First Symposium on Steller's and White-tailed Sea Eagles in East Asia pp. 29-44, 2000
UETA, M. & MCGRADY, M.J. (eds) ©Wild Bird Society of Japan, Tokyo Japan

Steller's Sea Eagle in Magadan District and in the North of Khabarovsk District

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Abstract. The numbers of Steller's Sea Eagles *Haliaeetus peragicus* were recorded on the coastline and rivers of the northern part of the Sea of Okhotsk during surveys in the summers of 1991-1998, and during relatively small scale surveys in 1999. A total of 1852 km of coastline (165 nests) and 1148 km of rivers (109 nests) were surveyed. The breeding range was within a 100 km wide strip along the seacoast. Inland eagle breeding areas include large river valleys with high canopy forests where tree nests were constructed. On coasts eagles nested on both trees and cliffs. The inland border of the breeding range coincided with the upper limits of the spawning grounds of Pacific salmon. There were some locations where the landscape appeared appropriate, but breeding did not occur. The average breeding density varied from 0.7 pairs / 10 km on rivers to 0.9 pairs / 10 km on the coast. Several places had high densities of breeding eagles. Percentage of coastal breeding pairs, as well as the percentage of breeding pairs in both coastal and river habitats combined showed a decline over the study period. Thirty-nine percent of occupied nests on rivers produced chicks, as did 65% of the coastal nests (overall mean 53%). Average brood size was stable over years at around 1.23 chicks / successful nest (1.4 on the coast and 1.1 on rivers). Sampled breeding success was 70% (N = 31) and was not different between riverine and coastal habitats. The total number of chicks fledged per territorial pair declined from 0.8 in 1993 to 0.5 in 1998.

INTRODUCTION

The Steller's Sea Eagle *Haliaeetus peragicus* is a CITES Appendix II species (Eliseev 1985), but little detail is known of its distribution and numbers throughout most of its range. Counts have been made in some parts of the breeding range including Kamchatka (Lobkov & Neifeldt 1986) and Lower Amur (Babenko *et al.* 1988), and the size of the population has been estimated from winter surveys (Nakagawa *et al.* 1987). No accurate and up-to-date counts of

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Steller's Sea Eagles in the Northern Okhotia have been made and little information on breeding statistics has been published.

Notes on the history

The species was first found in the 1760s when the great Northern Expeditions reached the coast of the Sea of Okhotsk with Georg Steller employed as a collector. The scientific description of the species was made by Pallas (1811-1814) and was based on a specimen collected by Steller from "the islands between Kamchatka and American continent" (Stepanyan 1990). In 1789 the Tauy Bay was visited by C.H. Merck, a member of the Billings expedition. He mentioned the Steller's Sea Eagle as a common species around the Tauisk settlement (Stresemann 1948). In 1896-97 the environs around Okhotsk and the Gizhiga tundra were visited by collector N.V. Slynin, whose collection, including some Steller's Sea Eagles specimens, was processed by Menzbier (Menzbier 1900). N. Buxton, who collected specimens around the Gizhiga settlement, observed Steller's Sea Eagles several times in summer and shot one immature male in October (Allen 1905). The doctor of the hydrographical expedition aboard the RS "Okhotsk" visited Eirineyskaya Bay of the Lisyanskiy peninsula, and mentioned that there were many sea eagles building nests on top of larch trees and pinnacles (Buturlin 1911). Kharitonov (1915) mentioned the Steller's Sea Eagle as a common species in the areas close to Okhotsk. Dementiev (1940) noted that Steller's Sea Eagles were breeding in the Ola bay, where in 1939 three nestlings were taken and subsequently delivered to the Moscow Zoo.

Kishinskiy (1968) encountered the species breeding in the Bulun, Takor and Topolevka rivers (Shelikhova Bay). He also mentioned at least 3 pairs on the 30 km of coastline bordering the Babushkina Bay. Lobkov & Neifeldt (1986) referred to personal communications with A.V. Andreev, A.V. Krechmar, Zheleznov and Roslyakov that stated that the Steller's Sea Eagle is absent from the Taygonos peninsula, and defined the range of the eagle as a continuous strip along the coast from the Gizhiga River west to Okhota and Kukhtuy Rivers and probably up to the Uda river in the Shantar Bay. Some preliminary data were collected from the Kava and Chelomdja Rivers by S.V. Tarkhov of the Magadan State Reserve (Pererva *et al.* 1992). For details of occupancy and breeding success we present data from our own surveys, and include data from other sources (Pererva *et al.* 1992 (Kava and Chelomdja rivers); Leito *et al.* 1991 (Koni peninsula), Tarkov pers. comm. (Kava and Chelomdja rivers)) to provide a complete picture.

MATERIALS, METHODS AND REGIONS SURVEYED

Steller's Sea Eagles were counted during coastal and riverine surveys conducted by motorboat, on foot, and by air (Utekhina 1995). Most of the riverine systems were surveyed by air; coastal surveys were made from a small inflatable motorboat accompanied by a seaworthy ship that acted as a base. The surveys were conducted between June and August 1991 through

Table 1. Dates and portions of coastline surveyed.

