

Legacy Resource Management Program

Inventory and Monitoring of Neotropical Migratory
Landbirds on Fort Richardson, Alaska

Final Report

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EXECUTIVE SUMMARY

Information on distribution, abundance, and habitat use is central to the conservation of migratory birds on military installations. Because previous studies had not been conducted on Fort Richardson, Alaska, we initiated an inventory and monitoring program for breeding birds that focused on nearctic-neotropical migrants. From 1994 to 1999, we implemented a variety of inventory and monitoring methods that included: area searches/breeding bird atlas procedures, habitat-based point counts, Breeding Bird Survey (BBS) routes, and constant-effort mist-netting.

From 1996 to 1999, we spent 441 person-hr conducting atlas surveys. We sampled at least a portion of all 33 areas designated on the installation. Incidental observations supplemented these directed surveys. From a total of 122 species recorded during June and July, most species (86%) were considered possible, probable, or confirmed breeders; the remainder (14%) were summer visitants or migrants. Breeding was confirmed for several species on Fort Richardson that are only casual or rare breeders in eastern Upper Cook Inlet. Atlas procedures were the most effective method for developing a complete list of the breeding avifauna of Fort Richardson. Because of relatively complete coverage of the installation, no further atlas surveys are needed. Current data can be used to measure future changes in the distribution and abundance of birds breeding on Fort Richardson. A separate publication that depicts distribution and abundance of individual species is under development.

Two BBS routes were established in 1994; one route (Fort Richardson) consists of 50 stops, and 1 route (Alpenglow) includes 30 stops. Individuals from the Anchorage community are used as observers on these routes. The Fort Richardson route was surveyed in all 6 years, and the Alpenglow route was surveyed in 4 of 6 years. For species that had ≥ 1 individual recorded in a year, 50% are partial or complete nearctic-neotropical migrants. Counts of olive-sided flycatchers, western wood-pewees, and alder flycatchers were particularly high on the routes. Annual coverage of both BBS routes should continue.

A preliminary vegetation map for Fort Richardson was used to select a series of point-count sampling units. Between 1998 and 1999, a total of 632 point counts (10 min each) were made across the installation. Points were placed in all major vegetation types and were distributed across training areas in approximate proportion to the training area's size. The most common species (those that average >1.0 bird/point) were the Swainson's thrush, yellow-rumped warbler, and dark-eyed junco. Estimates of mean relative density (birds/point) were calculated for each small landbird species in each of 12 vegetation types. Relative density was also calculated for disturbed tall shrub and disturbed mixed forest. Compared to densities in closed forests, several shrub-inhabiting species increased in density when forests were disturbed. Formal modeling of the effects of vegetation type and other environmental variables on breeding bird density would be useful to further understand patterns of habitat use. Information obtained in 1998 and 1999 can be used to design a point-count monitoring scheme for the installation. Information could be combined with other sites in the Anchorage Bowl.

A constant-effort mist-netting station, that followed the Monitoring Avian Productivity and Survivorship protocol (MAPS), was operated adjacent to Otter Lake for 5 years (1994-98), and a second station, located in training area 12A, was operated for 1 year in 1994. At Otter Lake, 37 days and 2,231 net-hr resulted in the capture of 395 individuals of 24 species for an overall capture rate of 17.7 birds/100 net-hr. The most prevalent species captured (those that had >30 individuals) included the: black-capped chickadee, Swainson's thrush, yellow-rumped warbler, and dark-eyed junco. Only a small portion of individuals (9%) were recaptured in subsequent years. Therefore, operation of the Otter Lake station should not be continued.

The gradient in elevation that exists on Fort Richardson, from sea level to 1,585 m, provides a great variety of habitats for breeding birds. Accordingly, 91% of all bird species found breeding in eastern Upper Cook Inlet were suspected to be breeding on the installation. Habitats on Fort Richardson also support numerous breeding species that are otherwise rare in eastern Upper Cook Inlet. Because it contains the largest continuous block of low-elevation natural vegetation, Fort Richardson provides important habitats to migratory birds within the rapidly-developing Anchorage Bowl.

TABLE OF CONTENTS

EXECUTIVE SUMMARY ii

TABLE OF CONTENTS iv

INTRODUCTION 1

ACKNOWLEDGMENTS 1

METHODS 2

 Study Area 2

 Breeding Bird Atlas 3

 Breeding Bird Survey 6

 Point Counts 9

 Monitoring Avian Productivity and Survivorship 9

RESULTS 10

 Atlas Procedures 10

 Breeding Bird Survey 15

 Point Counts 17

 Monitoring Avian Productivity and Survivorship 21

RECOMMENDATIONS 24

LITERATURE CITED 25

INTRODUCTION

The Department of Defense instituted the Legacy Resource Management Program to assist the stewardship of natural, cultural, and historical resources on U. S. military lands. The Integrated Training Area Management program of the U. S. Army has a complementary goal of managing and protecting natural resources on its training lands. Concurrent with the establishment of these programs was the development of a Department of Defense strategy for the management of neotropical migratory birds and their habitats on departmental lands (Department of Defense ND). Fundamental to all these initiatives is the collection of reliable information on the distribution, habitat requirements, and population status of natural resources.

Like much of Alaska, baseline information on migratory landbirds is lacking from lands managed by the U. S. Army. Despite being located adjacent to Alaska's largest city, no extensive studies of landbirds have been previously conducted on Fort Richardson. Therefore, we initiated an inventory and monitoring program for migratory birds that focused on neotropical migrant landbirds. From 1994 to 1999, we implemented methods that included: 1) Monitoring Avian Productivity and Survivorship (MAPS) banding stations, 2) a breeding bird atlas, 3) Breeding Bird Survey routes (BBS), and habitat-based point counts. In addition to baseline information on distribution and status of breeding bird populations, data collected on bird-habitat associations, and effects of training disturbances, will directly contribute to the management of migratory landbirds on Fort Richardson. These data will provide the raw material for the development of effective management plans for migratory birds. Herein, we report on the results of these programs.

ACKNOWLEDGMENTS

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METHODS

Study Area

Fort Richardson is located 16 km north of Anchorage, Alaska (61°20'N, 149°40'W), and encompasses 24,300 ha of training and cantonment areas (Fig. 1). Rising from sea level to 1,585 m, Fort Richardson contains a wide range of habitats, and, because of its geographical location, the flora is composed of an unique mix of Aleutian Island, interior Alaska, and southeastern Alaska elements (R. Lipkin, Univ. of Alas., pers. commun.). Broad vegetation types, however, are typical of northern regions and include tidal wetlands, muskegs, lakes and ponds, deciduous and coniferous forests, shrublands, and alpine tundra. Intensity, duration, and type (mechanized or infantry) of training has created a variable disturbance regime among training areas on Fort Richardson. Burning associated with homesteading in the 1930s and 1940s has produced young deciduous forests on the northern part of the installation (W. A. Quirk, U. S. Army, pers. commun.). Despite these disturbances, Fort Richardson contains the largest continuous block of natural, low-elevation (<150 m) vegetation in the Anchorage Bowl.

