Western Alaska Yellow-billed Loon Survey - 2007

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Abstract:

We conducted an aerial survey for loons in June 2007 sampling the Seward Peninsula and Cape Krusenstern area of Western Alaska. We searched all lakes larger than 7 hectares on twenty-four 12km x 12km plots. Combined with similar data from 2005, we estimated 431 (90% confidence range = 305 - 558) yellow-billed loons with 95% of these occurring on the northern Seward Peninsula near Cape Espenberg. Including the results from 4 replicated plots, the Cape Espenberg region showed similar indices of 387 in 2005and 395 in 2007 for yellow-billed loons, and a change from 81 to 47 nests. We also estimated a total of 1371 (1049 – 1723) Pacific loons and 66 (32 - 99) red-throated loons on >7 ha lakes.

INTRODUCTION

This report summarizes results from a yellow-billed loon (*Gavia adamsii*) aerial survey conducted in and around Bering Land Bridge National Preserve (BELA) and Cape Krusenstern National Monument (CAKR) in June 2007. Yellow-billed loons are a species of concern having a small global population estimated at 16,650 - 21,000 birds (Fair 2002, Earnst 2004). The breeding range of the species is dispersed in arctic tundra regions of Russia, Canada, and Alaska. In Alaska, nesting is restricted to the Arctic Coastal Plain (north of the Brooks Range) and western Alaska on or near the Seward Peninsula. The population on the Arctic Coastal Plain (ACP) of Alaska has been estimated at 3,369 birds (Earnst 2004), while the population in the vicinity of the Seward Peninsula was estimated at 418 birds in 2005 (Mallek et al. 2005). This survey presented an opportunity to add to the 2005 data and confirm the population estimate for yellow-billed loons on the Seward Peninsula area of western Alaska.

METHODS

Study Area

The survey area (Fig. 1) included 13,572 km^2 of potential yellow-billed loon habitat in western Alaska as determined from previous aerial transect surveys conducted for all waterbirds on the Seward Peninsula and Selawik in 1992, 1993, 1996, and 1997 (unpubl. USFWS data, Platte 1999). Three distinct wetland regions were sampled: a) the Interior wetland area on the Seward Peninsula (4584 km^2), b) Cape Espenberg on the northern Seward Peninsula (7010 km^2), and c) Cape Krusenstern (1978 km^2) northwest of Kotzebue. Stratum boundaries included all wetland habitats and surrounding lowland areas. Non-wetland habitat, even if within National Park Service boundaries, was not sampled.

Sampling Design

The 2007 survey for yellow-billed loons in western Alaska continued the sampling design used in 2005. Sampling involved a lake-circling aerial search for loons on all lakes larger than 7 hectares (0.07 km^2) within 12x12 km plots. If the lake centroid point fell within the plot, the entire lake was searched even if part of the lake area extended beyond the plot boundary. Similarly, if the centroid point was not in the plot, the lake was not searched even if part of the lake was in the plot. Lakes >7 ha were determined based on a GIS coverage taken from the National Hydrography Dataset (NHD). The 7 ha criterion was based on field observations on the ACP where the smallest brood-rearing lake on the Colville River Delta was 13.4 ha (North and Ryan 1989). Further field observations on the Colville confirmed this finding although a few loons nested on smaller lakes before moving their broods to larger lakes (Earnst 2004). Aerial search of ACP lakes on 7x7 km plots in 2003 and 2004 included 3 yellow-billed loons incidentally observed on lakes <7 ha and 1 yellow-billed loon observed on a small stream channel (Stehn et al. 2005). These 4 birds made at least temporary use of smaller lakes but caused little bias in comparison to the 477 yellow-billed loons sighted on lakes >7 ha. On these ACP plot surveys, 98% of the yellow-billed loons were on lakes >10 ha and 94% were on lakes >15 ha (unpubl. USFWS data, Stehn). By surveying lakes as small as 7 ha, we sampled close to all the lakes used by yellow-billed loons. Nevertheless, in 2007 we did record two incidental sightings, a single and a pair, of yellow-billed loons on a <7 ha lake.