Year	Months	Place	Means of surveys
1993	26-28 May	Koni peninsula, Umara Island	Motor-boat, boat
	24 Jul. - 3 Aug.	Koni peninsula	Motor-boat, boat, on foot
1994	11 Jun.	Staritskogo Peninsula	Motor-boat
	27 Jun. - 3 Aug.	Coastline from Tauy estuary to the Shestakova peninsula, portions of coastline from Yama estuary to Taygonos peninsula	Motor-boat
	10 Aug.	Gertnera Bay coastline, Staritskogo peninsula	Motor-boat, on foot
1995	24-25 Jun.	Rechnoy Bay - Umara island coastline	Motor-boat
	30 Jul.	Staritskogo peninsula	Motor-boat
	13-14 Aug.	Koni peninsula, Odyan Bay	Motor-boat
1996	31 May	Staritskogo peninsula	Motor-boat, on foot
	2-10 Jul.	Odyan Bay, Koni peninsula	Motor-boat, boat
	15-26 Jul.	coastline from Tauy estuary to point Enken	Motor-boat, boat
	7-12 Aug.	Motykley Bay	Motor-boat, on foot
1997	3 Jun.	Staritskogo peninsula	Motor-boat
	20 Jun., 10 Jul.	Odyan bay and Koni peninsula	Motor-boat
	14-17 Jul.	Odyan Bay	Motor-boat
	1-4 Jul.	Coastline from Tauy Estuary to Gavantsa cape	Motor-boat
	18-27 Jul.	Coastline from Sheltinga bay to Okhotsk sea port, Umara and Spafariev islands, Motykley Bay	Motor-boat, boat
	31 Jul., 1 Aug.	Odyan Bay	Motor-boat
	9-15 Aug.	Yama river	Motor-boat, rafting
	22-30 Sep.	Chelomdja and Tauy rivers	rafting
1998	2 Apr. - 18 May	Talan island	on foot
	12-17 Jun.	Lisyanskiy peninsula	on foot, motor-boat, boat
	13 Jul.	Staritskiy peninsula, Nedorasumenia Island	motor-boat
	14-18 Jul.	Lisyanskiy Peninsula, Spafariev island	Motor-boat
	30-31 Jul.	Umara island, Odyan Bay	Motor-boat
	1 Aug.	Onatsevicha peninsula - Shestakova cape	Motor-boat
	5 Aug.	Lisyanskiy peninsula	Motor-boat
	9 Aug.	Lisyanskiy peninsula - Izmailova Cape	Motor-boat
	10 Aug.	Talan Island, Khmitievskiy peninsula	Motor-boat
	12 Aug.	Motykley Bay	Motor-boat

1998 with a small-scale survey in 1999, mostly in the Magadan Reserve. All calculations on the occupancy, breeding rate and reproductive success were made on the basis of 1991-1998 results. The dates and areas of surveys are given in Table 1 and Figure 1. The surveyed regions were within the Magadan and Khabarovsk (Khabarovsk Kray) Administrative Districts.

During the surveys Steller's Sea Eagle territories were identified, and, if possible, occupancy and reproductive success were determined. Territories were identified by the presence of nests. A territory was considered occupied if at least one non-juvenile eagle was present. Breeding pairs were those that produced at least one egg, and breeding success was achieved when at least one chick was produced. The ratio of successful nests to the number of breeding attempts is defined as 'breeding success' in this study. We also recorded encounters with immature eagles; these were often not associated with a particular territory.