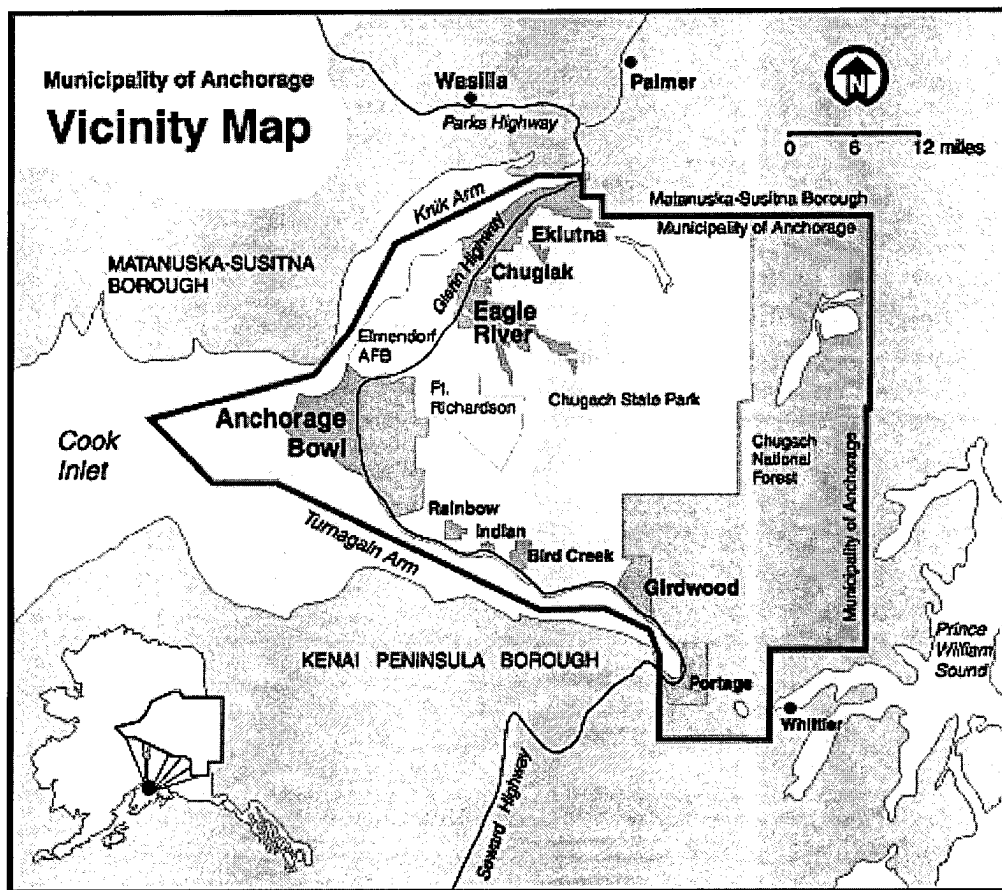


Figure 1. Location of Fort Richardson northeast of Anchorage, Alaska.

Breeding Bird Atlas

Information on bird distribution and abundance was obtained following guidelines developed for use on Alaska National Wildlife Refuges (Andres 1995). By surveying every training area, we are able to produce a complete breeding bird atlas for Fort Richardson. We used all designated training areas and 5 non-training areas as the geographic framework for collecting atlas information. Two of the smaller, adjacent training areas (8A/B, 6A/B) were combined to produce a total of 33 unique areas (TA).

In each TA, observers recorded the date and the amount of time they spent conducting the survey. Effort was recorded as the number of person-hours spent in each TA (the sum of the number of hours each observer surveyed). If 2 observers surveyed a TA together, the effort was calculated as 1.5 times the hours surveyed together. Effort was allocated proportional to the size of the TA with a minimum target of 4 person-hr spent in each TA. Coverage of a TA was dictated somewhat by access, but we tried to survey all major habitats in each TA. All surveys were conducted between 4 June and 24 July.

We used the behavior of birds to determine the breeding evidence (status) for all species encountered in a TA (Table 1). Specific status codes were included in raw plot data, but 4 broad status classes (observed, possible, probable or confirmed [Table 1]) were used for TA and installation-wide summaries. Definitions of breeding status followed recommendations of the North American Ornithological Atlas Committee (1990) and have been used in many state breeding bird atlases (e.g., Jacobs and Wilson 1997). We strove to confirm breeding by as many species as possible on the installation.

To provide information on relative abundance that extended beyond mere occurrence, we determined the categorical abundance of each species, based on encounters per hour, during each TA survey (Table 2). Kessel (1989) used a similar birds per hour metric to describe differences in bird abundance among habitats on the Seward Peninsula. We used the categorical abundances recorded on each TA, where the species was present, to calculate a mean abundance for the entire installation. To determine distribution across Fort Richardson, we calculated the percentage of TAs where the species was recorded. We delineated categories for mean bird abundance (Table 3) so that the distribution of mean abundance ranks generally followed a truncated lognormal distribution (Preston 1980). A complete atlas depicting distribution and abundance of individual species, by TA, is currently under development.

In addition to specific atlas surveys, we included information on nest box occupancy by boreal and northern saw-whet owls that was collected by other observers (T. Swem, U. S. Fish Wildl. Serv., unpubl. data), and included information from breeding owl surveys conducted in 1997 and 1998. Observations made incidental to other landbird fieldwork conducted from 1994 to 1999 and from observers working on Eagle River Flats from 1991 to 1999 were considered.

Table 1. Descriptions and codes of breeding status of birds recorded on training areas of Fort Richardson, Alaska, 1994-99.

Status	Code	Description
Observed		Male or female observed, but did not show evidence of breeding, was not in suitable nesting habitat or was an obvious migrant.
Possible		Species (male or female) heard or seen in suitable nesting habitat but no further evidence of breeding was noted; included soaring birds (raptors) over suitable habitat.
Probable		Any of the following behaviors:
	PO	Pair observation - Male and female simultaneously observed in suitable habitat.
	PT	Permanent territory - Permanent territory presumed by observation of multiple, well-spaced, singing males (indicated territory holders). Also, if chases of individuals of the same species were seen.
	PC	Courtship behavior - Male-female behavior observed that was indicative of breeding or observed copulation; included aerial displays of pipits, longspurs, and shorebirds.
	PA	Agitated behavior - Adults seen exhibiting anxiety behavior, including distress calls.
Confirmed		Any of the following behaviors:
	CN	Carrying nesting material - Adult observed transporting nest building items such as sticks.
	CB	Nest building - Adults seen constructing nest at singular nest site.
	CO	Occupied nest - Adults observed repeatedly entering or leaving a nest site with food items or long bouts of nest occupation (contents of treetop or cavity nests that could not be directly observed).
	CD	Distraction display - Adults observed feigning injury (used by ground-nesting species to deter predators from detecting nest or young).
	CE	Nest with eggs - Nest found that contained eggs.
	CY	Nest with young - Live young seen or heard; dead, identifiable hatchlings found in a nest.
	CG	Precocial young - Flightless young observed in the immediate nest area and were dependent on adults or had limited development.
	CF	Carrying food - Adults seen delivering food to young.
	CR	Recently fledged young - Young birds (either precocial or altricial) observed that were incapable of sustained flight and were restricted to the natal area by dependence on adults or by limited mobility.
	CI	Feeding recently fledged young - Adult observed feeding recently fledged young (those incapable of sustained flight) away from nest site.

Table 2. Abundance ranks, and their descriptions, for breeding birds found on training areas of Fort Richardson, Alaska, 1994-99.

Abundance rank	Description (per area-day)
1	1 individual per day
2	2-4 individuals per day, <1 individual per hour
3	5-9 individuals per day, 1 individual per hour
4	10-49 individuals per day, 2-5 individuals per hour
5	≥50 individuals per day, ≥6 individuals per hour

¹ day = 8 person-hours.

Table 3. Range of abundance ranks, averaged across all training areas, for areas only where a species was encountered, and descriptive abundance categories used for summaries of breeding birds found on Fort Richardson, Alaska, 1994-99.

Descriptive abundance category	Range of averaged ranks
rare	≤1.00
uncommon	1.01 - 1.99
fairly common	2.00 - 2.49
common	>2.50

Breeding Bird Survey

Bird counting procedures are standardized throughout the BBS program. Each route consists of 50 stops placed at 0.8-km (0.5-mile) intervals along a 39.4-km (24.5-mile) stretch of road. Routes are surveyed once each year by an observer who is familiar with the sight and song of birds in the region. At each of the stops, the observer records the number of individuals of each species heard or seen during a 3-min period; only birds detected within 0.4 km of the road are counted. Surveys begin 30 min before sunrise (no earlier than 0230 hr in Alaska) and are completed within 4-5 hr. Most Alaska routes are surveyed between the second and fourth weeks of June. Because of differences in the skills of observers, the same observer is encouraged to survey the route for a number of years.