In 2005 we sampled the Interior region with 7 plots, Cape Espenberg with 18 plots, and the Cape Krusenstern with 6 plots. Plots were randomly selected in each stratum with restrictions that a) the center point of the plot was within the stratum boundary, b) no plot overlapped any other plot (either the center point x or y coordinate differed by >12 km from every other plot), and c) the plot was at least an additional 4 km from any other plot boundary. The resulting over dispersed pattern was similar to systematic sampling in that it ensured that no geographic section of the area was missed simply by chance. In 2007, we searched 18 plots at Cape Espenberg and 6 plots at Cape Krusenstern, matching the previous 2005 sampling effort but with different plot locations. Due to the low density of yellow-billed loons observed in the Interior region in 2005 (only one yellow-billed loon observed on seven plots), sampling in this stratum was not repeated. In 2007 we did not use the additional plot spacing of 4000 m because the new plots were sufficiently dispersed just by having to fit without overlap among the 2005 plots. In fact, within the Cape Espenberg stratum, finding 12x12 km unsampled areas for more than 14 plots was difficult; and as a result, we chose to repeat four of the 2005 plots to make a total of 18 plots. One of these was a plot that was not completely searched in 2005 because of fog (plot #16 about 58% searched in 2005 was repeated as plot #9 in 2007). The other 3 repeated plots were selected randomly (plot #9 in 2005 was numbered plot #15 in 2007, #10 now #20, #5 now #21). A total of 51 plots and 868 lakes were searched combining both years of data (Table 1).

Observers

In the 2007 aerial survey, KSB flew the aircraft as pilot/observer and DKM served as right-seat observer. Both observers were highly experienced in aerial waterfowl transect surveys including a minimum of 6 years experience in observation of yellow-billed loons. For pilot KSB, this was her first lake-circling survey flown specifically for loons. The 2005 survey was flown by Edward Mallek (pilot/observer) and Tamara Mills (observer) who, along with DKM, had flown yellow-billed loon plot surveys on the ACP in 2003 and 2004.

Flight and observation techniques

As in 2005, the survey was flown in a Cessna 206 amphibious aircraft at a height of 45–60 m (150-200 ft) above the ground at airspeeds of 150-175 km/hr (80-98 knots). Navigation to each plot was accomplished using the aircraft Global Positioning System (GPS). The pilot used a moving map display upon which plot boundaries, lakes to be surveyed, and flight track of the aircraft was displayed and updated in real time, all of which aided in surveying each plot. Navigation within each plot was further enhanced by use of paper maps managed by the right-seat observer. Each plot was mapped on a single sheet (8.5” x 11”) and these sheets were compiled into a spiral-bound notebook. The plot boundary was overlaid on a 1:63,360 scale topographic map background, all lakes to be surveyed within each plot were colored yellow, and a unique lake number was printed in red. Observations were voice recorded by the pilot using a laptop computer recording system that associated each observation with the GPS location of the aircraft at that same time. The observer also marked and labeled loon sightings directly to the paper maps. There was constant communication and teamwork between the pilot and observer.

The shorelines of all sampled lakes were flown with the aircraft approximately 50m onshore (over land) from the lake edge. This flight path provided a clear and unobstructed view of both the lake and shoreline for detecting both birds and nests. The right- or left-seat observer had a less-obstructed view depending on clockwise or counterclockwise direction of travel, but with banked turns, looking forward or back, and many shifts in direction, both observers contributed to finding loons. Many of the lakes contained bays and peninsulas which required multiple aircraft passes and turns to ensure complete coverage of the shoreline. For larger lakes where coverage of the water was incomplete with only a shoreline pass, flight lines were also flown over the surface of the lake in a systematic manner to ensure complete coverage. A significant amount of ice was present on many of the lakes and, on some of the largest lakes, only a narrow moat of open water was present along the shoreline. For these lakes, survey time was much reduced. Percentage ice cover was recorded for all lakes surveyed, although ice coverage did not seem to influence whether loons were present or absent. Loons were often present on lakes having only a narrow moat of open water but quantitative analysis of habitat conditions are not presented in this report. Notes were also recorded for lakes whose water levels were drawn down or mostly dry, differing from what was shown on the topographic map or the National Hydrography Dataset polygons. We recorded incidental observations of loons (mostly Pacific loons and red-throated loons) on non-numbered lakes (<7 hectares) within plots and between plots, but these were not included in analysis.

All loons observed were identified to species and were recorded as a single, pair, group, or nest. In some instances loons would dive at the approach of the aircraft. Diving behavior was often exhibited by Pacific loons but rarely by yellow-billed loons. Multiple passes at varying altitudes were sometimes necessary to verify species identification of diving loons.

