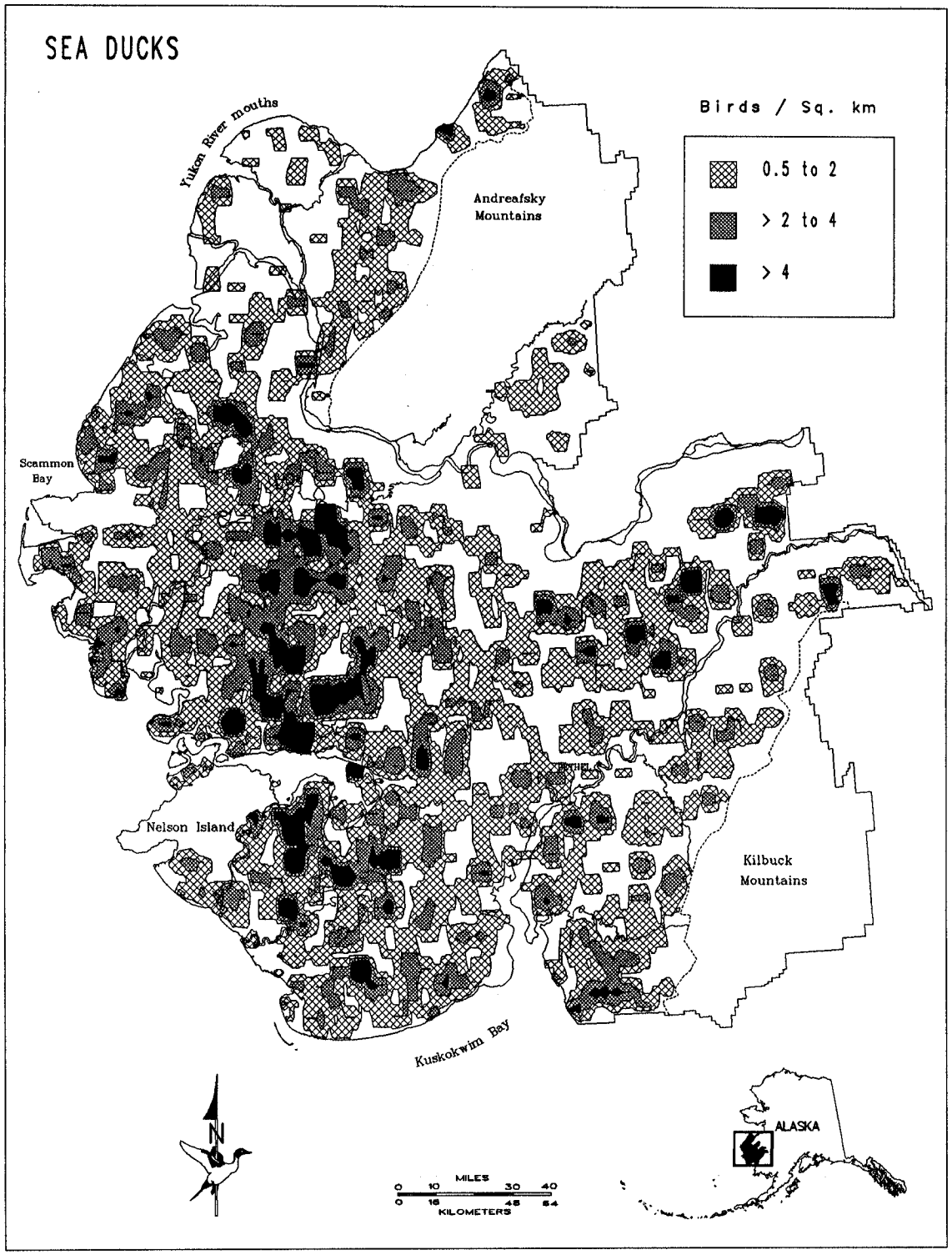

Figure 9. Relative density distribution of sea ducks (indicated total birds) from aerial surveys in June 1989-1992 on Yukon Delta National Wildlife Refuge, Alaska.

