Captive Cranes of North West Frontier Province, Pakistan

A research report on "Captive Breeding" and "Multiple Clutching" techniques

"*Cranes are a group of birds that can leave the human spirit as few other wild animals can do. Their great size, marvellous soaring abilities, humanoid traits such as "Dancing" and penetrating voices, all strike deep into the human psyche and forcefully remind us of the beauty and mystery of the natural world around us."* ***(Paul A. Johnsgard****).*

Demoiselle crane family

Photo Credit: Zafar Ali

The Ministry of Environment's Pakistan Wetlands Programme

July 2007

Cover photograph: Captive Demoiselle Crane Family at Bannu, NWFP

All photographs used in this report are taken during the study by Zafar Ali unless other specified. The report is produced for the Federal Ministry of Environment's Pakistan Wetlands Programme and can be used as a reference giving credits to the Programme and the author

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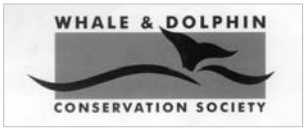

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First of all, I would like to say thanks to the Programme donors for funding Pakistan Wetlands Programme, which has made the present study possible.

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July, 2007

Executive Summary

There are fifteen crane species in the world and most of them are migratory. At least five species of cranes out of the total are in danger of extinction. Four species of cranes have been recorded in Pakistan including demoiselle, Eurasian, Siberian and Sarus crane. Worldwide, populations of many wild cranes have declined and have vanished entirely from some countries. In order to safeguard the populations against extinction, captive breeding programmes have been initiated by various national and international organisations, such as the International Crane Foundation (ICF) and Cracid Breeding and Conservation Centre (CBCC). Captive breeding is a complex science that includes observation, response to bird behaviour, design of surroundings, attention to nutrition, cleanliness and detailed records of the birds' geneology and health.

The sub-output 9.13 of the Pakistan Wetlands Programme regards the conservation of cranes especially Eurasian and demoiselle in district Bannu, Lakki Marwat and adjacent tribal areas in the Kurram valley of North West Frontier Province, Pakistan through captive breeding. Most of the people residing in these areas are crane breeders. They are using different techniques for production of cranes in which the multiple clutching techniques is important.

The Pakistan Wetlands Programme conducted this research study during the summer of 2007 with the basic objective of assessing breeding of captive cranes as alternate to crane hunting. Results of the research revealed that 241 crane keepers breed demoiselle and 40 crane keepers breed Eurasian cranes. A total of 1400 demoiselle and 213 Eurasian cranes were found in captivity with them. There were 676 demoiselle and 102 Eurasian cranes breeding out of the 1400 and 213 cranes respectively.

In captivity demoiselle cranes laid 706 eggs while Eurasian cranes laid 107 eggs, of which 228 eggs of demoiselle and 65 eggs of Eurasian cranes addled. Demoiselle crane successfully hatched 478 eggs while 42 eggs of Eurasian cranes successfully hatched, however 101 and 10 chicks of demoiselle and of Eurasian cranes died respectively due to either accidents or diseases. Once chicks hatched the parent cranes fed them with small pieces of egg shells, mud, small insects e.g. mosquitoes, house flies and different worms up to 7 days.

The eggs from multiple clutching are hatched through broody hens and broody ducks and chicks are left with parent cranes for rearing. Generally cranes accept those chicks hatched through broody hens and ducks. The research findings recommend to organize the crane breeders in the area into an association for promotion of captive breeding of cranes.

Contents

List of Tables

List of Figures

List of Acronyms and Abbreviations

CBCC.....Cracid Breeding and Conservation Center

DFO ..... Divisional Forest Officer

Hakims.....Local medical practitioner

ICF.....International Crane Foundation

MC .....Multiple Clutching

Mou..... Memorandum of understanding

NWFP .....North West Frontier Province

PWP .....Pakistan Wetlands Programme

US.....United States

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1. Introduction

Cranes are important migratory birds. They demonstrate connections, between birds and their habitats, between human and wildlife, and among people of many cultures. In order to understand cranes fully, one must study their routes of migration–where cranes nest and breed, where they spend summers and winters, which routes they fly and the dangers they encounter. Understanding cranes is more than mere science.

There are fifteen crane species inhabiting six continents of the world. The continents of South America and Antarctica do not have any cranes. Australia is home to two of these crane species, which include brogla and Sarus cranes. The other thirteen crane species are found around the world include black-crowned crane, black-necked crane, blue crane, demoiselle crane, Eurasian crane, grey-crowned crane, hooded crane, red-crowned crane, Siberian crane, wattled crane, white-naped crane, whooping crane, and sandhill crane.

At least five species of cranes out of the fifteen are in danger of extinction. The most rare crane species out of these five is the whooping crane (*Grus Americana*). However, in 1966, the Canadian Wildlife and the US Fish and Wildlife Service began a whooping crane captive breeding programme for conservation of this rare species of the world. In 1941 only 16 individuals of whooping crane remained. A team of US and Canadian scientist's took six eggs from Wood Buffalo National Park and transported them by plane in portable incubator to the Patuxent Wildlife Research Centre near Laurel, Maryland. To establish a captive flock and eventually release offsprings to bolster the wild population of whooping crane, 230 eggs were collected between 1967 and 1996. During 1975–1988, another experiment took place wherein 216 eggs were collected from wood Buffalo National Park and shipped to Grays Lake National Wildlife Refuge in Idaho and were placed in the nests of greater sandhill cranes where they were raised by foster-parents. In 1996, the migratory population of whooping crane in wood Buffalo consisted of 45 breeding pairs and 159 individuals and is the only wild flock of the species. (Whooping crane, www.icf.org). Recently there have been experiments of successful captive breeding of cranes using techniques of artificial insemination, multiple clutching and imprinting.

1.1 Crane species of Pakistan

Four species of cranes have been recorded in Pakistan. These include demoiselle crane (*Anthropoid Virgo*) which is relatively plentiful and the Eurasian crane (*Grus Grus*) that is rarely seen. The central population of Siberian crane (*Grus luecogeranus*) has traditionally over flown Pakistan in their annual migrations. This specie is no more recorded on its wintering and breeding grounds and therefore suggested as extinct. The Sarus crane (*Grus Antigone*) once resident species in Pakistan is now regarded to be irregular visitor to the wetlands of the country.

Pakistan falls on the migratory route of Eurasian cranes, demoiselle cranes and Siberian cranes. However, Siberian cranes have never been observed with absolute surety as is the case with other crane species in Pakistan (UNEP/CMS 1995). Four species of cranes have so far been reported from Pakistan, which include the resident Sarus crane and the three migratory species including the Siberian crane, Eurasian crane and demoiselle crane, however, there is little known about the ecology, distribution, migration patterns and population status of these cranes in Pakistan. What is known in Pakistan is due to the work of a few leading biologist, such as Tom Roberts, Dr. Steven Landsfried, the late Dr. Ron Sauey, Ashiq Ahmad Khan, Dr. Mumtaz Malik and Dr. Abdul Aleem Chaudhry (Khan 2004). It is estimated that there are currently 12,000 captive cranes in the Kurram valley, of NWFP in Pakistan, of which hunters use around one-third as decoys in the trapping and hunting of

cranes in each migration season (Khan et al.1999). The NWFP Wildlife Department permits keeping of cranes in captivity and issues a possession licence for these cranes. However, those that are bred in captivity are excluded from regulations and can be kept without a license. This creates difficulty with enforcement since it is difficult to differentiate wild caught and captive bred cranes (Khan 2004)

1.2 Captive Breeding

It is the process of breeding rare or endangered species in human controlled environments with restricted settings, such as wildlife preserves, zoos and other conservation facilities; sometimes the process is construed to include release of individual organisms to the wild, when there is sufficient natural habitat to support new individuals or when the threat to the species in the wild is lessened. This technique has been used with great success for many species for some time, with probably the oldest known such instances of captive breeding being attributed to menageries of European and Asian rulers, a case in point being the Pere David's deer. The idea was popularized among modern conservationists independently by Peter Scott and Gerald Durrell in the 1950s and 1960s, founders of the Wildfowl and Wetlands Trust and Jersey Zoo - who demonstrated considerable success with a wide variety of life forms in the 1970s ranging from birds (eg. pink pigeon), mammals (eg. pigmy hog), reptiles (eg. Round Island boa) and amphibians (eg. poison arrow frogs). Such techniques are usually difficult to implement for highly mobile species like some migratory birds (eg. cranes) and fishes (eg. hilsa). If the captive breeding population is too small, inbreeding may occur due to reduced gene pool, which may lead to the population lacking immunity to diseases and other problems. Over sufficient number of generations, inbred populations can regain "normal" genetic diversity. (wikipedia.org).

Worldwide, populations of many wild cranes have declined and have vanished entirely from some countries. In order to safeguard the populations against extinction, captive breeding programmes have been initiated by various national and international organisations, such as the International Crane Foundation (ICF) and the Cracid Breeding and Conservation Centre (CBCC). Captive breeding is a complex science that includes observation, response to bird behaviour, design of surroundings, attention to nutrition, cleanliness and detailed records of the birds' geneology and health. Captive breeding has a high success rate. 90% of all mammals, 74% of all birds added to U.S. zoo collections since 1985 were born in captivity. A successful captive breeding program by US Fish and Wildlife Service with a bobwhite quail generated the creation of a wildlife refuge in southern Arizona to allow its successful reintroduction (Primack 1998).

As all the species of cranes can reliably interbreed with one another so, the emphasis in captive programmes has shifted from the management of individual to the management of healthy populations to meet the conservation needs. The appropriate integration of captive propagation techniques e.g. multiple clutching or single egg removal, translocation, rearing at release sites, hatching of eggs collected from the wild, artificial insemination, releasing youngs, supplemental feeding and field management techniques are a few of the critical needs that continues to challenge the creativity and ingenuity of crane conservationists.

An estimated population of 4,000 Eurasian and 8,000 demoiselle cranes are in captivity in Bannu, Lakki Marwat and adjacent tribal areas (Khan 2004). Majority of them have come through capturing from the wild, while a tremendous proportion of it includes many homebred pairs.

1.3 Cranes and the Pakistan Wetlands Programme

Survival of cranes depends upon the quality and health of the wetlands. For cranes and other international migratory birds, the conservation of wetlands is essential in each and every part of the world the cranes visit.

The sub-output 9.13 of the Pakistan Wetlands Programme regards the conservation of cranes especially Eurasian and demoiselle crane species in districts of Bannu, Lakki Marwat and adjacent tribal areas through captive breeding. Most of the people of Bannu, Lakki Marwat and adjacent tribal areas are potential crane breeders. They are using different techniques for production of cranes in which the multiple clutching technique is important. It is important to identify these potential crane breeders, assess their local methods of breeding and enhance and encourage their efforts for the conservation of cranes. The Pakistan Wetlands Programme commissioned this study with a broader objective of assessing the current status of captive breeding of cranes in the southern districts of NWFP and exploring potential of it as a conservation tool for the population of cranes migrating through the Kurram valley.

2. Objectives of the study

The following are the specific objectives of the research:

- Identify potential crane breeders, their local breeding techniques and the extent of their experiences with multiple clutching;
- Know reasons of failures and successes in captive breeding of cranes:
- Promote captive breeding of cranes in the region in collaboration with NWFP Wildlife Department;
- Document local knowledge regarding captive crane behaviour, diseases, chick feeding and others;
- Document recruitment to captive flocks from wild population versus captive breeding.

3. Methods

The following methods were used in the survey process.

3.1 Informal meetings

Informal meetings with crane keepers were held to identify crane breeders in the area. During these meetings questions related to captive breeding and multiple clutching techniques were asked including questions on their experiences with multiple clutching techniques along with their successes and failures in captive breeding. Their personal experiences, comments and recommendations for the improvement of captive breeding techniques were recorded. All the information and data were collected in a friendly environment. The data collected from each individual are arranged in the tabular form.

3.2 Interviews

Interviews were held with the crane breeders with a focus on those who had experiences with captive breeding and multiple clutching techniques. During interviews they were asked about captive-breeding programme to be initiated by the NWFP Wildlife Department at the crane conservation centre near Kurram Bridge. They quoted their comments about cooperation of people and chances of successes of this programme. Their recommendations were also recorded (see figure 1).

Fig. 1: Research Assistant discussing captive breeding and multiple clutching techniques with crane breeders

3.3 Group discussions

Group discussions about captive breeding and multiple clutching techniques were held with the crane breeders. They shared information about their experiences of captive breeding. The information gathered were cross-checked and agreed upon data was recorded. During group discussions, their comments and opinions about captive breeding were also noted.

