National Studbook Nicobar Pigeon (*Caloenas nicobarica*)

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National Studbook of Nicobar Pigeon (*Caloenas nicobarica*)

Published as a part of the Central Zoo Authority sponsored project titled “Development and maintenance of studbooks for selected endangered species in Indian zoos”

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FOREWORD

Extensive illegal trade along-with habitat selectivity of Nicobar Pigeons (*Caloenas nicobarica*) has led to declines in the population of the species. The distribution of the species in India is restricted to small islands in Nicobar region of Andaman and Nicobar Islands. The coastal forest habitat of the species is further vulnerable to effects of climate change. These factors necessitate initiation of *ex-situ* conservation measures for ensuring an insurance population of the species.

The Central Zoo Authority in collaboration with zoos in India has identified the species for *ex-situ* conservation. Scientific management based on pedigree records contained in studbooks forms the basis for ensuring the long-term genetic viability and demographic stability of captive populations.

As a part of the endeavour to effectively managing *ex-situ* populations of species prone to extinction, a Memorandum of Understanding has been signed with the Wildlife Institute of India for compilation and update of studbooks of identified species in Indian zoos. As part of the project outcomes, the WII has compiled the National Studbook of Nicobar Pigeon (*Caloenas nicobarica*).

The report highlights the need for individual bird identification through appropriate marking techniques besides standardizing practices that address housing and husbandry needs in captivity. The report also highlights the need for adopting appropriate methods for identification of sex of captive specimens and maintenance of records on life-history events and lineages in captivity. The recommendations contained in the studbook will form the basis for long-term management of the species in captivity. It is hoped that the holding institutions will adopt these recommendations and keep the WII informed of changes in their populations on a regular basis to enable the timely update of the studbook.

(Dr. D.N. Singh, I.F.S.)
Member Secretary,
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Alipore Zoological Garden, Kolkata

Nandankanan Biological Park, Bhubaneswar

Nehru Zoological Park, Hyderabad

Sakkarbaug Zoo, Junagadh

Kamla Nehru Zoological Garden, Ahmedabad

We also thank Mr. Mukesh Arora for layout and design of this document.

Authors

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Species Biology: Nicobar Pigeon (*Caloenas nicobarica*)

Nicobar Pigeon, a large pigeon that inhabits rainforests below 500 m on select islands in the Indian ocean. It forages on the ground and roosts on trees in its rainforest habitat and is characterized by its large size, long hackles, short tail and iridescent plumage.

Taxonomy

Kingdom:	Animalia
Phylum:	Chordata
Class:	Aves
Order:	Columbiformes
Family:	Columbidae
Genus*:*	*Caloenas*
Species*:*	*nicobarica*

Nicobar pigeons are members of the family Columbidae in the order Columbiformes. The order is a monophyletic group that includes all pigeons and doves (Sibley and Ahlquist 1990). The members of the order are characterized by small or absent caeca, a fleshy cere over the slit like nares, tarsi covered with hexagonal scales on the back and lateral sides and a dense plumage. Additionally the members have a well developed bi-lobed crop producing pigeon milk (Sibley and Ahlquist 1990).

Shapiro et al (2002) based on molecular genetics analyses and fossil record suggested a close relationship between Nicobar pigeon, dodo and the solitaire with the later two being sister taxa within the family columbidae and Nicobar pigeon being a close relative. Subsequently Pereira et al. (2007) based on mitochondrial and nuclear DNA studies confirmed the monophyly of the order and established three clades within it. These include the New World pigeons and allies, the Neotropical ground doves, and the Afro-Eurasian and Australasian pigeons and doves. Nicobar pigeons were placed in the Afro-Eurasian and Australasian clade along with the extinct dodo and solitaires that were earlier placed in a separate subfamily, the Raphidae. They; however, refrained from proposing a family level delineation of genera and suggested the need for further studies based on non-molecular data (morphology and behavior).

Phylogenetic studies, carried out to establish the taxonomic position of the Spotted Green Pigeon established the presence of two extinct species in the genus *Caloenas* viz. *C. canacorum* (Kanaka Pigeon) and *C. maculata* (Spotted Green Pigeon) with the genus showing close affinities to the Dodo clade (Heupink et al. 2014) thus making Nicobar Pigeons as the lone representative of the Genus *Caloenas*. Two subspecies, *C. n. nicobarica* extending from Andaman and Nicobar Islands to Solomon Islands and *C. n. pelewensis* inhabiting Palau Islands are recognized. *C. n. pelewensis* can be distinguished from *C. n. nicobarica* by their shorter neck hackles (Grimmett et al. 2012).

Description

The species is characterized by the shining mane like hackles and white tail covert and tail feathers. They are larger in size than the rock pigeon and have a body length of approximately 41 cm (Ali and Ripley 1969) with longer legs and wings (Goodwin 1983). They have a slate-grey body with feathers on the upper-body ranging from shining metallic blue-green and copper-bronze. Females are similar to males in appearance; however, they can be distinguished by their duller colouration and shorter neck hackles (Ali and Ripley 1969). The bill and cere are black or dark grey, with relatively smaller cere in females. Their feet are purple or purple-red in colour with yellow or light brown claws (Goodwin 1983). The immature forms are similar to females in appearance with an absence of the neck hackles and bronze-green tails.

