headed woodpecker points, 28 grassland bird points, and 29 pine barrens points. Surveys were conducted between 23 May and 30 June 2023, with 423 points surveyed by MNFI and 29 points covered by DMVA. We recorded 102 bird species across all 452 points surveyed (Table 2). During 2023 surveys, we documented new EOs of common nighthawk, golden-winged warbler, grasshopper sparrow, eastern whip-poor-will, upland sandpiper, and wood thrush, while also updating existing EOs of common loon, golden-winged warbler, Kirtland's warbler, and red-headed woodpecker with substantial new data. We note that our Kirtland's warbler observations do not represent all occurrences for CGJMTC as additional targeted surveys are conducted annually by DMVA across the installation. Several other rare species, such as red-shouldered hawk, northern goshawk, and trumpeter swan, were recorded during surveys but the information was not sufficient to create new or update existing EOs. In addition, we recorded several featured species of the DNR, Wildlife Division, and focal species of the Upper Mississippi / Great Lakes Joint Venture (JV; Table 2).

Golden-winged Warbler
We surveyed 249 (98%) of the 253 survey points identified in the Year 3 panel of our golden-winged warbler survey stations, with the small number of points being dropped because they occurred within active or recently completed logging operations. Golden-winged warblers were detected at 4% of the survey points, which is less than the 6% of points having observations in 2022 but greater than the 2% of points with detections recorded in 2021. Although the proportion of golden-winged warbler points with detections was lower than 2022, the total number of warblers observed was the greatest of the three years. We recorded 13 golden-winged warblers at 11 survey points, with another 16 being detected incidentally while moving among survey locations (Figure 6). We also observed three Brewster's warblers, which is a golden-winged warbler x blue-winged warbler hybrid. About 60% of the observations occurred in aspen stands, typically in young growth or along the edges of more mature stands (Figure 7), 20% were in balsam poplar and shrub wetlands (Figure 8), and the remaining 20% were in other deciduous or mixed forest types. The distribution of our golden-winged warbler detections was similar to what we observed in past years, with observations falling within three general areas (Figure 6): 1) northern half of the North Camp (NTA 15, 20, 21, 22, 25, and 30); 2) west-central portion of the South Camp (STA 8); and 3) southwest part of South Camp (STA 22). Our golden-winged warbler observations resulted in four new EOs and provided new data to update two existing EOs. In addition to being a SGCN and JV focal species, golden-winged warbler is a DoD mission-sensitive species, meaning it is a species with high potential to impact DoD missions if federally listed under the Endangered Species Act (DoD 2021).

Table 2. Proportion of points with bird species detected during 2023 surveys at Camp Grayling by target species or group.

Species	Special Status[1]	Golden-winged Warbler	Red-headed Woodpecker	Grassland and Pine Barrens Birds
Alder Flycatcher	---	0.036	---	---
American Crow	---	0.209	0.322	0.246
American Goldfinch	---	0.048	0.089	0.053
American Kestrel	---	---	0.021	---
American Redstart	---	0.241	0.055	0.140
American Robin	---	0.329	0.664	0.228
American Woodcock	DNR	---	0.007	---
Baltimore Oriole	---	0.032	0.068	0.035
Barred Owl	---	---	---	0.018
Belted Kingfisher	---	---	---	0.018
Black-and-white Warbler	---	0.068	0.048	0.018
Black-billed Cuckoo	DoD-2	0.165	0.103	0.158
Black-capped Chickadee	---	0.233	0.212	0.298
Black-throated Green Warbler	---	0.008	---	---
Blue Jay	---	0.731	0.829	0.860
Blue-headed Vireo	---	---	0.007	---
Blue-winged Warbler	---	0.032	---	---
Brewer's Blackbird	---	---	0.007	0.088
Brewster's Warbler	---	0.004	---	---
Brown Creeper	---	0.016	0.041	---
Brown Thrasher	---	0.145	0.260	0.509
Brown-headed Cowbird	---	0.133	0.062	0.105
Canada Goose	DNR	0.080	0.096	0.088
Cedar Waxwing	---	0.193	0.171	0.088
Chestnut-sided Warbler	---	0.092	0.041	0.035
Chipping Sparrow	---	0.028	0.137	0.316
Clay-colored Sparrow	---	0.004	---	0.123
Common Grackle	---	0.076	0.123	0.123
Common Loon	T, SGCN	0.008	0.027	0.035
Common Nighthawk	SC, SGCN	0.004	0.014	0.018
Common Raven	---	0.305	0.205	0.632
Common Yellowthroat	---	0.153	0.048	---
Dark-eyed Junco	---	0.012	0.123	0.105
Downy Woodpecker	---	0.024	0.014	0.053
Eastern Bluebird	---	0.016	0.068	0.070
Eastern Kingbird	---	0.036	0.048	0.105
Eastern Meadowlark	SC, DNR	0.004	---	0.035
Eastern Phoebe	---	---	0.014	---

Table 2. Continued.

