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Bird Use of Coastal Tundra: 1991 Report

by
Troy Ecological Research Associates

Prepared for
BP Exploration (Alaska) Inc.

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1991 REPORT
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This report was prepared under contract to BP Exploration (Alaska) Inc. Inquiries about this report may be addressed to:

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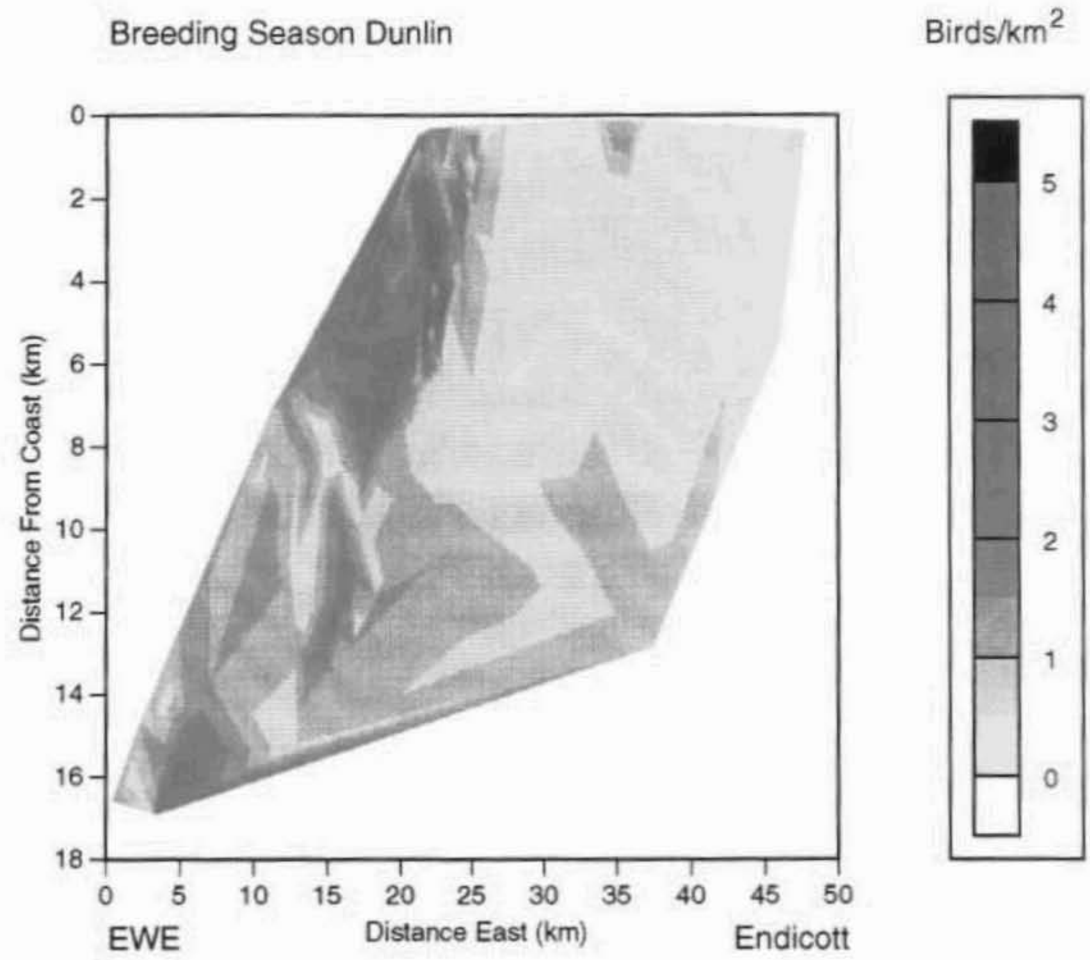

Breeding Season Dunlin
Birds/km2
Distance From Coast (km)
0
2
4
6
8
10
12
14
16
18
0
5
10
15
20
25
30
35
40
45
50
EWE
Distance East (km)
Endicott
5
4
3
2
1
0

Executive Summary

On Alaska's North Slope, some tundra types, especially saline tundra, are restricted to areas bordering the Beaufort Sea. These wetlands are thought to be extensively used by waterfowl and shorebirds. This study was initiated to describe use of a variety coastal habitats by the predominant members of the North Slope bird community. We sampled 30 coastal plots including 10 plots in each of three classes: (1) wet saline tundra; (2) non-saline tundra, represented by areas adjacent to "salt marshes" but not influenced by salt; and (3) dry coastal tundra. Data from 10 plots sampled in the Pt. McIntyre Reference Area (PMRA) were included in our analyses as examples of noncoastal (inland) tundra. These plots were sampled from early-June through late-August. Our objectives were to compare bird use among these three types of coastal tundra and to compare use of coastal plots with plots farther inland.

Considerable variability was found in the use of the three types of coastal plots sampled. The highest nesting densities (especially Semipalmated Sandpiper and Lapland Longspur) occurred in nonsaline tundra. Saline tundra received high use by breeding-season phalaropes. During the post-breeding season, saline tundra was the single most important habitat, especially for Lapland Longspur, Red-necked Phalarope, and Dunlin. Dry habitats received low use for nesting and by breeding-season birds, but Lesser Golden-Plover and Buff-breasted Sandpiper made considerable use of dry tundra during the post-breeding season.

The species composition of coastal plots differed slightly from the rest of the Prudhoe Bay area. Ruddy Turnstone and Baird's Sandpiper are rare in the Prudhoe Bay area but were relatively numerous on the coastal plots. Overall, there was considerable similarity in the species composition of coastal plots and the Prudhoe Bay area as a whole. The three types of coastal habitats varied in their use as nest sites and by breeding-season birds. In general, there was low use of dry areas and high use of nonsaline tundra; use of saline tundra was intermediate. The species composition in coastal areas was not as diverse as in the PMRA. Following nesting there was a tendency for some species to increase use of coastal habitats. During the post-breeding season, coastal habitats, especially saline tundra, supported the highest relative densities of all species examined except King Eiders and Pectoral Sandpipers.

