

SURVIVAL RATIO OF RELEASED HOUBARA BUSTARD FROM HOUBARA RESEARCH AND REHABILITATION CENTER (SALLUWALI RAHIM YAR KHAN, PUNJAB, PAKISTAN)

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Abstract. The survival ratio of re-released Houbara Bustard was studied at three different localities in Pakistan by radio tracking. Survival ratio was 60.0 % after 4 months in Nag Valley, with 20.0 % birds predated and 20.0 % lost. In Khairpur, 46.67 % birds survived for 2 months, 26.67 % were predated, 6.66 % lost, and 20.0 % hunted. In Rahim Yar Khan 80.0 % birds survived for 1.5 months whilst 20.0 % were lost. Food availability, predator density and hunting activities may be factors that influence the post-release survival ratio of re-released Houbara in Pakistan.

Key words: Pakistan, Houbara Bustard, *Chlamydotis undulata*, rehabilitation, survival.

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Выживаемость джеков, выпущенных исследовательским и реабилитационным центром в Саллували Рахим Яр Хан (Пенджаб, Пакистан). - М.С. Надим, М. Асиф, Г. Рашид. - Беркут. 12 (1-2). 2003. - Выживаемость выпущенных изучалась в нескольких регионах Пакистана при помощи радиопрослеживания. В долине Наг она составила 60,0 % после 4 месяцев, 20,0 % птиц были добыты хищниками и 20,0 % потеряны. В Хаирпуре через 2 месяца выжило 46,67 % птиц, 26,67 % птиц были добыты хищниками, 6,67 % – потеряны, 20,0 % добыты охотниками. В Рахим Яр Хане 80,0 % выжило на протяжении 1,5 месяцев, 20,0 % были потеряны. Основными факторами, влияющими на выживаемость выпущенных птиц, являются доступность корма, плотность хищников и активность охоты.

INTRODUCTION

The Asian Houbara Bustard (*Chlamydotis undulata macqueenii*) is a medium sized desert bird, declining in all areas of its distribution due to over exploitation and degradation of habitat. Houbara Bustard are trapped (illegally) during their migration to wintering areas of Pakistan. They are smuggled to Middle Eastern States, where falcons are trained utilizing the Houbara as quarry. This harvest is thought to extend to 4,000 to 7,000 birds per year (Goriup, 1997). However, the capture record is not available and could be anybody's guess. The trappers and transporters being not fully trained in handling these birds, often cause the death of Houbara. The operation being illegal, Government functionaries confiscate such illegal consignments. The birds thus caught, due to crowded conditions, poor husbandry and insufficient food supply are usually sick and diseased. To rehabilitate such birds Houbara Foundation International Pakistan (HFIP) established a Houbara Research and Rehabilita-

tion Center (HRRC) in 1996. The main Objectives of HRRC are: To provide medical treatment, rehabilitate the birds so they are not a health risk for free living populations and monitor the survival ratio of the released birds.

HFIP releases Houbara Bustard every year. The confiscated Houbara are often received in poor condition and are treated at HRRC Rahim Yar Khan. They are released back in the wild after treatment. Survival ratio of these released birds is an important subject. To monitor the survival and movement of released Houbara, radio transmitters were used. The survival ratio of Houbara was studied in different localities (Nag Valley, Khairpur and Rahim Yar Khan).

MATERIALS AND METHODS

Houbara with radio transmitters were released (Photo 1–7) in different areas and monitored up to expiry of batteries. Forty-two birds were released in Nag Valley, including ten Houbara with transmitters and monitored for



Photo 1. Transmitter is being installed on Houbara Bustard.

four months. Fifteen Houbara were released in Khairpur (all with transmitters) and 5 in Rahim Yar Khan with transmitters. The release sites were Houbara Research Rehabilitation and Breeding Center (HRRBC) at Nag Valley $27^{\circ} 16.263$ N, and $64^{\circ} 50.542$ E, Kadinwali, Khairpur $27^{\circ} 09.720$ N, and $69^{\circ} 19.424$ E and Houbara Research and Rehabilitation Center (HRRC), Salluwali Rahim Yar Khan $28^{\circ} 32.908$ N, and $70^{\circ} 55.927$ E. The weight of each transmitter was 21.5 grams and its battery life was four months.