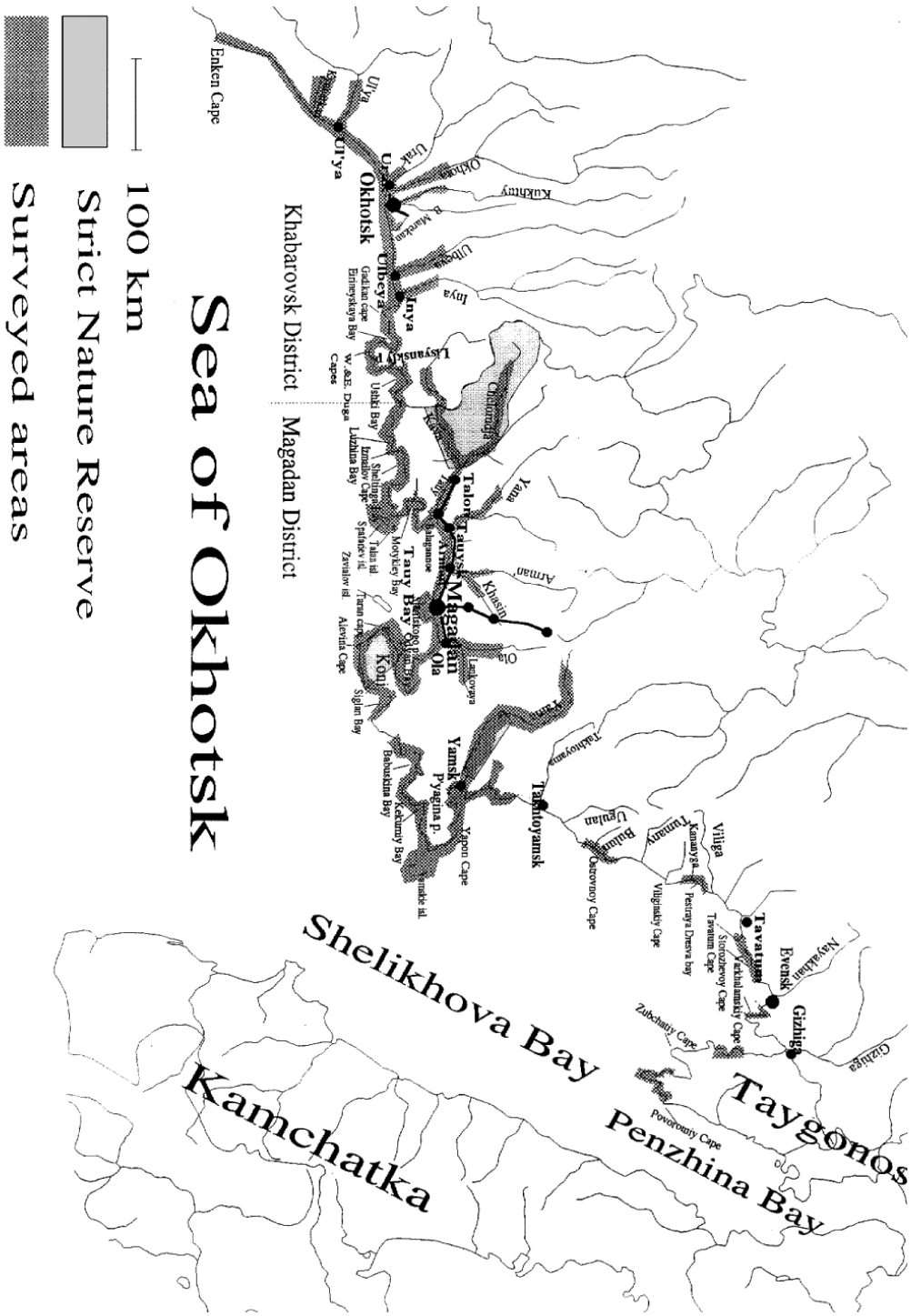

Fig. 1. The coastline and the rivers within the study area.

The density of breeding eagles was calculated as the number of pairs / 10 km of coastline or 10 km of the main stretch of the river. The density of immature eagles is the maximum number of the immatures observed in a single run along a portion of the coastline or river in any year per 10 km of the coastline or river stretch.

RESULTS AND DISCUSSION

Overall distribution of the Steller's Sea Eagle in the region

In the northern Sea of Okhotsk Steller's Sea Eagles breed along the coastline (including most of the larger islands) and along the lower reaches of large rivers (Fig. 2). Distribution of breeding eagles was uneven, with large gaps along some portions of coastline and rivers, and dense clusters of nests along others. In some places eagles nested close to human settlements, but in other areas where the landscape appeared otherwise appropriate, breeding was absent close to settlements and roads. Several areas of high breeding density displayed stable breeding rates over years.

Distribution of the immature eagles was also uneven (Fig. 3). Densities of immatures in some areas was lower than densities of territorial pairs in the same areas. In fact, it appears that immatures may avoid areas with high breeding densities. In any given breeding season, the number of immatures we observed did not exceed 45 individuals.

Coastal nests

Topography along the coast appeared to be linked to local breeding density. Most areas of high density were on south-facing portions of coastline, portions of the coast where there were cliffs and in low-lying areas on bays like Motykley and Siglan. Areas of high nesting density nesting areas are located on the Lisyansky and Koni peninsulas and on the coastal cliffs between the Tauy estuary and Uski Bay. Low coastal areas with wide beaches, such as is found between the Arman' and Tauy rivers, and between the Shilki , Urak, and Yama estuaries had no breeding pairs.

We saw no indication of breeding nor did we observe solitary eagles on the Tayganos peninsula during incomplete surveys of the area (Potapov *et al.* 1995). This is consistent with reports by other observers (Lobkov & Neifeldt 1986, Matvienko pers. comm.). No eagles were found on the Tainochin Cape. Fragmentary surveys along the coastline between the Gizhiga estuary and Yama lagoon indicated only a few territorial pairs the Nayakhan river estuary and at the capes at Storozhevoy, Ostrovnoy, and Tavatum consistent with Matvienko (pers. comm). No eagles breed from Shilki Bay to the Enken cape (see Fig. 2 and Table 2). In Shelikhova Bay Steller's Sea Eagle is scarce (Dementiev 1940, Matvienko pers. comm). The most northerly territorial pair observed during our surveys was in Pestraya Dresva Bay (Potapov *et al.* 1995), however there is some reliable information that it breeds in the more northerly locations in Nayakhan Bay (Matvienko pers. comm.).

Although some eagles fed mostly on sea birds (and these pairs usually reared more than