We established 2 routes (Fort Richardson and Alpenglow, Fig. 2,3) on the installation (Fig. 2,3). Because of the extent of the road coverage, one of the routes (Alpenglow) had to be limited to 30 stops. Other routes that contain <50 stops have been established in Alaska. The Fort Richardson and Alpenglow routes generally sample forest and shrub habitats. Routes surveyed on Fort Richardson contribute to a regional database on bird population trends. Currently, about 3,400 permanent routes are established in North America and about 80 routes are now surveyed annually in Alaska.

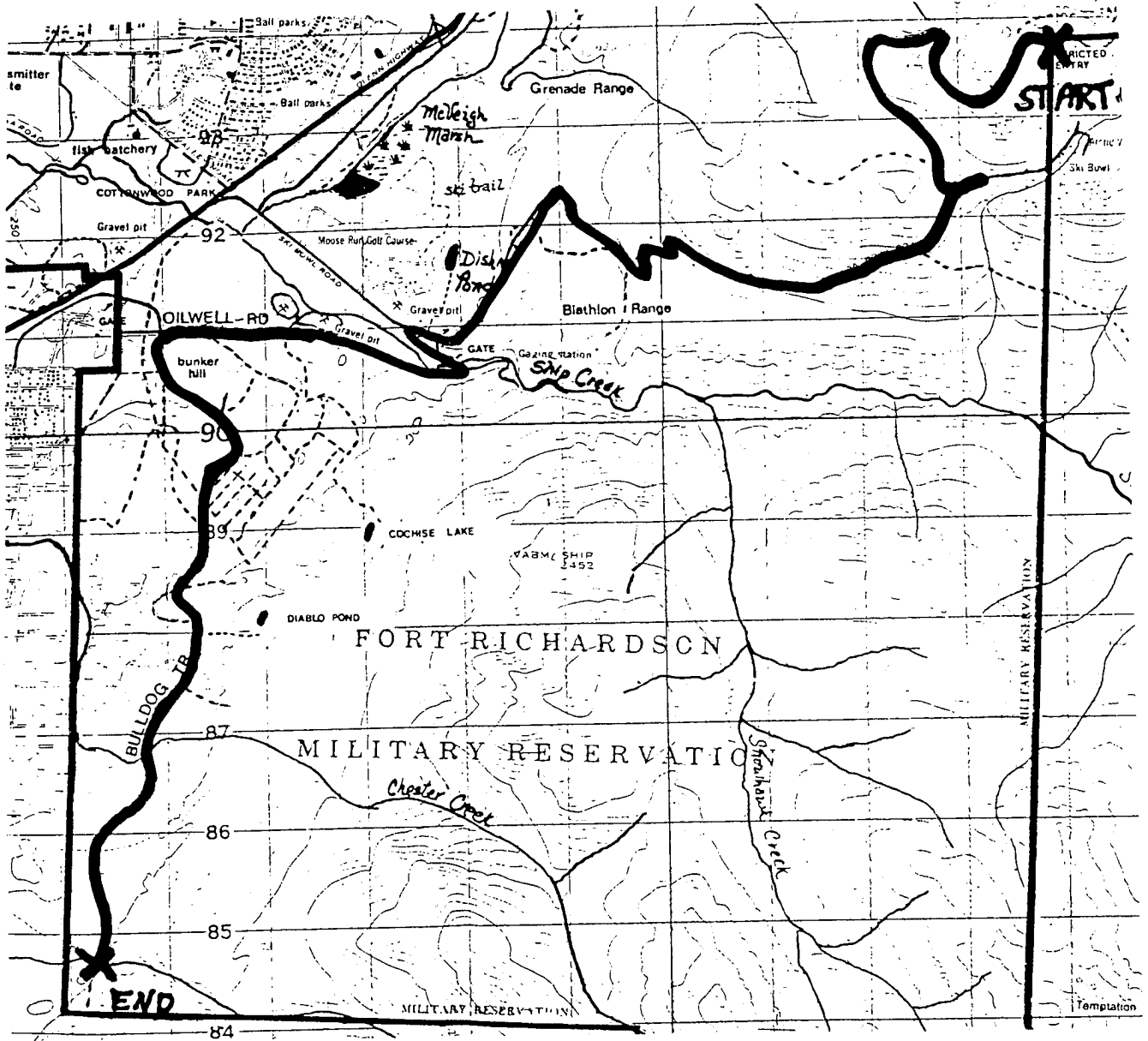


Figure 2. Location of the Alpenglow Breeding Bird Survey route (30 stops).

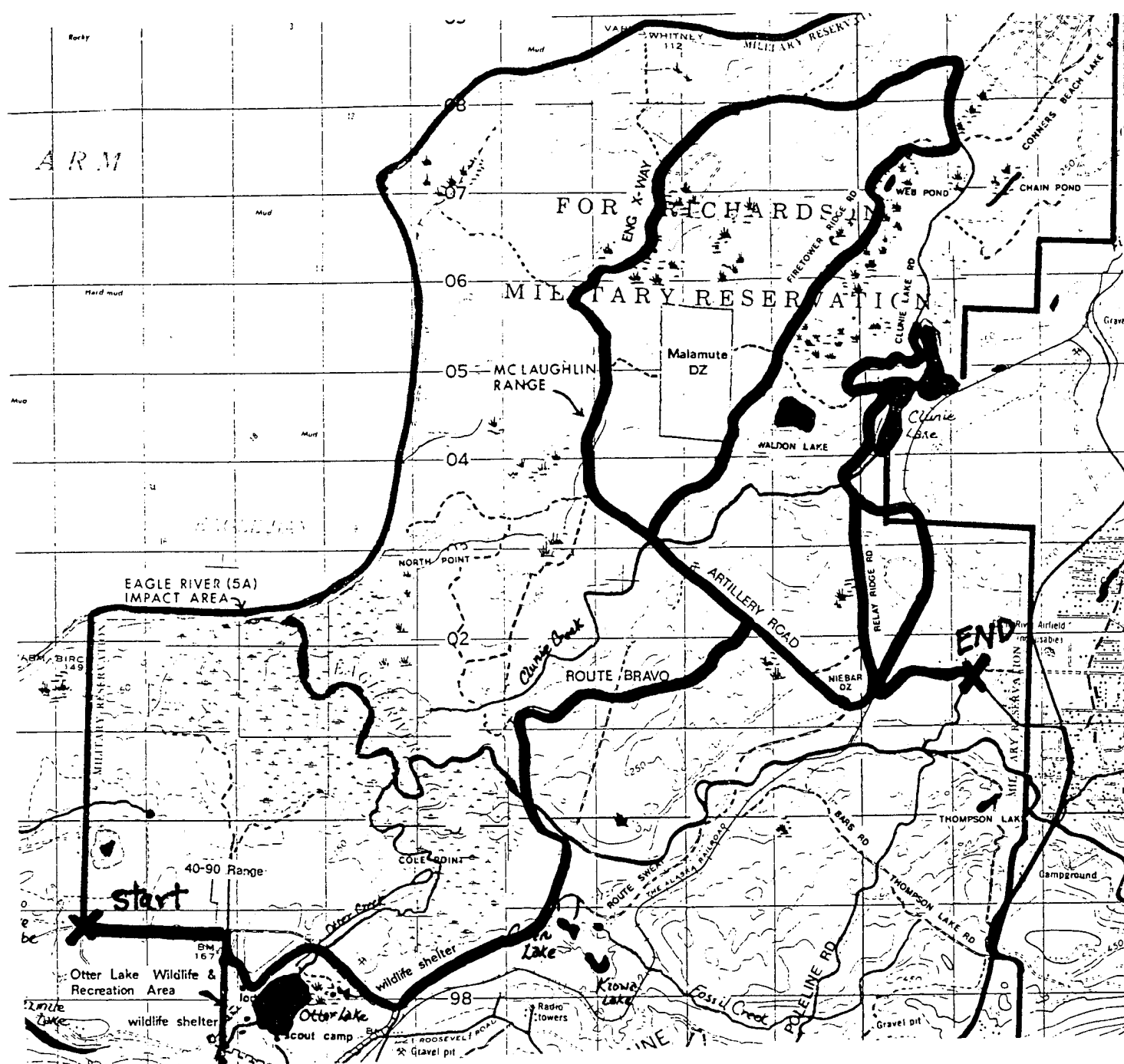


Figure 3. Location of the Fort Richardson Breeding Bird Survey route (50 stops).