After release an extensive search was carried out from all accessible high points to record the bird's signals. The signals were heard on an AOR receiver, model AR 8000.



Photo 2. Release of Houbara with transmitters.

The search for signals started from the release point and after every one kilometer the frequency of each bird was checked for signals. Whenever the signals were heard, the bird was followed and located. The intensity of signals helped to determine the direction of the bird. When there were signals from all sides, they indicated the proximity of the bird within 4–7 feet. Then the antenna was placed closer to the ground to determine the exact direction.

On locating, the position of each bird was recorded with a Global Positioning System (GPS). Moreover the vegetation and characteristics of the area were also recorded. Once a Houbara was located, its changing positions were recorded every week. Using the GPS information movements from the release sites could be charted.

Tests were made with the transmitters and receiver to see at what distance the transmitters could be detected under field conditions.

All the distances given are aerial and have been recorded with the GPS.

RESULTS

Survival ratio by radio tracking

Survival ratio of radio-tagged Houbara was studied in three different localities, Nag Valley, Khairpur and Rahim Yar Khan.

Nag Valley

Forty-two Houbara were released from HRRBC on 15.04.2000. These birds had been rescued from trappers in Balochistan in December 1998. Due to absence of a research center there, the birds were shifted to HRRC Rahim Yar Khan from where they were transferred to Nag on 10.04.2000 after certification. Out of forty two, ten



birds (6 females and 4 males) were harnessed with transmitters and monitored for four months from 15.04 to end of August 2000, until the transmitter batteries expired. The survival ratio was 60 % (Table 1). The distance covered by Houbara between locations is shown in Table 2. Maximum distance covered was 14.82 km and minimum was 0.21 km. The morphometry of these ten birds is also given in Appendix A. Index Value (Weight/Tarsus), calculated from morphometric data represented the general health of these birds.



Photo 3. Tracking of Houbara in Nag Valley.

Some interesting observations were made during this radio tracking. When there were signals from all sides, it proved that the bird was within 5–7 feet distance. The Houbara camouflaged itself so perfectly that it could not be seen, although there were signals from all sides indicating that the bird was only 5–7 feet away. Once a Houbara (frequency 215.400) was just 4 feet away but it was not spotted, until it flew away. Similarly a Houbara (frequency 215.222) was sighted when it was only 2 feet from the observer but had hidden in such a way in a *Cymbopogon* clump that it was not visible until it suddenly walked away slowly. This bird was again observed sitting under a *Periploca*. Photographs were taken from 5 feet from a standing position on the ground. It did not move and calmly remained seated, vigilantly observing around. Similarly

215.433 was also observed 5–7 feet away from the vehicle sitting under *Zygophyllum* and did not move. Thus it is clear, that in the wild it is very difficult to detect Houbara, even from a few feet, due to its cryptic color and perfect camouflage. So, only 5 sighting were made of Houbara without a transmitter, from the 32 that were released.

It was observed that whenever a Houbara was sighted it would change its position. But if the positions were recorded when there were signals from all sides and the bird was hidden, then it would not change its position, perhaps considering the area safe. This is clear from the first four positions of 215.881 and 215.524, when they were not seen but the positions were recorded from multidirectional signals. Similarly in the case of 2nd to 5th positions of 215.373 and 215.462 and 3rd to 6th position

Table 1

Survival ratio of radio tagged Houbara in different localities, %
 Выживаемость джеков с радиопередатчиками в разных местах, %

Locality	Number of Houbara	Predated	Lost	Hunted	Survival
Nag Valley	10	20.00	20.00*	–	60.00
Khairpur	15	26.67	06.66**	20.00	46.67
Rahim Yar Khan	5	–	20.00***	–	80.00

* Lost after one week, ** lost immediately after release, *** lost after two weeks.