Habitat Ecology:

Table 1: Morphometrics of Nicobar pigeon

Characteristics	Range
Body length	40 cm
Body weight (Adult)	
Male	460-525 g
Female	490-600 g

The species nests on small tropical islands with dense coastal forests in the Indo-Australian realm and move to larger islands with dense forest cover for feeding. The preferred area of occupancy is from sea level to 500 m (Gibbs et al. 2001). The smaller islands are used during the breeding season while the larger islands with presence of large number of fruiting trees are preferred during the non-breeding season (Gibbs et al. 2001).

Food and Feeding

Foraging activity is primarily limited to the ground where they forage on fallen fruit and any invertebrates that they encounter. The species is able to digest hard seeds and nuts due to the presence of a muscular thick walled gizzard, lined with horny plates. It is further aided by the swallowing of grit and small pebbles less than 10 mm (Gibbs et al. 2001). The birds move between the breeding and feeding islands during the breeding season, while in the non-breeding season they remain on the larger feeding islands (Gibbs et al. 2001). The feeding and breeding islands must be in close proximity for the birds to effectively utilize them (Pratt and Beehler 2015).

Behaviour and Social Organization:

Table 2: Life history traits of Nicobar pigeon

Breeding season	January to March
Incubation period	30 days
Clutch size	1

The species occurs solitary or in small groups of two to three birds when foraging; however for movement between islands flocks of upto 30 birds may be formed (Gibbs et al. 2001). They are primarily terrestrial birds, spending a large part of their daily active periods on the ground foraging. They roost and nest colonially in trees at heights ranging from 2 – 12 m (Gibbs et al. 2001). Detailed behavioral records of the species from the wild are not available.

Reproduction

They are colonial breeders nesting on trees in small uninhabited islands with thick coastal forests. A bowing display precedes nest building, with both sexes participating. The nest is a rudimentary structure of twigs placed haphazardly on trees 2 – 12 m above the ground (Gibbs et al. 2001) with females remaining on the nest as it nears completion to protect the nest (Bell 1981). A single elliptical egg is incubated by both parents for upto 30 days. Studies in captivity by Bell (1981) have helped in understanding the reproductive biology of the species. He suggests that as nest nears completion courtship feeding and frequent copulations occur after which a single elliptical egg is laid. The egg is incubated by both parents for upto 30 days. Both sexes take part in parental care and squabs are fed pigeon milk until fledging.

The squabs fledge at three months in the wild (Gibbs et al. 2001), while records from captivity suggest that they may do so by the first month (Bell 1981). In captivity the young start feeding independently after fledging. The first moult occurs in captivity between 5 – 14 months and the earliest recorded onset of reproductive activity was after 12 months of age.

Communication:

Usually a silent species, vocalizations include cooing, and pig like grunts and a harsh croak. A bowing display with erect plumage and neck feathers has been described in literature as an aggressive posture (Gibbs et al. 2001). Detailed studies on communication are unavailable.

Distribution

They are small island specialists inhabiting suitable island homes. The subspecies/ race *Caloenas nicobarica nicobarica* occurs from Nicobar islands in India, through Mergui archipelago (Myeik Kyunzu), Myanmar, islands off south-west peninsular Thailand, islands around Peninsular Malaysia, islands off southern Cambodia and Vietnam, islands around Sumatra, Wallacea and Papua (formerly Irian Jaya), Indonesia, possibly also Timor-Leste, many islands in the Philippines, islands in Papua New Guinea to the Solomon Islands. The subspecies/ race plus *C. n. pelewensis* is reported from the Palau islands (BirdLife International 2001).

Figure 1: Distribution of Nicobar pigeon

Distribution in India

The subspecies/ race *C. n. nicobarica* inhabits small islands in coastal regions in the Nicobar Islands, with few reports suggesting the presence of birds northwards upto Coco island in Andamans (Ali and Ripley 1969).

Threats and Status

Exact population estimates of the species have not been made; however, it is believed to be declining due to habitat destruction, trapping for food and as part of the pet trade as well as due to introduced predators (BirdLife International. 2016). The tsunami of 2004 is believed to have reduced available habitat due to destruction of coastal forests (Porwal et al. 2012). It is therefore placed in Schedule I Part III of the Wildlife Protection Act of India, while the IUCN Red List of Threatened Species classifies it as a Near Threatened species. The species is in extensive illicit trade of live birds and body parts for various uses and is included in appendix I of CITES.

Status in Captivity

A review of the global status of Nicobar Pigeons in captivity was performed from the holding pattern of the species downloaded from the Species360 website. It revealed that the captive population is widely distributed across all six regions having its representation. The species has sizeable representation in zoological institutions both within its range in Asia as well as in zoos in Europe and North America.