Point Counts

We used the installation's GIS-derived vegetation type map as the basis for selecting points. Vegetation type was classified to Viereck et al's (1992) Level III with some modifications (e.g., splitting to birch and nonbirch broadleaf forest; splitting low scrub habitats by elevation). We attempted to distribute point count effort proportionately by vegetation type and by TA. To increase the number of samples, we selected points that could be accessed with relative ease. Randomly-selected points had previously proven to be very inefficient. Thus, we choose points along trails and secondary roads where the canopy cover, in forest types, was $\geq 50\%$. Points were chosen to fall completely within 1 vegetation type and were spaced at ≥ 250 m to avoid double-counting. Vegetation types of the selected points were verified in the field and were reassigned if necessary.

We conducted 10-min counts at each point and recorded detections by distance (those detected < 50 m and > 50 m) and noted if a detection was made outside of the designated vegetation type. Counts, made between sunrise and 0930 hr, were conducted from 7 to 28 June in 1998 and 1999. The mean relative density (birds/point) was estimated for 12 separate vegetation types. Individuals detected outside of the designated vegetation type and as fly-overs were excluded from these calculations. In addition to undisturbed points, we surveyed points in various vegetation types that had disturbance indices of $\geq 40\%$. Further development of models that related habitat features and relative density of breeding birds is planned for 2001.

Monitoring Avian Productivity and Survivorship (MAPS)

In 1994, we established 2 intensive mist-netting stations; 1 was located in training area 12A (≈ 23 ha, Bunker Hill) and 1 on the northeast corner of Otter Lake (≈ 18 ha). The Bunker Hill study site was a fairly homogenous site and consisted of an Open Paper Birch Forest with a white spruce understory. Past tank training disturbed most of this area; the disturbance removed trees and created an open park-like appearance. Patches of scrub birch were also present. Ground cover was intact and shrub cover was minimal. The Otter Lake study site was characterized as a mature Closed Paper Birch Forest with white spruce present in the sub-canopy layer. Parts of the site consisted of a mesic mixed forest of white spruce and paper birch. A black spruce and sedge wetland bordered the site. Ten mist nets (12 x 2.6 m, 30-mm mesh) were erected at each site and were placed ≥ 50 m apart. In 1994, mist nets at each site were operated at weekly intervals from 1 June to 31 July and nets were opened 6 hr on each banding day. Nets were checked at 30-min intervals and captured birds were removed and transported to a central banding and processing station. Collection of age, sex, and morphometric data followed Ralph et al (1993).

Because of vandalism, the Bunker Hill site was abandoned at the start of the 1995 season. We then treated the Otter Lake station as a MAPS site and operated the nets once in every 10-day period. Because of changes in MAPS procedures, we banded between 6 and 9 periods from 31 May to 28 August. Complete methods are outlined by Burton and DeSante (1998).

RESULTS

Breeding Bird Atlas

We spent 441 person-hr in specific atlas surveys from 1996 to 1998 and were able to survey at least a portion of all 33 designated areas. Since 1994, a total of 122 species were recorded during the June and July on Fort Richardson (Table 4). Scientific names are provided in Table 10. Seventeen of these species (14%) were considered as migrants or visitants. Of the remaining 105 species, we determined that 94 species (89%) were confirmed or probable breeders on the installation; we confirmed breeding for 89 species. Across the installation (excluding Eagle River Flats), the dark-eyed junco (100% of the training areas) and the common redpoll (97% of the training areas) were the most widely recorded species. Other widespread species (>85% of the training areas) included the alder flycatcher, black-capped chickadee, boreal chickadee, Swainson’s thrush, hermit thrush, orange-crowned warbler, yellow-rumped warbler, and Lincoln’s sparrow. Breeding was confirmed for several species on Fort Richardson that are casual or rare breeders in the eastern Upper Cook Inlet (R. L. Scher ND): gadwall, ring-necked duck, bald eagle, red-tailed hawk, golden eagle, merlin, rock ptarmigan, sandhill crane, wandering tattler, three-toed woodpecker, black-backed woodpecker, northern wheatear, Townsend’s solitaire, bohemian waxwing, American tree sparrow, and gray-crowned rosy-finch. Including probable breeders, 82% of all bird species breeding in eastern Upper Cook Inlet were found on Fort Richardson; with the inclusion of possible breeders, the percentage increased to 91%.

Table 4. Breeding status, abundance (in areas where observed), and distribution (% of areas where species was recorded) of birds observed during June and July, 1994-99, on Fort Richardson, Alaska.

Common name	Breeding status	Abundance	% of areas
Pacific Loon	visitant		
Common Loon	confirmed	rare	12
Horned Grebe	visitant		
Red-necked Grebe	confirmed	fairly common	9
Trumpeter Swan	visitant		
Canada Goose	confirmed	fairly common	33
Gadwall	confirmed	fairly common	6
American Wigeon	confirmed	fairly common	15
Mallard	confirmed	fairly common	24
Northern Shoveler	possible		

Common name	Breeding status	Abundance	% of areas
Northern Pintail	confirmed	fairly common	9
Green-winged Teal	confirmed	fairly common	21
Canvasback	confirmed	rare	3
Ring-necked Duck	confirmed	fairly common	12
Greater Scaup	possible	fairly common	3
Harlequin Duck	confirmed	rare	6
Common Goldeneye	confirmed	uncommon	18
Barrow's Goldeneye	possible	rare	3
Common Merganser	possible	rare	3
Osprey	visitant		
Bald Eagle	confirmed	uncommon	33
Northern Harrier	confirmed	rare	18
Sharp-shinned Hawk	confirmed	uncommon	24
Northern Goshawk	probable	rare	18
Red-tailed Hawk	confirmed	uncommon	39
Golden Eagle	confirmed	uncommon	9
Merlin	confirmed	rare	15
Peregrine Falcon	possible	rare	3
Gyr Falcon ¹	visitant		
Spruce Grouse	confirmed	uncommon	70
Ring-necked Pheasant	visitant ²		
Willow Ptarmigan	confirmed	uncommon	15
Rock Ptarmigan	confirmed	uncommon	6
White-tailed Ptarmigan	confirmed	fairly common	3
Sandhill Crane	confirmed	uncommon	21
Semipalmated Plover	confirmed	fairly common	9
Greater Yellowlegs	confirmed	fairly common	36
Lesser Yellowlegs	confirmed	uncommon	36
Solitary Sandpiper	confirmed	uncommon	15

Common name	Breeding status	Abundance	% of areas
Wandering Tattler	confirmed	rare	3
Spotted Sandpiper	confirmed	fairly common	24
Whimbrel	migrant		
Surfbird	confirmed	uncommon	12
Semipalmated Sandpiper	migrant		
Western Sandpiper	migrant		
Least Sandpiper	confirmed	rare	6
Pectoral Sandpiper	migrant		
Short-billed Dowitcher	confirmed	fairly common	9
Common Snipe	confirmed	uncommon	39
Wilson's Phalarope ¹	visitant		
Red-necked Phalarope	confirmed	fairly common	6
Bonaparte's Gull	probable	uncommon	15
Mew Gull	confirmed	fairly common	42
Herring Gull	confirmed	uncommon	15
Glaucous-winged Gull	visitant		
Caspian Tern	visitant		
Arctic Tern	confirmed	fairly common	12
Rock Dove	possible		
Great Horned Owl	confirmed	uncommon	45
Boreal Owl	confirmed	uncommon	42
Northern Saw-whet Owl	confirmed	uncommon	45
Belted Kingfisher	confirmed	uncommon	15
Downy Woodpecker	confirmed	uncommon	58
Hairy Woodpecker	confirmed	uncommon	48
Three-toed Woodpecker	confirmed	uncommon	48
Black-backed Woodpecker	confirmed	rare	3
Northern Flicker	probable	uncommon	21
Olive-sided Flycatcher	confirmed	uncommon	61

