Field Report –31 May 2012

Aerial survey of waterbirds on Kenai National Wildlife Refuge and Susitna Basin wetlands

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The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the U.S. Fish and Wildlife Service.

Introduction

An annual aerial waterbird survey has been flown on Kenai National Wildlife Refuge and Susitna Basin wetlands in southcentral Alaska since 1957 as part of the North American Waterfowl Breeding Population and Habitat Survey (Mallek and Groves 2012). However, this survey was limited to 10 segments of 16 statute miles each on 6 transects flown on the Kenai-Susitna stratum. In 2003, an expanded aerial survey was designed using systematic sampling throughout the entire Kenai-Susitna stratum to obtain more precise waterbird population indices and to better determine waterbird distribution. The survey was repeated in 2010 using a set of transects intermediate to the set flown in 2003. Objectives of the surveys were to obtain baseline indices of population size and distribution. In addition to reporting these indices and distribution patterns, this field report describes methods, observation conditions, and analyses completed on waterbird observations recorded in 2003 and 2010.

Methods

The boundary of the 2003 survey area was the same as used for aerial surveys of loons conducted in the late 1990's and early 2000's. That boundary was screen-digitized around wetlands of the Kenai National Wildlife Refuge and Susitna Basin based on digital raster graphics of 1:250,000 scale topographic maps. The survey area included 18,526 km^2 with a transect area observed in 2003 of 742 km^2, and 752 km^2 observed in 2010, a 4.0% sampling fraction each year. The survey area essentially encompasses all the wetlands in the area and includes the area of the WBPHS stratum.

We used a custom True BASIC program and ArcGIS® (Environmental Systems Research Institute, Inc., Redlands, California) geographic information system (GIS) software to generate 2 sets of systematic transects from a random coordinate within the survey area. Transects were oriented east west along great circle routes and spaced 9.6 km apart each year (Fig. 1). The first set of transects was flown in 2003 and the second set of transects was flown in 2010.

The surveys were flown around the third week of May each year to coincide with egg-laying or early incubation stages for breeding waterbirds. Survey methods followed the standard protocol established for waterfowl breeding ground surveys in North America (USFWS and Canadian Wildlife Service 1987). A Cessna 206 amphibious aircraft was flown at 145-170 km per hour, 30-46 m of altitude, with wind speed <24 km per hour, ceilings >152 m, and visibility >16 km. The pilot used a global positioning system (GPS) and moving map software displayed on a notebook computer screen to maintain a precise course while flying transects.

Both pilot and observer used a computerized data collection program called Survey Recording Program written by John Hodges (retired USFWS, Migratory Bird Management, Juneau,

Alaska). This system consisted of a notebook computer connected with the aircraft's GPS receiver and a remote microphone/mouse. The observers voice recorded each transect number, transect start and stop points, and every bird sighted within the 200 m wide strip on either side of the aircraft into a WAV format sound file using the remote microphone/mouse. The observers identified birds (primarily waterfowl and other large waterbirds) to species and recorded group size as a single, pair, or number of birds in flocks. Simultaneously, at the mouse click for each sighting, the latitude/longitude coordinates (WGS84 datum) were automatically downloaded from the aircraft GPS to a computer file. We then used a computer transcription program to replay the sound files, enter header information (e.g. year, month, day, observer initials, transect number), species and group size, and combine these with the geographic coordinates to produce a final data file. The recording program was also used to record coordinates every 5 seconds during flights thus providing data that was incorporated into the GIS to plot flightlines and produce strip transects by buffering each observer's track by 100 meters. GPS positions of each bird sighting were plotted to produce distribution maps. Sightings data were pooled for both years and a kernel density procedure was used to create estimated density distribution of bird sightings.

Duck population indices were based on indicated total birds: 2 * (S + P) + F, where S = number of single birds sighted, P = number of pairs sighted, and F = number of birds in flocks. A flock was defined as 5 or more ducks occurring together. A single male duck was assumed to represent a breeding pair because the nesting hen was usually not observable, and therefore a single male duck was doubled for all species except scaup. Scaup tend to have an unbalanced sex ratio with an excess of males in the population, therefore a single male scaup does not reliably indicate an unseen female. The indicated total bird index was calculated by doubling singles observed for all ducks (except scaup), cranes, and dark geese species. Singles observed were not doubled for the other species, i.e. loons, grebes, swans, gulls, and raptors where the sexes are not obviously dimorphic and their population indices only included total birds sighted. Density of each species was calculated by dividing number of birds sighted by area searched. Population indices were calculated by expanding the density to the entire survey area. We did not use any visibility correction factors on the population indices.

Results

The 2003 survey was flown May 19-23 by Paul Anderson and Dennis Marks while the 2010 survey was flown from May 19-22 by Heather Wilson and Paul Anderson. Weather conditions at Anchorage were well within the specifications for aerial surveys for both years and showed little differences between years (Fig. 2).

Population indices

Population indices for most species varied between the 2 survey years (Table 1). Common mergansers had the highest index in 2003 whereas glaucous gulls were most numerous in 2010. Pintails, mallards, and scaup had relatively high population indices in 2003 compared to other species. The index for pintails in 2010 was about half that of 2003 whereas mallards were twice as abundant and scaup about 4 times that of 2003. American wigeon, canvasbacks, sandhill cranes, and trumpeter swans had similar indices between the 2 years.