Table 2

Weekly distance (km) covered by Houbara in Nag Valley
Недельное расстояние (км), покрываемое джеками в долине Нар

Weeks	Birds transmitter frequencies									
	215.881	215.524	215.373	215.821	215.222	215.433	215.462	215.702	215.584	215.4000
1 st	–	–	4.40	1.30	4.22	1.80	3.80	1.39	1.99	1.89
2 nd	–	–	–	–	–	–	–	Predated		–
3 rd	–	–	–	–	–	–	–	–	–	–
4 th	–	–	–	–	–	8.40	–	–	–	10.82
5 th	–	–	–	–	–	–	–	–	–	–
6 th	–	–	–	–	2.40	–	–	–	–	–
7 th	14.82	14.20	11.04	–	1.20	–	10.99	–	–	8.74
8 th	2.81	1.23	–	–	2.17	11.20	0.24	–	–	1.85
9 th	0.43	–	0.63	–	Predated		7.50	–	–	1.26
10 th	0.32	0.69	2.89	–	–	6.99	1.32	–	–	–
11 th	–	0.76	9.43	–	–	0.88	1.20	–	–	11.02
12 th	4.80	0.29	–	–	–	0.40	7.82	–	–	–
13 th	–	–	3.62	–	–	0.56	–	–	–	7.38
14 th	1.40	9.20	2.72	–	–	0.22	9.82	–	–	–
15 th	1.90	2.10	–	–	–	0.32	2.31	–	–	9.36
16 th	–	–	–	–	–	0.21	–	–	–	–
Average	3.78±5.10	4.07±5.43	4.96±3.81	1.30	2.50±1.26	3.50±4.14	4.69±4.23	1.39	1.99	6.54±4.19

– Houbara could not be located.

of 215.400. The Houbara 215.433 changed the position only 0.66 km away when not seen. But when it was seen, it moved a longer distance. Conversely, in the last month (August) 215.433 changed its positions by only small distances, although it was seen many times. It

may be by that time it had become familiar with our vehicle.

All birds with transmitters remained alone from one another and did not unite with the others. It was observed that female 215.433 paired twice with another bird (2nd and 3rd position) without transmitter, which was male and ringed. Although five birds observed in Meshetal area (with 2–3 birds without transmitters) were very close to each other, they were never found together. All of them were observed singly within 5 km area.

Test showed that transmitter detection range was rather low for the receiver that we used. On one occasion the signals were received from 2.76 km but the transmitter was in a nomad's house, placed on high place. The maximum recep-



Photo 4. Recovered transmitter with Houbara feathers.



Weekly distance (km) covered by Houbara in Khairpur
Недельное расстояние (км), покрываемое джеками в Хайрпуре

Table 3

Weeks	Birds transmitter frequencies													
	215.193	215.310	215.612	215.102	215.551	215.731	215.344	215.761	215.280	215.009	215.911	215.642	215.491	
1 st	1.20	0.80	0.90	1.20	1.40	0.80	1.32	2.23	0.50	1.26	0.90	1.32	1.40	
2 nd	3.10	2.61	7.89	3.10	7.89	—	5.26	3.40	4.80	2.05	4.80	7.80	5.26	
3 rd	2.85	2.15	0.53	2.85	—	2.36	6.84	—	—	0.54	—	4.50	4.90	
4 th	4.28	Predated	6.37	5.88	6.80	—	Predated	—	6.80	Predated	3.90	—	5.80	
5 th	Hunted	3.58	Hunted	2.10	5.10	—	—	—	—	—	—	—	11.30	
6 th	—	3.20	—	7.90	—	—	—	—	3.20	—	5.60	5.60	7.90	
7 th	—	—	—	3.67	—	—	—	—	—	—	—	—	—	
8 th	—	—	—	12.90	—	—	—	—	—	—	—	—	—	
Average	2.86±1.26	1.85±.94	3.74±2.92	3.26±1.94	6.09±4.02	2.75±2.17	4.47±2.84	2.81±.82	3.82±2.66	1.28±.75	3.80±2.05	4.80±2.69	6.09±3.30	

— Houbara could not be located.

tion was 1.16 km but mostly pulses were heard within one km. The range of receiver was often checked but the reception was always found to be poor and signals heard within a kilometer. Once 215.433 was checked from all sides and signals were heard 0.68 km in south, 1.1 km in east, 1 km in west and 0.99 km in north side (in plain area). All this depends on the bird's position; whenever a bird is in low-lying area, such as ditches on the bank of nullas etc, the reception will be very poor. Once, when the Houbara 215.433 was found in such a place, it did not respond from 0.5 km. Pulses were heard from 3–4 hundred meters. Similarly, to check the range, a recovered transmitter was placed on ground besides a bush. Its signals were audible at 0.84 km from north, 1.2 km from west, 1.4 km from south and 0.96 km from east side. This range was further reduced when batteries were nearing expiry after three and a half months. The same problem was faced in Khairpur and Rahim Yar Khan areas.

