

Kodiak National Wildlife Refuge
2007 Bald Eagle Nesting and Productivity Survey

ANNUAL REPORT



by

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Executive Summary

In accordance with the Kodiak National Wildlife Refuge (KNWR) Migratory Bird Management Plan's bald eagle survey five-year schedule, personnel conducted the refuge wide bald eagle (*Haliaeetus leucocephalus*) nesting and productivity surveys during May and July of 2007. The surveys covered all regions of the refuge where bald eagles have ever been observed and is considered a census. A total of 1141 nests were located during the May survey with 439 (38%) nests occupied or active. The 2007 nest occupation rate of 38% was down from 2002 (55%) and 1997 (52%) rates and less than 2/3 of the historic occupation average of approximately 60%. The 2007 total occupied/active nests tallied (439) were down from the previous comprehensive refuge surveys conducted in 2002 (628) and 1997 (530) but similar to 1992 (440) totals. Of the 439 nests occupied in May, 436 (99%) were re-checked for production with 208 (48%) nests successful in producing young. In 2002 and 1997, 53% and 54% of the occupied/active nests were successful, respectively. Nest productivity results during 2007 were 0.7 fledglings/occupied nest compared to 0.9 in 2002 and 0.8 in 1997. Expanded occupied/active nest estimates of KNWR bald eagles from random plot surveys since 2003 indicate nesting effort on KNWR has been declining with the downward trend confirmed by the 2007 comprehensive survey.

KNWR's nesting bald eagle population apparently peaked in 2002, decreasing over 30% by 2007 to reach the lowest nesting effort level seen since 1992. Despite this year's drop, bald eagle nesting activity is still nearly 170% more, along with estimated 54% greater production of young, than when KNWR aerial surveys began in 1963.

Introduction

The monitoring of bald eagle nesting activity on the Kodiak National Wildlife Refuge (Figure 1) started in 1959 with boat surveys along the shores of Karluk Lake (Chrest 1964). Aerial surveys of all Kodiak refuge lands began in 1963. The historic KNWR bald eagle nesting population has been previously described (Hensel and Troyer 1964, Troyer and Hensel 1965, Zwiefelhofer 2007) and compared to other North American bald eagle populations (Sprunt et al. 1973). The KNWR's Migratory Bird Management Plan directs that all refuge lands be surveyed for bald eagle nesting activity at five-year intervals. During intervening years, stratified random plots consisting of 5 degree longitude-latitude blocks are utilized to monitor bald eagle nesting and productivity. The total number of refuge plots containing bald eagle nesting activity by strata were: Low stratum (**L**) - 70 plots; Medium stratum (**M**) - 70 plots; High stratum (**H**) - 47 plots; and Very High stratum (**VH**) - 16 plots; for a grand total of 203 bald eagle nest survey plots on KNWR (Figure 2). X(?) blocks with no historic nest observations were eliminated from the survey.

Methods

Surveys were accomplished utilizing Office of Aircraft Safety A1-B Husky (N28HY) piloted by K. Van Hattan and a PA-18 Piper Supercub (N278Z) piloted by D. Carlson. WB Zwiefelhofer was the observer in both aircraft. The follow-up productivity survey utilized N28HY only piloted by J. Traub with WB Zwiefelhofer as the observer. The initial occupancy survey flights

to determine nest location and status were completed on 19-28 May and expended approximately 45 hours of flight time. The follow-up productivity surveys to determine the status of nests found during the May survey were completed on 27-31 July and took an additional 30 hours of flight time.

☰ surveys were flown at approximately 200 foot AGL with the passenger as the primary observer and the pilot acting as a secondary observer. Nest sites were determined to be active by the presence of an adult in an incubating stance or eggs in the nest or with an adult standing in the nest. Occupied nests had one or more of the following criteria: fresh nesting materials present, two adults actively defending the nest, or 2 adults perched in the nest or nest tree but no eggs or young visible. Active and occupied nests will be combined and referred to as “active” for the purposes of this report. Empty nests contained no evidence of use and no indication of added nest material or fresh construction activity (Bowman 1990). All observations were placed on U.S. Geological Survey 1:63,360 scale topographic maps. Data are then digitized into the refuge’s GIS database. Nest locations, survey dates, nest type and status are sent to Juneau Migratory Bird Management (Raptor Management) for inclusion in the state wide database.

Results

A total of 1141 nests were found during the May survey with 426 nests classified as active and 13 nests classified as occupied for a total of 439 (38%) nests (Table 1, Figure 3). Active ground nests comprised 29% (n=126) while the remaining 71% (n=313) active nests were found in four different species of trees (Table 1). Of the active tree nests, 85% (n=265) were cottonwood (*Populus trichocarpa*) with black spruce (*Picea stichenis*) comprising 8% (n=26), black alder (*Alnus sinuate*) 3.5% (n=11), black birch (*Betula kenaica*) 3.2%, (n=10) and willow (*Salix sp.*) 0.3% (n=1) contributing the remainder (Table 1). Of the active ground nests, ground/cliff nests comprised 98% (n=126) and sea stacks 2% (n=3) (Table 1).

A total of 436 (99%) of the 439 May active nests were revisited to assess production of young. Of the 436 nests checked, 208 (47%) were successful in producing a total of 307 young eagles (Table 2). All of the 13 nests classified as occupied during the May survey failed to produce young. Tree nests supported production of 76% (n=233) of the young while the remaining 24% (n=74) young were found in ground nests (Table 2). Nests in cottonwood trees were by far the most productive containing 86% (n=201) of all young bald eagles found in tree nests (Table 2). Each of the remaining 4 tree species containing nests produced less than 10% of the remaining tree nest young (Table 2). Mean production of young per active nest decreased to 0.7 in 2007 compared to 0.9 in 2002 (Zwiefelhofer 2002), 0.8 in 1997 (Zwiefelhofer 1997), and 0.9 in 1992 (Zwiefelhofer 1992)(Table 3). While 5% (n=15) in 2002 (Zwiefelhofer 2002), 2% (n=6) in 1997 (Zwiefelhofer 1997) and 3% (n=7) in 1992 (Zwiefelhofer 1992) of successful nests produced 3 young respectively, only a single nest produced 3 eaglets in 2007 (Tables 2, 3).

