AVIAN SURVEYS OF EXPLORATION SITES IN THE NATIONAL PETROLEUM RESERVE–ALASKA, 2001

FINAL REPORT

Prepared for

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INTRODUCTION

During the summer of 2001, ABR, Inc. conducted aerial surveys for important waterfowl in an area encompassing multiple sites that were proposed for oil exploration by PHILLIPS Alaska, Inc.(PHILLIPS). These surveys were designed to gather initial avian data on these new sites and identify wildlife resources that potentially could be affected by oil development. This report summarizes information for the sites where PHILLIPS proposes to conduct exploration drilling during the winter of 2001–2002 in the National Petroleum Reserve–Alaska (NPR–A).

As part of long-term monitoring of avian species in the oilfields, ABR has been studying the distribution, abundance, and productivity of Spectacled Eiders (*Somateria fischeri*), Tundra Swans (*Cygnus columbianus*), and other waterfowl that annually use the Arctic Coastal Plain during summer (see Murphy and Anderson 1993, Stickney et al. 1993, Anderson et al. 2001). As the oilfields have expanded westward into the Colville River Delta, these same species have been monitored to determine baseline populations prior to oil exploration activities and any subsequent oilfield development (Smith et al. 1994, Johnson et al. 1999). In 1999, ARCO Alaska, Inc. (ARCO), purchased leases in the NPR–A, and in preparation for exploration activities in NPR–A in winter 1999–2000, ARCO initiated waterfowl surveys to evaluate the distribution and abundance of important breeding species in the vicinity of the lease blocks (Anderson and Johnson 1999). Prior to the exploration program in winter 2000–2001, PHILLIPS, which purchased all of ARCO's NPR–A leases, requested that additional sites in NPR–A be surveyed (Murphy and Stickney 2000). Eiders and Tundra Swans were selected as the focus of these surveys, because of their special status (threatened status for Spectacled and Steller's [*Polysticta stelleri*] eiders) or their interest to management agencies (Tundra Swans). The goals of these surveys in 2001 were to determine the distribution, abundance, and productivity of selected avian species in a broad area spanning exploration sites proposed for drilling during winter 2001–2002 in the northeastern planning area of the NPR–A. A more detailed study covering a broader range of species was conducted concurrently in a portion of this survey area that is proposed for development (henceforth, development area); the purpose of that study was to evaluate the use of the area by important wildlife species for development planning (Burgess et al., in prep). We had three specific objectives for the exploration surveys:

- determine the abundance and distribution of eiders (primarily Spectacled Eiders, but also any Steller's and King eiders present in the survey area) during pre-nesting;
- locate eider nests that were near exploration sites, focusing primarily on searching areas and habitats used by pre-nesting Spectacled Eiders; and
- locate and count Tundra Swan nests, adults, and broods and determine annual productivity.

BACKGROUND

Although our surveys focused primarily on Spectacled Eiders, Steller's Eiders, and Tundra Swans, other tundra-nesting species, such as King Eider and Brant, also were recorded opportunistically during our field activities. The following section provides an overview of the agency concerns regarding these species and aspects of their life history that are relevant to development planning.

SPECTACLED EIDER

The Spectacled Eider population in Alaska has declined substantially in recent years, primarily on the Yukon-Kuskokwim Delta, and was listed by U.S. Fish and Wildlife Service (USFWS) as "threatened" under the Endangered Species Act on 10 June 1993 (58 FR 27474-27480). This special status mandates habitat protection on their breeding grounds in areas of development and in areas of oil exploration, such as within the NPR–A. Recent surveys estimate the current northern breeding population of Spectacled Eiders to be at least 6,000–7,000 birds (Larned et al. 2001). These recent surveys also suggest that the Arctic Coastal Plain now supports the main breeding population of Spectacled Eiders in Alaska (USFWS 1996).

Spectacled Eiders are uncommon nesters (i.e., they occur regularly but are not found in all suitable habitats) on Alaska's Arctic Coastal Plain, and tend to concentrate on large river deltas

(Johnson and Herter 1989). Their breeding range extends east to Bullen Point and Barter Island, near the western edge of the Arctic National Wildlife Refuge. Derksen et al. (1981) described them as common breeders in the NPR–A, but uncommon east of there at Storkersen Point. Recent studies have shown, however, that Spectacled Eiders also are relatively frequent breeders in the Prudhoe Bay and Kuparuk oilfields and on the Colville River Delta, although they do not use all the available habitat (TERA 1996, Johnson et al. 2000, Anderson et al. 2001).

Spectacled Eiders arrive on the coastal plain in late May and initiate nests by mid-June (Warnock and Troy 1992, Anderson and Cooper 1994). Males do not participate in incubation or rearing of young and leave the area by late June. Eggs begin hatching in mid-July, and brood-rearing continues until late August or early September, when the young can fly. Spectacled Eider broods have been seen in the Prudhoe Bay area until late August (TERA 1996). No data are available on departure dates from the Arctic Coastal Plain, but most birds probably leave by mid-September, when lakes and ponds begin to freeze. Pre-nesting habitats used by Spectacled Eiders vary somewhat among areas, but observations suggest that eiders primarily use open water, including both flooded tundra and permanent waterbodies, as well as salt-affected habitats, particularly on the Colville Delta (Johnson et al. 2000, Anderson et al. 2001). Nesting Spectacled Eiders also use a variety of habitats including Aquatic Sedge Marsh, Aquatic Sedge with Deep Polygons, Wet Sedge–Willow Meadow, Salt-killed Tundra, Brackish Water, Basin Wetland Complexes, and Nonpatterned Wet Meadow (Johnson et al. 2000, Anderson et al. 2001).