Survey conditions and time of day

We based the survey out of Kotzebue and made observations from 16 June through 23 June 2007. The survey was flown 14 – 21 June in 2005. Timing of the survey was past the peak of nest initiations. Flight time totaled 40 hours in 2007. This total did not include ferry time (~ 4 hrs flight time) from and to the aircraft base station at Fairbanks. Weather conditions prevented flying for 1.5 days from 21 June through mid-afternoon on 22 June. Otherwise, the weather was good for surveying with winds less than 12 knots and skies from clear to overcast (Table 2). Surveys were flown during the hours from 1023 to 1919 hrs AKDT. Weather and timing had no apparent influence on visibility of loons during the survey. The number of lakes per plot ranged from 2 to 46 and time spent surveying ranged from 14 to 205 minutes per plot.

Data analysis

Although total plot size was constant at 144 km^2, the wetland area within plots was variable because plot boundaries often extended into nearshore marine lagoons or upland areas without lakes. We excluded such areas of non-habitat. Only 13 of the 51 plots were completely within wetlands, although 67% of the plots were at least 80% wetlands. The mean and variance of the observed loon density per km^2 was calculated using a ratio estimator to accommodate the unequal size sampling units. We reduced the estimated variance by the finite population correction factor, 1 – proportion sampled. The nests recorded were in addition to birds observed, i.e. a single loon sitting on a nest site was recorded as both a single and a nest. We calculated the density of total birds observed and density of nests detected without modification, simply the total number seen per km^2 of wetland habitat (total of both land and lake area). Density was expanded by the total area of each stratum to calculate the population index.

We also calculated a "indicated pairs" measure that may reflect the number of breeding pairs or the number of loon occupied lake territories. A single bird, a pair, or 2 separated single loons on a given lake was considered as one "indicated pair". Three or four birds observed on a single lake was taken to indicate two "indicated pairs". Observation of a single loon could actually be an unpaired bird, or two single loons could actually be from two different pairs (with their mates undetected), or three loons could actually be one pair plus a temporary intruder from a different lake. Two single loons observed on different lakes could be a pair with one loon temporarily foraging on another lake. We have no ground observations or behavioral data to evaluate the reliability of assigning observations to "indicated pair" units. We do not even suggest a likely direction for bias of this derived index measure. We considered the "indicated pair" (occupied lake units) index measure of value if only as a reminder that the total loons observed measure is also an uncalibrated index to the actual population size.

RESULTS

We observed 136 yellow-billed loons and 18 nests on 24 plots in 2007 compared to 121 loons and 25 nests on 31 plots surveyed in 2005. The geographic distribution and number of loons observed per plot for both 2005 and 2007 are displayed in Figure 2. Based on 18 plots in 2005 and 18 plots sampled in 2007 at Cape Espenberg, a comparison of the expanded population indices showed similar estimates for yellow-billed loons, an increased number of Pacific loons (not significant), and significantly fewer detected nests of both species in 2007 (t-tests, $p<0.05$) (Table 3). The comparison of results from Cape Krusenstern wetlands showed no significant differences between years (Table 3).

We calculated average population indices by including plots from both years. To avoid overemphasis of the repeated sample on 4 plots in the Cape Espenberg area, the data from two plots in 2005 (#10 and #16) and two plots in 2007 (#15 and #21) were dropped and the observations on these same plots as searched in 2007 (now numbered #20 and #9, respectively) and in 2005 (numbered as #9 and #5) were used. The yellow-billed loon total population index was 431 observed birds (90% confidence range = 305 - 558) and 72 (49 - 94) detected nests (Table 3). Of the estimated total birds, 409 (95%) of the 431 were on wetland habitat in the northern part of the Seward Peninsula. With 7,010 km2 of wetlands and an estimated 1,022 lakes >7 ha (Table 1), this area is the most important YBLO habitat in western Alaska. Using indicated pairs as the index measure, we estimated 274 (195 - 354) occupied lake units (Table 3). We also calculated estimated population size indices for each species in each region as subdivided by land management status either within or outside Bering Land Bridge National Preserve or Cape Krusenstern National Monument (Table 4). Approximately 81% of the total estimate of yellow-billed loons were estimated to be on BELA park service lands near Cape Espenberg.