Distribution

Latitude and longitude coordinates of the aircraft position were captured for each bird sighting and these were used to indicate bird distribution by species for each year of the survey. Figures 3-7 show species sightings by number of birds for the major species encountered during the

surveys. Waterbird distribution based on the 2 years of aerial surveys generally reflected the distribution of wetland complexes and estuarine areas. Distribution maps were relatively coarse based on the spacing of the strip transects. However, kernel density surfaces derived from pooled 2003 and 2010 sightings showed several higher density areas (Fig. 8) such as the outlet of Skilak Lake, the mouth of the Susitna River, and the Redoubt Bay Critical Habitat Area across Cook Inlet from the city of Kenai. Common loons were relatively abundant on the northern half of the Kenai Peninsula, an area of numerous lakes of various sizes. Many areas contained few waterbirds such as portions of the east side of the Kenai Peninsula survey area which had a much lower density of lakes.

Discussion

Many factors associated with aerial surveys can potentially affect the numbers of birds sighted among years. These factors include weather, phenology, observers, aircraft type, interannual differences in breeding effort, and change in population size. There was little difference in survey dates between the 2 years and weather conditions appeared similar (Fig. 2) therefore the timing of the surveys relative to phenology seemed appropriate and not to have affected results.

Two changes in the crew conducting the survey occurred in 2010 with the 2003 pilot switching to being the right-seat observer in 2010 and a new pilot in the left seat. These changes in observers may have contributed to the large interannual variability in population indices.

These surveys have accomplished the objectives of obtaining a valid systematic sample of waterbirds in the wetlands of the Kenai/Susitna lowlands. These results provide a baseline for waterbird population numbers and relative distribution that will be beneficial for future management of the area. Future surveys would benefit by modifying the survey area boundary to omit large areas with few birds or habitat.

Literature Cited

MALLEK, E.J. AND D.J. GROVES. 2012. Alaska – Yukon Waterfowl Breeding Population Survey, May 13 to June 7 2011. Unpubl. USFWS report, Fairbanks, AK.

U.S. FISH AND WILDLIFE SERVICE AND CANADIAN WILDLIFE SERVICE. 1987. Standard operating procedures for aerial breeding ground population and habitat surveys in North America. Unpubl. Manual. U.S. Fish and Wildl. Serv., Can. Wildl. Serv., Laurel MD, 103pp.