STELLER'S EIDER

The breeding population of Steller's Eider in Alaska was listed as threatened in 1997 (62 FR 31748) because it declined substantially in recent years (Kertell 1991, Quakenbush and Cochrane 1993). Steller's Eiders have essentially disappeared from the Yukon-Kuskokwim Delta, and the breeding range has contracted elsewhere in Alaska, likely contributing to the overall population decline. On the Arctic Coastal Plain, Steller's Eiders historically nested across most or all of the coastal plain (Kertell 1991, Quakenbush and Cochrane 1993), but currently, they nest primarily around Barrow, although the total breeding range probably extends from Point Lay to near the Colville River Delta (Day et al. 1995; Quakenbush et al. 1995). The Steller's Eider has been recorded periodically in the Prudhoe Bay, Kuparuk, and Colville River Delta areas (USFWS 1998, ABR unpubl. data).

In arctic Alaska, breeding Steller's Eiders nest and raise broods in areas dominated by low-centered polygons and shallow ponds with emergent grasses and sedges, flooded tundra (i.e., wet meadows), lakes, and drained lake basins; presence of emergent plants seems to be important during brood-rearing (Quakenbush and Cochrane 1993). In the Barrow area, waterbodies with pendant grass (*Arctophila fulva*) received considerable use (greater than their availability) during the pre-nesting, nesting, and brood-rearing periods (Quakenbush et al. 1995). Timing of breeding activities for Steller's Eiders is similar to that of other eiders.

KING EIDER

Although King Eiders are not listed as threatened in Alaska, their breeding population does appear to be declining at the eastern edges of their breeding range (primarily in western Canada) (Dickson et al. 1997). King Eiders nest in high densities in the Prudhoe Bay area (Troy 1988) and at Storkersen Point (Bergman et al. 1977). In the late 1970s, Derksen et al. (1981) suggested that King Eider densities appeared to decline west of the Colville River, but BLM (1998) reported that some of the highest densities of King Eiders on the coastal plain occur in the NPR–A planning area. On the Colville Delta, they are common visitors but uncommon or rare nesters (Simpson et al. 1982, North et al. 1984, Johnson 1995). Nesting phenology is similar to that of the Spectacled Eider, but King Eiders tend to nest in drier tundra habitats farther from waterbodies (Anderson et al. 2000).

TUNDRA SWAN

Tundra Swans are common breeders across the Arctic Coastal Plain of Alaska, and because they are sensitive to human disturbance, they have been used as indicators of the general ecosystem

health within the region (Anderson et al. 1998). Breeding pairs of Tundra Swans mate for life and defend a nesting territory to which they return annually. Because of their fidelity to nesting territories, changes in the distribution and abundance of swans can be used as a measure of the effects of development projects on waterbird populations (King 1973, Ritchie et al. 1990).

Swans begin arriving on the Arctic Coastal Plain while the ground is mostly snow-covered (late-May), and as snow melt progresses, breeding pairs move to territories and begin nesting by early June. After eggs hatch in early July, the family groups remain together during brood-rearing, although they may range widely to find suitable foraging habitat (Johnson and Herter 1989). While the young are flightless, adults molt their flight feathers and become flightless for about 3 weeks. This flightless period is the time when swans are most vulnerable to predators and when broods are sensitive to disturbance. Although brood-rearing swans remain in single family flocks until departure in fall, nonbreeding swans may form large staging flocks of up to several hundred birds during September (Rothe et al. 1983, Smith et al. 1994, Johnson et al. 1998). The young are ready to fledge by mid-to-late September, and fall migration peaks along the Beaufort Sea coast in late September and early October (Johnson and Herter 1989).

BRANT

Brant colonies and brood-rearing areas also have received special consideration during oilfield planning because of declining populations of this species throughout its range in Alaska and the importance of traditional sites for the long-term maintenance of the breeding population. Accordingly, Brant colonies were recorded on an opportunistic basis during the course of our eider and swan surveys. A survey specifically for Brant colonies was conducted in the development area during 2001; the results of the survey and other observations of Brant are reported by Burgess et al. (in prep.).

STUDY AREA

The PHILLIPS exploration area surveyed in 2001 encompassed 15 drill sites proposed for exploration drilling during winter 2001–2002: Hunter A, Hunter 2; Grandview 1; Rendezvous 3; Spark 6, 7, and 8; Lookout 2; Mitre 1; Nova 1 and 2; Tuvaaq 1, 2, and 3; and Pioneer 1 (Figure 1). The area surveyed contains 1,022 km² and is located in the northeastern section of the NPR–A (70º 03'–70º 20' N, 151º 12'–152º 15'W), approximately 16–48 km west of the village of Nuiqsut, Alaska and approximately 125 km west of Prudhoe Bay on the Arctic Coastal Plain of Alaska.

Landforms, vegetation, and wildlife habitats in the northeastern NPR–A were described in the recent Environmental Impact Statement for the lease area (BLM 1998) and are similar to those of the western Kuparuk Oilfield and the Alpine Transportation Corridor (Johnson et al. 1997, Jorgenson et al. 1997). Landforms in the northeastern section of the NPR–A are influenced by the predominately northeastern winds during summer, which produce oriented thaw lakes on the coastal plain (BLM 1998). Vegetative cover within the northeastern NPR–A has been analyzed by satellite imagery (Landsat TM). Large-scale cover classes include water, aquatic (*Carex* or *Arctophila* dominant), flooded tundra (nonpatterned, low-centered polygons), wet tundra, moist tundra (sedge/grass meadow, tussock tundra, moss/lichen), shrub (dwarf, low, tall), and barren ground (sparsely vegetated, dunes/dry sand, other) (BLM 1998).

