NOTE

Wildlife Science

Fracture status of wild cranes (*Grus monacha* and *G. vipio*) found dead or in a weak condition at Izumi Plain in Japan

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ABSTRACT. The Izumi Plain in Kagoshima Prefecture, Japan, is a major wintering ground for wild cranes. Between October 2009 and March 2016, a total of 204 Hooded Cranes *Grus monacha* and White-naped Cranes *G. vipio* were found dead or in a weak condition in the plane. Of these, 56 cranes had bone fractures. The rate of incidence of fracture was considered to be higher in White-naped than in Hooded Cranes. Tibia fractures were the most common. The leg and wing fracture numbers were almost equal. Forty six percent of the fracture cases were believed to be caused by collisions with the power line.

KEY WORDS: bone fracture, Hooded Crane, White-naped Crane, wild crane

The Izumi Plain in Japan is known worldwide as a major wintering ground for multiple species of cranes [5, 13]. Since 1997, over 10,000 cranes winter every year between mid-October and late March, with the numbers peaking from December to January. In the winter of 2015 to 2016, the number of cranes migrated there exceeded 17,000 [6]. With regard to the species composition of the wintering cranes, Hooded Cranes *Grus monacha* and White-naped Cranes *G. vipio* account for approximately 80% and 20%, respectively [6]. A small number of Sandhill Crane *G. canadensis* and Urasian Crane *G. grus* are also observed there. Every year, more than 30 of wintering cranes die of various causes. The Joint Faculty of Veterinary Medicine at Kagoshima University has been performing autopsies to investigate the causes of death of these cranes. The findings so far have already been reported [4], and the causes of death of 93 carcasses were categorized into visceral coccidiosis, other parasitic infections, hepatitis, highly pathogenic avian influenza (HPAI), other infectious diseases, prostration, collision, injury, and unidentified.

Between October 2009 and March 2016, a total of 204 Hooded Cranes and White-naped Cranes that migrated to the Izumi Plain were found dead or in a weak condition and subsequently died at facilities of the Rescue Center for Cranes while being protected which were preserved in a refrigerated room until use. At autopsy, 56 out of them were found to have bone fractures of which 25 cases were contained in the previous report [4]. These fractures were observed in the collision and injury cases, however, detailed analysis hadn't been made. In the present study, we tried to analyze and categorize the findings on these fracture cases. Fracture state of each crane was examined in an ordinary autopsy. Prior to autopsy, all of these cranes were confirmed avian influenza virus infection negative. Since the virus infection has occurred among wintering cranes in the plane in Dec. 2010 and Feb. 2011, all of the cranes found dead or in a weak condition have been tested for the virus by PCR method. The location points where these cranes with fractures were found were confirmed on a map on a scale of 1/25,000, and the distance from that point to the nearest high-voltage power line was estimated. Around wintering area for cranes in the Izumi Plane, there are no railways, high buildings or other high facilities to which crane could collide, except for high-voltage power lines and towers. The following information was recorded for each crane with fractures: species, sex, age group (juvenile or adult), months of occurrence, fracture site, and number of fractures. Birds were considered juvenile if they had yellow-brown feathers from the head to the neck; otherwise they were considered adults [4]. The sexing was made by macroscopic examination of genital structures of the birds.

The results and discussion are as follows. Fifty-six birds found with fractures were consisted with 40 Hooded Cranes and 16 White-naped Cranes (Table 1). The ratio of Hooded Cranes to White-naped Cranes in the Izumi Plain is approximately 80% to 20%. Therefore, it may be possible to guess that fractures have been occurring at a higher rate in the White-naped Cranes than in Hooded Cranes. We found no clear correlations between the sex or age group and the numbers of fractures. The numbers of fractured cranes in each year varied widely. Especially, that in 2010 was only one because the examination was not done due to the onset of HPAI.

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Table 1. Number of wild cranes accompanied with fractures in the Izumi Plain, 2009–2016

Species	Sex	Juvenile	Adult	Total
Hooded Crane	Male	12	8	20
	Female	11	9	20
White-naped Crane	Male	4	7	11
	Female	3	2	5
Total		30	26	56

Fig. 1. Monthly numbers of wild cranes with fractures during wintering periods in the Izumi Plain, 2009–2016.

Fig. 2. Number of wild cranes with fractures at each bone-site in the Izumi Plain, 2009–2016. The total number exceeds the total number of the cranes studied because where multiple fractures were confirmed in one crane; all of these fractures were counted.

On the other hands, those on each month were interesting as shown in Fig. 1. The highest numbers were found in January: a total of 21 birds (16 Hooded Cranes and 5 White-naped Cranes). Fourteen cranes (8 Hooded Cranes and 6 White-naped Cranes) were found during the Decembers, and 12 cranes (9 Hooded Cranes and 3 White-naped Cranes) were found during the Februaries. The other numbers were five for March, three for November, and one for April. While the number of cranes migrating to the Izumi Plain usually peaks in December every year, the highest numbers of fracture cases were reported in January, followed by December. These months may coincide with the stage when cranes that have arrived at the plain start expanding their feeding area.