The results of this study were combined with those of similar plot-based studies from the Prudhoe Bay area, to document abundance gradients along east-west and distance-from-coast axes. Depending on the species, the location of a study plot could account for up to 30 percent of the variability in bird and nest densities. Species exhibiting the strongest geographic gradients were Semipalmated Sandpiper, Dunlin, Stilt Sandpiper, Red-necked Phalarope, Red Phalarope, and Lapland Longspur. Coastal gradients could go in either direction; for some species, densities were highest near the coast, but for others the converse was true. For example, during the breeding season, Dunlin densities increased near the coast, whereas Stilt Sandpiper densities generally increased inland.

Table of Contents

List of Figures

List of Tables

Bird Use of Coastal Tundra
1991 Report

INTRODUCTION

On Alaska's North Slope, some tundra types, especially saline tundras, are restricted to areas immediately adjacent to the Beaufort Sea coast. Bergman et al. (1977) studied water bird use of several wetland types on the Arctic Coastal Plain and found coastal wetlands to be scarce but intensively used by birds. They recommended that oil-related activities be minimized near these wetlands. Regulatory agencies have adopted this recommendation. For example, State of Alaska lease sale guidelines for coastal areas include mitigation measures requiring maintenance of buffers around key wetlands including Class VIII wetlands (the Bergman designation for coastal wetlands). Keiser and Meehan (USFWS undated) wrote that "all of this relatively scarce coastal habitat must be viewed as equally valuable bird habitat and managed conservatively."

There is widespread agreement that coastal habitats may be extensively used by arctic birds and/or may have different use patterns than inland areas. However, there is little consistency in the use of the term *coastal* by various authors. *Coastal* is used both as a specific and relative term. *Coastal* can be used very specifically to refer to littoral habitats along the Beaufort Sea (Connors 1981, Andres 1989) or salt-influenced areas (Keiser and Meehan undated). Alternatively, coastal habitats can be viewed more broadly to include all areas close to the Beaufort Sea, defined either by some distance criterion or by some other measure, for example, elevation or temperature. Temperature gradients along the Beaufort Sea coast are steep within a band about 5–7 km wide (Walker et al. 1980). Cantlon (1961) referred to the cold maritime tundra, defined as within the 7°C July normal isotherm, as "littoral tundra." In the Prudhoe Bay area this band includes most areas north of the Deadhorse airport; i.e., most of the Prudhoe Bay oil field. On an even broader scale, all of the Arctic Coastal Plain is by definition coastal. The coastal plain is of variable width, but in the central Beaufort region it extends farther inland and thus completely encompasses the Prudhoe Bay oil field. This broad definition may be the most applicable in discussions of the importance of coastal areas for breeding birds or movements of post-breeding shorebirds from foothill nesting areas to coastal areas. In the context of evaluating oil field areas and the influence of oil fields on birds, any or all of these definitions may be appropriate depending on the application.

Little quantitative sampling of bird use of strictly coastal habitats (areas under saline influence or adjacent to the Beaufort Sea) has taken place. Both Bergman et al. (1977) and Keiser and Meehan (undated) noted that the existing data base was limited. They recommended additional studies to differentiate among types of coastal habitats and to describe use patterns of a broader array of bird species than included in Bergman et al.'s study.

In 1991, Troy Ecological Research Associates, under contract to BP Exploration (Alaska) Inc., initiated the present study to characterize those areas adjacent to the Beaufort Sea in order to augment our understanding of bird distribution and abundance within the Prudhoe Bay area oil fields. Areas unique to the coast, such as those influenced by salt water, received special attention. The inland extent of the coastal area, by necessity, remains imprecisely defined. Our sampling is concentrated in the unambiguous areas in proximity of the coastline (usually <1 km, somewhat greater where low relief and river channels permit salt water intrusions farther inland). By comparison with other studies, we hope to derive a better working definition of *coastal* based on bird use.

Our primary objectives were to describe bird use of three types of coastal habitats and to contrast bird use of coastal areas with areas farther inland. Specifically our purpose was to:

- Document bird use of wet saline tundra (salt marsh) habitat,
- Compare bird use of wet saline tundra and adjacent nonsaline wetlands, and
- Document use of dry coastal habitats including coastal bluff and stabilized dunes.

Coastal wetlands as defined by Bergman et al. (1977) include all habitats bordering the Beaufort Sea that are influenced by salt water. This broad definition includes coastal lagoons, ponds, barren flats, and tundra with a characteristic vegetation dominated by *Carex subspathacea* and *Puccinellia phryganodes*. This latter type, identified as *wet saline tundra* on the Webber-Walker geobotanical maps (Everett et al. 1981), is the type of coastal wetland that we emphasized in our sampling. These habitats appear to be intensively used by brood-rearing geese, especially Brant (Bergman et al. 1977, Murphy et al. 1988) and to a lesser degree Snow Geese (Burgess and Ritchie 1987) and some species of post-breeding shorebirds (Bergman et al. 1977, Connors et al. 1979, Andres 1989). Due to the nesting failure of most Brant and Snow Geese in the Prudhoe Bay area during 1991 (Johnson 1991, Stickney et al. 1992), few data were collected pertaining to brood use of coastal habitats. We anticipate collecting additional data on this topic in 1992.