The climate of the northeastern NPR–A is typical of other coastal areas in the Arctic. Winters are cold and summers are cool; the thaw period lasts only about 90 days during summer (1 June–31 August) and the average summer air temperature is 5º C (43º F; Kuparuk Oilfield records: National Oceanic and Atmospheric Administration, unpubl. data). Mean summer precipitation is under 7.5 cm (3 in), most of which falls as rain in August. The soils are cold and underlain by permafrost, and temperature of the active layer of thawed soil above permafrost ranges from 0 to 10º C (32–50º F) during the growing season.

METHODS

EIDERS

One aerial survey was conducted for breeding pairs of eiders on 11–12 June 2001 following the same methods, although with half the coverage,

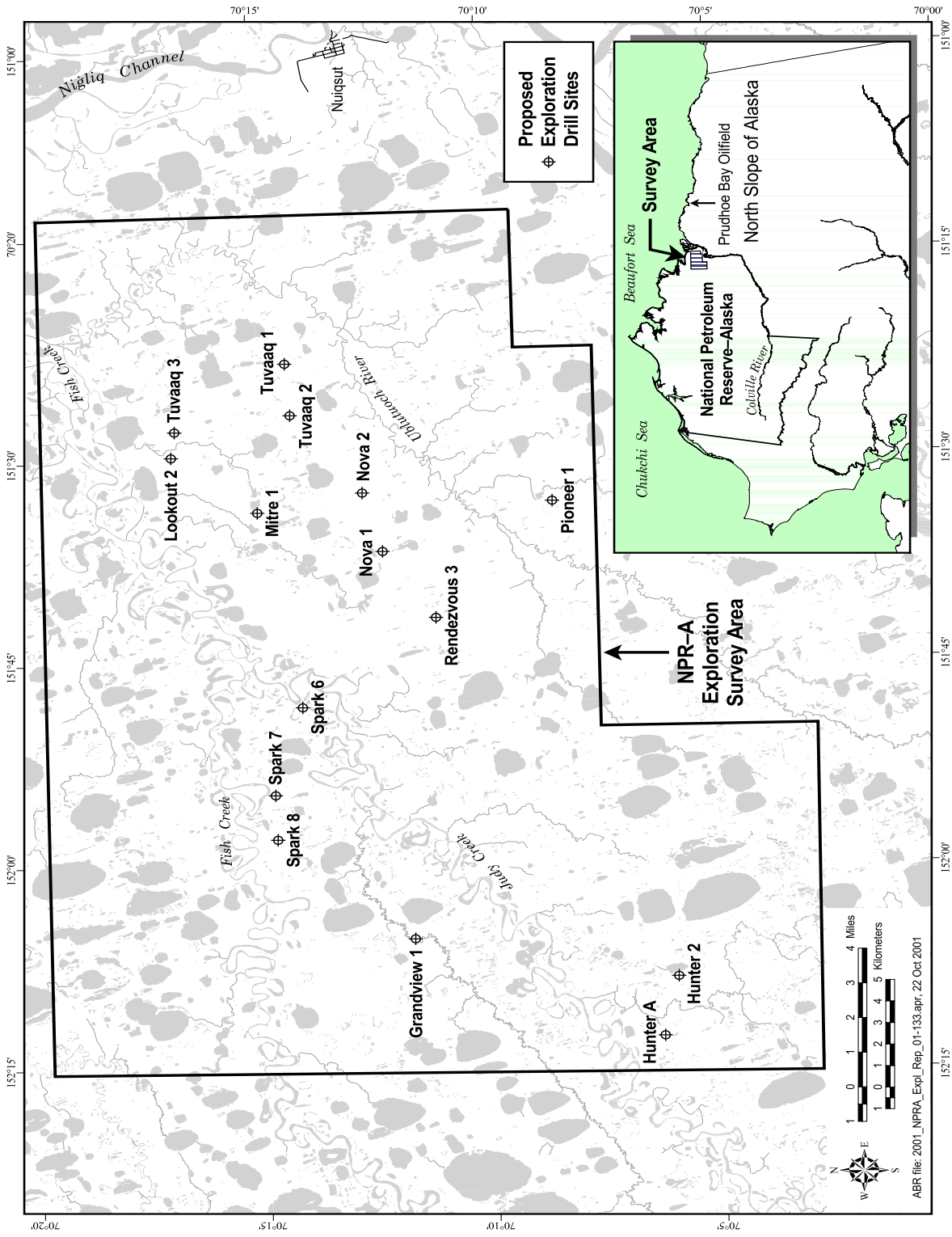

Figure 1. Survey area for avian studies of PHILLIPS' proposed exploration sites in the National Petroleum Reserve–Alaska, June-August 2001.

used previously in NPR–A (Anderson and Johnson 1999, Murphy and Stickney 2000) and on the Colville Delta since 1992 (Smith et al. 1993, 1994; Johnson et al. 1995, 1996, 1997, 1998, 1999, 2000). During the survey, the pilot navigated a Cessna 185 aircraft along east–west transect lines using a global positioning system (GPS) receiver and topographic maps. An observer on each side of the aircraft counted eiders in fixed-width strips (200 m on each side of the aircraft) along transect lines, which were spaced 800 m (~0.5 mi) apart, for 50% coverage of the study area (Figure 2). Observers used marks on the airplane's struts and windows to visually delimit the outer edges of the transect strip (Pennycuick and Western 1972). Flight altitude for each survey was 30–50 m above ground level (agl) and flight speed was approximately 145 km/h. For each observation, observers noted on tape recorders the species of eider, number of each sex, number of identifiable pairs, transect number, and whether the birds were flying or on the ground. Each observer also marked their eider locations on 1:63,360 USGS maps of the study area. We calculated unadjusted densities (i.e., without a sightability correction factor) for eiders based on the total area covered during the survey and calculated the total indicated birds following the procedures of the USFWS survey protocol (Appendix A). All observations were digitized and added to a geographical information system (GIS) database that contains all aerial-survey observations in the adjacent Kuparuk and Colville River areas since 1992.