We compared observation data from individual lakes on the 4 plots searched both in 2005 and 2007 on Cape Espenberg. Of the 54 lakes searched twice, 42 lakes had no yellow-billed loon at either search and 6 lakes had 1 or 2 loons present in both years, thus occupancy on 48 of 54 lakes (=89%) was apparently constant. Changes were seen on 6 lakes with 1 lake changing from 0 to 1 yellow-billed loons observed and 5 lakes changing from 1 or 2 yellow-billed loons observed to 0 observed. Of the 12 lakes occupied by yellow-billed loons at least once, 50% changed in occupancy status 2 years later. We did not make such comparisons on Pacific loon observations.

DISCUSSION

A comparable study with lake-circling aerial search of lakes >7ha was conducted on 7x7 km plots in the Arctic Coastal Plain in 2003 and 2004. The observed loon data indicated an estimated total population index was 3,206 (se = 433) yellow-billed loons (unpublished USFWS data, Stehn et al. 2005). With the 431 estimated yellow-billed loons in north-western Alaska, the total population index in Alaska summed to 3,637 (se = 440) birds. The population on the Seward Peninsula near Cape Espenberg contributed 11%. The density on the northern Seward Peninsula averaged 0.058 (se = 0.011) birds/ km^2, which was 44% of the average density of 0.134 (se = 0.023) birds/ km^2 in the higher of two density strata covering 20,558 km^2 on the Arctic Coastal Plain (unpublished USFWS data, Stehn et al.).

The tendency for yellow-billed loons to use the same lakes or areas in successive years can be used to better monitor the trend in population size. The standard error of the difference between years in the proportion of yellow-billed loons present on 54 paired lakes was smaller (62%) than the standard error of the estimate calculated by falsely assuming independent samples. Analysis of plot-sized units (clusters of lakes) also showed the estimated standard error of the difference was smaller (49%) compared to assuming unpaired plots. A valid sampling design that considers repeated measures over time on at least some of the same lakes or plots will improve our ability to detect a significant difference in population size.

We detected fewer nests in 2007. We did not estimate nest detection rate in either year. The change in estimated number of nests might be confounded by the change in observers, search effort, or some other difference in nest detection rate between years, although we are not aware of any differences in observation criteria, search technique, or typical duration of search. Variability among years in nesting and production is typical of yellow-billed loons on the Colville Delta (Earnst 2004). The relatively late chronology of spring-warming temperatures in 2007 was an environmental factor that correlated with the smaller number of nests. The first day at Shishmaref when the 5-day running average of daily mean temperature reached 33 deg F (a temperature measure correlated with nest initiation date of Cackling geese on the Yukon-Kuskokwim Delta) was 3 June 2007 compared to 28 May 2005. Compared to 2007, only 2001 had a later chronology for warming spring temperatures among the last 7 years.

The estimated population indices for Pacific loon and red-throated loon are certainly biased low because our sample design only included those lakes >7 ha. Both of these species use, and perhaps prefer, smaller lakes for their nesting territories.

We confirmed nesting of a common loon on Cape Krusenstern National Monument by visual species identification of the pair at the nest. We landed on the lake to confirm species identification. Previous aerial data included an observation of two single common loons recorded 13 June 1993 on a lake 5.6 km northwest of the mouth of the Nugnugaluktuk River on the Seward Peninsula. This aerial observation did not mention a nest site nor was it confirmed by ground observation.

The data collected are suitable for an analysis of lake and other habitat characteristics that are important to yellow-billed loons, similar to the habitat characterization study conducted on the Arctic Coastal Plain (Stehn et al. 2005). Consideration of other data layers (e.g. lake depth, presence and abundance of fish, precipitation and temperature, timing of ice-out and freeze-up) would also be useful.