The 2007 nest survey and production survey results by strata are presented in Tables 4 and 5.

Discussion

It appears KNWR's bald eagle nesting population may have reached carrying capacity in 2002 and is now declining to hopefully stabilize at some lower level in the near future (Zwiefelhofer 2007). The 2007 total active nests tallied (439) were down from the previous two refuge wide surveys in 2002 (628) and in 1997 (530) but nearly identical to the tally from 1992 (440) (Table 3, Figure 4). The 2007 nest occupation rate of 38% was also down from previous comprehensive surveys: 55% in 2002, 52% in 1997, and 50% in 1992 (Table 3). The total mean active nest estimates (Figure 4) and estimates for the four individual nest strata showed greater variation between years with some strata up and some down though the overall trend from 2002 was downward (Figure 5). The estimated total number of young bald eagles produced overall has also shown a downward trend since 2003 (Figure 6), while the individual strata differed somewhat in their trends (Figure 7). The overall increase in estimated production in 2003 (Figure 6) appears to have been driven by the High and Very High strata plots sampled (Figure 7) with High stratum plots mean production estimates all above the overall production estimates during the period.

While the estimated proportion of successful nests (Figure 8) and the mean number of young produced per active nest (Figure 9) actually increased between 2002 and 2005, the 2006 estimates for these production parameters were similar to the production results of the 2007 census.

Severe late spring weather in 2006 and 2007 resulting in interior areas like Karluk Lake still being ice covered in mid-May probably contributed in reducing the nesting effort in these years. However, just as climatic variation wasn't likely the sole factor responsible for the tremendous increase in Kodiak's bald eagle population from 1963 to 2002 (Zwiefelhofer 2007) what other factors are driving the current decrease in the population are not known. Changes in bald eagle production parameters likely involve a variety of variables that may change annually, depending on the locality of the population of interest. For non-migratory bald eagle populations like Kodiak's, the overall survival rate from fledging to adulthood is likely the primary factor of concern in long-term population stability but unfortunately this parameter is no less dynamic or understood than the productivity issue. Biologists have long debated what production thresholds are needed to maintain a stable bald eagle populations (Sprunt et al. 1973, Wiemeyer et al. 1984, Grim and Kallemeyn 1995). Sprunt et al. (1973) indicated that a minimum of 50% of the nests needed to be successful with production of 0.7 young/occupied nest was needed to keep a bald eagle population stable. Wiemeyer et al. (1984) felt that a higher standard of 70% nest success and 1.0 young/occupied nest was required particularly when considering the potential impacts of contaminants can have on bald eagle reproduction. KNWR's bald eagle 2007 reproductive results of 47% successful nests and 0.7 young/occupied nest have reached the lower limits of this range and suggests the population will need to stabilize at this production level or will continue to decline. However, with ongoing global climatic changes, in conjunction with other possible human induced impacts, continued monitoring of Kodiak's bald eagle nesting population will be necessary to confirm whether this is true.

A statistical evaluation of the current bald eagle random plot survey design used between full census years has been contracted to TerraStat Consulting; Seattle, WA. The primary objectives of the evaluation are to determine whether strata and sampling protocol used in the past produce acceptably precise estimates for non-census years and are acceptably powerful to detect trends. The analysis will compare a variety of sampling designs and survey efforts for use during non-census year surveys.

Acknowledgements

I would like to acknowledge several individuals that made these surveys possible. First without the skill of the dedication and expertise of the three pilots: Don Carlson, Jim Traub, and Kevin Van Hatten the surveys would not have been completed. I would also like to thank Refuge Manager Gary Wheeler and Supervisory Wildlife Biologist Wm. Pyle for believing the surveys were important enough to fund. Lastly I wish to thank Alice Shelly (TerraStat Consulting) and Alaska region's Refuge Biometrician Joel Reynolds for taking on the daunting task of analyzing the historic data and evaluating the current sampling design for these surveys. Thanks again to all of you.

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Table 1. Number and percent of the different nest substrates and substrate types for active and empty nests found during a bald eagle nest survey on Kodiak NWR conducted on May 19-28, 2007.

Nest Substrate	Nest Substrate Types	Active Nests (%)	Empty Nests (%)	Total Nests (%)
TREE		313 (71)	445 (63)	758 (66)
	Cottonwood (<i>Populus trichocarpa</i>)	265 (85)	365 (82)	630 (83)
	Black Spruce (<i>Picea stichenis</i>)	26 (8)	50(11)	76 (10)
	Black Alder (<i>Alnus sinuate</i>)	11 (3.5)	17 (4)	28 (4)
	Black Birch (<i>Betula kenaica</i>)	10 (3.2)	13 (3)	23 (3)
	Willow - (<i>Salix sp.</i>)	1 (0.3)	0	1 (<1)
GROUND		126 (29)	257 (37)	383 (34)
	Ground/Cliff	123 (98)	253 (98)	376 (98)
	Sea Stack	3 (2)	4 (2)	7 (2)
TOTAL		439 (38)	702 (62)	1141

Table 2. Number and percent of nest substrate and substrate types of the bald eagle nests found to have produced 0, 1, 2, and 3 young during a bald eagle production survey on Kodiak NWR conducted on July 26-31, 2007