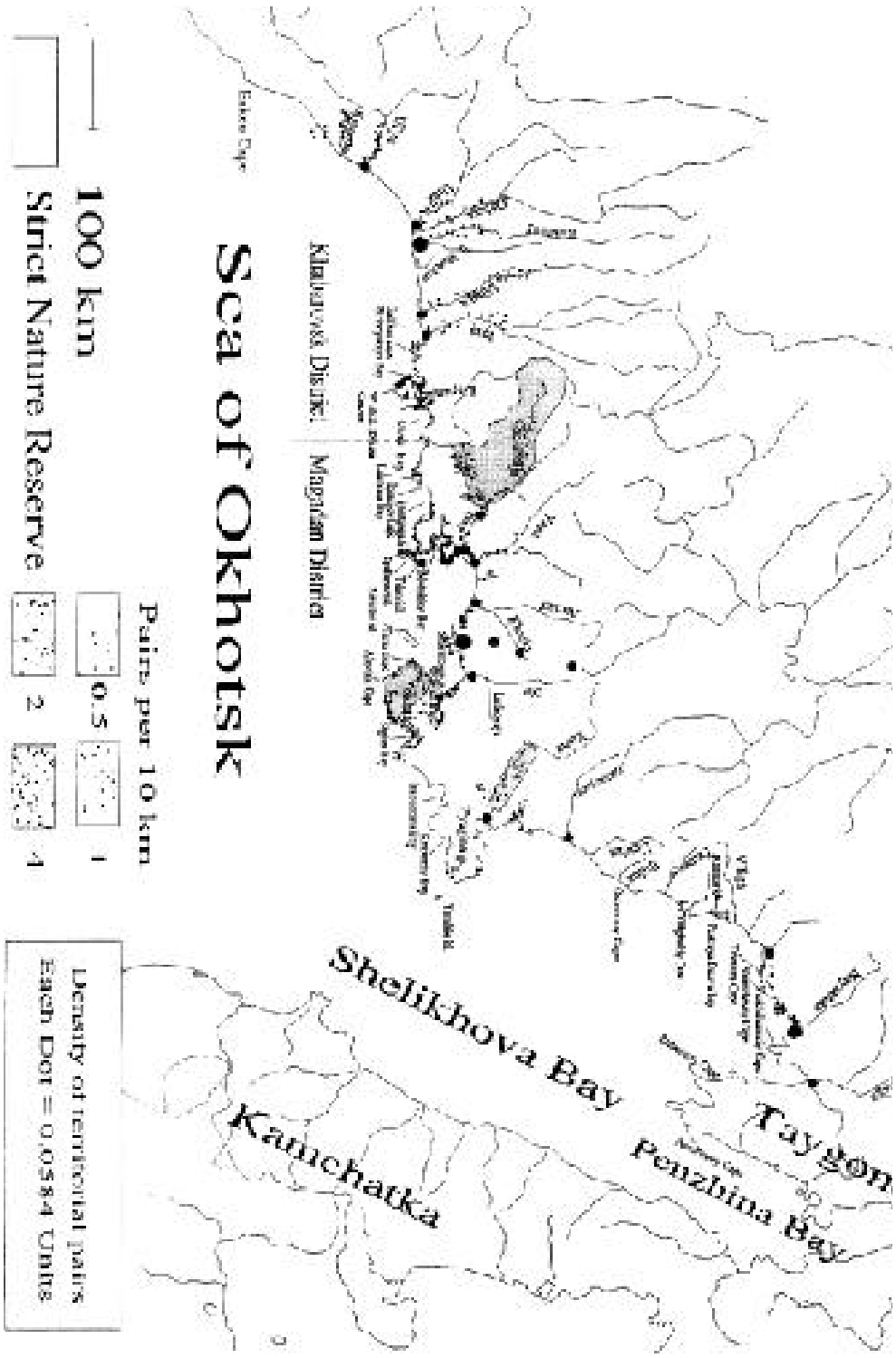

Fig. 2. Density of territorial Steller's Sea Eagles pairs in surveyed areas (pairs per 10 km coastline or 10 km or river stretch).

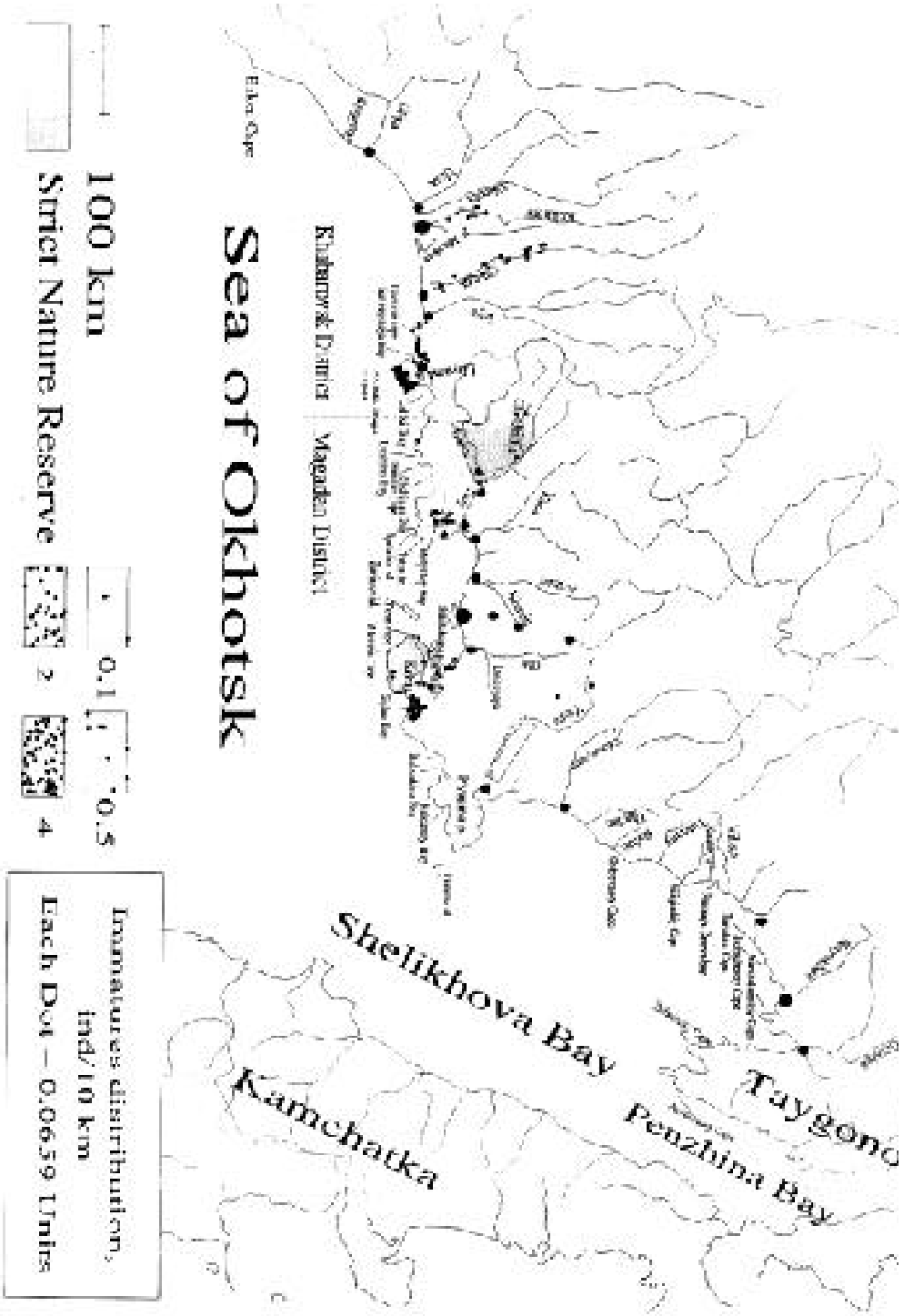

Fig. 3. Density of immature eagles (individuals per 10 km coastline or 10 km or river stretch).