Lake polygons from the National Hydrography Dataset (NHD) were used to determine lake size and select those lakes >7 hectares for search. These polygons were based on historic USGS digital line graph hydrography data. Our aerial survey observations provided an opportunity to compare this hydrography with a visual assessment of current water level conditions. We recorded field notes during lake searches and tabulated 121 lakes (about 14%) that had some indication of a possibly drying condition including such comments as shallow, mostly vegetated, muddy shoreline, drained, remnant water around edge, small pothole lakes, and mud hole. We noted a few locations (e.g. Fig. 3) where several lakes clearly showed a reduction in size or near absence of water relative to the NHD polygons. One correlated factor is the average annual temperature increase of 3.4 deg F from 1949-2007 in Alaska (Alaska Climate Research Center, http://climate.gi.alaska.edu/ClimTrends/Change/TempChange.html). Increased temperature may cause permafrost melting, thermokarsting, and potential lake drainage (Yoshikawa and Hinzman 2003, Busey et. al. 2006). One consequence of a warming climate could be loss of lakes and habitat for yellow-billed loons. Nevertheless, without further observations we cannot rule out temporary or cyclic changes in lake levels due to the influence of rainfall, snowmelt, and evaporation. The landscape shows a complex pattern of apparent historic lake basins of unknown age (Fig 3).

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Table 1. Plots, lakes, and area searched during lake-circling aerial surveys for loons conducted on 12x12 km plots sampling wetlands near Cape Krusenstern, Cape Espenberg, and Seward Peninsula Interior in 2005 and 2007.

Region	Year	N plots	Searched km^2	Sampling Fraction	Stratum total km^2	N lakes searched	Estimated number of lakes >7ha	SE estimated n lakes
Krusenstern	2005	6	516	0.261	1978	85	326	90
Krusenstern	2007	6	574	0.290	1978	86	296	109
Krusenstern	2005+07	12	1090	0.551	1978	171	310	69
Espenberg	2005	18	2065	0.295	7010	280	1010	156
Espenberg	2007	18	2362	0.337	7010	358	1062	108
Espenberg	2005+07	36	4428	0.632	7010	638	1010	113
Espenberg [1]	2005+07	32	4025	0.574	7010	587	1022	129
Interior Basin	2005	7	821	0.179	4584	110	614	176
Total	2005+07	55	6339	0.467	13572	919	1934	220
Total [1]	2005+07	51	5937	0.437	13572	868	1947	228

[1] Estimates calculated without one of the replicate searches made on 4 plots.

Table 2. Time and weather condition details noted on yellow-billed loon plots flown in 2007.

Plot Number	Date Flown	Number of Lakes Surveyed	Minutes to Survey Plot	Time Plot Flown -hrs AKDT	Wind direction and speed (kts)	Sky Conditions
1	22 June	2	14	1801-1815	270 at 04	Overcast
2	22 June	13	44	1630-1714	210 at 04	ovc; fog in area
3	22 June	6	28	1732-1800	230 at 04	Broken
4	22 June	7	37	1537-1614	210 at 06	Overcast
5	20 June	15	48	1026-1114	230 at 05	Clear
6	20 June	43	205	1119-1629	220 at 06	Clear
7	16 June	17	85	1211-1336	120 at 10	ovc; light rain
8	16 June	46	156	1337-1653	120 at 07	ovc: light rain
9	19 June	33	123	1238-1441	340 at 04	Scattered
10	19 June	30	121	1442-1724	340 at 06	Scattered
11	17 June	29	91	1023-1154	130 at 04	Overcast
12	17 June	37	177	1154-1451	130 at 04	Overcast
13	18 June	11	53	1542-1635	270 at 07	Scattered
14	17 June	19	57	1620-1717	090 at 09	Overcast
15	17 June	6	27	1452-1519	150 at 05	Overcast
16	23 June	22	118	1027-1225	calm	Scattered
17	19 June	28	109	1730-1919	320 at 07	Scattered
18	23 June	6	23	1232-1255	calm	Broken
19	18 June	11	57	1111-1208	260 at 04	ovc; fog in area
20	18 June	14	59	1636-1735	330 at 11	Clear
21	18 June	16	67	1216-1328	270 at 04	ovc; fog in area
22	23 June	10	48	1432-1520	025 at 04	ovc: light rain
23	17 June	13	56	1522-1618	150 at 05	Overcast
24	18 June	21	68	1422-1525	260 at 07	Scattered

Table 3. Aerial population indices and standard errors for Yellow-billed Loon (YBLO), Pacific Loon (PALO), Red-throated Loon (RTLO), and Common Loon (COLO) based on 2005 and 2007 aerial search of lakes >7ha on 12x12 km plots.