Primary Nest Substrate	Secondary Nest Substrate	Nests With				Total Young(%)
		0 Yg(%)	1 Yg(%)	2 Yg(%)	3 Yg(%)	
TREE	Cottonwood * (<i>Populus trichocarpa</i>)	131(50)	62(24)	68(26)	1(<1)	201(86)
	Black Spruce (<i>Picea stichenis</i>)	14(54)	6(23)	6(23)	0	18(8)
	Black Alder (<i>Alnus sinuate</i>)	7(64)	4(32)	0	0	4(2)
	Black Birch (<i>Betula kenaica</i>)	4(40)	3(30)	3(30)	0	9(4)
	Willow - (<i>Salix sp.</i>)	0	1(100)	0	0	1(<1)
	Subtotals		156(50)	76(25)	77(25)	1(<1)
GROUND	Ground/Cliff	72(59)	32(26)	19 (15)	0	70
	Sea Stack	0	2(66.5)	1(33.5)	0	4
Subtotals		72(57)	34(27)	20(16)	0	74(24)
TOTALS		228(52)	110(25)	97(22)	1(1)	307

* Three cottonwood tree nests were not checked for production

Table 3. Summary of Kodiak Bald Eagle Nest Survey Data 1963 to 2007.

Survey Year	Empty Nests	Active: No Production Check	Active W/O Yg	Active W/1 Yg	Active W/2 Yg	Active W/3 Yg	Yg/Occ. Nest	Total Young
2007'	702	3	228	110	97	1	0.7	307
2006'''	136	0	53	26	35	0	0.8	96
2005'''	126	0	43	35	35	0	0.9	105
2004'''	115	0	66	33	29	1	0.7	94
2003''''	139	0	45	39	46	5	1.1	146
2002'	505	30	279	133	171	15	0.9	520
2001''''	116	2	31	25	19	0	0.8	63
2000''''	161	0	17	18	11	1	0.9	43
1999''''	91	0	42	30	25	1	0.8	83
1998''''	104	1	50	23	26	4	0.8	87
1997'	480	12	238	143	131	6	0.8	423
1996''''	107	0	21	29	18	0	0.9	65
1995''''	89	0	35	21	19	1	0.8	62
1994''''	87	0	28	24	34	0	1.1	92
1993''''	96	0	24	26	26	2	1.1	84
1992'	436	33	170	112	120	7	0.9	373
1991''''	145	36	28	22	22	0	0.9	66
1990''	380	5	149	108	160	6	1.1	446
1989''	308	3	94	94	134	13	1.2	401
1988''''	119	4	35	57	52	4	1.2	173
1987'	318	94	81	66	63	0	0.9	192
1986''''	92	8	39	47	21	1	0.9	92
1985	25	1	17	23	18	1	1.1	62
1982'	155	197	2	9	14	1	1.5	40
1980	75	11	20	15	10	0	0.8	35
1978	67	9	29	19	4	0	0.5	27
1977	106	17	10	13	20	0	1.2	53
1976	79	17	10	24	7	1	1.0	41
1975'	136	151	18	23	14	0	0.9	51
1974	85	48	14	15	17	0	1.1	49
1973	117	54	21	13	8	0	0.7	29
1972'	135	135	8	8	8	0	1.0	24
1971	9	4	14	13	7	0	0.8	27
1970	31	40	6	14	8	0	1.1	30
1968	68	57	11	8	14	2	1.2	42
1967'	91	109	17	11	26	0	1.2	63
1966'	85	81	15	10	14	0	1.0	38
1965'	91	86	16	12	7	0	0.7	26
1964'	55	48	23	8	13	1	0.8	37
1963'	95	72	27	20	26	3	1.1	81

' = Complete KNWR survey coverage.

'' = Includes Afognak, Shuyak, Whale, Raspberry, Ban, Amook, Uganik, and Spruce Islands plus the north and western coasts of Kodiak Island.

''' = Random plot data only.

Note: Occupied and active nests are combined and reported as "active".

Table 4. Number and percent of active and empty nests by nest strata from 2007 Kodiak NWR bald eagle nest survey results.

NEST STRATA	NUMBER OF PLOTS	ACTIVE NESTS	EMPTY NESTS	TOTAL NESTS
Low	70(35)	41(9)	100(14)	141(12)
Medium	70(35)	120(27)	188(27)	308(27)
High	47(22)	172(40)	225(32)	397(35)
Very High	16(8)	106(24)	189(27)	295(26)
TOTALS	203	439(38)	702(62)	1141

Table 5. Percent of successful nests, number of young, and average number of young per active nest by nest strata from 2007 Kodiak NWR bald eagle productivity survey results.

Nest Strata	Percent Successful Nests	Number of Young by Strata	Average Young per Active Nest
Low	46	33	0.72
Medium	52	90	0.71
High	42	112	0.57
Very High	41	72	0.63
TOTAL	47	307	0.66

Figure 1. Location and boundaries of the Kodiak National Wildlife Refuge.