Because pre-nesting aerial surveys alone are not sufficient for identifying the nesting locations of eiders in tundra areas on the Arctic Coastal Plain, nest searching was conducted where pre-nesting Spectacled Eiders were seen near (≤ 1.6 km) proposed exploration sites. Search methods were identical to those used on the Colville Delta (Johnson et al. 2000). Basins and lakes in the area of the pre-nesting locations were used as boundaries for nest searches.

TUNDRA SWANS

We followed the USFWS Tundra Swan Survey Protocol (USFWS 1987b, 1991) for our aerial surveys of Tundra Swans; these methods were identical to those used previously in NPR–A (Anderson and Johnson 1999, Murphy and Stickney 2000), in the Kuparuk Oilfield (Ritchie et al. 1990, 1991; Stickney et al. 1992, 1993, 1994; Anderson et al. 1995, 1996, 1997, 1998, 1999, 2000, 2001), and on the Colville River Delta (Smith et al. 1993, 1994; Johnson et al. 1996, 1997, 1998, 1999, 2000).

During the aerial surveys, we flew in a Cessna 185 aircraft along fixed-width, east–west transects. Transects were oriented along township and section lines, and all observations were mapped on 1:63,360 USGS maps (Figure 2). The aircraft was maintained at a speed of 145 km/h and at an altitude of 150 m agl. Each of the two observers scanned a strip 800 m wide on his/her side of the aircraft to achieve 100% coverage, while the pilot navigated and scanned ahead of the aircraft. The age (adult or young) and number (single, pair, flock [flock size]) of swans seen and whether the adults were attending a nest or with a brood were recorded on the USGS maps. When observers located a nest, the aircraft left the transect line and circled the nest so that they could plot an accurate location and take photographs with a 35-mm camera of the nest site. During the brood-rearing survey, we used an identical procedure for recording data but did not circle or photograph broods.

In 2001, the nesting survey was flown on 19 June and the brood-rearing survey was flown on 20 August. After each survey, we entered all location data into digital maps (developed from 1:63,360 USGS maps by AeroMap, U.S., Inc.) in a GIS system. Summary statistics for nesting surveys followed the format established for the Kuparuk Oilfield in 1988 and modified in 1990 (Ritchie et al. 1989, 1991), which categorizes adults as either with nests or broods or without nests or broods. The latter two categories include nonbreeding subadults, as well as failed or nonbreeding adults. These individuals will be referred to collectively as "nonbreeders."

RESULTS AND DISCUSSION

EIDERS

SPECTACLED EIDER

During the aerial pre-nesting survey on 11–12 June 2001, 21 Spectacled Eiders were seen, of which one pair was in flight. Most of the