Species	Special Status[1]	Golden-winged Warbler	Red-headed Woodpecker	Grassland and Pine Barrens Birds
Eastern Towhee	---	0.333	0.541	0.333
Eastern Whip-poor-will	T, SGCN, DoD-2, JV	0.012	---	0.018
Eastern Wood-Pewee	---	0.245	0.459	0.140
Field Sparrow	---	0.213	0.349	0.491
Golden-crowned Kinglet	---	0.004	---	---
Golden-winged Warbler	T, SGCN, DNR, DoD-M, JV	0.044	---	---
Grasshopper Sparrow	SC, SGCN, DoD-2	---	0.007	---
Gray Catbird	---	0.012	0.007	0.018
Great-crested Flycatcher	---	0.149	0.137	0.123
Hairy Woodpecker	---	0.048	0.068	0.123
Hermit Thrush	---	0.329	0.363	0.298
Horned Lark	---	---	---	0.053
House Wren	---	0.048	0.027	0.053
Indigo Bunting	---	0.301	0.336	0.193
Killdeer	---	0.004	---	---
Kirtland's Warbler	E, SGCN, DNR, JV	---	---	0.193
Least Flycatcher	---	0.048	0.014	---
Lincoln's Sparrow	---	0.024	0.014	0.158
Mallard	DNR	---	0.007	---
Mourning Dove	---	0.233	0.315	0.333
Mourning Warbler	---	0.052	---	---
Nashville Warbler	---	0.450	0.322	0.474
Northern Cardinal	---	0.052	0.055	0.018
Northern Flicker	---	0.185	0.205	0.211
Northern Waterthrush	---	0.004	---	---
Ovenbird	---	0.908	0.705	0.456
Pileated Woodpecker	DNR	0.020	0.041	0.018
Pine Warbler	---	0.080	0.116	0.035
Purple Finch	---	0.008	---	---
Red-bellied Woodpecker	---	0.048	0.096	---
Red-breasted Nuthatch	---	0.028	---	0.105
Red-eyed Vireo	---	0.695	0.616	0.386
Red-headed Woodpecker	SC, SGCN, DNR, DoD-2, JV	0.008	0.158	---
Red-shouldered Hawk	SC, SGCN, DNR	0.028	0.014	---
Red-tailed Hawk	---	---	0.041	---
Red-winged Blackbird	---	0.120	0.027	0.123
Ring-billed Gull	---	---	0.027	---
Rose-breasted Grosbeak	---	0.783	0.466	0.456
Ruffed Grouse	DNR	0.080	0.014	0.035

Table 2. Continued.

Species	Special Status[1]	Golden-winged Warbler	Red-headed Woodpecker	Grassland and Pine Barrens Birds
Sandhill Crane	---	0.104	---	0.070
Scarlet Tanager	---	0.277	0.370	0.316
Sedge Wren	---	0.004	---	---
Song Sparrow	---	0.068	0.021	0.035
Swainson's Thrush	---	0.004	---	---
Swamp Sparrow	---	0.032	---	---
Tennessee Warbler	---	0.008	---	---
Tree Swallow	---	0.004	0.007	0.018
Trumpeter Swan	SC, SGCN	---	---	0.018
Tufted Titmouse	---	0.020	0.068	0.018
Turkey Vulture	---	0.004	0.014	---
Upland Sandpiper	T, JV	0.004	---	0.316
Veery	---	0.173	0.068	0.035
Vesper Sparrow	---	0.040	0.137	0.316
White-breasted Nuthatch	---	0.044	0.075	0.018
White-throated Sparrow	---	0.048	0.014	0.018
Wild Turkey	DNR	0.076	0.021	0.018
Wilson's Snipe	JV	0.004	---	0.018
Winter Wren	---	0.012	---	---
Wood Duck	---	0.004	---	---
Wood Thrush	SC, DNR, JV	0.008	---	---
Yellow Warbler	---	0.052	0.014	0.035
Yellow-bellied Sapsucker	---	0.241	0.041	0.175
Yellow-billed Cuckoo	---	0.124	0.089	0.193
Yellow-rumped Warbler	---	0.008	0.007	0.018
Yellow-throated Vireo	---	0.028	0.027	---