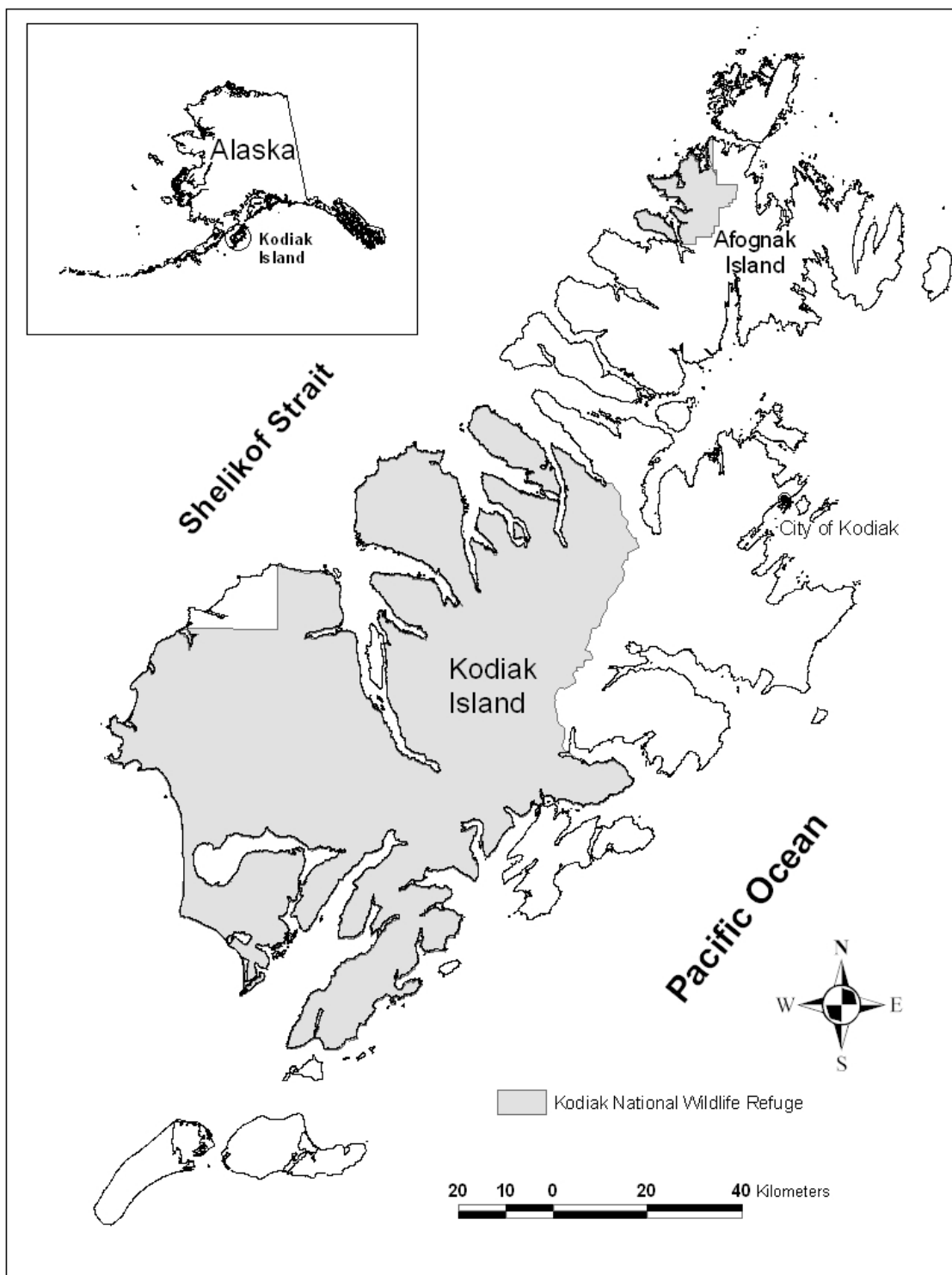


Figure 2. Map of Kodiak National Wildlife Refuge's 5x5 minute longitude/latitude blocks used as bald eagle nest survey sampling plots.