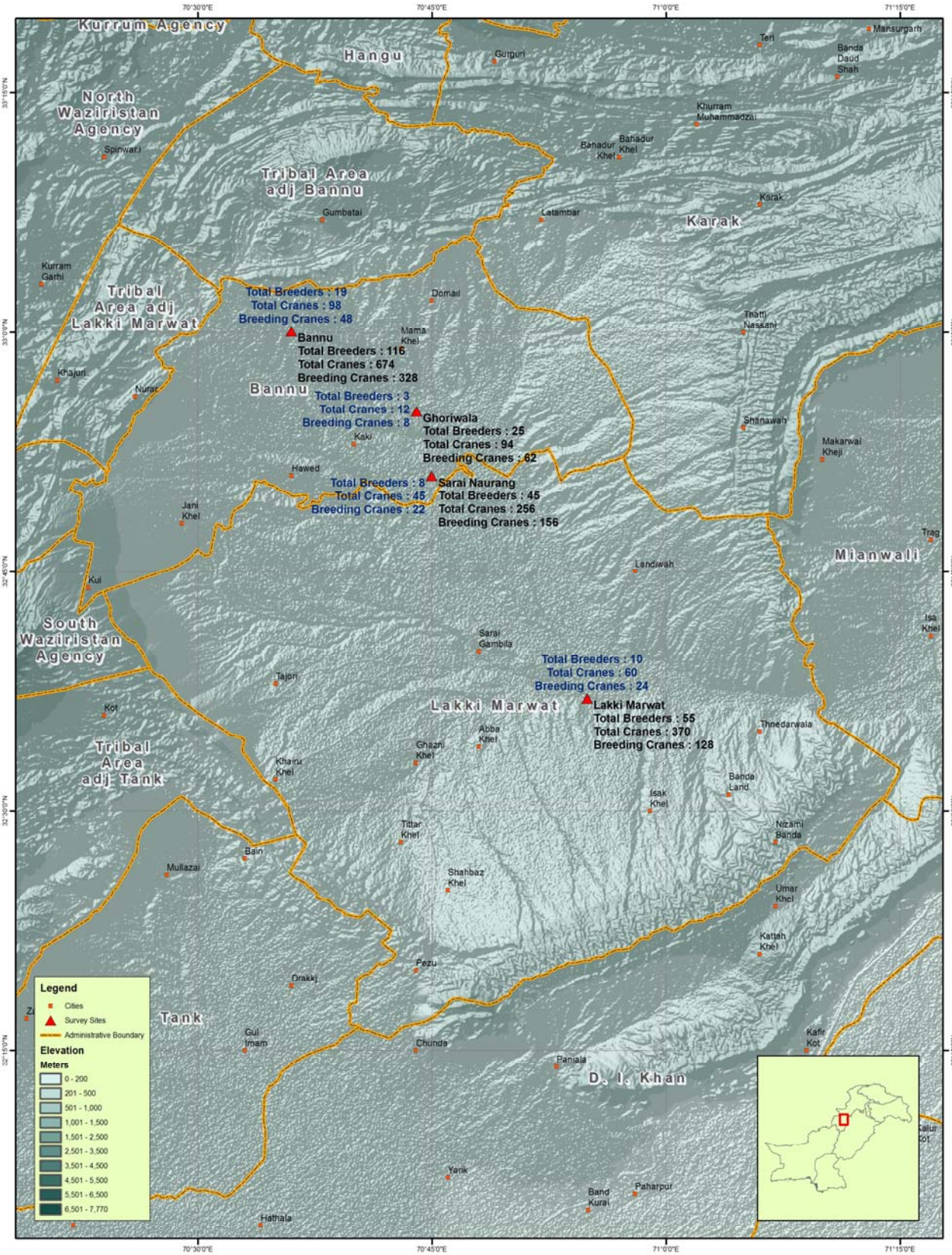
4. Study Area

The study area is a part of the Kurram Valley, which is located in the southern part of the North West Frontier province, Pakistan (see figure 3 for location map of the study area).The districts of Bannu, Lakki Marwat and adjacent tribal areas in the Kurram valley fall on the migratory route of Eurasian and demoiselle cranes. Spring migration of demoiselle cranes usually starts in the first week of March and continues till second week of April, while the Eurasian crane starts migration a few days later in the second week of March and ends it in the third week of April. The demoiselle crane migration starts in the first week of September and continues till first week of October, while the migration of Eurasian cranes starts in the last week of September and continues till first week of November (*Personal Communication with local hunters of the area*). The spring crane hunting begins around the first week of March and continues until early April; the autumn hunting runs from early September to mid-October (Roberts and Landfried 1987). Although a little information is available on the exact entry and exit routes for cranes in Pakistan, it is believed that cranes enter and leave Pakistan through several major and minor corridors (Ahmad and Khurshid 1991, Ahmad and Jan 1995, and Ahmad et. al 1993). These corridors spread over the north-western border with Iran and Afghanistan and eastern border with India (Ahmad and Jan 1995 and Farooq et. Al 1993).To trap cranes from the wild, the hunters of Kurram Valley (Bannu and Lakki districts) in the North West Frontier Province (NWFP) use captive cranes as decoys to attract wild cranes by their presence and calls so that the wild ones can be captured or trapped (Khan 2004). The wild cranes spiral continuously down towards the calls of the decoy cranes. As cranes are about to land, the hunters swirl the "*Soai*" and silently hurl the weighted cords skyward (see figure 2 for crane hunting by "*soai*"). The cranes captured are usually kept by the captors themselves, given to friends and a few are entrusted to the care of men with a reputation for successfully breeding cranes in captivity (Roberts and Landfried 1987).

About 12,000 Eurasian and demoiselle cranes are present in Bannu, Lakki Marwat and adjacent tribal areas. Majority of them have come through capturing from the wild, while a large proportion is bred in captivity. Every person of the area is associated with these cranes in one way or the other. Cranes have become a part of their tribal and cultural heritage and their extreme love for them is in their blood.

From generations the people of this area are deeply involved in this prestigious game of trapping and keeping cranes as pets. The local crane breeders have gained knowledge through their decades long relationships with cranes. The professional captive breeders have evolved their local techniques that are extraordinary. In short, Bannu, Lakki Marwat and adjacent tribal areas are important for those who work for the conservation of cranes.

Fig. 2: Crane hunter throwing “Soai” for live crane hunting. (Zafar Ali, April 2007)



Sites Surveyed in the Kurram Valley

Bannu and Lakki Marwat Districts

Note: Figures in black colour are for demoiselle crane
Figures in blue colour are for Eurasian crane

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Fig. 3: Sites surveyed in the Kurram Valley

5. Findings

The following Information about captive breeding and experience with multiple clutching techniques of crane breeders have been collected in the three months research and survey in Bannu and Lakki Marwat districts conducted on behalf of the Ministry of Environment's Pakistan wetlands programme.

5.1 Demoiselle Crane

5.1.1 Captive breeding status in District Bannu and Lakki Marwat

The research identified and interviewed 241 demoiselle crane breeders in Bannu and Lakki Marwat Districts. A total of 1400 demoiselle cranes were found in captivity with them. There were about (338 pairs, approx. 48%) of the total were identified as active breeding cranes and the rest (approx. 52%) were non-breeding. (see table 1 at page 27 and figures 4(a) and 4(b).

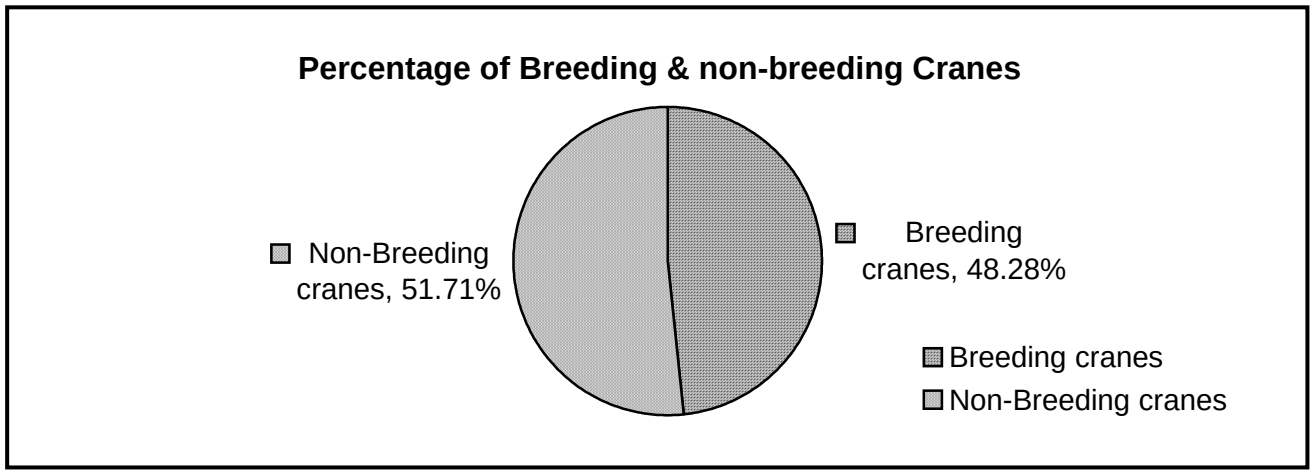

Fig. 4 (a): Percentage of breeding and non-breeding demoiselle cranes in captivity

A total of 706 eggs were found hatched by these breeding captive cranes. Out of the total egg laid 228 eggs (approx. 32%) addled. The number of eggs successfully hatched were 478 (approx. 68 %) of the total eggs, (see table 1 at page 27 and figures 5(a) and 5(b). Out of the total 478 chicks, 101 died (approx. mortality rate of 21%), while 377 (approx. 79%) chicks survived (see table 1 at page 27 and figure 6).

Fig. 4 (b): Demoiselle crane eggs under incubation process. (Zafar Ali, June 2007**)**

Fig. 5 (a): Demoiselle crane family in search of food. (Zafar Ali, June 2007)

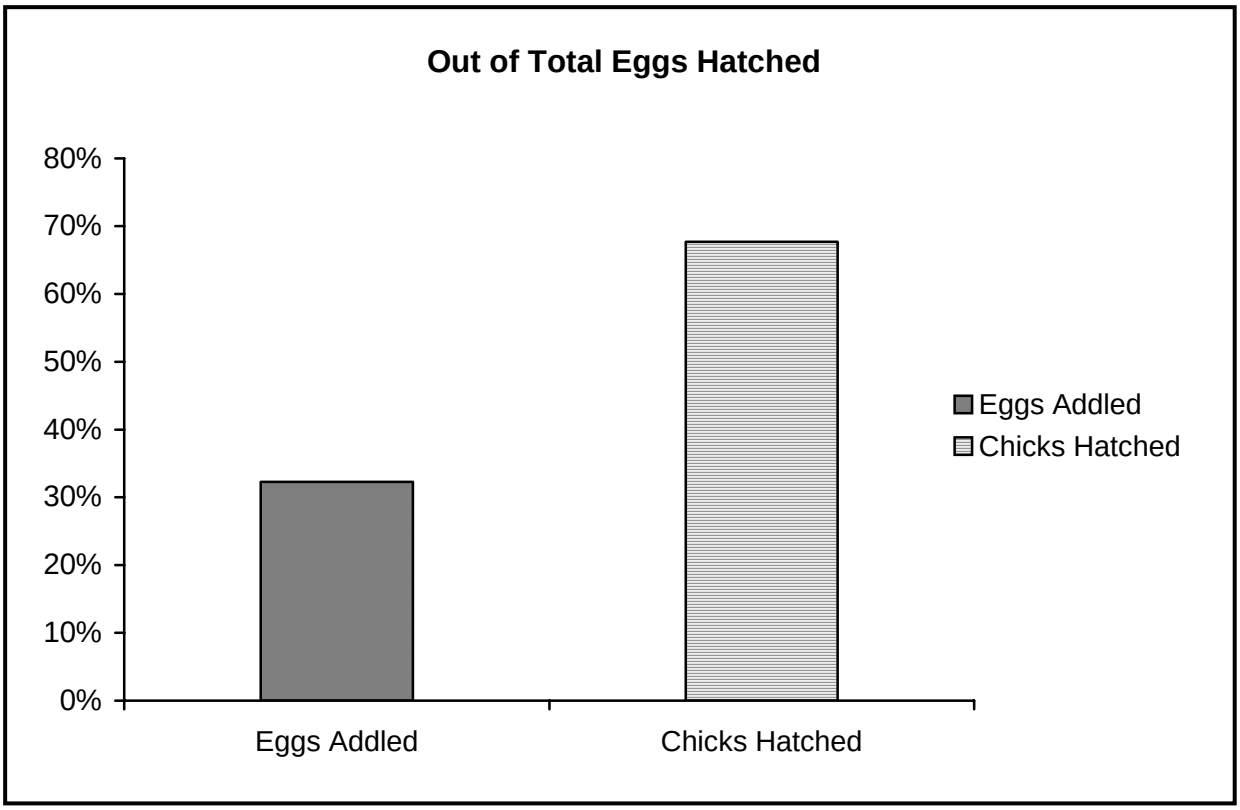

Fig. 5 (b): Percent of total demoiselle crane eggs addled and chicks hatched

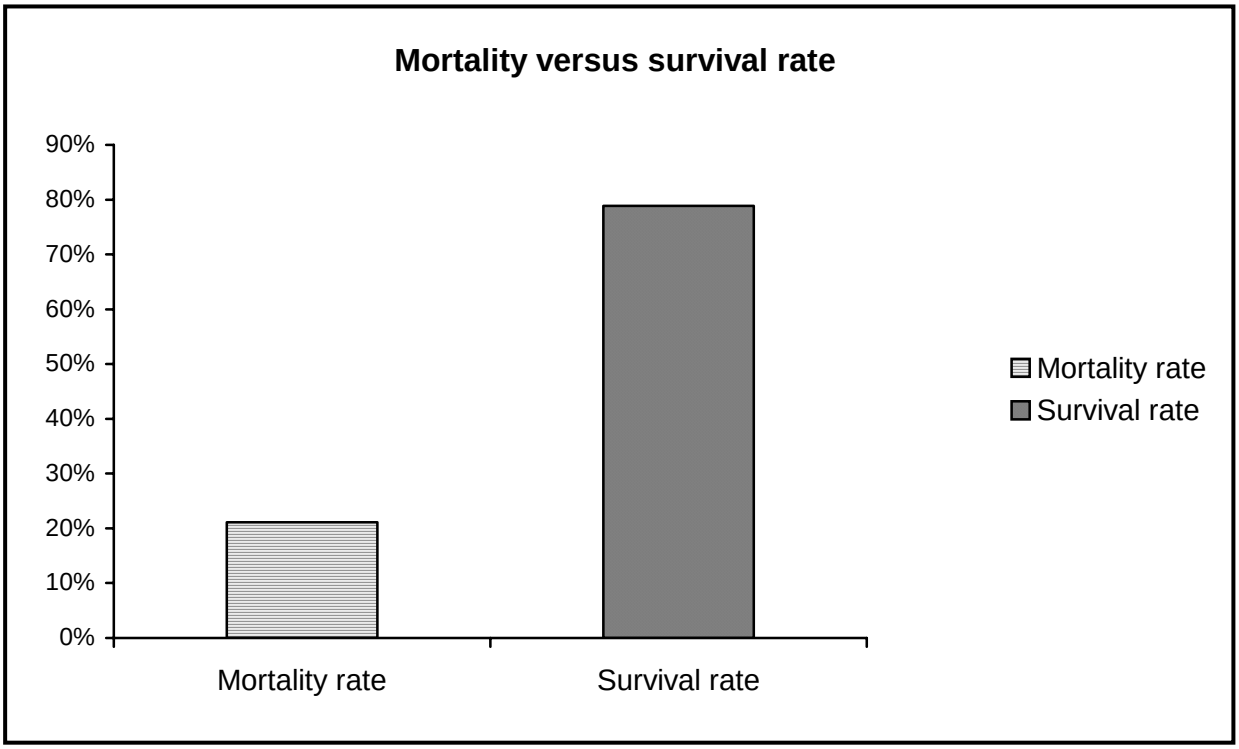

Fig. 6: Mortality and survival rate of demoiselle crane chicks

Two main reasons causing mortality of chicks: are various accidents or in other words due to carelessness of the owners, and different diseases were identified. The former was the major cause of mortality in chicks. Out of the total chicks died, 48 were found dead due to some accidents. Six chicks drowned in water tubs and five were killed in road accidents. The rest of the chicks died due to legs bent, blockage of pharynx and some other unknown diseases. Thus it was found that the mortality caused by different accidents was about 47% of the total mortality occurred while the rest (approx. 53%) occurred due to some known and unknown diseases, (see table 1 at page 27 and figures 7(a) and 7(b).