Our sampling of *nonsaline tundra* was to permit comparison of bird use of saline wet tundra and the adjacent tundra that was not salt influenced. The reason we want to make this comparison is to determine if there is a special attribute of salt-influenced tundra over tundra situated along the coast. The perceived importance of salt marshes results from frequent observations of brood-rearing geese in these habitats. Flightless geese tend to remain near escape habitat, usually large water bodies. For geese nesting along the Beaufort Sea coast, especially those that nested on coastal islands, as do most Brant and Snow Geese in the Prudhoe Bay area, low-relief wetlands close to the water are most probably saline habitats. This does not mean that being saline is a preferred habitat; indeed, if a choice was present, the converse could be true. For example, although Brant are probably considered the goose species most associated with salt marshes, their major molting area near Teshekpuk Lake is in freshwater habitat. Snow Goose brood-rearing areas near the Endicott development include wet (nonsaline) tundra as well as salt marshes (Burgess and Ritchie 1987). Therefore, we wish to compare salt and nonsalt-influenced tundra adjacent to the coast. The distribution of nonsaline plots was similar to the saline-influenced plots in an attempt to maximize similarity by all other criteria.

From a regulatory perspective, virtually the entire coastal plain is considered wetland. During the permitting phase of oil field development attempts are made to avoid wetland types that have been assigned high value by resource and regulatory agencies. The importance of wetlands and resulting attempts to avoid them have resulted in a disproportionate amount of facility construction in drier habitats. Despite the preponderance of concerns regarding *Arctophila* wetlands, drained lake basins, and coastal tundra, dry tundras are probably the rarest types of tundra on the Arctic Coastal Plain. Dry tundra comprises 0.6 to 2.0 percent of the Prudhoe Bay area, depending on the particular area sampled (Walker et al. 1983). In addition to being rare, dry habitats appear to be preferred by some species of nesting birds such as Lesser Golden-Plover and Buff-breasted Sandpiper. These species might be adversely affected by habitat losses caused by the focus on protecting wet and aquatic tundra types. The third group of plots, those sampling *dry coastal habitats*, were sampled to evaluate the importance of these rare habitats. We sampled coastal bluffs (Heald Point) and stabilized dunes (Heald Pt./East Dock area and in the Sagavanirktok delta) to maximize the representation of dry tundra in these plots.

This study monitors population trends of the entire tundra bird community. For simplicity in reporting and in realization of the limits of the statistical tests, data summaries are provided for only the ten most numerous species based on nest records in the Prudhoe Bay area (Table 1). The sampling intensity for this study is such that some of the less common species, especially their nests, are infrequently encountered, and their densities are preliminary. As more data are acquired, the reliability of the estimates will improve. The focus species selected are those monitored in detail as part of the

Table 1. Focus species for analyses and reporting.

Code	Common Name	Scientific Name
KIEI	King Eider	*Somateria spectabilis*
LGPL	Lesser Golden-Plover	*Pluvialis dominica*
SESA	Semipalmated Sandpiper	*Calidris pusilla*
PESA	Pectoral Sandpiper	*C. melanotos*
DUNL	Dunlin	*C. alpina*
STSA	Stilt Sandpiper	*C. himantopus*
BBSA	Buff-breasted Sandpiper	*Tryngites subruficollis*
RNPH	Red-necked Phalarope	*Phalaropus lobatus*
REPH	Red Phalarope	*P. fulicaria*
LALO	Lapland Longspur	*Calcarius lapponicus*

population trend monitoring in the Pt. McIntyre Reference Area (PMRA); these are thought to represent the numerically dominant breeding birds in the Prudhoe Bay area (TERA 1991).

METHODS

Field Methods

A total of 30 study plots similar in design to those used in most of our North Slope studies (e.g., TERA 1992a) were sampled (Fig. 1). Study plot locations are in three areas: the Sagavanirktok delta adjacent to the Endicott Road, Heald Pt./East Dock area, and the West Dock/Pt. McIntyre area. The plot design and sampling of these plots were the same as for the ten PMRA study plots that provide comparative information for this study.

The 30 coastal plots are distributed such that there are 10 plots in each of three general habitat classes:

- Wet saline tundra,
- Nonsaline coastal tundra, and
- Dry coastal tundra.

Plots were censused following the same procedures used in similar studies we have conducted (see TERA 1992a for details). The primary sampling methods were:

Search—A single observer walked slowly through the plot in a zigzag pattern, making four passes (a "W") through each grid. One side of the plot (even- or odd-numbered grids) was completed before the observer continued down the other side to the starting point. The "W" pattern was reduced to a "V" during census periods when nesting was unlikely (e.g., during August post-breeding censuses). The location, behavior, sex, age, and habitat of all birds seen on the plot were recorded. Attempts were made to locate any nests suspected to be present because of a bird's behavior.

Rope drag—Two observers, one walking the centerline and the other the outside edge of the plot, dragged a rope over the tundra, flushing birds from nests. The two biologists walked up one side of the centerline before returning down the other side to the starting point. Nests located were recorded as above.

The census schedule provided near periodic sampling from early June through late August (Table 2). All these visits are used in the report to summarize seasonal trends in use of coastal habitats. Census Periods 2 through 5 (early June, mid-June, late June/early July, and mid-July) span most of the nesting season and comprise the core of the tundra bird studies. Rope drags of each plot have been made during Census Periods 3 and 4, which encompass most of the incubation interval. Results from these four visits, averaged to provide a single value, are used to characterize breeding-season use. Similarly, results of Census Periods 8, 9, and 10 were averaged to provide a density for the brood-rearing season, and Census Periods 6 and 7 were averaged to provide a density for the post-breeding season.

Additional visits were scheduled to check nests, and as hatch dates grew closer, an attempt was made to visit the plots at least every other day.

Table 2. Plot census periods for the Coastal Tundra study.