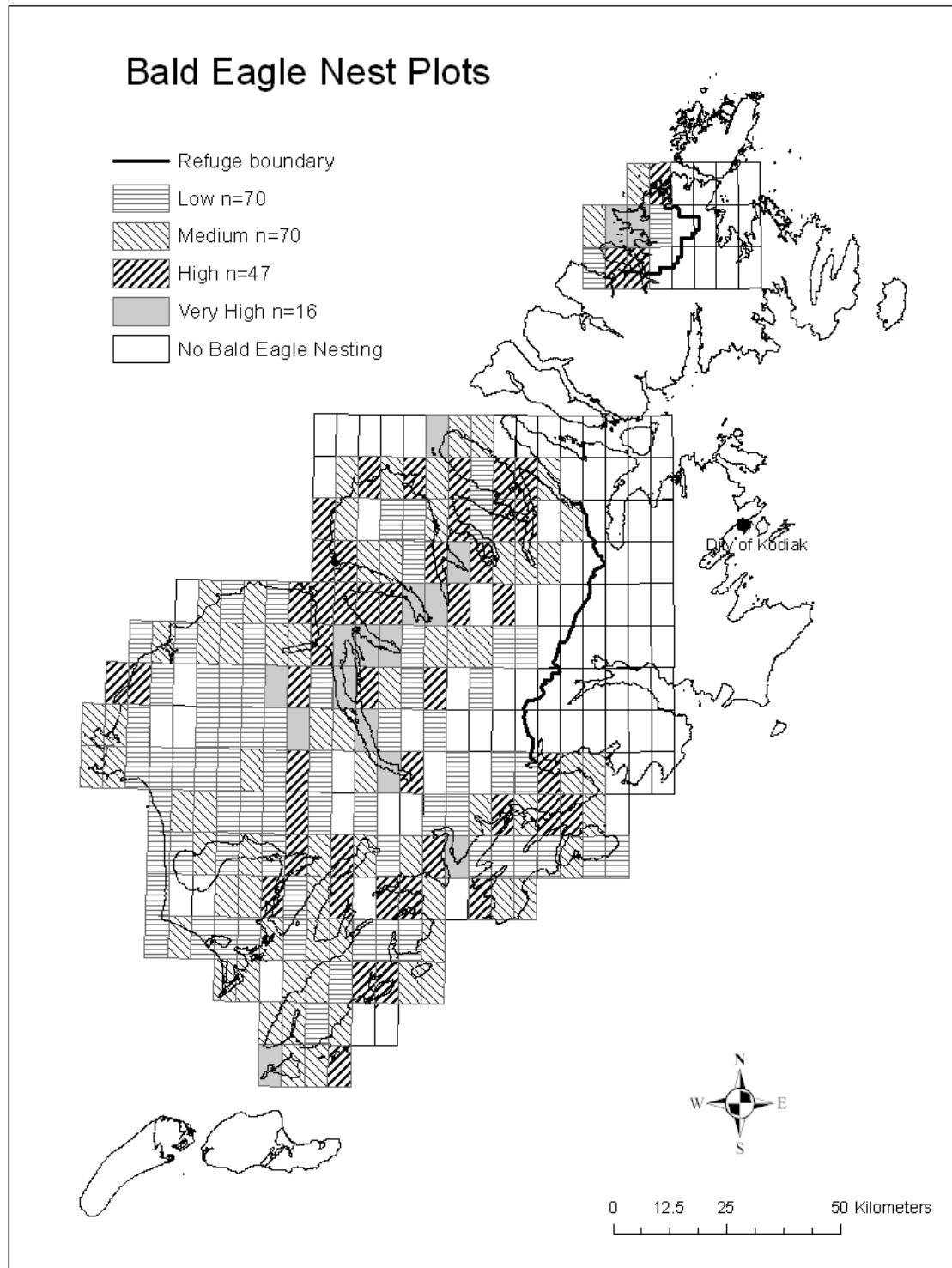


Figure 3. Locations of the active and occupied bald eagle nests found on Kodiak National Wildlife Refuge during the May 2007 refuge wide survey.

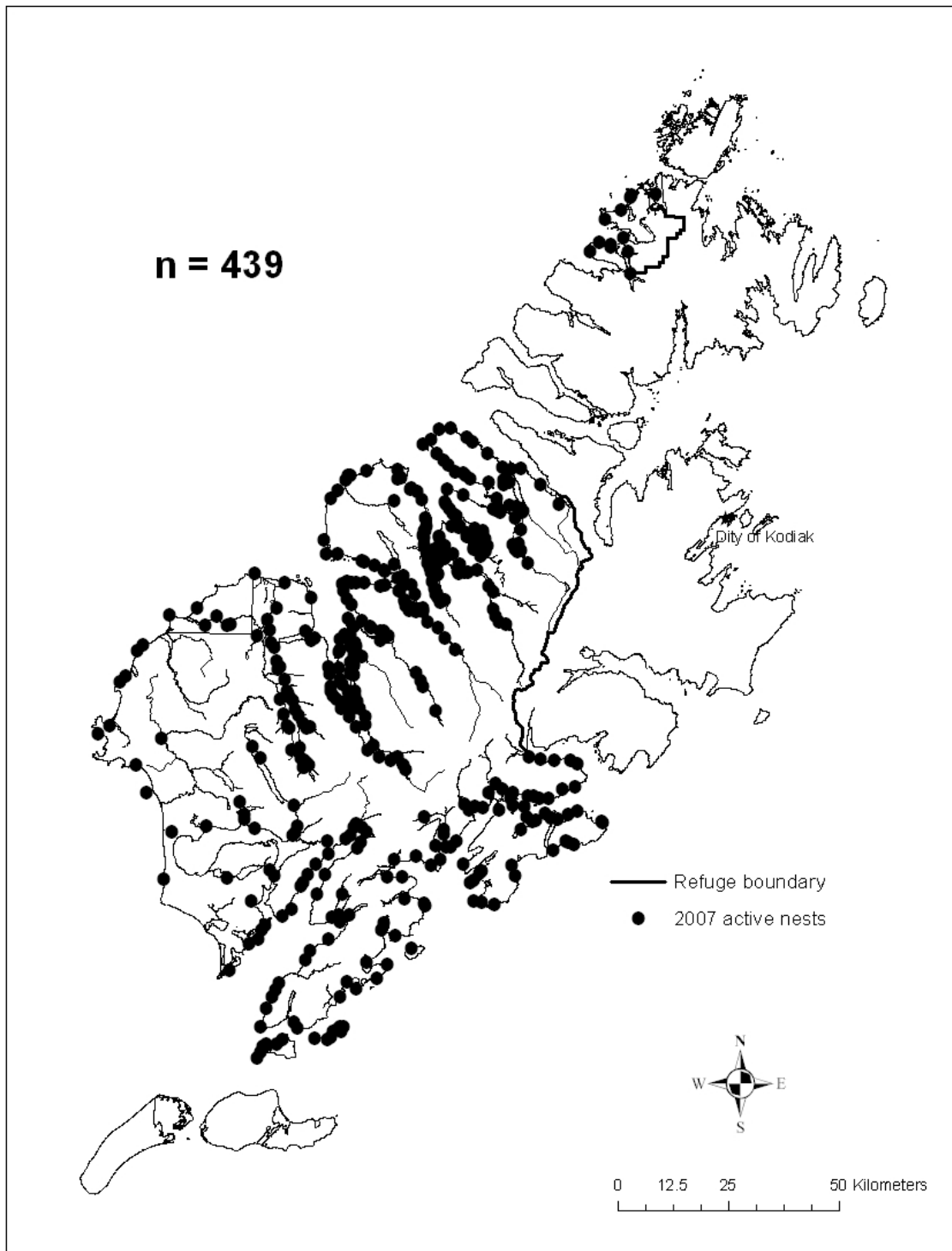


Figure 4. Actual or mean estimated number of active bald eagle nests on the Kodiak National Wildlife Refuge 1992-2007 with upper and lower 90% confidence levels displayed.