			YBLO			PALO			RTLO	COLO
Region	Year		Ind. pair	Birds	Nests	Ind. pair	Birds	Nests	Birds	Birds
Krusenstern	2005	Pop	**15**	**23**	**4**	**234**	**395**	**81**	**12**	**0**
		SE	*8*	*11*	*3*	*102*	*180*	*55*	*11*	*0*
Krusenstern	2007	Pop	**10**	**10**	**7**	**124**	**210**	**34**	**10**	**7**
		SE	*4*	*4*	*4*	*44*	*75*	*16*	*7*	*6*
Krusenstern	2005+07	Pop	**13**	**16**	**5**	**176**	**298**	**56**	**11**	**4**
		SE	*4*	*6*	*2*	*52*	*91*	*26*	*6*	*3*
Espenberg	2005	Pop	**244**	**387**	**81**	**343**	**557**	**102**	**58**	**0**
		SE	*31*	*49*	*13*	*66*	*107*	*22*	*16*	*0*
Espenberg	2007	Pop	**249**	**395**	**47**	**445**	**709**	**50**	**42**	**0**
		SE	*46*	*73*	*9*	*56*	*89*	*13*	*14*	*0*
Espenberg	2005+07	Pop	**247**	**391**	**63**	**397**	**638**	**74**	**49**	**0**
		SE	*42*	*67*	*12*	*64*	*102*	*19*	*16*	*0*
Interior Basin	2005	Pop	**6**	**6**	**0**	**257**	**435**	**28**	**11**	**0**
		SE	*5*	*5*	*0*	*84*	*141*	*14*	*11*	*0*
Total	2005+07	Pop	**265**	**413**	**69**	**830**	**1371**	**159**	**71**	**4**
		SE	*43*	*68*	*13*	*118*	*196*	*35*	*20*	*3*
Total [1]	2005+07	Pop	**274**	**431**	**72**	**837**	**1386**	**154**	**66**	**4**
		SE	*48*	*77*	*14*	*124*	*205*	*36*	*20*	*3*

[1] The combined year estimates calculated without one of the replicate searches made on 4 plots.

Table 4. Aerial population indices and standard errors for loons in each wetland region as subdivided by conservation management status of Bering Land Bridge National Monument (BELA), Cape Krusenstern National Preserve (CAKR), and other land ownership. Many plots were subdivided by land ownership boundaries accounting for the total of 84 partial plots rather than 55 designed plots.

						YBLO			PALO			RTLO	COLO
Region	Park Unit	Years	N plots	Stratum wetland km^2		Ind. Pair	Birds	Nests	Ind. Pair	Birds	Nests	Birds	Birds
Krusenstern	CAKR	2005+07	7	825.9	**Pop**	**4**	**4**	**0**	**95**	**164**	**35**	**7**	**0**
					SE	*2*	*2*	*0*	*35*	*60*	*18*	*4*	*0*
Krusenstern	Other	2005+07	11	1151.8	**Pop**	**9**	**13**	**5**	**81**	**134**	**22**	**4**	**4**
					SE	*2*	*3*	*2*	*22*	*37*	*9*	*3*	*2*
Espenberg	BELA	2005+07	34	5552.1	**Pop**	**211**	**332**	**52**	**349**	**567**	**67**	**42**	**0**
					SE	*19*	*31*	*6*	*24*	*40*	*8*	*7*	*0*
Espenberg	Other	2005+07	24	1458.4	**Pop**	**35**	**58**	**12**	**46**	**68**	**7**	**7**	**0**
					SE	*5*	*9*	*3*	*11*	*16*	*2*	*3*	*0*
Interior	BELA	2005	6	2688.5	**Pop**	**0**	**0**	**0**	**17**	**25**	**8**	**0**	**0**
					SE	*0*	*0*	*0*	*16*	*25*	*8*	*0*	*0*
Interior	other	2005	2	1895.6	**Pop**	**5**	**5**	**0**	**198**	**338**	**18**	**9**	**0**
					SE	*4*	*4*	*0*	*52*	*85*	*11*	*9*	*0*
NW Alaska total		2005+07	84	13572.3	**Pop**	**263**	**411**	**69**	**787**	**1295**	**157**	**69**	**4**
					SE	*20*	*32*	*6*	*73*	*121*	*26*	*12*	*2*