Common name	Breeding status	Abundance	% of areas
Western Wood-Pewee	confirmed	uncommon	70
Alder Flycatcher	confirmed	common	88
Say's Phoebe	possible	rare	3
Northern Shrike	confirmed	uncommon	9
Gray Jay	confirmed	fairly common	79
Steller's Jay	possible	rare	3
Black-billed Magpie	confirmed	fairly common	30
Common Raven	confirmed	uncommon	82
Horned Lark	confirmed	common	15
Tree Swallow	confirmed	uncommon	36
Violet-green Swallow	confirmed	fairly common	27
Bank Swallow	confirmed	common	9
Cliff Swallow	confirmed	fairly common	9
Black-capped Chickadee	confirmed	common	91
Boreal Chickadee	confirmed	common	88
Red-breasted Nuthatch	confirmed	uncommon	76
Brown Creeper	confirmed	uncommon	33
Winter Wren	visitant		
American Dipper	confirmed	uncommon	6
Golden-crowned Kinglet	confirmed	uncommon	67
Ruby-crowned Kinglet	confirmed	fairly common	82
Arctic Warbler	visitant		
Northern Wheatear	confirmed	fairly common	9
Townsend's Solitaire	confirmed	rare	3
Gray-cheeked Thrush	possible	uncommon	9
Swainson's Thrush	confirmed	common	91
Hermit Thrush	confirmed	common	91
American Robin	confirmed	common	85
Varied Thrush	confirmed	fairly common	64

Common name	Breeding status	Abundance	% of areas
American Pipit	confirmed	fairly common	15
Bohemian Waxwing	confirmed	uncommon	18
Orange-crowned Warbler	confirmed	common	88
Yellow Warbler	confirmed	uncommon	27
Yellow-rumped Warbler	confirmed	common	91
Townsend's Warbler	confirmed	fairly common	48
Blackpoll Warbler	confirmed	uncommon	45
Northern Waterthrush	confirmed	uncommon	21
Wilson's Warbler	confirmed	fairly common	64
American Tree Sparrow	probable	rare	9
Savannah Sparrow	confirmed	fairly common	82
Fox Sparrow	confirmed	uncommon	24
Song Sparrow	probable	rare	6
Lincoln's Sparrow	confirmed	common	91
White-crowned Sparrow	confirmed	common	85
Golden-crowned Sparrow	confirmed	common	33
Dark-eyed Junco	confirmed	common	100
Red-winged Blackbird	visitant		
Rusty Blackbird	confirmed	fairly common	9
Gray-crowned Rosy-Finch	possible	rare	3
Pine Grosbeak	possible	rare	6
Red Crossbill	visitant		
White-winged Crossbill	confirmed	common	79
Common Redpoll	confirmed	common	97
Pine Siskin	confirmed	uncommon	85

Breeding Bird Survey

Since 1994, the Fort Richardson route (50 stops) has been surveyed every year and the Alpenglow route (30 stops) has been surveyed 4 of 6 years. Sixty-six species have been recorded on the Fort Richardson route, whereas only 37 species have been recorded on the Alpenglow route (Table 5). Townsend’s warblers were only recorded on the Alpenglow route. Because of its placement, this route had a greater representation of high elevation species, and few waterbirds were recorded. For species that had ≥ 1 individual recorded in a year (on either route), 50% are partial or complete Nearctic-Neotropical migrants. The mean number of olive-sided flycatchers recorded on the Fort Richardson route (6.3 birds) is above the median of the average number recorded on routes in Alaska.

Table 5. Mean annual number, standard error (SE), and average percentage of stops of birds recorded on the Fort Richardson (*n* = 50 stops) and Alpenglow (*n* = 30 stops) Breeding Bird Survey routes located on Fort Richardson, Alaska, 1994-99.

Common name	Fort Richardson (<i>n</i> = 6 years)			Alpenglow (<i>n</i> = 4 years)		
	Mean	SE	% of stops	Mean	SE	% of stops
Common Loon	2.4	0.7	3.7			
Horned Grebe	0.9	0.9	0.9			
Red-necked Grebe	6.4	2.4	6.6			
Canada Goose	4.4	1.5	2.6	0.7	0.5	2.5
Mallard	0.3	0.3	0.3			
American Wigeon	1.1	0.6	1.1			
Greater Scaup	0.4	0.4	0.3			
Common Goldeneye	0.3	0.3	0.3			
Common Merganser	0.4	0.4	0.9			
Bald Eagle	0.1	0.1	0.3	0.3	0.3	0.8
Red-tailed Hawk	0.6	0.3	1.1			
Spruce Grouse	0.3	0.2	0.6			
Sandhill Crane	3.4	1.0	3.7			
Greater Yellowlegs	5.1	1.3	6.6			
Lesser Yellowlegs	4.7	1.5	6.0	1.0	0.6	1.7
Solitary Sandpiper	0.1	0.1	0.3			
Spotted Sandpiper	0.6	0.4	1.1			
Common Snipe	4.1	1.1	6.6	1.0	0.7	3.3
Mew Gull	12.4	3.1	7.1	3.7	1.7	4.2
Arctic Tern	1.0	0.5	1.4			
Belted Kingfisher	0.3	0.2	0.6			
Downy Woodpecker	1.4	0.4	2.9	0.3	0.3	0.8
Hairy Woodpecker	0.6	0.2	1.1			

Common name	Fort Richardson (<i>n</i> = 6 years)			Alpenglow (<i>n</i> = 4 years)		
	Mean	SE	% of stops	Mean	SE	% of stops
Three-toed Woodpecker	0.1	0.1	0.3			
Northern Flicker	0.6	0.4	0.9			
Olive-sided Flycatcher	6.3	0.7	9.7	1.0	0.7	3.3
Western Wood-Pewee	7.9	0.8	11.1			
Alder Flycatcher	68.4	4.9	63.1	22.3	1.5	45.0
Horned Lark	3.7	3.7	0.3			
Tree Swallow	1.9	0.5	2.6	0.5	0.5	0.8
Bank Swallow	0.1	0.1	0.3			
Cliff Swallow	0.7	0.7	0.6			
Gray Jay	4.3	1.5	4.6	1.3	0.9	3.3
Steller's Jay				0.3	0.3	0.8
Black-billed Magpie	0.6	0.4	1.1	1.7	1.1	5.8
Common Raven	0.7	0.4	1.1	1.7	0.6	4.1
Black-capped Chickadee	12.9	3.4	9.1	3.7	1.3	9.2
Boreal Chickadee	1.1	0.8	0.6	0.5	0.5	0.8
Red-breasted Nuthatch	1.0	0.5	1.7	0.7	0.3	2.5
Brown Creeper	0.4	0.2	0.9			
Arctic Warbler	0.1	0.1	0.3			
Golden-crowned Kinglet	0.3	0.2	0.6			
Ruby-crowned Kinglet	13.9	1.8	16.3	3.7	0.9	11.7
Townsend's Solitaire	0.1	0.1	0.3			
Gray-cheeked Thrush	0.1	0.1	0.3			
Swainson's Thrush	43.7	6.4	48.9	27.3	8.3	49.2
Hermit Thrush	3.9	1.2	6.3	15.5	3.0	31.7
American Robin	54.6	4.5	55.1	9.3	2.9	27.5
Varied Thrush	12.9	4.1	15.1	3.0	1.9	8.3
Bohemian Waxwing				1.0	1.0	0.8
Orange-crowned Warbler	34.6	6.5	41.1	39.3	4.9	75.8
Yellow Warbler	3.1	1.2	5.4	1.0	0.4	3.3
Myrtle Warbler	53.6	5.5	55.7	16.7	5.7	39.2
Townsend's Warbler				6.3	3.4	16.7
Blackpoll Warbler	4.4	0.7	6.9	0.5	0.5	1.7
Northern Waterthrush	2.0	0.7	3.4			
Wilson's Warbler	6.3	3.5	8.9	6.7	2.8	15.0
Savannah Sparrow	3.3	0.5	4.3	5.0	1.1	11.7
Fox Sparrow	0.7	0.4	1.1	4.5	1.2	12.5
Song Sparrow	0.7	0.5	1.1			