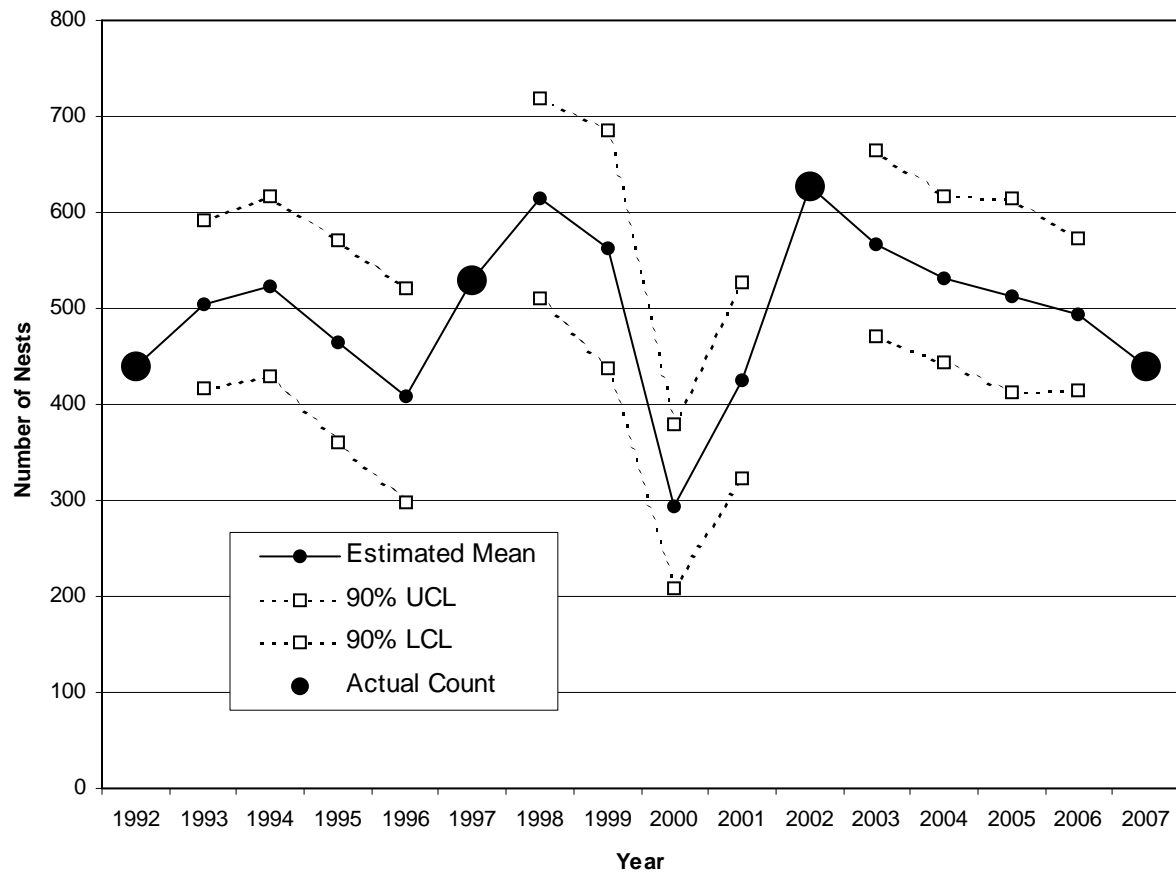


Figure 5. Actual or estimated number of active nests in four nest strata on the Kodiak National Wildlife Refuge 1992-2007 with upper and lower 90% confidence levels displayed.