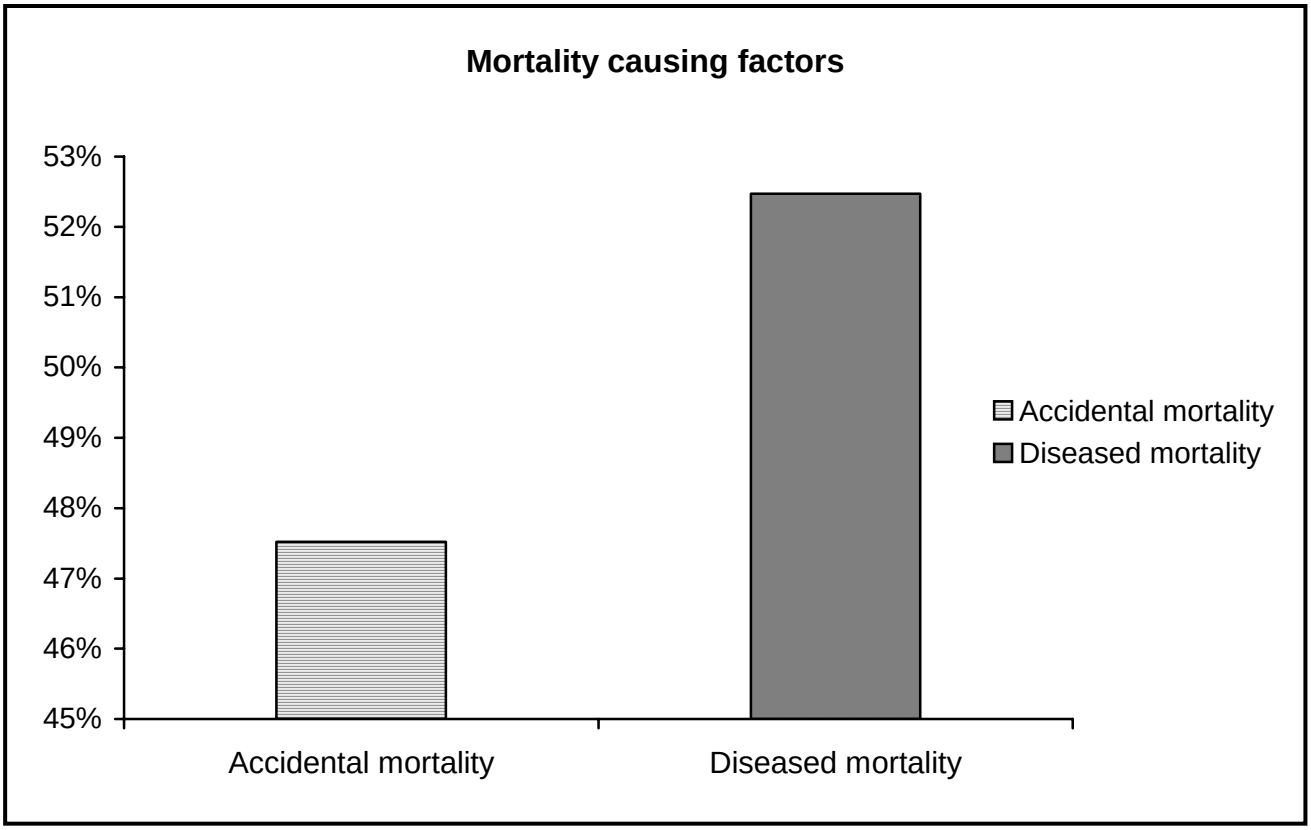

Fig. 7 (a): Percent of total demoiselle chicks mortality caused by accidents and diseases

The chicks of both demoiselle and Eurasian cranes are delicate and weak in early stages of their lives. In the first week, they are vulnerable to accidents, at the age of 15 to 25 days, these are susceptible towards diseases because at this stage of the life, the chicks require significantly high amount of energy for their feathers development process. Most of the mortality recorded in these two stages of life, which is approx. 56% within the first week and approx. 43% in the second week of their life. According to the study mortality in crane chicks is about 1% between age of three weeks to two months. (see table 1 at page 27 and figure 8).

Fig. 7 (b): Accidentally killed D-crane chick. (Zafar Ali, May 2007)

Fig. 8: Percent of total mortality occurred within age of 1week, 1month and 2months

5.1.2 Experience of crane breeders with "Multiple Clutching"

Most of the crane breeders are familiar with multiple clutching, however some didn't know about it. Out of the total 241 identified crane breeders, 225 (approx. 93%) were found familiar with the multiple clutching, and only 38 were practically applying it. The rest of 16 (about 6%) crane breeders out of 241 were found unaware about the multiple clutching techniques, (see table 2 at page 39 and figure 9).

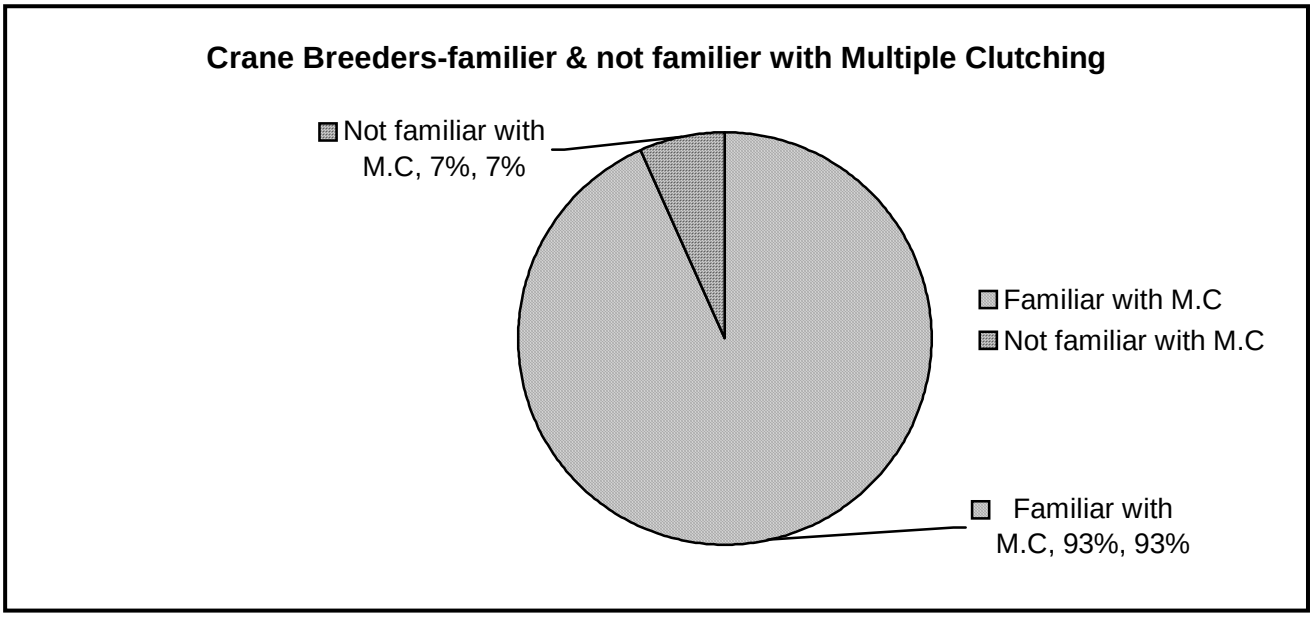

Fig. 9: Percent of familiar and non familiar demoiselle crane breeders with multiple clutching

Out of the total crane breeders familiar with multiple clutching, approx. 17% were practically applying and the rest of 83% were not using this technique due to some threats in their mind related to it. (see figure 10(a). A few of the breeders believed that multiple clutching technique badly affect health of crane and also degrades quality of calls of a crane, which make the cranes unfit for hunting purposes. Others gave the reason of this being time consuming, requiring intensive parental care for chicks and with low probability of desired results at the end.

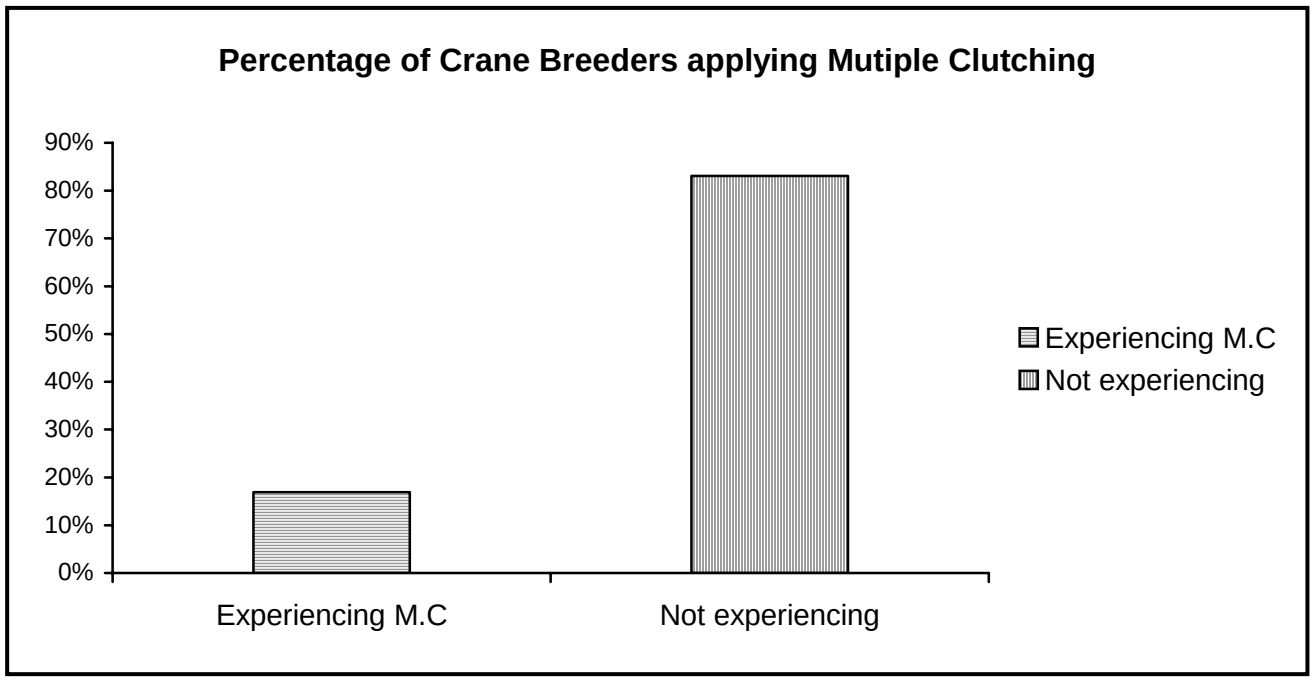

Fig. 10 (a): Percentage of crane breeders applying multiple clutching

The crane breeders who practically apply the multiple clutching techniques have adopted their own local methods and techniques of getting clutches (eggs) from their cranes. They have made wooden models of crane eggs and replace those with original eggs they pick. (see figure 10(b) for Eurasian crane's wooden egg model). Out of 38 breeders using the techniques, approx. 84% were getting from 3 to 5 eggs per pair of cranes, while the rest of approx. 16% of the crane breeders were getting from 6 to 8 eggs per pair, (see table 2 at page 39 and figures 11(a) and 11(b).

Fig. 11 (a): Demoiselle crane breeders getting 3-5 and 6-8 eggs clutches

Fig.10 (b): Crane breeder showing the wooden Eurasian egg model

Fig. 11 (b): Three eggs clutch of demoiselle crane. (Zafar Ali, June 2007)

5.2 Eurasian Crane

5.2.1 Captive breeding status in Bannu and Lakki

There are about 213 Eurasian cranes with 40 identified crane keepers in selected areas of Bannu and Lakki Marwat Districts. In the study area. the number of captive Eurasian cranes is lesser than the number of captive demoiselle cranes probably due to demoiselle cranes migrate to the area in larger number than Eurasian cranes, and hunting of demoiselle cranes is easier than that of Eurasian cranes. Out of 213 Eurasian captive cranes 102 (i.e. 51 pairs) were found as breeding constituting approx. 48% of the total and the rest 111 constituting approx. 52% of the total were non-breeding, (see table 3 at page 40 and figure 12).