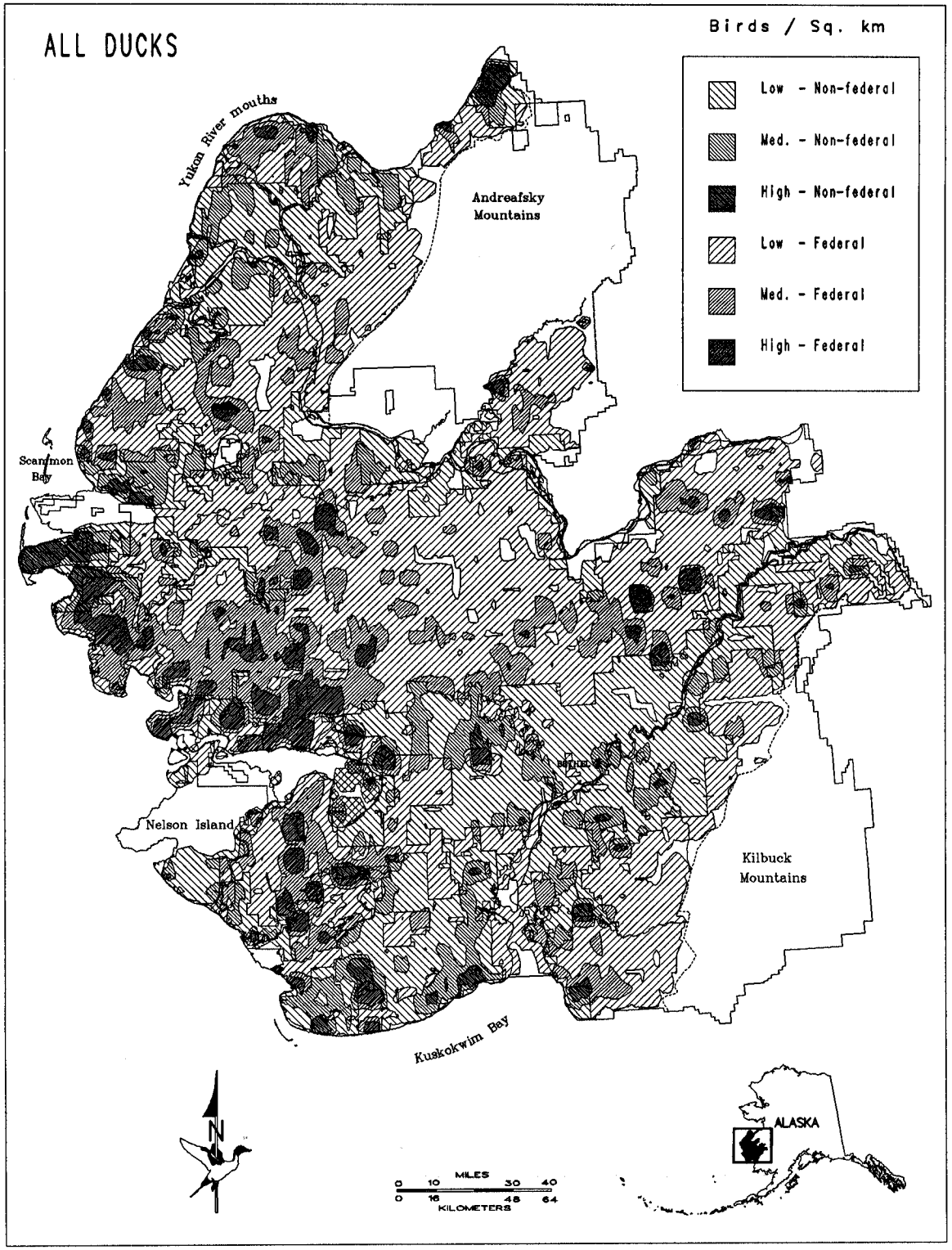

Figure 10. Relative density distribution of combined duck species (indicated total birds) from aerial surveys in June 1989-1992 on federal versus non-federal land on Yukon Delta National Wildlife Refuge, Alaska.

Table 1. Visibility correction factors used to correct population indices from fixed-wing aerial surveys on Yukon Delta National Wildlife Refuge, Alaska, 1989-1992.