Actual or Estimated Active Nests

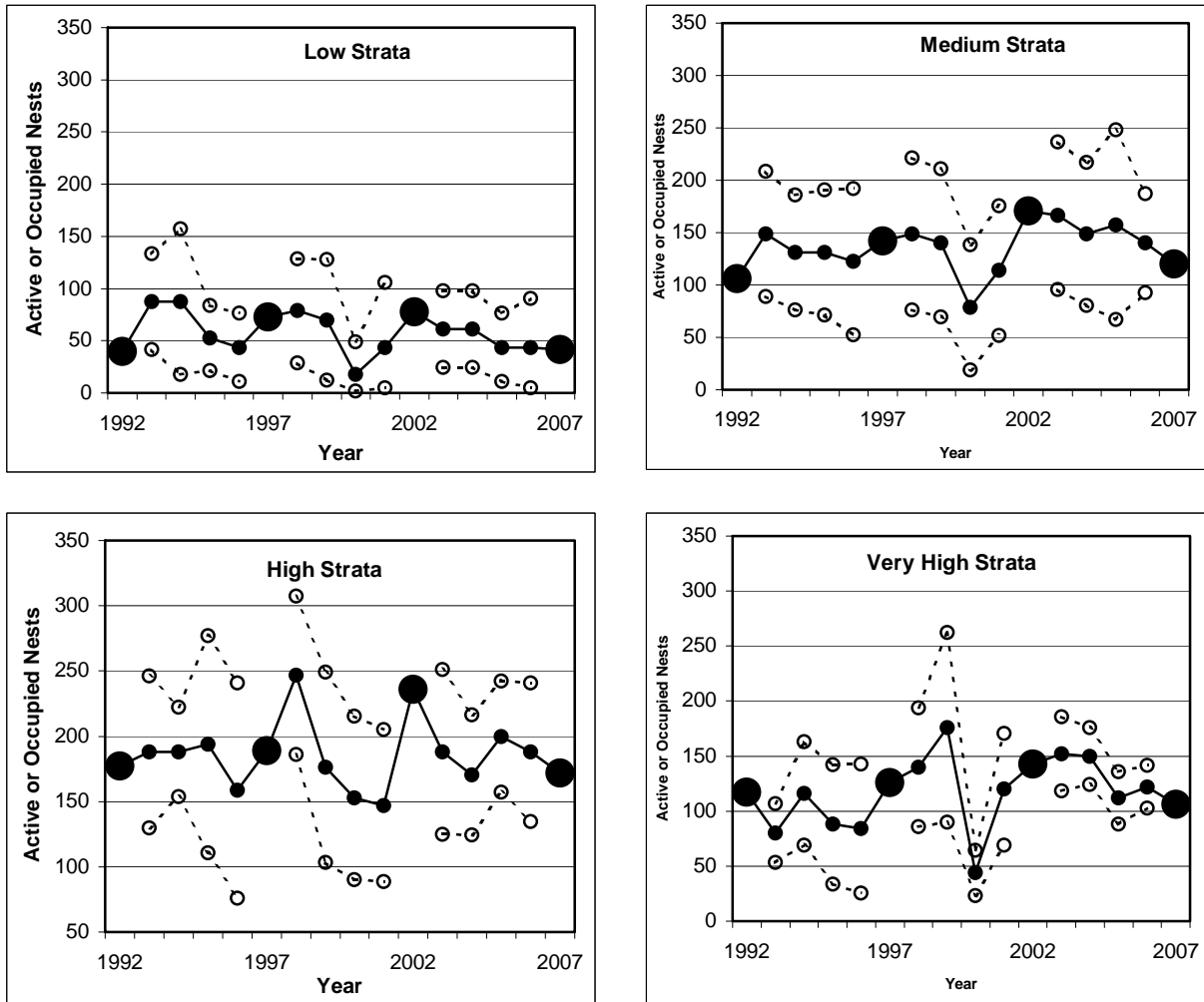


Figure 6. Actual or estimated number of young bald eagles produced on the Kodiak National Wildlife Refuge 1992-2007 with upper and lower 90% confidence levels displayed.

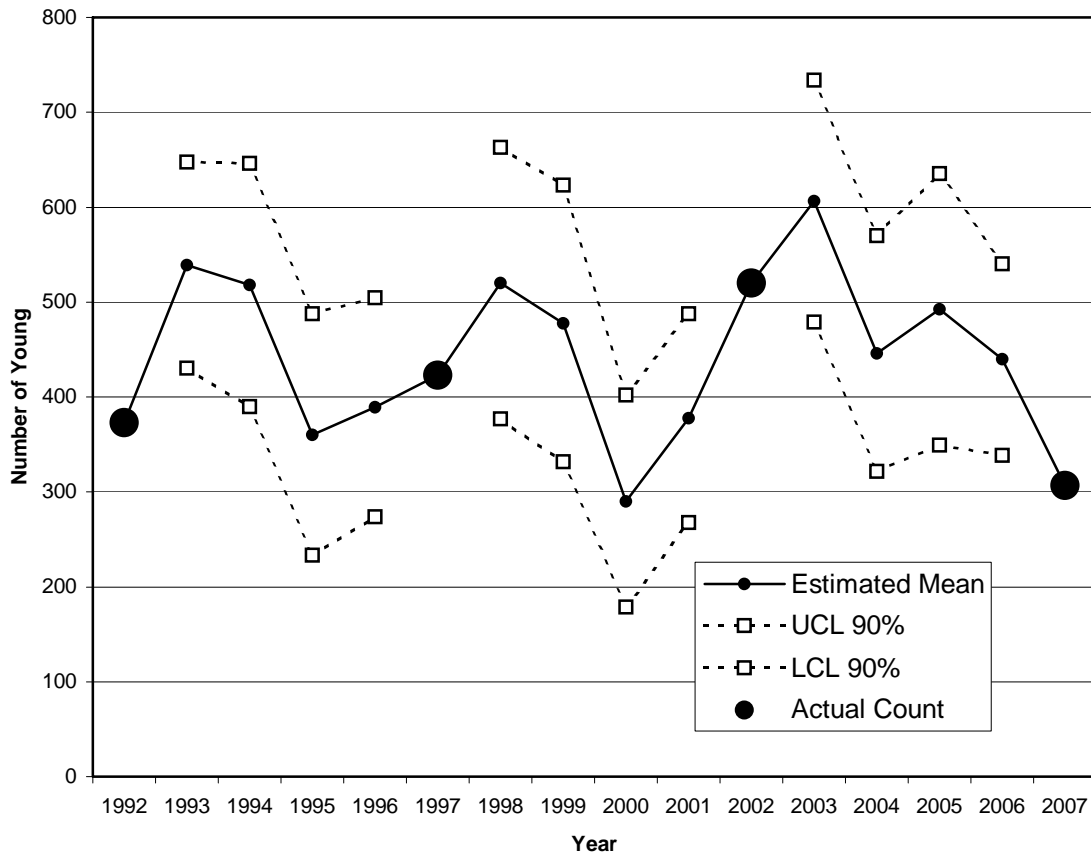


Figure 7. Actual or estimated number of young bald eagles produced in the four nest strata on the Kodiak National Wildlife Refuge 1992-2007 with the upper and lower 90% confidence levels displayed.