Khairpur (Sukkur)

Transmitters were harnessed on 9 males and 6 females on 12–13.12.2000 in HRRC. They had spent three weeks in captivity. The birds were transported from Rahim Yar Khan to Kadanwali, District Khairpur. It took 9 hours to reach the release site. There were already footprints of a wild Houbara and a fox at the release site. The vegetation in the area was dry, dominated by *Aerva javanica*, *Calligonum polygonoides*, *Dipterygium glaucum*, *Pro-*



Photo 5. Carcass of Houbara (Frequency 215.222).

sopis cineraria and *Capparis decidua*. Distance covered by Houbara between locations are shown in Table 3 and morphometric measurements of released birds are given in Appendix B. The birds remained within 3–5 km in the first two weeks after release.

After two months the survival ratio was 46.67 %, with 26.67 % birds predated, 20.0 % hunted and 6.66 % lost (Table 1). Predation was high in females as three females and one male were predated. Locals hunted two birds while Arab falconers in Sukkur area hunted one, as they were in operation from first week of January. There were confirmed reports that they hunted one Houbara with a transmitter in



Photo 6. Houbara (frequency 215.433) resting under *Zygophyllum* shade at 10.06 A.M.

the third week of January 2001 but they did not return the transmitter. Thus, the hunted bird could be one of the Houbara recorded as missing during the last two weeks, as the exact frequency was not known.

At the check post of Rangers (Kadanwali 1 km away from release site), they have two camels for transport and they fed them by mashed feed mainly composed of maize. It was surprising to note that in the first week of February, the two males, 215.551 and 215.612, fed for three days on this

camel feed, early in the morning. This suggests that may be there was shortage of food in the habitat or may be the birds became habitual of this type of food at HRRC.

Pairing

The male 215.911, which was alone, joined another male 215.612 on the third day after release. One female 215.310 joined male 215.731 on the second day of release. The male 215.102 paired with male 215.193. Another female 215.491 joined male 215.551, while 215.009 (male) remained alone. Similarly male 215.761 and female 215.280 were alone, while 215.344 (female) paired with 215.642 (female). In the first week, two birds were in a southeast direction from the release site, one was on the west side, two in the east, six were in north in a *Capparis* dominated area, one was in the northwest and one in a northeast direction.

After 10 days of release female 215.344 joined another female 215.491, while 215.551 (male) joined with another male 215.612. and 215.911 (male) joined 215.280 (female).

After one month of release, the birds had further changed their pairing, male 215.551 joined back with female 215.491. Another



male 215.612 joined the female 215.280. The male 215.911 paired with female 215.642. The other two males 215.731 and 215.761 were found singly. Sometime the pairs were found at the same place, sometimes there was a distance of 1–2 km between each member of a pair. After another week, the male 215.551 joined another male 215.612, while females 215.491 and 215.280 were found singly. The male 215.911 remained with female 215.642.

Weekly distance (km) covered by Houbara in Rahim Yar Khan
Недельное расстояние (км), покрываемое джеками в Рахим Яр Хане

Table 4

Weeks	Birds transmitter frequencies				
	215.102	215.009	215.193	215.344	215.310
1 st	1.13	1.13	2.06	3.00	0.55
2 nd	4.00	2.74	4.28	4.70	1.06
3 rd	–	5.47	3.45	10.40	4.32
4 th	–	10.70	2.99	4.30	6.75
5 th	–	25.50	2.80	3.47	2.67
6 th	–	2.49	17.40	4.38	14.30
7 th	–	–	32.40	14.90	2.85
Average	2.56±2.03	8.00±9.22	9.34±11.49	6.45±4.47	4.64±4.73

Rahim Yar Khan

Five Houbara were released with transmitters in Rahim Yar Khan on 27.01.2002. These birds had spent one month in HRRC. The transmitters were those recovered from predated birds of Nag and Khairpur areas. They were reused because their batteries were still functional. The release site was outside the premises of Houbara Research and Rehabilitation Center (HRRC) Salluwali 28° 32.908 N and 70° 55.927 E. The survival ratio after 1.5 months was 80 % (Table 1). The distances covered by Houbara between locations are given in Table 4 and morphometric measurements are also given in Appendix C. The maximum distance covered by Houbara in one week was 25.50 km and minimum 0.55 km.