Mallard	4.01
Gadwall	3.04
Northern pintail	3.05
Green-winged teal	8.36
Blue-winged	10.31
American wigeon	3.84
Northern shoveler	3.79
Redhead	3.11
Ring-necked duck	4.02
Canvasback	2.43
Scaup	1.93
Goldeneye	3.61
Bufflehead	1.86
Oldsquaw	1.87
Spectacled eider	3.58
Common eider	3.58
King eider	3.58
White-winged scoter	1.17
Surf scoter	1.17
Black scoter	1.17
Red-breasted merganser	1.27
Geese	1.00
Swans	1.00
Cranes	1.00
Grebes	1.00
Loons	1.00

Table 2. Waterbird average densities, population indices and variability from aerial survey in June 1989 on Yukon Delta National Wildlife Refuge, Alaska.

	Density		Population Index*					
Species	mean	se	total	se	%CV[1]	lo95CI[2]	up95CI[3]	%CI[4]
Mallard	0.91	0.26	65,878	18,686	28	29,254	102,502	56
Gadwall	0.01	0.01	951	597	63	-220	2,122	123
Northern pintail	4.00	0.41	287,995	30,046	10	229,104	346,886	20
Green-winged teal	0.50	0.13	35,316	9,033	26	17,611	53,022	50
Blue-winged teal	0.05	0.04	3,226	3,063	95	-2,778	9,230	186
American wigeon	0.50	0.14	35,748	10,055	28	16,041	55,455	55
Northern shoveler	1.41	0.26	101,994	18,782	18	65,181	138,807	36
Dabbler Subtotal	7.38	0.78	531,108	56,026	11	421,299	640,919	21
Redhead**	0.03	0.01	2,190	977	45	275	4,104	87
Ring-necked duck**	--							
Canvasback	0.06	0.03	4,372	1,928	44	593	8,152	86
Scaup**	2.63	0.21	189,336	14,965	8	160,004	218,667	15
Goldeneye	0.12	0.03	8,472	2,475	29	3,622	13,323	57
Bufflehead	0.004	0.004	291	287	98	-271	853	193
Diver Subtotal	2.84	0.21	204,661	15,242	7	174,787	234,534	15
Oldsquaw	0.34	0.07	24,284	4,890	20	14,700	33,869	39
Spectacled eider	--							
Unknown eider	0.05	0.02	3,361	1,536	46	350	6,731	90
Common eider	0.24	0.09	17,084	6,447	38	4,448	29,720	74
Steller's eider	--							
King eider	--							
White-winged scoter	--							
Surf scoter	--							
Black scoter	1.44	0.13	103,703	9,162	9	85,745	121,661	17
Red-breasted merganser	0.01	0.004	397	282	71	-155	950	139
Misc. Duck Subtotal	2.08	0.22	148,829	15,711	11	118,036	179,624	21
TOTAL DUCKS	12.27	0.85	884,598	61,409	7	764,239	1,004,961	14
Canada goose**	0.93	0.23	66,809	16,490	25	34,489	99,129	48
Brant**	0.01	0.01	782	514	66	-225	1,790	129
Emperor goose**	0.32	0.13	23,391	9,473	40	4,824	41,958	79
White-fronted goose**	0.64	0.13	45,921	9,322	20	27,651	64,192	40
TOTAL GEESE	1.90	0.43	136,903	31,004	23	76,135	197,672	44
Tundra swan**	0.91	0.11	65,792	8,075	12	49,966	81,618	24
Sandhill crane**	0.64	0.13	46,469	9,456	20	27,935	65,003	40
Red-necked grebe**	0.06	0.01	3,990	712	18	2,595	5,385	35
Common loon**	0.02	0.01	1,095	357	33	396	1,794	64
Yellow-billed loon**	--							
Pacific loon**	0.49	0.06	34,969	4,193	12	26,750	43,188	24
Red-throated loon**	0.05	0.01	3,677	961	26	1,792	5,561	51
TOTAL LOONS	0.56	0.06	39,741	4,623	12	30,681	48,802	23

* Population index = T * V * A/S
A = Square kilometers in survey area = 72,117 T = indicated total birds: 2 * (singles + pairs) + flocks
S = Square kilometers in sample = 922 V = visibility ratio

** Single birds not doubled to calculate indicated total birds

-- None observed during survey
1 Percent coefficient of variation
2 Lower 95% confidence limit
3 Upper 95% confidence limit
4 Percent confidence interval

Table 3. Waterbird average densities, population indices and variability from aerial survey in June 1990 on Yukon Delta National Wildlife Refuge, Alaska.