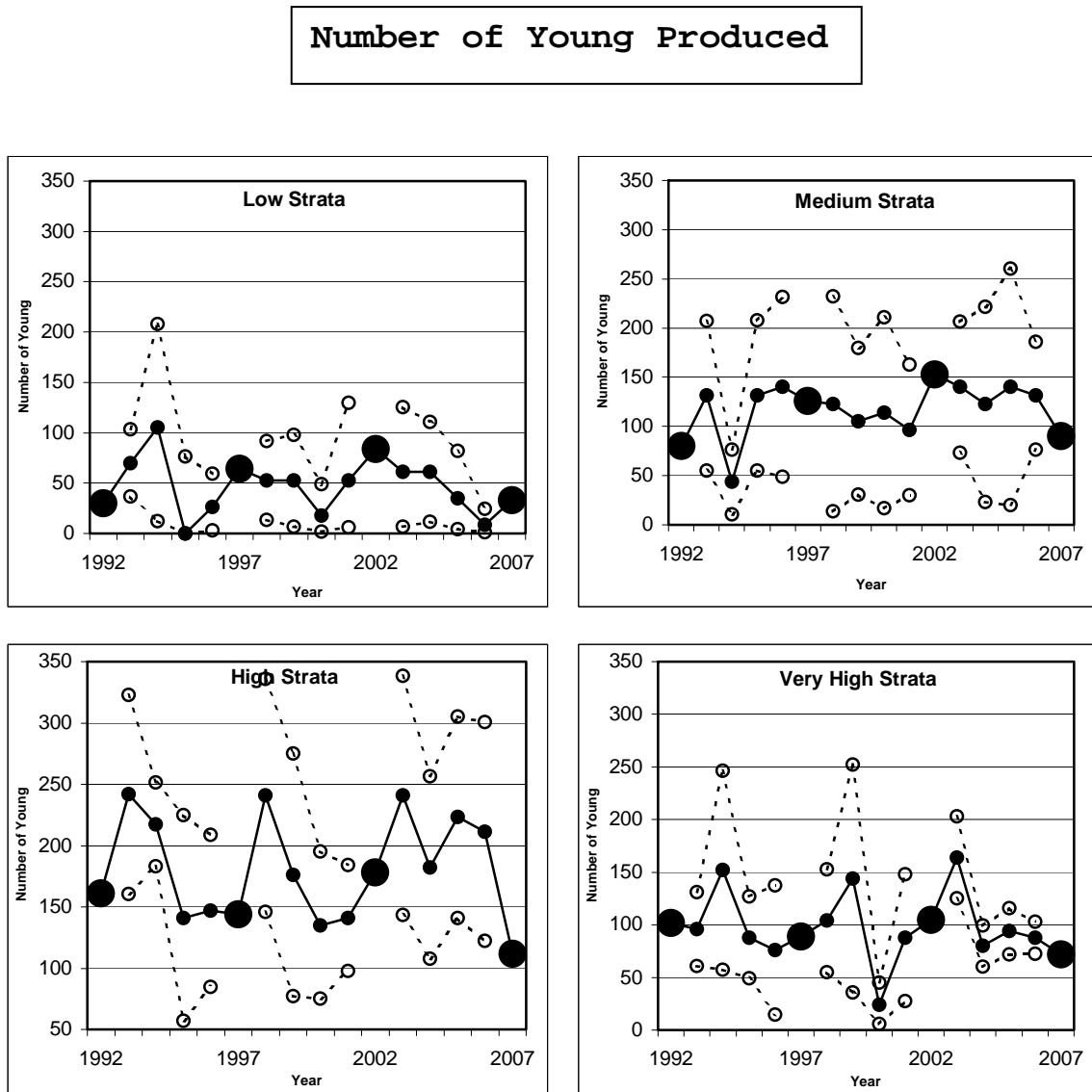


Figure 8. Actual or estimated mean proportion of successful active bald eagle nests on the Kodiak National Wildlife Refuge 1992-2007 with upper and lower 90% confidence levels displayed.

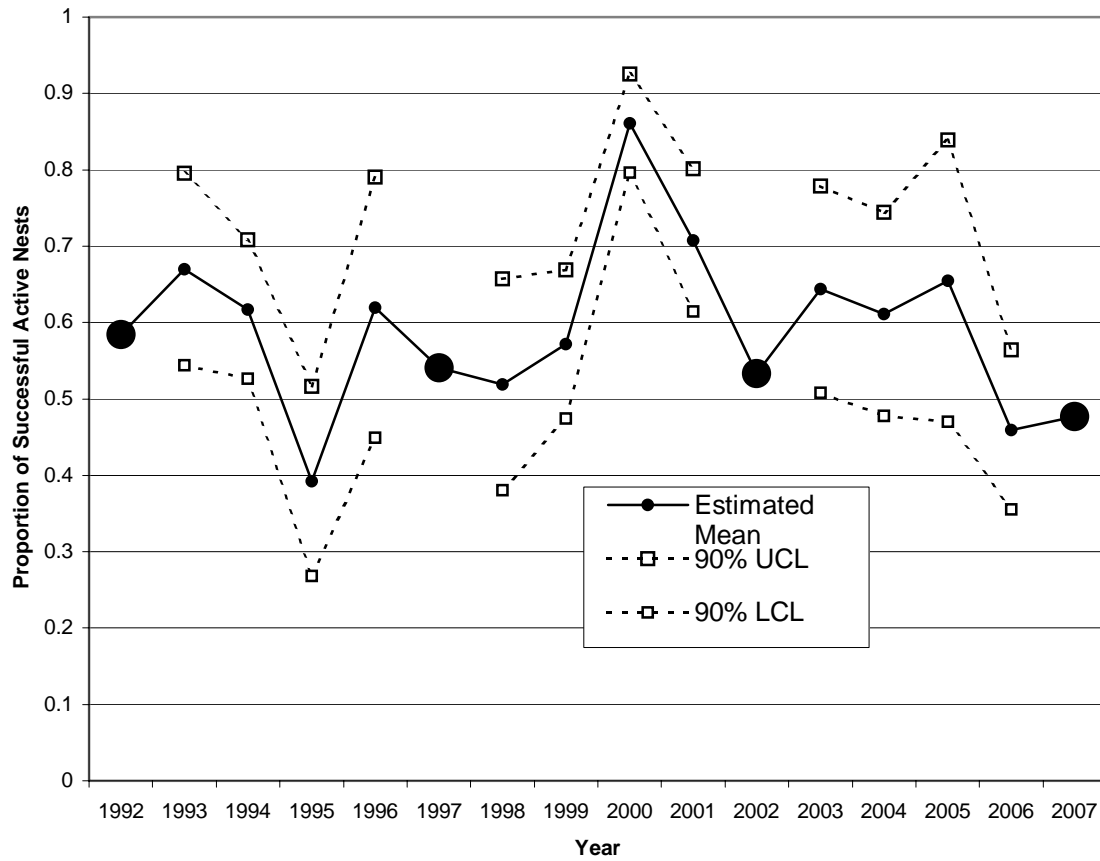


Figure 9. Actual or estimated mean number of young produced per active bald eagle nests on the Kodiak National Wildlife Refuge 1992-2007 with the upper and lower 90% confidence levels displayed.