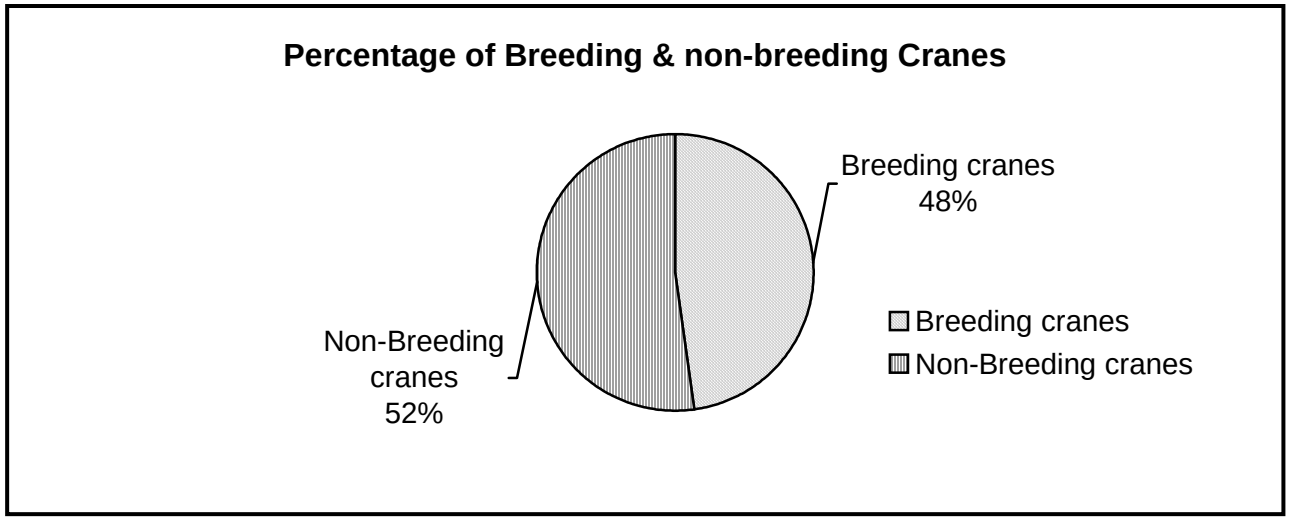

Fig. 12: Percent of breeding and non-breeding Eurasian cranes in captivity

Eurasian cranes laid a total of 107 eggs, out of which 65 (approx. 60%) were addled and 42 (approx. 40%) hatched. (see table 3 at page 40 and figure 13). Crane breeders incubated nine eggs using broody hens and broody ducks in which five addled and four hatched (see figures 14 and 15 for crane eggs beneath broody hens for incubation). Out of total 42 chicks hatched, 10 chicks (approx. mortality rate 24%) were dead and 32 chicks (approx. survival rate 76%) survived and were found in healthy condition (see table 3 at page 40 and figure 16).

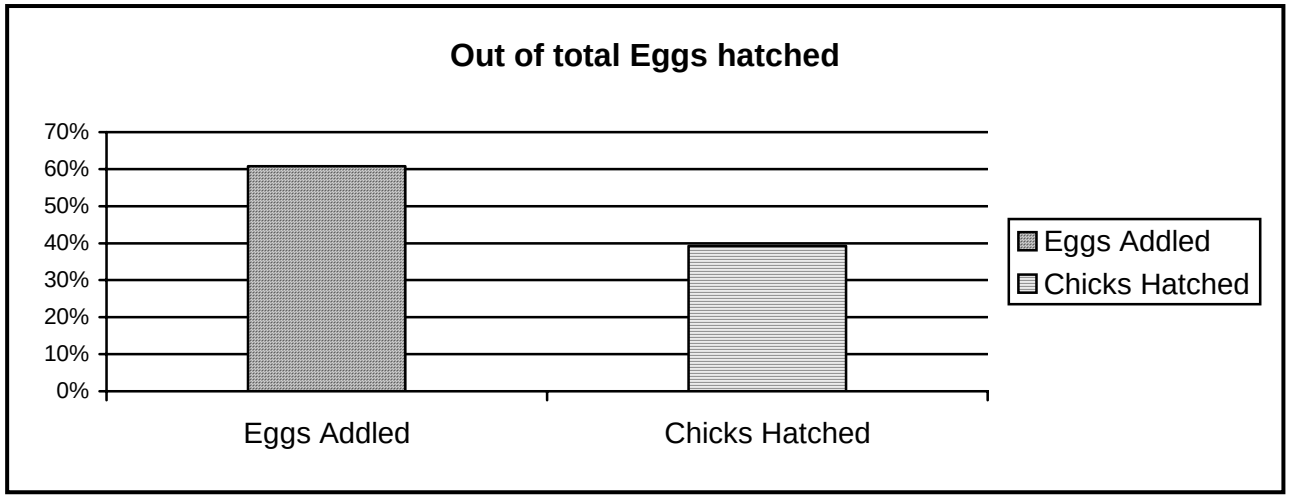

Fig. 13: Percent of total breeding Eurasian crane eggs addled and chicks hatched.

Fig. 14: Demoiselle crane in incubation. (Zafar Ali, May 2007)

Fig. 15: Eurasian crane eggs beneath broody hen for incubation. (Zafar Ali, May 2007)

Two main reasons causing mortality of chicks were: different accidents or in other words due to carelessness of the owner, and different diseases. The former was the major cause of mortality in chicks. Predators such as dogs killed two chicks out, while one in a road accident of the seven (approx. 70%) killed in accidents. Three (approx. 30%) of the seven killed in accidents died because of diseases (see table 3 at page 40 and figure 17).

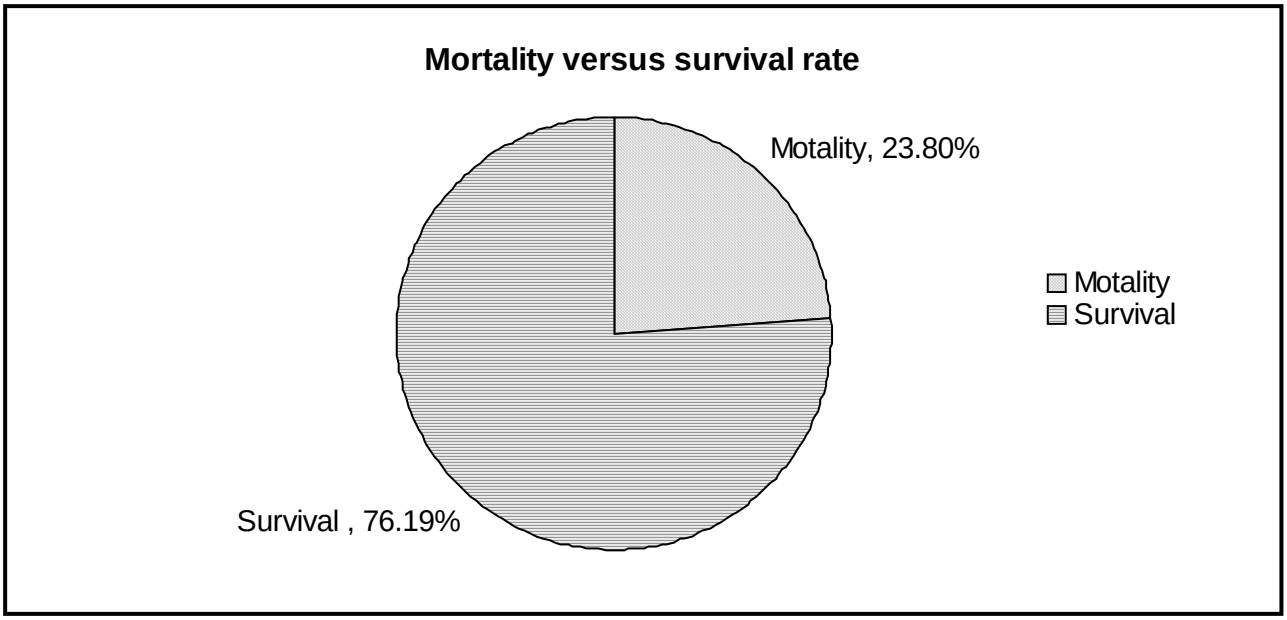

Fig. 16: Mortality and survival rates of Eurasian crane chicks

Comparatively chicks of Eurasian cranes were observed to be more tantalizing and susceptible to diseases and accidents than demoiselle cranes, especially, at the age of one week and at the age of 20 to 30 days respectively. Chicks died within one week were recorded with approx. mortality rate of 60% of the total mortality and the rest with approx. mortality rate of 40% of the total mortality occurred within the age of one month (see table 3 at page 40 and figure 18). No single chick was found died at the age of more than one month.

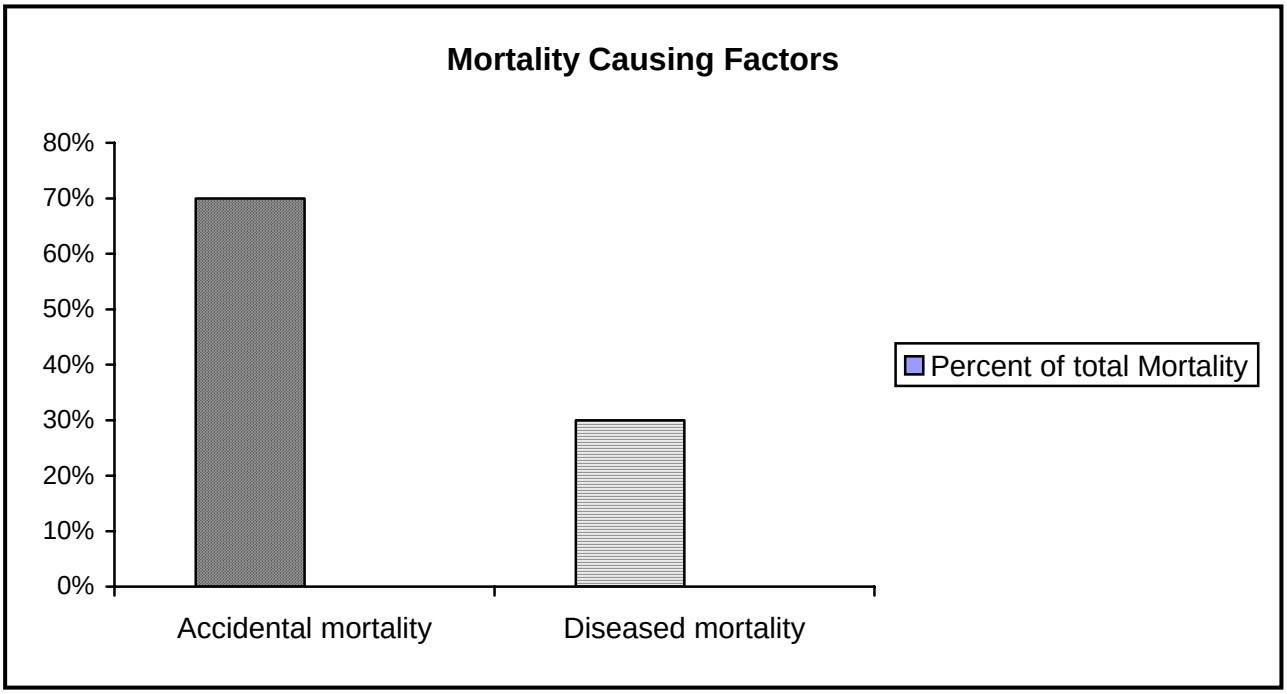

Fig. 17: Percent of Eurasian chicks Mortality caused by accidents and diseases

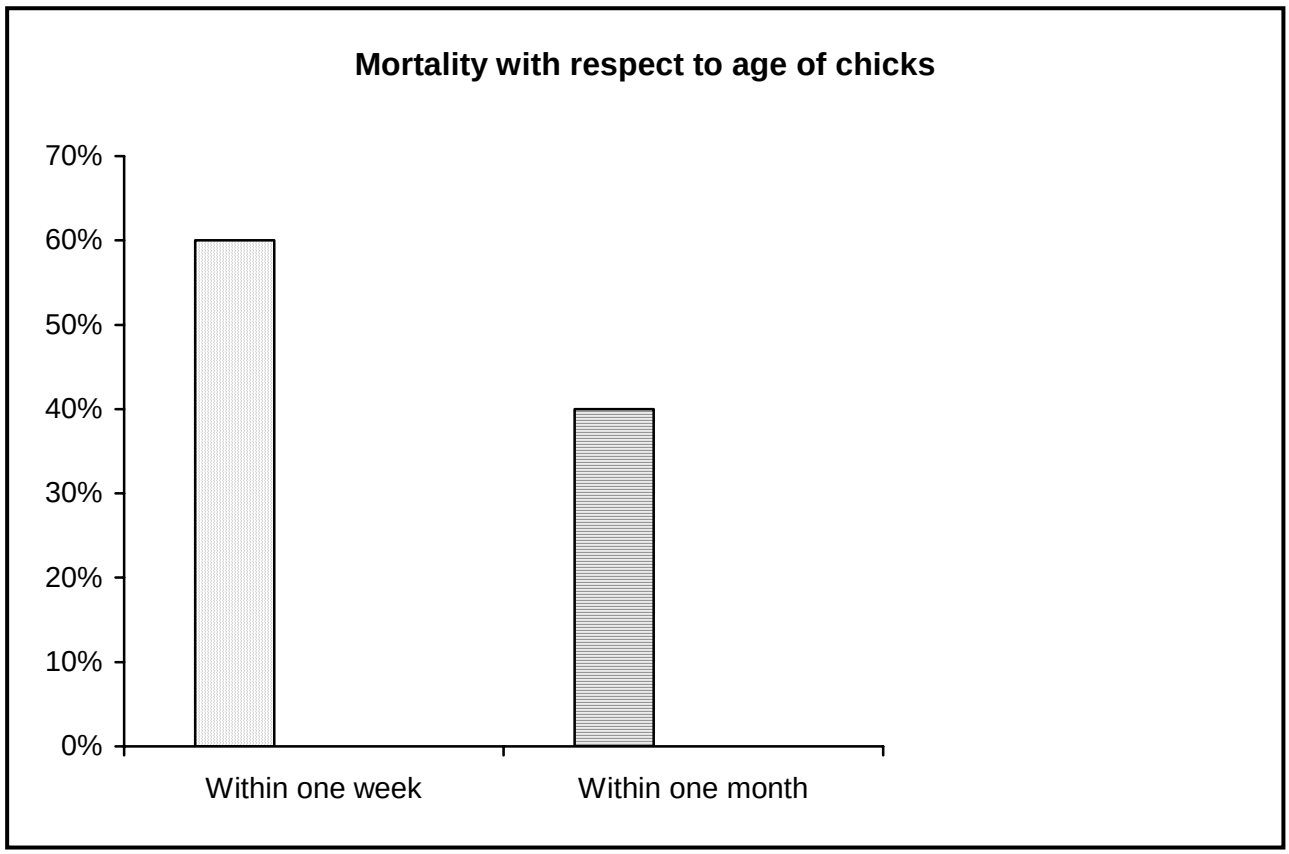

Fig. 18: Percent of Eurasian chicks Mortality caused within age of 1week and 1month

Crane keepers of the area believe that once the chicks exceed the age of one month, then their survival chances increases i.e. the most critical time for the mortality of chicks is considered from hatching up to the age of one month. After one month of hatching, chicks gained energy and they can defend themselves from accidents as well as develop immunity towards diseases. They added that captive breeding is not an easy task and requires twenty four hours provision of care to the chicks at least within the age of one month.