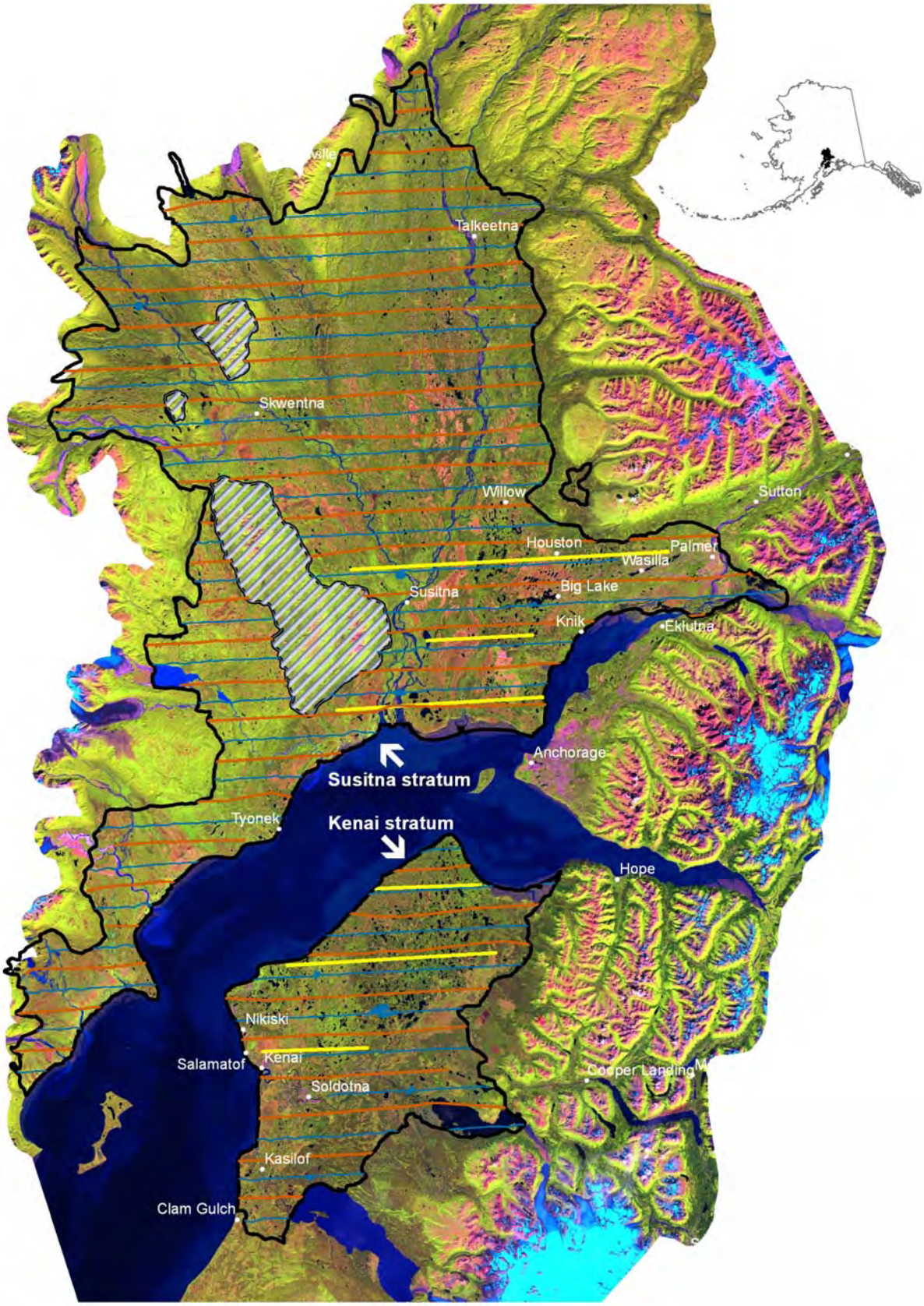

Fig. 1. Traditional aerial survey transects (yellow), expanded aerial survey area (black line) and transects (2003 blue, 2010 orange), and Landsat 7 ETM+ satellite imagery of the Kenai/Susitna lowlands, Alaska. Cross-hatched areas are not part of the survey area.

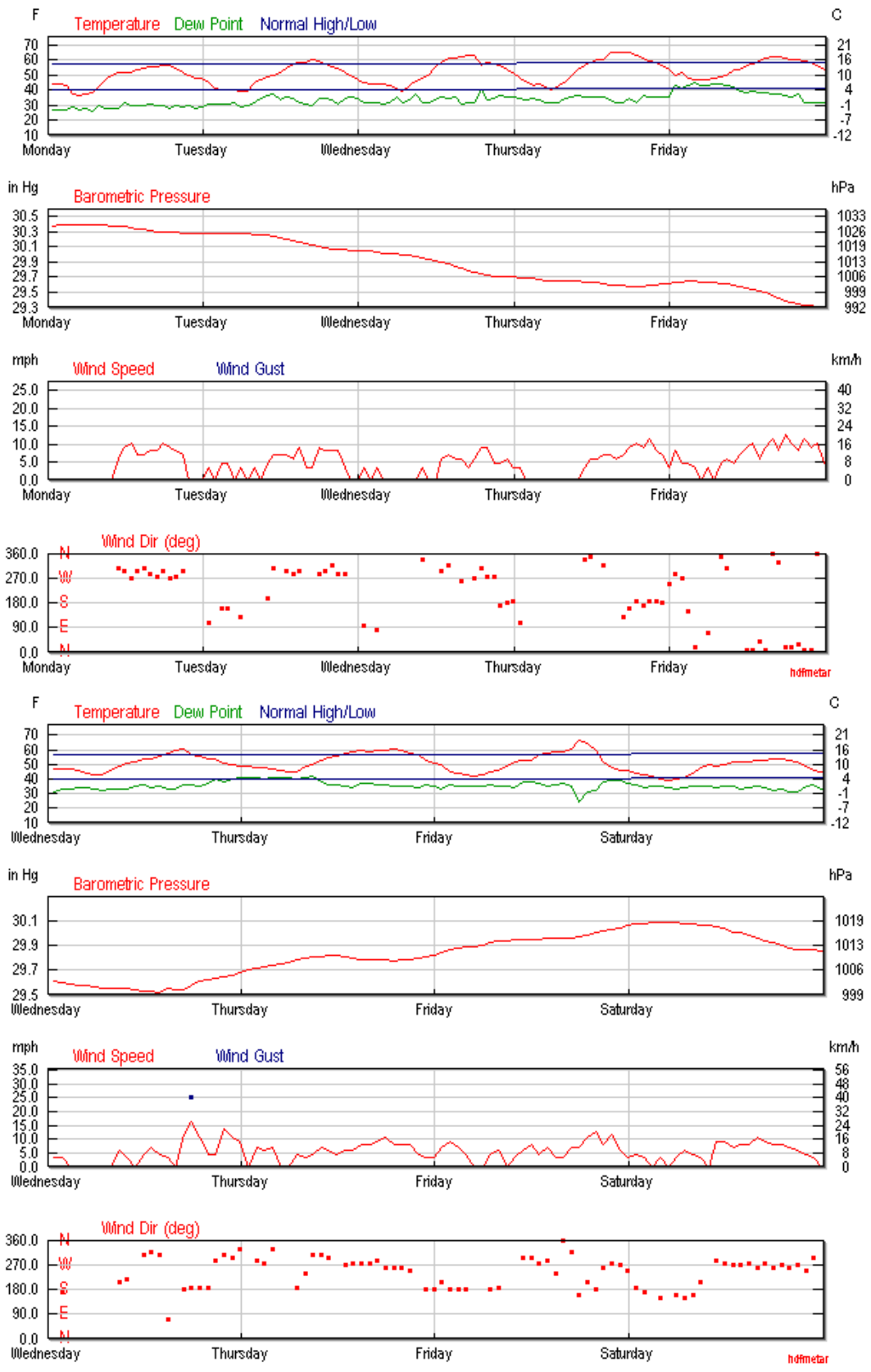

Fig. 2. Anchorage, Alaska weather conditions during May 19-23, 2003 (top 4 graphs) and May 19-22, 2010 (bottom 4 graphs) aerial surveys of the Kenai/Susitna lowlands, Alaska.

