

On the Demography of the Imperial Eagle *Aquila heliaca* in Kazakhstan

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ABSTRACT

Although rare in most of its range, the Imperial Eagle is one of the most widespread eagles in Kazakhstan and there appear to be roughly 750-800 pairs. Its breeding distribution covers more than 60% of the country and excludes only the mountainous and northern forested regions. The population in and around the Naurzum Reserve has been studied since 1978. The location and occupancy of nesting sites have remained relatively constant. In Naurzum Reserve 86% of 336 nesting attempts were successful (1978-1997), but in surrounding areas it was approximately 40%. Within the reserve, wind is a major cause of nest failure, whereas outside it is human activity. Between 1994 and 1996 17 nestlings fitted with radio transmitters survived to dispersal. Five of the 10 eagles radio-tagged in 1994 were detected, three in 1995, two in 1996 and two in 1997.

Naurzum Reserve has four other endangered species and overall 17 species of raptors nest there. It needs International Biosphere Reserve status and support to establish a model for the sustainable population of eagles and other rare species, and to identify migration routes and plan for their protection. It is necessary to carry out in-depth research using new technology and methodology.

INTRODUCTION

The Imperial Eagle *Aquila heliaca* is one of the most widespread eagles in Kazakhstan. Its breeding distribution covers more than 60% of the country and excludes only the mountainous and northern forested regions. However, this species is very rare throughout most of its range. Breeding densities have only been determined in areas east of the Aral Sea, at 0.18 pairs/1,000 km² (Lobachev 1960) and in the Andasay Zakaznik (South Betpak-Dala) at 2 pairs/1,000 km² (Koshvar 1986).

One of the main factors limiting the breeding distribution of the Imperial Eagle is the scarcity of trees in the steppe and desert landscapes of Kazakhstan. The region south of Kostanai, where the steppe contains scattered small islands of pine forests, provides ideal conditions for the Imperial Eagle and many other predatory birds, including Saker Falcon *Falco cherrug*, Kestrel *F. tinnunculus*, Red-Footed Falcon *F. vespertinus*, Hobby *F. subbuteo*, Merlin *F. columbarius*, White-Tailed Eagle *Haliaeetus albicilla* and others.

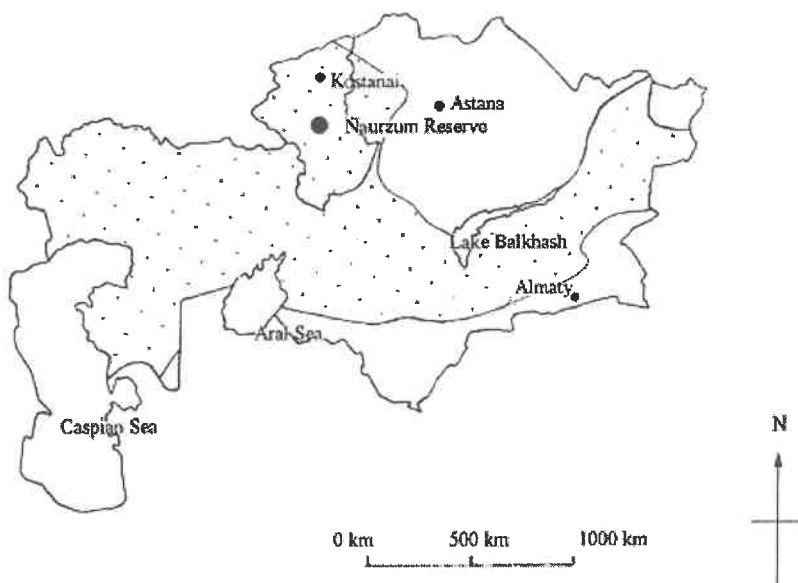
STUDY AREA AND METHODS

The study was conducted in Naurzum Nature Reserve (877 km²) and surrounding areas (Figure 1) from 1978-1997. In 1996-1997, additional areas were examined to establish the number of rare

and endangered raptors in other forests in the Kostanai region, including an area covering more than 60,000 km², from the border of Russia to the Sary-Copa lake in the south.

The terrain of this region is flat, with the exception of slopes of the Turgai valley, and includes different steppe vegetation communities with isolated forests and salt and fresh lakes. In the north of this region, steppe landscapes contain approximately 4.3% birch woodland and mostly open country. About 60% of the region is used for cultivation of wheat. In the dry steppe landscape south of Kostanai woodland comprises only 0.3%. There are three main forested areas, which appear mainly to be pine: Kazanbasi, Amankaragai and Kuandagash. Naurzum (180 km²) and Tersek (41 km²) are pine and Sipsin (140 km²) is birch. There are also three isolated and highly fragmented forest areas in Naurzum Reserve (877 km²) which are the most southerly. About 50% of the steppe surrounding the reserve has not been ploughed and consequently Siberian Marmot *Marmota bobac* and three species of suslik (Table 1) occur. The other main landscape is wetland.