	Period	Dates	Activity
1	Melt	1–8 June	Plot setup and maintenance
2	Early June	9–13 June	Nesting—Census
3	Mid-June	15–27 June	Nesting—Rope Drag
4	Late June – early July	1 July –10 July	Nesting—Census, Rope-Drag
5	Mid July	11–18 July	Nesting—Census
8	Mid July	19–25 July	Brood-rearing—Census
9	Late July	26 July – 1 August	Brood-rearing—Census
10	Early August	2–9 August	Brood-rearing—Census
6	Mid August	10–16 August	Post-breeding—Census
7	Late-August	15–23 August	Post-breeding—Census
11	End-August	24–29 August	Post-breeding—Census

Analyses

This study is primarily a descriptive one designed to document bird use patterns of coastal habitats through the summer. Coastal tundra, especially saline tundra, is perceived to be disproportionately important to birds; therefore, our focus is on comparing bird use of the various types of coastal tundra. Comparisons among habitat types are done using the Kruskal-Wallis test. This test evaluates the hypothesis that whichever measure—nest density, breeding-season density, brood-rearing density, or post-breeding-season density—is the same in all four habitat classes (PMRA, Saline, Nonsaline, Dry). Results of tests were considered significant based on a criterion of $\alpha = 0.05$.

The analyses are intended to address the following questions:

- Do coastal habitats support higher densities of birds than non-coastal habitats?
- Are saline habitats used by higher densities of birds than nonsaline habitats?
- Are wet coastal habitats used by higher densities of birds than dry coastal habitats?

To provide additional information describing differential use by birds of coastal vs. inland areas, and to determine if there is a coastal band affecting bird distribution, comparisons were made among all study plots we have sampled in the Prudhoe Bay area since 1981. In previous studies we have suspected that underlying geographic gradients along both coastal-inland and east-west axes were influencing our plot densities (Troy 1991, TERA 1992b). Stepwise regression analyses were used to attempt to determine if gradients were present and to isolate the relative importance of coastal and east-west influences. Each plot was characterized by the density of each focus species, its distance from the coast, and its position on an east-west gradient. In the case of plots sampled in multiple years (e.g., the PMRA plots), the average density over all years was used. The distance to the coast was the shortest distance from the centroid of the plot to the coast. The east-west position was measured from the plot centroid to a north-south line (UTM) west of all plots (near Z-Pad) near the westernmost boundary of the Prudhoe Bay oil field.

Stepwise regression routines select variables based on ANOVA results; therefore, testing for significance of the resultant model is circular and the associated probabilities unreliable. Selection of either distance (from coast or from the east) is taken as evidence of a gradient in densities and the order of selection as indicative of the relative importance of the two potential gradients.

RESULTS

Nesting

Species Composition

Most nests found on the coastal plots were of the species typical of the Prudhoe Bay region as a whole. Semipalmated Sandpiper and Lapland Longspur dominated the nesting community as typically found in the region. The species composition of the coastal plots appears to exhibit some differences in the relative importance of species as compared to the overall composition of the Prudhoe Bay area (Fig. 2). Species proportionately more frequent on the coastal plots than expected based on other studies included Baird's Sandpiper, Ruddy Turnstone, and to a lesser extent, Oldsquaw. In contrast, Stilt Sandpiper, Buff-breasted

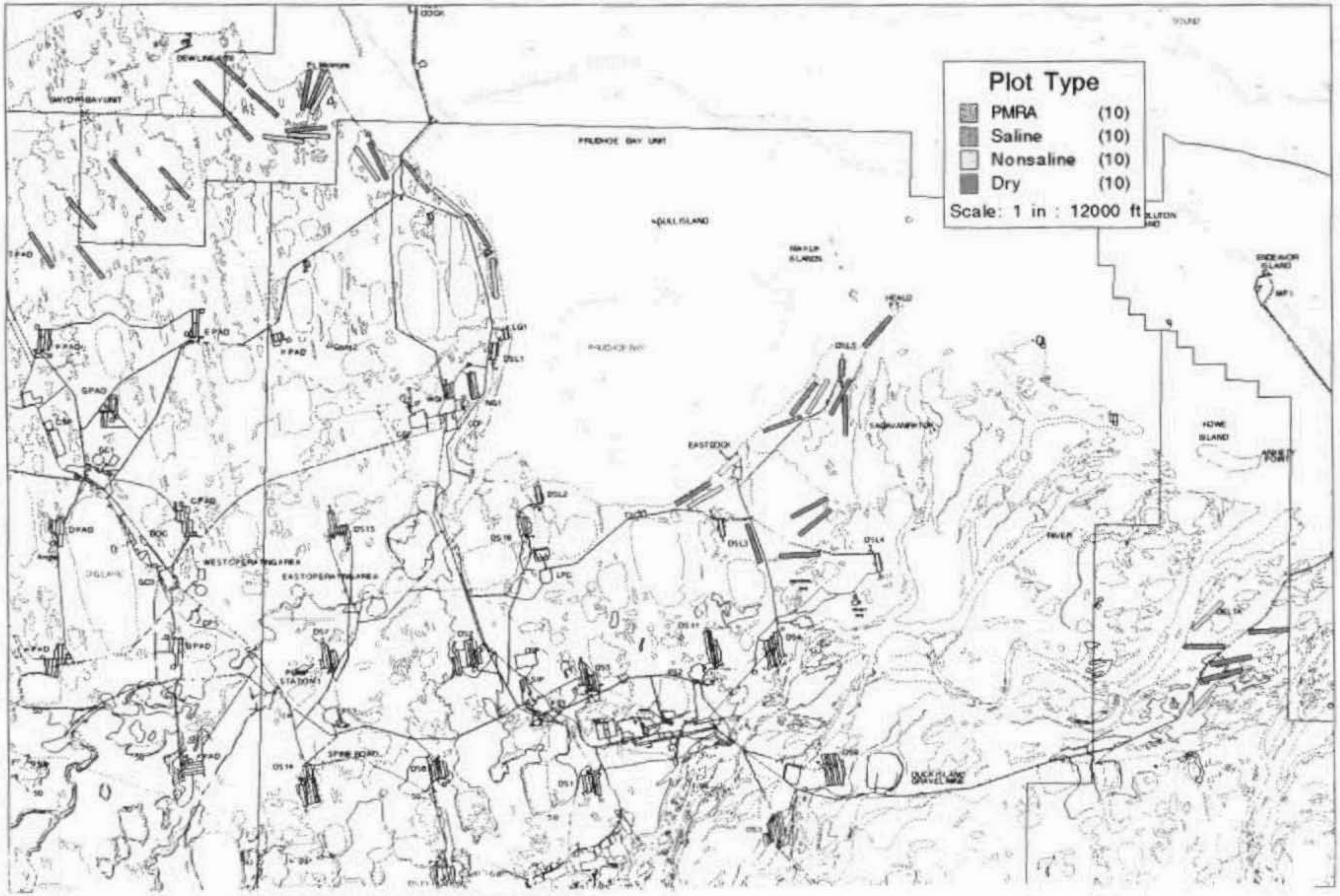

Figure 1. Locations of study plots sampled for the Coastal Tundra Study.