5.2.2 Experience of crane breeders with "Multiple Clutching"

The Eurasian crane breeders are comparatively more experienced in captive breeding than demoiselle crane breeders. Out of the total of 40 identified crane breeders, 37 (approx. 92%) were found familiar with multiple clutching techniques and 3 (approx. 8%) were not familiar with it (see table 4 at page 42 and figure 19). Out of the total familiar crane breeders, 12 (approx. 45%) were found practically applying the technique, of which 9 (approx. 75%) were getting three to five eggs per pair and three (approx. 25%) were getting up to six to eight eggs per pair of Eurasian cranes (see table 4 at page 42, figures 20, 21(a) and 21(b).

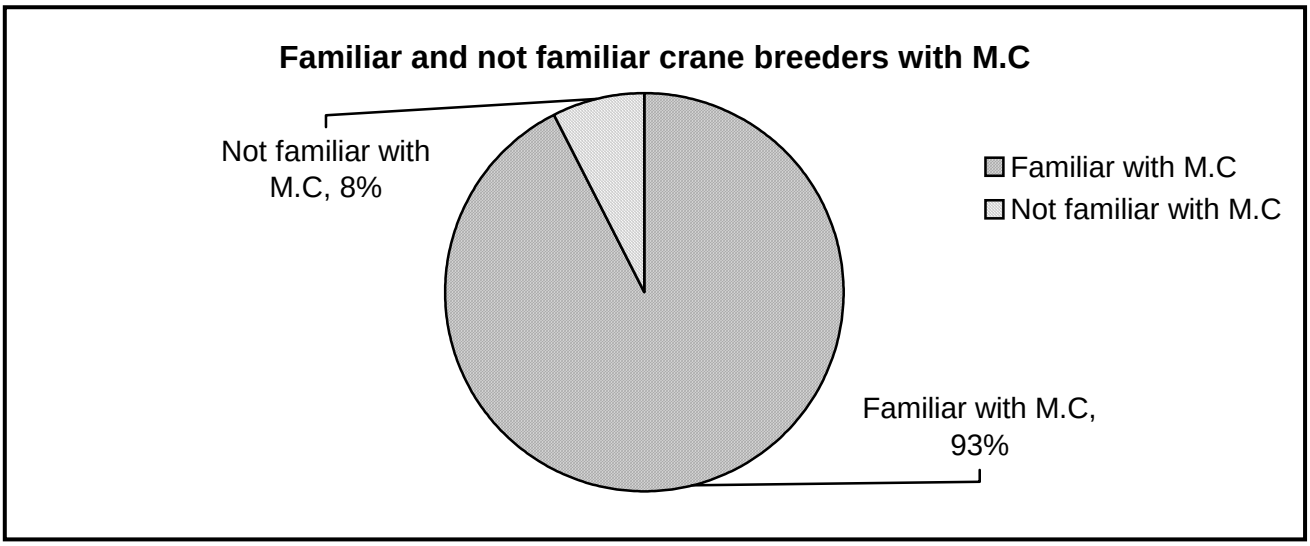

Fig. 19: Percent of Eurasian crane breeders familiar and non-familiar with multiple clutching

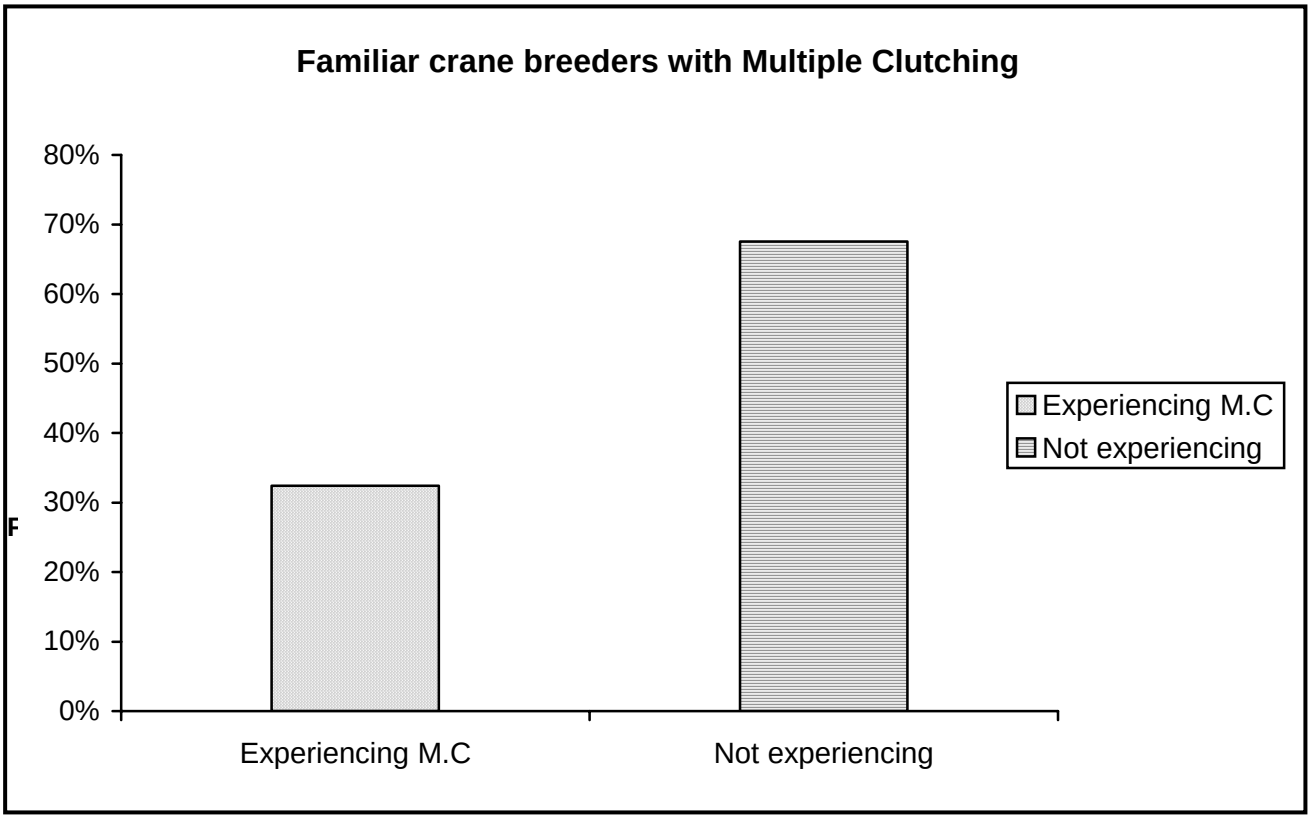

Fig. 20: Eurasian crane breeders experiencing and not experiencing multiple clutching

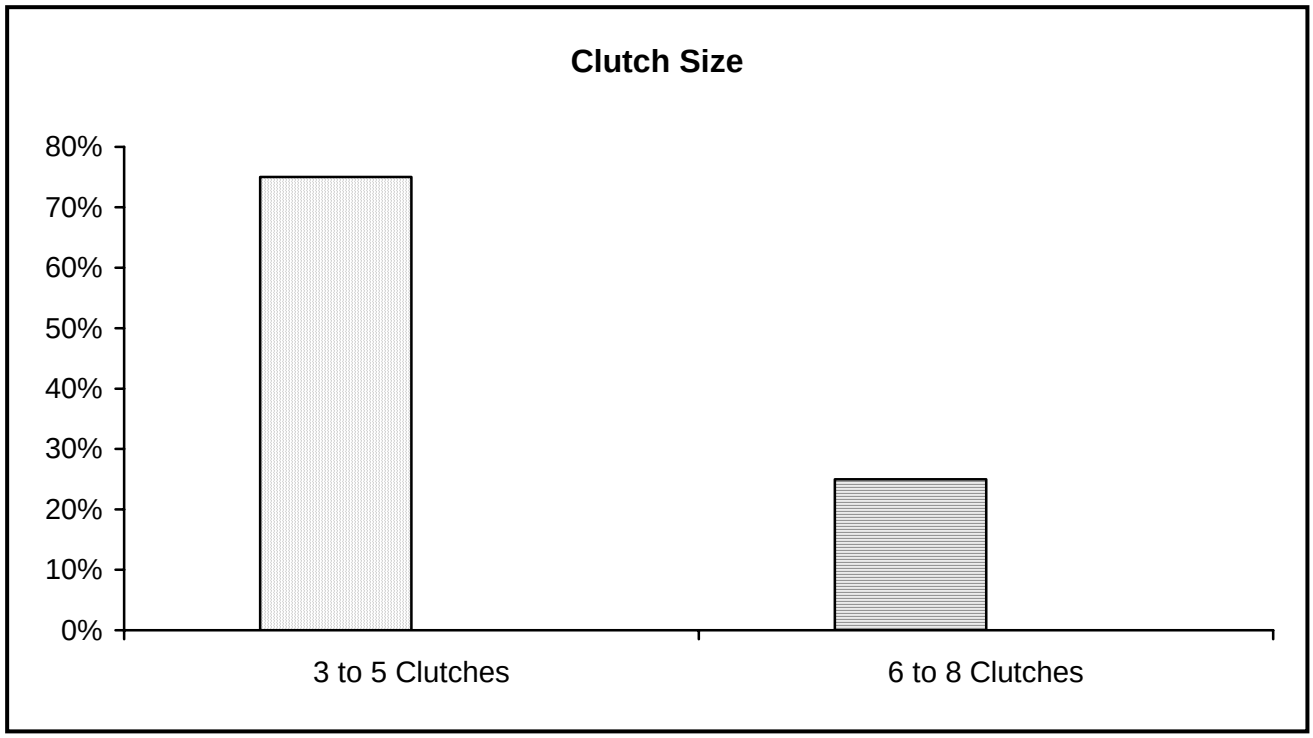

Fig. 21 (a): Eurasian crane breeders getting 3-5 and 6-8 clutches of eggs per pair

Fig. 21 (b): Unison Calls of decoy Eurasian crane used in hunting**.** (Zafar Ali, May 2007)

6. Feeding and local disease management of chicks

In nature cranes usually hatch two eggs but only one chick survives, while in captivity not only both chicks may survive but also a pair may lay up to twelve viable eggs. This is due to the fact that crane takes a period of three to four days in laying two successive eggs. In nature, the older chicks or the later hatching starts running around and the parent crane leaves the other egg. In case of successful hatching as the first one is big and strong usually kills the one that hatch late. Immediately after hatching the chicks are frail and weak. They need undivided attention from their parents. Once chicks hatch, parent cranes feed them with small pieces of egg shells, small insects e.g. mosquitoes, house flies and various worms. Up to 7 days this feeding continues. To follow nature's trail; crane breeders putrefy meat under soil and feed the worms to chicks.

At the age of one week, the chicks are fed with grasshoppers, small pieces of pigeon meat, small sized fishes, wheat seeds, worms, leaves and twigs of different grasses and plants up to one month (see figure 22). At the age of two months, chicks gain energy and strength and they start fighting each other; however, still they are dependent on parents for feeding. After starting flights, they start eating anything which the adult cranes can eat. The chicks hatched through broody hens and broody ducks are left with the parent cranes for rearing. Generally chicks hatched through broody hens and ducks are usually accepted by parent cranes having chicks.

There is no veterinary technician in the area to treat the sick cranes; however, the local people are using local ways of medication and treatment for crane diseases. In three cases, the breeders were found successful in remedying the diseases e.g. for legs bent, they were using mustard oil along with physical exercise. Some local "*Hakims*" and veterinary doctors also deliver the services.

Fig. 22: Crane breeder caught grasshoppers, crane chicks' food. (Zafar Ali, May 2007)

7. Conclusion

It is concluded from the present research study that a number of crane hunters and keeprs in Bannu, Lakki Marwat and adjacent tribal areas have turned to breeding captive cranes. Crane breeding is getting popularity and breeders have adapted local techniques for breeding cranes in captivity, yet all of them are not considered experts in it. The results of these old breeders are extraordinary, while comparatively new breeders are satisfactory. If the expertise of the old breeders is conveyed to the new breeders, then the basic aim of crane conservation could be achieved. Although captive breeding process is tough and requires hard work but the love of people for cranes exceeds it. It is expected that facilitation and encouragement of captive crane breeders will substantially add to the population of captive cranes in the area, and will ultimately contribute to reduction in dependence on trapping of cranes from the wild for various purposes.

8. Recommendations

The research results lead us to the following recommendations for improving breeding of captive cranes:

8.1 Formation of Captive Crane Breeders Association

The crane hunters currently breed captive cranes on their own interest and mostly in isolation from each other. This doesn't allow them to share experiences of each other and exchange their views on improving techniques on improved captive breeding, controlling mortality in chicks and getting multiple clutches from a single pair. The Pakistan Wetlands Programme recommends to organize the crane hunters and breeders to form a Captive Crane Breeders Association. Such an association will provide a forum where crane breeders may get an opportunity of sharing their experiences and exchanging views. The Pakistan Wetlands Programme will initially facilitate in organizing and mobilizing the proposed association and provide initial support for in motivation and organization.