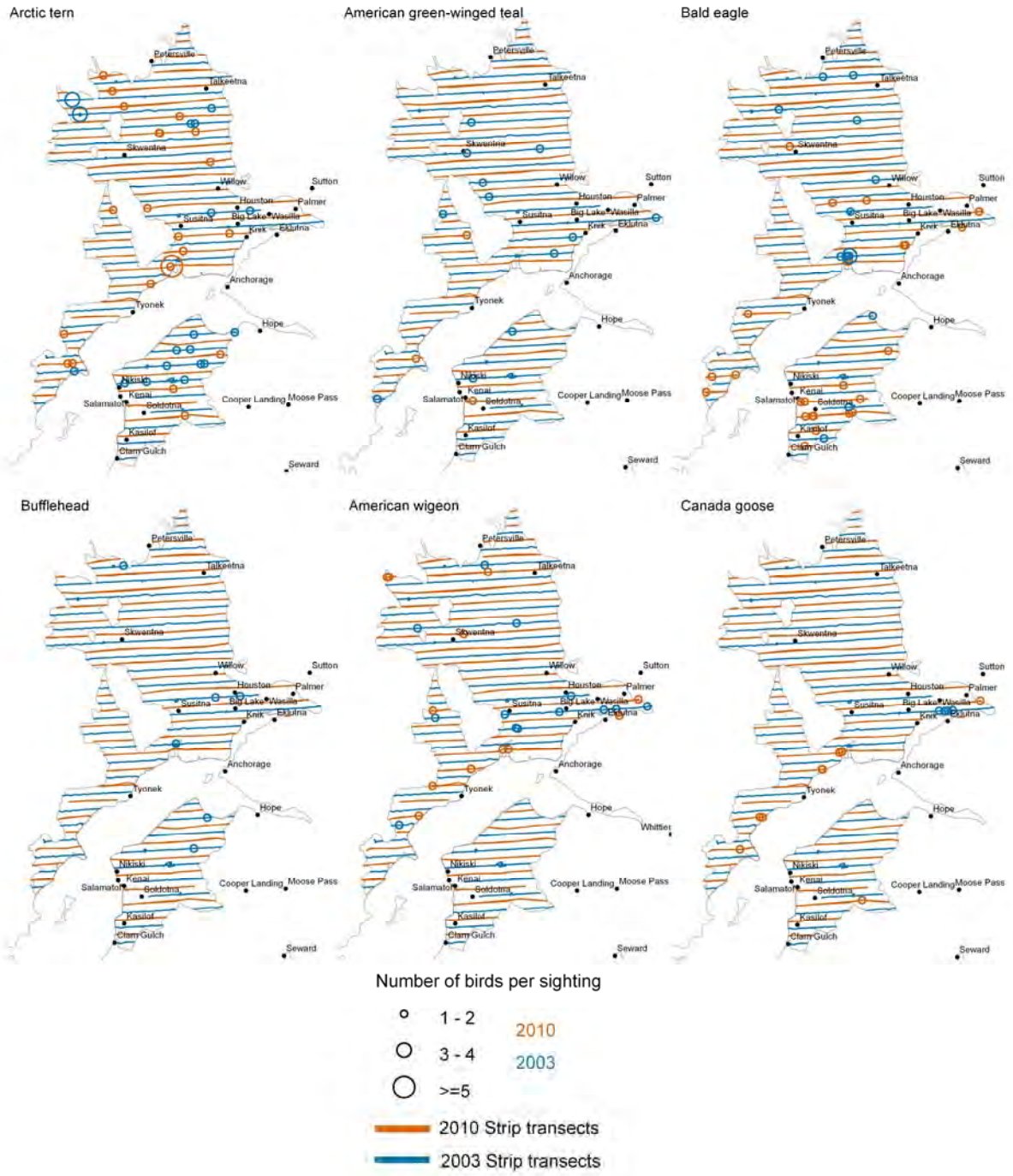

Fig. 3. Aerial survey strip transects and bird sightings by species for 2003 and 2010 on the Kenai Peninsula and Susitna Lowlands, Alaska.