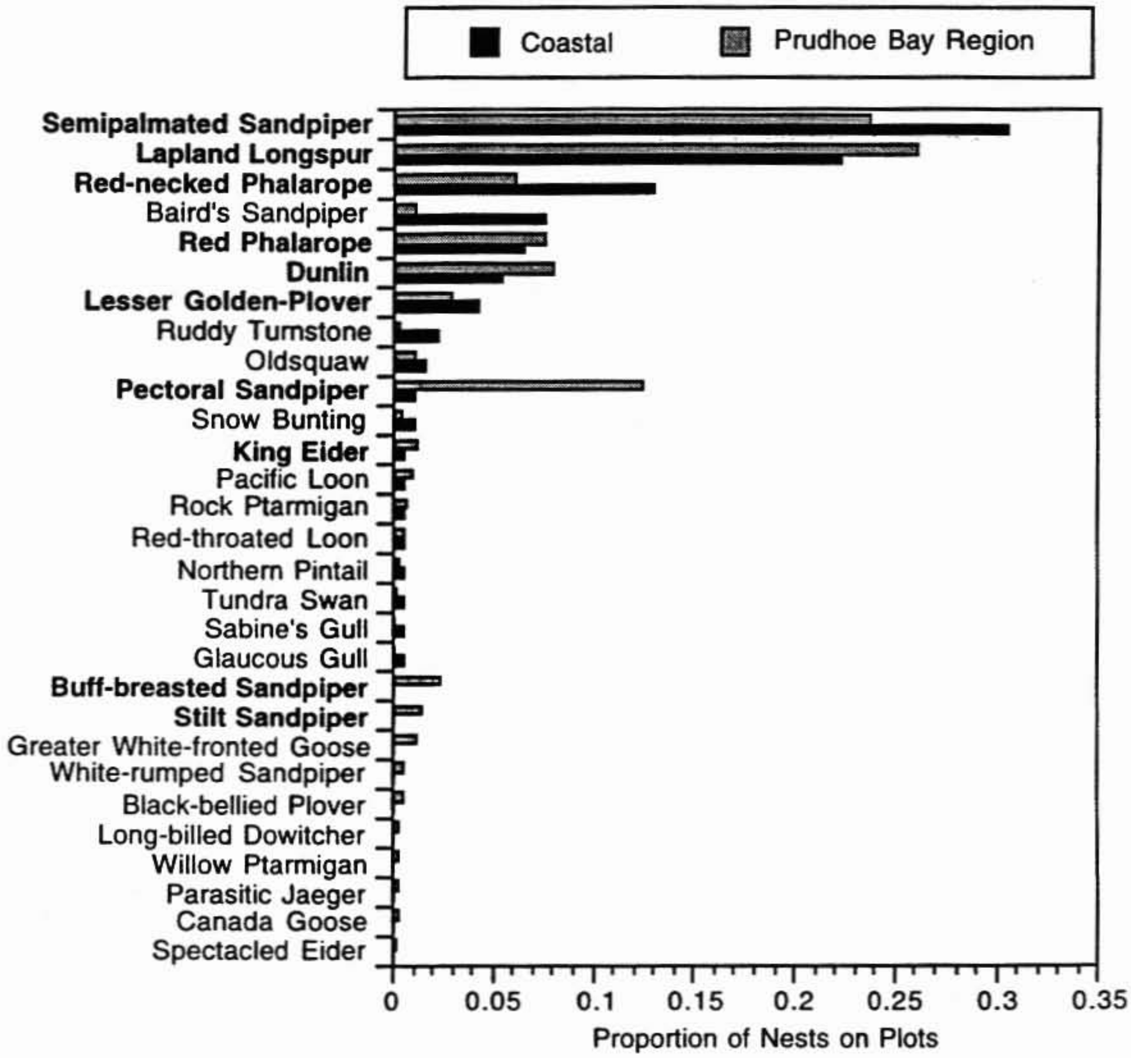

Figure 2. Species composition of birds nesting on coastal plots in comparison to the Prudhoe Bay area tundra bird community (from TERA 1992a). Species are listed in decreasing order of abundance on coastal plots. Species shown in boldface are the species detailed in the analyses.

Sandpiper, King Eider, and especially Pectoral Sandpiper were of lesser importance than generally found in the Prudhoe Bay area. As this investigation continues, we will see if these differences persist as more data are accumulated and the species composition is more accurately described.

Densities

Nest densities of the key study species are shown by plot type in Table 3. More species reached their peak abundance in the PMRA (five) than in any other habitat. However, nonsaline plots had the highest density of almost as many species (four), and had a higher total density due to the extremely high density of Semipalmated Sandpiper. No key species had its peak abundance on saline or dry plots; indeed, most species had their lowest densities on dry plots.

Statistically significant differences in use of the plot types were found for Semipalmated Sandpiper and Lapland Longspur (Table 4, Fig. 3). Semipalmated Sandpiper nest density was markedly higher on nonsaline plots than any other type (Table 3). The lowest densities were found on dry plots and in the PMRA. (Although the mean density in these two plot types was the same, the median densities indicate higher use of the PMRA than dry plots.) Lapland Longspur density was also highest on nonsaline plots, although only slightly higher than in the PMRA (Table 3). The lowest density was found on saline plots.