Figure 1. Geographic location of Kostanai Region, Naurzum Reserve and Imperial Eagle breeding ares in Kazakhstan.



On the reserve and surrounding area, I identified nest locations and established productivity for each year 1978-1997. Prey data were collected from 1978-1985. In 1994 and 1996 17 young eagles from the reserve were marked with 5-year backpack radio-tags and were monitored to migration. In following years, attempts were made to find them returning from wintering areas. The distant nests found in 1996-97 were visited twice - after hatching and close to leaving the nest.

RESULTS AND DISCUSSION

In the Naurzum Reserve there were 40 eagle nest sites, of which 22-34 were occupied in any given year. Immature eagles were also present during the breeding season, sometimes concentrated in groups of 7-32 birds. The average ratio of immature to adult, breeding birds was 1:1.25.

The location and occupancy of nesting sites have remained relatively constant. In the 10-20 years of observation, occupancy averaged 85% (range 80-91%): 37% of nests were occupied each year; 33% were unoccupied for only 1-2 years; 15% were unoccupied 3-4 years; and 4% were

unoccupied for five or more years. The yearly average of pairs fledging young was 70% (range 67-92%) of the reserve population. Maximum duration of annual nesting in the same area was 11 years, plus an additional 6 years after a 1 year interval. However, more often the duration of continuous breeding has been 3-5 years, continued after one (sometimes two) or more years.

Some 290 (86.3%) of 336 Imperial Eagle nesting attempts were successful in the Naurzum Reserve (1978-1997), which is a very high rate. Here wind was a major cause of nest failure, whereas outside the reserve it was human activity (disturbance during incubation, including wilful destruction of eggs), reducing success to 40%. Average clutch size was 2.1 (range 1.7-2.4). The most successful nest produced an annual average of 1.8 fledged young (range 1.1-2.2) and overall productivity was 1.5 young per active nest (range 1.1-1.8). Nesting success, measured as the proportion of fledged eaglets from eggs laid, was 77% in the reserve and 49% for the surrounding area. The mortality rate of nestlings was approximately 7%. After fledging, two young were known to have died on electric power lines.

All 17 nestlings fitted with backpack radio transmitters survived to dispersal. Between 1994 and 1997, five of the 10 eagles radio-tagged in 1994 were detected: three in 1995, two in 1996 and two in 1997. Three of the birds were detected twice: one in 1996 and 1997, and two in 1995 and 1997. Thus, the survival rate of young eagles to year 1 was at least 50% and to year 3 was at least 30%. However, none of the seven eagles radio-tagged in 1996 were detected a year later, possibly because they remained south of the Naurzum area.

The mortality of territorial eagles was estimated by indirect methods, assuming that an interval in the occupancy of a nesting site reflected the death of at least one bird from the pair. In some cases, the dead eagle was found. On this basis, a very rough estimate of adult mortality is 8-9% annually.

Monitoring the population of Imperial Eagles in the Naurzum Reserve has shown that the distribution and nesting density have not changed during the last 20-30 years. There are no complete data for the overall number of Imperial Eagles from earlier time periods. However, comparative analysis of Imperial Eagle's diet now, during 1935-1936, and during 1946-1949, 1955, 1966-1969 shows a stabilization between 1950 and 1960 (Table 1).

Table 1. Long-term changes of occurrence (%) of main prey species (or groups of species) in the diet of the Imperial Eagle in Naurzum pine forest.

PREY	1935-1936 ¹		1946,1947,1955 ²		1966-69 ³		1978-1985 ⁴	
	RANGE	MEAN	RANGE	MEAN	RANGE	MEAN	RANGE	MEAN
Suslik ⁵	13-19	15,9	7-24	18,6	22-23	27,1	34-49	45,7
Hamster	2-3	2,4	7-26	13,4	1-4	2,1	0-1	0,5
<i>Cricetus cricetus</i>								
Hedgehog	0-15	7,4	1-3	1,5	0	0	1-2	1,3
<i>Erinaceus auritus</i>								
Microtines	2-3	2,4	7-37	18,5	3-7	5,3	1-9	5,4
<i>Microtus</i>								
Corvidae ⁶	9-15	11,8	1-10	5,9	10-25	16,1	14-30	23,5
Waterfowl ⁷	7-16	11,6	2-5	3,7	17-38	29,7	17-34	22,9
Galliformes ⁸	6-34	20,2	7-20	14	2-7	4,6	1-2	1,4
Little Bustard	7-14	10,7	12-29	21,4	0	0	0-1	0,1
<i>Otus tetrax</i>								
Owls ⁹	0-2	0,9	3-15	4,7	0	0	0-1	0,1

¹Osmolovskaja 1953; ²Gibet 1960; ³Solomatin 1970; ⁴this study.