8.2 Awareness campaign for Captive Crane Breeders

A comprehensive awareness campaign in general and seminars and workshops in particular will, to some extent, ensure the deviation of local crane hunters' trends from hunting towards captive breeding. Through workshops and seminars the hunters will be attract towards captive breeding of cranes, thus helping in minimizing the pressure of crane hunting in the area.

8.3 Sharing of indigenous knowledge with regards to Multiple Clutching

The process of multiple clutching is easy to understand, but it is difficult to practice. Some of the crane breeders have developed special techniques of multiple clutching. There is a need to replicate their indigenous techniques and transfer knowledge from experienced hunters to less experienced one in this field.

8.4 Training and capacity-building of Captive Crane Breeders

A training in captive breeding in general and multiple clutching in particular, and crane husbandry for the crane breeders in order to improve their skills in the respective fields is recommended. The NWFP Wildlife Department, International Crane Foundation and the Pakistan Forest Institute may collaborate in organizing such a training.

8.5 Enhancement of medication for disease management

A training for staff of the NWFP Wildlife Department at the Lakki Crane Centre, NWFP in diseases management and treatment of cranes is recommended. With such a training to the staff of the centre, it may turn to a nucleus for conservation of cranes in the area, and a

source of winning confidence of the crane hunters and keepers for governmental and non-governmental initiatives regarding crane conservation in the area.

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Table 1: Tabular data of demoiselle crane breeders collected during 2007

#	Name	Address	Total captive cranes	Breeding cranes	Eggs hatched	Eggs addled	Chicks hatched	Mortality in the age of				Reasons for Mortality	Chicks survival
								1 wk	1 mon.	2 mon	3 mon.		
1	Ashraf Ali	Sheeri Khel, Bannu.	2	2	5	2	3	-	-	-	-	-	3
2	Shafi Nawaz	Sheeri Khel, Bannu.	7	4	4	-	4	2	-	-	-	Legs bent and died	2
3	Jabar	Sheeri Khel, Bannu.	2	2	2	2	-	-	-	-	-	-	-
4	Amir	Hassan Khel, Bannu.	5	4	6	4	2	1	-	-	-	Legs bent and died	1
5	Javid	Hassan Khel, Bannu.	5	2	2	-	2	-	-	-	-	-	2
6	H.M.Yousaf	Hassan Khel, Bannu.	4	2	2	-	2	-	-	-	-	-	2
7	Hazrat	Hassan Khel, Bannu	2	2	3	1	2	-	-	-	-	-	2
8	Rohan Shah	Hassan Khel, Bannu	4	2	2	-	2		1	-	-	Accidental	1
9	Ghulam Fayaz	Hassan Khel, Bannu	6	2	4	4	-	-	-	-	-	-	-
10	Nazar Ali	Hassan Khel, Bannu	10	2	2	1	1	-	-	-	-	-	1
11	Mumtaz Khan	Hassan Khel, Bannu	4	2	2	2	-	-	-	-	-	-	-
12	Ziaullah	Toorka Bazar, Bannu.	8	4	4	3	1	-	-	-	-	-	1
13	Ashraf Khan	Kotka Bazed, Bannu.	10	6	6	2	4	-	-	-	-	-	4
14	Bahadur Nawaz	Basya Khel, Bannu.	4	2	2	-	2	-	1	1	-	Legs bent and died	-
15	Ikramullah	Basya Khel, Bannu.	2	2	2	-	2	-	2	-	-	Legs bent and died	-
16	Neek Mohammad	Basya Khel, Bannu.	6	2	2	2	-	-	-	-	-	-	-
17	Shafi ur Rehman	Miralam Kale, Bannu.	6	2	2	-	2	-	-	-	-	-	2
18	Mir Qadar	Miralam Kale, Bannu.	4	2	2	2	-	-	-	-	-	-	-
19	Azad Khan	Village Ghuriwala, Bannu.	6	2	2	-	2	-	-	-	-	-	2
20	Gul Khan	Village Ghuriwala, Bannu.	2	2	2	-	2	-	1	-	-	accidental	1
21	Bahadur Khan	Ghuriwala, Mechal, Khel, Bannu.	2	2	2	-	2	-	-	-	-	-	2
22	Nisar	Ghuriwala, Mechal Khel, Bannu.	6	4	3	3	-	-	-	-	-	-	-
23	Mustafa Ali	Aslam Khan, Ghuriwala, Bannu.	2	2	2	-	2	-	1	-	-	accidental	1
24	Mir Ghaffar	Kotka Zarif, Ghuriwala, Bannu.	14	2	2	-	2	-	-	-	-	-	2
25	Malik Khan	Baisalam, Ghuriwala, Bannu.	2	2	2	-	2	-	1	-	-	Legs bent and died	1
26	Gul Baz	Shagi Mechal khel, Ghuriwala, Bannu.	4	2	2	-	2	-	-	-	-	-	2

#	Name	Address	Total captive cranes	Breeding cranes	Eggs hatched	Eggs addled	Chicks hatched	Mortality in the age of				Reasons for Mortality	Chicks survival
								1 wk	1 mon.	2 mon	3 mon.		
27	Hukam zad	Shagi Mechal khel, Ghuriwala, Bannu.	2	2	2	-	2	1	-	-	-	Legs bent and died	1
28	M. Rashid	Shagi Mechal khel, Ghuriwala, Bannu.	2	2	2	2	-	-	-	-	-	-	-
29	Amir Saudat Khan	Kotka Shah Alam, Ghuriwala, Bannu.	6	4	6	3	3	-	-	-	-	-	3
30	Amir Nawaz	Ghuriwala, Bannu.	2	2	2	-	2	1	-	-	-	accidental	1
31	Naeem khan	Ghuriwala, Bannu.	2	2	2	-	2	-	-	-	-	-	2
32	Mumtaz	Ghuriwala, Bannu.	6	2	2	-	2	1	-	-	-	Legs bent and died	1
33	Shah Baraz Khan	Shamshi Khel, Ghuriwala, Bannu.	2	2	2	-	2	-	-	-	-	-	2
34	Ayaz Khan	Shamshi Khel, Ghuriwala, Bannu.	8	4	5	-	5	-	-	-	-	-	5
35	Nazir Khan	Shamshi Khel, Ghuriwala, Bannu.	2	2	2	1	1	-	-	-	-	-	1
36	Niaz Khan	Shamshi Khel, Ghuriwala, Bannu.	2	2	2	-	2	-	-	-	-	-	2
37	Mohabbat Khan	Shamshi Khel, Ghuriwala, Bannu.	4	4	4	-	4	-	-	-	-	-	4
38	Nafaid Ali	Shamshi Khel, Ghuriwala, Bannu.	4	4	4	-	4	-	-	-	-	-	4
39	Javid	Shamshi Khel, Ghuriwala, Bannu.	4	4	4	-	4	-	-	-	-	-	4
40	Kanaz Khan	Shamshi Khel, Ghuriwala, Bannu.	2	2	2	-	2	-	-	-	-	-	2
41	Falak Naz	Mama Khel, Sarai Naurang, Lakki Marwat.	6	6	4	2	2	1	-	-	-	accidental	1
42	Hayatullah	Mama Khel, Sarai Naurang, Lakki Marwat.	8	4	2	-	2	-	-	-	-	-	2
43	Anwar	Mama Khel, Sarai Naurang, Lakki Marwat.	6	6	4	3	1	-	-	-	-	-	1
44	Habibullah	Mama Khel, Sarai Naurang, Lakki Marwat.	6	6	6	6	-	-	-	-	-	-	-
45	Abdullah	Mama Khel, Sarai Naurang, Lakki Marwat.	4	2	2	-	2	1	-	-	-	accidental	1
46	Farman	Mama Khel, Sarai Naurang, Lakki Marwat.	2	2	3	-	3	-	2	-	-	accidental	1

#	Name	Address	Total captive cranes	Breeding cranes	Eggs hatched	Eggs addled	Chicks hatched	Mortality in the age of				Reasons for Mortality	Chicks survival
								1 wk	1 mon.	2 mon	3 mon.		
47	Munawar	Mama Khel, Sarai Naurang, Lakki Marwat.	10	6	4	2	2	1	-	-	-	accidental	1
48	Zahidullah	Mama Khel, Sarai Naurang, Lakki Marwat.	6	6	6	-	6	-	1	-	-	accidental	5
49	Moosa khan	Sarai Naurang, Lakki Marwat	10	6	4	-	4	-	1	-	-	accidental	3
50	Abdul Hamid	Zafar Mama Khel, Sarai Naurang, Lakki Marwat.	30	20	26	10	16	4	2	-	-	-	10
51	Haji. Noor Zaman	Zafar Mama Khel, Sarai Naurang, Lakki Marwat.	2	2	2	-	2	-	-	-	-	-	2
52	Rahimullah	Zafar Mama Khel, Sarai Naurang, Lakki Marwat.	16	2	2	-	2	1	-	-	-	Kill by male crane	1
53	Samiullah	Zafar Mama Khel, Sarai Naurang, Lakki Marwat.	2	2	2	-	2	1	-	-	-	Legs bent and died	1
55	Azad Khan	Shamooni Khattak, Sarai Naurang, Lakki Marwat.	4	2	2	-	2	-	-	-	-	-	2
56	Ibrahim	Haisoor Kale, Sarai Naurang, Lakki Marwat.	2	2	2	1	1	-	-	-	-	-	1
57	Raza Khan	Sarai Naurang, Lakki Marwat.	4	2	2	-	2	-	-	-	-	-	2
58	Nikam Khan	Nasar Khel, Sarai Naurang, Lakki Marwat.	14	6	6	1	5	2	-	-	-	Legs bent and died	3
59	Khan Bahadur	Nasar Khel, Sarai Naurang, Lakki Marwat.	4	2	2	-	2	-	1	-	-	Accidental	1
60	Rosi Khan	Nasar Khel, Sarai Naurang, Lakki Marwat.	4	2	2	-	2	-	-	-	-	-	2
61	Farman	Marmandi sarai Naurang, Lakki Marwat.	8	2	2	-	2	-	-	-	-	-	2
62	Irfanullah	Marmandi sarai Naurang, Lakki Marwat.	2	2	4	4	-	-	-	-	-	-	-
63	Atta ur Rehman	Marmandi sarai Naurang, Lakki Marwat.	2	2	6	4	2	-	-	-	-	-	2
64	Badre Alam	Marmandi sarai Naurang, Lakki Marwat.	12	6	7	5	2	-	-	-	-	-	2

#	Name	Address	Total captive cranes	Breeding cranes	Eggs hatched	Eggs addled	Chicks hatched	Mortality in the age of				Reasons for Mortality	Chicks survival
								1 wk	1 mon.	2 mon	3 mon.		
65	Syed Alam	Marmandi sarai Naurang, Lakki Marwat.	12	10	14	6	8	1	3	-	-	1 due to Legs bent and died and 3 accidentally	4
66	Aziz Khan	Marmandi sarai Naurang, Lakki Marwat.	4	4	7	4	3	1	-	-	-	accidental	2
67	Safdar	Marmandi sarai Naurang, Lakki Marwat.	2	2	2	-	2	1	-	-	-	accidental	1
68	Younas	Marmandi sarai Naurang, Lakki Marwat.	4	4	4	2	2	-	2	-	-	accidental	-
69	Samiullah	Mohammad Kale, Sarai Naurang, Lakki Marwat.	4	2	2	-	2	-	-	-	-	-	2
70	Mamoor Khan	Mohammad Kale, Sarai Naurang, Lakki Marwat.	2	2	2	-	2	-	1	-	-	Legs bent and died	1
71	Sher Jamal	Sarai Naurang, Lakki Marwat.	4	2	2	1	1	-	-	-	-	-	1
72	Rashid Ahmad	Sarai Naurang, Lakki Marwat.	4	2	2	-	2	1	-	-	-	accidental	1
73	Qazi khan	Sarai Naurang, Lakki Marwat.	4	2	2	-	2	-	-	-	-	-	2
74	M. Nasim	Sarai Naurang, Lakki Marwat.	6	2	2	-	2	-	-	-	-	-	2
75	Ajab Khan	Mangalay Village, Lakki Marwat.	8	2	2	1	1	-	-	-	-	-	1
76	Farhad	Mangalay Village, Lakki Marwat.	2	2	2	-	2	-	-	-	-	-	2
77	Rustam	Mangalay Village, Lakki Marwat.	8	2	2	-	2	1	-	-	-	Due to blockage of pharynx	1
78	Alamgir	Mangalay Village, Lakki Marwat.	2	2	2	-	2	-	-	-	-	-	2
79	Rehmat Khan	Mangalay Village, Lakki Marwat.	4	2	8	5	3	1	-	-	-	Legs bent and died	2
80	Habib	Mirazam Mechan Khel, Lakki Marwat.	6	2	2	2	-	-	-	-	-	-	-
81	Fazle Rehman	Mirazam Mechan Khel, Lakki Marwat.	2	2	2	1	1	1	-	-	-	accidental	-
82	Saddar Zaman	Mirazam Mechan Khel, Lakki Marwat.	4	2	3	1	2	-	-	-	-	-	2