	Density		Population Index*					
Species	mean	se	total	se	%CV[1]	lo95CI[2]	up95CI[3]	%CI[4]
Mallard	0.91	0.14	65,802	10,031	15	46,142	85,463	30
Gadwall	0.01	0.01	473	481	102	-470	1,416	199
Northern pintail	4.41	0.60	318,322	43,241	14	233,569	403,075	27
Green-winged teal	2.49	0.30	179,444	21,324	12	137,649	221,239	23
Blue-winged teal	--							
American wigeon	0.89	0.16	64,207	11,378	18	41,906	86,508	35
Northern shoveler	1.11	0.25	79,877	17,761	22	45,066	114,689	44
Dabbler Subtotal	9.82	0.96	708,125	69,142	10	572,606	843,645	19
Redhead*	--							
Ring-necked duck*	--							
Canvasback	0.20	0.13	14,174	9,145	65	-3,750	32,098	126
Scaup*	2.85	0.45	205,633	32,584	16	141,768	269,498	31
Goldeneye	0.07	0.04	5,054	2,524	50	106	10,001	98
Bufflehead	--							
Diver Subtotal	3.12	0.55	224,861	39,524	18	147,392	302,328	34
Oldsquaw	0.45	0.10	32,722	7,456	23	18,108	47,336	45
Spectacled eider	0.02	0.01	1,671	810	48	83	3,258	95
Unknown eider	0.01	0.01	557	533	96	-488	1,602	188
Common eider	0.03	0.02	2,227	1,542	69	-794	5,249	136
Steller's eider	--							
King eider	0.11	0.05	8,074	3,280	41	1,646	14,503	80
White-winged scoter	0.01	0.004	546	298	55	-39	1,131	107
Surf scoter	0.04	0.02	3,185	1,428	45	386	5,983	88
Black scoter	1.12	0.14	84,986	10,209	12	64,976	104,996	24
Red-breasted merganser	0.01	0.01	790	387	49	32	1,548	96
Misc. Duck Subtotal	1.80	0.22	134,758	16,190	12	103,025	166,490	24
TOTAL DUCKS	14.81	1.41	1,067,744	101,313	9	869,170	1,266,316	19
Canada goose**	0.56	0.13	40,596	9,410	23	22,153	59,039	45
Brant**	0.01	0.003	389	231	59	-63	841	116
Emperor goose**	0.15	0.09	10,577	6,635	63	-2,427	23,581	123
White-fronted goose**	0.36	0.10	25,898	6,950	27	12,276	39,519	53
TOTAL GEESE	1.08	0.30	77,460	21,408	28	41,057	137,970	54
Tundra swan**	0.86	0.08	61,750	5,931	10	50,125	73,374	19
Sandhill crane**	0.26	0.04	19,054	2,861	15	13,447	24,661	29
Red-necked grebe**	0.06	0.02	3,966	1,467	37	1,092	6,841	72
Common loon**	0.02	0.01	1,167	352	30	447	1,856	59
Yellow-billed loon**	--							
Pacific loon**	0.58	0.09	41,918	6,272	15	29,625	54,211	29
Red-throated loon**	0.09	0.02	6,766	1,107	16	4,596	8,936	32
TOTAL LOONS	0.69	0.10	49,851	7,239	15	35,663	64,038	28

* Population index = T * V * A/S
A = Square kilometers in survey area = 72,117 T = indicated total birds: 2 * (singles + pairs) + flocks
S = Square kilometers in sample = 927 V = visibility ratio

** Single birds not doubled to calculate indicated total birds

-- None observed during survey
1 Percent coefficient of variation
2 Lower 95% confidence limit
3 Upper 95% confidence limit
4 Percent confidence interval