⁵Suslik: *Spermophilus fulvus*, *S. major*, *S. pygmeus* (before 1955 *S. pygmeus* only).

⁶Corvidae: Rook *Corvus frugilegus*, Jackdaw *C. monedula*, Carrion Crow *C. corone*, Magpie *Pica pica*.

⁷Waterfowl: ducks, coot, grebes, gulls, plovers, Heron *Ardea cinerea*

⁸Galliformes: Black Grouse *Tetrao tetrix*, Willow Grouse *Lagopus lagopus*, Grey Partridge *Perdix perdix*, Quail *Coturnix coturnix*.

⁹Owls: Long-eared Owl *Asio otus*, Marsh Owl *A. flammeus*

Before 1960, the main (>10%) kinds of prey in the diet of the Imperial Eagle changed almost every year (Table 1). After 1952 Large-toothed Suslik *Spermophilus fulvus* appeared and became widely distributed in the area until 1960, while numbers of Siberian Marmot also began to increase (Formozov 1959). Each year from 1966-1969 and 1978-1985, only three groups of prey were important (in different habitats): mammals (suslik or marmot) were the most important, followed by Corvidae (usually Rook *Corvus frugilegus*) and waterfowl. The most striking change was the increased proportion of suslik and marmot. It is possible that the distribution and population of Imperial Eagles also increased during 1950-1960. This eagle is now not so rare north of Naurzum reserve, although no data are available on nesting activities prior to this study. During April and May 1997 the following nests were found: 41 (33 active) in forests of the north of the reserve; five north of Kostanai town; and 36 in forests of the south dry steppe.

Present data do not allow us accurately to estimate the overall number of Imperial Eagles throughout Kazakhstan, because the breeding distribution of this species is very patchy. In at least 70% of the area, it is probable that the nesting density is close to 0.18 pairs/1000 km² as it is in the eastern Aral Sea region (Lobachev 1960). The main reason for this is that the eagles' breeding areas are located in relatively similar landscapes. In good habitats, which cover 400,000-500,000 km² (including the borders of desert with Haloxylon forest and some areas of isolated woodlands) the nesting density is about 1-1.1 pairs/1000 km², and a population size can be roughly estimated at 750-800 pairs. The Kostanai region holds more than 10% of the total number of Imperial Eagles in Kazakhstan, including approximately 5% in the Naurzum Reserve.

Nesting densities, productivity and survival of Imperial Eagles in the Kostanai region show that this population is now reaching stability. However, it is also vulnerable, because more than 50% of the nests outside the reserve fail as a direct result of human activities. The large nests of this eagle are usually located in the canopy of isolated trees or trees growing on the forest edge, where human activity is greatest, and such nests attract a lot of unwanted attention. Unfortunately, the attitude of the local people towards the eagles is not positive, due to the low level of cultural and ecological knowledge. It is conceivable that this situation could be dangerous to the eagle population as a whole.

The current social and economic crisis has had a large impact on some of the natural resources in rural areas, as the old system that provided local communities with these resources was destroyed. Extremely dangerous for the Imperial Eagle is the mass cutting of trees for fuel in cooking and heating homes. Furthermore it seems unlikely that a simple ban on the felling of trees that contain eagle nests will change the situation. Protection of the eagle needs the creation of a system that encourages local communities to protect trees that contain nests, both from disturbance and destruction.

It is clear that global conservation of birds of prey will require preservation of their habitats. Any definition of "key areas" of habitats for birds of prey would undoubtedly include the Naurzum Reserve. In addition to the Imperial Eagle, the area has four other endangered species, including 12 pairs of White-tailed Sea Eagles (11-13% of the total population in Kazakhstan - which the Red Data Book [Anon1996] estimates at 95-110 pairs) and five pairs of Golden Eagles *Aquila chrysaetos*, as well as Steppe Eagles *A. rapax* and Saker Falcons. Overall, 17 species of birds of prey nest on the reserve. The forested areas of Naurzum support the highest densities of small-sized falcons, such as the Kestrel (mean = 850 pairs/100 km²), Red-footed Falcon, Hobby and Merlin. Unfortunately, Naurzum reserve currently suffers from critical financial problems, which hinder protection and management activities. Therefore, Naurzum Reserve needs International Biosphere Reserve status and support. It is already contributing uniquely to the conservation of eagles and other rare raptors through the development of new population models, the identification of migration routes, and planning for the protection of these routes and the rare species that use them. It is essential to continue this in-depth research, and associated development of new conservation technologies.

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