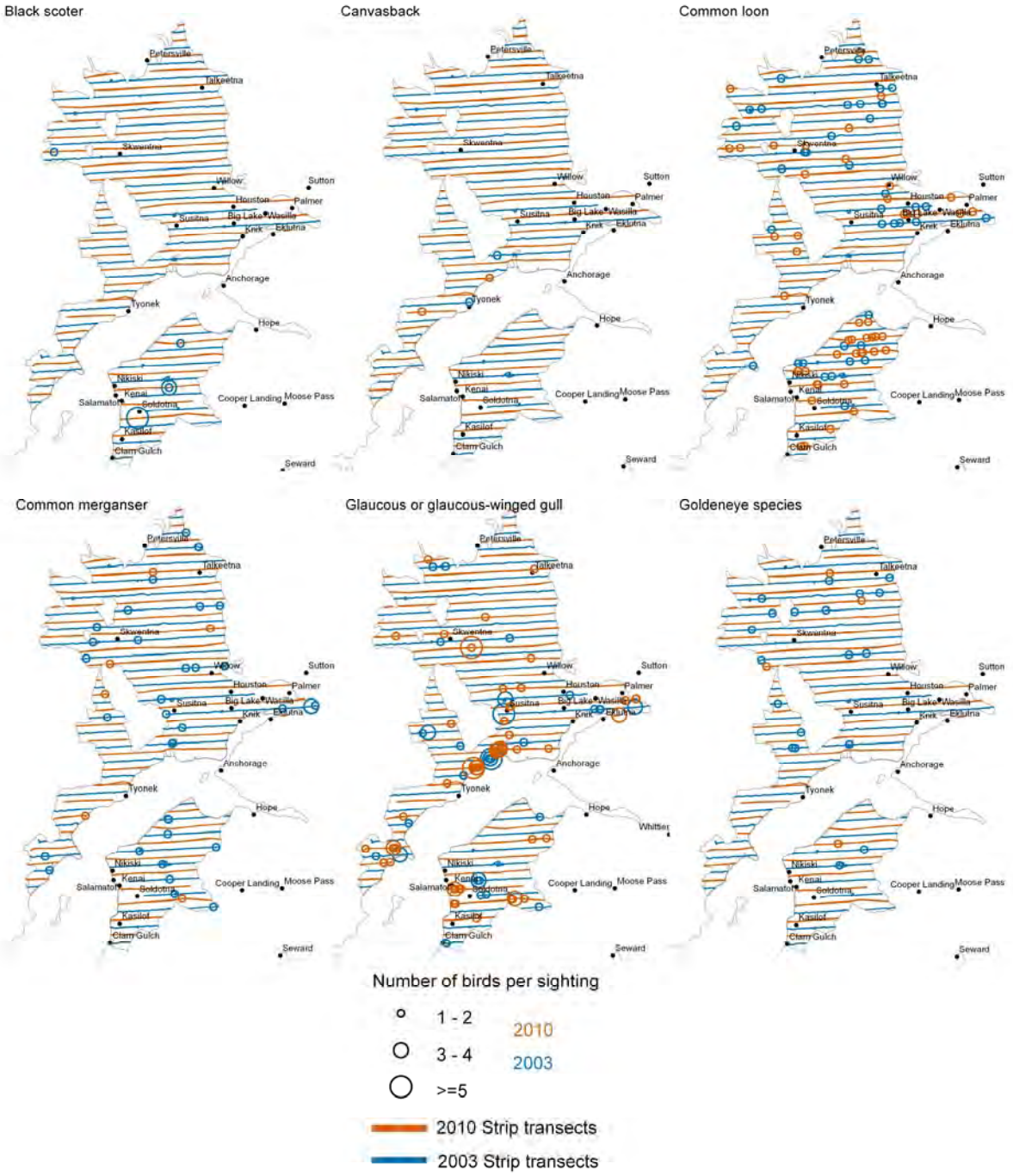

Fig. 4. Aerial survey strip transects and bird sightings by species for 2003 and 2010 on the Kenai Peninsula and Susitna Lowlands, Alaska.