Initially one male (215.009) and female (215.102) remained in a pair for one week but subsequently were found individually. After three days of release 215.193 (female) and 215.344 (male) joined together but again separated after a week. In the last week of February 215.193 (female) joined 215.344 (male) again but only for a few days. A male (215.310) remained near the mustard field for two weeks, just a few yards away from HRRC. The birds remain within 5 km of the release site in the first two weeks and within 30 km during the one and half month they were located. Maxi-

imum distance traveled between consecutive locations was 25.5 km, with an overall average of 6.8 km for these Rahim Yar Khan birds.

DISCUSSION

The survival ratio of released Houbara was studied by radio tracking in three localities. Forty-two birds were released, in Nag, including ten birds with transmitters. Out of these ten birds, after 4 months two were predated (20 %), six (60 %) were observed continuously until their batteries expired, while two birds (20 %) were seen only for one week after release. If we consider lost birds as dead, then the survival ratio comes to 60 %. Both predated birds were male. Thus the survival rate in females was higher. If we extrapolate the survival ratio to all 42 houbara released, then 26 birds survived (62 %), 8 birds (19 %) were predated and 8 birds (19 %) died or moved away from the area. This survival ratio (62 %) is very encouraging, considering the fact that these birds had spent over one year in captivity at Rahim Yar Khan and a high rate of pre-dation was expected.

Out of fifteen Houbara, released with radio transmitters in Khairpur, four were predated, three hunted and one lost after release. The survival ratio after two months was



Photo 7. Houbara (frequency 215.193) in Rahim Yar Khan.

46.67 %, while 26.67 % birds were predated and 20 % were hunted. Predation was higher in females as three females and one male were predated.

The birds released in Nag Valley had spent one and a half years in HRRC and predation deaths might be expected to be higher in them, as they have had longer in captivity to damage feathers, accumulate injuries, etc. But the predation was highest (26.67 %) in Houbara released in Khairpur, although they had spent only three weeks in HRRC, which could be because the predators density was high in the Khairpur area. Three birds were lost in the third week of January and remaining one in the first week of February, although their batteries were still alive.

There were Arab falconers in Khairpur area on 4.02. Therefore may be birds left the area due to disturbance of falconers or due to shortage of food. Perhaps they moved locally and could not be followed (the Indian border was only 30 km from release site) or they started some migration movements in early February due to hot weather.

Four Houbara (80 %) survived in Rahim Yar Khan for one and half months, while one (20 %) was lost after two weeks. If the lost birds were considered as predated or hunted, then the survival rate was 80 %, which is higher than the previous two localities, which may be

explained because the hunting and predator pressure was very low in the area of Rahim Yar Khan.

It appears that food availability, predator density and hunting activities may be factors that influence the post-release survival ratio of re-released Houbara in Pakistan.

The transmitter detection range of the receiver used was very low (i. e. only 1–2 km). Due to this short range several problems were faced in locating the birds. There were only ten birds for monitor in Nag Valley. If more birds (e. g.

thirty birds) will released with transmitters, then it would be very difficult to monitor them with such a short range receiver.

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The 24th International Ornithological Congress will be held in Hamburg, Germany, 13–19 August 2006. The scientific program committee has been formed and a web page is in place (<http://www.i-o-c.org/>).