[1]Special status abbreviations: SC = State Special Concern; T = State Threatened; E = State Endangered; SGCN = species of greatest conservation need (Derosier et al. 2015); DNR = Department of Natural Resources, Wildlife Division feature species for the state or northern Lower Peninsula; DoD-M = Department of Defense mission-sensitive species; DoD-2 = Department of Defense Tier 2 species; and JV = focal species of the Upper Mississippi / Great Lakes Joint Venture.
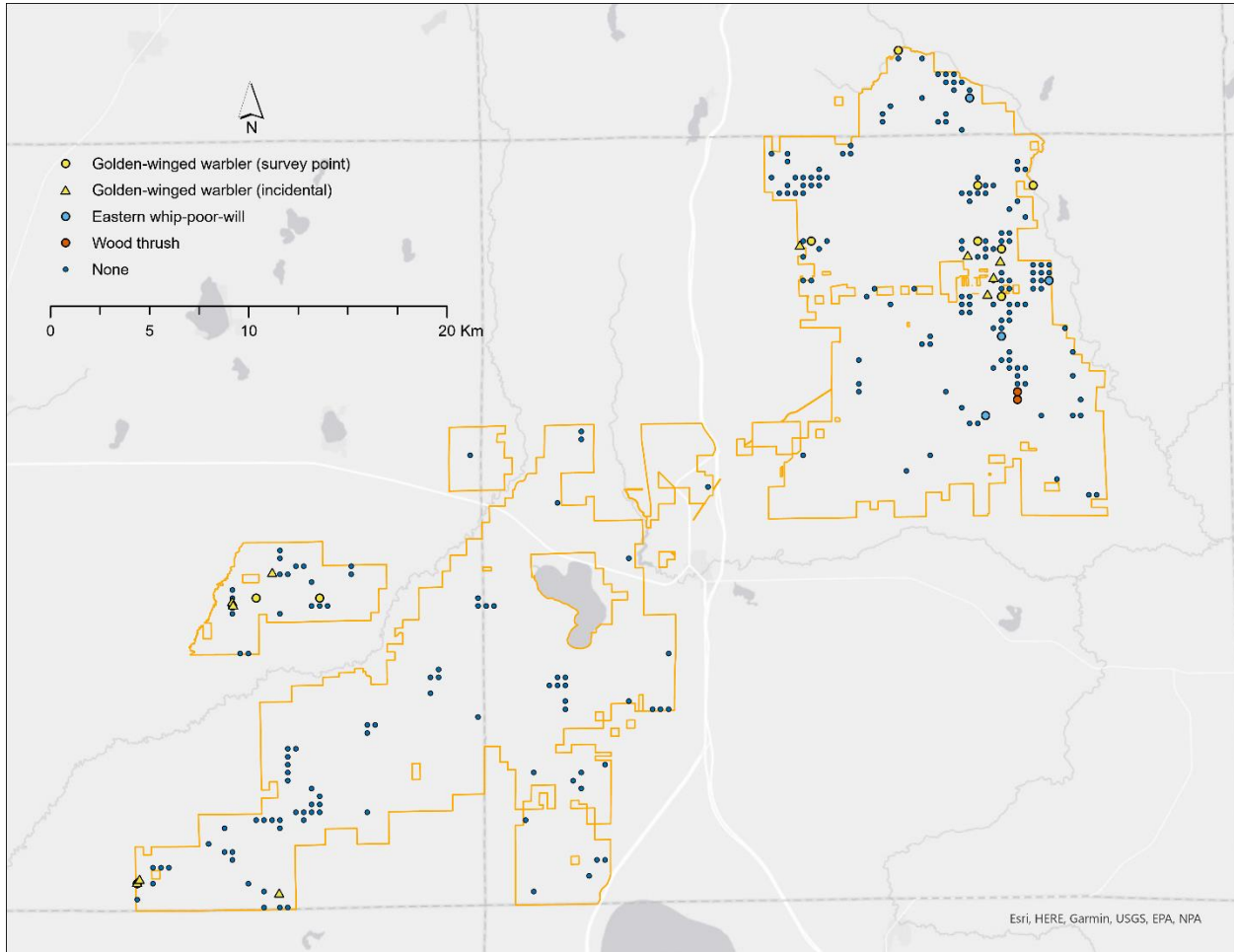
Figure 6. Golden-winged warbler point-count stations where surveys were conducted within Camp Grayling in 2023.

Figure 7. Aspen stand in Camp Grayling where a golden-winged warbler was detected in 2023. Photograph by E.C. Branch.

Figure 8. Example of wetland in Camp Grayling used by breeding golden-winged warblers in 2023. Photograph by E.C. Branch.

We recorded 88 bird species while conducting surveys for golden-winged warbler (Table 2). Ovenbird, rose-breasted grosbeak, blue jay, and red-eyed vireo were the most common species observed at these survey points. We recorded ovenbird at nearly 91% of the points and the other three most common species were all observed between 70-80% of the points. Seven species, Nashville warbler, eastern towhee, American robin, hermit thrush, common raven, indigo bunting, and scarlet tanager, were detected at 25-50% of the points. Eighteen species were recorded at 10-25% of the points, and the remaining 59 species were uncommon and observed at < 10% of the points visited.