#	Name	Address	Total captive cranes	Breeding cranes	Eggs hatched	Eggs addled	Chicks hatched	Mortality in the age of				Reasons for Mortality	Chicks survival
								1 wk	1 mon.	2 mon	3 mon.		
83	M. Zaman	Mirazam Mechan Khel, Lakki Marwat.	2	2	2	-	2	-	1	-	-	Unknown disease	1
84	Nadir Khan	Mirazam Mechan Khel, Lakki Marwat.	4	4	5	Bricked by crane	-	-	-	-	-	-	-
85	Nikam Khan	Mirazam Mechan Khel, Lakki Marwat.	6	2	2	2	-	-	-	-	-	-	-
86	Badre Zaman	Mirazam Mechan Khel, Lakki Marwat.	4	2	2	-	2	-	-	-	-	-	2
87	Abdul Ghani	Sarkata Mechan Khel, Lakki Marwat.	5	2	2	-	2	-	-	-	-	-	2
88	Mirpayan Jan	Sarkata Mechan Khel, Lakki Marwat.	2	2	4	2	2	-	-	-	-	-	2
89	Ismail	Atashi Mechan Khel, Lakki Marwat.	6	4	4	2	2	1	1	-	-	accidental	-
90	Dilawar	Atashi Mechan Khel, Lakki Marwat.	2	2	2	-	2	-	1	-	-	accidental	1
91	Yousaf	Atashi Mechan Khel, Lakki Marwat.	2	2	2	1	1	-	1	-	-	accidental	-
92	Ghulam Jalil	Atashi Mechan Khel, Lakki Marwat.	2	2	2	-	2	1	-	-	-	Legs bent and died	1
93	Aftab Ali	Yasin Manjeewala, Lakki Marwat.	200	30	32	4	28	-	-	-	-	-	28
94	Naqibullah	Vill/ Daud Shah, Bannu	8	8	3	1	2	-	-	-	-	-	2
95	Rukh Niaz	Vill/ Daud Shah, Bannu	6	2	2	-	2	-	-	-	-	-	2
96	Ubaidullah	Vill/ Daud Shah, Bannu	6	2	2	-	2	-	-	-	-	-	2
97	Dost Mohammad	Vill/ Daud Shah, Bannu	8	2	2	-	2	-	-	-	-	-	2
98	Ribat Khan	Vill/ Daud Shah, Bannu	2	2	2	1	1	1	-	-	-	Caught by snake	-
99	Asif	Vill/ Daud Shah, Bannu	5	2	2	-	2	-	-	-	-	-	2
100	Dilabaz	Vill/ Daud Shah, Bannu	8	2	2	-	2	1	-	-	-	Legs bent and died	1
101	Nazir Ali	Vill/ Daud Shah, Bannu	8	4	4	4	-	-	-	-	-	-	-
102	Jan Ali	Mamash Khel, Bannu	2	2	2	-	2	-	-	-	-	-	2
103	Mainullah	Mamash Khel, Bannu	10	4	4	4	-	-	-	-	-	-	-
104	Abdul Qayum Jan	Officers colony, Bannu	8	2	2	-	2	1	-	-	-	Legs bent and died	1
105	Subhan	Peeran Mamash Khel, Bannu.	10	4	4	3	1	-	-	-	-	-	1

#	Name	Address	Total captive cranes	Breeding cranes	Eggs hatched	Eggs addled	Chicks hatched	Mortality in the age of				Reasons for Mortality	Chicks survival
								1 wk	1 mon.	2 mon	3 mon.		
106	Mustafa	Bandewan Mamash Khel, Bannu.	10	6	6	-	6	-	-	-	-	-	6
107	Dilfaraz Khan	Tape Kale, Bannu	2	2	2	-	2	-	-	-	-	-	2
108	Sultan Ayaz	Landi Dak, Haweed, Bannu	4	2	4	2	2	-	-	-	-	-	2
109	Jehangir	Vill/ Dardaraz, Bannu	4	2	2	-	2	-	-	-	-	-	2
110	Asmatullah	Haweed Village, Bannu	6	6	6	4	2	1	-	-	-	accidental	1
111	Zarwali Khan	Haweed Village, Bannu	2	2	2	-	2	-	1	-	-	Legs bent and died	1
112	Fazle Subhan	Banda Mir abbas, Bannu	4	2	2	-	2	-	-	-	-	-	2
113	Gulab	Bangash Khel, Bannu	2	2	2	-	2	-	1	-	-	accidental	1
114	Shah Qayas Khan	Niazi Village, Bannu	2	2	2	-	2	-	-	-	-	-	2
115	Najibullah Khan	Khawaja Ahmad Khan Village, Bannu	15	4	4	2	2	-	-	-	-	-	2
116	Mustafa	Soorani Mandozai, Bannu	20	6	6	5	1	-	-	-	-	-	1
117	Haji Zardad	Bazida Kokal Khel, Bannu	4	4	3	-	3	-	-	-	-	-	3
118	Akhtar Khan	Bazida Kokal Khel, Bannu	2	2	2	2	-	-	-	-	-	-	-
119	Aminullah	Sadrawan village, Bannu	8	6	6	2	4	2	-	-	-	Legs bent and died	2
120	Mujib-Rehman	Sadrawan village, Bannu	10	4	2	-	2	-	-	-	-	-	2
121	Safirullah	Sadrawan village, Bannu	2	2	2	-	2	1	-	-	-	Eye+mouth infection	1
122	Salahuddin	Sadrawan Kotka Feroz, Bannu	4	4	4	2	2	1	-	-	-	accidental	1
123	Atlas	Sadrawan Kotka Feroz, Bannu	2	2	2	-	2	-	-	-	-	-	2
124	Sifatullah	Sadrawan Kotka Feroz, Bannu	4	4	6	3	3	1	-	-	-	accidental	2
125	Sanatullah	Sadrawan Kotka Feroz, Bannu	2	2	2	-	2	-	-	-	-	-	2
126	Fazle Aziz	Jando Khel, Bannu	2	2	2	-	2	-	-	-	-	-	2
127	Haqdar Ali	Jando Khel, Bannu	4	2	3	1	2	1	-	-	-	accidental	1
128	Burhan uddin	Jando Khel, Bannu	3	2	2	1	1	-	-	-	-	-	1
129	Imtiaz	Jando Khel, Bannu	4	2	2	-	2	-	-	-	-	-	2
130	Noorkali Gul	Jando Khel, Bannu	2	2	2	-	2	-	-	-	-	-	2
131	Iftikhar	Bazar Ahmad Khan, Bannu	6	2	2	1	1	-	-	-	-	-	1

#	Name	Address	Total captive cranes	Breeding cranes	Eggs hatched	Eggs addled	Chicks hatched	Mortality in the age of				Reasons for Mortality	Chicks survival
								1 wk	1 mon.	2 mon	3 mon.		
132	Haroon	Bazar Ahmad Khan, Bannu	2	2	2	-	2	1	-	-	-	accidental	1
133	Ghani Khan	Heshani Kala, Bannu	6	2	2	-	2	-	-	-	-	-	2
134	Guldar Ali	Hassan Khel Esaki, Bannu	4	2	2	-	2	-	-	-	-	-	2
135	Zahir Khan	Malik Khel, Bannu	6	2	2	-	2	-	-	-	-	-	2
136	Baz Mohammad	Shahbaz Azmat Khel, Bannu	8	2	2	-	2	-	-	-	-	-	2
137	Hidayatullah	Shahbaz Azmat Khel, Bannu	4	2	2	-	2	-	-	-	-	-	2
138	Abdul Nawaz	Painda khel wazir, Bannu	4	2	1	-	1	-	1	-	-	Influenza	-
139	Fazle Rabi	Painda khel wazir, Bannu	6	4	4	1	3	-	-	-	-	-	3
140	Salim Khan	Painda khel wazir, Bannu	6	4	4	-	4	-	-	-	-	-	4
141	Farman	Marmandi sarai Naurang, Lakki Marwat.	4	2	2	-	2	-	2	-	-	Legs bent and died	-
142	Safdar	Marmandi sarai Naurang, Lakki Marwat.	6	2	2	-	2	1	-	-	-	Legs bent and died	1
143	Nimatullah	Chekare banda, Bannu	4	2	2	-	2	-	-	-	-	-	2
144	Aslam Khan	Sarai naurang, Lakki Marwat	2	2	2	-	2	-	2	-	-	Legs bent and died	-
145	Ashraf Ali	Marmandi sarai Naurang, Lakki Marwat.	2	2	2	-	2	-	-	-	-	-	2
146	Hafiz Jan	Mirazam Mechan Khel, Lakki Marwat.	4	2	1	1	-	-	-	-	-	-	-
147	Mohammad Nawaz	Mama Khel, Sarai Naurang, Lakki Marwat.	2	2	3	3	-	-	-	-	-	-	-
148	Momin Khan	Mama Khel, Sarai Naurang, Lakki Marwat.	4	2	2	-	2	-	-	-	-	-	2
149	Kalimullah	Mama Khel, Sarai Naurang, Lakki Marwat.	6	2	2	-	2	-	-	-	-	-	2
150	Anwar Khan	Tahte Kale, Sarai Naurang, Lakki Marwat	2	2	2	-	2	-	-	-	-	-	2
151	Zahidullah	Ahundan, Landi jalendar, Bannu	4	2	2	-	2	-	1	-	-	Legs bent and died	1
151	Zarif Khan	Kotka Mohammad Khan, Bannu	4	2	2	-	2	-	-	-	-	-	2

#	Name	Address	Total captive cranes	Breeding cranes	Eggs hatched	Eggs addled	Chicks hatched	Mortality in the age of				Reasons for Mortality	Chicks survival
								1 wk	1 mon.	2 mon	3 mon.		
152	Zafarullah	Gari Kale, Link road, Bannu	4	4	4	2	2	-	-	-	-	-	2
153	Waris Khan	Qamar Kale, Link road, Bannu	10	2	2	2	-	-	-	-	-	-	-
154	Muhtiar Khan	Qamar Kale, Link road, Bannu	6	2	2	2	-	-	-	-	-	-	-
155	Zameer Khan	Ghani Khel, Link road, Bannu	12	6	7	4	3	1	-	-	-	Legs bent and died	2
156	Rasool Nawaz	Madi khel, Link road, Bannu	4	2	2	-	2	-	1	-	-	Legs bent and died	1
157	Syed Adam	Madi khel, Link road, Bannu	4	2	2	-	2	-	-	-	-	-	2
158	Ghulam Mohammed	Adam kale, Link road, Bannu	6	2	2	-	2	2	-	-	-	Accidental	-
159	Ali Bughdad	Madi khel, Link road, Bannu	4	2	2	-	2	-	1	-	-	Legs bent and died	1
160	Tariq Ayub	Adam kale, Link road, Bannu	10	6	6	4	2	-	-	-	-	-	2
161	Syed Nawaz	Adam kale, Link road, Bannu	6	2	2	-	2	-	2	-	-	Legs bent and died	-
162	Inayat ur Rehman	Adam kale, Link road, Bannu	2	2	2	-	2	1	-	-	-	Legs bent and died	1
163	Alladad Khan	Lapri Kale, Link road, Bannu	50	8	6	-	6	-	-	-	-	-	6
164	Awal Ayaz	Lapri Kale, Link road, Bannu	6	2	2	-	2	-	1	-	-	Legs bent and died	1
165	Mohammad Khan	Lapri Kale, Link road, Bannu	2	2	2	1	1	-	-	-	-	-	1
166	Oresham Khan	Lapri Kale, Link road, Bannu	4	2	2	-	2	-	-	-	-	-	2
167	Gul Rahim	Abad Khel, Link road, Bannu	4	4	4	2	2	1	-	-	-	Legs bent and died	1
168	Mohammad Salim	Abad Khel, Link road, Bannu	4	2	2	-	2	1	-	-	-	Legs bent and died	1
169	Nek Mohammad	Abad Khel, Link road, Bannu	4	2	2	1	1	-	-	-	-	-	1

#	Name	Address	Total captive cranes	Breeding cranes	Eggs hatched	Eggs addled	Chicks hatched	Mortality in the age of				Reasons for Mortality	Chicks survival
								1 wk	1 mon.	2 mon	3 mon.		
170	Ashraf Ali	Abad Khel, Link road, Bannu	4	2	2	2	-	-	-	-	-	-	-
171	Sadam Khan	Abad Khel, Link road, Bannu	2	2	2	1	1	1	-	-	-	Legs bent and died	-
172	Sanaullah	Mohammad khan kale,Link road, Bannu	6	2	2	2	-	-	-	-	-	-	-
173	Afzal khan	Azeem Kale, Link road, Bannu	12	6	6	2	4	-	-	-	-	-	4
174	Ayaz Khan	Azeem Kale, Link road, Bannu	4	2	2	-	2	1	-	-	-	Legs bent and died	1
175	Ghafoor Khan	Azeem Kale, Link road, Bannu	4	4	4	2	2	-	-	-	-	-	2
176	Saeed Khan	Azeem Kale, Link road, Bannu	6	2	2	1	1	-	-	-	-	-	1
177	Baseerullah	Kotka Meeryan, Highway road, Bannu	6	2	5	2	3	-	-	-	-	-	3
178	Inayatullah	Patool khel, Domail, Bannu	4	2	2	-	2	-	-	-	-	-	2
179	Umar Ayaz	Patool khel, Domail, Bannu	4	2	2	1	1	-	-	-	-	-	1
180	Syed Nawaz	Patool khel, Domail, Bannu	4	2	2	-	2	-	-	-	-	-	2
181	Saleh Jan	Patool khel, Domail, Bannu	6	2	1	-	1	-	-	-	-	-	1
182	Gul Shahzad	Patool khel, Domail, Bannu	2	2	2	-	2	-	1	-	-	Accidental	1
183	Irfanullah	Patool khel, Domail, Bannu	4	2	2	-	2	-	-	-	-	-	2
184	Dilnawaz	Patool khel, Domail, Bannu	4	2	2	-	2	1	-	-	-	Accidental	1
185	Khalid Gul	Patool khel, Domail, Bannu	4	2	2	-	2	1	-	-	-	Accidental	1
186	Salim Khan	Patool khel, Domail, Bannu	2	2	2	1	1	-	-	-	-	-	1
187	Gul Raees	Patool khel, Domail, Bannu	4	2	2	-	2	-	-	-	-	-	2