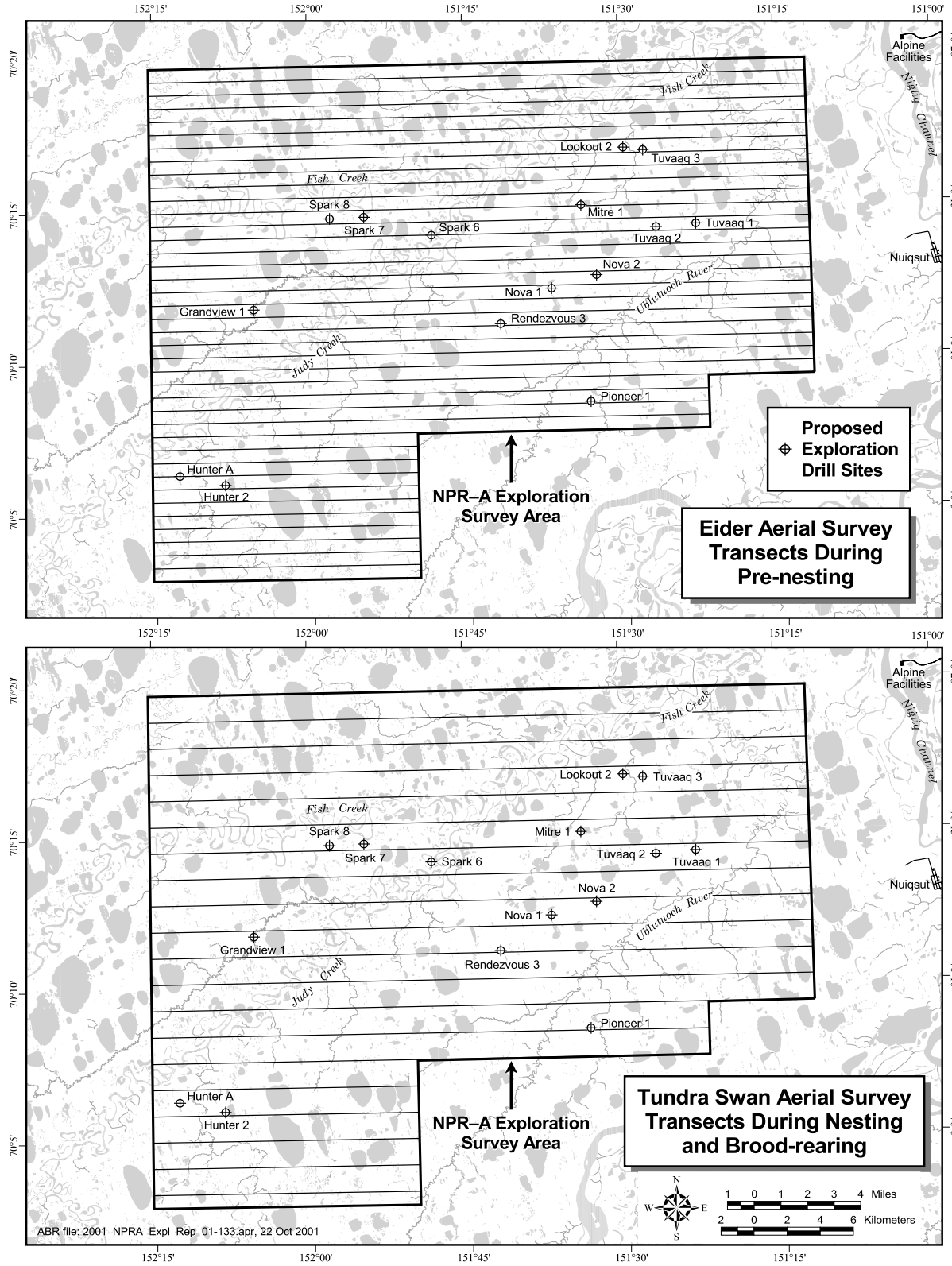

Figure 2. Transect lines of aerial surveys for pre-nesting eiders (above) and for Tundra Swans (both nesting and brood-rearing, below) in PHILLIPS' exploration survey area of the National Petroleum Reserve–Alaska, 2001. Strip transects were 400 m wide for eiders and 1,600 m wide for Tundra Swans.

Spectacled Eiders were located in the northern portion of the exploration survey area (Figure 3). The density of Spectacled Eiders was 0.04 birds/km² (based on total indicated birds) (Table 1), which falls within the range previously reported for this species in northeastern NPR–A (_0.05 birds/km²; BLM 1998; Anderson and Johnson 1999; Murphy and Stickney 2000). This density was lower than that recorded in the adjacent CD North study area on the Colville River Delta in 2001 (0.15 birds/km²; Johnson et al. in prep.), Kuparuk Oilfield in 2000 (0.08 birds/km²; Anderson et al. 2001), and across the Arctic Coastal Plain in 2000 (0.19 birds/km²; Larned et al. 2001). These density comparisons demonstrate that this section of the northeastern NPR–A supports relatively few breeding pairs of Spectacled Eiders and lower densities than found in nearby coastal areas or the developed oilfields to the east, probably due to differences among the areas in availability of suitable habitats.

Only one site, Mitre 1, had a Spectacled Eider in its vicinity (~1.4 km away) during the pre-nesting survey. No Spectacled Eider nests were found there during ground searches, but four King Eider nests were found ~0.6 km from Mitre 1. Only one Spectacled Eider nest (two unidentified eider nests await species identification) was found during nest searching in NPR–A in 2001; this nest was ~8 km north of Spark 7. A full account of nest searches conducted in the development area of NPR–A is provided by Burgess et al. (in prep.).

STELLER'S EIDER

One Steller's Eider male was seen flying in the southwestern portion of the NPR–A exploration survey area during the pre-nesting aerial survey in 2001. Steller's Eiders have been recorded in the general vicinity in the past—one observation to the south of the exploration survey area in 1993 and one to the northeast of the exploration survey area in 1995 (BLM 1998). In 1995, five Steller's Eiders were seen on the outer Colville Delta (J. Bart, Boise State University, pers. comm.), and a pair also was observed on the Colville Delta in 2001 (Johnson et al., in prep.).

KING EIDER

King Eiders were approximately five times more numerous than Spectacled Eiders in the NPR–A exploration survey area during the pre-nesting aerial survey, and they were distributed throughout most of the area (Table 1, Figure 3). The density of King Eiders in the exploration survey area in 2001 was 0.20 birds/km² (based on total indicated birds with flying birds excluded). This density was within the range of densities (0.07–0.47 birds/km²) previously reported for the NPR–A planning area (BLM 1998). The density in the NPR–A exploration survey area was lower than densities in the Kuparuk Oilfield in 2000 (0.35 birds/km²; Anderson et al. 2001) and the Alpine Transportation Corridor in 1997 (0.47 birds/km²; Johnson et al. 1998), but higher than that in the CD North area on the Colville River Delta in 2001 (0.08 birds/km²; Johnson et al., in prep.). Density maps in BLM (1998) indicate that the highest densities (1.0–4.32 birds/km²) of King Eiders in the northeastern NPR–A are east of Teshekpuk Lake. Therefore, the NPR–A exploration survey area appears to support higher numbers of King Eiders than the Colville Delta, but not at the levels found east of the Colville River or farther north in NPR–A.

TUNDRA SWANS

NESTING

During the aerial survey for nesting Tundra Swans on 19 June 2001, 56 adults were associated with 32 nests (Table 2). An additional 14 nests (not included in totals or comparisons) were found on the eider aerial survey, and all nests were distributed throughout the NPR–A exploration survey area (Figure 4).

Nest density in the exploration survey area was 0.03 nests/km², similar to the 12-year mean nest density recorded in the Kuparuk Oilfield ($\bar{x}$ = 0.04 nests/km²; range = 0.01–0.05 nests/km²; 1989–2000; Anderson et al. 2001) but half the 8-year mean nest density recorded on the Colville Delta ($\bar{x}$ = 0.06 nests/km²; range = 0.03–0.08 nests/km²; 1992–1993, 1995–1998, and 2000; Johnson et al. 2000). Density of Tundra Swan nests in the exploration survey area also was lower than nest densities recorded on the eastern Arctic Coastal Plain (0.04–0.06 nests/km²; Platte and Brackney 1987).