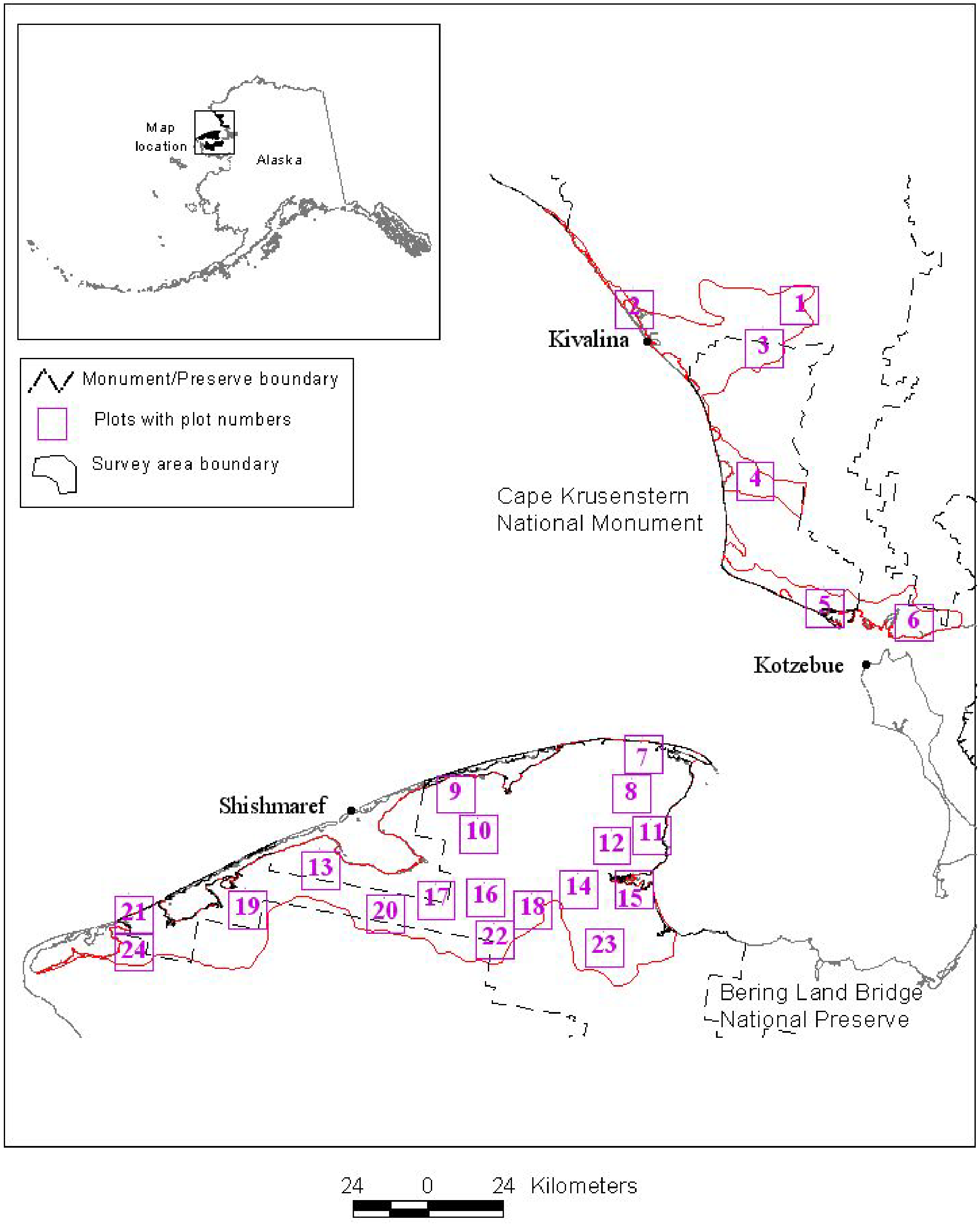

Fig. 1. Plots containing lakes aerially searched for loons from June 16-23, 2007 on 2 survey areas in the vicinity of Bering Land Bridge National Preserve and Cape Krusenstern National Monument, Alaska.