Seasonal Use

Trends Over the Entire Summer

Seasonal abundance of the key species is summarized by plot type in Figure 4. These data reveal several

Table 3. Nest densities (nests/km²) in coastal habitats and in the PMRA.

Species	PMRA	Saline	Nonsaline	Dry
King Eider	2	0	1	0
Lesser Golden-Plover	4	2	4	2
Semipalmated Sandpiper	10	19	36	10
Pectoral Sandpiper	6	1	1	0
Dunlin	8	5	5	0
Stilt Sandpiper	3	0	0	0
Buff-breasted Sandpiper	1	0	0	0
Red-necked Phalarope	2	11	12	1
Red Phalarope	6	4	8	0
Lapland Longspur	22	8	23	10

Table 4. Test results of Kruskal-Wallis analyses for among-areas differences in nest density. In all cases the degrees of freedom for the test statistics are 3 (four areas – 1). H is the Kruskal-Wallis test statistic. Significant test results are shown in boldface.

Species	H	p	Comments
King Eider	0.293	0.9613	
Lesser Golden-Plover	1.171	0.76	
Semipalmated Sandpiper	16.393	**0.0009**	High in nonsaline, low in dry
Pectoral Sandpiper	4.435	0.2181	
Dunlin	7.582	0.0555	
Stilt Sandpiper	0.878	0.8307	
Buff-breasted Sandpiper	0.22	0.9744	
Red-necked Phalarope	4.674	0.1973	
Red Phalarope	4.926	0.1773	
Lapland Longspur	12.58	**0.0056**	High in PMRA & nonsaline

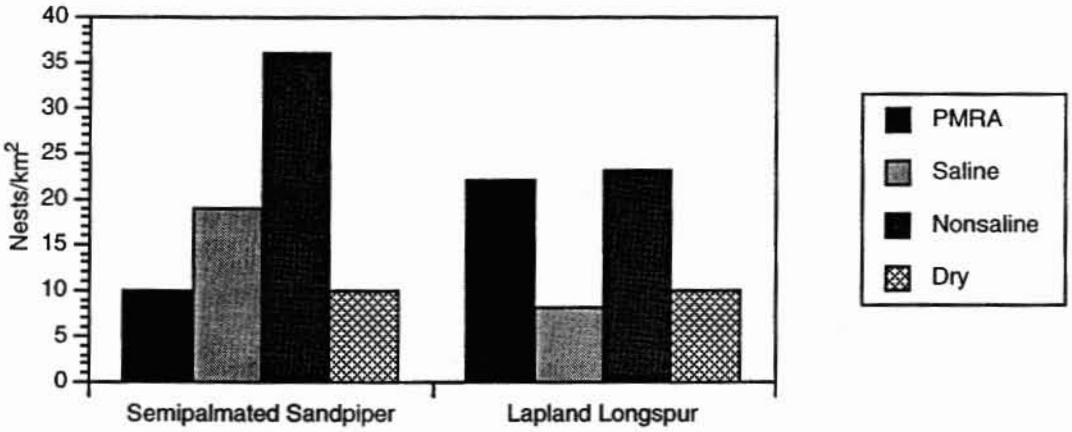

Figure 3. Nest densities of the two species, Semipalmated Sandpiper and Lapland Longspur, having significant differences in density among plot types.

patterns of seasonal use of the study plots. Change in species composition over the course of the summer is demonstrated by the marked diminution in abundance of Semipalmated Sandpiper after mid-July. However, post-breeding-season abundance of Stilt Sandpiper and Buff-breasted Sandpiper was much greater than during the breeding season.

King Eider was the only species that had it peak abundance in midsummer (second half of July). At this time most King Eiders were found on the nonsaline plots. Several patterns were exhibited by the shorebirds, with peaks in use occurring in any combination of early season (nesting), late July (adult migration), or mid-August (mostly juvenile migrants). Dry plots were widely used by shorebirds only during migration, especially by Lesser Golden-Plover, Dunlin, and Buff-breasted Sandpiper. Saline plots received some use throughout the summer but never supported high densities of shorebirds relative to other types of tundra. The species making the greatest use of saline plots were post-breeding Stilt Sandpiper and both species of phalaropes (especially post-breeding Red-necked Phalarope). Nonsaline plots were used by most study species, with the greatest use by Semipalmated Sandpiper and Pectoral Sandpiper. Use of nonsaline plots appears to be proportional to the abundance of these species; i.e., there did not appear to be habitat-specific variations in abundance on nonsaline plots such as the intermittent peaks in use of dry and saline plots.

All species of shorebirds used the PMRA during the breeding season, but post-breeding-season presence on these plots was species specific. Some species, such as Lesser Golden-Plover, Buff-breasted Sandpiper, and especially Semipalmated Sandpiper decreased in abundance as the summer progressed. Pectoral Sandpiper, in contrast, made increased use of the PMRA during the post-breeding season.

Lapland Longspur density was highest during the breeding season. The highest densities were in the PMRA and on the nonsaline plots. Abundance decreased in mid-July but increased during the post-breeding season to levels somewhat lower than the breeding season peak. During the post-breeding season many species shifted from use of the PMRA and nonsaline plots onto saline plots.