#	Name	Address	Total captive cranes	Breeding cranes	Eggs hatched	Eggs addled	Chicks hatched	Mortality in the age of				Reasons for Mortality	Chicks survival
								1 wk	1 mon.	2 mon	3 mon.		
188	Reesham Jan	Patool khel, Domail, Bannu	4	2	2	1	1	-	-	-	-	-	1
189	Amanullah	Patool khel, Domail, Bannu	10	4	2	-	2	-	-	-	-	-	2
190	Gul Ghaffar	Patool khel, Domail, Bannu	6	2	2	1	1	-	-	-	-	-	1
191	Nadir Khan	Patool khel, Domail, Bannu	4	2	2	1	1	-	-	-	-	-	1
192	Syed Ayaz	Dandi Kale, Highway road, Bannu	6	2	2	-	2	-	2	-	-	Legs bent and died	-
193	Saranjam Khan	Dandi Kale, Highway road, Bannu	4	2	2	1	1	-	-	-	-	-	1
194	Saadullah	Dandi Kale, Highway road, Bannu	2	2	2	1	1	-	-	-	-	-	1
195	Gul Rehman	Dandi Kale, Highway road, Bannu	4	4	5	3	2	1	-	-	-	Accidental	1
196	Hushdil Khan	Dandi Kale, Highway road, Bannu	6	2	2	1	1	-	-	-	-	-	1
197	Hakimullah	Dandi Kale, Highway road, Bannu	4	2	2	2	-	-	-	-	-	-	-
198	Ghani Ahmad	Dandi Kale, Highway road, Bannu	6	2	2	-	2	-	-	-	-	-	2
199	Sabir Jan	Ahundan Kale, Landi Jalendar, Bannu	6	2	2	-	2	-	-	-	-	-	2
200	Liaqat Ali	Dalo Khel, Lakki Marwat	4	2	2	-	2	-	-	-	-	-	2
201	Sherdil Khan	Dalo Khel, Lakki Marwat	6	2	2	-	2	-	-	-	-	-	2
202	Iqbal Khan	Dalo Khel, Lakki Marwat	2	2	2	1	1	-	-	-	-	-	1
203	Amir Nawaz	Meena khel, Lakki Marwat	2	2	2	1	1	-	-	-	-	-	1
204	Jehangir	Huidad Khel, Lakki Marwat	6	2	2	2	-	-	-	-	-	-	-
205	Haji Guldad	Huidad Khel, Lakki Marwat	2	2	2	1	1	-	-	-	-	-	1
206	Mohammad Shah	Huidad Khel, Lakki Marwat	2	2	2	1	1	-	-	-	-	-	1
207	Gulfaraz	Langar Khel, Lakki Marwat	4	2	2	-	2	1	-	-	-	Accidental	1

#	Name	Address	Total captive cranes	Breeding cranes	Eggs hatched	Eggs addled	Chicks hatched	Mortality in the age of				Reasons for Mortality	Chicks survival
								1 wk	1 mon.	2 mon	3 mon.		
208	Aslam	Wanda Shahab khel, Link road, Bannu	4	2	2	-	2	1	-	-	-	Accidental	1
209	Amir Nawaz	Baghban Mohallah, Lakki Marwat	6	2	2	1	1	-	-	-	-	-	1
210	Sifatullah	Khwaja khel, lakki Marwat	2	2	2	-	2	1	-	-	-	Accidental	1
211	Burhan	Khwaja khel, lakki Marwat	6	4	6	4	2	-	-	-	-	-	2
212	Aziz	Khwaja khel, lakki Marwat	4	4	4	-	4	-	-	-	-	-	4
213	Dawar	Khwaja khel, lakki Marwat	2	2	2	1	1	-	-	-	-	-	1
214	Gulfaraz	Khwaja khel, lakki Marwat	7	2	2	-	2	-	-	-	-	-	2
215	Nasim	Adamzai, Lakki Marwat	2	2	2	-	2	-	-	-	-	-	2
216	Mohammad Gul	Adamzai, Lakki Marwat	2	2	2	-	2	-	-	-	-	-	2
217	Aziz khan Bahabur	Adamzai, Lakki Marwat	6	2	2	-	2	-	-	-	-	-	2
218	Rosi khan	Adamzai, Lakki Marwat	8	2	2	-	2	-	-	-	-	-	2
219	Zahoor	Tajazai, lakki Marwat	2	2	2	1	1	-	-	-	-	-	1
220	Farooq	Dalo khel, Lakki Marwat	2	2	1	-	1	-	-	-	-	-	1
221	Syed Rehman	Dalo khel, Lakki Marwat	2	2	2	-	2	-	2	-	-	Legs bent and died	-
222	Abdur Rashid	Dalo khel, Lakki Marwat	2	2	2	-	2	-	-	-	-	-	2
223	Mohammad Nawaz	Dalo khel, Lakki Marwat	2	2	2	-	2	-	-	-	-	-	2
224	Riaz	Tajazai, lakki Marwat	2	2	2	-	2	1	-	-	-	Accidental	1
225	Shamsher	Meena khel, Lakki Marwat	2	2	2	1	1	-	-	-	-	-	1
226	Jehanzeb	Saeed khel, Lakki Marwat	2	2	2	1	1	-	-	-	-	-	1
227	Hamidullah	Mohammad Ghani khel, Lakki Marwat	3	2	2	1	1	-	-	-	-	-	1
228	Mohammad Usman	Mohammad Ghani khel, Lakki Marwat	6	2	2	-	2	-	-	-	-	-	2
229	Shahidullah	Mohammad Ghani khel, Lakki Marwat	8	2	2	1	1	-	-	-	-	-	1
230	Abdul Ghaffar	Mohammad Ghani khel, Lakki Marwat	4	4	4	4	-	-	-	-	-	-	-
231	Farmanullah	Mohammad Ghani khel, Lakki Marwat	3	2	2	-	2	2	-	-	-	Accidental	-
232	Rashid Aslam	Landi Jalendar, Highway road, Bannu	6	2	2	1	1	1	-	-	-	Accidental	-
233	Usman Shah	Langar khel, Lakki Marwat	6	2	2	Break by parent crane	-	-	-	-	-	-	-

#	Name	Address	Total captive cranes	Breeding cranes	Eggs hatched	Eggs addled	Chicks hatched	Mortality in the age of				Reasons for Mortality	Chicks survival
								1 wk	1 mon.	2 mon	3 mon.		
234	Attah Mohammad Khan	Karak painda khel, Sarai Naurang, Lakki Marwat	2	2	2	-	2	-	1	-	-	Legs bent and died	1
235	Fida Ullah	Karak painda khel, Sarai Naurang, Lakki Marwat	4	2	2	Break by parent crane	-	-	-	-	-	-	-
236	Gul dad	Karak painda khel, Sarai Naurang, Lakki Marwat	2	2	2	Break by parent crane	-	-	-	-	-	-	-
237	Haji Honi Khan	Karak painda khel, Sarai Naurang, Lakki Marwat	4	2	2	2	-	-	-	-	-	-	-
238	Rashid Khan	Jangi Kale, Ghuriwala, Bannu	4	2	2	-	2	-	-	-	-	-	-
239	Aurang Zeb	Jangi Kale, Ghuriwala, Bannu	2	2	2	1	1	-	-	-	-	-	1
240	Awal Ayaz	Ghuriwala village, Bannu	2	2	2	-	2	1	-	-	-	Accidental	1
241	Afsar Ali	Esaki Sheehan, Bannu	6	2	2	-	2	-	-	-	-	-	2
		Total=	1400	676	706	217	478	57	43	1	0	-	375

Table 2: Experiences of demoiselle crane breeders with multiple clutching techniques

#	Categories	Number of responses	Remarks
1	Familiar with M.C	225	Although familiar with M.C, however all of them not practically applying due to some reasons.
2	Practically applying M.C	38	Not only familiar but also practically applying the M.C technique
3	Crane breeders taking 3 to 5 clutches of eggs per pair.	32	Practically applying and getting 3 to 5 clutches of eggs per pair by using special techniques.
4	Crane breeders taking 6 to 8 clutches of eggs per pair.	6	Practically applying and getting 6 to 8 clutches of eggs per pair by using special techniques.
5	Not familiar with multiple clutching	16	They did not know the concept of multiple clutching, however they were told and properly guide about it

Table 3: Tabular data of Eurasian crane breeders collected during 2007

#	Name	Address	Total captive cranes	Breeding cranes	Eggs hatched	Eggs addled	Chicks hatched	Mortality in the age of				Reasons for Mortality	Chicks survival
								1 Wk.	1 Mon.	2 Mon.	3 Mon.		
1	Amir	Hassan Khel Esaki, Bannu.	2	2	2	2	-	-	-	-	-	-	-
2	Rohan shah	Hassan Khel Esaki, Bannu.	2	2	2	-	2	1	-	-	-	Legs bent and died	1
3	Jalil Khan	Baisalam Ghuriwala, Bannu.	4	4	2	-	2	-	-	-	-	-	2
4	Amir Saudat Khan	Kotka Shah Alam, Ghuriwala, Bannu	6	2	2	-	2	-	-	-	-	-	2
5	Shahbaraz Khan	Shamshi Khel Ghuriwala, Bannu.	2	2	2	1	1	-	-	-	-	-	1
6	Falak Naz	Mama Khel, Sarai Naurang.	6	2	2	-	2	-	-	-	-	-	2
7	Nasrullah	Mama Khel, Sarai Naurang.	2	2	4	1	3	-	-	-	-	-	3
8	Ali Zaman	Mama Khel, Sarai Naurang.	2	2	2	2	-	-	-	-	-	-	-
9	Anwar	Mama Khel, Sarai Naurang.	6	2	4	2	2	1	-	-	-	accidental	1
10	Abdul Hamid	Zafar mama Khel, Sarai Naurang.	7	4	3	2	1	1	-	-	-	Legs bent and died	-
11	Rahimullah	Zafar mama Khel, Sarai Naurang.	18	6	6	4	2	-	-	-	-	-	2
12	Asad Khan	Nasar Khel, Sarai Naurang.	2	2	2	1	1	-	-	-	-	-	1
13	Qazi khan	Main Bazar Sarai Naurang.	2	2	2	1	1	-	1	-	-	Legs bent and died	-
14	Farhad	Mangalay, Lakki Marwat.	2	2	2	-	2	-	-	-	-	-	2
15	Rustam	Mangalay, Lakki Marwat.	4	2	2	2	-	-	-	-	-	-	-
16	Alamgir	Mangalay, Lakki Marwat.	2	2	2	-	2	-	1	-	-	Accidental	1
17	Aftab Ali	Yasin Manjewala	28	6	4	3	1	1	-	-	-	Accidental	-
18	Ubaidullah	Banda Daud shah, Bannu	2	2	2	-	2	-	-	-	-	-	2
19	Nazir Ali	Banda Daud shah, Bannu	2	2	2	2	-	-	-	-	-	-	-
20	Abdul Qayum Jan	Officers colony, Bannu.	4	4	2	-	2	-	-	-	-	-	2
21	Subhan	Peeran Mamash Khel, Bannu	10	2	2	2	-	-	-	-	-	-	-
22	Mustafa	Badwan Village , Bannu	6	2	2	-	2	-	2	-	-	accidental	-
23	Anwar	Village Dardaraz< Bannu	2	2	2	1	1	1	-	-	-	Accidental	-
24	Mustafa	Soorani Mandozai, Bannu	4	2	2	2	-	-	-	-	-	-	-
25	Haji Zardad	Bazida Kokal Khel, Bannu	12	4	8	6	2	1	-	-	-	Accidental	1
26	Shah Nawaz	Nariwa patool khel, Bannu	2	2	2	2	-	-	-	-	-	-	-
27	Ihsanullah	Patool khel, Domail, Bannu	24	2	2	1	1	-	-	-	-	-	1
28	Khan Wali	Abad khel, Link road, Bannu	2	2	2	1	1	-	-	-	-	-	1
29	Mohammad Salim	Abad khel, Link road, Bannu	2	2	2	-	-	-	-	-	-	-	-
30	Haji Abu Khan	Abad khel, Link road, Bannu	2	8	8	-	-	-	-	-	-	-	-

#	Name	Address	Total captive cranes	Breeding cranes	Eggs hatched	Eggs addled	Chicks hatched	Mortality in the age of				Reasons for Mortality	Chicks survival
								1 Wk.	1 Mon.	2 Mon.	3 Mon.		
31	Sher Gul	Chetta khel, Link road, Bannu	5	2	2	2	-	-	-	-	-	-	-
32	Fida ullah	Karak Painda khel, Sarai Naurang, Lakki Marwat	5	2	2	2	-	-	-	-	-	-	-
33	Daud Khan	Azeem kale, link road, Bannu	4	2	2	1	1	-	-	-	-	-	1
34	Gul Tiaz	Ahundan kale, Landi jalender, Bannu	4	2	2	1	1	-	-	-	-	-	1
35	Dawar	Khawaja khel, Lakki Marwat	2	2	6	5	1	-	-	-	-	-	1
36	Mohammad usman	Khawaja khel, Lakki Marwat	2	2	2	2	-	-	-	-	-	-	-
37	Kabil Khan	Kotka Meeryan, highway road, Bannu	4	2	2	2	-	-	-	-	-	-	-
38	Mohammad Arif	Meena khel, Lakki Marwat	2	2	2	-	2	-	-	-	-	-	2
39	Gul Sahar Shah	Mama khel, Sarai Naurang, Lakki Marwat	10	2	2	1	1	-	-	-	-	-	1
40	Zainullah	Mama khel, Sarai Naurang, Lakki Marwat	4	2	2	1	1	-	-	-	-	-	1
		Total=	213	102	107	65	42	6	4	-	-	-	32

Table 4: Experiences of Eurasian crane breeders with multiple clutching techniques

#	Categories	Number of responses	Remarks
1	Familiar with Multiple Clutching	37	Although familiar with Multiple Clutching, however all of them not practically applying due to some reasons.
2	Practically applying Multiple Clutching	12	Not only familiar but also practically applying the Multiple Clutching technique
3	Crane breeders taking 3 to 5 clutches of eggs per pair.	9	Practically applying and getting 3 to 5 clutches of eggs per pair by using special techniques.
4	Crane breeders taking 6 to 8 clutches of eggs per pair.	3	Practically applying and getting 6 to 8 clutches of eggs per pair by using special techniques.
5	Not familiar with multiple clutching	3	They did not know the concept of multiple clutching, however they were told and properly guide about it