Common name	Fort Richardson (<i>n</i> = 6 years)			Alpenglow (<i>n</i> = 4 years)		
	Mean	SE	% of stops	Mean	SE	% of stops
Lincoln's Sparrow	8.9	1.5	11.7	1.0	0.7	3.3
Golden-crowned Sparrow				9.3	1.7	20.0
White-crowned Sparrow	25.4	4.5	18.0	7.0	0.4	16.7
Dark-eyed Junco	63.4	8.3	58.0	22.2	3.2	53.3
Red-winged Blackbird	0.1	0.1	0.3			
Pine Grosbeak	1.1	0.8	0.6			
Red Crossbill	0.3	0.3	0.3			
White-winged Crossbill	10.9	5.4	2.6	0.7	0.7	0.8
Common Redpoll	21.0	8.3	12.9	23.3	4.8	44.2
Pine Siskin	5.7	3.6	2.3	1.7	1.2	4.1

Point Counts

In 1998 and 1999, we conducted 632 point counts across the installation. Within undisturbed vegetation types, points were distributed among forests (341 points), shrubs (94 points), herbaceous (19 points), and alpine (43 points). Another 135 points were conducted in TAs where >40% of the vegetation was disturbed. Seventy-five species were recorded on point counts of which most species were small landbirds. Not surprisingly, relative density of most species varied markedly among vegetation types, and few species were prevalent in only 1 type (Table 6). Species with the most restricted habitat use were those that bred in alpine areas. Further statistical testing and model building is needed to verify these patterns.

Compared to mixed closed forest, relative densities of most common species (those that were ≥1.0 birds/point) were 50% greater in disturbed mixed forest. Only the boreal chickadee and three-toed woodpecker exhibited a substantial, negative effect of disturbance in mixed forests. Increases in the relative density of the ruby-crowned kinglet, Swainson’s thrush, American robin, varied thrush, and yellow-rumped warbler in disturbed mixed forests were moderately positive (Table 6).

Compared to undisturbed tall shrub habitats, relative density decreased by ≥50% in disturbed tall shrubs for hermit thrush, yellow warbler, Wilson’s warbler, Lincoln’s sparrow, and golden-crowned sparrow. Increases of a similar magnitude occurred in relative densities of alder flycatcher, Swainson’s thrush, American robin, and varied thrush. Further analysis and modeling is needed to confirm these patterns.

The most abundant species were shared among counting methods (Table 7). Fifty-three percent of the species were 1 of the 15 most abundant species recorded in all 3 methods, and only 16% were 1 of the 15 most abundant species in only 1 method.

Table 6. Relative density (birds/point) of small landbirds among point counts made in 12 major vegetation types found on Fort Richardson, Alaska, 1998-99. Highlighted cells indicate highest relative densities for each species.

Common name	Alpine shrub			Low			Herb.			Tall shrub		Dwarf		Mixed forest			Broadleaf		Spruce	
	dwarf	low	shrub	shrub	shrub	shrub	Herb.	undist.	dist.	undist.	dist.	spruce	dist.	open	disturbed	closed	forest	forest	forest	forest
No. of points surveyed:																				
Downy Woodpecker								0.05	0.05					0.02	0.05	0.02		0.07		0.02
Hairy Woodpecker									0.03					0.02	0.05	0.01		0.02		
Three-toed Woodpecker								0.05						0.13		0.11		0.03		
Northern Flicker															0.05	0.01		0.01		
Olive-sided Flycatcher			0.03	0.03	0.05	0.07	0.11					0.36		0.09	0.30	0.16		0.06		0.19
Western Wood-Pewee			0.07	0.07		0.02	0.11							0.07	0.20	0.07		0.13		0.02
Alder Flycatcher		0.14	1.03	0.80		1.35	2.49					0.29		0.54	1.40	0.49		0.44		0.30
Horned Lark	0.28																			
Tree Swallow			0.03																	
Violet-green Swallow			0.07	0.42																
Bank Swallow																0.01				
Gray Jay		0.09	0.07	0.05	0.05	0.16	0.24					0.36		0.32	0.45	0.27		0.10		0.33
Black-billed Magpie	0.07	0.09				0.05								0.02		0.01				
Common Raven																0.09				
Black-capped Chickadee		0.05	0.03	0.05	0.05	0.09	0.03							0.46	0.85	0.50		0.37		0.02
Boreal Chickadee		0.09	0.14	0.05	0.05	0.12						0.21		0.20	0.15	0.34		0.07		0.26
Red-breasted Nuthatch																		0.04		
Brown Creeper									0.03									0.10		
Golden-crowned Kinglet															0.35	0.10		0.06		0.28
Ruby-crowned Kinglet		0.09	0.14	0.05	0.05	0.16	0.11					0.43		0.21	0.45	0.44		0.17		0.93
Townsend's Solitaire	0.02																			
Swainson's Thrush			0.31	0.16	0.16	0.51	1.49					0.57		1.32	2.15	1.57		1.12		1.00
Hermit Thrush	0.02	0.82	0.07	0.05		1.00	0.38					0.21		0.34	0.65	0.37		0.09		0.21
American Robin	0.02	0.14	1.17	1.16		0.42	1.30					0.64		0.39	0.70	0.83		1.20		1.07

Common name	Alpine shrub		Low		Herb.	Tall shrub		Dwarf spruce	Mixed forest			Broadleaf forest		Spruce forest
	dwarf	low	shrub	shrub		undist.	dist.		open	disturbed	closed	forest	forest	
Varied Thrush		0.05				0.12	0.19		0.18	0.45	0.34	0.39	0.33	
American Pipit	0.56													
Orange-crowned Warbler	0.05	1.14	0.86	0.63	0.63	1.58	2.14	0.43	0.39	1.00	0.44	0.38	0.35	
Yellow Warbler		0.05				0.30	0.08		0.02	0.15	0.02	0.04		
Yellow-rumped Warbler		0.09	0.45	0.42	0.42	0.51	0.59	0.36	1.21	2.65	2.11	1.92	1.12	
Townsend's Warbler		0.23				0.12	0.13		0.55	0.50	0.14	0.01	0.05	
Blackpoll Warbler			0.03			0.05	0.05			0.05	0.03	0.02	0.05	
Northern Waterthrush			0.03	0.05	0.05		0.03				0.01	0.03		
Wilson's Warbler		1.00	0.07	0.16	0.16	0.72	0.35	0.21	0.23	0.20	0.24	0.05	0.12	
Savannah Sparrow	0.65	1.86	0.41	0.47	0.47	0.35	0.22				0.01	0.01		
Fox Sparrow		0.05	0.03			0.14	0.13		0.25		0.02	0.01		
Lincoln's Sparrow		0.36	0.72	1.47	1.47	0.63	0.30	0.29	0.07	0.30	0.17	0.04	0.28	
Golden-crowned Sparrow	0.30	1.77				0.49	0.08	0.29						
White-crowned Sparrow	0.12	0.73	0.65	0.32	0.32	0.61	0.89	0.29	0.04	0.20	0.03	0.05	0.12	
Dark-eyed Junco	0.14	0.50	0.69	0.63	0.63	1.30	1.46	1.29	1.14	2.35	1.34	0.98	1.37	
Rusty Blackbird			0.14											
Pine Grosbeak														
White-winged Crossbill									0.02		0.01		0.02	
Common Redpoll						0.05	0.13	0.07	0.05	0.10	0.06	0.02	0.16	
Pine Siskin		0.05				0.02	0.11		0.05		0.10		0.09	

Table 7. The 15 most abundance species recorded on breeding bird atlas surveys, Breeding Bird Survey routes, and vegetation-based point counts made on Fort Richardson, Alaska, 1994-99.