Breeding Season

Tests for differences in habitat use during the breeding season were based on average number of birds recorded during the four breeding-season cen-

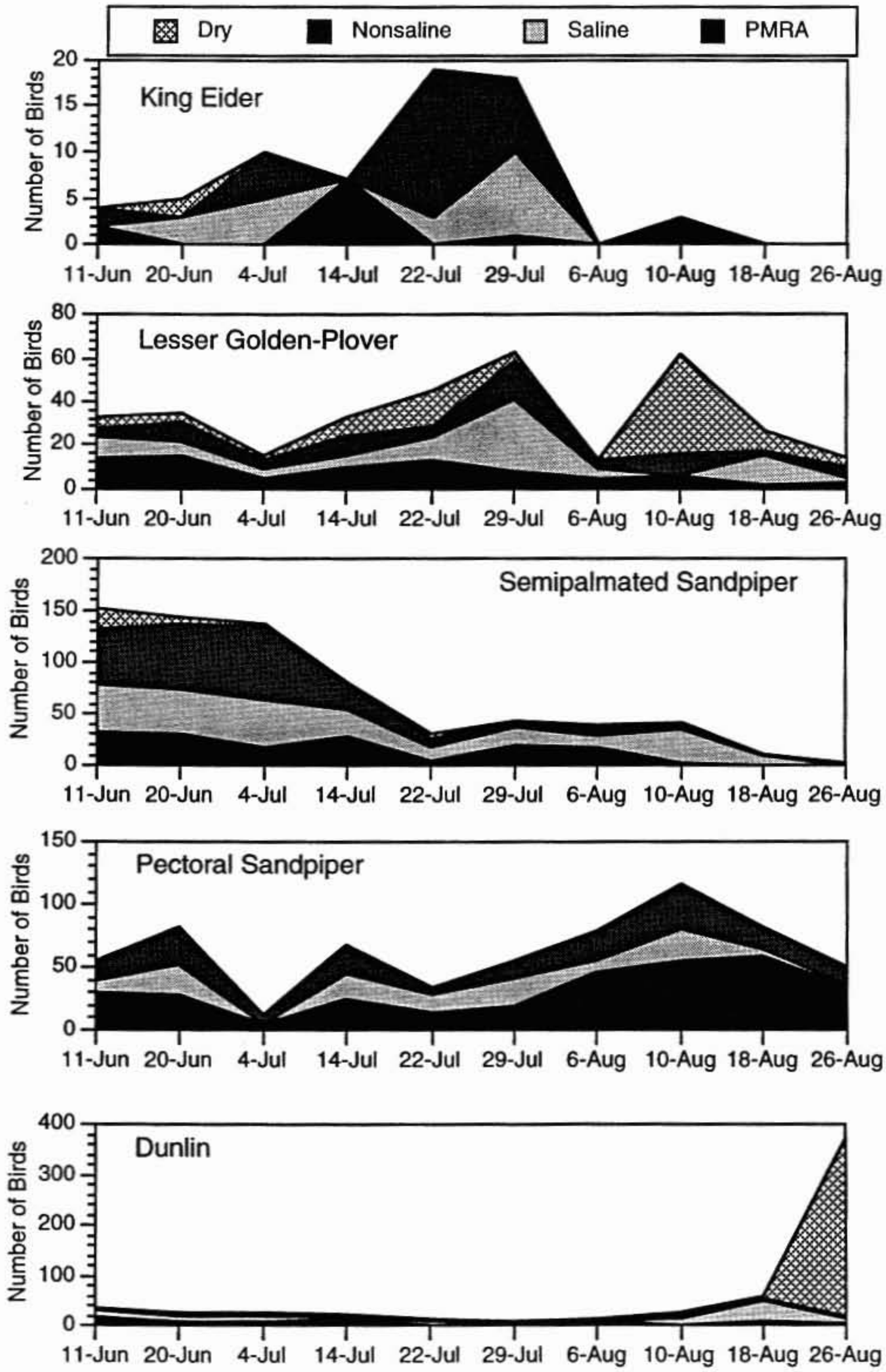

Figure 4. Seasonal abundance of birds by plot type.