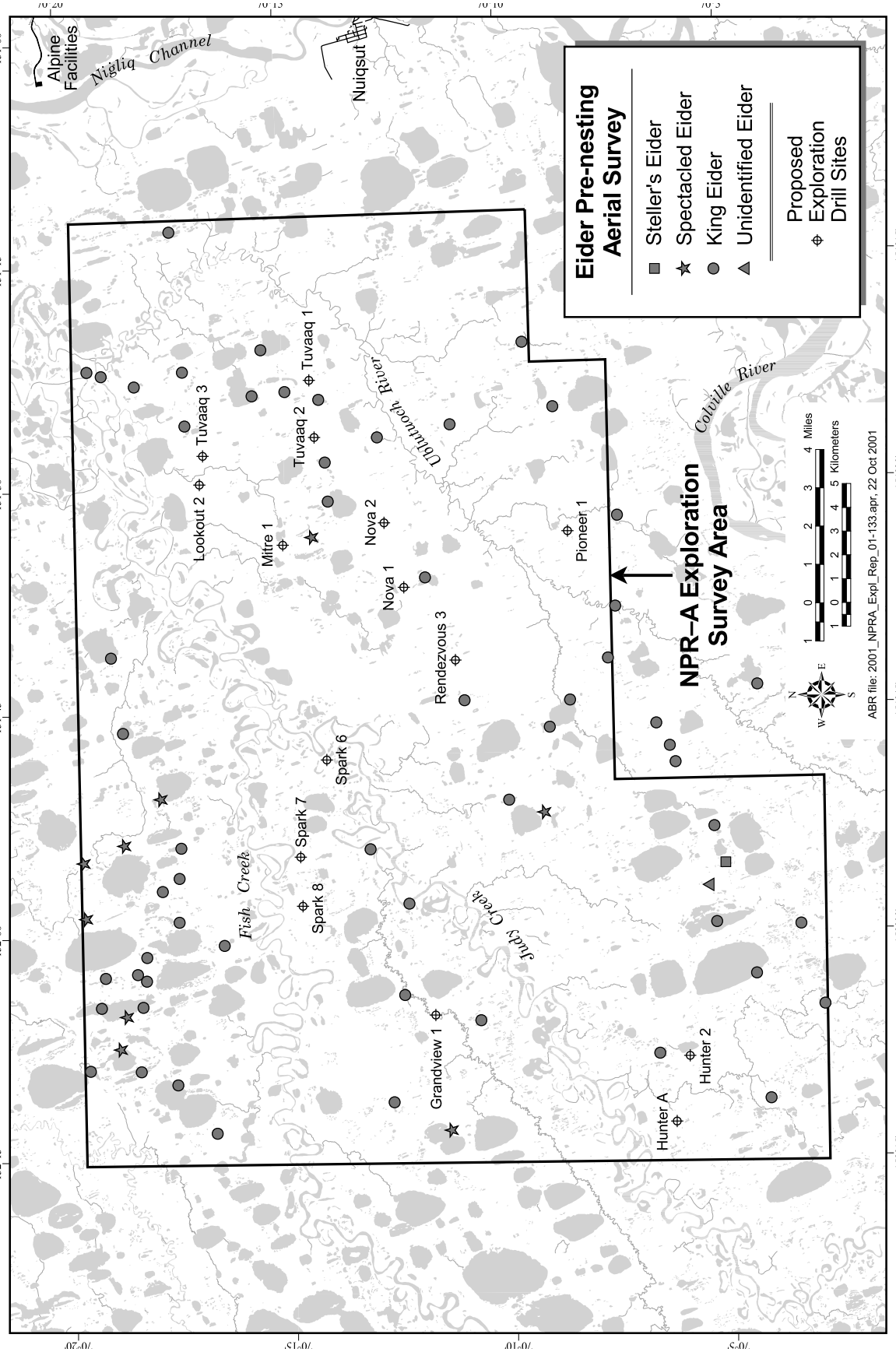

Figure 3. Eider observations recorded during a pre-nesting aerial survey (50% coverage) of PHILLIPS' exploration survey area in the National Petroleum Reserve–Alaska, 11–12 June 2001.

Table 1. Numbers and densities of eiders recorded during a pre-nesting aerial survey of PHILLIPS' exploration area in the northeastern National Petroleum Reserve–Alaska, 11–12 June 2001. Coverage was 50% of the 1,022-km² survey area (Figure 2).

	Numbers Observed						Densities (birds/km²)		
Species	Males	Females	Total Birds	Observed Pairs	Groups	USFWS Indicated Total Birds[a]	Breeding Pairs[b]	Total Birds[c]	USFWS Indicated Total Birds
SPECTACLED EIDER									
On Ground	10	9	19	9	8	20	0.02	0.04	0.04
Flying	1	1	2	1	1		<0.01	<0.01	
All Birds	11	10	21	10	9		0.02	0.04	
KING EIDER									
On Ground	50	42	92	41	39	100	0.10	0.18	0.20
Flying	18	18	36	16	12		0.04	0.07	
All Birds	68	60	128	57	51		0.13	0.25	
STELLER'S EIDER									
Flying	1	0	1	0	1		<0.01	<0.01	
UNIDENTIFIED EIDER									
On Ground	3	2	5	2	1	6	0.01	0.01	0.01

[a] USFWS Indicated Total Birds is calculated according to the standard protocol (USFWS 1987a) see Appendix A; flying birds are not counted.
[b] Density of breeding pairs = total males/511 km².
[c] Unadjusted density of total birds = total birds/511 km².

Table 2. Numbers of Tundra Swans and nests observed during an aerial survey of PHILLIPS' exploration area in the northeastern National Petroleum Reserve–Alaska, 19 June 2001.

	Numbers	Density[a] (no./km^2)
Nests	32	0.03
Swans with Nests		
Singles	8	0.01
Pairs	24	0.02
Total Adults	56	0.05
Swans without Nests		
Singles	23	0.02
Pairs	44	0.09
In Flocks	24	0.02
Total Adults	135	0.13
Total Swans	191	0.19

[a] Density based on a survey area of 1,022 km^2.