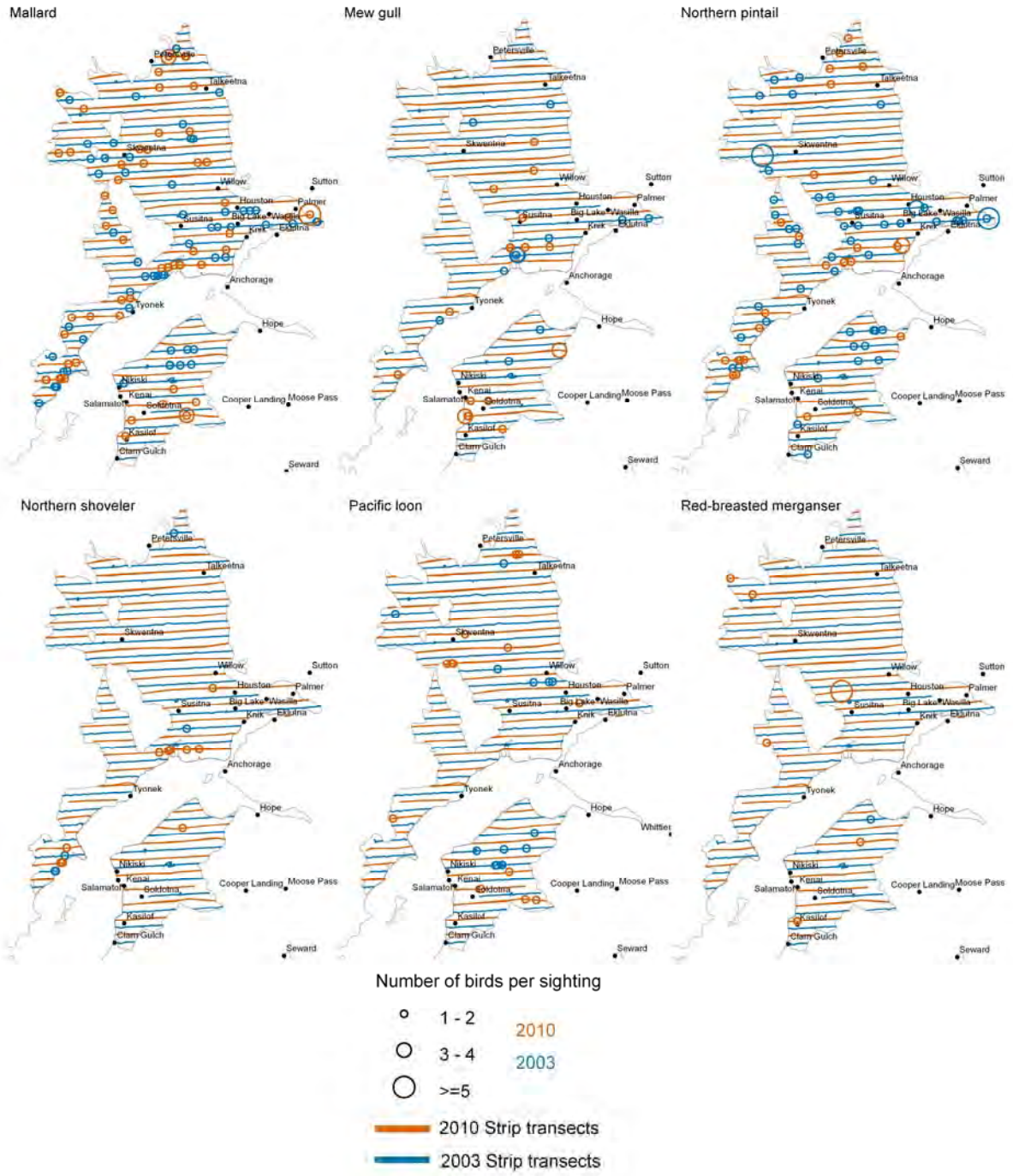

Fig. 5. Aerial survey strip transects and bird sightings by species for 2003 and 2010 on the Kenai Peninsula and Susitna Lowlands, Alaska.

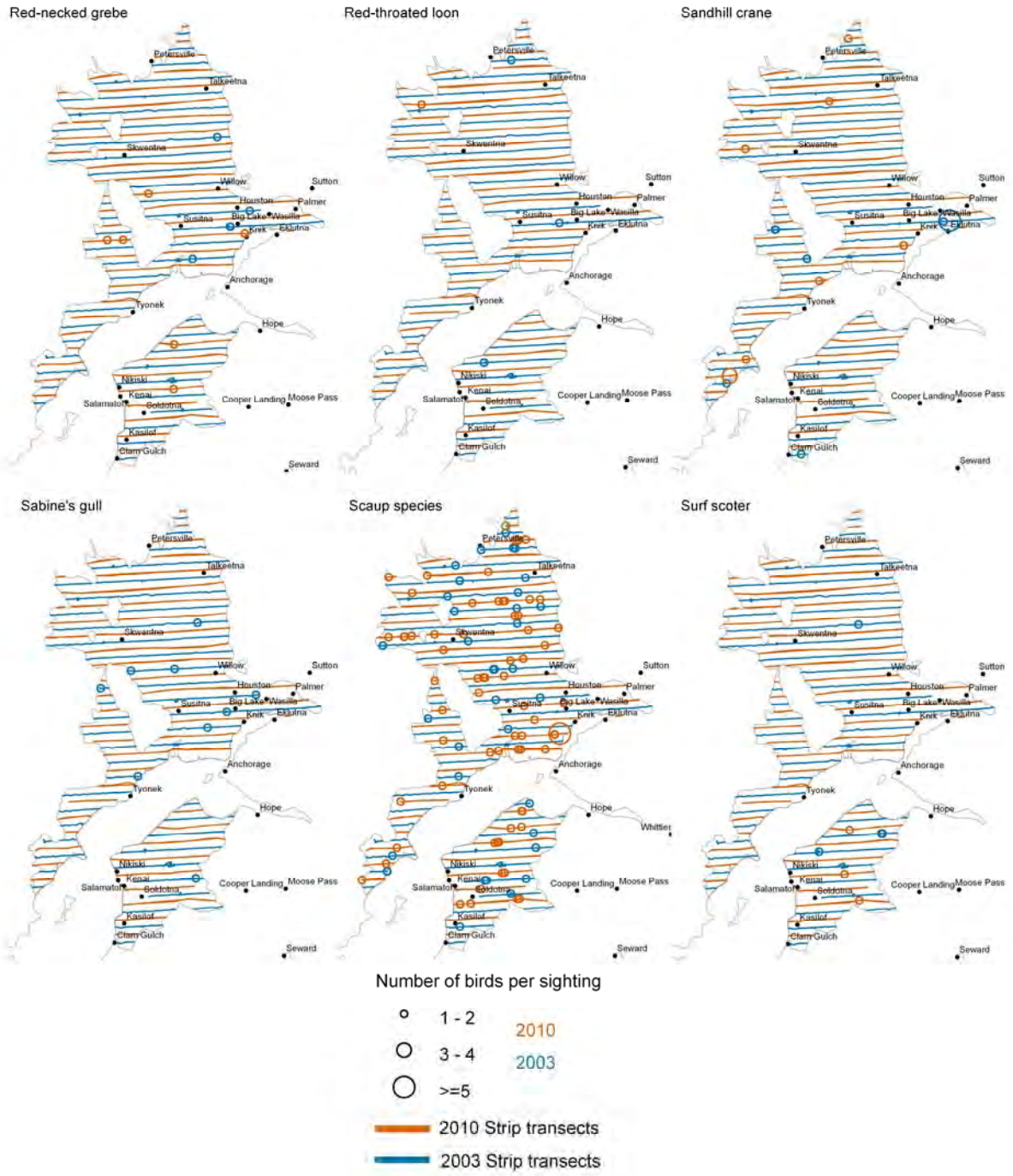

Fig. 6. Aerial survey strip transects and bird sightings by species for 2003 and 2010 on the Kenai Peninsula and Susitna Lowlands, Alaska.