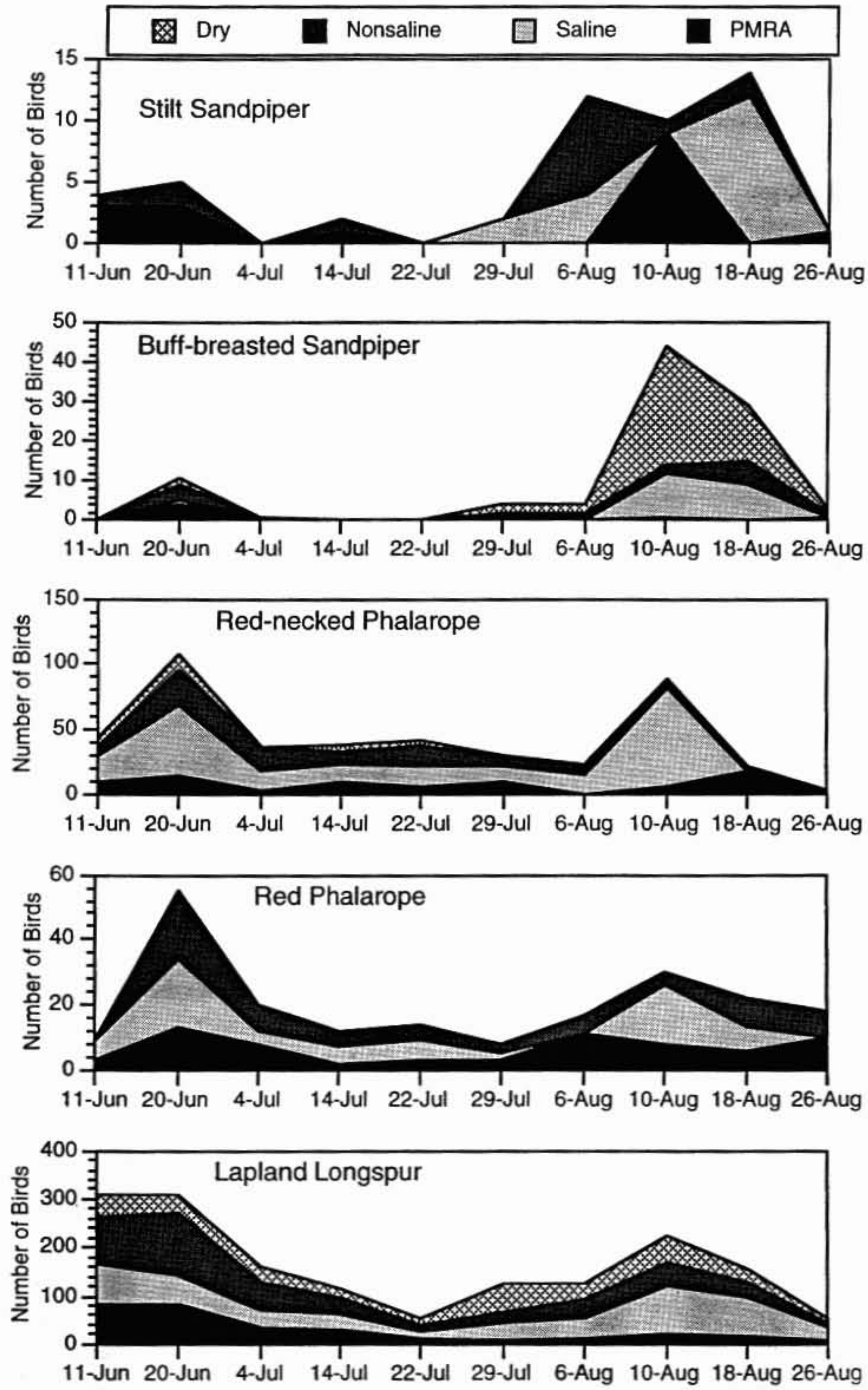

Figure 4. Continued.

Table 5. Average breeding-season density (#/km²) of birds in coastal habitats and the PMRA.

Species	PMRA	Saline	Nonsaline	Dry
King Eider	2.2	2.0	1.8	0.5
Lesser Golden-Plover	11.0	6.0	6.8	5.2
Semipalmated Sandpiper	27.5	40.2	53.5	7.2
Pectoral Sandpiper	22.8	12.5	18.2	1.8
Dunlin	14.5	9.2	6.0	0.0
Stilt Sandpiper	1.8	0.0	1.0	0.0
Buff-breasted Sandpiper	1.2	0.2	1.0	0.5
Red-necked Phalarope	9.0	26.0	15.2	6.5
Red Phalarope	6.5	9.0	8.2	0.2
Lapland Longspur	58.5	51.2	82.5	31.5

Table 6. Test results of Kruskal-Wallis analyses for among-year changes in breeding-season bird density (d.f. = 3). "H" is the Kruskal-Wallis test statistic.

Species	H	p	Comments
King Eider	0.552	0.9073	
Lesser Golden-Plover	5.613	0.132	
Semipalmated Sandpiper	17.652	**0.005**	Low use of dry
Pectoral Sandpiper	13.07	**0.0045**	Low use of dry
Dunlin	19.32	**0.0002**	Low use of dry; high use of PMRA
Stilt Sandpiper	5.298	0.1512	
Buff-breasted Sandpiper	0.718	0.8689	
Red-necked Phalarope	6.412	0.0932	
Red Phalarope	7.972	**0.0466**	Low use of dry
Lapland Longspur	17.649	**0.0005**	Low use of dry; high use of nonsaline

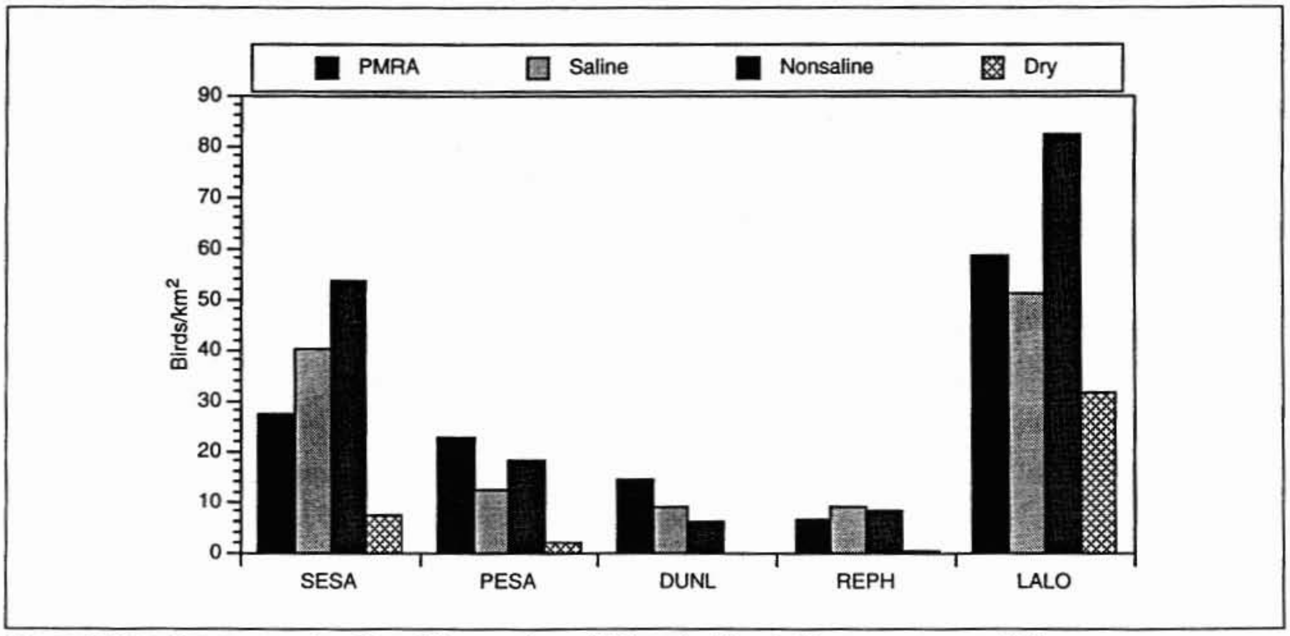

Figure 5. Breeding-season densities of the species exhibiting significant differences among plot type.