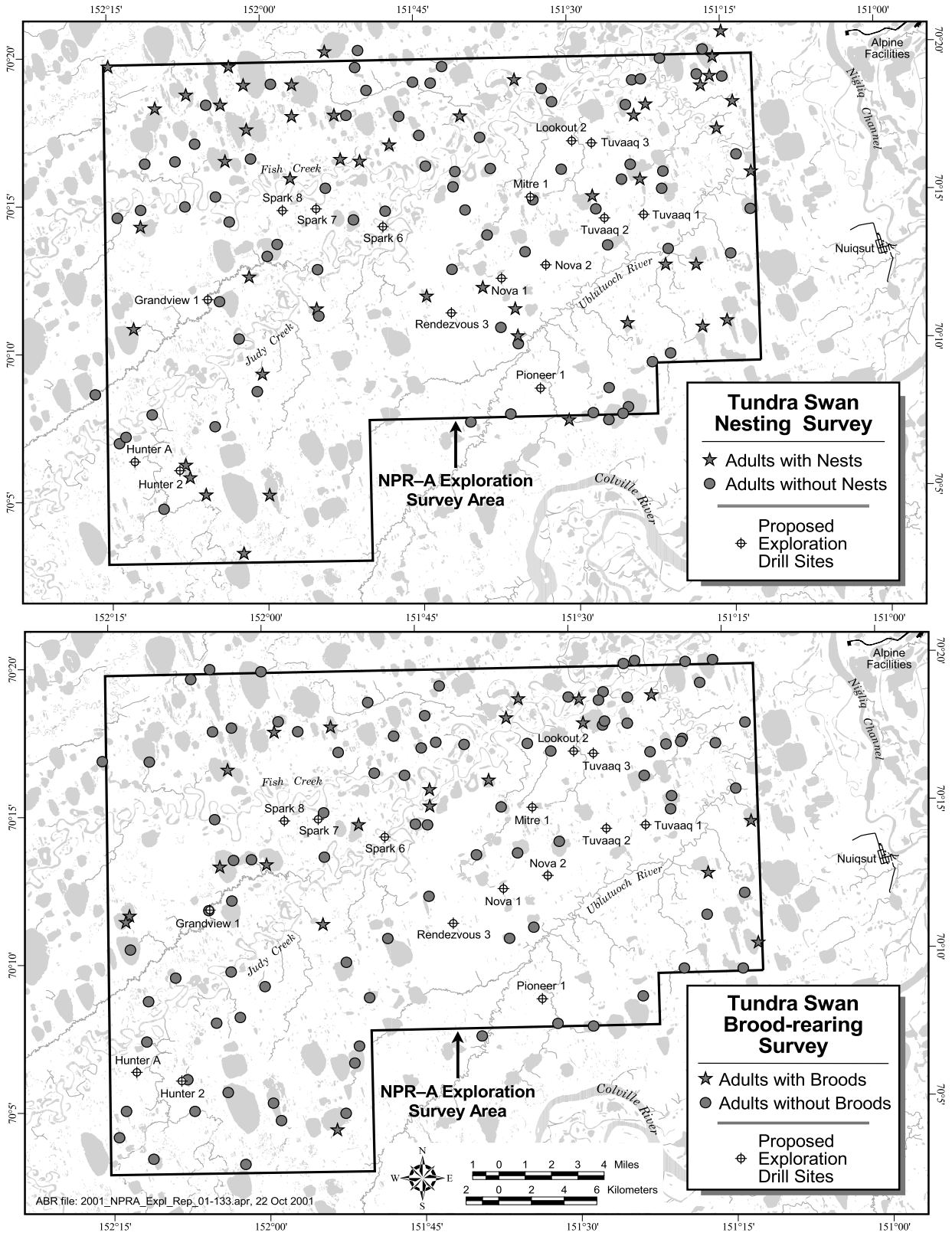

Figure 4. Locations of Tundra Swans observed during nesting (above) and brood-rearing (below) aerial surveys of PHILLIPS' exploration survey area in the National Petroleum Reserve–Alaska, 19 June and 20 August 2001, respectively.

More nonbreeding swans than breeding swans were observed in the exploration survey area in 2001 (135 and 56 adults, respectively). Densities of breeding adults (0.05 birds/km²), nonbreeders (0.13 birds/km²), and total swans (0.19 birds/km²) were similar to densities in the Kuparuk Oilfield in 2001 (0.06, 0.12, and 0.17 birds/km², respectively) (Anderson et al., in prep.).

Thus, comparisons among the exploration survey area and adjacent areas indicated that the density of swan nests in the exploration survey area generally was on the low end of densities reported elsewhere on the coastal plain (Platte and Brackney 1987, Anderson et al. 2001, Johnson et al. 2000). The density of adult swans found in the exploration survey area during the nesting season was within the density range (>0–0.59 birds/km²) reported by BLM (1998) for the northeastern NPR–A.

BROOD-REARING

We counted 270 Tundra Swans in the exploration survey area during the brood-rearing aerial survey on 20 August 2001 (Table 3, Figure 4). Most broods were located north of Judy and Fish creeks. We observed 21 broods comprising 53 young and 40 adults. The mean brood size in 2001 was 2.5 young/brood (range 1–4), which was the same as the 12-year mean of 2.5 young/brood recorded in the Kuparuk Oilfield (Anderson et al. 2001), and higher than the brood size recorded in NPR–A during 2000 (1.6 young/brood; Murphy and Stickney 2000).