In addition to golden-winged warbler, we recorded five other species of greatest conservation need (SGCN), red-shouldered hawk, eastern whip-poor-will, red-headed woodpecker, common loon, and common nighthawk. Wood thrush, Wilson's snipe, and upland sandpiper, along with four SGCN, golden-winged warbler, red-headed woodpecker, eastern whip-poor-will, and Kirtland's warbler, are focal species for conservation planning and implementation within the JV region due to declining populations (Potter et al. 2007, Soulliere et al. 2018, 2020). The

eastern whip-poor-will observations occurred in North Camp (NTA 15, 21, and 29) and contributed to two new EOs. We recorded our wood thrush observations in NTA 8, resulting in one new EO. The Kirtland's warbler detections will be used to update an existing element occurrence. Several of these species are also considered DNR featured species for habitat management, as are Canada goose, mallard, American woodcock, ruffed grouse, wild turkey, and pileated woodpecker.

Red-headed Woodpecker
We surveyed all 146 point count stations in the Year 3 panel in 2023 (Figure 9), all of which were in the South Camp. Red-headed woodpeckers were observed at 23 (16%) of the points with 33 individuals recorded. Two additional red-headed woodpeckers were recorded during point counts conducted for golden-winged warbler and four were observed while traveling to conduct surveys for other species (Figure 9), one of which occurred outside of CGJMTC. The proportion of points with detections and total number observed in 2023 was lower than 2022 (26%, 48 individuals) and 2021 (25%, 54 individuals). Most observations occurred in mature oak forests (Figure 10), but some red-headed woodpeckers were observed in stands classified as low-density trees (Figure 11). Incidental observations resulted in two new element occurrences in the North Camp, whereas the other records updated the main occurrence created in 2021. Red-headed woodpecker is a SGCN, JV focal species, and DoD Tier 2 species. Most Tier 2 species have been experiencing long-term declines and have some potential to impact future missions if federally listed (DoD 2021). Although Tier 2 species are not considered a high priority based on current review criteria, proactive monitoring and management is encouraged when and where appropriate (DoD 2021).
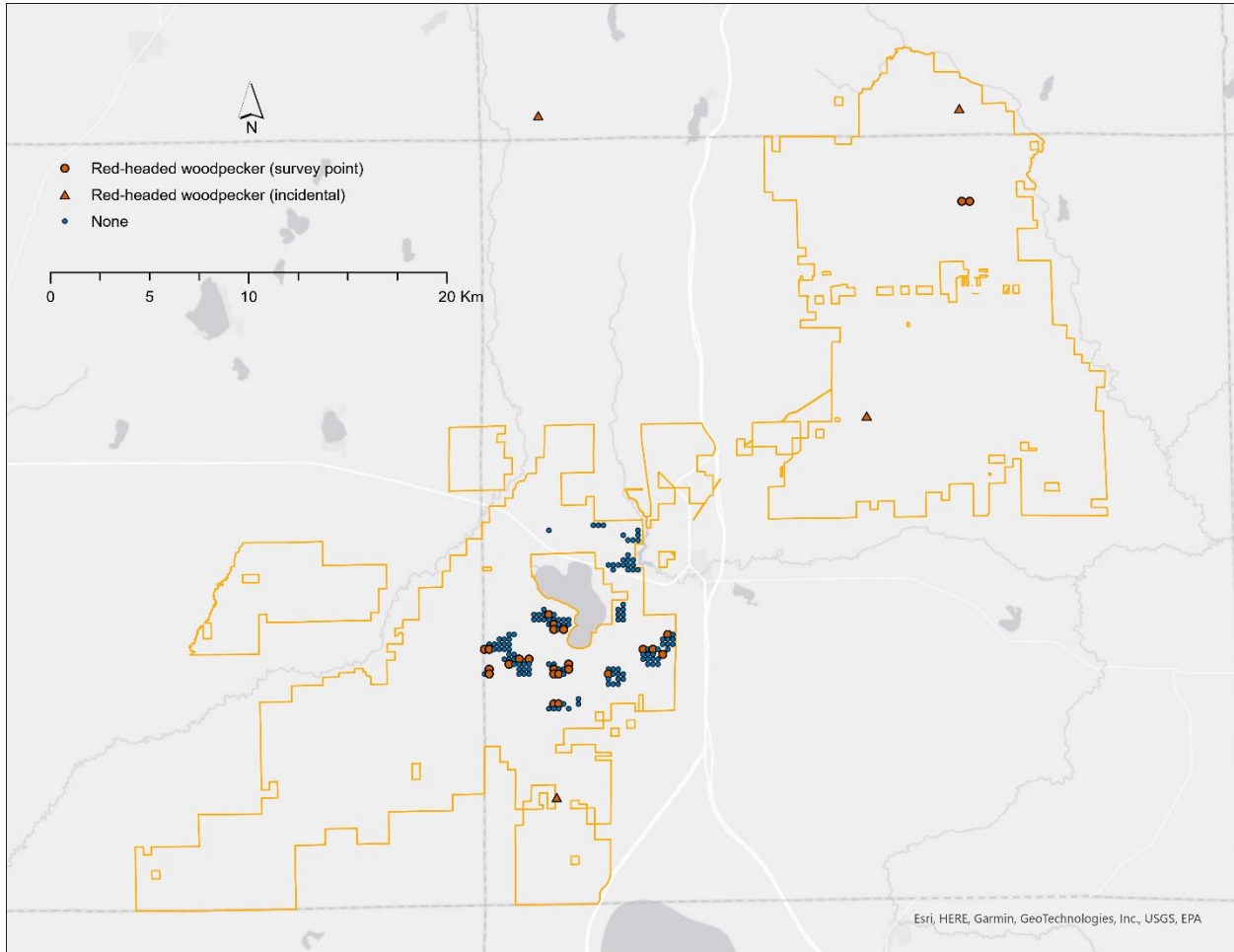
Figure 9. Red-headed woodpecker point-count stations where surveys were conducted within Camp Grayling in 2023. Points with red-headed woodpecker observations are shaded red and incidental observations are indicated by red triangles.

Figure 10. Survey station with a red-headed woodpecker observation during surveys in Camp Grayling during 2023. Photograph by A.A. Cole-Wick.

Figure 11. Recently harvested stand in Camp Grayling where red-headed woodpecker was detected in 2023. Photograph by A.A. Cole-Wick.

We recorded 74 bird species while conducting points counts for red-headed woodpeckers in 2023 (Table 2). Blue jay and ovenbird were the most common species observed and were detected at 83% and 71% of the points, respectively. American robin, red-eyed vireo, and eastern towhee were observed at about half to two-thirds of the points surveyed. Ten species, rose-breasted grosbeak, eastern wood-pewee, scarlet tanager, hermit thrush, field sparrow, American crow, indigo bunting, Nashville warbler, mourning dove, and brown thrasher, were regularly detected at 25-50% of the points. Twelve species were recorded at about 10-25% of the points and the remaining 47 bird species were detected at less than 10% of the points (Table 2).

Along with red-headed woodpecker, we recorded the following four SGCN during surveys targeting red-headed woodpecker: common loon, common nighthawk, red-shouldered hawk, and grasshopper sparrow. Our grasshopper sparrow observation resulted in the first EO for the species in CGJMTC. Red-headed woodpecker was designated as a regional focal species for the JV Landbird Habitat Conservation Strategy because of long-term declining populations within the upper Midwest and Great Lakes regions (Soulliere et al. 2020). We observed eight statewide featured species for habitat management by the DNR's Wildlife Division: American woodcock, Canada goose, mallard, pileated woodpecker, red-headed woodpecker, red-shouldered hawk, ruffed grouse, and wild turkey.

Grassland and Pine Barrens Birds
We surveyed 63 points in the Year 3 panel targeting rare grassland and pine barrens bird species (Figure 12). Two grassland-dependent species, eastern meadowlark and upland sandpiper, were recorded during these surveys. Eastern meadowlark was recently added as a species of special concern and upland sandpiper as a threatened species. A third grassland species, grasshopper sparrow, was observed incidentally while conducting surveys for red-headed woodpecker. Only three eastern meadowlarks were observed at two survey points, whereas we documented 27 upland sandpipers at about 32% of the points and found an active nest (Figure 13). These observations resulted in three new eastern meadowlark EOs, three new upland sandpiper EOs, and one new grasshopper sparrow EO. We detected 15 Kirtland's warblers at 11 points, resulting in one new and two updated EOs. Common nighthawk was observed at six locations across all bird surveys, which provided information to create one new EO and update four existing EOs. Detections of rare grassland and barrens species were concentrated in three general areas (Figure 12): 1) northern part of North Camp (NTA 27, 28, and 30); 2) Pine Barrens Management Area; and 3) areas to the west and northwest of Lake Margrethe (small arms safety area, STA 2, 4, and 5).

Seventy bird species were observed while conducting surveys targeting rare bird species of grasslands and pine barrens (Table 2). Blue jay was the most common species recorded, detected at 86% of the points, followed by common raven (63%) and brown thrasher (51%). Thirteen species were observed at 25-50% of the points: field sparrow, Nashville warbler, ovenbird, rose-breasted grosbeak, red-eyed vireo, eastern towhee, mourning dove, chipping sparrow, scarlet tanager, upland sandpiper, vesper sparrow, black-capped chickadee, and

hermit thrush. We recorded 20 species at about 10-25% of the points, and the remaining 34 species were only observed sporadically (< 10% of points; Table 2).
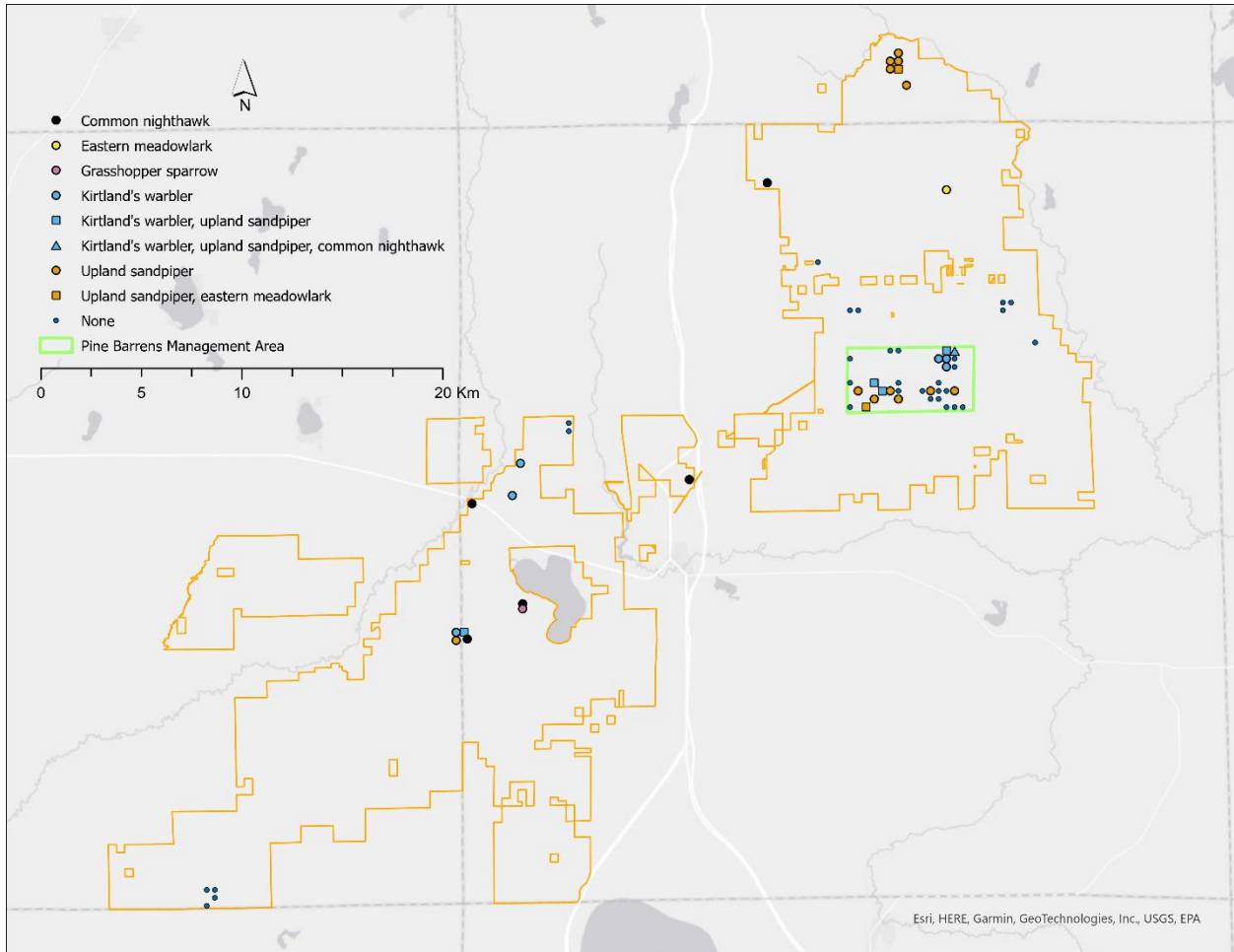

Figure 12. Point-count stations used to target rare pine barrens and grassland bird species during surveys conducted within Camp Grayling in 2023.

Figure 13. Upland sandpiper nest found while conducting surveys for rare grassland and pine barrens bird species in Camp Grayling in 2023. Photograph by E.C. Branch.

Five of the species recorded during grassland and pine barrens surveys, Kirtland's warbler, common loon, eastern whip-poor-will, common nighthawk, and trumpeter swan, are considered SGCN. Kirtland's warbler and eastern whip-poor-will are focal species of the Joint Venture Landbird Habitat Conservation Strategy (Soulliere et al. 2020). Upland sandpiper along with Wilson's snipe, which was detected during surveys, are considered focal species of the Joint Venture's regional shorebird plan (Potter et al. 2007). Six of the species recorded during grassland and pine barrens surveys are also statewide featured species of the DNR Wildlife Division: Canada goose, eastern meadowlark, Kirtland's warbler, pileated woodpecker, ruffed grouse, and wild turkey.

DISCUSSION

Working in partnership with the DMVA, MNFI successfully implemented the third year of what is intended to be a long-term monitoring program. Surveys for rare raptors, golden-winged warbler, red-headed woodpecker, grassland birds, and pine barrens birds were designed so that approximately one-third of the potential survey points would be visited in a given year, thus all of the points would be surveyed over three years. By completing our Year 3 survey points, we have now finished a complete cycle of surveys. Using the data gathered over the last three years, we recommend evaluating if the level of survey effort used is necessary to achieve survey objectives moving forward, or if surveys could be scaled back to reduce costs while still meeting desired outcomes.