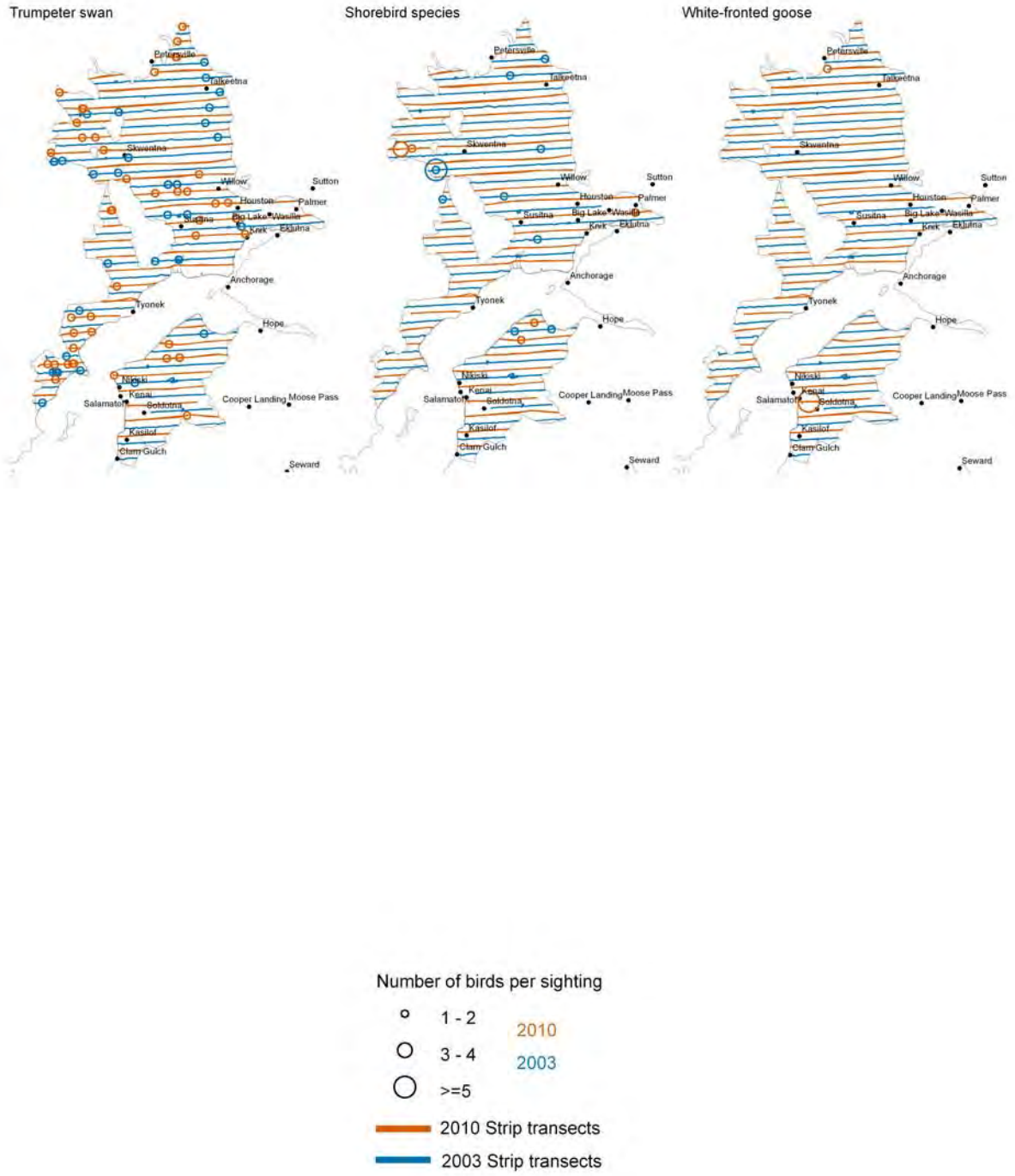

Fig. 7. Aerial survey strip transects and bird sightings by species for 2003 and 2010 on the Kenai Peninsula and Susitna Lowlands, Alaska.