We cannot calculate an actual measure of nesting success for the exploration survey area (due to the possibility of brood movements), but the number of broods located in the survey area suggests a minimum nesting success of 66% (21 of 32 nests successful). However, weather conditions during the brood-rearing survey were poor due to low cloud ceilings, precipitation, and fog, so the number of broods may have been undercounted. A comparable brood-rearing survey was flown in the Kuparuk Oilfield and on the Colville Delta in 2001, and preliminary calculations indicate minimum nesting success rates of 88% and 79%, respectively (ABR, Inc., unpubl. data.). The success rate in NPR–A also was low in 2000 (42%; Murphy and Stickney 2000), suggesting that this portion of NPR–A is not as productive as other nearby breeding areas.

In addition to brood-rearing groups, 177 adult swans without broods were observed, primarily in pairs scattered throughout the exploration survey area (Table 3, Figure 4). Swans without broods appear to be more concentrated in the northern portion of the NPR–A exploration area.

OTHER AVIAN SPECIES

In addition to surveys conducted specifically to collect information about avian use of proposed exploration sites in the NPR–A, regional surveys have been conducted to collect information about the presence of selected avian species on the Arctic Coastal Plain, including the NPR–A. Peregrine Falcons and Brant both have been target species of these regional surveys. In 1999, Ritchie and Wildman (2000a) found a Peregrine Falcon pair with a nest approximately 3.5 km northwest of Spark 7 on the bank of Fish Creek. Peregrine nests also were found in the transition area between the Coastal Plain and the Brooks Range Foothills. Nests in this transition area tended to be on top of streambanks cut by meandering rivers and

Table 3. Numbers of Tundra Swans and broods observed during an aerial survey of PHILLIPS' exploration area in the northeastern National Petroleum Reserve–Alaska, 20 August 2001.

	Numbers	Density[a] (no./km²)
Broods	21	0.02
Swans with Broods		
Singles	2	<0.01
Pairs	19	0.04
Young	53	0.05
Total Adults	40	0.04
Swans without Broods		
Singles	15	0.01
Pairs	52	0.10
In Flocks	58	0.06
Total Adults	177	0.17
Total Adults	217	0.21
Total Young	53	0.05
Total Swans	270	0.26

[a] Density based on a survey area of 1,022 km².

occasionally on high-relief banks along lake shorelines (Ritchie and Wildman 2000a). The peregrine population in NPR–A apparently is expanding, and suitable substrates for nesting occur within the exploration area.

Brant nesting surveys have been flown along the Arctic Coastal Plain from the Colville River Delta to at least as far west as Barrow since 1994 (Ritchie and Wildman 2000b). These surveys focus primarily on coastal habitats, where Brant are most abundant, but these surveys in some years have included the Fish Creek drainage. In 1996, 4 nests were found in a colony ~2 km northwest of the proposed location for Lookout 2 (ABR, unpubl. data). All other Brant colonies located on that survey were closer to the coast. In 2001, the NPR–A development area (within the boundaries of the exploration survey area) was surveyed for Brant nests, and all seven Brant locations were in the northernmost section of that area (Burgess et al., in prep.). The closest Brant nests to an exploration site in 2001were four nests that were in the same location as the colony found in 1996, ~2 km from Lookout 2.

SUMMARY AND CONCLUSIONS

PHILLIPS' NPR–A exploration area surveyed in 2001 supports low densities of Spectacled Eiders compared to the Colville River Delta and oilfields to the east. Only one Spectacled Eider nest was found (~8 km from the Spark 7 site). Although we expect more nests occur in the survey area because of its large size (1,022 km²) and the apparent habitat suitability in northern portions of the area, the actual number of nests probably is small given the low numbers of Spectacled Eiders there during pre-nesting. Tundra Swan nest densities were similar to those reported for other areas of the Arctic Coastal Plain, but nest success appears to be lower than in nearby areas. The most productive portion of the exploration survey area for nesting eiders and swans was the area around and north of Judy and Fish creeks. The wetlands around these creeks also attract larger numbers of other waterfowl and loons than does the rest of the exploration area (ABR, Inc. unpubl. data), suggesting that the habitats around these streams are favored by nesting waterbirds. Although these portions of the NPR–A exploration area support moderate concentrations of diverse avian species, exploration drilling in NPR–A would occur during winter on ice pads and using ice roads for transportation routes, so any effects of the exploration program should be seasonal and likely would be inconsequential to birds breeding during summer.

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Appendix A. U. S. Fish and Wildlife Service protocol for determining indicated total birds from aerial breeding-pair surveys.

For aerial surveys of Spectacled Eiders, we calculated the density of the "indicated total breeding population" using the USFWS (1987a) breeding population survey protocol:

Total indicated birds = (lone males × 2) + (flocked males × 2) + (pairs × 2) + (group total × 1).

Each of these categories is defined in the USFWS protocol:

1) "lone males" are single, isolated males without a visible associated female;
2) "flocked males" are two or more males in close association (limited to 2–4 males per flock; no females in the flock);
3) a "pair" is a male and female in close association; and
4) a "group" is three or more of a mixed-sex grouping of the same species in close association, which cannot be separated into singles or pairs (one female with two males was considered to be a pair and a lone male, and one female with three males was considered to be a pair and two lone males).

Lone females are not counted using this protocol, because it is assumed they are accounted for by doubling the count of lone males. Flying birds are counted only if their flight originated or terminated within the transect boundaries; because we were unable to determine this on our survey, we have excluded all flying birds from the FWS calculations. The USFWS also uses a sightability correction factor of 3.58 to adjust actual counts for the probable number of eiders missed by observers (sightability is defined as "the probability that an animal within the observer's field of search will be seen by that observer" [Caughley 1974: 923]). We do not present totals or densities adjusted using this correction factor because there is some question as to whether this correction factor, which was developed for surveys on the Yukon-Kuskokwim Delta, is applicable to the Arctic Coastal Plain.