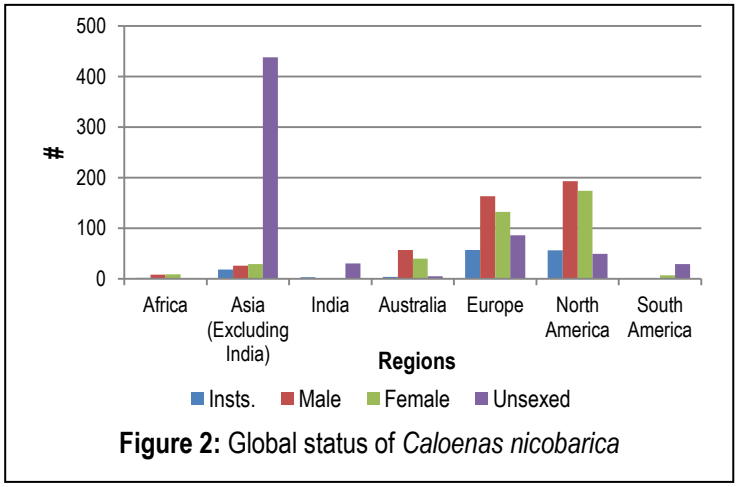

Figure 2: Global status of *Caloenas nicobarica*

The species includes two recognized subspecies, *viz*. *Caloenas nicobarica nicobarica* and *Caloenas nicobarica pelewensis.* Identification of captive birds at the subspecies level exists at select institutions only with European zoos (26) holding a large proportion (238) of the specimens of *C. n. nicobarica*, while *C. n. pelewensis* is held at a single institution in France.

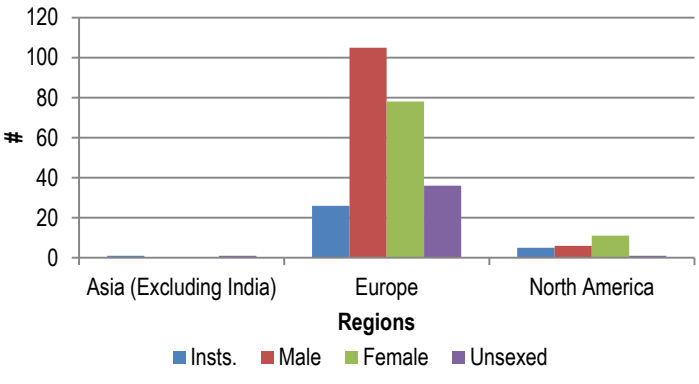

Figure 3: Global status of *Caloenas nicobarica nicobarica*

Three Indian zoos namely Kamla Nehru Zoological Garden Ahmedabad, Sakkarbaug Zoo, Junagadh and Nehru Zoological Park, Hyderabad have specimens in captivity according to the holding pattern based on Species360 records. The Louisville Zoological Garden, in USA maintains a studbook for the

specimens held at Association of Zoos and Aquarium institutions. A perusal of inventory of animals maintained by the Central Zoo Authority indicates presence of the species at a single location, Kamla Nehru Zoological Garden, Ahmedabad in India with a total population of 29 birds as of 31 March 2017. A comparison of the records obtained from Species360 website and CZA inventory is presented in table 3.

Table 3: Comparative status of Nicobar Pigeon based on Species360 and CZA inventory

Holding Zoos	Species360 records				CZA inventory			
	Male	Female	Unsexed	Total	Male	Female	Unsexed	Total
Kamla Nehru Zoological Garden, Ahmedabad	0	0	29	29	0	0	29	29
Nehru Zoological Park, Hyderabad	0	0	1	1	-	-	-	-
Sakkarbaugh Zoo, Junagadh	0	1	0	1	-	-	-	-
Total	**0**	**1**	**31**	**30**	**0**	**0**	**29**	**29**

Methods

Data on individual history was collected by means of questionnaires, zoo visits and from the websites of CZA and ZIMS (Zoological Information Management System). Questionnaires were sent to institutions housing Nicobar pigeon in India, requesting information for each captive specimen. The information available was in the form of an inventory and not amenable for entry in Single Population Analysis and Records Keeping System (SPARKS *v* 1.66) (ISIS 2004) as records on individual life history events and parentage details were unavailable. The information received from holding zoos was corroborated with inventory of animals maintained by Central Zoo Authority and entered in MS-EXCEL. Crude demographic analysis that includes census trends, mortality and natality patterns was calculated from the available information using MS-EXCEL.

Scope of the Studbook

The studbook of Nicobar Pigeon (*Caloenas nicobarica*) includes records of all specimens held in zoos made available by holding zoos and those obtained from CZA Inventory of the species. The available records have limited information content in them due to the lack of individual markings of birds as a result the information was available in the form of an inventory.

- The studbook accordingly lists the year-wise inventory of specimens at individual locations.
- Institution names as they appear on the CZA website were used to indicate individual locations.
- Detailed demographic and genetic analysis of the population was not carried out due to data limitations. Census trends of the population since records were available are provided based on information provided by holding zoos and CZA inventory.
- