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Natural Resource Program Center

Landbird Inventory for Lewis and Clark National Historical Park (2006)

Natural Resource Technical Report NPS/NCCN/NRTR—2009/166

ON THE COVER
Pacific-slope flycatcher
Photograph courtesy of NPS files

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Abstract

We designed this landbird inventory project to determine habitat-specific density of landbirds during the breeding season at Lewis and Clark National Historical Park (LEWI), using methods consistent with those employed in other parks across the North Coast and Cascades Network (NCCN). The goals of the inventory were to estimate habitat-specific density and park-wide abundance for a large suite of species, and to produce information that will assist park managers and cooperators in designing the park's long-term landbird monitoring program. An earlier attempt by us to inventory landbirds at Lewis and Clark NHP (Wilkerson and Siegel 2009) was less than fully successful because we were unable to secure access to portions of the Fort Clatsop unit which were in the process of being transferred to park management, and because Cape Disappointment and Clark's Dismal Nitch were not yet within the identified scope of the project. Our results were therefore based on a relatively small number of survey points in a very circumscribed portion of the park. During the 2006 pilot season of the NCCN's long-term landbird monitoring program, we had the opportunity to redo the landbird inventory at LEWI, with full access to the park.

During the 2006 field season, we completed point counts at 81 point count stations arrayed systematically across Cape Disappointment, Clark's Dismal Nitch, Fort Clatsop, and Sunset Beach. We detected 59 bird species during point counts, and documented the presence of an additional 15 species not detected during point counts (some of these were detected during our fieldwork in 2004, but not during the 2006 work). For the 59 species detected during point counts, we provide maps indicating the locations of each point count station where they were detected, and tabulate the number of points with detections and the total number of detections at each of the four park units. For 31 species, we use distance sampling techniques to account for detectability, and provide estimate of density (birds/ha) for each of the four park units. These density estimates can serve as benchmarks against which future changes in park bird populations can be measured.

Acknowledgments

We thank S. Stonum for his hospitality and logistical assistance while our crew worked at Lewis and Clark National Historical Park. We are grateful for the hard work and dedication of our field crew: Mandy Holmgren (crew leader), Jeremy Krumlauf, Sarah Marek, and Julia Shewan. We thank all members of the NCCN Landbird Monitoring Group for their assistance in developing this project. J. Bolin assisted with the administration of our NPS contract. This is Contribution No. 303 of The Institute for Bird Populations.

Introduction

Reported declines of many birds breeding in North America have stimulated interest in avian population trends and mechanisms driving those trends (DeSante and George 1994). The North American Breeding Bird Survey suggests that landbird populations in Pacific Northwest late-seral forests appear to be in serious decline (Sauer et al. 2003), and data from the national parks are particularly important for teasing out possible causes. Quantitative survey data for bird habitat usage and abundance at Lewis and Clark National Historical Park are currently lacking. Existing presence/absence data are insufficient for tracking population changes over time, or for gauging the effects of any future management actions that may alter habitat conditions. These goals require species-specific density estimates.

In September 2000, personnel from throughout the North Coast and Cascades Network met with landbird monitoring experts to produce recommendations for a long-term monitoring plan for landbirds (Siegel and Kuntz II, 2009). The panel recommended that each of the major parks in the network begin by initiating an inventory to elucidate spatial patterns of abundance for a large suite of species. Because birds are well-suited to serve as indicators of ecological change (Furness et al. 1993), these inventories could then serve as baselines for monitoring future ecological changes within the park, assessing the affects of future management actions on bird populations, and formulating efficient long-term bird monitoring strategies.

We designed this inventory project to determine habitat-specific density of landbirds during the breeding season at Lewis and Clark National Historical Park, using methods consistent with those employed in other parks across the North Coast/Cascades Network (Siegel et al 2009c; Siegel et al. 2009a; Siegel et al. 2009b; Wilkerson et al. 2005). An earlier attempt by us to inventory landbirds at Lewis and Clark NHP (Wilkerson and Siegel 2009) was less than fully successful because we were unable to secure access to portions of the Fort Clatsop unit which were in the process of being transferred to park management, and because Cape Disappointment and Clark's Dismal Nitch were not yet within the identified scope of the project. Our results were therefore based on a relatively small number of survey points in a very circumscribed portion of the park. During the 2006 pilot season of the NCCN's long-term landbird monitoring program, we had the opportunity to redo the landbird inventory at LEWI, with full access to the park.

Methods

Survey Design

The sample design for this project was developed as part of the Landbird Monitoring Protocol for National Parks in the North Coast and Cascades Monitoring Network (Siegel et al. 2006a). In brief, we used existing geographic information system (GIS) data to define a systematic grid established in the N-S and E-W directions with a random grid starting point at each of the following park units: Cape Disappointment, Clark's Dismal Nitch, Fort Clatsop, and Sunset Beach. Each grid cell was 350m x 350m, and the vertices of the cells served as point count stations.

Crew Training and Testing

At the beginning of the field season we provided our field crew, who were to spend most of the field season conducting surveys at Mount Rainier, Olympic, and North Cascades National Parks, with an intensive three-week training program at Olympic and North Cascades National Parks. We trained our crew members, who had prior experience birding and conducting biological fieldwork, in visual and aural bird identification, distance estimation, plant identification, orienteering, backcountry safety, and project protocols. Crew members honed their bird identification skills by spending days in the field birding and practicing point counts with experienced trainers, and then reviewing at night with the aid of field guides, recorded songs and calls, and an instructional CD-ROM. At the end of the training period, we gave all crew members a rigorous exam involving the identification of approximately 100 recorded songs and calls (some of them grouped together in rapid succession to produce 'simulated point counts') as well as 30-40 photographic images (generally of rarer species or less obvious female plumages). Crew members were not permitted to conduct point counts until they passed the exam, which was altered for each administration. Passing the exam, which required a near-perfect score, ensured that observers could competently identify by sight and sound all landbird species expected to occur in any of the NCCN parks.

Data Collection

We used five-minute point counts with distance estimation to survey birds. Detailed field methods are provided in Siegel et al. (2006a), but in brief, conducting point counts with distance estimation entailed recording the horizontal distance, estimated to the nearest meter, to every bird seen or heard during the point count. Each morning in the field, each person sampled approximately 5-6 points from the predefined sample grid, and also classified the dominant habitat(s) within 50 m of the survey point, again, following the detailed methodology provided in Siegel et al. (2006a). Prior to leaving for the field, observers were provided with coordinates and maps of intended sample points for the morning. Observers used standardized pacing, and navigated using a map, compass, and GPS unit to find successive points in the grid. Coordinates of all point count stations are available in the NCCN landbird monitoring database.

Point counts began within ten minutes of local sunrise, and continued until 3.5 hours after local sunrise. 'Flyovers'—defined as birds that flew over the top of the vegetation canopy, never touched down in the observer's field of view, and did not appear to be foraging, displaying, or behaving in any other way that might suggest a link to the habitat below—were tallied separately from other bird detections. Birds thought to have been recorded previously at another point were

marked accordingly on the data forms. Geographical coordinates based on GPS readings and topographic maps were recorded at each sampling point. We recorded whether each bird was initially detected during the first three minutes or the last two minutes of the point count, in order to provide comparability with data from the Breeding Bird Survey (BBS), which utilizes three-minute counts. We also recorded whether each bird was initially detected visually or aurally, and whether the bird sang at any time during the count.

Additionally, whenever crew members detected species thought to be rare or difficult to sample in the park, they completed "Rare Bird Report Forms", including descriptions of the birds' appearance and behavior and geographical coordinates. These reports covered not only birds detected during point counts, but also birds detected while sampling vegetation, hiking between points, or at any other time within the survey dates that our crew was present at the park. Although our project focused explicitly on diurnal passerine and near-passerine birds, we also used these Rare Bird Report Forms to document the presence of owls, raptors, shorebirds, and other species which were poorly sampled by our point count protocol, regardless of their actual rarity.

Data Entry and Verification

Crew members followed the guidelines in Siegel et al. (2006a) to enter all data into the NCCN landbird monitoring database, which is a custom-designed MS Access database. The database includes built-in quality assurance components such as pick-lists and validation rules to test for missing data or illogical combinations. While entering the data, the data entry person visually reviewed her work to ensure that the data on the screen matched the field form. When all the data were entered, we inspected the database for incompleteness and errors, and used the built-in Quality Assurance Tools to check for logical inconsistencies and data outliers. Any errors or data omissions were then corrected.

Data Analysis

All data analyses followed the guidelines provided in the NCCN Landbird Monitoring Protocol (Siegel et al. 2006a). To estimate density, we used detectability parameters published in Siegel et al. (2006b), which were obtained from detectability models based on data from landbird inventory projects and landbird monitoring data from Mount Rainier National Park, North Cascades National Park Service Complex, Olympic National Park, and San Juan Island National Historical Park. Details of the modeling methods are provided in Siegel et al. (2006a and 2006b), and the detectability parameters we used are reprinted in Appendix 1 of this report.

Following the guidelines in Siegel et al. (2006a) we imported our point count data into the software program *Distance 5.0* (Thomas et al. 2005), and entered the appropriate species-specific detectability parameters—sampling width, detection probability estimate, standard error of detection probability estimate, degrees of freedom of detection probability estimate, and the number of detections on which the detectability estimate was based. In *Distance*, we selected the uniform key function with no series expansions—thus instructing the program to simply use the given parameter values, rather than constructing new models—and calculated a species-specific density estimate for each species at each of the four surveyed park units.

Results

Scope of Work Completed

All observers who collected data are listed in Table 1. We completed point counts at 81 point count stations at LEWI in 2006 (Table 2). Eleven intended point count stations had to be discarded when site-visits revealed they were located on dangerously steep slopes (two points at Clark's Dismal Nitch and four points at Fort Clatsop) or because they were in areas inundated with water (five points at Cape Disappointment). All fieldwork was completed from May 24 through June 7 of 2006.

Table 1. Observers who conducted point counts at Lewis and Clark National Historical Park in 2006.

Observer	Role
Mandy Holmgren	Field Lead
Jeremy Krumlauf	Technician
Robert Kuntz II	NPS Lead
Sarah Marek	Technician
Julia Shewan	Technician
Rodney Siegel	Project Lead

Table 2. Number of survey points situated in each major habitat in the four surveyed units of Lewis and Clark National Historical Park. Habitat designations are based on on-the-ground classifications made by the bird survey crew.

Park Unit	Dominant Habitat	No. of Points Surveyed
Cape Disappointment	Beach	1
	Conifer-Deciduous Mix	7
	Mixed Conifer	3
	Palustrine Wetland	3
	Red Alder	6
	Sitka Spruce	11
	Water	2
	Western Hemlock	4
	Willow/Shrub Wetland	8
	Total	**45**
Clark's Dismal Nitch	Douglas-fir	1
	Western Hemlock	1
	Total	**2**

Table 2. Number of survey points situated in each major habitat in the four surveyed units of Lewis and Clark National Historical Park. Habitat designations are based on on-the-ground classifications made by the bird survey crew (continued).

Park Unit	Dominant Habitat	No. of Points Surveyed
Fort Clatsop	Conifer-Deciduous Mix	1
	Pasture	1
	Red Alder	1
	Riverine Wetland	1
	Shrub	4
	Western Hemlock	21
	Total	**29**
Sunset Beach	Shore Pine	3
	Shrub	2
	Total	**5**

Bird Species Detected in the Park

All bird species detected in the park during the 2006 field season, as well as additional species that we detected during our more limited fieldwork in 2004, are listed in Table 3. We emphasize that Table 3 does not constitute an exhaustive list of bird species that use LEWI lands, for multiple reasons:

- We conducted our surveys in the breeding season only; additional species may visit the park during migration or the winter season.

- Although we detected numerous shorebird species, our methodology was designed specifically for landbirds, and would not have been an appropriate choice if we were trying to inventory shorebirds; any shorebird detections should therefore be considered anecdotal data only.

- Even restricting ourselves to landbirds during the breeding season, the considerable turnover in the species detected during our 2004 fieldwork versus our 2006 fieldwork (that is, species detected in 2004 but not in 2006, or vice versa) suggests there are likely additional species in the park which we have not yet detected.

Table 3. All bird species detected in the Lewis and Clark National Historical Park during our landbird inventory. All species were detected during the 2006 fieldwork, except for those indicated by asterisks, which we detected during our limited fieldwork in the park in 2004, but not during the 2006 field season.

Common Name	Scientific Name
Brown Pelican	*Pelecanus occidentalis*
Double-crested Cormorant*	*Phalacrocorax auritus*
Great Blue Heron*	*Ardea herodias*
Turkey vulture	*Cathartes aura*
Canada Goose	*Branta canadensis*
Mallard	*Anas platyrhynchos*
Osprey	*Pandion haliaetus*
Bald Eagle	*Haliaeetus leucocephalus*
Northern Harrier*	*Circus cyaneus*
Killdeer	*Charadrius vociferus*
Spotted Sandpiper*	*Actitis macularia*
Western Gull*	*Larus occidentalis*
Glaucous-winged Gull	*Larus glaucescens*
Caspian Tern	*Sterna caspia*
Band-tailed Pigeon	*Patagioenas fasciata*
Mourning Dove*	*Zenaida macroura*
Northern Pygmy-Owl	*Glaucidium gnoma*
Barred Owl	*Strix varia*
Rufous Hummingbird	*Selasphorus rufus*
Belted Kingfisher	*Ceryle alcyon*
Red-breasted Sapsucker	*Sphyrapicus ruber*
Hairy Woodpecker	*Picoides villosus*
Northern Flicker	*Colaptes auratus*
Pileated Woodpecker*	*Dryocopus pileatus*
Olive-sided Flycatcher	*Contopus cooperi*
Western Wood-Pewee	*Contopus sordidulus*
Willow Flycatcher*	*Empidonax traillii*
Pacific-slope Flycatcher	*Empidonax difficilis*
Hutton's Vireo	*Vireo huttoni*
Warbling Vireo	*Vireo gilvus*
Steller's Jay	*Cyanocitta stelleri*
American Crow	*Corvus brachyrhynchos*
Common Raven	*Corvus corax*
Violet-green Swallow	*Tachycineta thalassina*
Cliff Swallow*	*Petrochelidon pyrrhonota*
Barn Swallow	*Hirundo rustica*
Black-capped Chickadee	*Poecile atricapillus*
Chestnut-backed Chickadee	*Poecile rufescens*
Red-breasted Nuthatch	*Sitta canadensis*
Brown Creeper	*Certhia americana*
Bewick's Wren	*Thryomanes bewickii*
Winter Wren	*Troglodytes troglodytes*
Marsh Wren	*Cistothorus palustris*
Golden-crowned Kinglet	*Regulus satrapa*

Table 3. All bird species detected in the Lewis and Clark National Historical Park during our landbird inventory. All species were detected during the 2006 fieldwork, except for those indicated by asterisks, which we detected during our limited fieldwork in the park in 2004, but not during the 2006 field season (continued).

Common Name	Scientific Name
Swainson's Thrush	*Catharus ustulatus*
American Robin	*Turdus migratorius*
Varied Thrush	*Ixoreus naevius*
European Starling*	*Sturnus vulgaris*
Cedar Waxwing	*Bombycilla cedrorum*
Orange-crowned Warbler	*Vermivora celata*
Yellow Warbler	*Dendroica petechia*
Yellow-rumped Warbler	*Dendroica coronata*
Black-throated Gray Warbler	*Dendroica nigrescens*
Townsend's Warbler	*Dendroica townsendi*
Townsend's x Hermit Warbler hybrid*	*Dendroica sp.*
Hermit Warbler*	*Dendroica occidentalis*
MacGillivray's Warbler	*Oporornis tolmiei*
Common Yellowthroat	*Geothlypis trichas*
Wilson's Warbler	*Wilsonia pusilla*
Western Tanager	*Piranga ludoviciana*
Spotted Towhee	*Pipilo maculatus*
Savannah Sparrow	*Passerculus sandwichensis*
Song Sparrow	*Melospiza melodia*
White-crowned Sparrow	*Zonotrichia leucophrys*
Dark-eyed Junco	*Junco hyemalis*
Black-headed Grosbeak	*Pheucticus melanocephalus*
Red-winged Blackbird	*Agelaius phoeniceus*
Brewer's Blackbird*	*Euphagus cyanocephalus*
Brown-headed Cowbird	*Molothrus ater*
Purple Finch	*Carpodacus purpureus*
House Finch	*Carpodacus mexicanus*
Red Crossbill	*Loxia curvirostra*
Pine Siskin*	*Carduelis pinus*
American Goldfinch	*Carduelis tristis*

Bird Distribution and Density

We detected 59 bird species during point counts in 2006. Maps indicating the locations of the survey points from which each species was detected are provided in Figures 1-59. For each of these species, we tabulate the number of points with detections in each of the park's four surveyed units, as well as the total number of detections (Table 4).

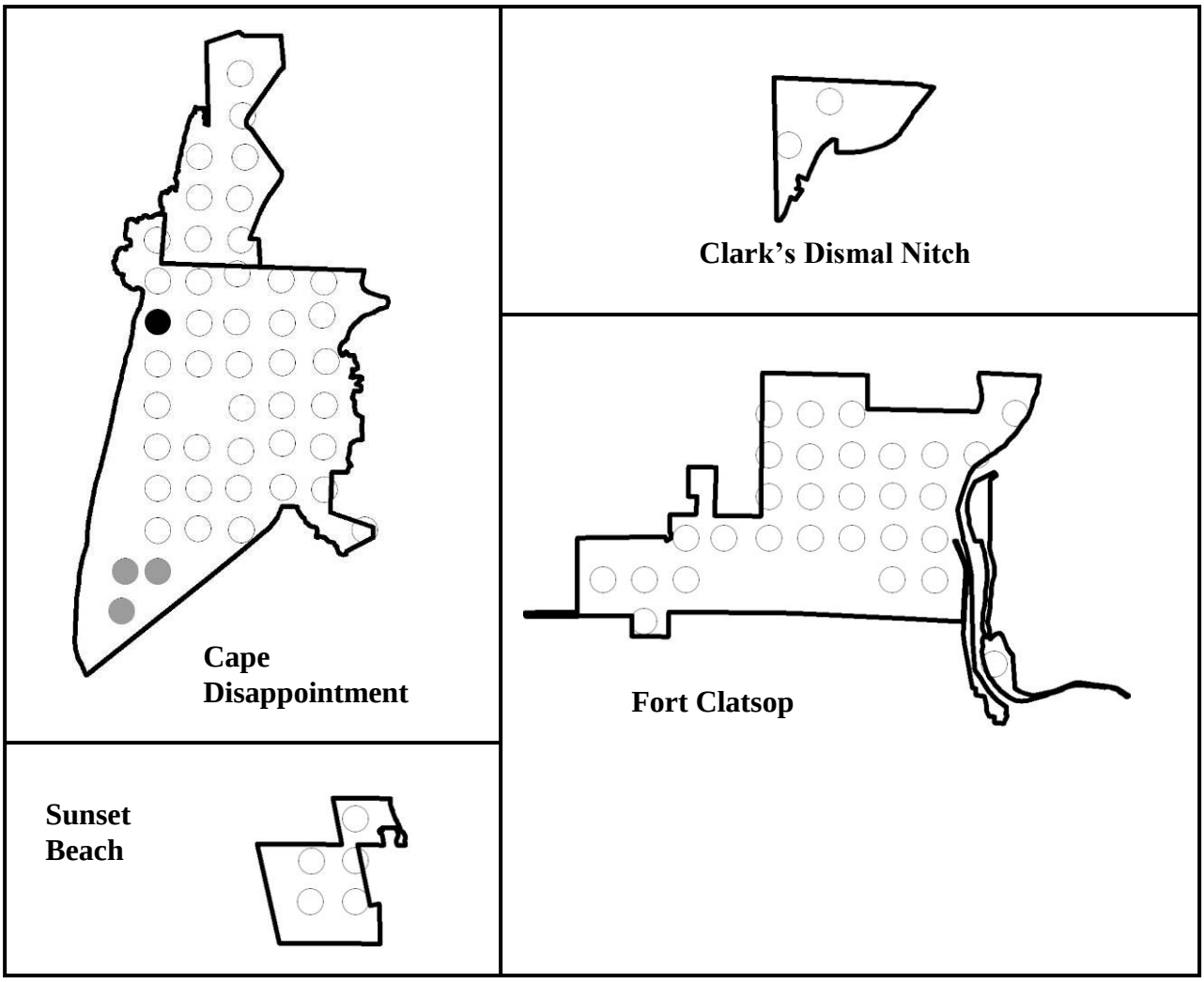

Figure 1. Locations of Brown Pelican detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

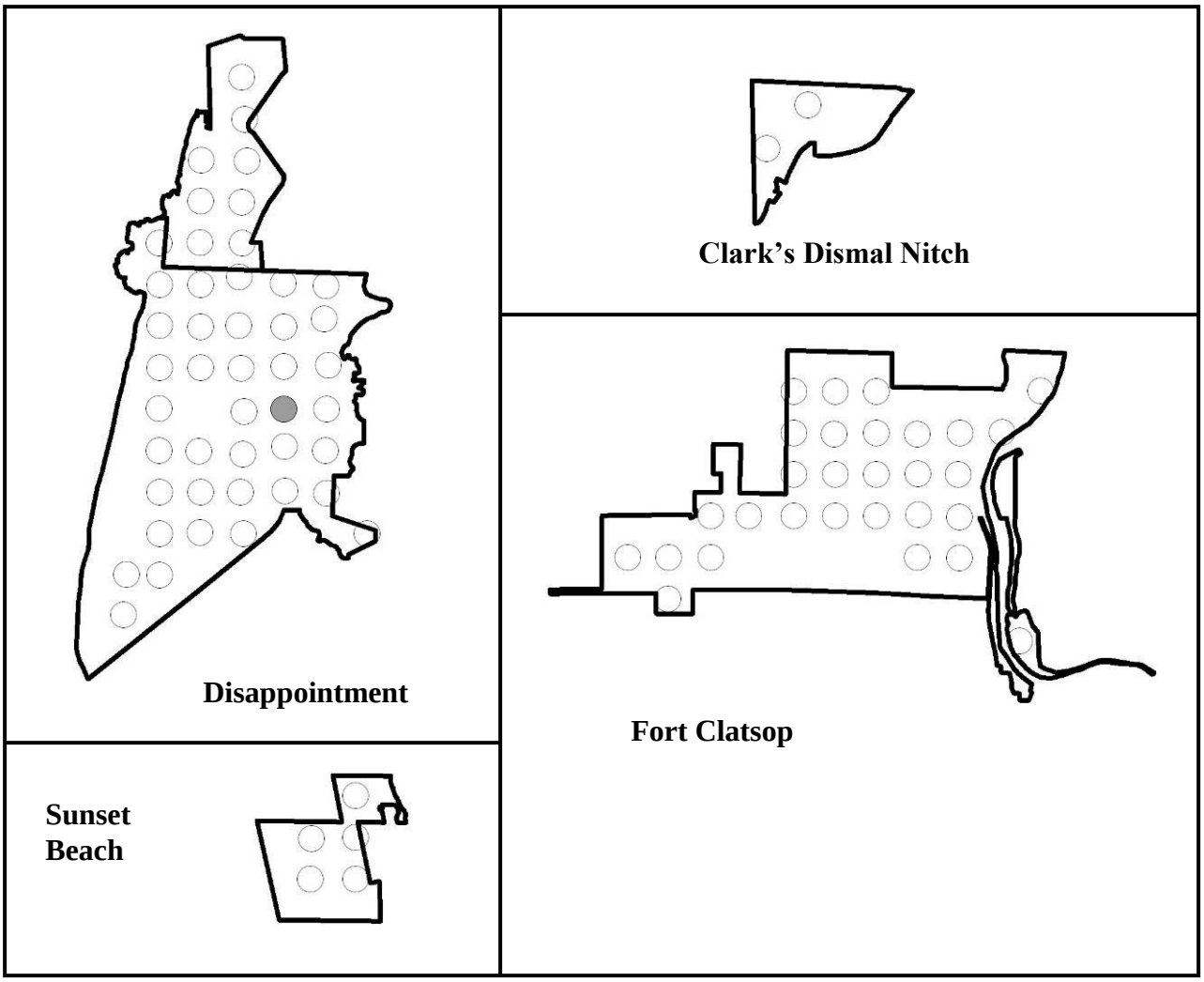

Figure 2. Locations of Turkey Vulture detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

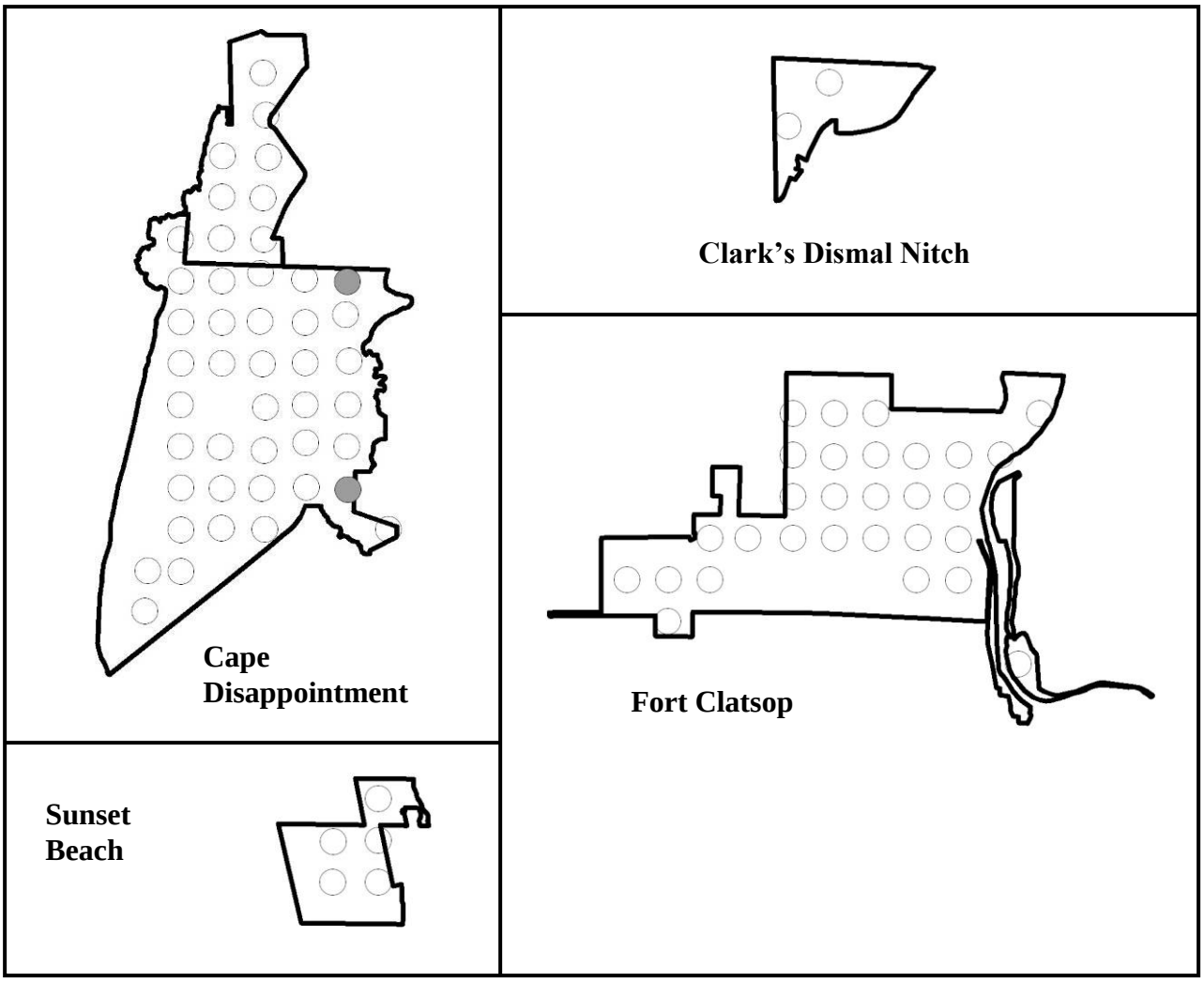

Figure 3. Locations of Canada Goose detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

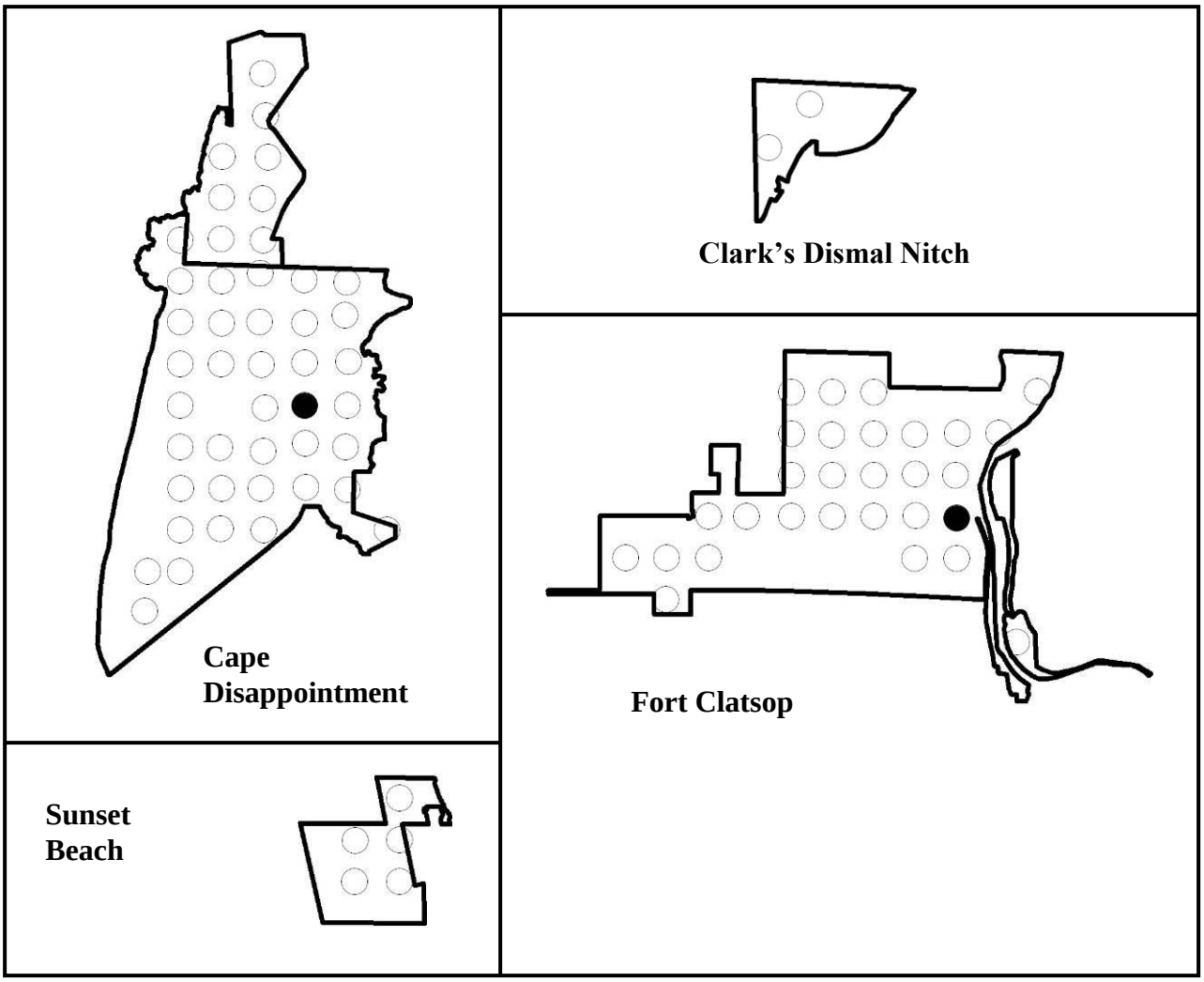

Figure 4. Locations of Mallard detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

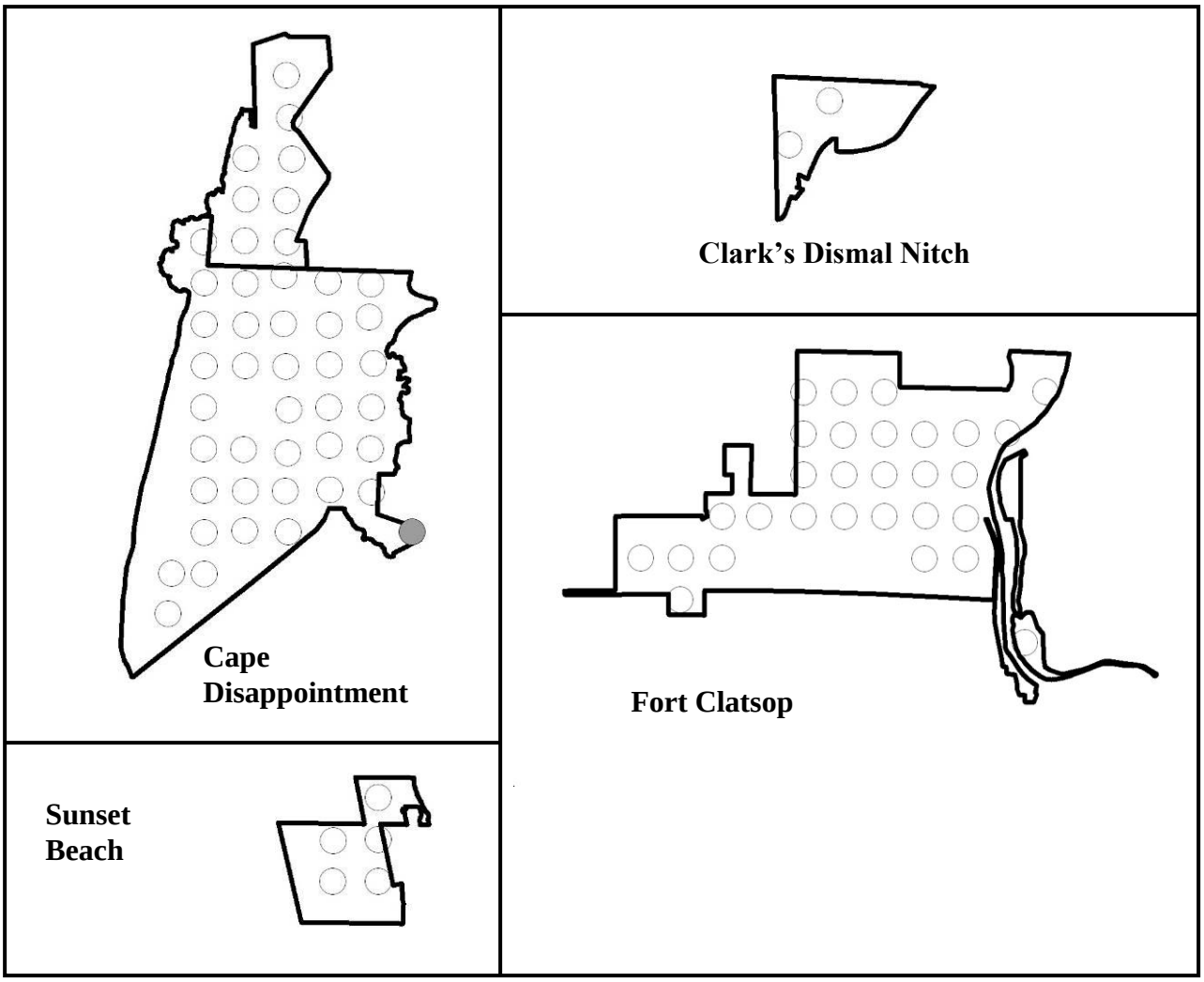

Figure 5. Locations of Osprey detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

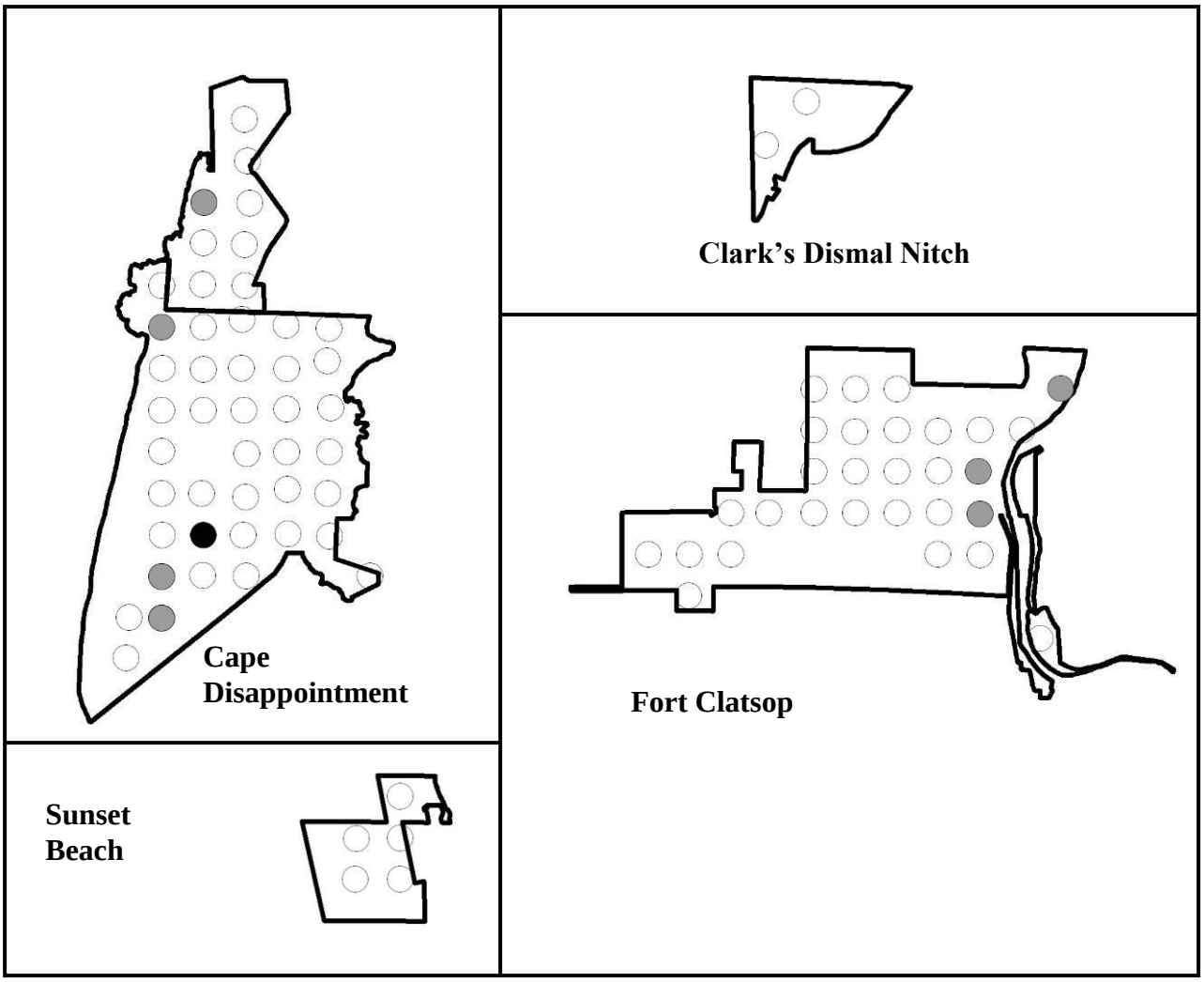

Figure 6. Locations of Bald Eagle detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

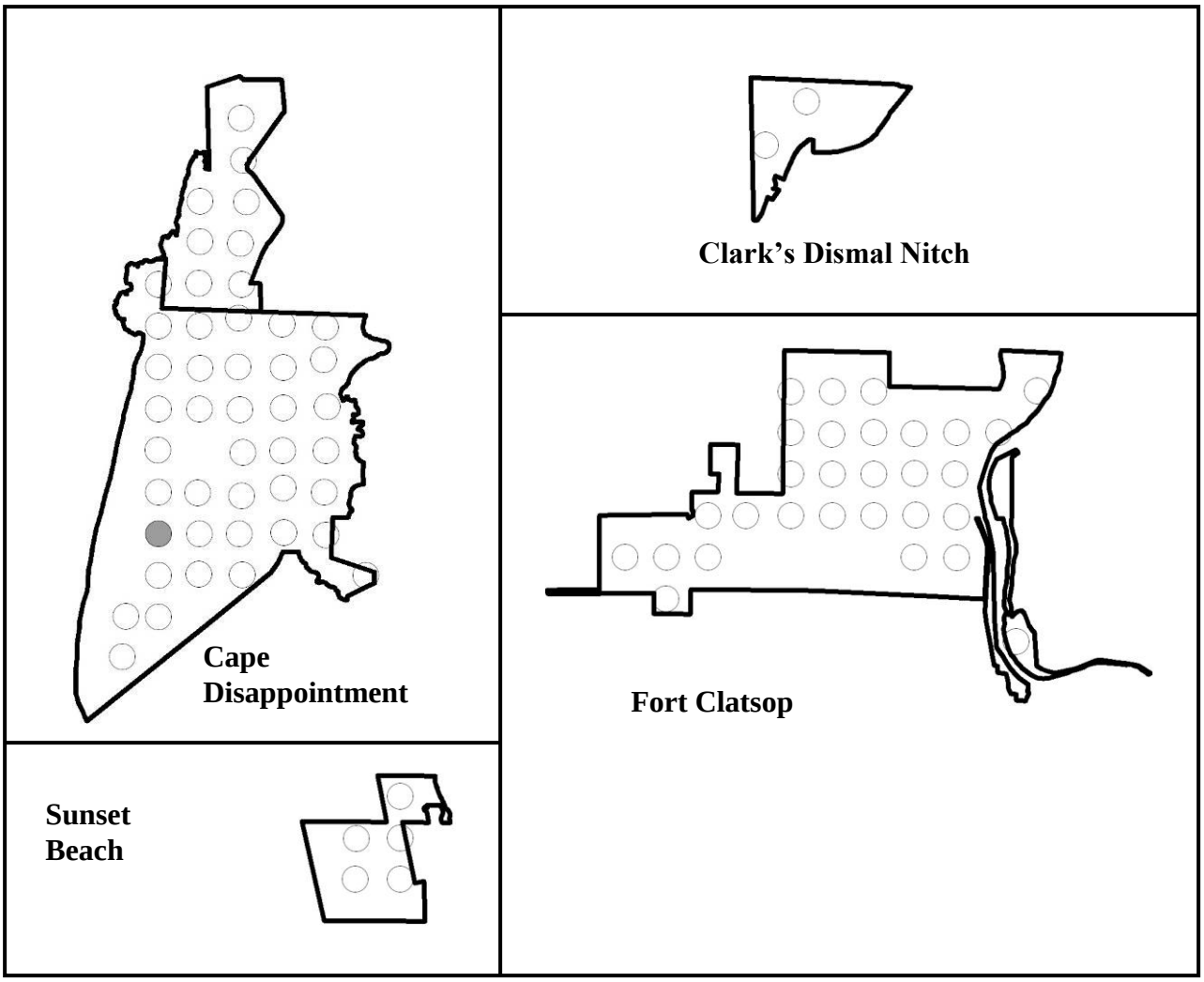

Figure 7. Locations of Killdeer detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

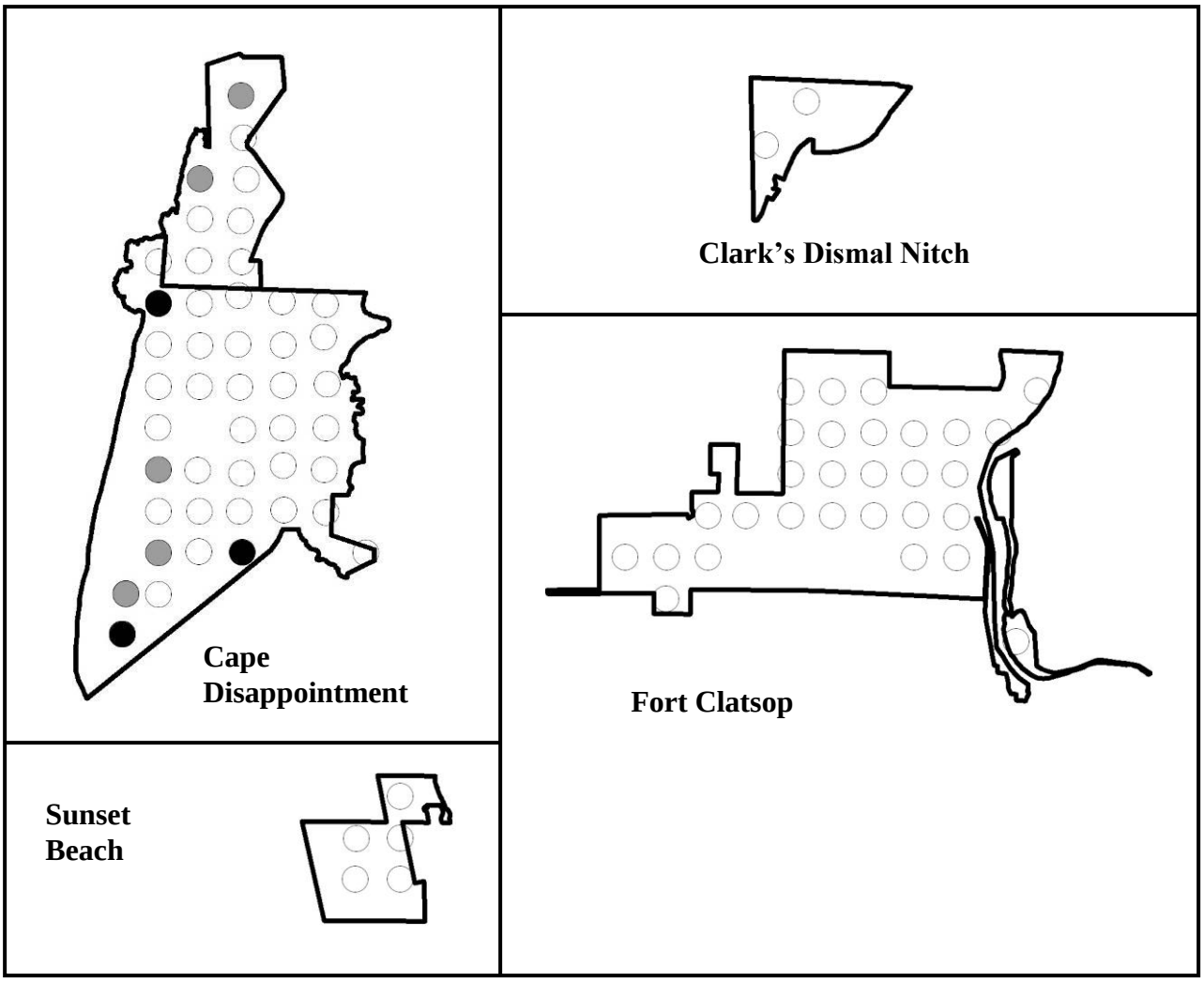

Figure 8. Locations of Glaucous-winged Gull detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

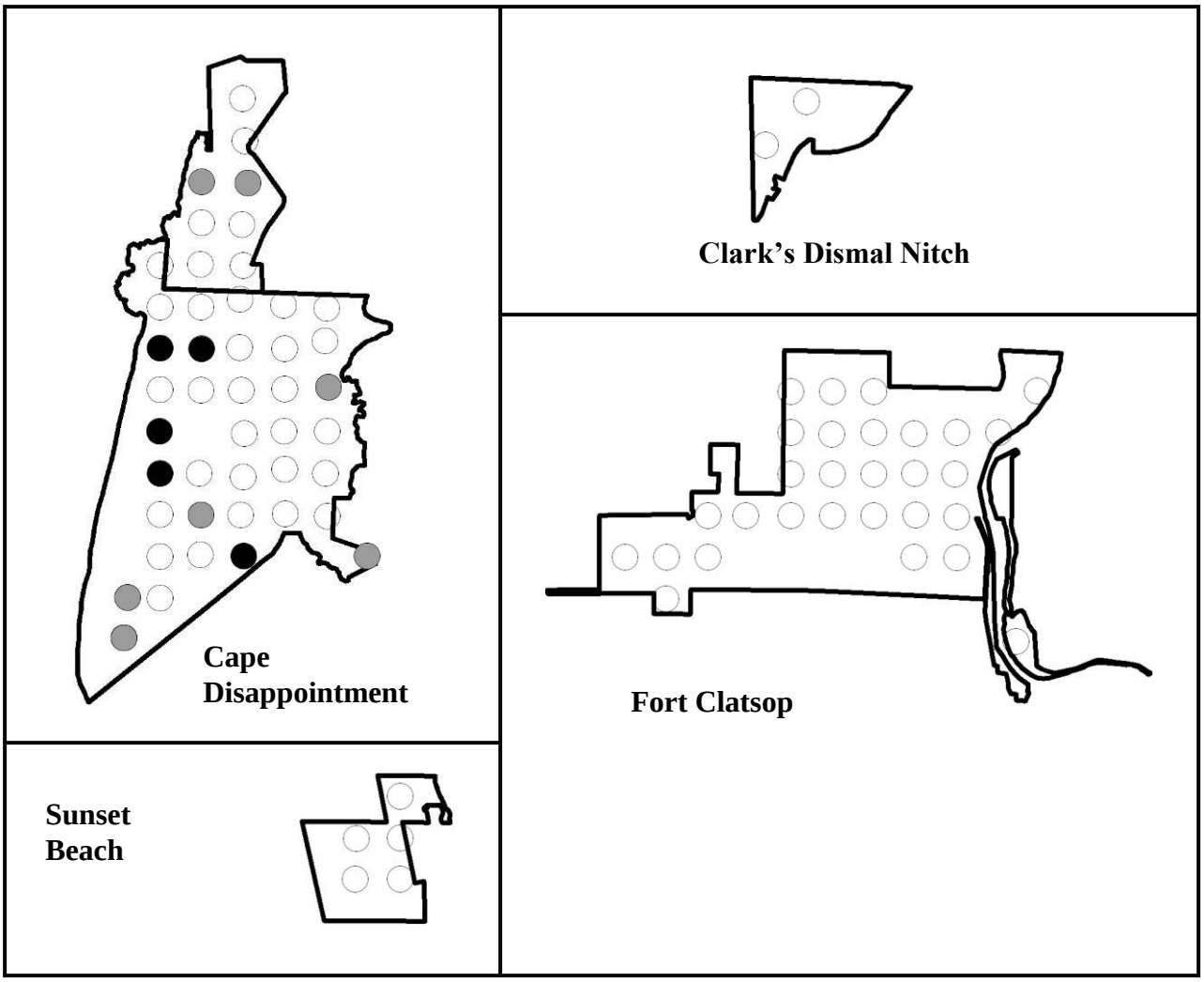

Figure 9. Locations of Caspian Tern detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

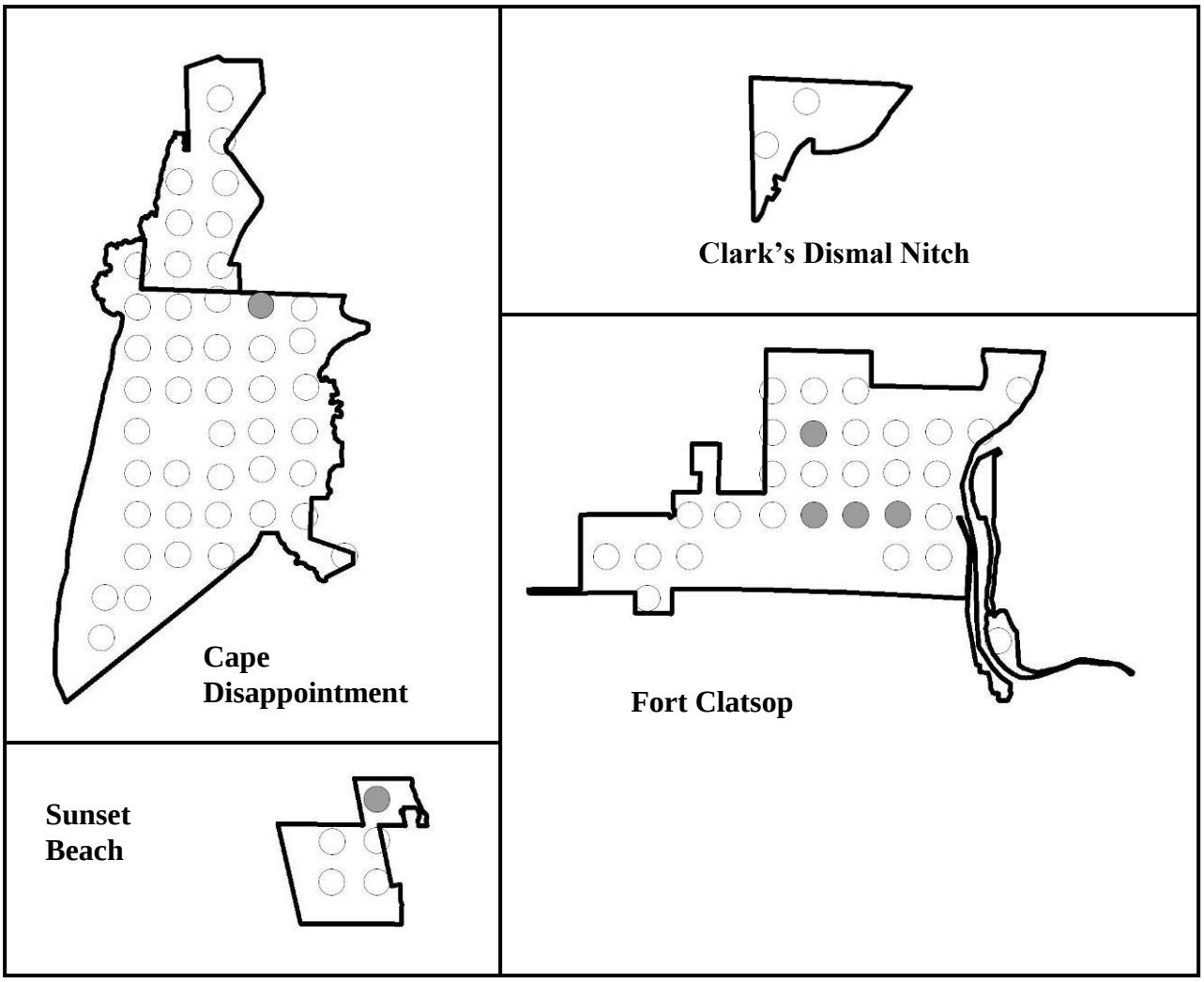

Figure 10. Locations of Band-tailed Pigeon detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

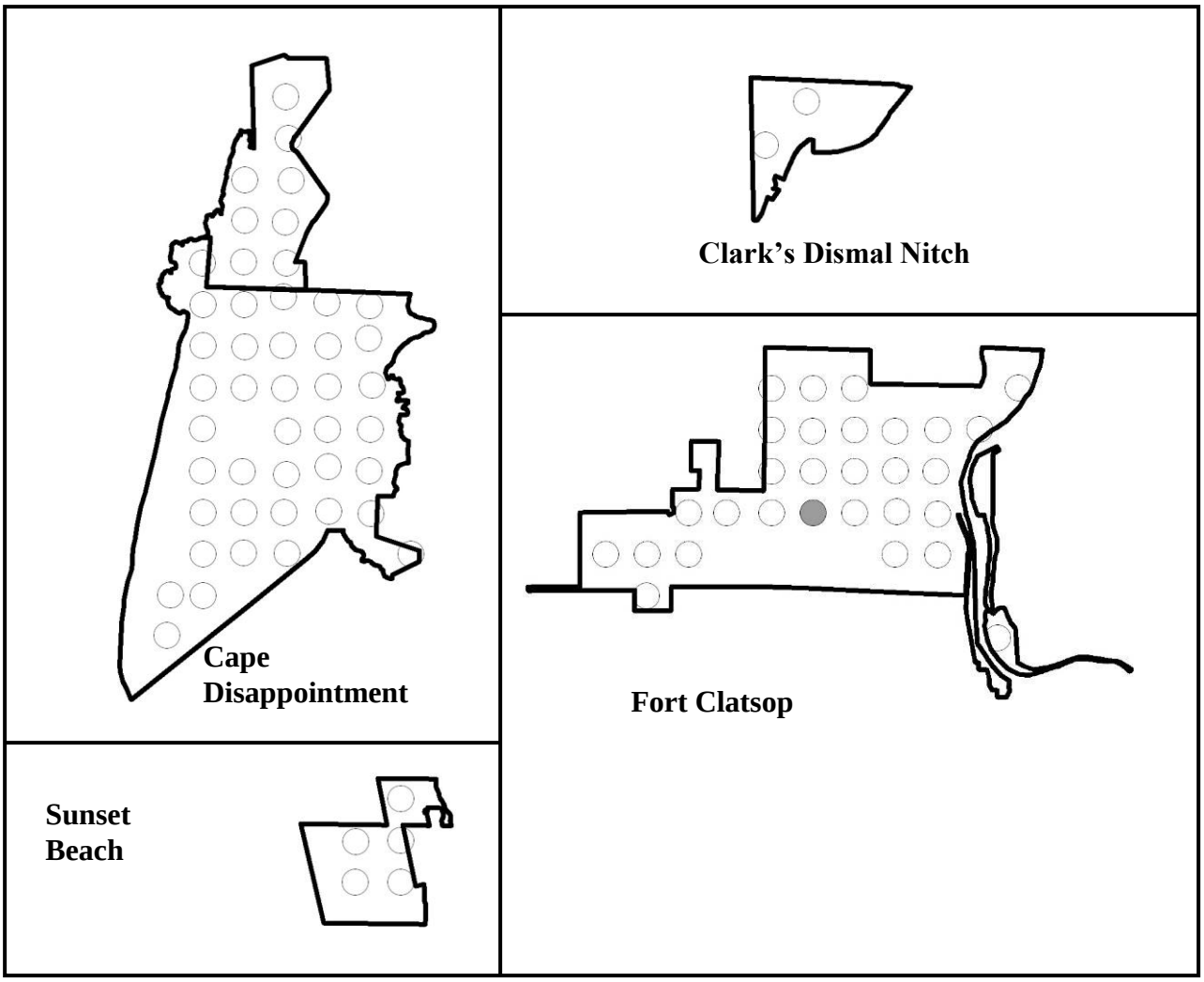

Figure 11. Locations of Northern Pygmy-Owl detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

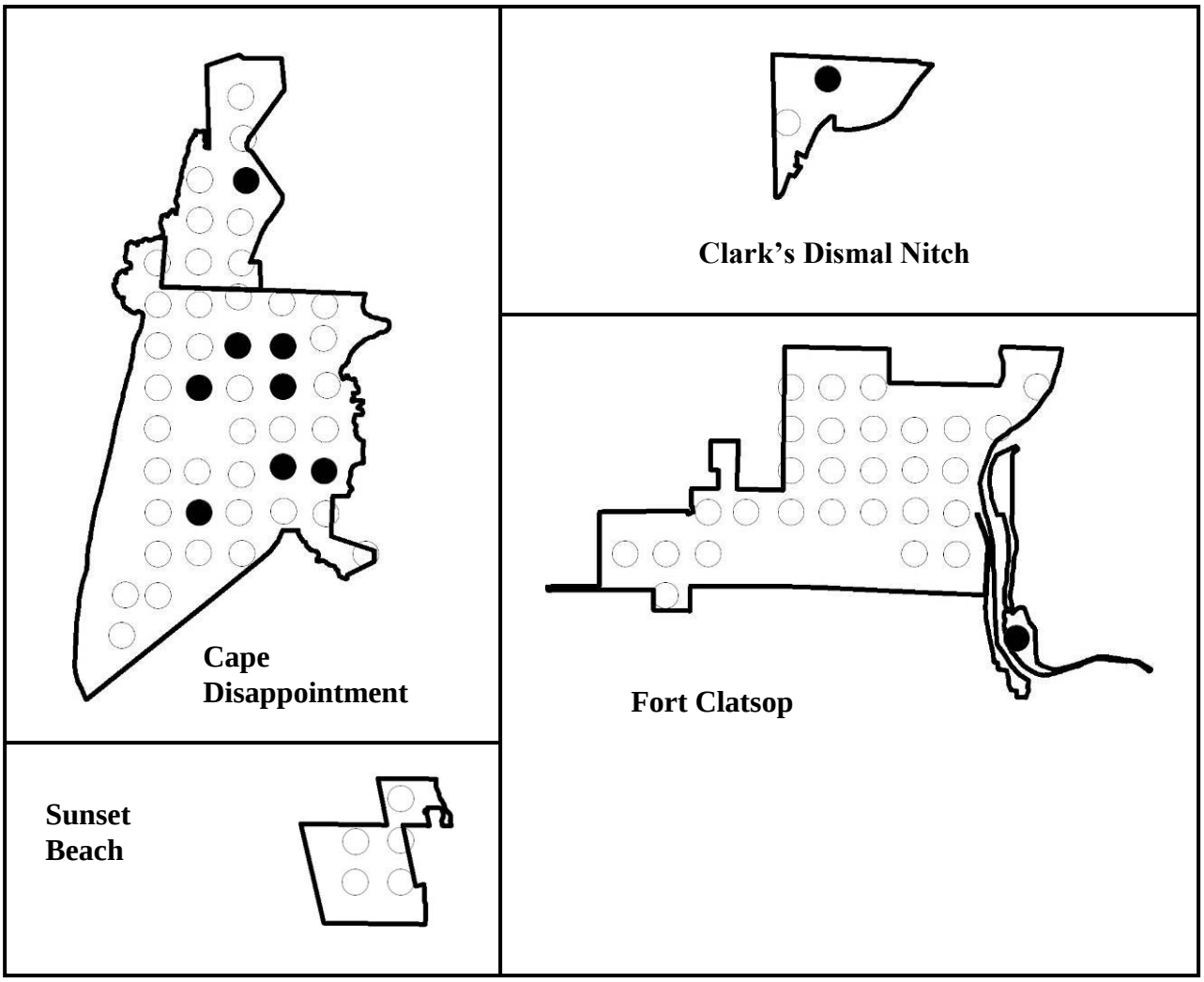

Figure 12. Locations of Rufous Hummingbird detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

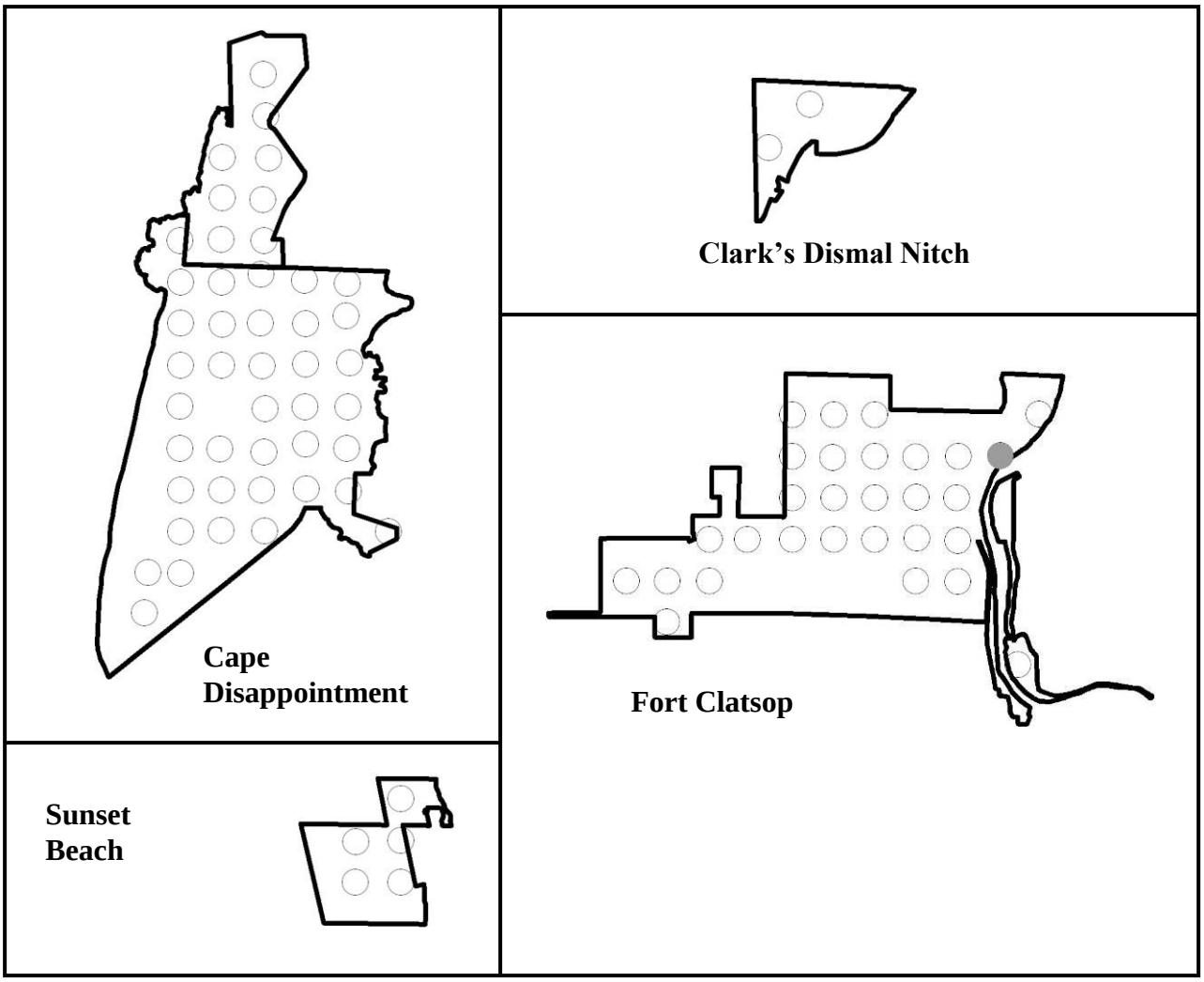

Figure 13. Locations of Belted Kingfisher detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

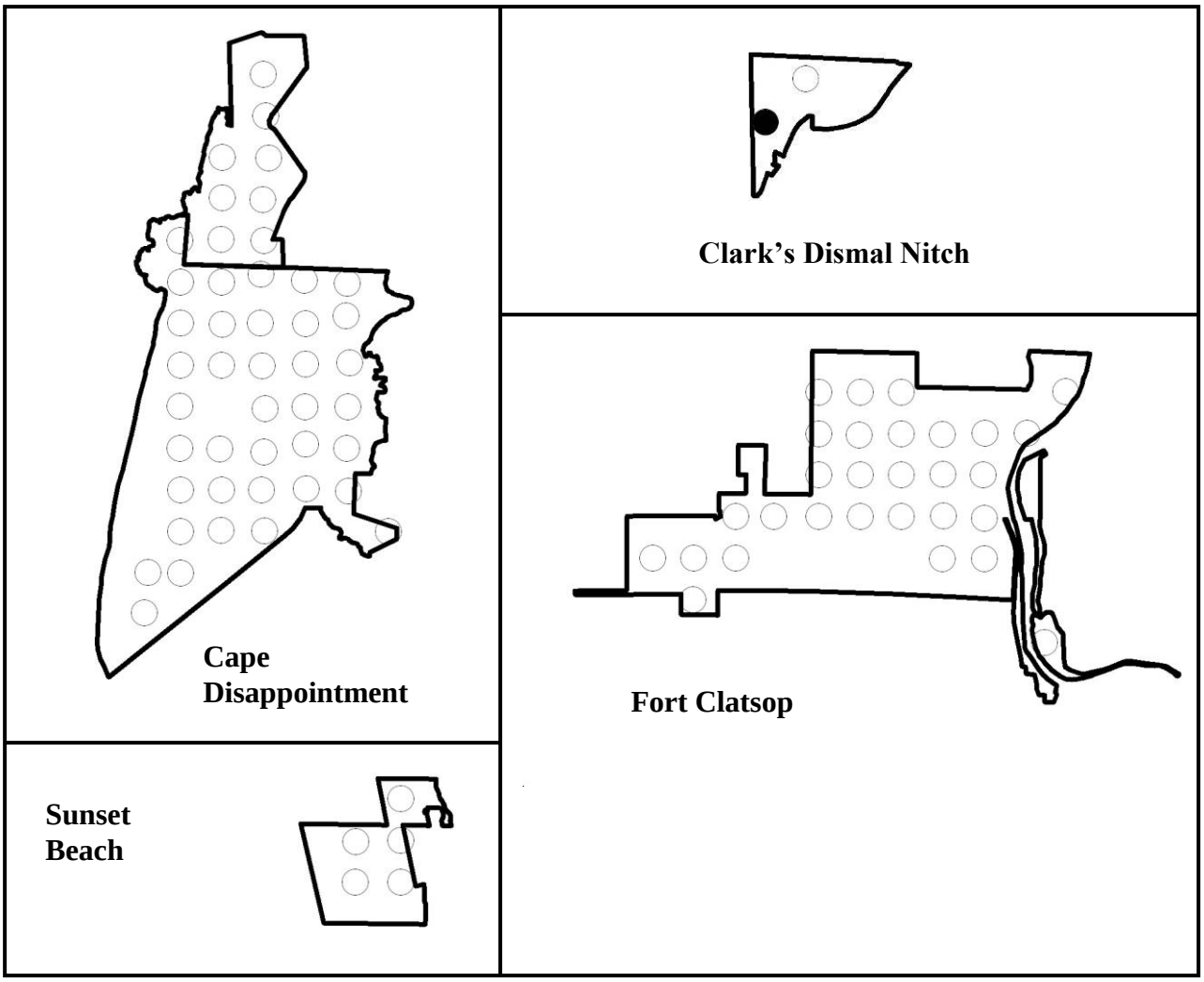

Figure 14. Locations of Red-breasted Sapsucker detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

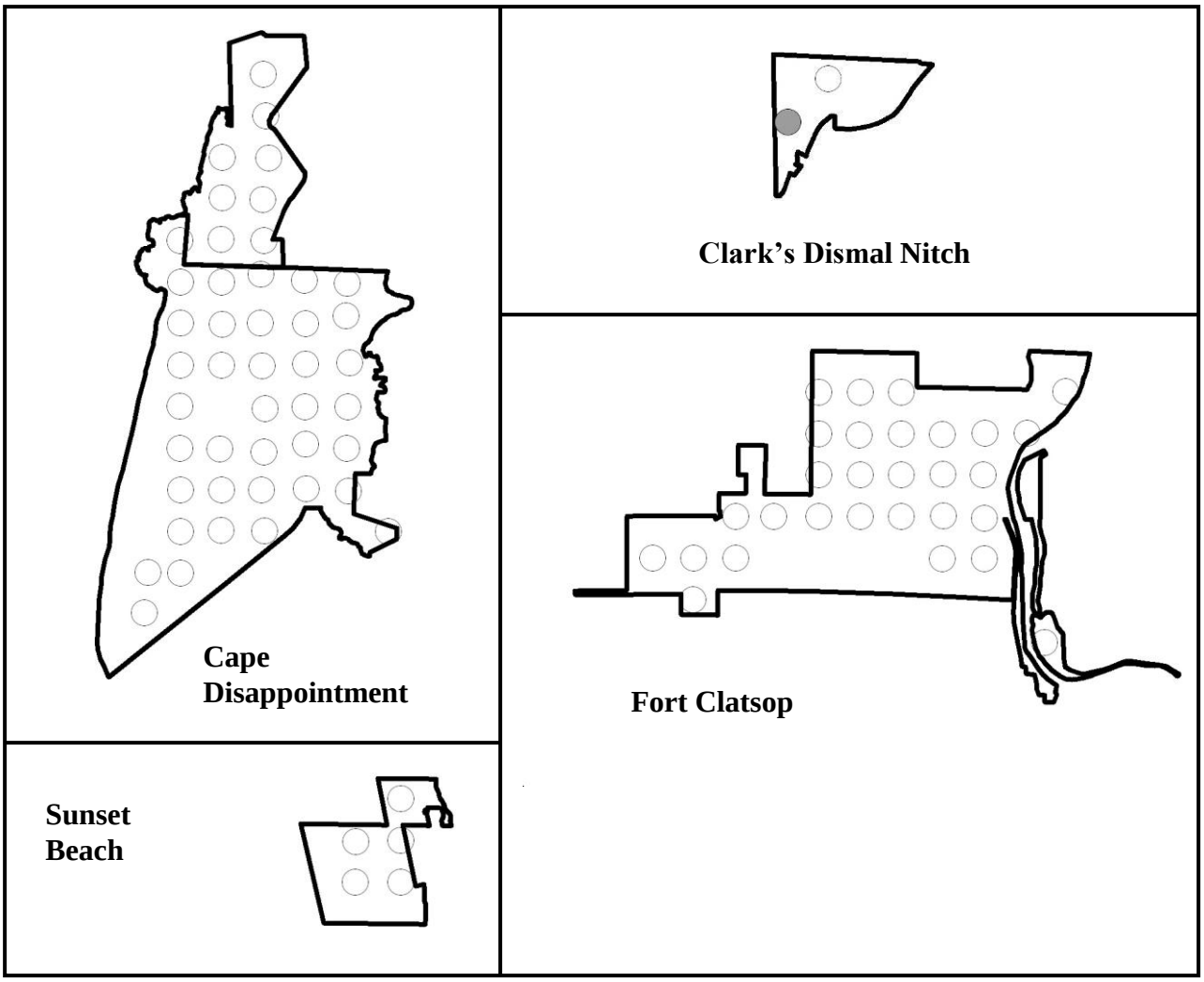

Figure 15. Locations of Hairy Woodpecker detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

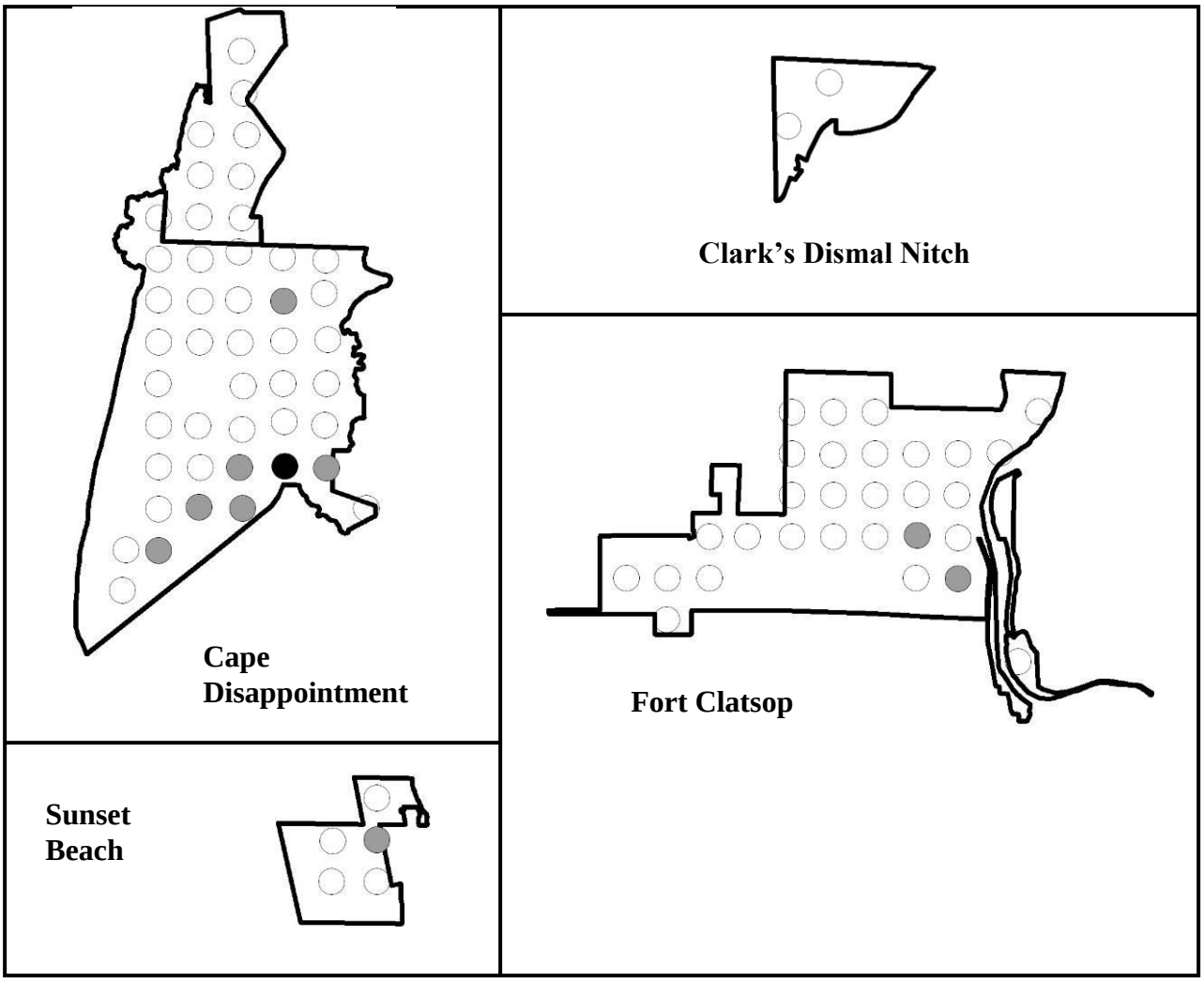

Figure 16. Locations of Northern Flicker detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

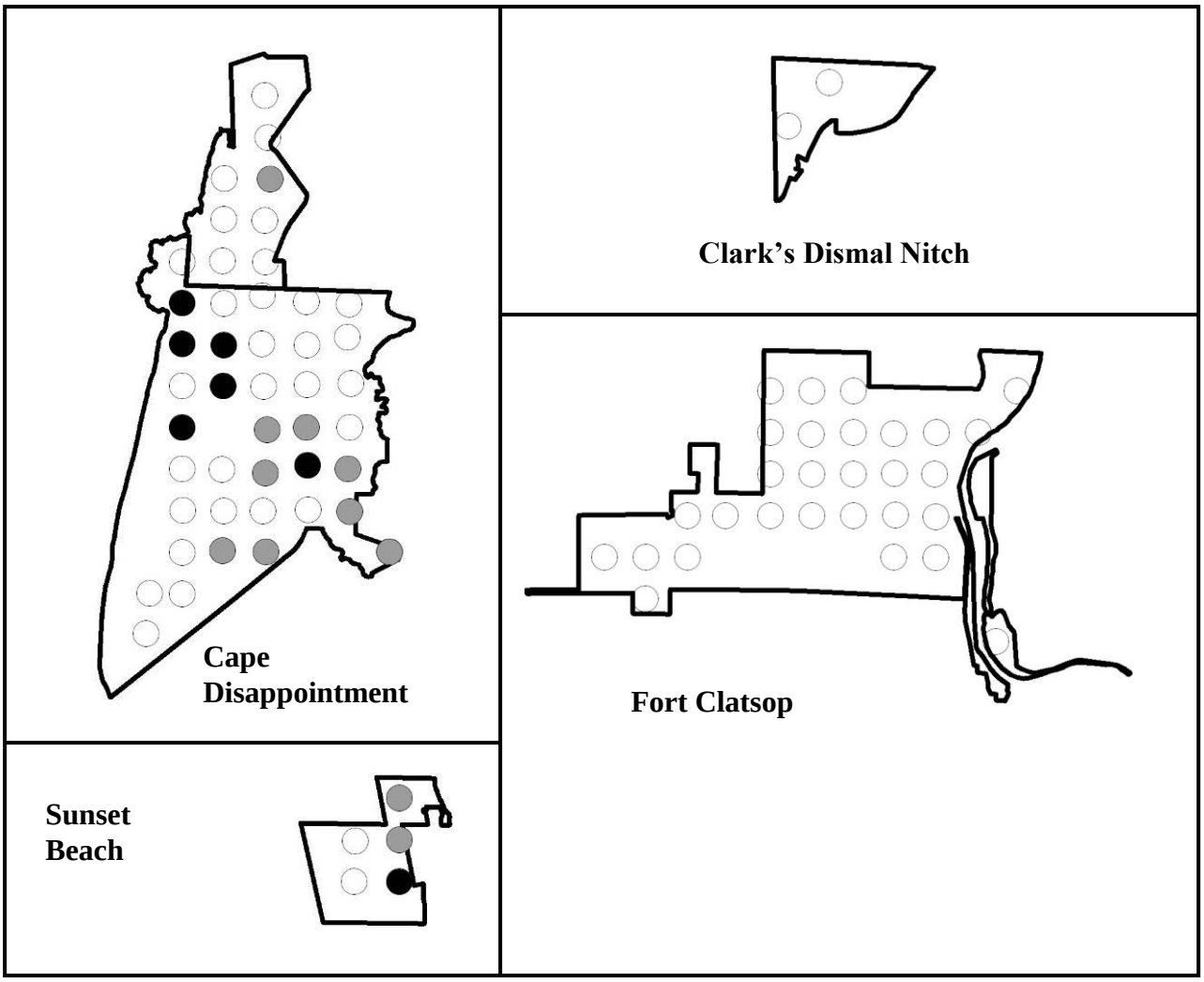

Figure 17. Locations of Olive-sided Flycatcher detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

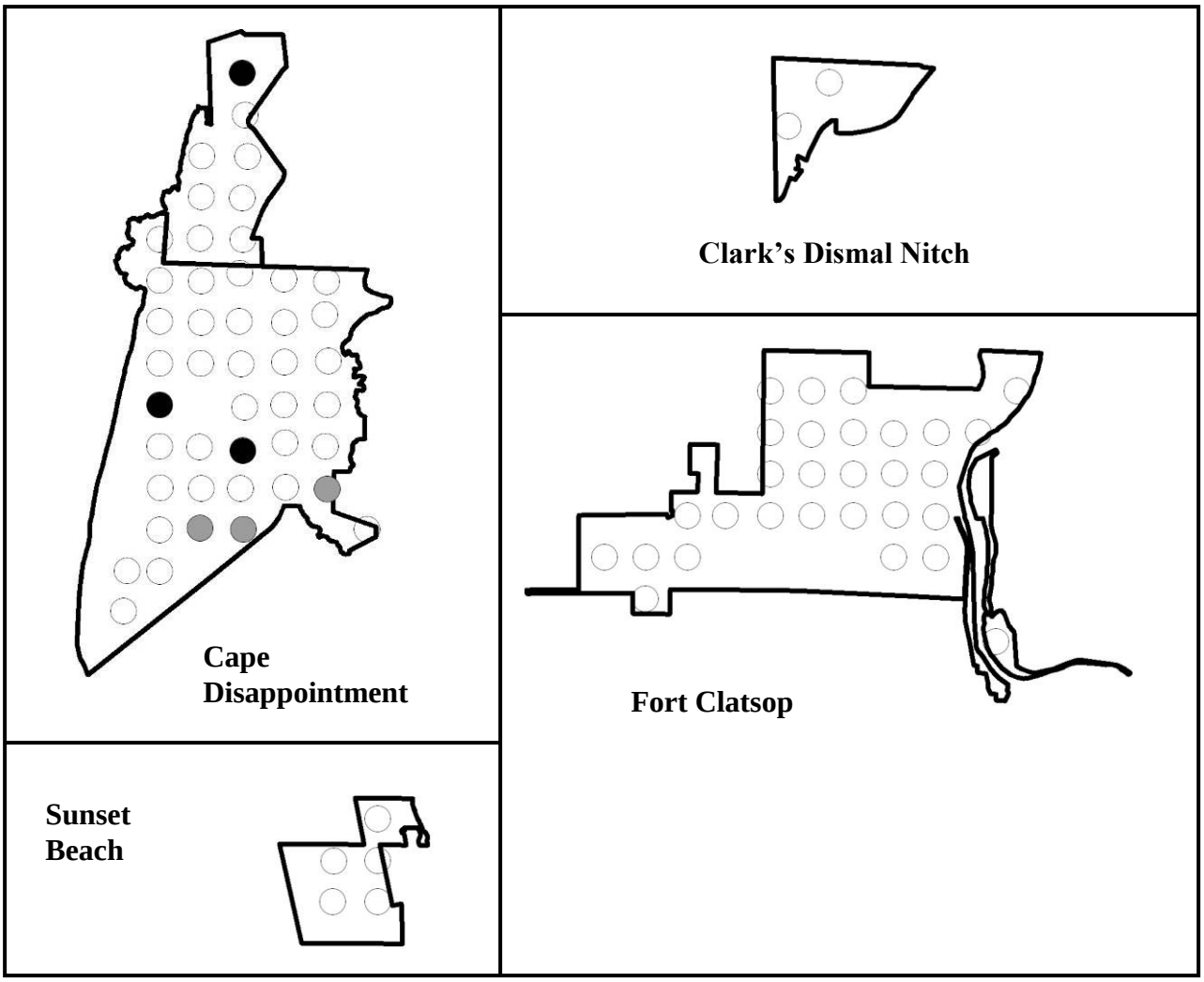

Figure 18. Locations of Western Wood-Pewee detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

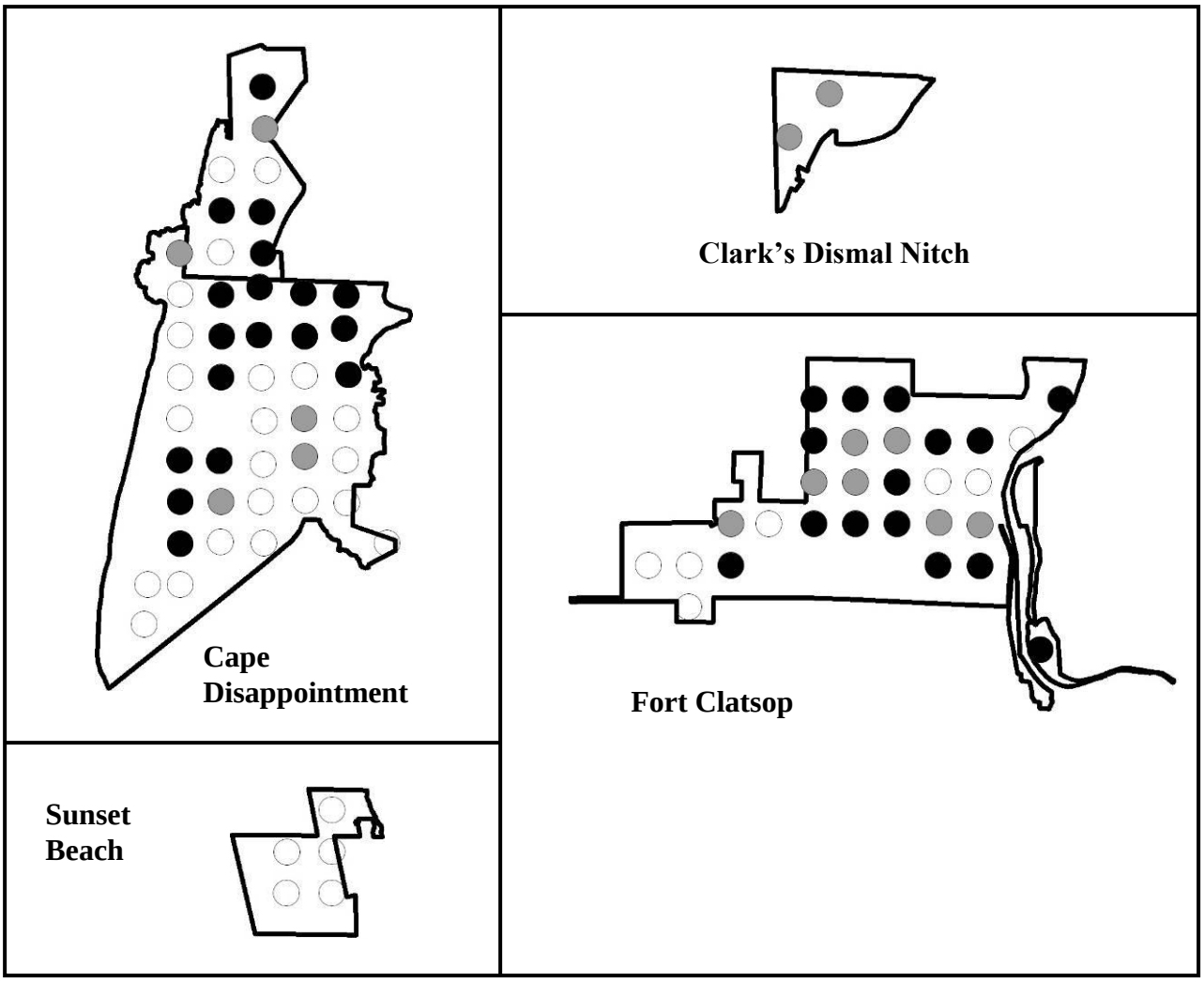

Figure 19. Locations of Pacific-slope Flycatcher detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

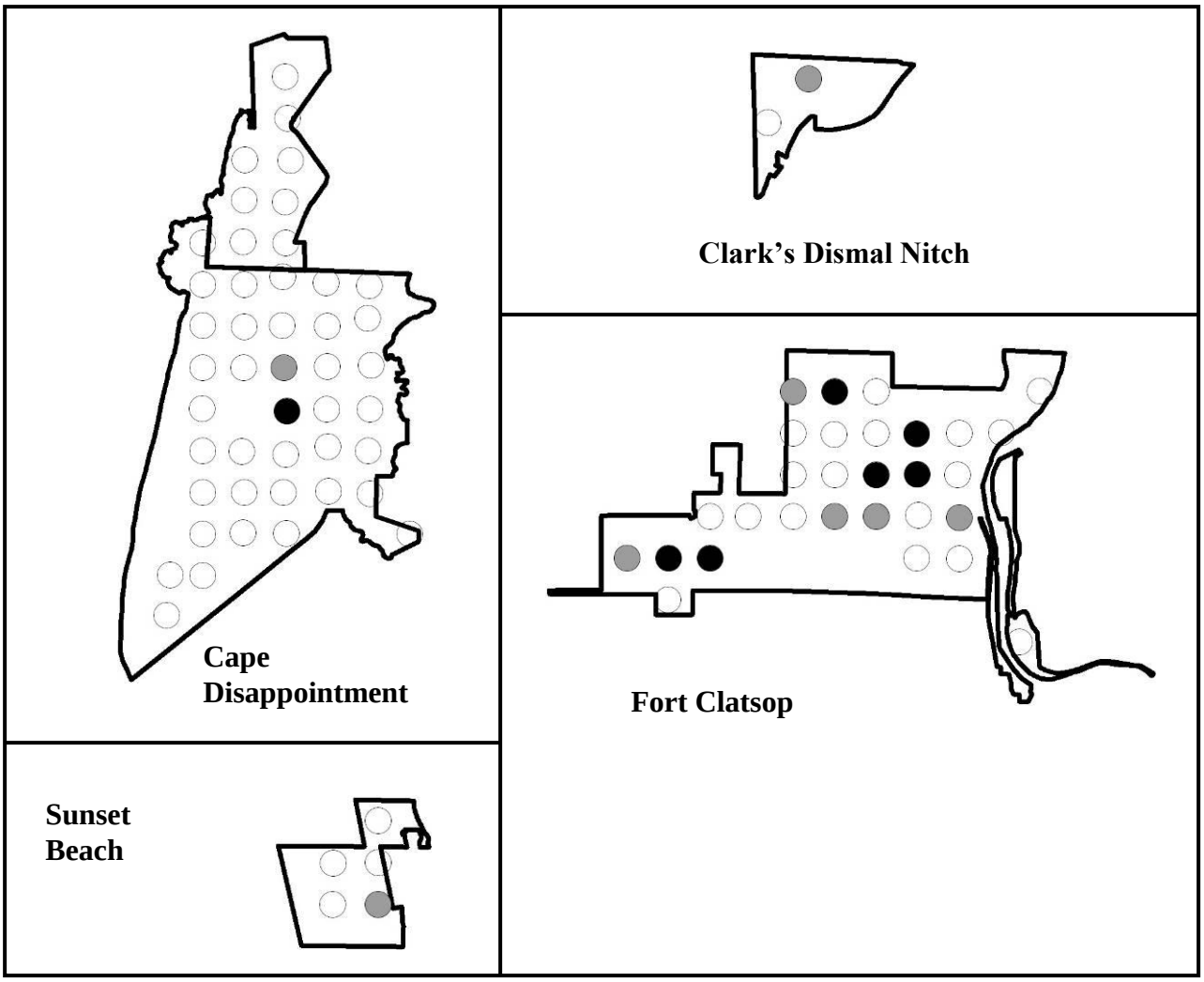

Figure 20. Locations of Hutton's Vireo detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

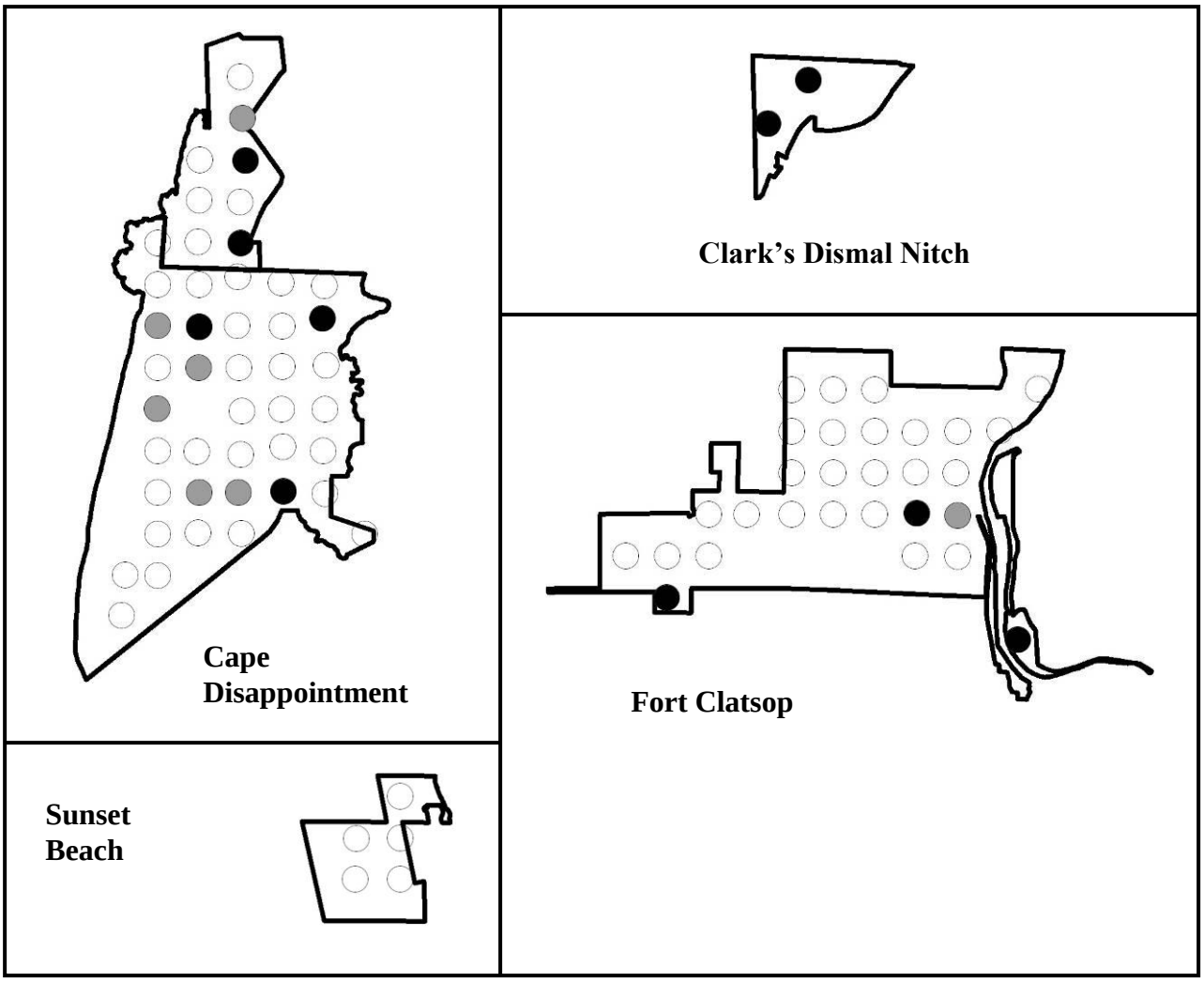

Figure 21. Locations of Warbling Vireo detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

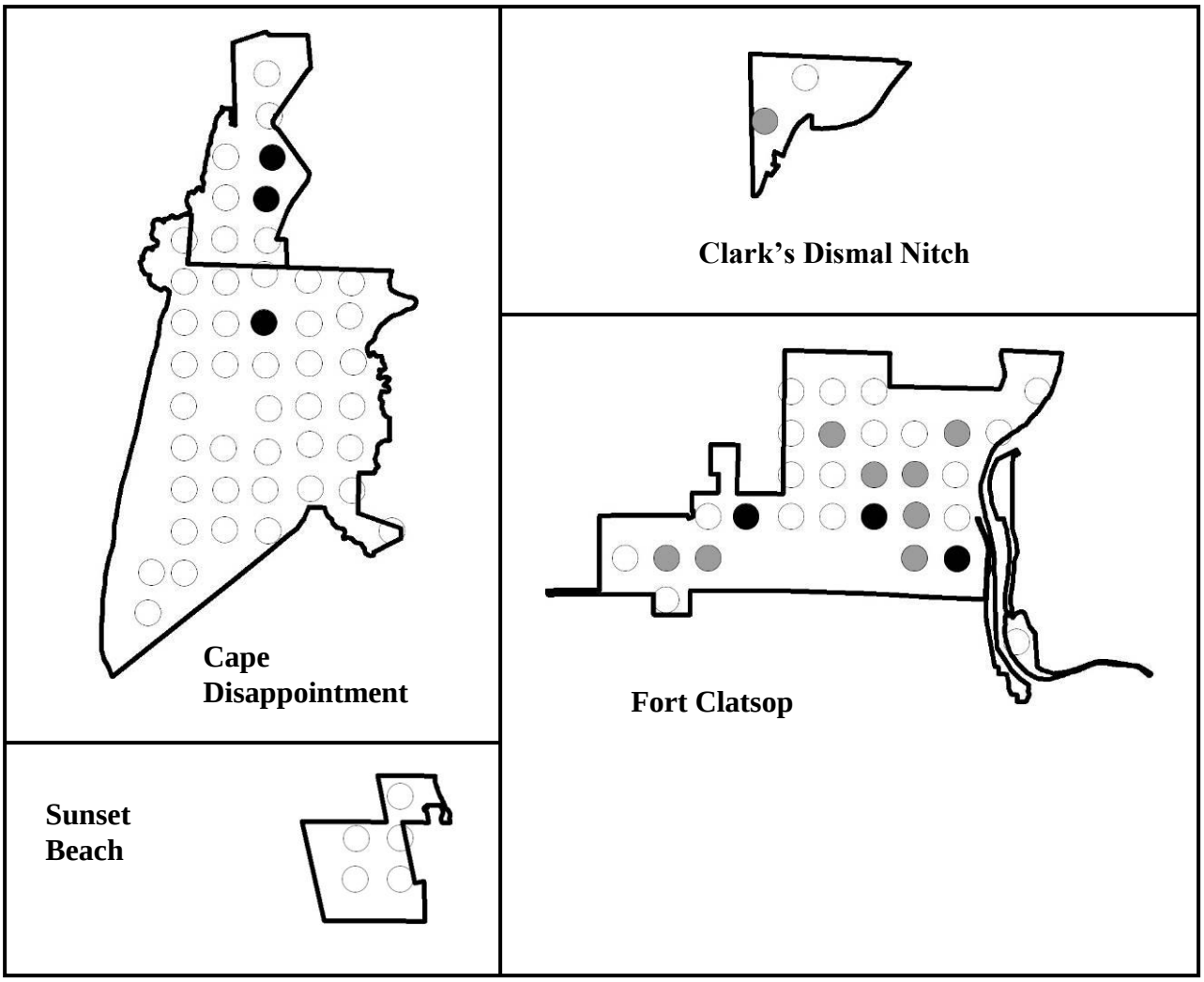

Figure 22. Locations of Steller's Jay detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

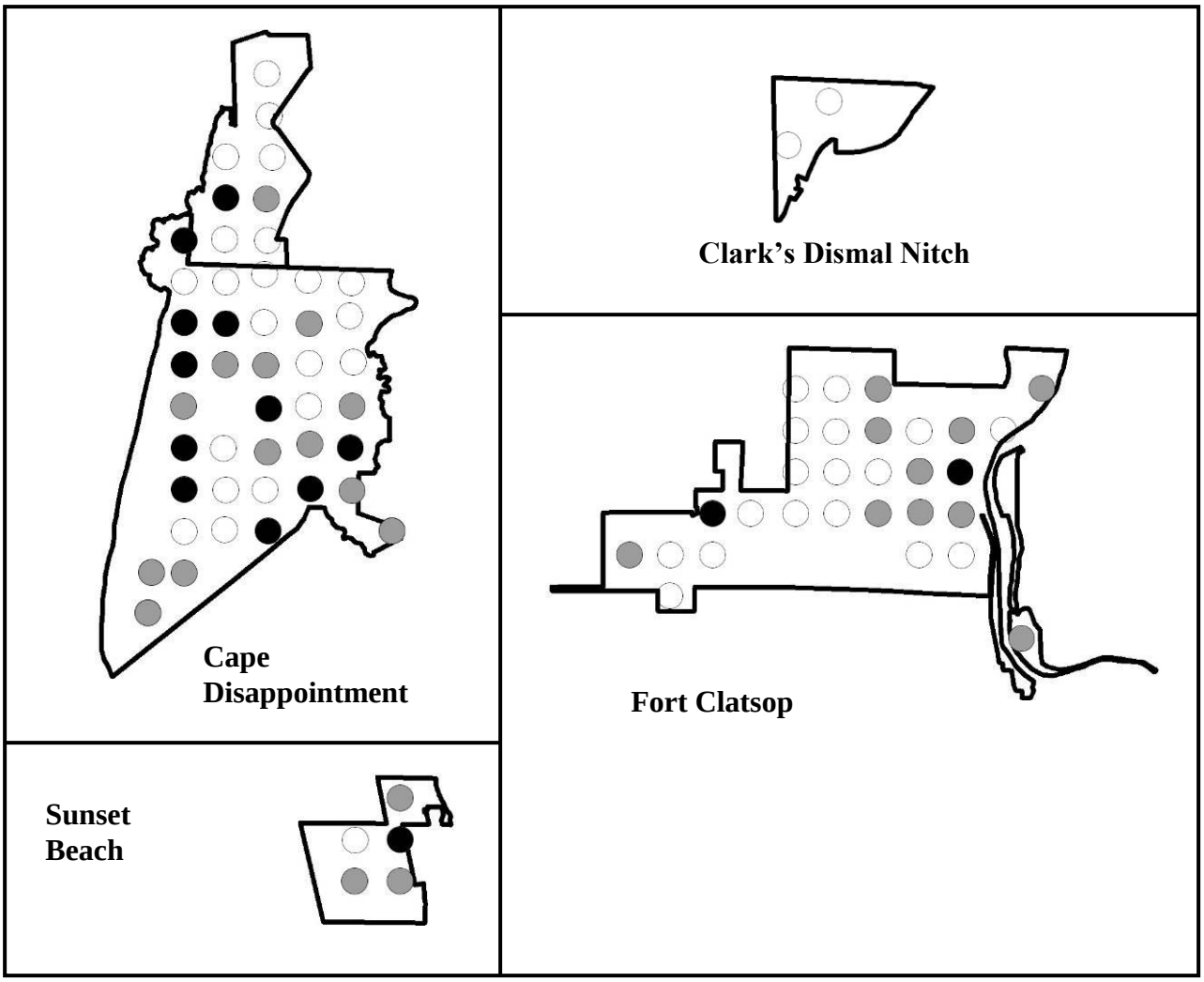

Figure 23. Locations of American Crow detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

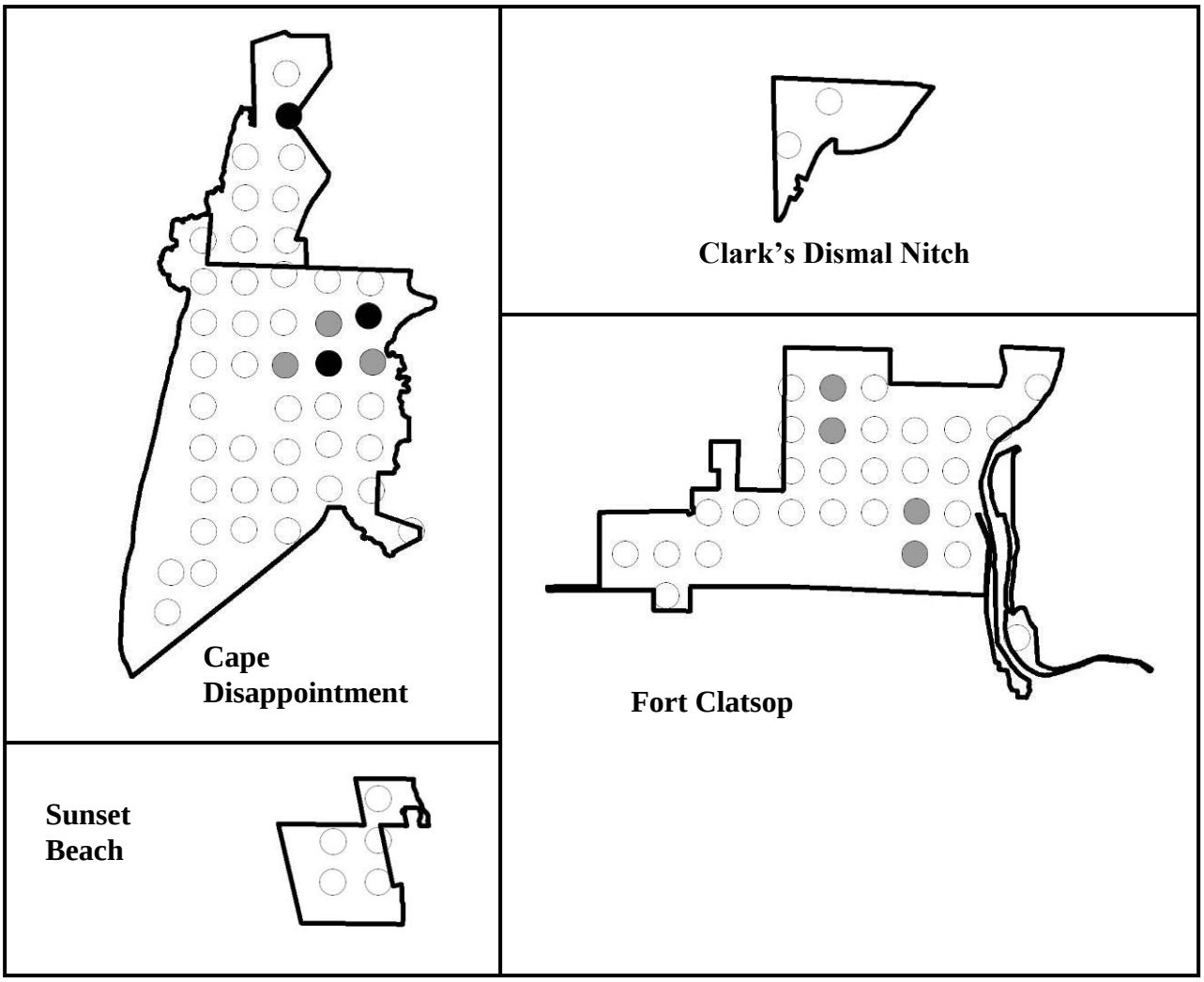

Figure 24. Locations of Common Raven detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

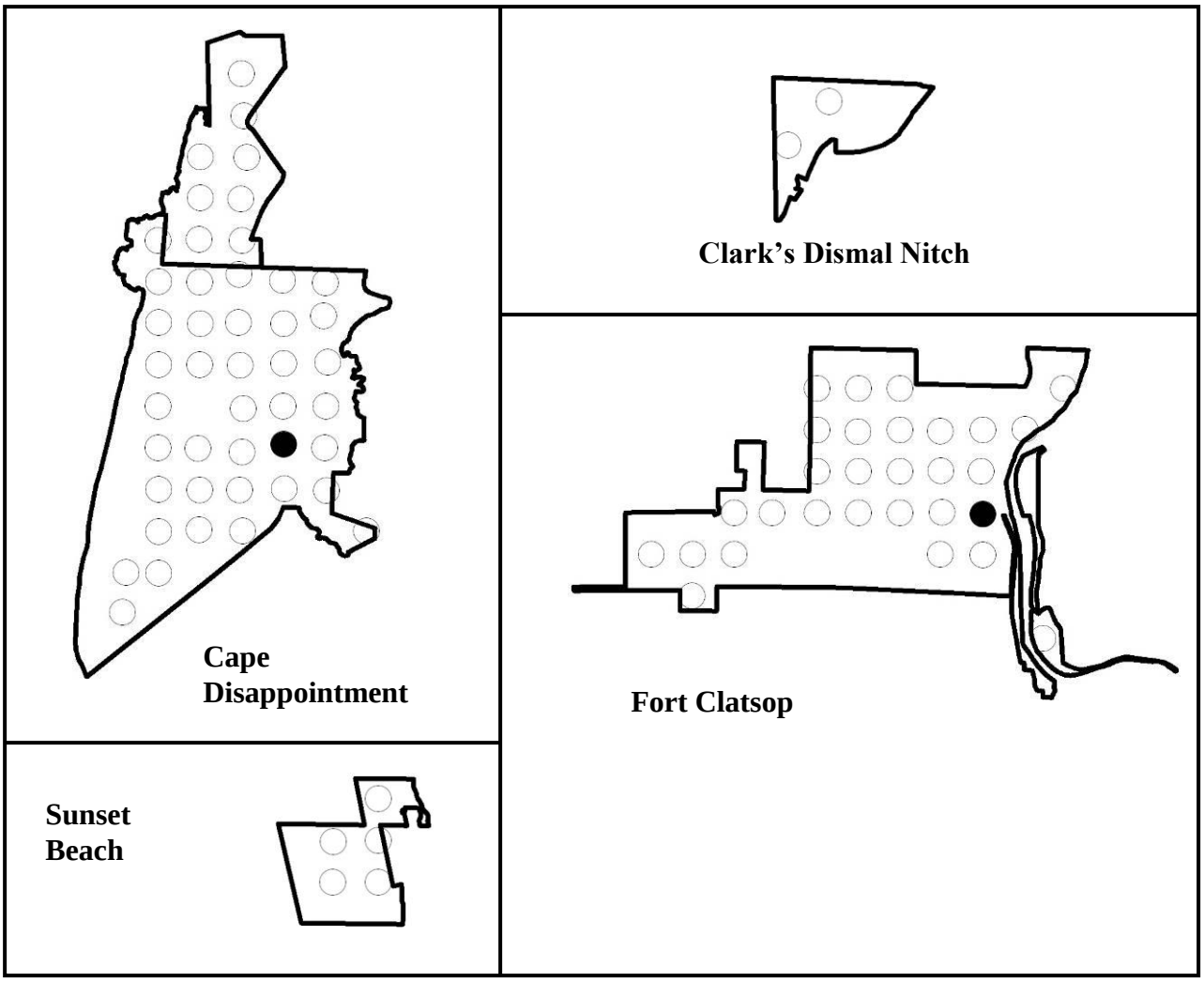

Figure 25. Locations of Violet-green Swallow detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

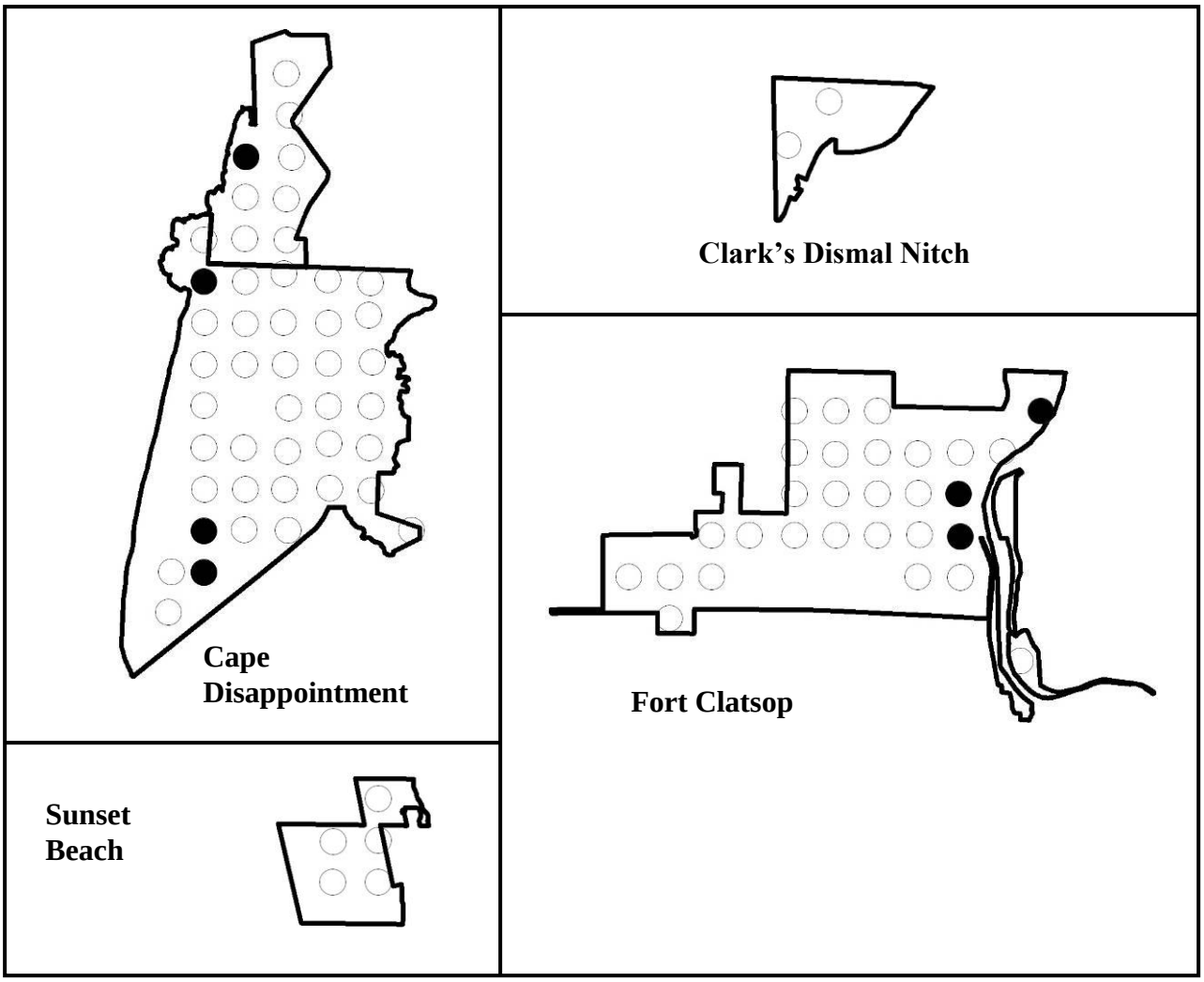

Figure 26. Locations of Barn Swallow detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

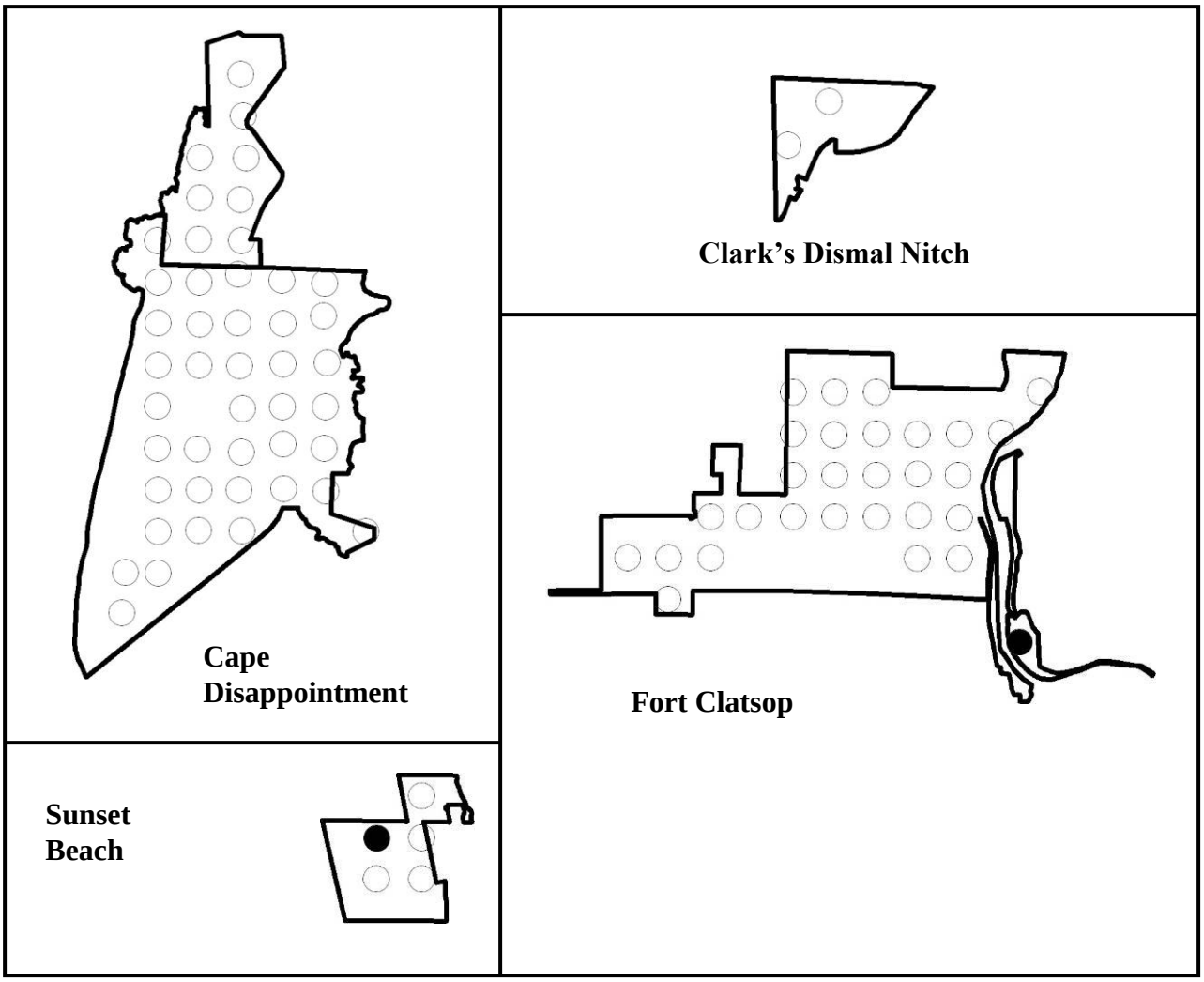

Figure 27. Locations of Black-capped Chickadee detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

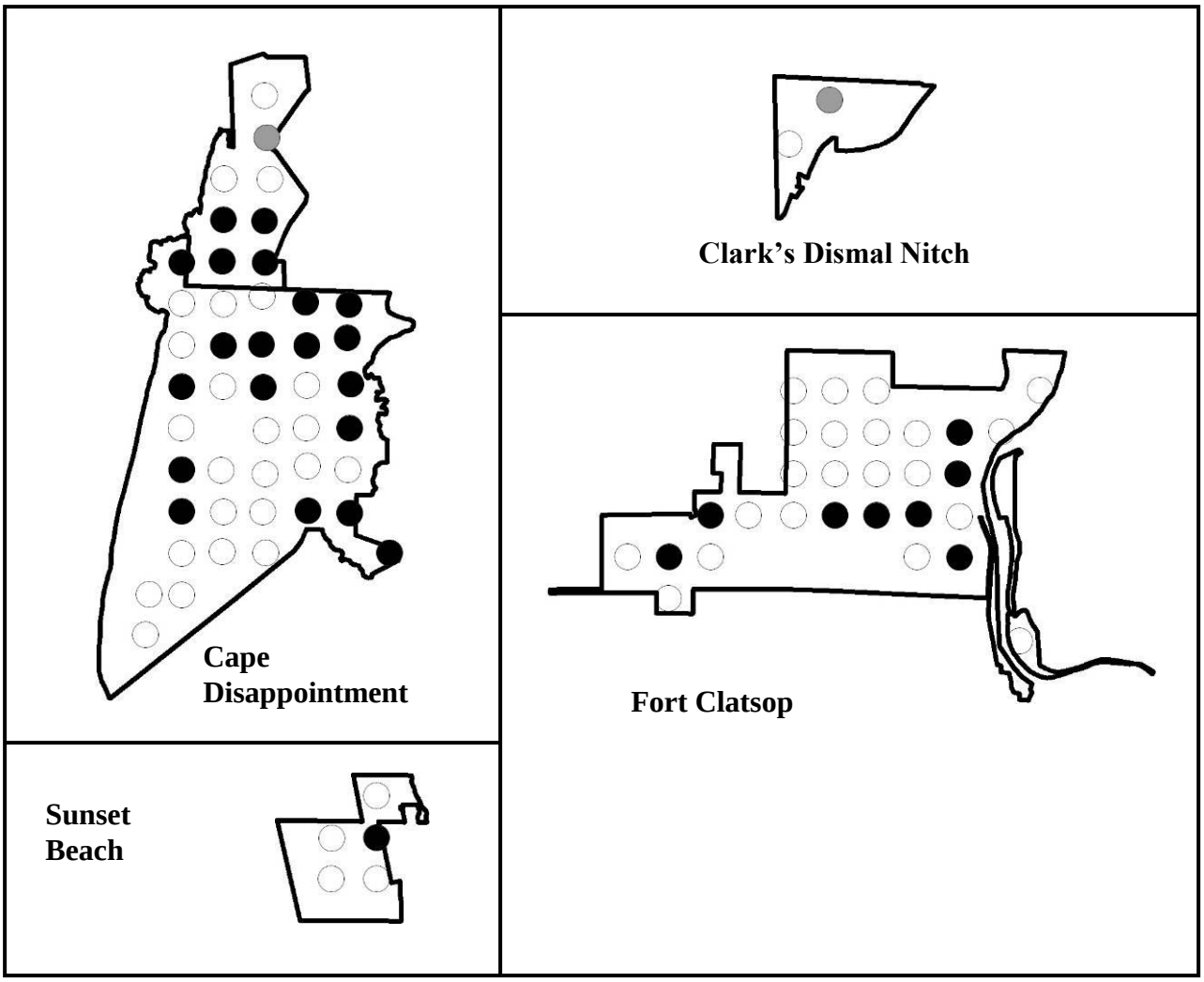

Figure 28. Locations of Chestnut-backed Chickadee detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

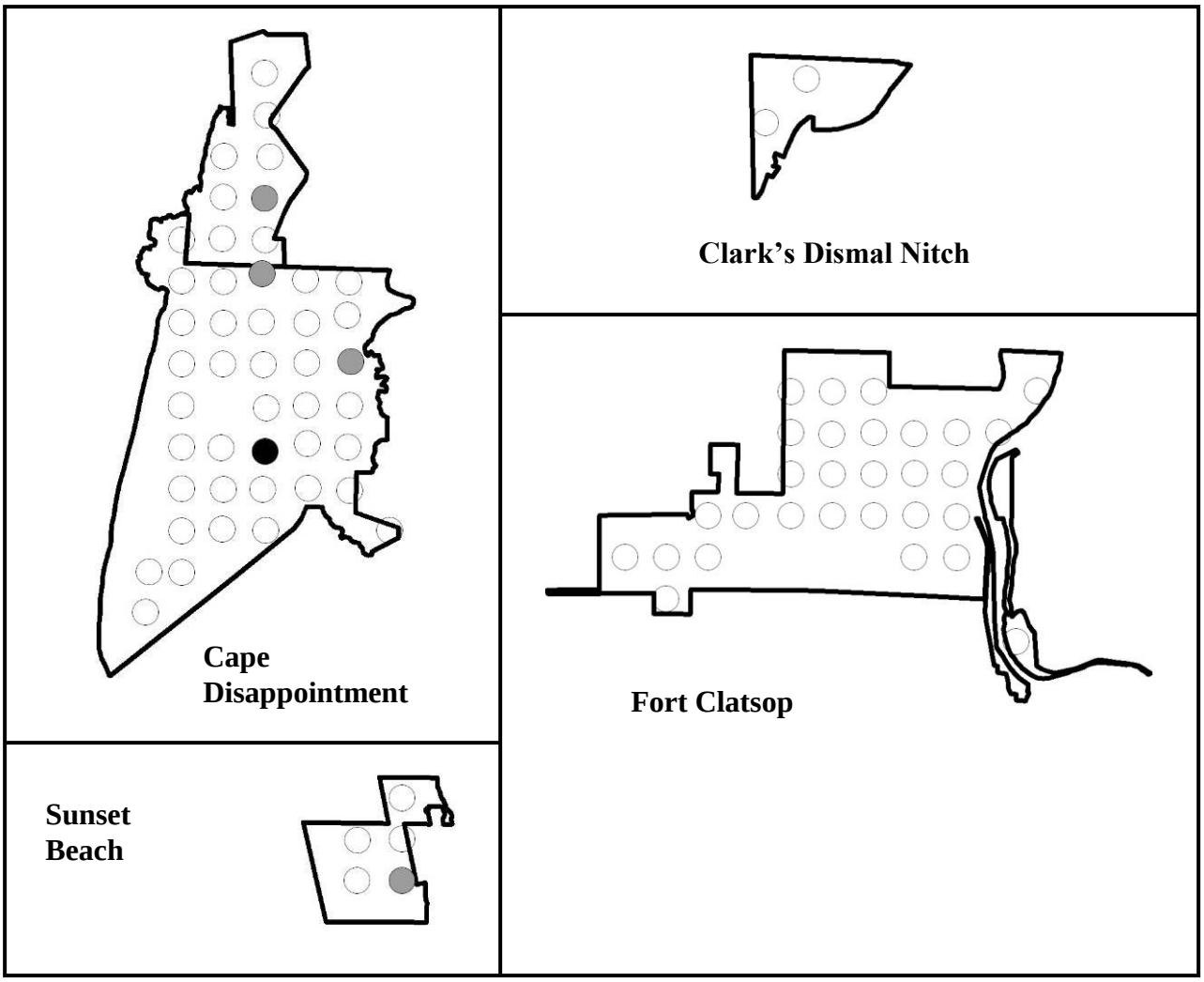

Figure 29. Locations of Red-breasted Nuthatch detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

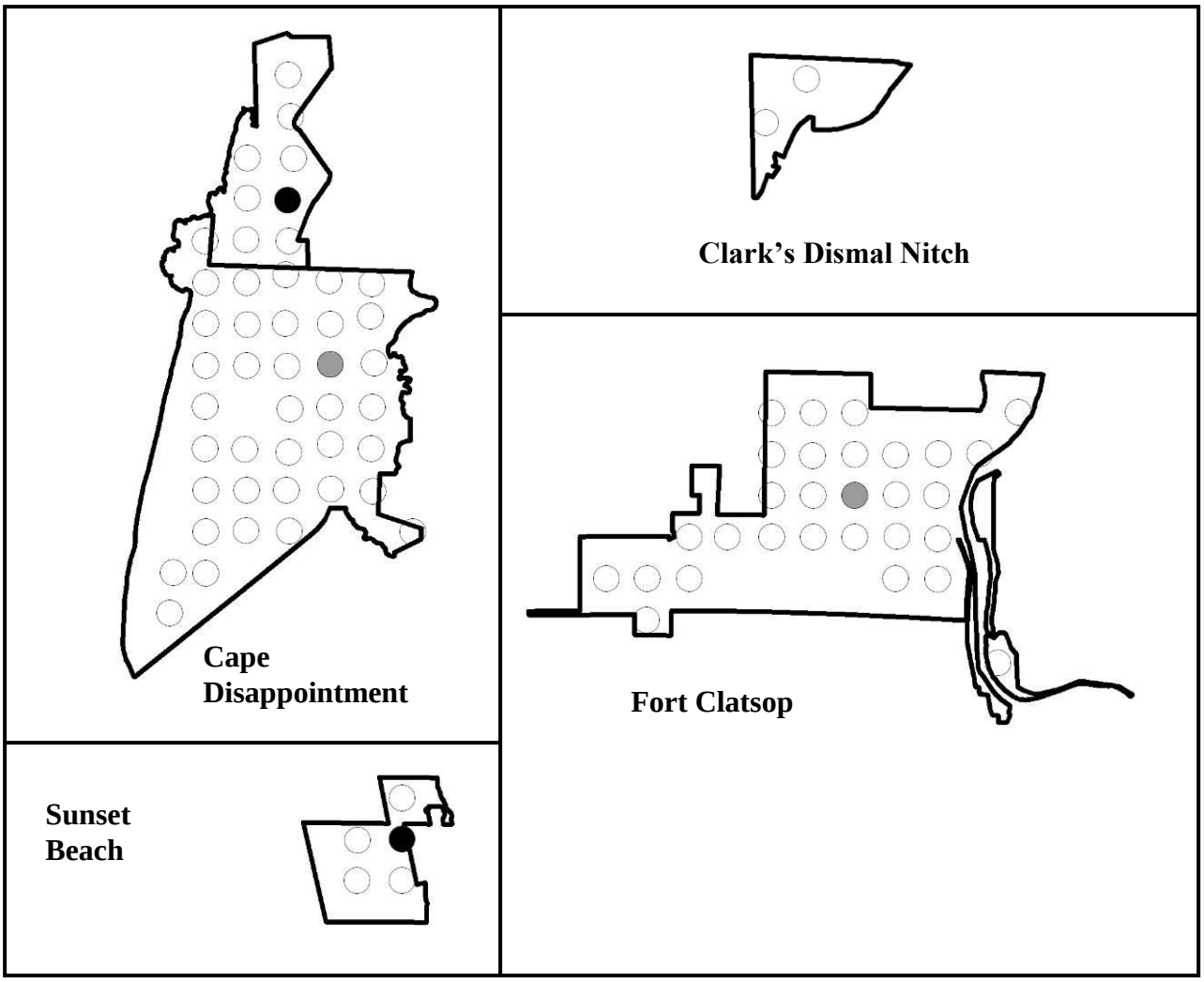

Figure 30. Locations of Brown Creeper detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

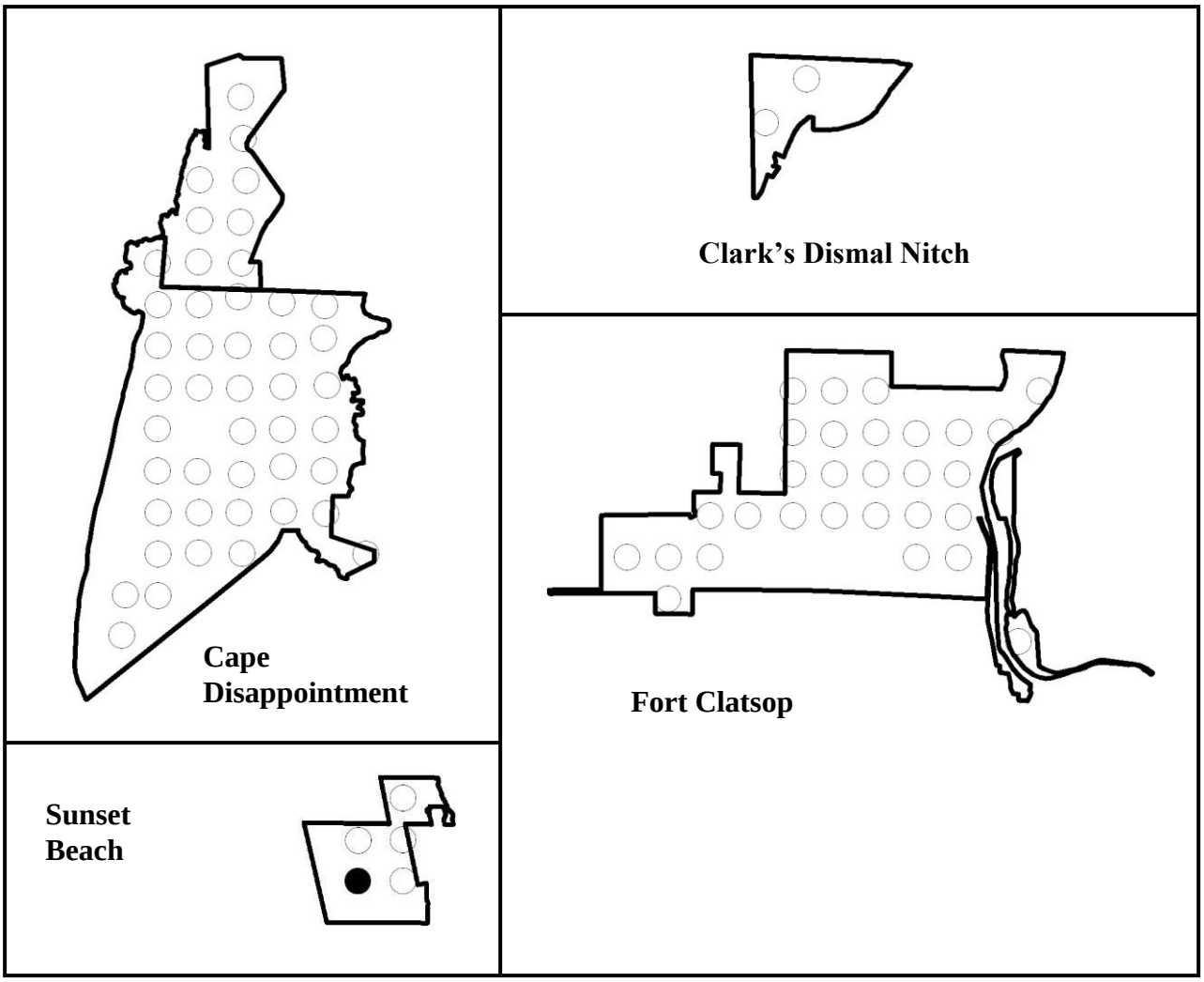

Figure 31. Locations of Bewick's Wren detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

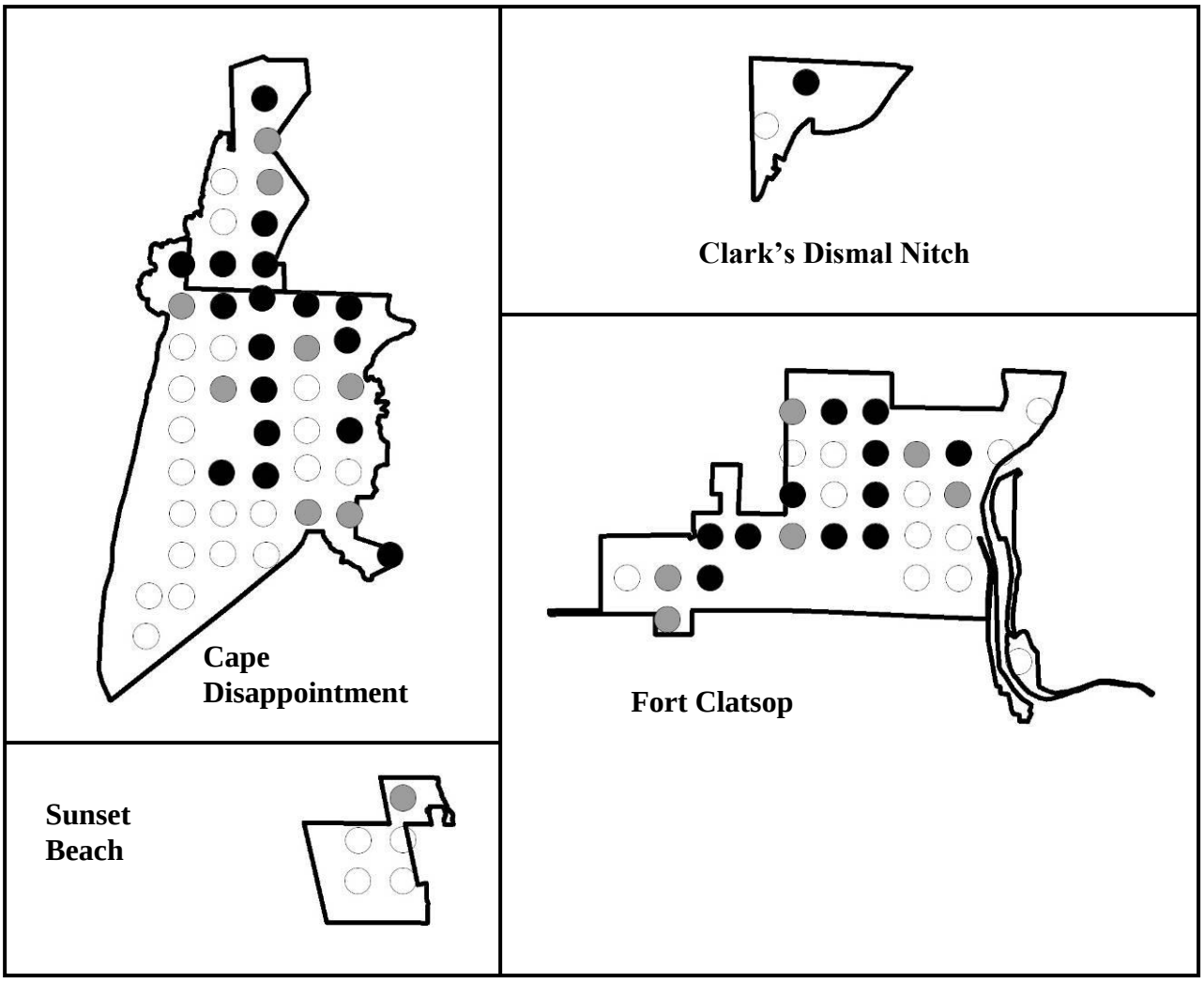

Figure 32. Locations of Winter Wren detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

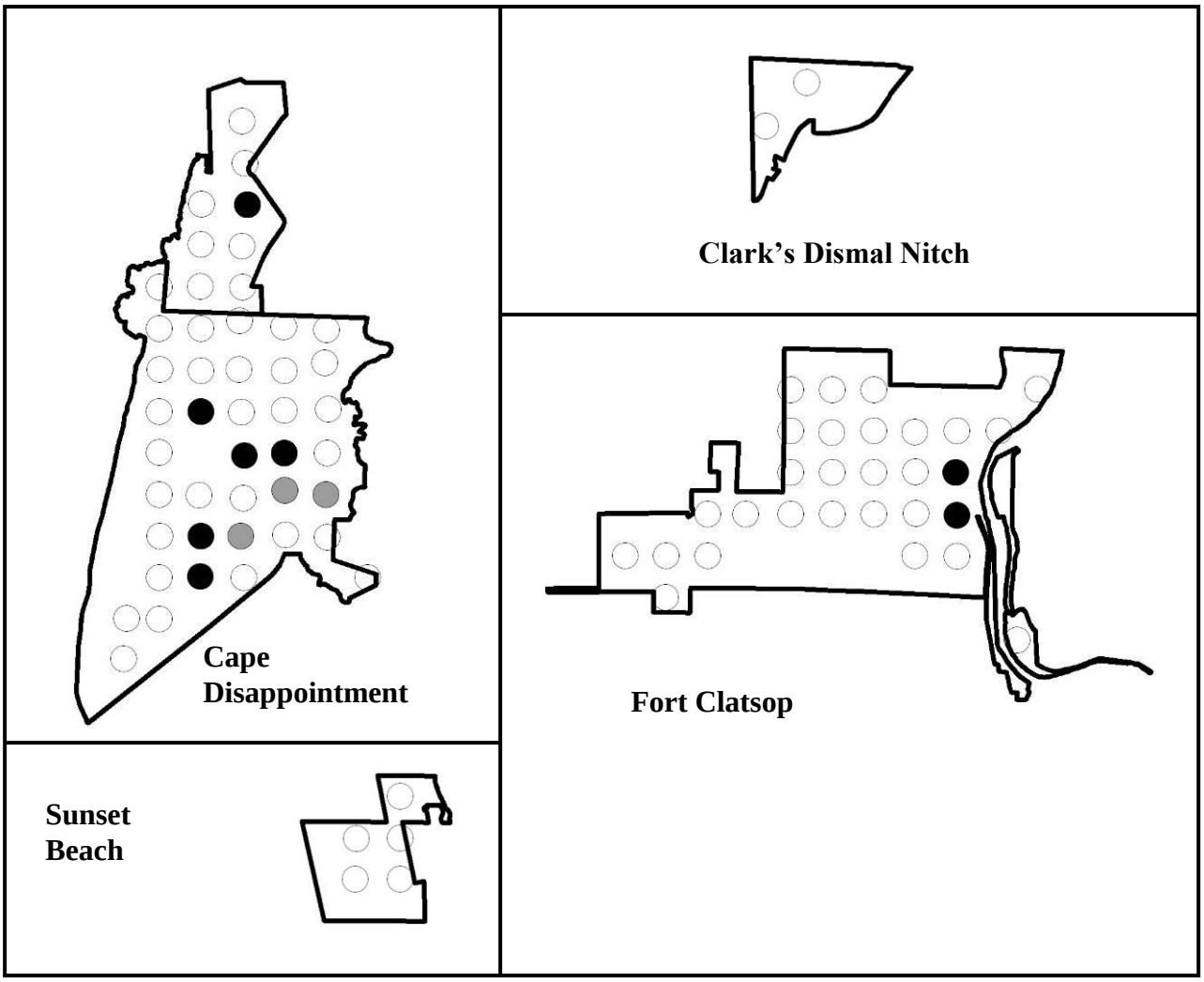

Figure 33. Locations of Marsh Wren detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

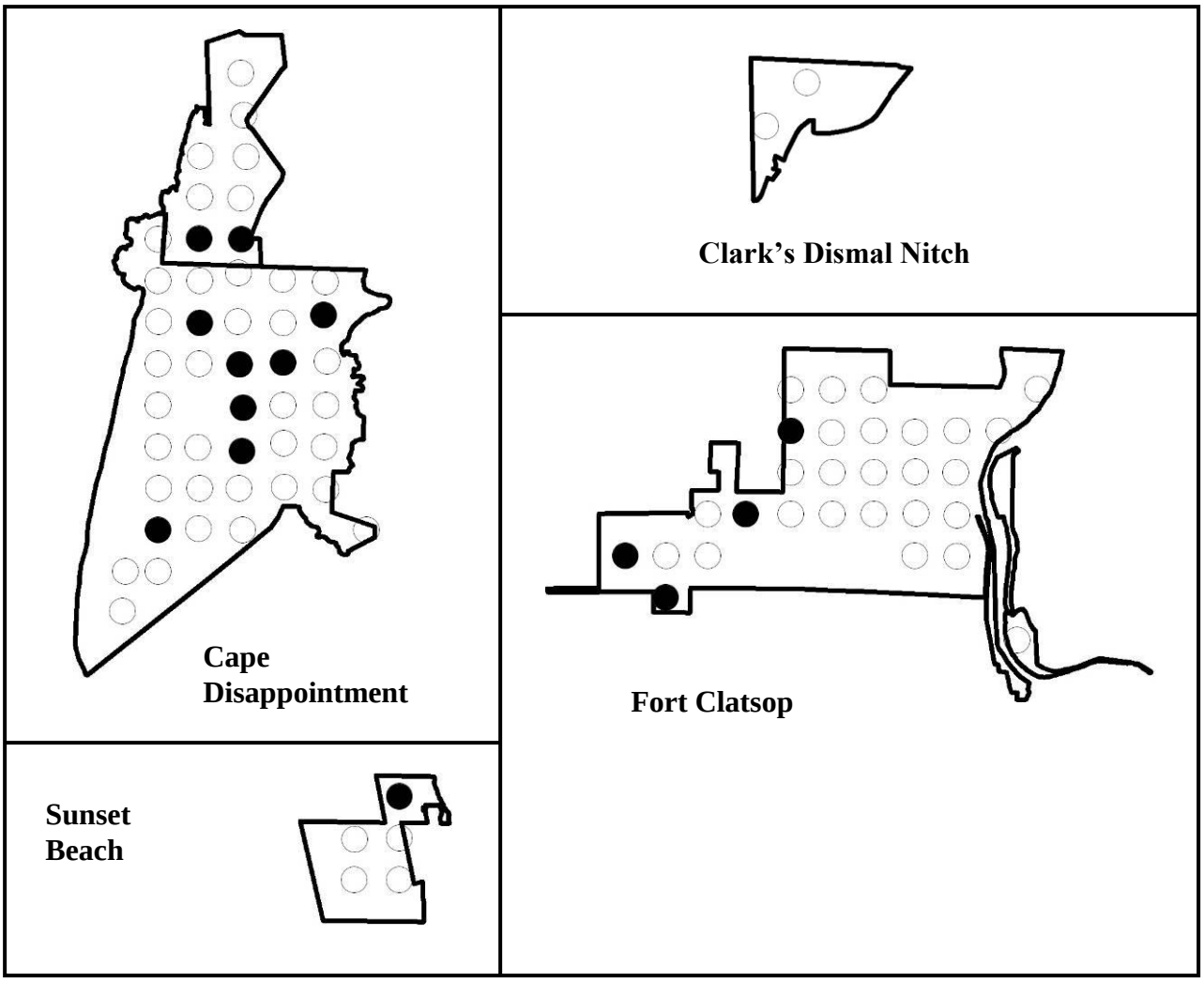

Figure 34. Locations of Golden-crowned Kinglet detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

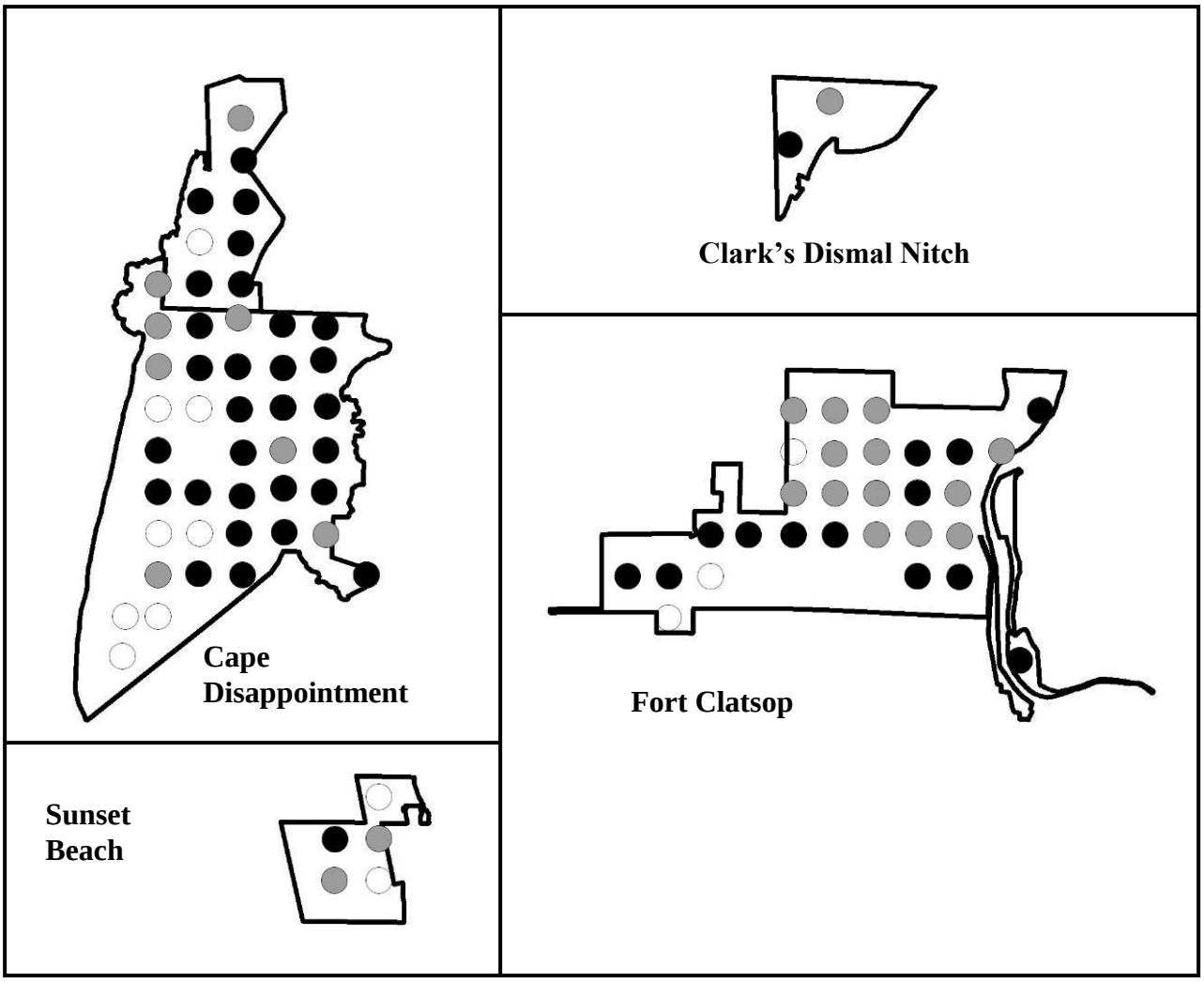

Figure 35. Locations of Swainson's Thrush detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

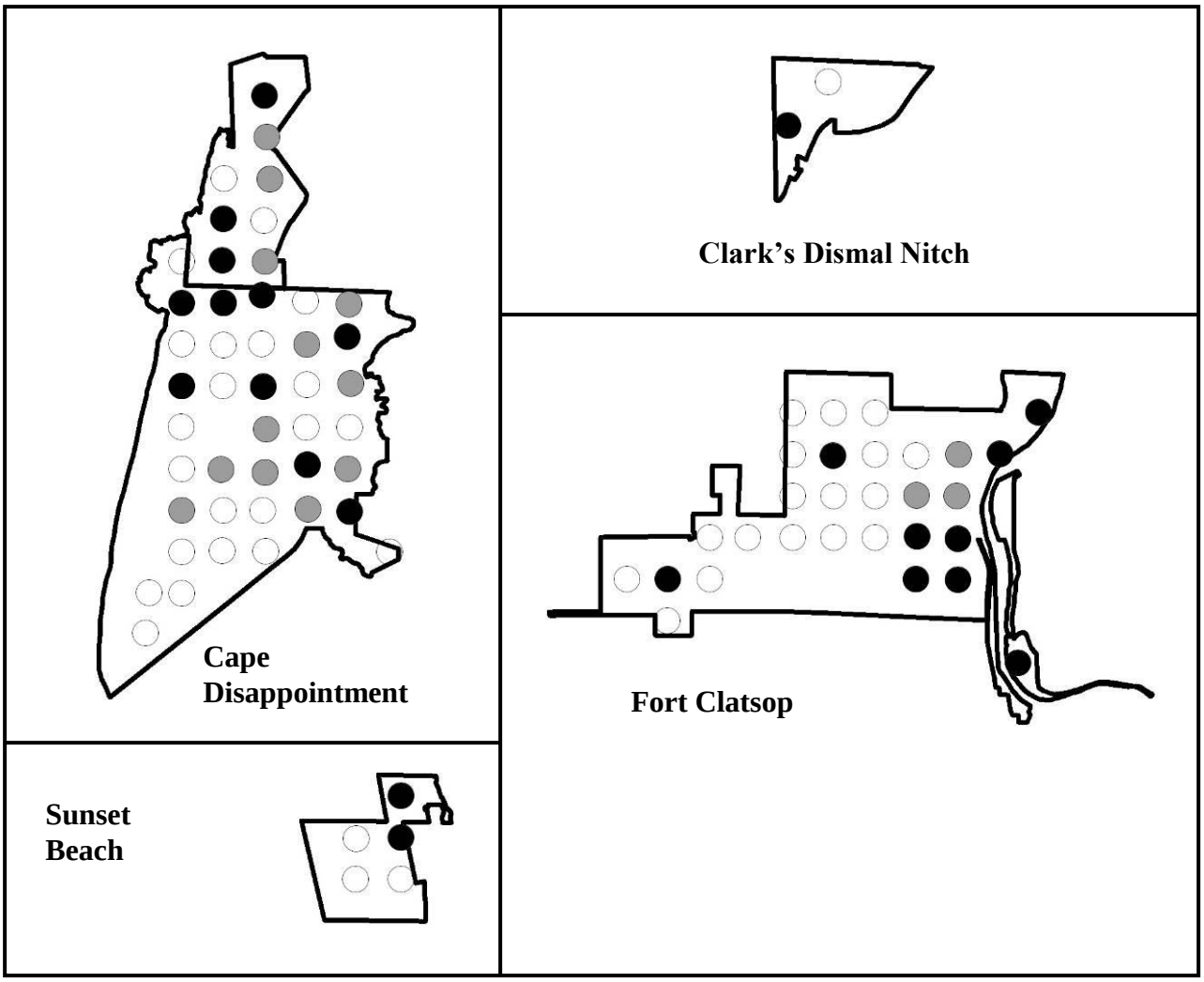

Figure 36. Locations of American Robin detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

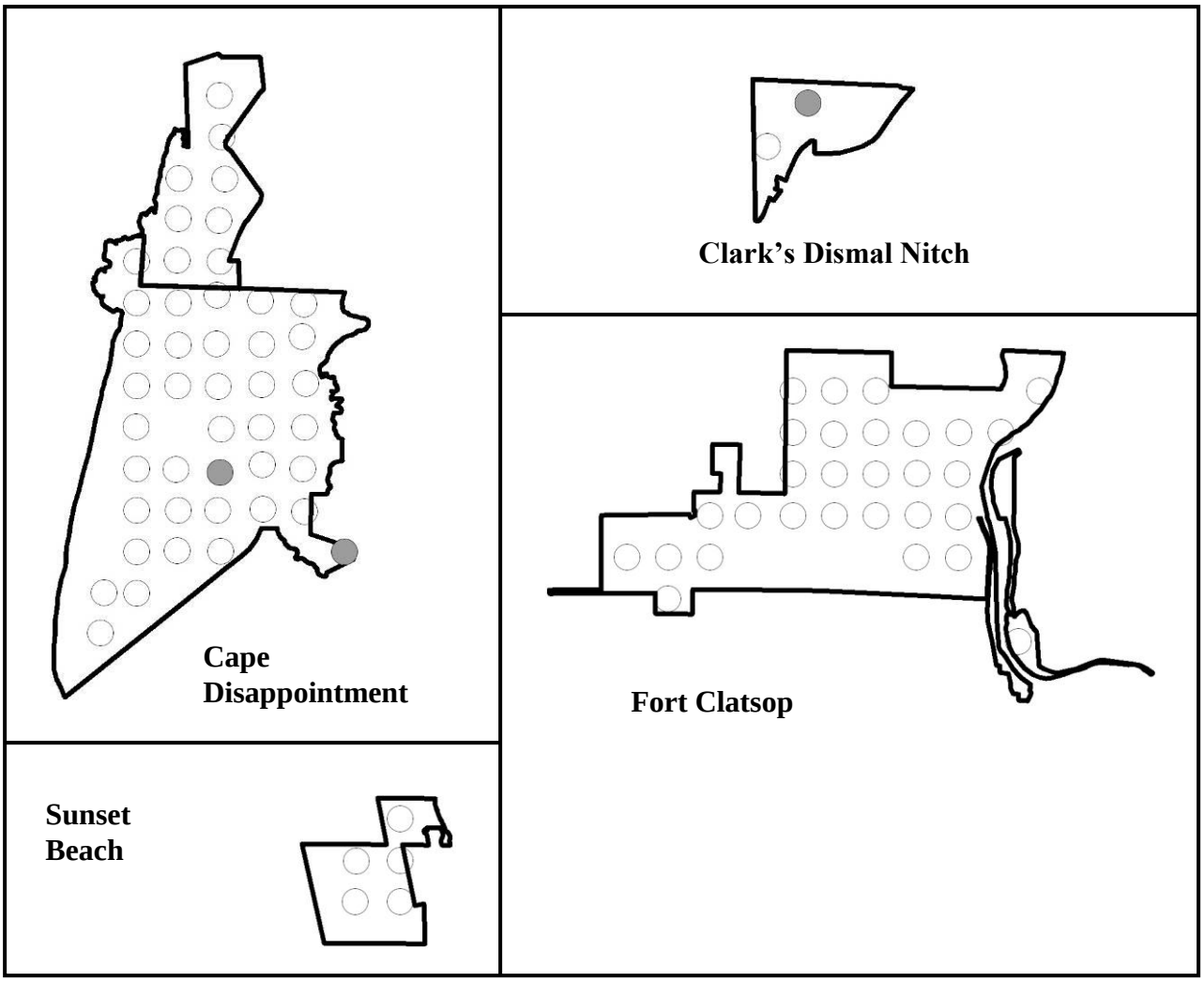

Figure 37. Locations of Varied Thrush detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

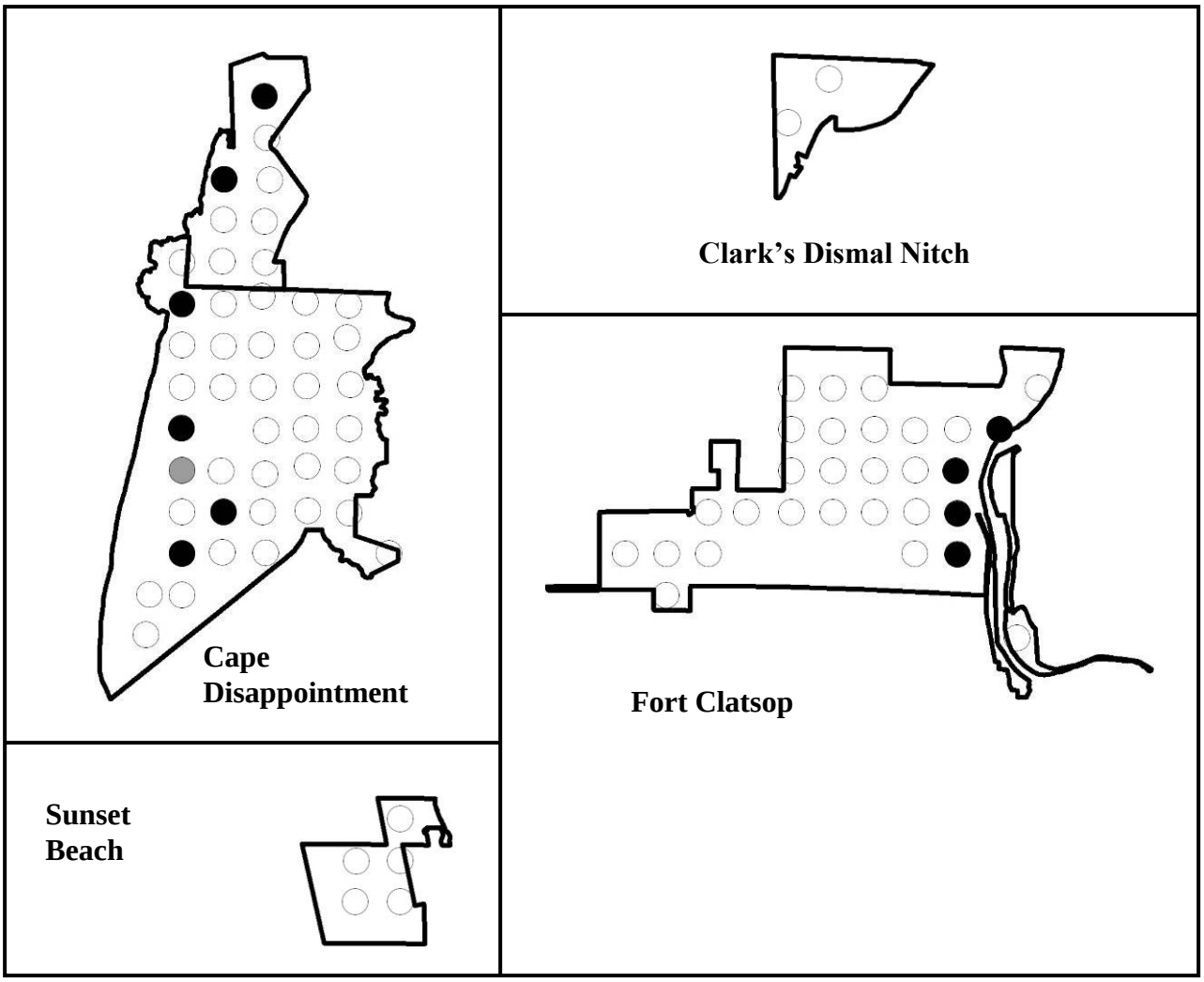

Figure 38. Locations of Cedar Waxwing detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

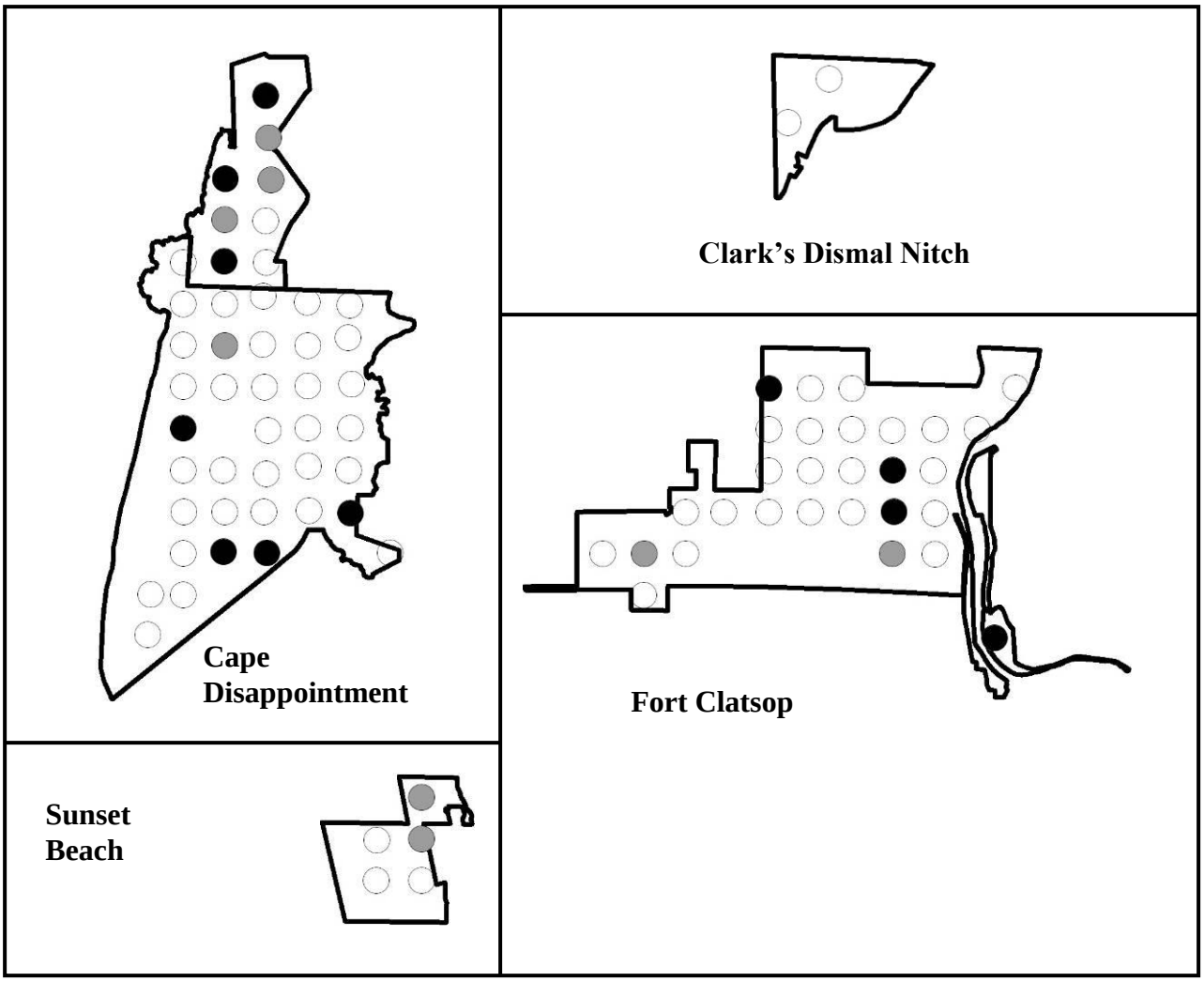

Figure 39. Locations of Orange-crowned Warbler detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

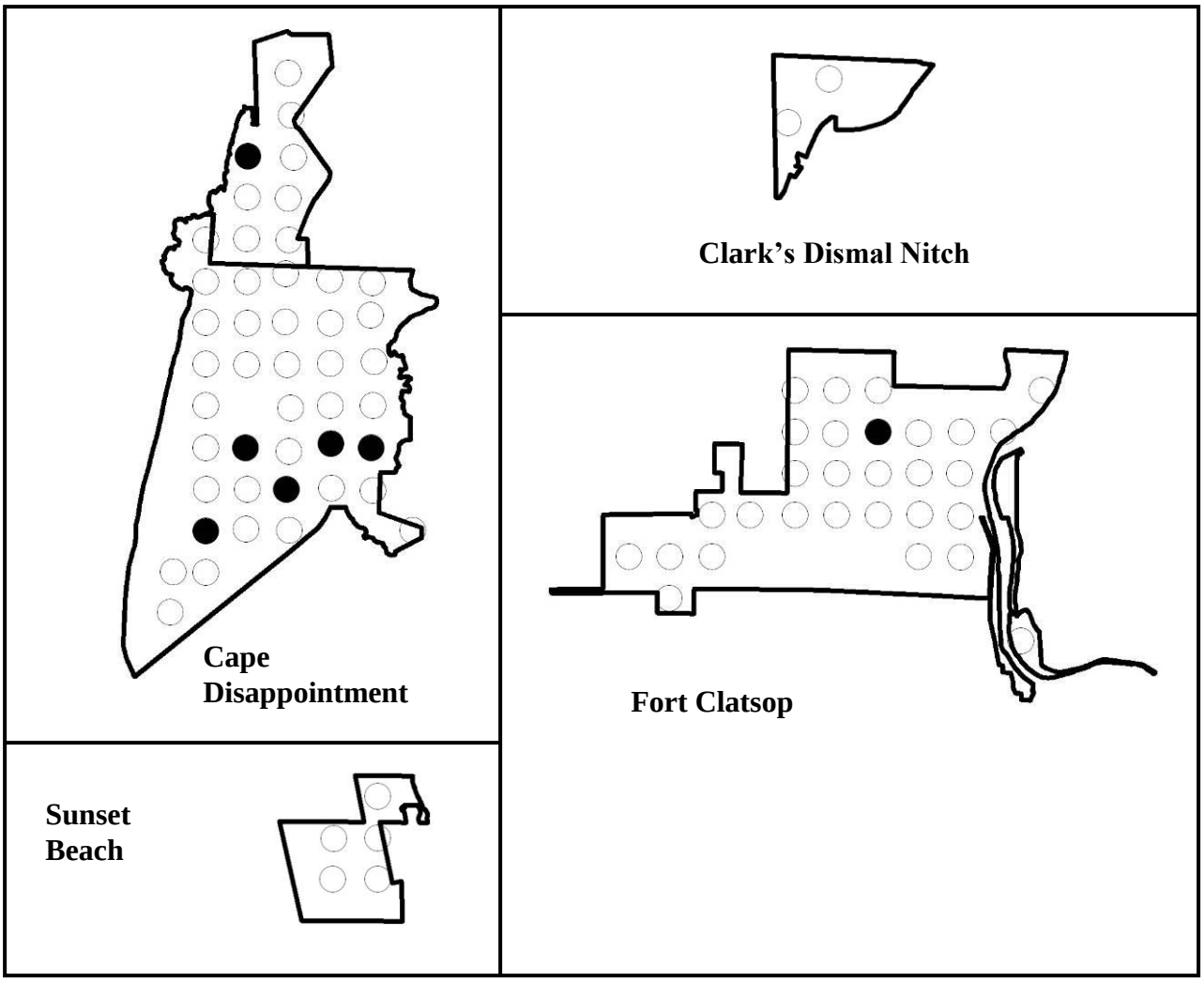

Figure 40. Locations of Yellow Warbler detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

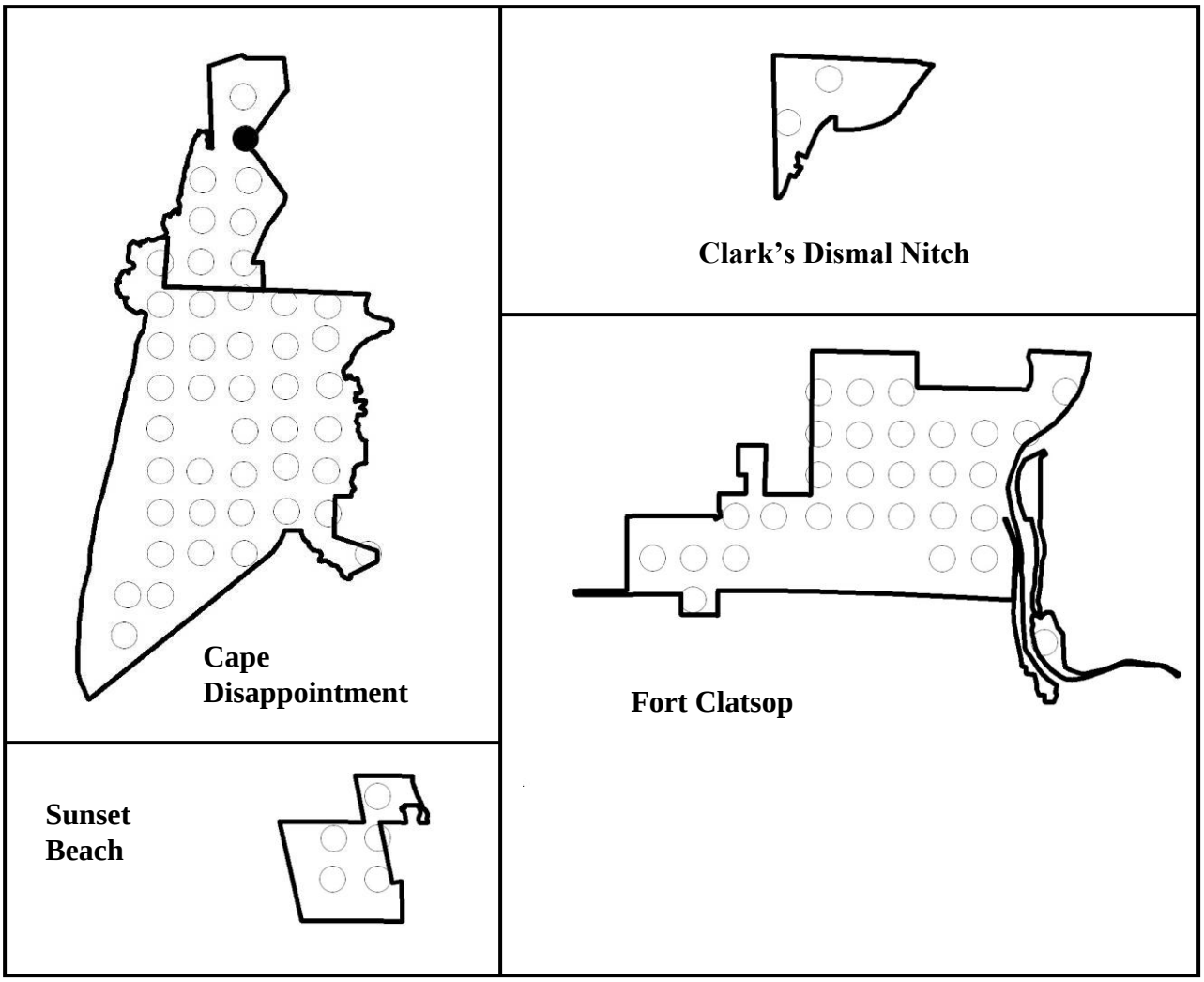

Figure 41. Locations of Yellow-rumped Warbler detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

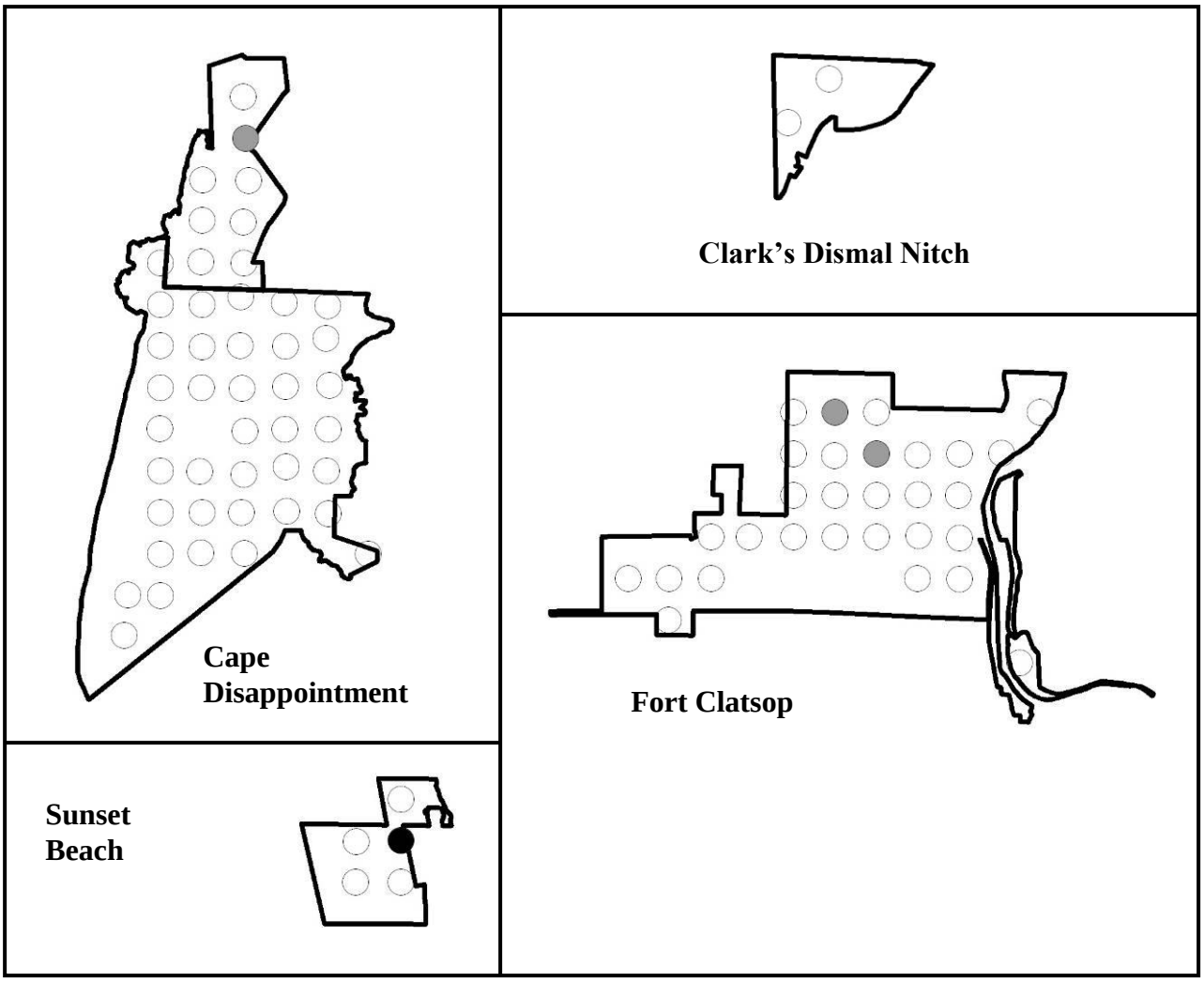

Figure 42. Locations of Black-throated Gray Warbler detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

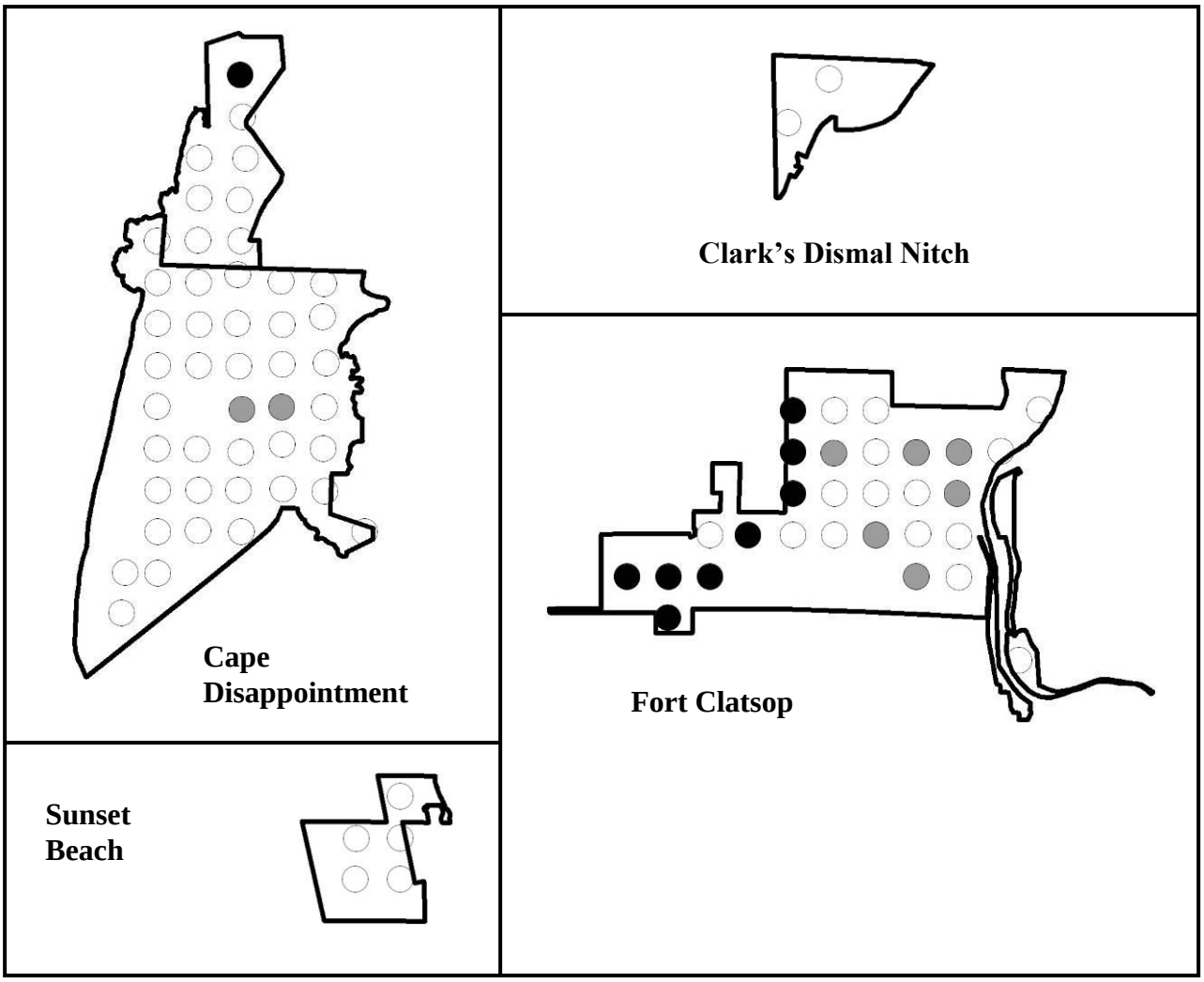

Figure 43. Locations of Townsend's Warbler detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

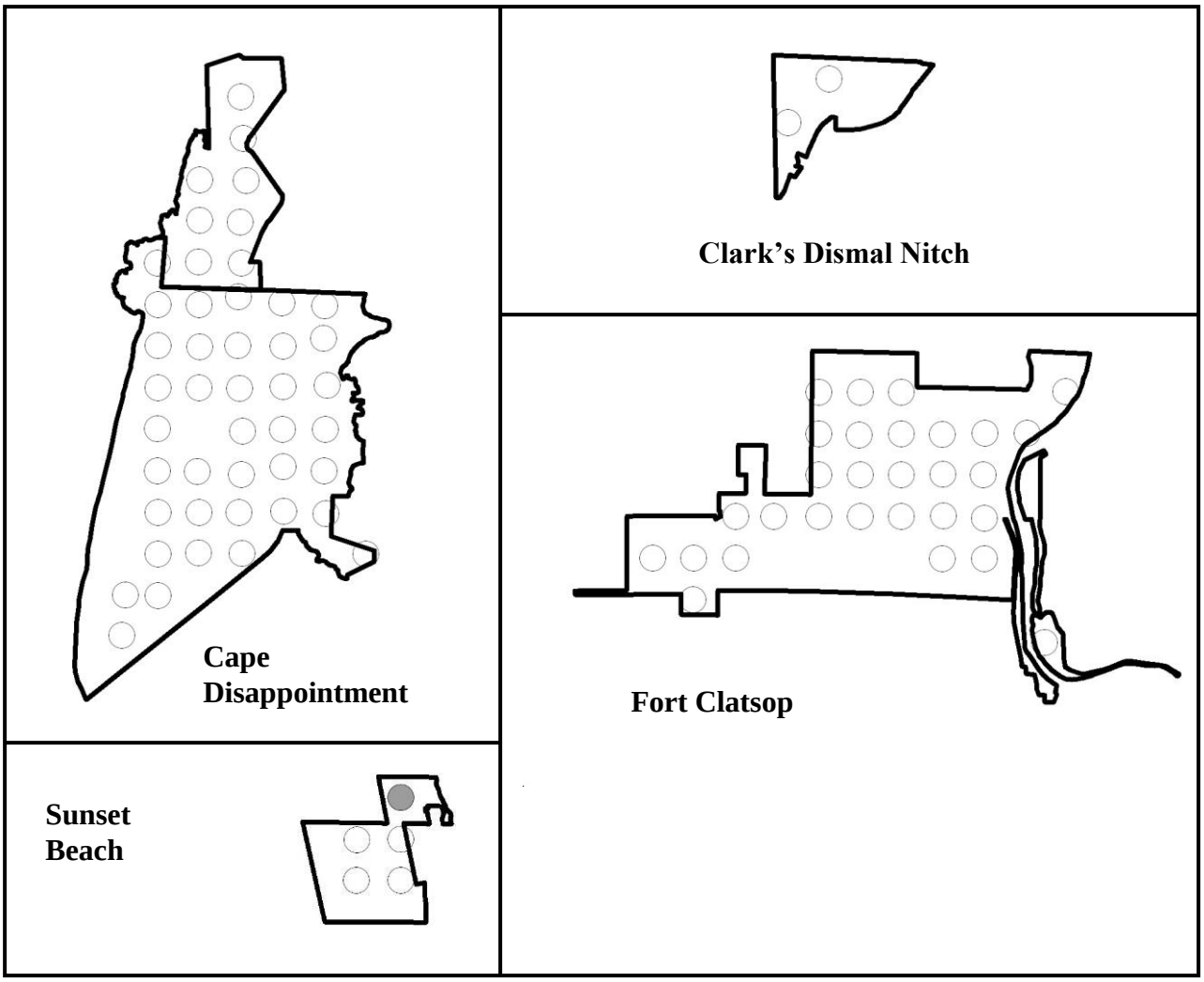

Figure 44. Locations of MacGillivray's Warbler detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

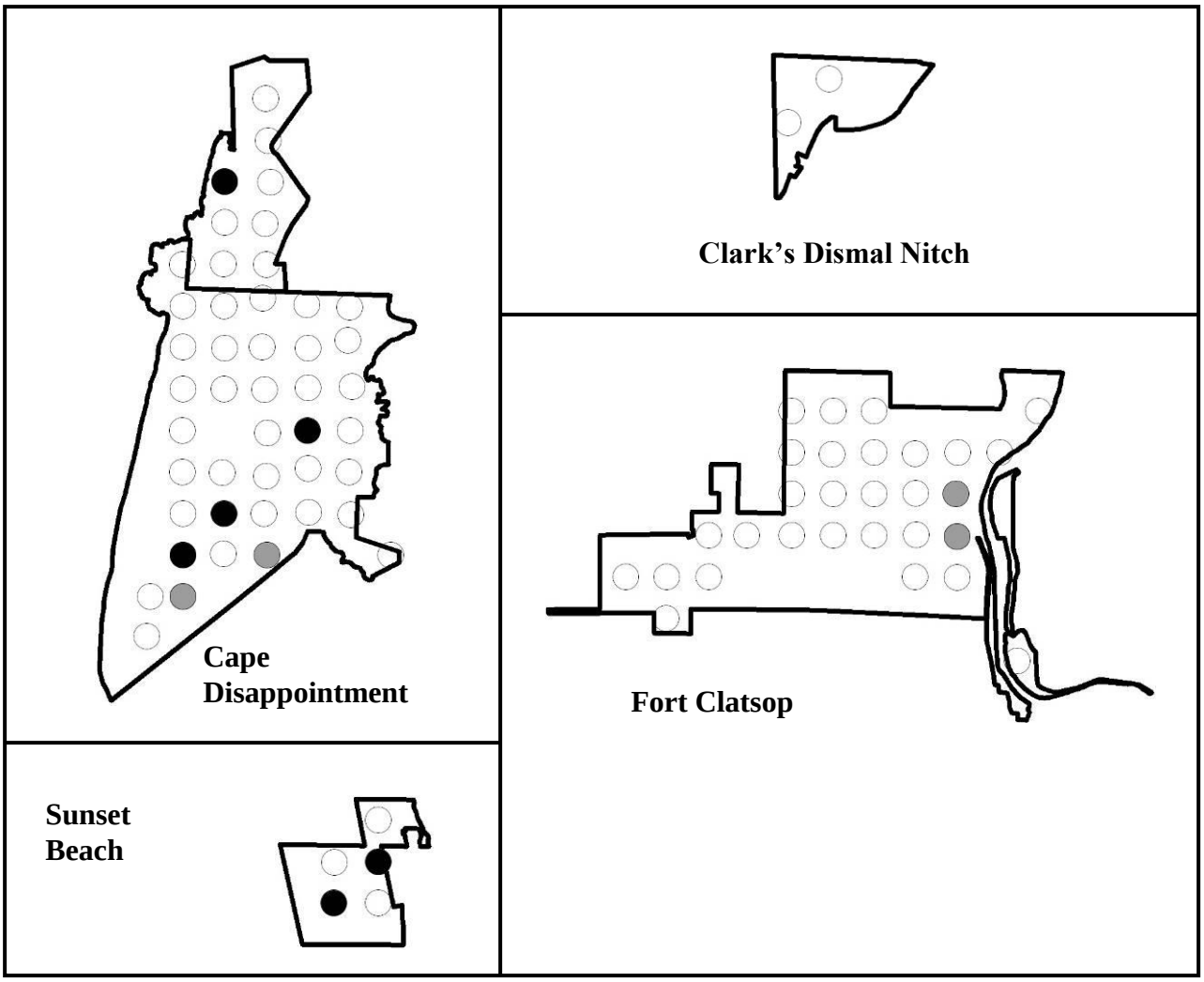

Figure 45. Locations of Common Yellowthroat detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

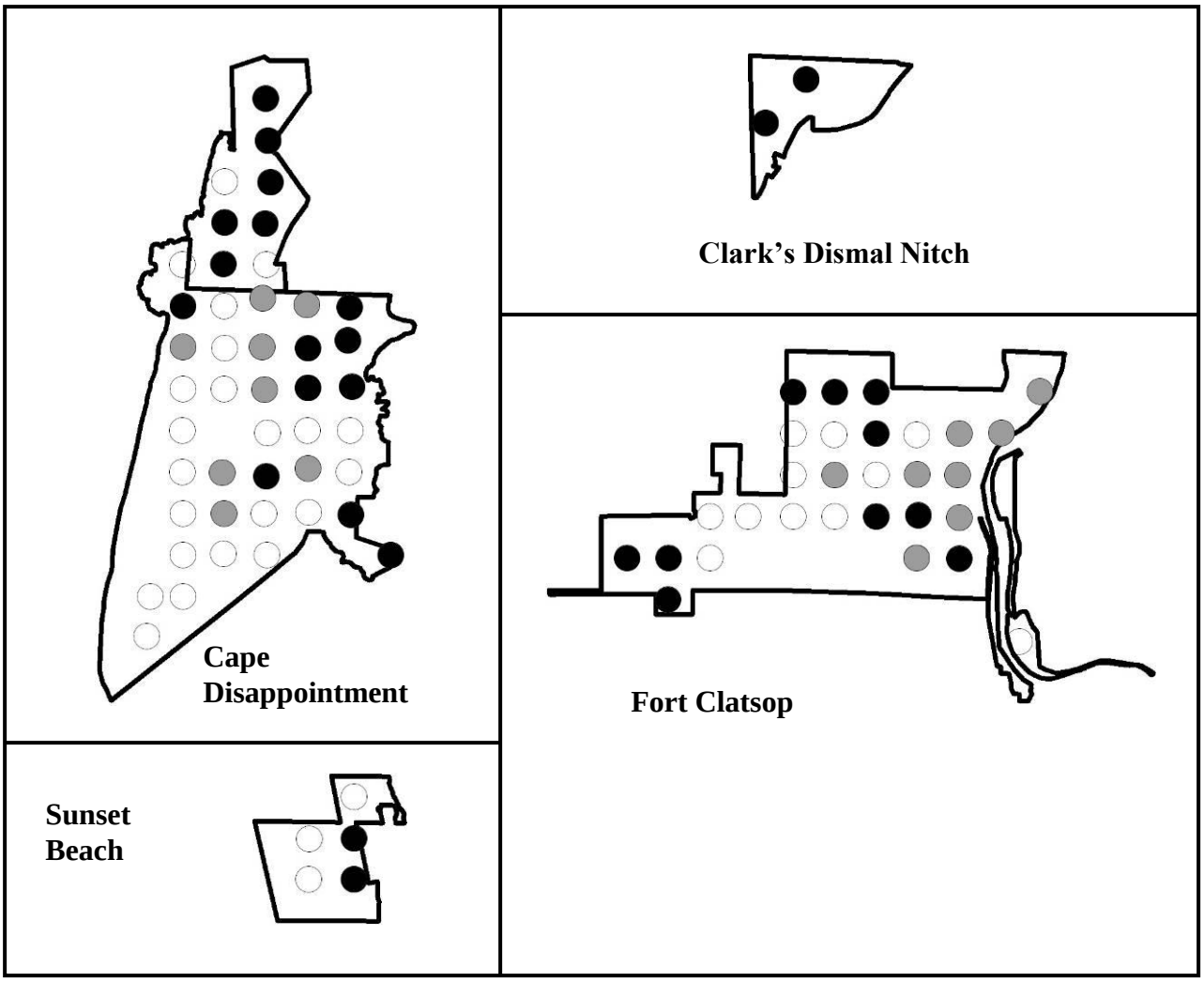

Figure 46. Locations of Wilson's Warbler detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

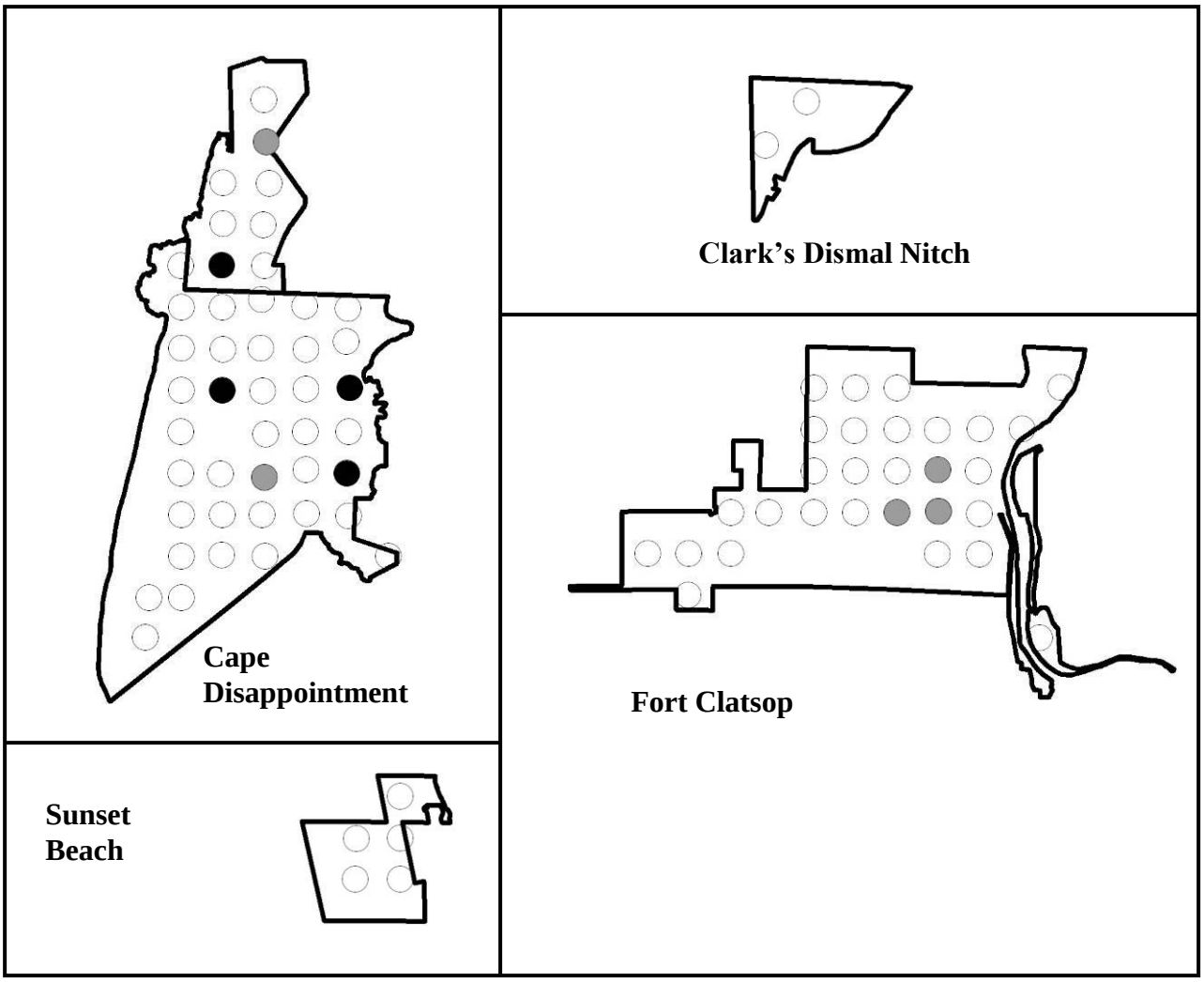

Figure 47. Locations of Western Tanager detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

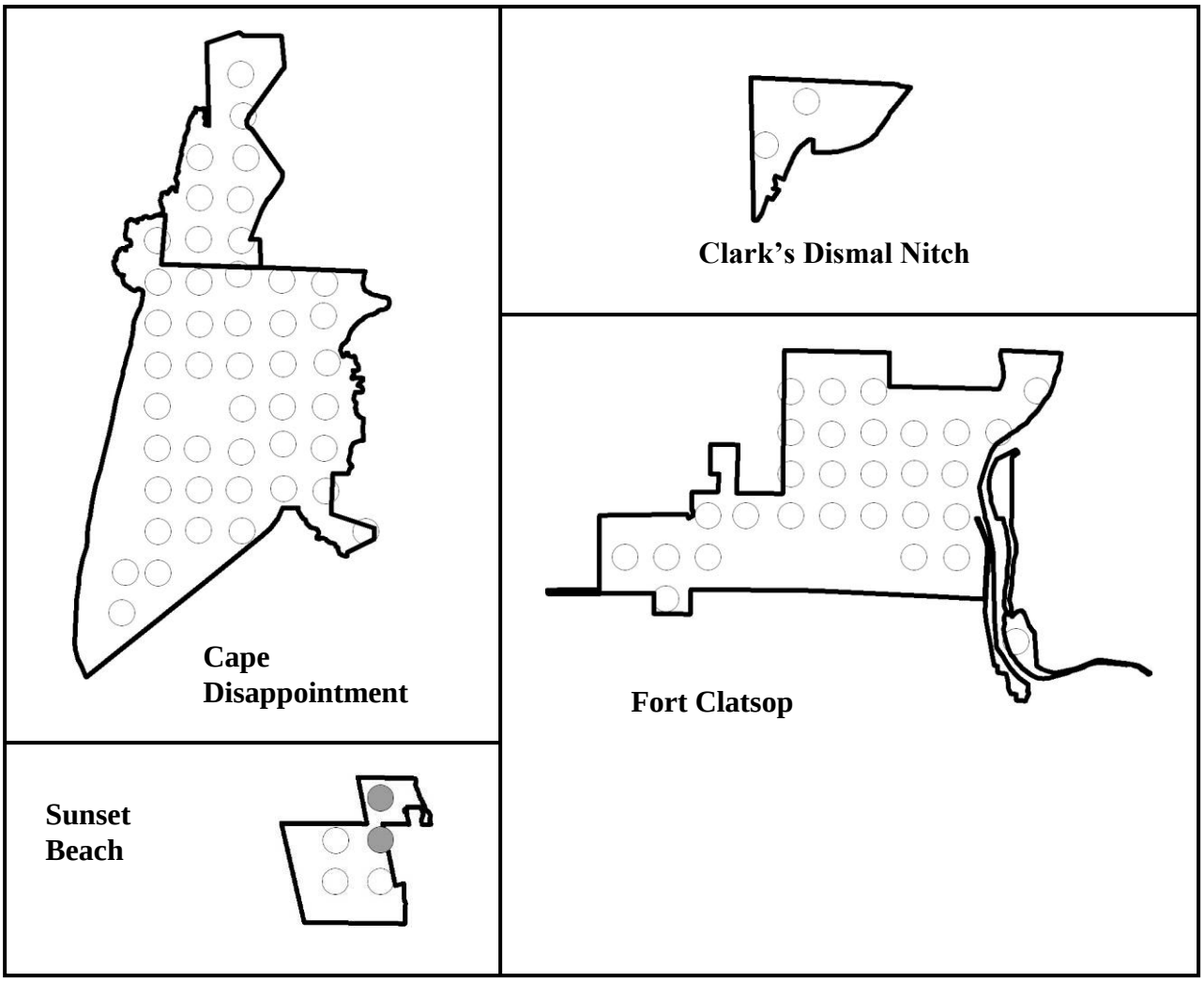

Figure 48. Locations of Spotted Towhee detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

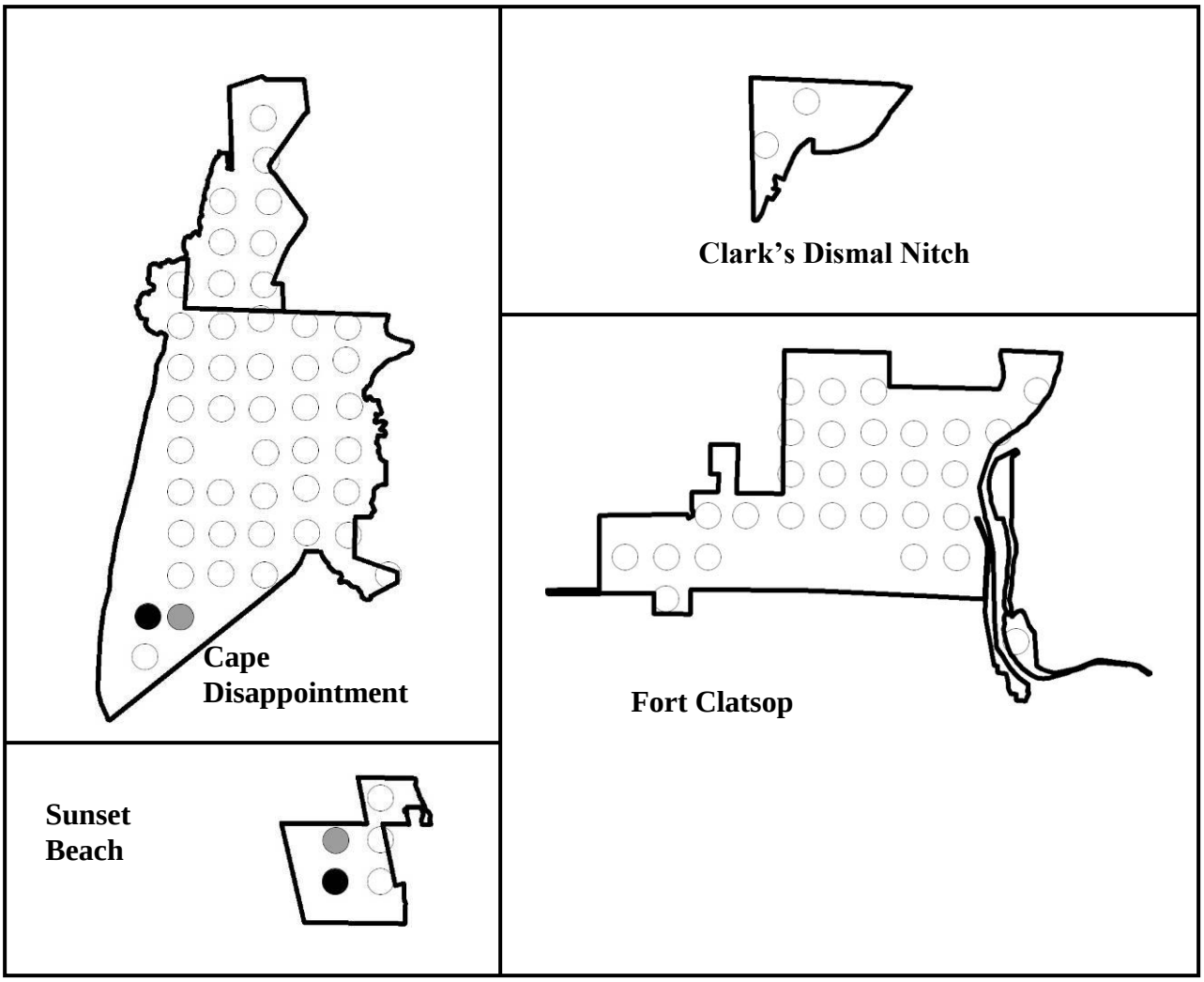

Figure 49. Locations of Savannah Sparrow detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

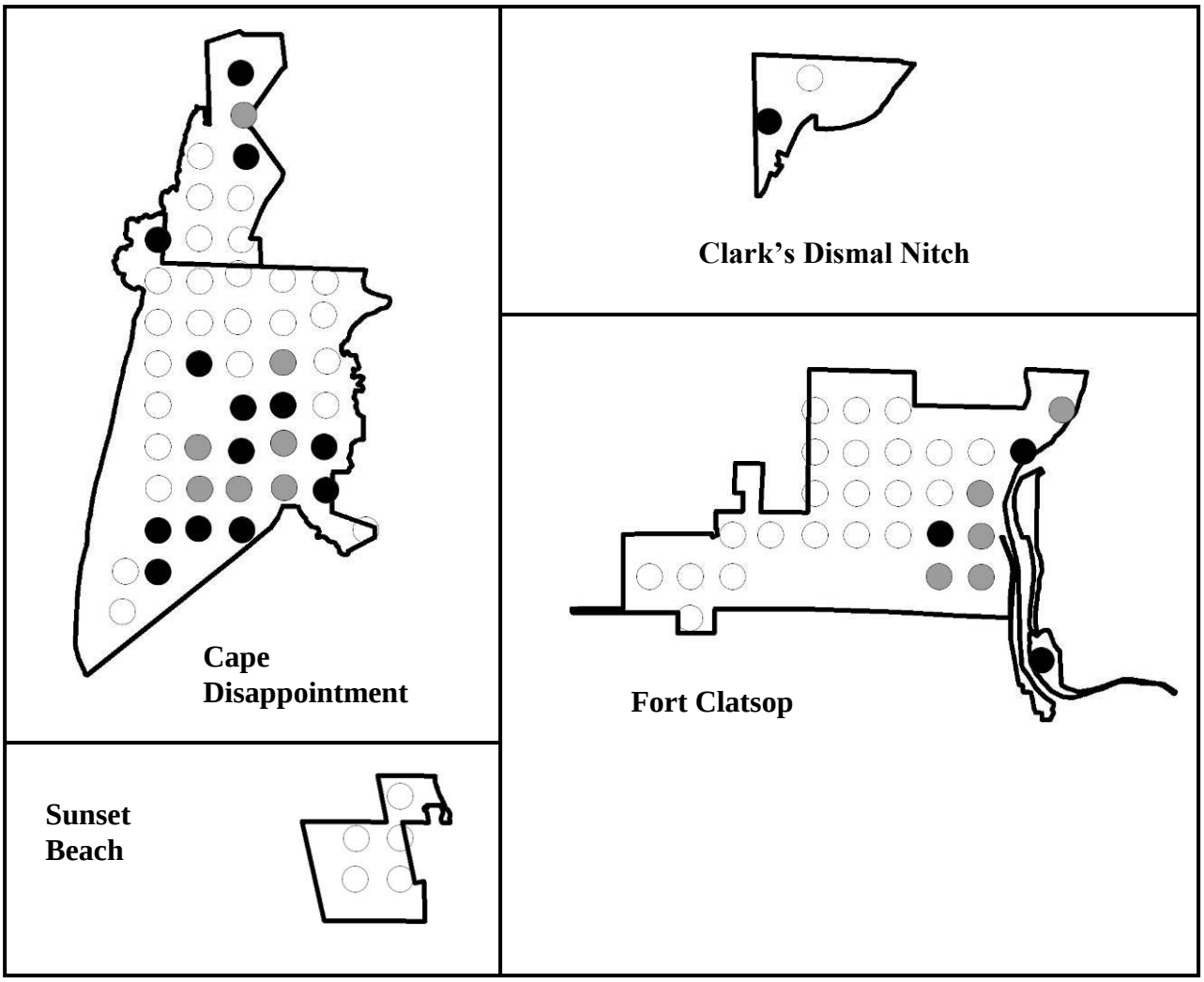

Figure 50. Locations of Song Sparrow detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

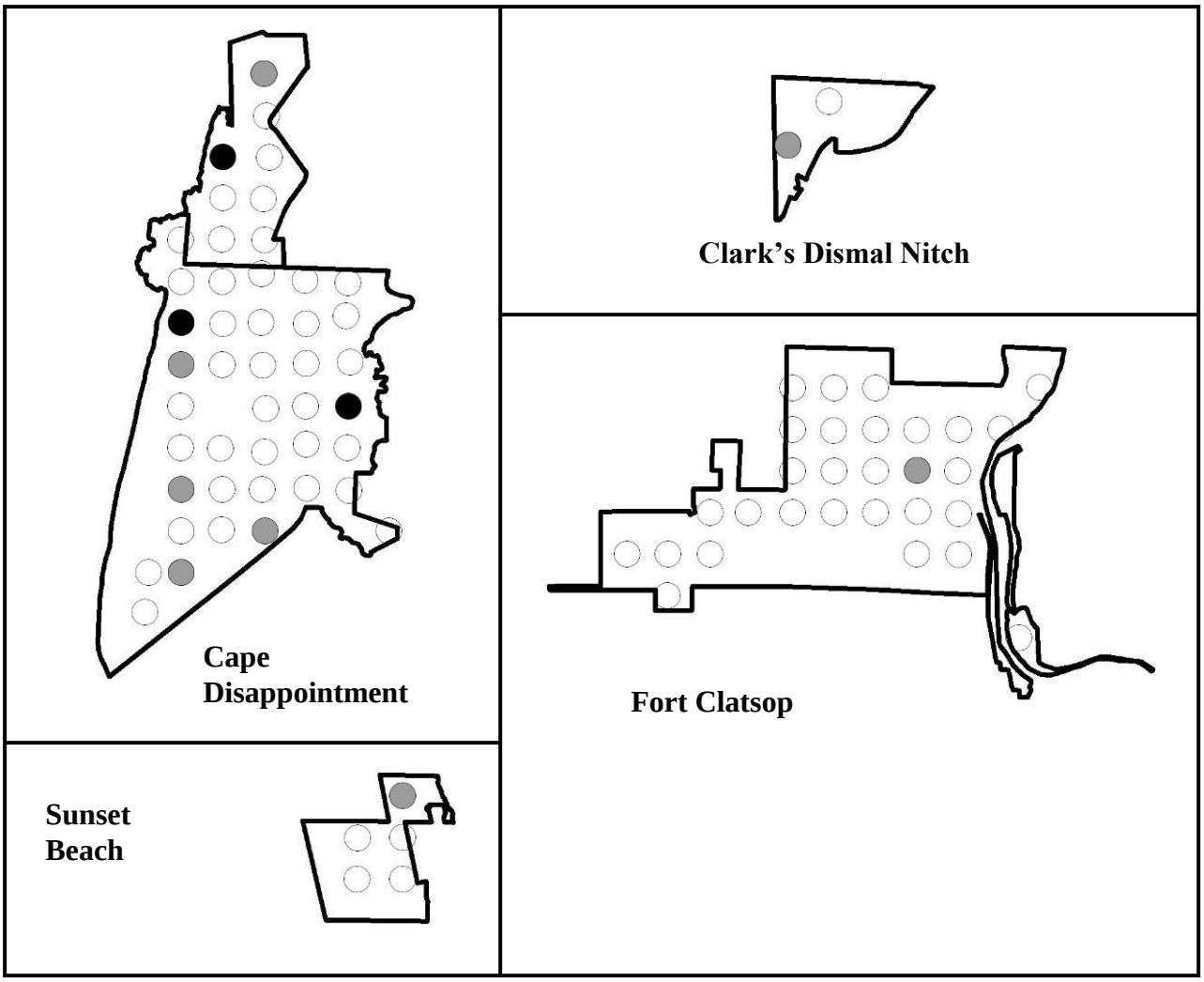

Figure 51. Locations of White-crowned Sparrow detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

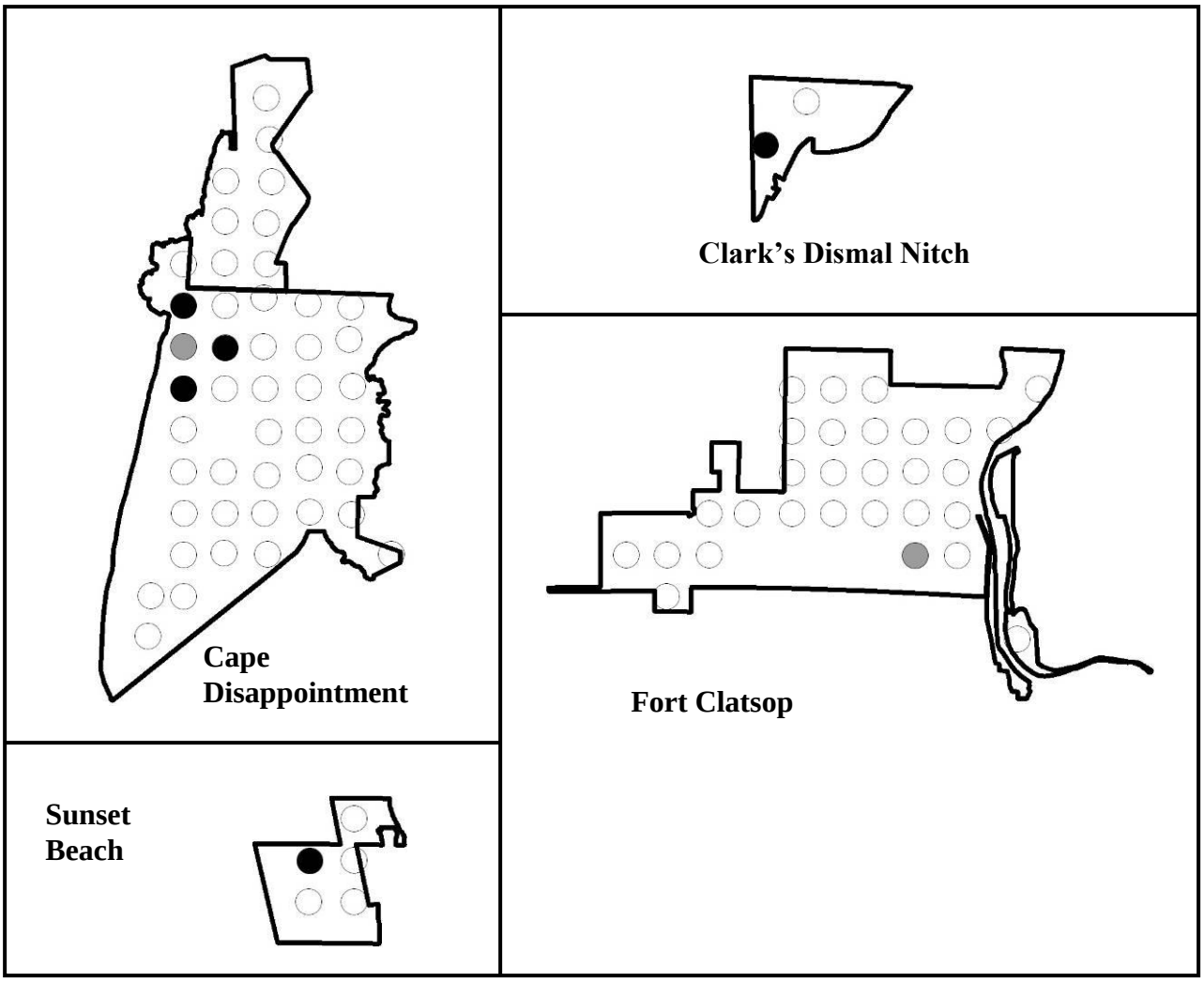

Figure 52. Locations of Dark-eyed Junco detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

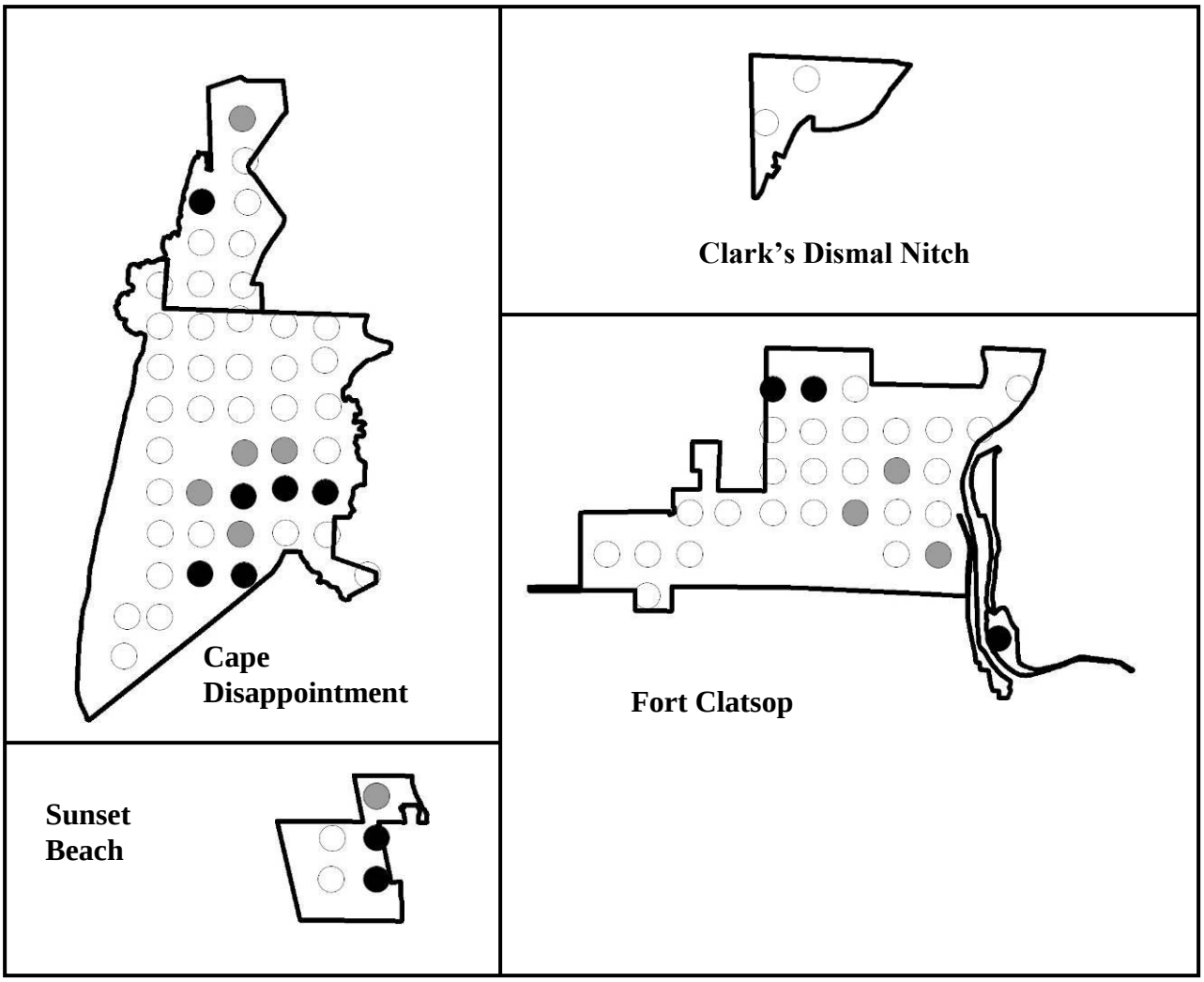

Figure 53. Locations of Black-headed Grosbeak detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

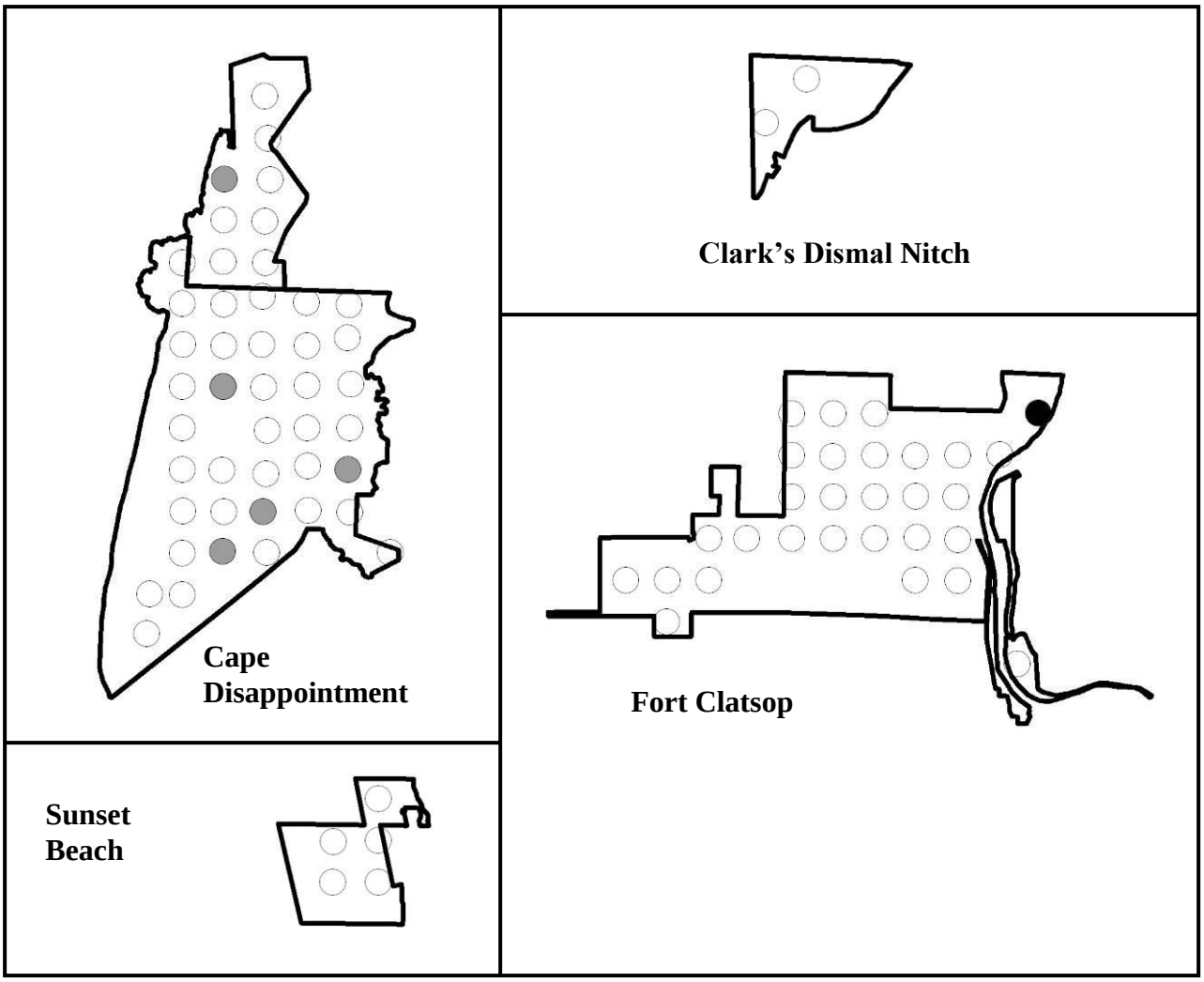

Figure 54. Locations of Red-winged Blackbird detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

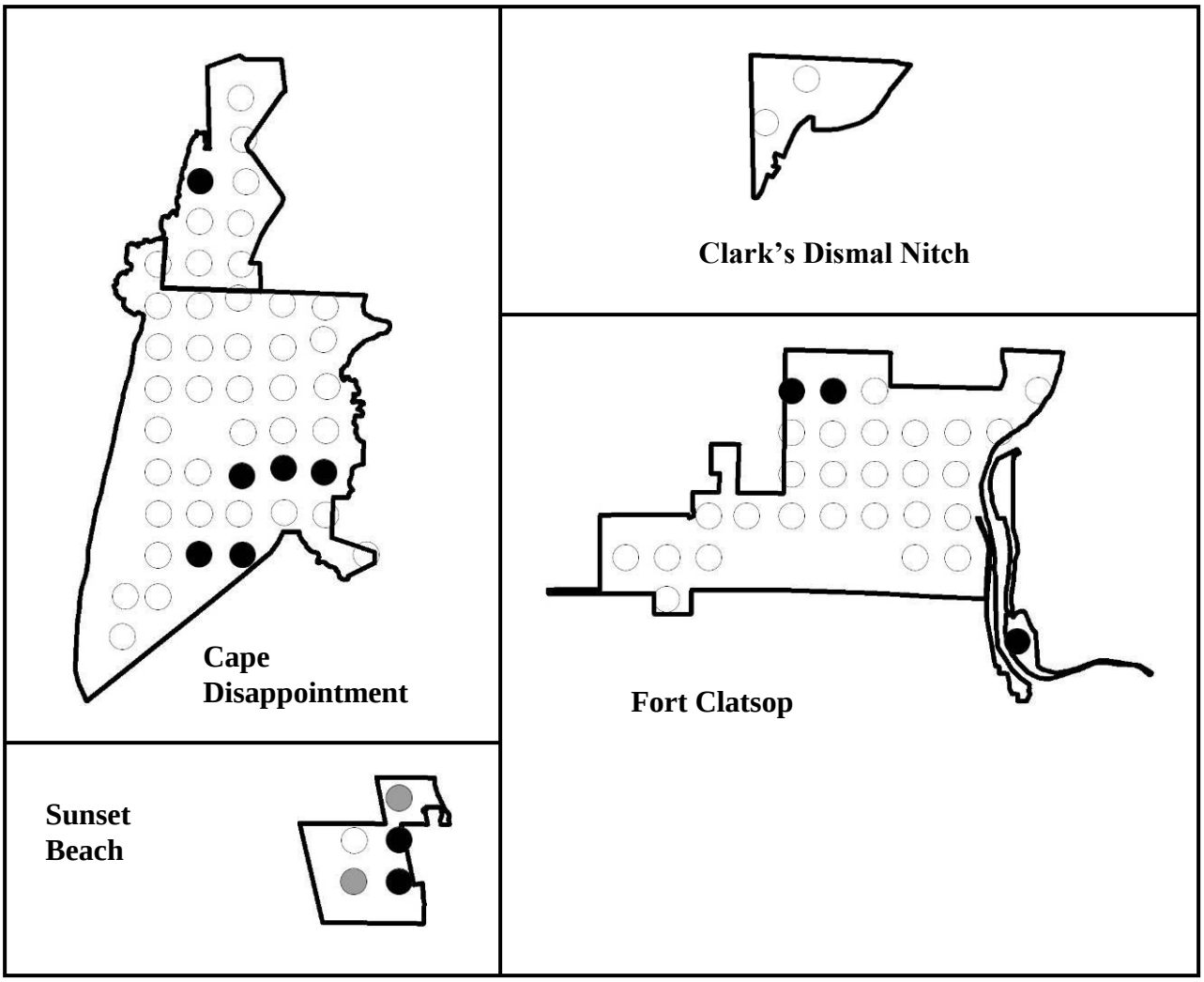

Figure 55. Locations of Brown-headed Cowbird detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

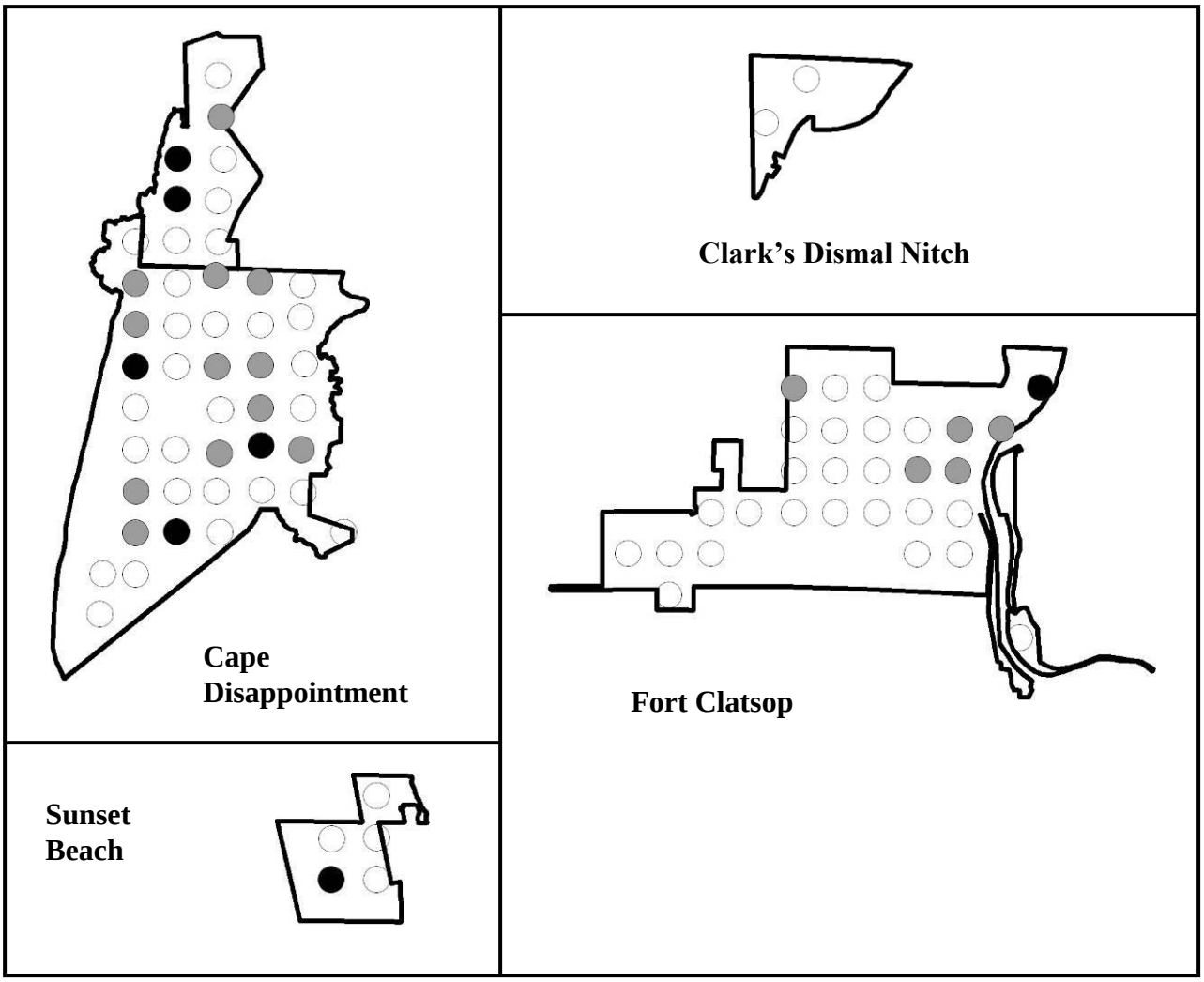

Figure 56. Locations of Purple Finch detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

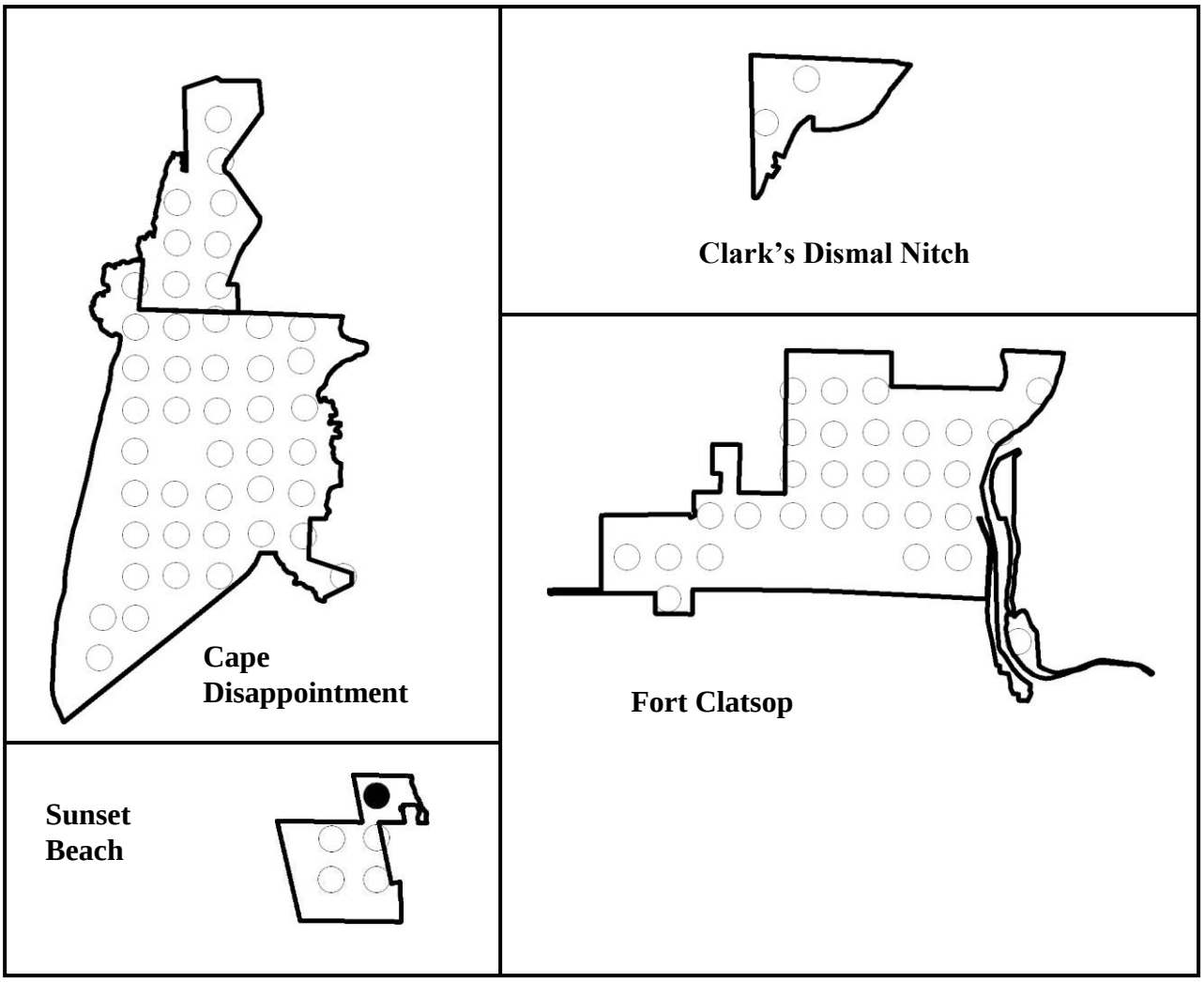

Figure 57. Locations of House Finch detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

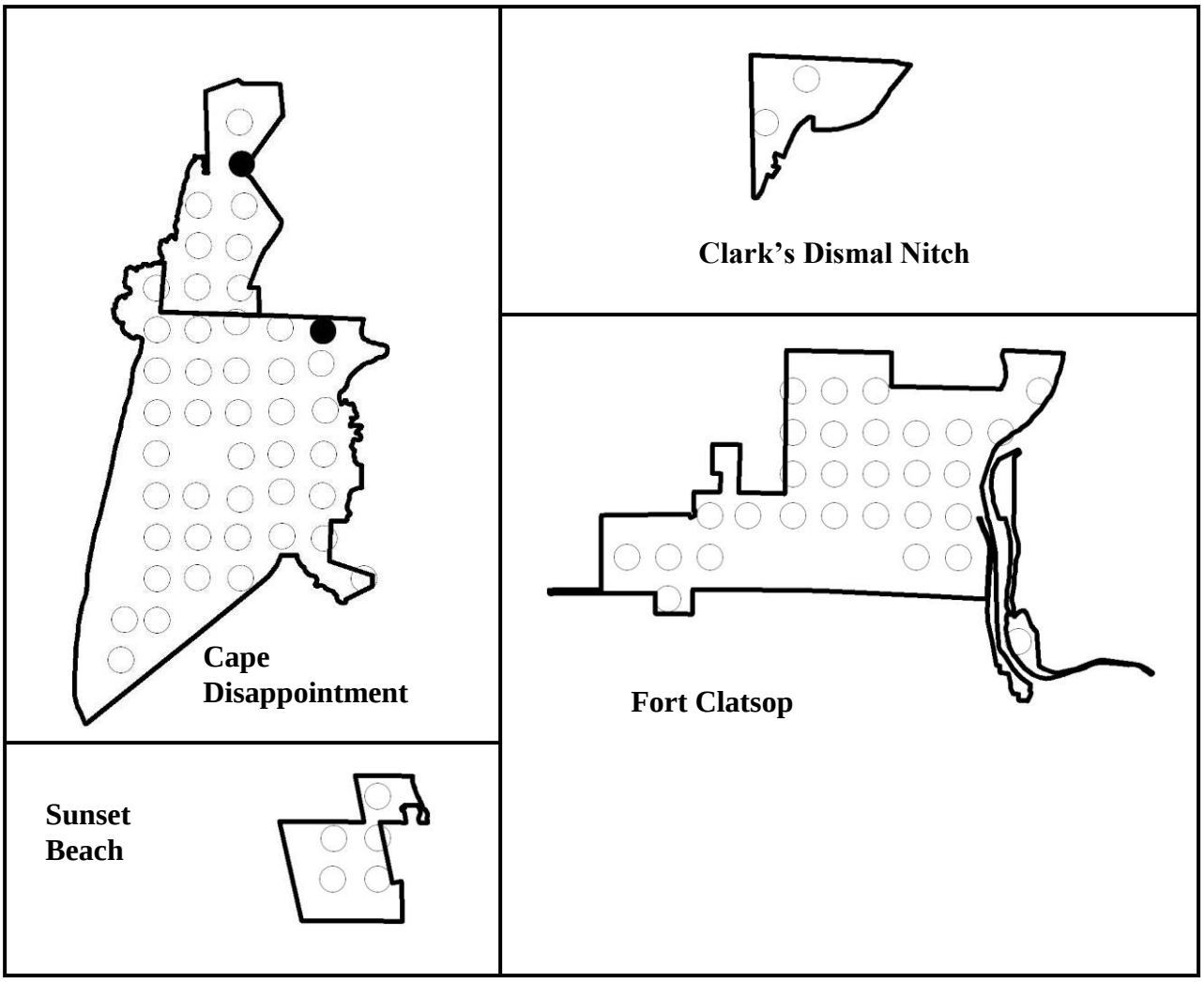

Figure 58. Locations of Red Crossbill detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

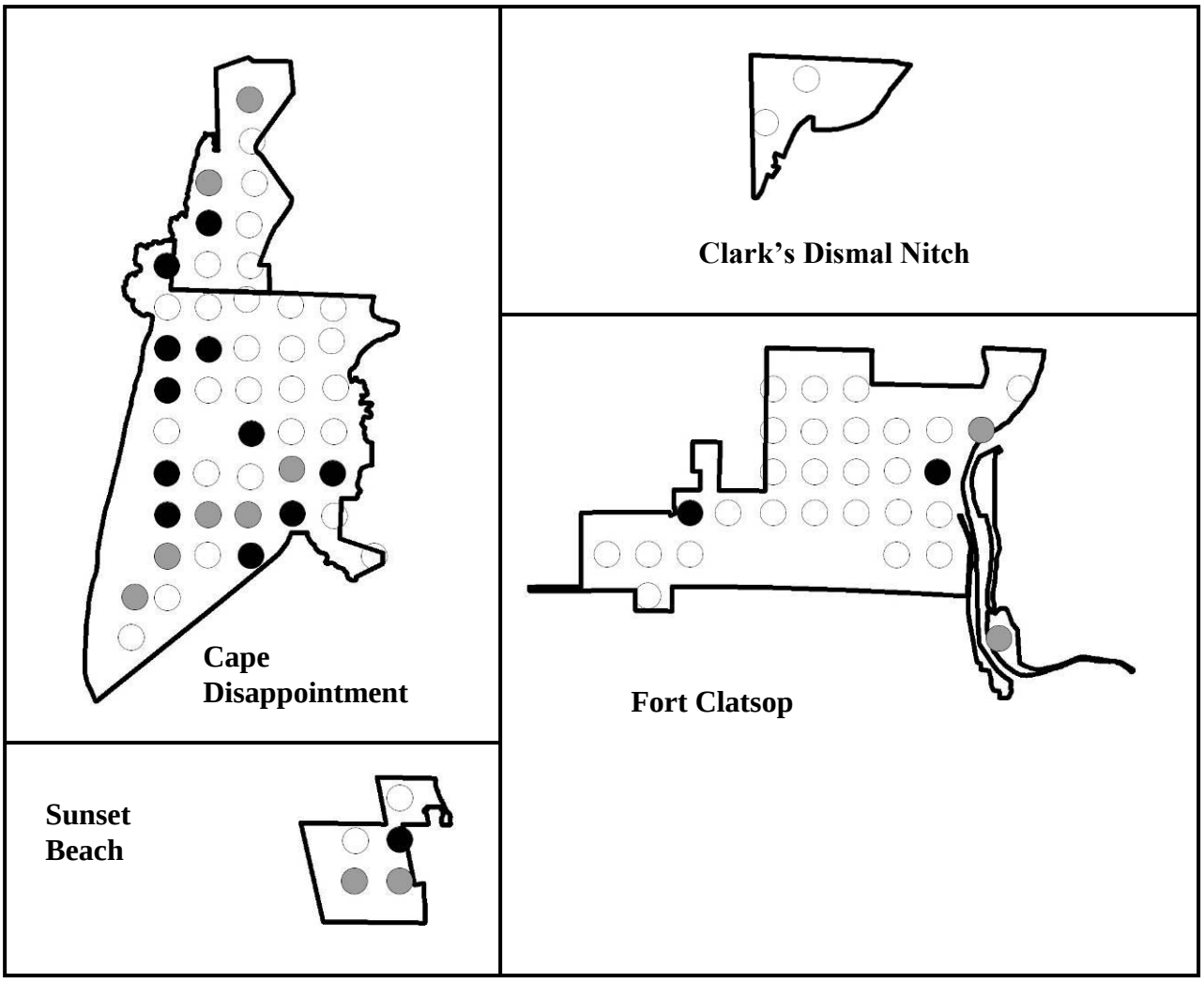

Figure 59. Locations of American Goldfinch detections during point counts at Lewis and Clark National Historical Park in May and June 2006. Black circles indicate points where the species was detected within 50m of the observer; gray circles indicate points where the species was detected, but not within 50m of the observer; white circles indicate points where the species was not detected.

Table 4. Number of points with detections and number of individual detections for each species detected during point counts in the four surveyed units of Lewis and Clark National Historical Park in 2006. Values for Sunset Beach and especially Clark's Dismal Nitch should be interpreted with caution, due to the small number of sampling points in those units.

	No. of Points with Detections				No. of Individual Detections			
Species	Cape Disappoint-ment	Clark's Dismal Nitch	Fort Clatsop	Sunset Beach	Cape Disappoint-ment	Clark's Dismal Nitch	Fort Clatsop	Sunset Beach
Brown Pelican	4	0	0	0	58	0	0	0
Turkey Vulture	1	0	0	0	2	0	0	0
Canada Goose	2	0	0	0	26	0	0	0
Mallard	1	0	1	0	3	0	1	0
Osprey	1	0	0	0	1	0	0	0
Bald Eagle	5	0	0	0	6	0	0	0
Killdeer	1	0	0	0	1	0	0	0
Glaucous-winged Gull	8	0	0	0	159	0	0	0
Caspian Tern	12	0	0	0	27	0	0	0
Band-tailed Pigeon	1	0	4	1	2	0	4	1
Northern Pygmy-Owl	0	0	1	0	0	0	1	0
Rufous Hummingbird	8	1	1	0	9	1	1	0
Belted Kingfisher	0	0	1	0	0	0	1	0
Red-breasted Sapsucker	0	1	0	0	0	1	0	0
Hairy Woodpecker	0	1	0	0	0	1	0	0
Northern Flicker	7	0	2	1	7	0	2	1
Olive-sided Flycatcher	15	0	0	3	17	0	0	3
Western Wood-Pewee	6	0	0	0	6	0	0	0
Pacific-slope Flycatcher	23	2	22	0	29	2	32	0
Hutton's Vireo	2	1	11	1	2	1	12	1
Warbling Vireo	11	2	4	0	13	2	4	0
Steller's Jay	3	1	11	0	3	1	16	0
American Crow	24	0	12	4	42	0	16	5
Common Raven	6	0	4	0	10	0	4	0
Violet-green Swallow	1	0	1	0	1	0	1	0
Barn Swallow	4	0	3	0	12	0	4	0
Black-capped Chickadee	0	0	1	1	0	0	1	1
Chestnut-backed Chickadee	21	1	8	1	29	1	13	1

Table 4. Number of points with detections and number of individual detections for each species detected during point counts in the four surveyed units of Lewis and Clark National Historical Park in 2006. Values for Sunset Beach and especially Clark's Dismal Nitch should be interpreted with caution, due to the small number of sampling points in those units (continued).

	No. of Points with Detections				No. of Individual Detections			
Species	Cape Disappoint-ment	Clark's Dismal Nitch	Fort Clatsop	Sunset Beach	Cape Disappoint-ment	Clark's Dismal Nitch	Fort Clatsop	Sunset Beach
Red-breasted Nuthatch	4	0	0	1	4	0	0	1
Brown Creeper	2	0	1	1	2	0	1	1
Bewick's Wren	0	0	0	1	0	0	0	1
Winter Wren	25	1	17	1	48	2	24	1
Marsh Wren	9	0	2	0	18	0	4	0
Golden-crowned Kinglet	9	0	4	1	10	0	4	1
Swainson's Thrush	3	1	11	0	74	4	40	4
American Robin	23	1	12	2	36	2	19	3
Varied Thrush	2	1	0	0	2	1	0	0
Cedar Waxwing	7	0	4	0	14	0	8	0
Orange-crowned Warbler	11	0	6	2	12	0	6	2
Yellow Warbler	6	0	1	0	9	0	1	0
Yellow-rumped Warbler	1	0	0	0	1	0	0	0
Black-throated Gray Warbler	1	0	2	1	1	0	2	1
Townsend's Warbler	3	0	14	0	3	0	20	0
MacGillivray's Warbler	0	0	0	1	0	0	0	1
Common Yellowthroat	6	0	2	2	9	0	3	2
Wilson's Warbler	23	2	18	2	34	4	22	3
Western Tanager	6	0	3	0	6	0	4	0
Spotted Towhee	0	0	0	2	0	0	0	2
Savannah Sparrow	2	0	0	2	3	0	0	3
Song Sparrow	20	1	8	0	27	2	10	0
White-crowned Sparrow	8	1	1	1	11	2	2	1
Dark-eyed Junco	4	1	1	1	6	1	1	1
Black-headed Grosbeak	6	0	3	2	6	0	3	3
Red-winged Blackbird	5	0	1	0	6	0	2	0
Brown-headed Cowbird	6	0	3	4	6	0	3	5
Purple Finch	17	0	6	1	17	0	7	1

Table 4. Number of points with detections and number of individual detections for each species detected during point counts in the four surveyed units of Lewis and Clark National Historical Park in 2006. Values for Sunset Beach and especially Clark's Dismal Nitch should be interpreted with caution, due to the small number of sampling points in those units (continued).

	No. of Points with Detections				No. of Individual Detections			
Species	Cape Disappoint-ment	Clark's Dismal Nitch	Fort Clatsop	Sunset Beach	Cape Disappoint-ment	Clark's Dismal Nitch	Fort Clatsop	Sunset Beach
House Finch	0	0	0	1	0	0	0	1
Red Crossbill	2	0	0	0	3	0	0	0
American Goldfinch	9	0	3	2	11	0	4	2

We used detectability parameters developed in Siegel et al. (2006b) to estimate density (birds/ha) of birds in each of the four park units in which we worked (Table 5). Detectability parameters were available for 31 species (Table 5). Density estimates indicate that the five most common species at Cape Disappointment, in descending order, are: Chestnut-backed Chickadee, Swainson's Thrush, Wilson's Warbler, Winter Wren, and American Robin. At Fort Clatsop the list differs only slightly: Swainson's Thrush, Chestnut-backed Chickadee, Pacific-slope Flycatcher, Wilson's Warbler, and American Robin. Such rankings at Clark's Dismal Nitch and Sunset Beach are unreliable because of the small number of sampling points, but it should be noted that the species with the single highest density estimate at Sunset Beach was Brown-headed Cowbird.

Table 5. Estimates of density (birds/ha) in the four surveyed units of Lewis and Clark National Historical Park in 2006. Density estimates are based on detectability parameters developed in Siegel et al. (2006b), and reprinted in Appendix One of this report. Values are presented only for species for which detectability parameters were available. Density estimates of 0.00 indicate species that were not detected during points within the sampling width at that park unit; the species may nevertheless occur there at a low density. All values for Sunset Beach and especially Clark's Dismal Nitch should be interpreted with caution, due to the small number of sampling points in those units.

	Cape Disappointment		Clark's Dismal Nitch		Fort Clatsop		Sunset Beach	
Species	Mean Density	SE	Mean Density	SE	Mean Density	SE	Mean Density	SE
Red-breasted Sapsucker	0.00	0.00	1.67	1.74	0.00	0.00	0.00	0.00
Northern Flicker	0.07	0.03	0.00	0.00	0.03	0.02	0.09	0.09
Olive-sided Flycatcher	0.11	0.04	0.00	0.00	0.00	0.00	0.17	0.08
Western Wood-Pewee	0.08	0.03	0.00	0.00	0.00	0.00	0.00	0.00
Pacific-slope Flycatcher	0.53	0.12	0.46	0.46	0.94	0.19	0.00	0.00
Warbling Vireo	0.19	0.06	0.67	0.02	0.07	0.04	0.00	0.00
Steller's Jay	0.03	0.02	0.26	0.26	0.28	0.08	0.00	0.00
Chestnut-backed Chickadee	1.36	0.35	0.00	0.00	1.10	0.40	0.49	0.50
Red-breasted Nuthatch	0.04	0.02	0.00	0.00	0.00	0.00	0.09	0.10
Brown Creeper	0.04	0.04	0.00	0.00	0.00	0.00	0.34	0.34
Winter Wren	0.82	0.15	0.80	0.80	0.66	0.13	0.16	0.16
Golden-crowned Kinglet	0.71	0.23	0.00	0.00	0.33	0.19	0.64	0.64
Swainson's Thrush	1.32	0.15	1.26	0.42	1.13	0.15	0.50	0.21
American Robin	0.80	0.17	1.10	1.10	0.68	0.19	0.66	0.44
Varied Thrush	0.01	0.01	0.13	0.13	0.00	0.00	0.00	0.00
Orange-crowned Warbler	0.24	0.07	0.00	0.00	0.18	0.07	0.35	0.22
Yellow Warbler	0.33	0.14	0.00	0.00	0.06	0.06	0.00	0.00
Yellow-rumped Warbler	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00
Black-throated Gray Warbler	0.02	0.02	0.00	0.00	0.06	0.04	0.17	0.17
Townsend's Warbler	0.03	0.02	0.00	0.00	0.53	0.13	0.00	0.00
MacGillivray's Warbler	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.28
Wilson's Warbler	0.84	0.18	2.45	0.22	0.68	0.16	0.73	0.49
Western Tanager	0.09	0.04	0.00	0.00	0.07	0.05	0.00	0.00
Spotted Towhee	0.00	0.00	0.00	0.00	0.00	0.00	1.09	0.69

Table 5. Estimates of density (birds/ha) in the four surveyed units of Lewis and Clark National Historical Park in 2006. Density estimates are based on detectability parameters developed in Siegel et al. (2006b), and reprinted in Appendix One of this report. Values are presented only for species for which detectability parameters were available. Density estimates of 0.00 indicate species that were not detected during points within the sampling width at that park unit; the species may nevertheless occur there at a low density. All values for Sunset Beach and especially Clark's Dismal Nitch should be interpreted with caution, due to the small number of sampling points in those units (continued).

	Cape Disappointment		Clark's Dismal Nitch		Fort Clatsop		Sunset Beach	
Species	Mean Density	SE	Mean Density	SE	Mean Density	SE	Mean Density	SE
Savannah Sparrow	0.11	0.08	0.00	0.00	0.00	0.00	1.44	0.99
Song Sparrow	0.76	0.18	1.31	1.32	0.45	0.16	0.00	0.00
White-crowned Sparrow	0.11	0.04	0.46	0.46	0.03	0.03	0.09	0.09
Dark-eyed Junco	0.23	0.13	0.86	0.86	0.06	0.06	0.34	0.34
Black-headed Grosbeak	0.15	0.06	0.00	0.00	0.14	0.08	0.80	0.53
Brown-headed Cowbird	0.24	0.10	0.00	0.00	0.18	0.11	1.79	0.65
American Goldfinch	0.25	0.09	0.00	0.00	0.14	0.08	0.40	0.25

Discussion

Conservation Issues

Lewis and Clark National Historical Park encompasses a wide array of bird habitats, and provides important breeding-season habitat to many species. The park is of substantial value to local landbird populations, which represent an important resource that is well worth continued monitoring.

One note of concern is that we detected Brown-headed Cowbirds at each of the units except Clark's Dismal Nitch, and Brown-headed Cowbird appeared to be the single most abundant species at Sunset Beach. Brown-headed Cowbirds are obligate nest parasites and are capable of deleteriously affecting populations of numerous songbird species, including flycatchers, vireos, and warblers. Elsewhere in the North Coast and Cascades Network, cowbirds have been implicated in the local decline of MacGillivray's Warbler on San Juan Island National Historical Park (Lewis and Sharpe 1987). Particularly at Sunset Beach, but at the other units as well, nest parasitism by Brown-headed Cowbirds could be a significant conservation issue for susceptible species, and merits further attention.

Future Monitoring Efforts

Monitoring landbirds at Lewis and Clark National Park during May and June is made substantially more difficult than it otherwise would be by the frequent rain. The North Coast and Cascades Landbird Monitoring Group had initially hoped that all the points surveyed for this inventory could be resampled every second year, as part of the North Coast and Cascades Monitoring Network's long-term landbird monitoring program. Our experience working in the park in 2006 as well as 2004 suggests that the number of sampling points will need to be reduced substantially to make this a realistic goal, given existing funding and personnel constraints, and the relatively high proportion of mornings on which rain precludes conducting surveys.

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Appendix 1. Detectability parameters used for calculating density estimates.

	Density adjustment parameters obtained through detectability modeling*				
			Detection Probability		
Species	No. of Detections**	Sample Width (m)	*P*	SE	df
Red-breasted Sapsucker	62	89	0.12	0.034	57
Northern Flicker	82	150	0.32	0.034	80
Olive-sided Flycatcher	268	210	0.25	0.058	264
Western Wood-Pewee	83	123	0.34	0.023	82
Pacific-slope Flycatcher	1341	75	0.62	0.088	1336
Warbling Vireo	441	92	0.56	0.019	440
Steller's Jay	207	109	0.52	0.015	206
Chestnut-backed Chickadee	2094	52	0.48	0.079	2089
Red-breasted Nuthatch	1163	113	0.53	0.086	1160
Brown Creeper	359	60	0.52	0.068	356
Winter Wren	2813	95	0.44	0.030	2808
Golden-crowned Kinglet	1259	47	0.45	0.042	1257
Swainson's Thrush	1014	100	0.38	0.016	1012
American Robin	1007	110	0.24	0.012	1003
Varied Thrush	2156	152	0.54	0.091	2151
Orange-crowned Warbler	134	103	0.34	0.019	133
Yellow Warbler	209	70	0.39	0.023	208
Yellow-rumped Warbler	500	87	0.51	0.063	498
Black-throated Gray Warbler	293	82	0.55	0.099	291
Townsend's Warbler	1576	84	0.59	0.069	1573
MacGillivray's Warbler	170	69	0.48	0.044	169
Wilson's Warbler	260	76	0.45	0.041	258
Western Tanager	521	98	0.47	0.052	519
Spotted Towhee	157	83	0.17	0.027	153
Savannah Sparrow	165	91	0.16	0.026	161
Song Sparrow	227	105	0.22	0.029	225
White-crowned Sparrow	174	164	0.26	0.024	171
Dark-eyed Junco	2219	88	0.24	0.011	2217

Appendix 1. Detectability parameters used for calculating density estimates (continued).

	Density adjustment parameters obtained through detectability modeling*				
			Detection Probability		
Species	No. of Detections**	Sample Width (m)	*P*	SE	df
Black-headed Grosbeak	84	84	0.34	0.024	83
Brown-headed Cowbird	124	90	0.22	0.040	122
American Goldfinch	98	90	0.39	0.049	97

*Parameters are excerpted from Siegel et al. (2006b), and were obtained from detectability models based on data from landbird inventory projects and landbird monitoring data from Mount Rainier National Park, North Cascades National Park Service Complex, Olympic National Park, and San Juan Island National Historical Park. Details of the modeling methods are provided in Siegel et al. (2006b).

**Total number of detections, after truncation, on which the model was based.

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