With the help of DMVA staff, we conducted 589 point counts for rare raptors, secretive marsh birds, and other birds of conservation concern. Data collected in 2023 resulted in 20 new element occurrences for 11 bird species and allowed us to update 11 existing occurrences of six bird species. Across all surveys, 108 bird species were recorded within CGJMTC, which highlights the facility's value as habitat for breeding and migrating birds. Nineteen of these species had one or more special status designations, such as endangered, threatened, and special concern species, SGCN, DNR featured species, and focal species of the Upper Mississippi / Great Lakes Joint Venture.

In 2023 we observed five bird species considered by DoD Partners in Flight as mission-sensitive (golden-winged warbler) or Tier 2 (black-billed cuckoo, eastern whip-poor-will, grasshopper sparrow, and red-headed woodpecker) species (DoD 2021), and our data suggest CGJMTC is likely an important area for four of these species. We observed golden-winged warblers on about 2 – 6% of our survey points annually, resulting in detections at 31 survey stations and incidental observations at another 24 locations over the three years. Red-headed woodpeckers were detected at 16 – 26% of our survey points with 23 – 54 individuals recorded annually plus incidental observations outside of the survey area. We observed black-billed cuckoos during surveys for all our target species/groups, with 33 – 72 individuals recorded at 7 – 14% of all survey points annually. Our surveys were not designed to detect the crepuscular and nocturnal eastern whip-poor-will, so we only recorded a few during annual surveys. However, we often encountered them in the early mornings while traveling to survey sites, often on or near roads. Cink et al. (2020) noted whip-poor-wills regularly used gravel roads for sallying in Florida and foraged across gravel roads and highways within forested territories in Kansas. Surveys were implemented in CGJMTC for eastern whip-poor-will by DMVA in 2022 and 2023 using acoustic recording units (ARU), and preliminary results indicate the species was detected at most of the ARU stations (M. Kleitch, personal communication).

Consistent with 2021 and 2022, nesting activity by rare raptor species was limited. Despite observing red-shouldered hawk at several locations, we only confirmed one active nest. Our only northern goshawk observation was a territorial pair seen while walking between golden-winged warbler points; no nest was found. We did not survey 19 points because they fell within

recent or ongoing timber harvests. We plan to update our raptor sample frame by removing these and similar unsuitable points encountered over the three years.

Results of marsh bird surveys within the Black Creek and Barker Creek wetland complexes showed the value of repeated annual surveys. We reconfirmed the presence of American bittern in the Black Creek complex, which was observed in 2021 but not 2022. American bittern was confirmed in the Barker Creek wetlands; we observed the species there in 2022 but it was too distant to determine its location. We also detected two new species, pied-billed grebe and Virginia rail, in the Barker Creek complex in 2023. Beaver activity appeared to have raised water levels in the wetlands, possibly making the area more attractive to these species. While conducting surveys for golden-winged warbler, we noticed potential marsh bird habitat in STA 22 near Little Cannon Creek that we suggest surveying for secretive marsh birds in the future.

Surveys for other bird species of conservation concern provided substantial data on both rare species and the overall bird assemblages using the cover types targeted. Golden-winged warblers were observed in similar abundance to 2021 and 2022, whereas numbers of red-headed woodpecker were lower than previous years, though still locally abundant. Results of our surveys in herbaceous openlands and areas with low tree densities indicated these sites are not likely to support high numbers of rare grassland bird species, such as Henslow's sparrow or grasshopper sparrow; however, we often recorded upland sandpiper and Kirtland's warbler using these habitats and also observed eastern meadowlark and common nighthawk. Grasshopper sparrow was detected for the first time in Camp Grayling during a point count targeting red-headed woodpecker. We suggest continuing surveys for the at-risk species targeted over the last three years, while exploring options to reduce survey effort going forward, such as removing points occurring in unsuitable habitats and/or increasing the minimum spacing among points.

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APPENDIX A: LIST OF BIRD SPECIES DETECTED

Table A1. Common and scientific names of bird species detected in Camp Grayling in 2023.