Appendix A

Morphometry of radio-tagged Houbara released in Nag Valley

Transmitter frequency	Ring	Sex	Weight (g)	Wing (mm)	Tail (mm)	Tarsus (mm)	Sternum (mm)	Beak (mm)	Width at nostril	Length from nostril	Toe + Claw	Toe - Claw	Skull (mm)	Index value W/T
215.433	0004	F	850	320	140	73.5	84	47.5	11.5	20	37	30.5	88	12
215.462	0015	F	1000	330	150	73	87	47	12	24	46	37.3	92	14
215.584	0064	F	1000	290	105	71	69	38	9.1	16	33.5	23.9	78	14
215.400	0078	M	950	280	110	65	69.6	37.6	7.4	14.9	32.6	21.9	71	15
215.524	0112	F	900	310	125	71.2	72.6	38.5	9.9	17.6	39.9	31.5	80.5	13
215.222	0115	M	1450	360	190	92	88.5	49.4	14.2	26.4	47.6	37.5	92	16
215.821	0124	F	950	310	120	71	76	39.8	11.2	21.6	39.9	31.6	82.5	13
215.373	0083	M	1250	380	180	92	92.2	48.5	12.8	24.8	37.5	28.6	99.6	14
215.702	0028	M	1000	380	180	82	88	49	12.9	18	44.5	34	95	12
215.881	0175	F	900	370	180	84.3	92.9	49.1	12.4	23.2	47.6	38.9	95	11

Appendix B

Morphometry of radio-tagged Houbara released in Khairpur

Transmitter frequency	Ring	Sex	Weight (g)	Toe + Claw (mm)	Toe - Claw (mm)	Tarsus (mm)	Sternum (mm)	Beak total (mm)	Length from nostril	Width at nostril (mm)	Skull (mm)	Wing (mm)	Tail (mm)	Index Value W/T
215.193	0501	M	1600	47	32.3	103.1	101.2	54.1	21.3	11.4	104.1	360	200	15
215.249	0539	M	1650	46.2	35	101.7	101.5	55	21.9	12.4	104	350	200	16
215.612	0566	M	1150	47	31.5	100.3	97.6	54.3	22.1	11.3	102.6	350	190	11
215.310	0592	F	1150	43.3	32.3	95.3	89.3	50.8	20	10.5	93.2	320	190	12
215.102	0534	M	1400	48.4	35.3	99.9	101.1	52.2	21	12.1	101.6	340	200	14
215.731	0565	M	1300	48.4	34.6	105.6	102.4	62.2	23	11.2	107.6	390	200	12
215.670	0514	F	900	43.6	33.4	89.3	89.8	52.2	21.2	10.8	90	310	180	10
215.344	0578	F	900	37.4	31.3	83.8	89.4	51.2	22	11.1	98.2	310	180	11
215.761	0572	M	1680	47	35.3	95.3	104	57	22.2	13.2	105.1	370	215	18
215.280	0508	F	850	39.4	30.2	85.1	87.1	50.4	18.4	11	90	320	170	10
215.009	0540	M	1295	49	37	102.2	94.4	55.7	22.3	12.5	104.2	380	200	13
215.911	0510	M	1360	42.3	31	94.3	97.1	56.4	21.1	11.1	102.8	370	190	14
215.642	0532	F	1000	39	31.6	84.2	90.7	54	21.3	11	96	350	200	12
215.491	0569	F	1150	40.5	31.5	90.5	90	54.3	21.3	11.2	97.8	310	190	13
215.551	0517	M	1380	43.4	32.3	99.5	101.1	57.3	23.2	11.8	104.6	370	210	14

Morphometry of radio-tagged Houbara released in Rahim Yar Khan

Transmitter frequency	Ring	Sex	Weight (g)	Toe + Claw (mm)	Toe - Claw (mm)	Tarsus (mm)	Sternum (mm)	Beak total (mm)	Length from nostril (mm)	Width at nostril (mm)	Skull (mm)	Wing (mm)	Tail (mm)	Index Value W/T
215.009	0994	M	1575	52.7	40.0	100.4	103.9	60.3	26.3	13.3	106.8	390	220	16
215.102	0941	F	1010	45.2	35.0	87.2	84.3	51.6	20.9	12.4	94.7	310	180	12
215.344	0972	M	1330	44.2	33.7	96.0	95.7	55.8	22.4	12.8	100.5	370	180	14
215.193	0927	F	1140	45.7	33.9	96.8	88.9	55.9	24.1	13.7	99.1	320	190	12
215.310	0912	M	1195	48.7	38.5	96.4	92.3	54.3	22.3	13.5	102.2	380	190	12

Note: The transmitters were reused; those were recovered from predated birds.

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