Species	Atlas	BBS	Point counts
Mew Gull		X	
Alder Flycatcher	X	X	X
Gray Jay			X
Black-capped Chickadee	X	X	X
Boreal Chickadee	X		
Ruby-crowned Kinglet	X	X	X
Swainson’s Thrush	X	X	X
American Robin	X	X	X
Hermit Thrush	X	X	X
Varied Thrush		X	X
Orange-crowned Warbler	X	X	X
Yellow-rumped Warbler	X	X	X
Wilson’s Warbler		X	X
Savannah Sparrow	X		X
Lincoln’s Sparrow	X		X
White-crowned Sparrow	X	X	X
Dark-eyed Junco	X	X	X
White-winged Crossbill	X	X	
Common Redpoll	X	X	

Monitoring Avian Productivity and Survivorship

From 1994 to 1998, we spent a total of 37 days and 2,231 net-hr operating the Otter Lake station. Over this time, we captured a total of 395 individuals of 24 species for an overall capture rate of 17.7 birds/100 net-hr (Table 8). We caught >50 individuals of Swainson's thrushes, yellow-rumped warblers, and dark-eyed juncos. Species that were long-distance migrants constituted about 50% of all birds captured. Adult birds (AHY) accounted for 57% of the total captures. Hatching-year birds constituted only 39% of the captures of yellow-rumped warblers and 27% of the captures of Swainson's thrushes. Most hatching-year Swainson's thrushes (13 of 19 individuals) were captured after 21 July and may not have been locally-raised birds. Only 9% (35 individuals) of all birds banded were recaptured in subsequent years; most of these (77%) were captured only a year after banding.

An additional 129 individuals (26.9 birds/100 net-hr) of 18 species were captured in 1994 at the Bunker Hill station (Table 9). In the same year, 103 individuals (21.0 birds/100 net-hr) of 10 species were captured at Otter Lake (Table 9). High species diversity at Bunker Hill reflects the occurrence of more shrub habitat at that site. Only the Swainson's thrush, varied thrush, and northern waterthrush were more abundant at Otter Lake.

Table 8. Numbers of adult (AHY), hatching-year (HY), and unknown-aged birds captured and subsequently recaptured at a constant-effort mist-netting station (MAPS) located near Otter Lake on Fort Richardson, Alaska, 1994-99.

Species	Total number banded			No. of recaptures ¹		total no. of first captures ²
	AHY	HY	Unkown	1 year	2+ years	
Sharp-shinned Hawk	1					1
Downy Woodpecker	2					2
Hairy Woodpecker	1					1
Alder Flycatcher		3	1			4
Gray Jay	1	1				2
Black-capped Chickadee	10	17	1	2	2	32
Boreal Chickadee	3	5	1	1		11
Brown Creeper	1	3				4
Golden-crowned Kinglet	2					2
Ruby-crowned Kinglet		3	1			4
Gray-cheeked Thrush	1					1
Swainson’s Thrush	52	19		8	2	83
American Robin	19	5		1		25
Hermit Thrush		1				1
Varied Thrush	11	5		2		18
Orange-crowned Warbler	13	10				23
Yellow-rumped Warbler	38	24	1	4	3	72
Blackpoll Warbler		1				1
Northern Waterthrush	8	1	1		1	11
Wilson’s Warbler	1	1				2
Savannah Sparrow		1				1
Lincoln’s Sparrow	5	11				16
White-crowned Sparrow		2				2
Dark-eyed Junco	56	50	1	9	2	119

¹ number of individuals recaptured in subsequent years after initial banding.
² total number of new captures or first-time recaptures in each year from 1994 to 1999 (used for survival models).

Table 9. Numbers of adult (AHY) and hatching-year (HY) birds captured at a constant-effort mist-netting stations located near Bunker Hill (Training Area 12A) and Otter Lake on Fort Richardson, Alaska, 1994.

Species	Bunker Hill (<i>n</i> = 480 net-hr)		Otter Lake (<i>n</i> = 490 net-hr)	
	AHY	HY	AHY	HY
Sharp-shinned Hawk	1			
Alder Flycatcher	4			
Gray Jay	1	4		
Black-capped Chickadee	4	7	1	5
Boreal Chickadee		2	2	5
Ruby-crowned Kinglet	1			
Gray-cheeked Thrush			1	
Swainson’s Thrush	6	2	18	7
American Robin	9	2	4	
Varied Thrush	1		4	3
Orange-crowned Warbler	10	1	4	1
Yellow-rumped Warbler	10	4	10	6
Blackpoll Warbler	8			
Northern Waterthrush			3	
Savannah Sparrow		1		
Lincoln’s Sparrow	2	1		
White-crowned Sparrow	2	4		
Dark-eyed Junco	21	19	15	14
Pine Siskin	1			
Common Redpoll	1			

RECOMMENDATIONS

Breeding Bird Atlas

Breeding bird atlas procedures provide a thorough assessment of the breeding avifauna of Fort Richardson. No other method detected as many species as the atlas work. Person-hours spent primarily in atlas surveys (441 person-hr) did not differ substantially from effort at the banding station (\approx 473 person-hr) or conducting point counts (432 person-hr). Atlas work confirmed the importance of Fort Richardson to migratory birds; the relatively undisturbed habitats support >90% of the breeding avifauna of eastern Upper Cook Inlet. Baseline information collected from 1994 to 1999 can be used to monitor changes in distribution of breeding birds on the installation. An atlas publication that depicts distribution and relative abundance of each possible, probable, or confirmed breeding species will be completed in 2001, and no further atlas surveys are needed.

Breeding Bird Survey

Breeding Bird Survey routes on Fort Richardson effectively provide information for monitoring regional trends of migratory landbirds. For example, counts of olive-sided flycatchers, western wood-pewees, and alder flycatchers are particularly high on the routes. Annual consistency on the Alpenglow route needs to be improved. Observers need to be assured of access to gated areas of the installation; this has not been a problem in the past.

Point Counts

More point counts could be made in habitats that are currently represented by fewer than 30 points. However, some vegetation types are so rare that obtaining 30 points may not be possible. Because latitude and longitude of every point was recorded, vegetation type of a point could be reassigned if the current vegetation map is found to be inadequate. Further work might address the use of distance sampling to estimate density or the use of double-sampling methods to estimate detection rates. Increased survey effort in disturbed vegetation types might also be warranted. Further habitat modeling is planned for 2001.

Information collected on habitat use, in combination with considerations of Boreal Partners in Flight priority species, could be used to design a point-count monitoring scheme for Fort Richardson. Combining points into 12-point series (mini-routes) would allow for 15 mini-routes to be surveyed each year. By alternating years, these 30 routes should provide a large enough sample to meet standard power determinations. All 15 routes could be surveyed by 1 observer during June. Alternatively, routes on Fort Richardson could be combined with other routes in the Anchorage Bowl for analysis. A formal power analysis is needed to verify these preliminary suggestions.

Monitoring Avian Productivity and Survivorship

Fairly low capture rates and paltry return rates suggest that the MAPS station should not be continued. Information collected to date will be useful in designing a more rigorous approach for the MAPS program in Alaska. Information can also be used in conjunction with other stations in the Anchorage Bowl to produce regional estimates of survivorship. Other approaches to estimating productivity (e.g., nest searching) could be used to assess effects of disturbance on bird populations.

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Table 10. Common name and scientific names of birds of all bird species recorded during breeding bird surveys of Fort Richardson, Alaska, 1994-1999.