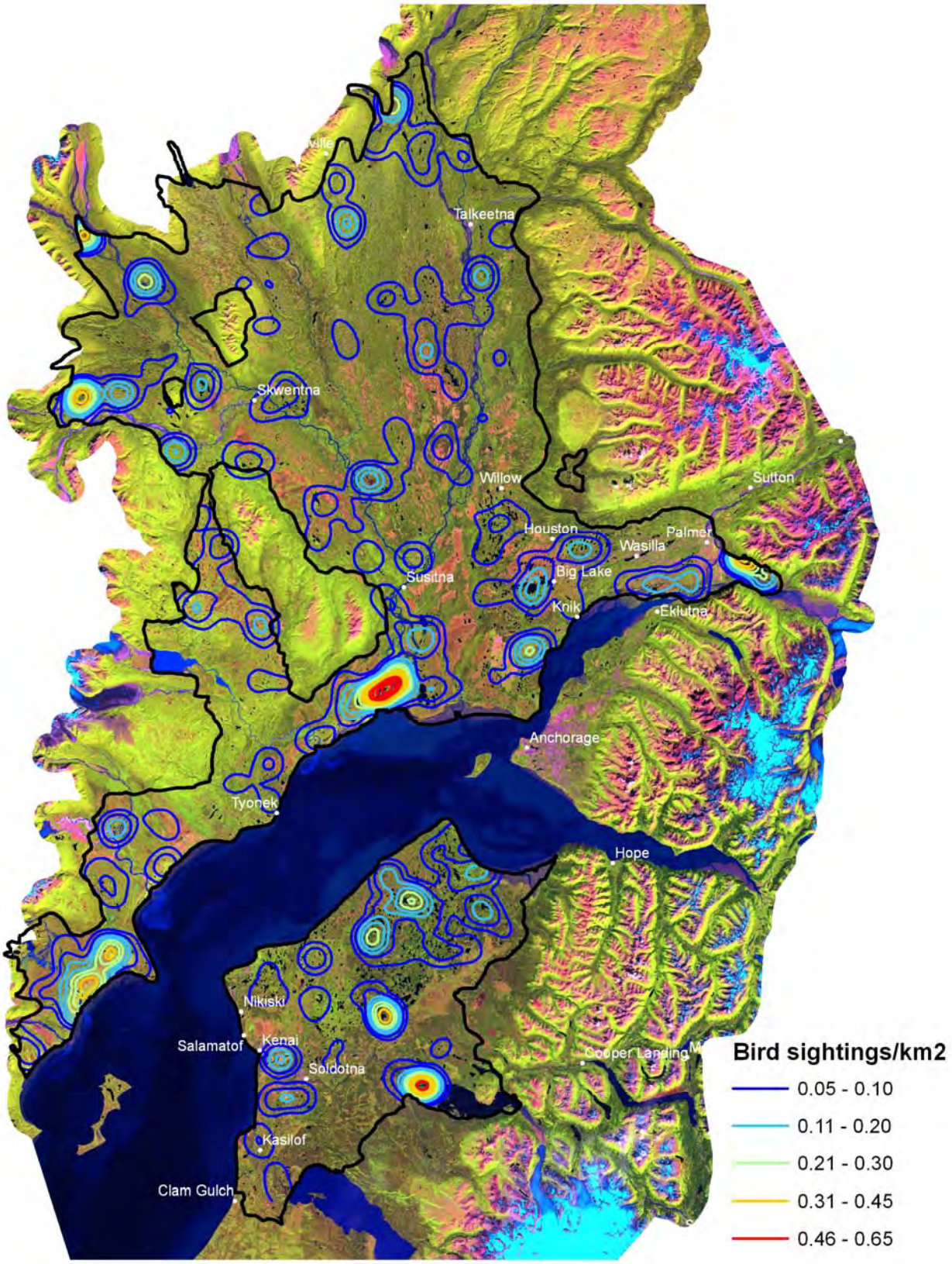

Fig. 8. Kernel density distribution of bird sightings from aerial suveys on the Kenai Peninsula and Susitna lowlands, Alaska in 2003 and 2010.

Table 1. Number of sightings, density, and population indices (indicated total birds) of birds on aerial surveys of the Kenai-Susitna lowlands, Alaska, 2003 and 2010.

	2003			2010		
Species	Number of birds	density	pop index	Number of birds	density	pop index
American green-winged teal	34	0.045	842	18	0.024	445
American wigeon	34	0.045	842	30	0.040	741
Arctic tern	35	0.047	867	98	0.131	2421
Bald eagle	19	0.025	471	27	0.036	667
Black scoter	0			47	0.063	1161
Bufflehead	2	0.016	297	0		
Canada goose	42	0.056	1040	38	0.051	939
Canvasback	4	0.005	99	4	0.005	99
Common loon	49	0.066	1214	69	0.092	1705
Common merganser	180	0.241	4458	41	0.055	1013
Common raven	0			1	0.001	25
Eagle nest	0			5	0.007	124
Gadwall	2	0.003	50	0		
Glaucous gull	132	0.176	3269	546	0.728	13489
Golden eagle	2	0.003	50	2	0.003	49
Goldeneye species	54	0.072	1337	19	0.025	469
Gull species	0			1	0.001	25
Gull species nest	0			9	0.012	222
Glaucous-winged gull nest	0			10	0.013	247
Hawk species	1	0.001	25	0		
Loon species	0			2	0.003	49
Mallard	130	0.174	3220	228	0.304	5633
Mew gull	33	0.044	817	138	0.184	3409
Mew gull nest	0			12	0.016	296
Northern pintail	142	0.190	3517	80	0.107	1976
Northern shoveler	12	0.016	297	51	0.068	1260
Pacific loon	21	0.028	520	18	0.024	445
Red-breasted merganser	2	0.003	50	89	0.119	2199
Red-necked grebe	6	0.008	149	8	0.011	198
Red-throated loon	3	0.004	74	1	0.001	25
Sandhill crane	14	0.019	347	12	0.016	296
Sabine's gull	20	0.027	495	0		
Scaup species	111	0.148	2749	526	0.701	12995
Snow goose	25	0.033	619	7	0.009	173
Surf scoter	34	0.045	842	16	0.021	395
Swan nest	10	0.013	248	13	0.017	321
Trumpeter swan	52	0.070	1288	67	0.089	1655
Unidentified large shorebird	7	0.009	173	4	0.005	99
Unidentified small shorebird	141	0.188	3492	3	0.004	74
White-fronted goose	0			7	0.009	173