Table 2. Inventory of the Steller's Sea Eagle in coastal areas of Northern Okhotia. L: length of the coastline surveyed, N: number of territorial pairs recorded, N / 10 km: number of territorial pairs per 10 km of the coastline.

Portion of the coastline	L	N	N / 10 km	Comments
Taygonos peninsula (Zubchatiy Cape - Povorotnyi Cape)	110	0	0.00	
Cape Tainochin - Cape Varkhalamsky	45	0	0.00	
Cape Glinyaniy - Cape Granitniy (Topolovka estuary)	30	0	0.00	
Cape Storozhevoy	20	1	0.50	Matvienko pers. comm.
Nayakhan Bay, Nayakhan estuary	20	1	0.50	Matvienko pers. comm.
Tavatum Cape	30	2	0.60	Matvienko pers. comm.
Pestraya Dresva Bay	20	1	0.50	
Cape Ostrovnoy	30	1	0.30	
Iret' Cape	18	1	0.55	
Yama lagoon and coastline up to Yapon Cape	110	0	0.00	
Cape Yapon - Cape Pyagina	37	1	0.27	
Cape Sredniy - Cape Tolstiy	30	1	0.33	
Kekurniy Bay	36	0	0.00	
Babushkina Bay	57	5	0.84	
Evreinova Cape	20	2	1.00	
Siglan Bay	22	5	2.27	
Kiras Cape - Burgauli estuary	57	11	1.92	
Berezovka estuary - Taran cape	58	6	1.03	
Zavialova island	58	2	0.34	
Taran Cape - Mekovodnaya Meteo stn	77	13	1.68	
Mekovodnaya Meteo stn - Naidenaya bay	38	7	1.84	
Beringa Cape - Rechnoy Cape	18	3	1.66	
Rechnoy Cape - Ola lagoon	25	1	0.40	
Uira spit - Dukcha estuary	23	1	0.43	
Staritskogo peninsula	39	3	0.77	
Nagaevo Bay	25	0	0.00	
Ostrovnoy Cape - Arman Mts.	19	1	0.53	
Nedorasumenia Isl.	7	1	1.42	
Arman estuary - Tauy estuary	66	0	0.00	
Shelikan Isl.	0.8	1	1.25	First breeding in 1999
Tauy estuary - Amakhton cape	22	5	2.27	7 pairs in 1994
Amakhton Bay - Motykley Cape	32	7	2.19	8 pairs in 1994
Motykley Bay	49	12	2.44	
Talan island	6	2	3.33	1 or 0 pairs in some years
Spafariev island	32	3	0.93	
Stanukevicha Cape - Oira estuary	102	25	2.45	
Bystrukha river - Ushki Bay	113	20	1.77	19 in some years
Ketlaski estuary - Kulku Bay	14	1	0.71	
Kulky Bay - Kulku estuary	19	2	1.05	
Kulku estuary - E. Duga cape	13	0	0.00	
W. Duga - E. Duga	1.5	0	0.00	
W. Duga - Eirineiysky Cape	22	9	4.09	
Eirineiysky cape - Kekurniy Cape	45	8	1.78	7 in some years
Kekurniy Cape - Shilki estuary	24	3	1.25	
Shilki estuary - Urak estuary	146	0	0.00	
Kynnerkan estuary - Ottynda estuary	22	1	0.45	
Ottynda estuary - Enken Cape	113	0	0.00	

one chick in most years), the presence of a seabird colony did not ensure the presence of eagles. No eagles were found on the Tainochin cape, despite the presence of a massive colony of the Thick- and Thin-billed Murres *Uria aalge* and *lomvia*. Nor did Steller's Sea Eagle breed near another large seabird colony on the Yamskie Islands. However, the small island of Talan and its large colony of seabirds normally accommodates two pairs of the eagles. The relatively large islands of Spafarieva and Zavialova have breeding eagles, but neither support massive sea birds colonies.

The total number of territorial pairs on the seacoasts, including estimated pairs and three pairs nesting on islands with sea-bird colonies is 165. Along the 1852 km of the coast surveyed the average breeding density was 0.9 pairs per 10 km of coastline, but this varied between 0 and 4.1 pairs / 10km of coast.

River nests

The Yama, Chelomdja, Kava, Tauy, Inya, Ulbeya, Kukhtuy, Okhota, and Ulbeya Rivers supported the highest densities of nests on rivers (Fig. 2, Table 3). Steller's Sea Eagle is common on the rivers that drain into Shelikhova Bay (Dementiev 1940, Matvienko pers. comm). From Shilki Bay to the Enken Cape (see Fig. 2 and Table 2) eagles breed only along the lower stretches of the larger rivers. Steller's Sea Eagles were absent on the Ola, Lankovaya, Arman' and Khasyn Rivers. Tauy River estuary supports nesting pairs, whereas no nests were found on the estuaries of the Yama, Arman', Yana, Inya, Ulbeya, Kukhtuy, or Okhota Rivers. Human disturbance is the likely cause of the absence of the Steller's Sea Eagles along the Ola and Arman' Rivers and the lower reaches of the Yama and Okhota.

Inland breeding of eagles was observed in large-river valleys with high canopy forests. Where the course of the river was, in general, perpendicular to the coast, the inland limit of the breeding range coincided with the upper limits of the spawning grounds of the Pacific salmon. The upper-most nest on the Yama River was located 89 km inland, whereas the most up-stream spawning ground is located at the river confluence with the tributary Tob about 100 km inland. Areas of highest breeding density on the Chelomdja River cover 75% of spawning grounds of Pink Salmon *Oncorhynchus gorbuscha*, 80% of that of Chum *O. keta* and about 100% of that of King Salmon *O. kishuch*.