Common Name	Scientific Name
Alder flycatcher	*Empidonax alnorum*
American bittern	*Botaurus lentiginosus*
American crow	*Corvus brachyrhynchos*
American goldfinch	*Spinus tristis*
American kestrel	*Falco sparverius*
American redstart	*Setophaga ruticilla*
American robin	*Turdus migratorius*
American woodcock	*Scolopax minor*
Baltimore oriole	*Icterus galbula*
Barred owl	*Strix varia*
Belted kingfisher	*Megaceryle alcyon*
Black-and-white warbler	*Mniotilta varia*
Black-billed cuckoo	*Coccyzus erythropthalmus*
Black-capped chickadee	*Aphanotriccus audax*
Black-throated green warbler	*Setophaga virens*
Blue jay	*Cyanocitta cristata*
Blue-headed vireo	*Vireo solitarius*
Blue-winged warbler	*Vermivora cyanoptera*
Brewer's blackbird	*Euphagus cyanocephalus*
Brewster's warbler	*Vermivora chrysoptera x cyanoptera*
Broad-winged hawk	*Buteo platypterus*
Brown creeper	*Spermestes cucullata*
Brown thrasher	*Toxostoma rufum*
Brown-headed cowbird	*Cinclocerthia ruficauda*
Canada Goose	*Branta canadensis*
Cedar waxwing	*Bombycilla cedrorum*
Chestnut-sided warbler	*Setophaga pensylvanica*
Chipping sparrow	*Spizella passerina*
Clay-colored sparrow	*Spizella pallida*
Common grackle	*Quiscalus quiscula*
Common loon	*Gavia immer*
Common nighthawk	*Chordeiles minor*
Common raven	*Corvus corax*
Common yellowthroat	*Geothlypis trichas*
Dark-eyed junco	*Junco hyemalis*
Downy woodpecker	*Dryobates pubescens*
Eastern bluebird	*Sialia sialis*
Eastern kingbird	*Tyrannus tyrannus*

Table A1. Continued

Common Name	Scientific Name
Eastern meadowlark	*Sturnella magna*
Eastern phoebe	*Sayornis phoebe*
Eastern towhee	*Pipilo erythrophthalmus*
Eastern whip-poor-will	*Antrostomus vociferus*
Eastern wood-pewee	*Contopus virens*
Field sparrow	*Spizella pusilla*
Golden-crowned kinglet	*Regulus satrapa*
Golden-winged warbler	*Vermivora chrysoptera*
Gray catbird	*Dumetella carolinensis*
Grasshopper sparrow	*Ammodramus savannarum*
Great crested flycatcher	*Myiarchus crinitus*
Hairy woodpecker	*Dryobates villosus*
Hermit thrush	*Catharus guttatus*
Horned lark	*Eremophila alpestris*
House wren	*Troglodytes aedon*
Indigo bunting	*Passerina cyanea*
Killdeer	*Charadrius vociferus*
Kirtland's warbler	*Setophaga kirtlandii*
Least flycatcher	*Empidonax minimus*
Lincoln's sparrow	*Melospiza lincolnii*
Mallard	*Anas platyrhynchos*
Mourning dove	*Zenaida macroura*
Mourning warbler	*Geothlypis philadelphia*
Nashville warbler	*Leiothlypis ruficapilla*
Northern cardinal	*Cardinalis cardinalis*
Northern flicker	*Colaptes auratus*
Northern goshawk	*Accipiter gentilis*
Northern waterthrush	*Parkesia noveboracensis*
Ovenbird	*Seiurus aurocapilla*
Pied-billed grebe	*Podilymbus podiceps*
Pileated woodpecker	*Dryocopus pileatus*
Pine warbler	*Setophaga pinus*
Purple finch	*Haemorhous purpureus*
Red-bellied woodpecker	*Melanerpes carolinus*
Red-breasted nuthatch	*Sitta canadensis*
Red-eyed vireo	*Vireo olivaceus*
Red-headed woodpecker	*Melanerpes erythrocephalus*
Red-shouldered hawk	*Buteo lineatus*
Red-tailed hawk	*Buteo jamaicensis*
Red-winged blackbird	*Agelaius phoeniceus*

Table A1. Continued

Common Name	Scientific Name
Ring-billed Gull	*Larus delawarensis*
Rose-breasted grosbeak	*Pheucticus ludovicianus*
Ruffed grouse	*Bonasa umbellus*
Sandhill crane	*Antigone canadensis*
Scarlet tanager	*Piranga olivacea*
Sedge wren	*Cistothorus platensis*
Song sparrow	*Melospiza melodia*
Swainson's thrush	*Catharus ustulatus*
Swamp sparrow	*Melospiza georgiana*
Tennessee warbler	*Leiothlypis peregrina*
Tree swallow	*Tachycineta bicolor*
Trumpeter swan	*Cygnus buccinator*
Tufted titmouse	*Baeolophus bicolor*
Turkey vulture	*Cathartes aura*
Upland sandpiper	*Bartramia longicauda*
Veery	*Catharus fuscescens*
Vesper sparrow	*Pooecetes gramineus*
Virginia rail	*Rallus limicola*
White-breasted nuthatch	*Sitta carolinensis*
White-throated sparrow	*Zonotrichia albicollis*
Wild turkey	*Meleagris gallopavo*
Wilson's snipe	*Gallinago delicata*
Winter wren	*Troglodytes hiemalis*
Wood duck	*Aix sponsa*
Wood thrush	*Hylocichla mustelina*
Yellow warbler	*Setophaga petechia*
Yellow-bellied sapsucker	*Sphyrapicus varius*
Yellow-billed cuckoo	*Coccyzus americanus*
Yellow-rumped warbler	*Setophaga coronata*
Yellow-throated vireo	*Vireo flavifrons*