Taxonomic group		
Family	Common name	Scientific name
Loons/Grebes		
Loons	Pacific Loon	<i>Gavia pacifica</i>
	Common Loon	<i>Gavia immer</i>
Grebes	Horned Grebe	<i>Podiceps auritus</i>
	Red-necked Grebe	<i>Podiceps grisegena</i>
Waterfowl		
Geese, Swans, Ducks	Trumpeter Swan	<i>Cygnus buccinator</i>
	Canada Goose	<i>Branta canadensis</i>
	Gadwall	<i>Anas strepera</i>
	American Wigeon	<i>Anas americana</i>
	Mallard	<i>Anas platyrhynchos</i>
	Northern Shoveler	<i>Anas clypeata</i>
	Northern Pintail	<i>Anas acuta</i>
	Green-winged Teal	<i>Anas crecca</i>
	Canvasback	<i>Aythya valisineria</i>
	Ring-necked Duck	<i>Aythya collaris</i>
	Greater Scaup	<i>Aythya marila</i>
	Harlequin Duck	<i>Histrionicus histrionicus</i>
	Common Goldeneye	<i>Bucephala clangula</i>
	Barrow's Goldeneye	<i>Bucephala islandica</i>
	Common Merganser	<i>Mergus merganser</i>
Raptors		
Hawks, Eagles	Osprey	<i>Pandion haliaetus</i>
	Bald Eagle	<i>Haliaeetus leucocephalus</i>
	Northern Harrier	<i>Circus cyaneus</i>
	Sharp-shinned Hawk	<i>Accipiter striatus</i>
	Northern Goshawk	<i>Accipiter gentilis</i>
	Red-tailed Hawk	<i>Buteo jamaicensis</i>
	Golden Eagle	<i>Aquila chrysaetos</i>
Falcons	Merlin	<i>Falco columbarius</i>
	Gyr Falcon	<i>Falco rusticolus</i>
	Peregrine Falcon	<i>Falco peregrinus</i>
Grouse/Cranes		
Pheasants/Grouse	Ring-necked Pheasant	<i>Phasianus colchicus</i>
	Spruce Grouse	<i>Falcipennis canadensis</i>
	Willow Ptarmigan	<i>Lagopus lagopus</i>

Taxonomic group		
Family	Common name	Scientific name
Cranes	Rock Ptarmigan	<i>Lagopus mutus</i>
	White-tailed Ptarmigan	<i>Lagopus leucurus</i>
	Sandhill Crane	<i>Grus canadensis</i>
Shorebirds		
Plovers	Semipalmated Plover	<i>Charadrius semipalmatus</i>
Sandpipers	Greater Yellowlegs	<i>Tringa melanoleuca</i>
	Lesser Yellowlegs	<i>Tringa flavipes</i>
	Solitary Sandpiper	<i>Tringa solitaria</i>
	Wandering Tattler	<i>Heteroscelus incanus</i>
	Spotted Sandpiper	<i>Actitis macularia</i>
	Whimbrel	<i>Numenius phaeopus</i>
	Surfbird	<i>Aphriza virgata</i>
	Semipalmated Sandpiper	<i>Calidris pusilla</i>
	Western Sandpiper	<i>Calidris mauri</i>
	Least Sandpiper	<i>Calidris minutilla</i>
	Pectoral Sandpiper	<i>Calidris melanotos</i>
	Short-billed Dowitcher	<i>Limnodromus griseus</i>
	Common Snipe	<i>Gallinago gallinago</i>
	Wilson's Phalarope	<i>Phalaropus tricolor</i>
	Red-necked Phalarope	<i>Phalaropus lobatus</i>
Seabirds		
Gulls, Terns	Bonaparte's Gull	<i>Larus philadelphia</i>
	Mew Gull	<i>Larus canus</i>
	Herring Gull	<i>Larus argentatus</i>
	Glaucous-winged Gull	<i>Larus glaucescens</i>
	Caspian Tern	<i>Sterna caspia</i>
	Arctic Tern	<i>Sterna paradisaea</i>
Doves/Owls		
Doves, Pigeons	Rock Dove	<i>Columba livia</i>
Owls	Great Horned Owl	<i>Bubo virginianus</i>
	Boreal Owl	<i>Aegolius funereus</i>
	Northern Saw-whet Owl	<i>Aegolius acadicus</i>
Kingfishers		
Kingfishers	Belted Kingfisher	<i>Ceryle alcyon</i>
Woodpeckers		
Woodpeckers	Downy Woodpecker	<i>Picoides pubescens</i>
	Hairy Woodpecker	<i>Picoides villosus</i>

Taxonomic group		
Family	Common name	Scientific name
	Three-toed Woodpecker	<i>Picoides tridactylus</i>
	Black-backed Woodpecker	<i>Picoides arcticus</i>
	Northern Flicker	<i>Colaptes auratus</i>
Songbirds		
Flycatchers	Olive-sided Flycatcher	<i>Contopus cooperi</i>
	Western Wood-Pewee	<i>Contopus sordidulus</i>
	Alder Flycatcher	<i>Empidonax alnorum</i>
	Say's Phoebe	<i>Sayornis saya</i>
Shrikes	Northern Shrike	<i>Lanius excubitor</i>
Jays, Crows	Gray Jay	<i>Perisoreus canadensis</i>
	Steller's Jay	<i>Cyanocitta stelleri</i>
	Black-billed Magpie	<i>Pica hudsonia</i>
	Common Raven	<i>Corvus corax</i>
Larks	Horned Lark	<i>Eremophila alpestris</i>
Swallows	Tree Swallow	<i>Tachycineta bicolor</i>
	Violet-green Swallow	<i>Tachycineta thalassina</i>
	Cliff Swallow	<i>Petrochelidon pyrrhonota</i>
	Bank Swallow	<i>Riparia riparia</i>
Chickadees	Black-capped Chickadee	<i>Poecile atricapilla</i>
	Boreal Chickadee	<i>Poecile hudsonica</i>
Nuthatches	Red-breasted Nuthatch	<i>Sitta canadensis</i>
Creepers	Brown Creeper	<i>Certhia americana</i>
Wrens	Winter Wren	<i>Troglodytes troglodytes</i>
Dippers	American Dipper	<i>Cinclus mexicanus</i>
Kinglets	Golden-crowned Kinglet	<i>Regulus satrapa</i>
	Ruby-crowned Kinglet	<i>Regulus calendula</i>
Old World Warblers	Arctic Warbler	<i>Phylloscopus borealis</i>
Thrushes	Northern Wheatear	<i>Oenanthe oenanthe</i>
	Townsend's Solitaire	<i>Myadestes townsendi</i>
	Gray-cheeked Thrush	<i>Catharus minimus</i>
	Swainson's Thrush	<i>Catharus ustulatus</i>
	Hermit Thrush	<i>Catharus guttatus</i>
	American Robin	<i>Turdus migratorius</i>
	Varied Thrush	<i>Ixoreus naevius</i>
	American Pipit	<i>Anthus rubescens</i>
Waxwings	Bohemian Waxwing	<i>Bombycilla garrulus</i>
New World Warblers	Orange-crowned Warbler	<i>Vermivora celata</i>

Taxonomic group		
Family	Common name	Scientific name
Sparrows, Buntings	Yellow Warbler	<i>Dendroica petechia</i>
	Yellow-rumped Warbler	<i>Dendroica coronata</i>
	Townsend's Warbler	<i>Dendroica townsendi</i>
	Blackpoll Warbler	<i>Dendroica striata</i>
	Northern Waterthrush	<i>Seiurus noveboracensis</i>
	Wilson's Warbler	<i>Wilsonia pusilla</i>
	American Tree Sparrow	<i>Spizella arborea</i>
	Savannah Sparrow	<i>Passerculus sandwichensis</i>
	Fox Sparrow	<i>Passerella iliaca</i>
	Song Sparrow	<i>Melospiza melodia</i>
	Lincoln's Sparrow	<i>Melospiza lincolnii</i>
	White-crowned Sparrow	<i>Zonotrichia leucophrys</i>
	Golden-crowned Sparrow	<i>Zonotrichia atricapilla</i>
	Dark-eyed Junco	<i>Junco hyemalis</i>
	Red-winged Blackbird	<i>Agelaius phoeniceus</i>
Blackbirds	Rusty Blackbird	<i>Euphagus carolinus</i>
Finches	Gray-crowned Rosy-Finch	<i>Leucosticte tephrocotis</i>
	Pine Grosbeak	<i>Pinicola enucleator</i>
	Red Crossbill	<i>Loxia curvirostra</i>
	White-winged Crossbill	<i>Loxia leucoptera</i>
	Common Redpoll	<i>Carduelis flammea</i>
	Pine Siskin	<i>Carduelis pinus</i>