Eagles breeding on rivers that run parallel to the coast may live above the level of the major spawning grounds. Two eagle territories are located upstream from the area of high eagle breeding density on of the Kava River. In the year this area was visited, only one territory was occupied. It was located 211 km up-river, but only 91 km from the sea because the river paralleled the coastline for much of its length.

The total length of the rivers surveyed was 1148 km. The average density was 0.7 territorial pairs per 10 km of river, with variation between 0 and 2.72 pairs per 10 km. A total of 109 territorial pairs have been recorded along the rivers surveyed.

Table 3. Steller's Sea Eagle breeding density along the rivers of Northern Okhotia.
L: Length of river surveyed(km); N: Number of territories; D: Distance between nests (km); DENS: Density (pairs / 10 km).

River	L	N	D	DENS	Comments
Gizhiga	0				Probably breeding
Garmanda	0				Probably breeding
Nayakhan	0	4			Matvienko, pers. comm.
Tavatum		0		0	Eagles have been noted, no breeding recorded. Matvienko, pers. comm.
Shirokaya	0	0			Eagles have been noted, no breeding recorded. Matvienko, pers. comm.
Tumany	0	1			1996, questionnaire
Kalaloga	0	1			1997, questionnaire
Topolovka	0	1			1997, questionnaire
Bulun	0				Possibly breeding, Kishinskiy 1968.
Malkachan	35	4	1.14		
Yama from sources to Alut tributary	80	0	0.00	0	
Yama from Alut tributary to Khalanchiga	67	10	1.49	6.4 (1.8-15.8)	
Khalanchiga	20	1	0.50		
Sivuch	20	2	1.00		Data 1998
Siglan	25	5	2.00	3.7 (1.5-6.0)	
Burgauli	15	1	0.67		
Khindya	14	1	0.71		
Kalkuty	12	1	0.83		No breeding
Ola	45	0	0.00		
Lankovaya	25	0	0.00		
Arman'	80	0	0.00		
Khasyn	35	0	0.00		
Oira	20	1	0.50		Data 1996
Yana	90	3	0.33		Data 1986
Omunka	10	1			questionnaire
Tauy	74	6	0.81	7.8 (2.6-12.0)	4 territories in 1998
Chelomdja (up to Khuren river)	84	17	2.02	5.4 (2.5-13.0)	
Chelomdja (From Khuren to Burgagylkan)	59	1	0.17		
Moldot	16	0	0.00		
Kava (From Ikrimun river to Tauy)	92	9	0.98	7.5 (3.8-17.3)	
Kava from sources to Ikrimun river	120	5	0.41		Questionnaire
Chukcha	14	1	0.71		
Omylen	16	1	0.63		
Usulu	22	1	0.45		Data 1994
Motykleyka	30	1	0.33		One old nest
Ukluchan`	10	1	1.00		
Kulku	12	1	0.83		
Inya	35	5	1.42		
Ulbeya	33	9	2.72	3.4 (1.5-6.5)	
B. Marekan	12	0	0.00		
Kukhtuy	35	4	1.14	5.8 (4.5-7.0)	
Okhota	28	3	1.07		Not complete information due to complexity of river system
Urak	10	1	1.00		
Ul'ya	22	4	1.81	3 (2.0-4.6)	
Kynnerkan	16	2	1.25		

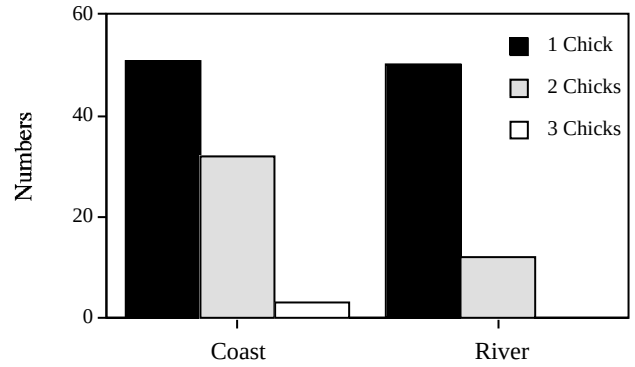

Fig. 4. Steller's Sea Eagle brood sizes in coastal and riverine nests.

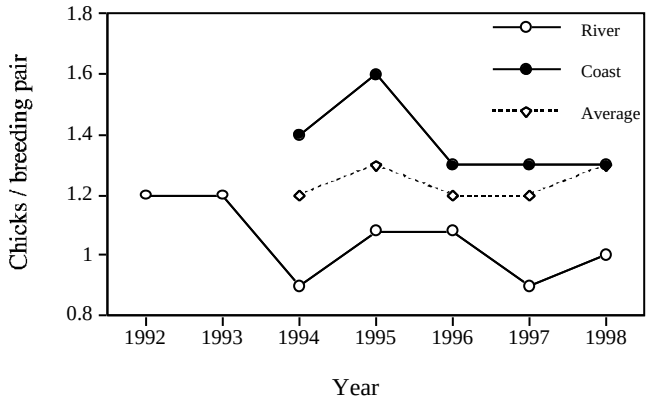

Fig. 5. Steller's Sea Eagle breeding success (number of chicks per breeding pair).

Breeding rate

Brood size

Average brood size for coastal nesting eagles was 1.4 ± 0.31 (SD), and 1.1 ± 0.15 for river nesting eagles. The distribution of the number of chicks in the broods was also different between the coastal and river nests (Fig. 4). Coastal broods more often had broods of two and three . Three chicks broods were observed only along the coast. The difference between river and coastal brood sizes was statistically significant (*T*-test assuming unequal variances, T= -3.23, $P = 0.001$, $N_{river} = 62$, $N_{coast} = 87$).