Fractures were found in the cervical vertebrae, thoracic vertebrae, coracoids, ribs, femurs, tibiae, metatarsi, humeri, ulnae, radii, and metacarpi (Figs. 2 and 3). Since multiple fractures were found in some cranes, the total number of fractures exceeded the total number of cranes studied (i.e., 56). Common fracture sites varied between species. Overall, the most common fracture site was the tibia (15 cases) followed by the radius and ulna (13 cases), and the rib (10 cases). When femur, tibia and metatarsus were collectively treated as legs, the total number of leg fractures was 25. When humerus, radius, ulna, and metacarpus were collectively treated as wings, the total number of wing fractures was 24; these two numbers were almost equal. Seven cases of coracoid fracture and four cases of thoracic vertebra fracture were also identified. No skull fractures were found. Bite marks, believed to be caused by other

Fig. 3. Representative fractures of wild cranes in the Izumi Plain, 2009–2016. a: Cervical vertebra, b: Coracoid, c: Thoracic vertebra, d: Rib, e: Radius and Ulna, f: Tibia (arrows show the fracture sections).

wildlife such as weasels, were found in the necks of two of the four cranes with cervical vertebra fractures. We guessed they were bitten while still alive because bite marks were accompanied with hemorrhage. The numbers of fractures sustained by individual cranes were as follows: 40 (71%) cranes had one fracture, 11 (20%) cranes had two fractures, three (5%) cranes had three fractures, and two (4%) crane had four or five fractures. Thus, the number of cranes with multiple fractures was 16 (29%) of the total.

Although the cranes with fractures were found over a wide area in the Izumi Plain, it is notable that the number of cranes found within 300 m of the power line was 26 (46%). We have already reported that many crane fracture cases observed in the Izumi Plane were attributed to collision with the high-voltage power line and were categorized as anthropogenic accidents [4], but further analysis hadn't been made. In the present study, we found that about a half of the cranes with fractures were collected under or near the power line, supporting our previous suggestion that the deaths were caused by collision with the power line. Many of these dead cranes in our study had multiple fractures, hepatorrhhexis and/or intraabdominal hemorrhage, but they had normal body weights and were believed to be otherwise healthy (data not published). We speculate that the cranes collided with the power line while flying and caused bone fractures. The cranes then fell to the ground and some of them caused further fractures, organ rupture, and/or intraabdominal/intrathoracic hemorrhaging. From 1950s, bird collision at power lines has been a serious problem in the world [1–3, 8, 14]. Between 12 and 64 million birds in US [9] or 2.5 to 25.6 million birds in Canada [11] were estimated to be killed by power line per year. To reduce collisions with power line of wild birds, attaching the markers on power

lines or underground cabling have been considered overseas [1–3, 11]. In the Izumi Plane, since before 2009, two trials to install color markers on the power line to prevent cranes from colliding with it were done in 1988 and 1999. Regrettably there was no information on the fractured birds before and after the trials, however, a lot of numbers of fractured cranes were found in recent years as reported here.

The number of wing fracture and leg fracture were almost equal. Cranes are characterized by their large wings and long, thin legs, and it is easy to understand that these bones are highly susceptible to fracture. In one rare case of this study, the wound of fracture site of a crane that had lost a part of its foot, from the metatarsal bone to the toe, had closed and recovered completely. However, in the wild it would be extremely difficult for a crane to survive with broken leg or wing. While it is desirable that debilitated cranes be found and rescued as soon as possible, monitoring the vast area of this plain is no easy task. Cranes show strong wariness toward humans and take off when humans get near them [13]. This behavior may cause them to collide with surrounding obstacles when frightened, resulting in bone fractures. If this is the case, preventative measures could involve protecting the birds from human contact and from other human factors such as car noise.

Fracture treatment in a bird is largely influenced by the site and degree of the fracture [10]. Although, a few cases of treatment for crane fracture have been reported [7, 12], it is difficult to do it in ordinary facilities. Cranes are generally difficult to capture. If a fracture was severe and the crane would not be able to move, they would be easily captured. However, such a fracture would be less likely to heal successfully, even if treated. Conversely, mild fractures would be more easily curable, but in this case, the cranes would resist capture vigorously, potentially aggravating their injuries. In any case, cranes with fractures are very difficult to capture and treat.

In conclusion, as fracture status of wild cranes migrated to the Izumi Plain, collision with power line seemed to be a main cause of the fractures. It is not easy to rescue and treat the fractured crane, so effective measures to prevent the collision should be developed immediately for conservation of wild cranes.

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