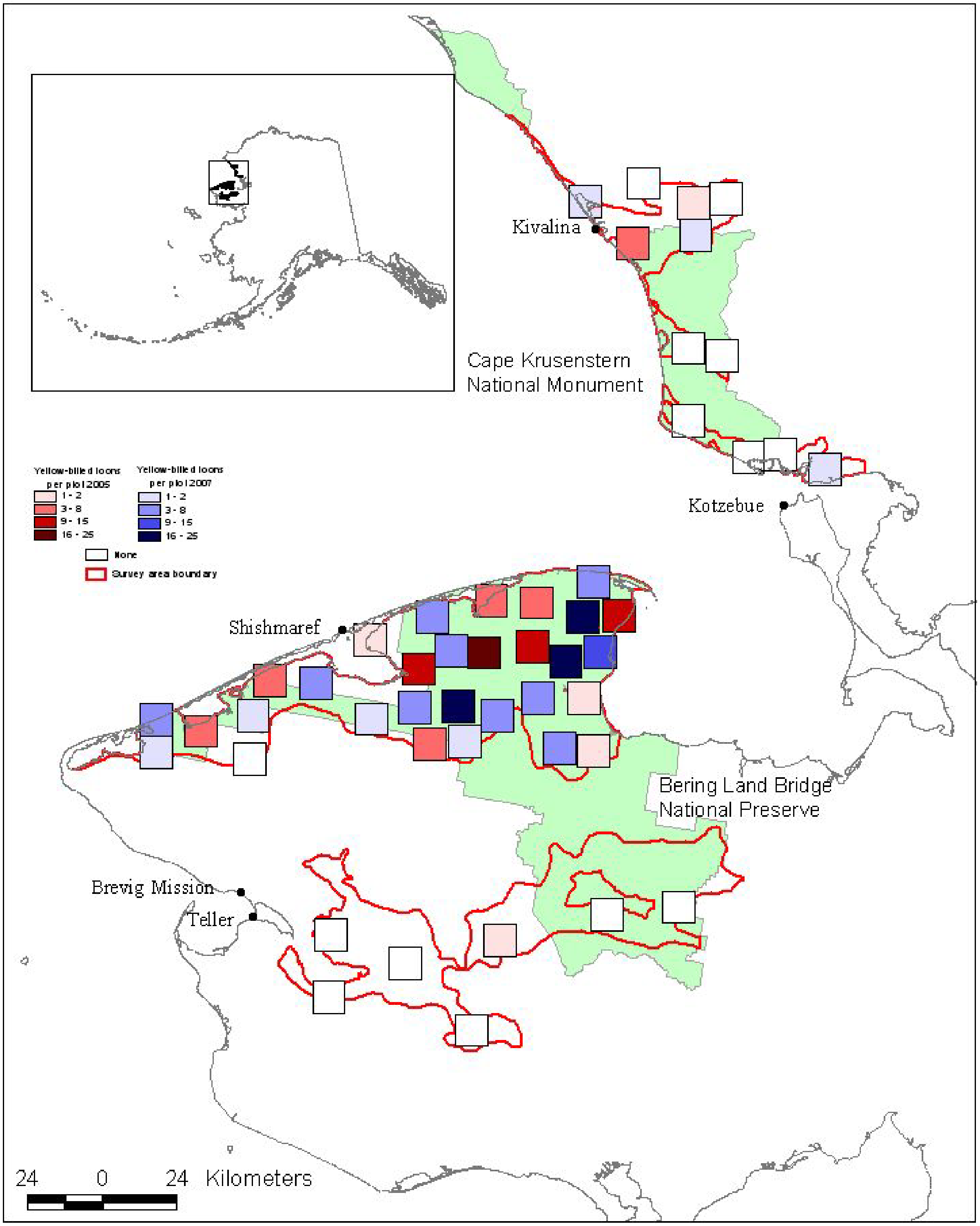

Fig. 2 Number of yellow-billed loons per plot sighted in 2005 and 2007 on aerial survey plots in the vicinity Bering Land Bridge National Preserve and Cape Krusenstern National Monument, Alaska.

Figure 3. The red square delineates plot #7 searched in 2005 on the northern Seward Peninsula just south of Cape Espenberg shown with a background of recent satellite imagery from the Alaska Mapped Best Data Layer Web Map Service. We surveyed all lake polygons >7 ha as obtained from the National Hydrography Dataset (yellow outlines) for yellow-billed loons. Aerial observers noted lake numbers 179, 186, 187, 208, and 210 (red numbers) were partially or mostly dried up compared to the NHD lake polygons. On this plot, yellow-billed loon pairs were seen on lakes 199, 204, 209, 211, and 248 and a nest was observed on lake 248.