Brood size was relatively stable (see Fig. 5) over the years and fluctuated between 0.9 and 1.2 chicks/nest along the rivers (average 1.1) and between 1.3 and 1.6 in coastal nests (average 1.4). The mean annual brood size for all nests fluctuated between 1.2 and 1.3 chicks / nest, with the average in all years of 1.23 chicks/nest. There was no significant trend over the years in the fluctuation of brood size in the river nests ($R^2 = 0.36$, $F = 2.90$, $P = 0.15$), coastal nests ($R^2 = 0.36$, $F = 1.74$, $P = 0.27$), or in the two habitats combined ($R^2 = 0.22$, $F = 1.45$, $P = 0.28$).

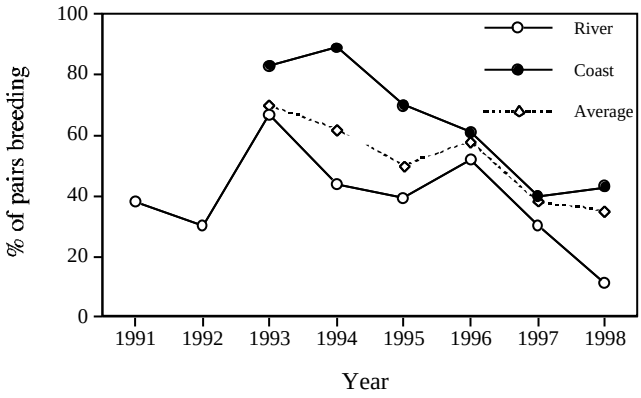

Fig. 6. Ratio of breeding pairs to the total number of territorial pairs of Steller's Sea Eagles (Occupancy).

Occupancy

The proportion of occupied territories in which breeding occurred was lowest in riverine territories (average 39%), and highest in the territories along the coasts (65%). The overall average was 53%.

There was a highly significant negative trend across years (Fig. 6) in the percentage of the pairs taking part in breeding in coastal areas (regression coefficient -9.98, $R^2 = 0.84$, $F = 27.2$, $P = 0.006$). There was no significant regression trend found in the occupancy of the river nests, but the trend of occupancy across both habitats was negative and significant (regression coefficient -6.68, $R^2 = 0.83$, $F = 20.4$, $P = 0.01$). The overall percentage of pairs participating in breeding declined from 70 to 35% in all monitored territories, and from 83 to 44% for coastal territories. The occupancy of the river territories fluctuated between 12.5 (1997) and 66.7% (1993).

Breeding success and overall breeding rate

The average breeding success was difficult to estimate since many nests were too remote to be visited several times per season. Nevertheless, the breeding success at a proportion of nests could be determined and used to estimate overall success. Breeding success was 80 ± 25 % ($N = 35$) in the coast nests and 70 ± 37% ($N = 22$) in the river nests. The overall reproductive success was 70 ± 31% ($N = 57$) for both coastal and river nests combined. Breeding success fluctuated from 62 to 88% (Fig. 7). There was no statistical difference in breeding success between years (Friedman $\chi^2 = 1.33$, $P = 0.93$). Breeding success in the coastal nests did not show significant correlation with the fluctuations of the success in the river nests ($R^2 = 0.36$, $F = 1.74$, $P = 0.27$).

The total number of chicks fledged per territorial pair fluctuated between 0.1 and 0.8 (average 0.4) in river nests and between 0.5 and 1.2 (average 0.7) for coastal nests. The average fluctuation for all nests was between 0.3 and 0.8 in different years, with the average for

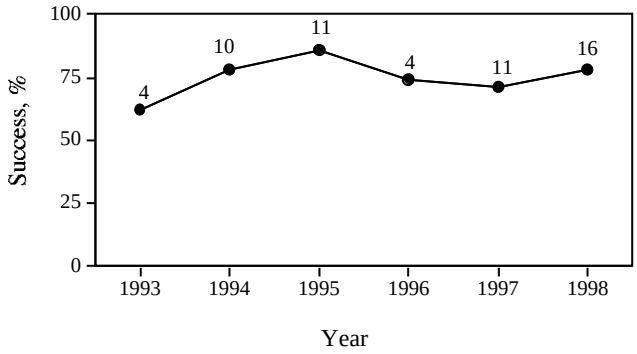

Fig. 7. Steller's Sea Eagle breeding success. Numbers indicate sample size.

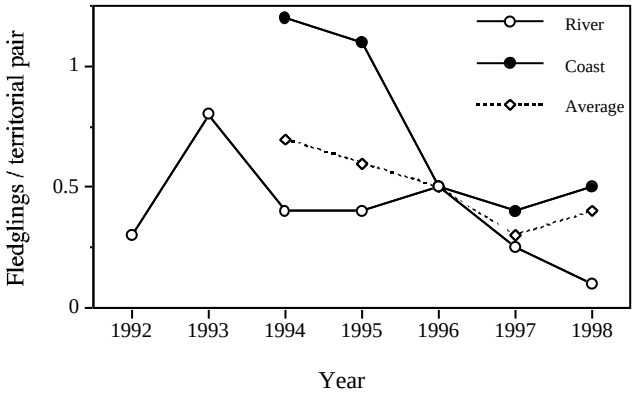

Fig. 8. Number of Steller's Sea Eagle chicks fledged per territorial pair.

all nests in all years being 0.55 fledglings per territorial pair (Fig. 8).

During the study period there was a significant decline in the breeding rate of eagles living on the coastline (Regression coefficient = -3.7, $R^2 = 0.77$, $F = 10.1$, $P = 0.05$), but there was no significant change observed on rivers (Regression coefficient = -5.4, $R^2 = 0.31$, $F = 2.27$, $P = 0.19$). The overall number of chicks fledged per territorial pair for both river and coastal nests combined showed a significant decline over the years of the study (Regression coefficient = -9.42, $R^2 = 0.89$, $F = 32.20$, $P = 0.005$).

Total number of Steller's Sea Eagle in North Okhotia and estimation of the breeding performance of the population

Over the years we surveyed the whole of the coast between Enken Cape (57°43'54"N 140°18'04"E) and Povorotniy Cape, Taigonos Penisula (60°43'11"N 160°47'46"E). We also visited all large rivers in the area up to a point where they became unnavigable by our small craft or up to the upper-most salmon spawning grounds. We estimate that we covered 50% of small creeks and 100% or large rivers (See Table 2). We covered 85% of the coastline, the other 15% was visited by local rangers and fish inspectors who can reliably identify Steller's

Sea Eagles and their nests. Because we had no detailed habitat information upon which to base extrapolation, our estimations of population size and breeding performance represent 'best guesses', rather than statistically reliable estimates. Our estimations were made by dividing the surveyed area into three habitat types: coastal cliff, coastal non-cliff, and riverine. We used mean densities of nesting territories, mean percentage of occupied territories, and mean values for reproductive success from these habitats in surveyed areas to crudely estimate likely values for areas we did not survey.

The number of recorded pairs of Steller's Sea Eagles in all years of the study in the North Okhotia was165 on the seacoast and 109 on rivers or a total of 274 pairs. Simple extrapolation from data on occupancy and breeding where surveys have been extensive suggests a total of 370 (± 2%) territorial pairs, or 200 breeding pairs for North Okhotia. On average these produce 1.24 chicks per brood, or a total of 248 chicks per year, of which 174 fledge (average reproductive success 70%). In addition, some 50 (extrapolated from 45 observed immatures) immature eagles are within the study area during the breeding season. Therefore, the total, pre-migratory local population of the Steller's Sea Eagles of all ages is estimated to be 934 individuals in North Okhotia.

DISCUSSION

Lobkov & Neifeldt (1986) hypothesized that Steller's Sea Eagles do not occupy low areas along the seacoast without forests, or areas along rivers without forested valleys and Pacific salmon spawning grounds. Generally, this study supports this statement, although eagles were not found breeding in the low coasts between the Arman' and Tauy Rivers or between the Shilki Fay and Urak Lagoons despite the occurrence of forested portions of coast.

The absence of eagles between the Arman' and Tauy Rivers is probably due to constant human disturbance caused by a busy road. Human disturbance is likely for the absence off the eagles at the estuaries of Arman', Ola, Inya, Urak, Kukhtuy and Okhota, as there are settlements at these locations. Absence of eagles from the Khasyn and Lankovaya Rivers is more difficult to explain, as there are no roads or areas of high levels of human activity. The paucity of eagles along the Ola River away from the estuary might be attributable to agricultural activities along the lower part of the river and the continuous presence of people. Cases of Steller's Sea Eagles deserting areas have been recorded in Kamchatka (Lobkov & Neifeldt 1986) at the Avacha River, lower Paratunka, Tigil and around the human activity centers of Petropavlovsk-na-Kamchatke and Kluchi. Nevertheless, around Magadan itself and near the village of Balagannoe Steller's Sea Eagles showed a capacity to coexist with humans. In one instance eagles successfully bred only 300 m from a busy coastal resort center despite the year-round presence of humans. A similar example of the coexistence of Steller's Sea Eagle and humans was described at Kizi Lake (Babenko *et al*. 1988), where eagles shared the lake with inhabitants of several settlements in the 1930s.

Extrapolation from our data may not give an absolutely precise estimate of the population

in North Okhotia. We were unable to visit nests several times during the breeding season, so we probably underestimated occupancy and breeding. On the other hand, we rarely saw adult eagles that we could not associate with a territory. Because our surveys were, for the most part, late in the breeding season, it is likely that our estimate of fledging success was better, but we also know that large eagle chicks sometimes do not fledge or that they die soon after fledging (McGrady *et al.* 2000). The estimate by Lobkov & Neifeldt (1986) for the Magadan District was of at least 200 breeding pairs and about 500 pairs on the coasts of the Khabarovsk district (out of which 200 live in the Lower Amur and Shantar Islands), or a total of 500 breeding pairs in the area covered by this study. This is somewhat higher than the 370 territorial pairs, and 200 breeding pairs we estimate. Since no exact data are available for the Lobkov & Neifeldt (1986) estimate, and it is not clear whether the estimate refers to breeding pairs or territorial pairs, there is no solid basis on which to conclude that there has been 40% decline in the breeding population over the last 12 years. However, the decline in occupancy and the total number of chicks produced per unit area during the period of this study causes concern that the population as a whole may be in decline. Nevertheless, as there are no precise data on survival rate of immatures (or other ages) and there is no knowledge of recruitment rates and age of first breeding, we are unable to confirm the stability of the population.

Because of the large area covered by our survey, it is likely to provide data that can be used to test predictions made by statistically based extrapolation in the future, and to provide context. It is important that when the resources become available, that a more comprehensive estimation of the population and breeding success in North Okhotia is made.

ACKNOWLEDGMENTS

The research was funded by Chugach National Forest, Institute for Wildlife Studies (California), WWF Russian Program Grant (1996), Institute of Biological Problems of the North (Russian Academy of Sciences), Magadan State Reserve, Olle & Signhild Engkvists Stiftelser and WWF/Sweden (grants to EP, 1996), US Department of Defense and personal contributions. We are grateful for help in the field by G. Bukaria, V. Mandehall, A.Ya. Kondratiev, B. Benter, M. Thompson, R. Shrank, A. Sovkov, Yu. Balulis, Matvienko, and D. Garcelon. We thank the Osprey Foundation for the 1996 endorsement grant of 1996 to IU and Avon Inflatables, Ltd. (Dyfed, Wales, UK) for the supply of the fine inflatable motor-boat (1994), which was a key tool in the surveys.

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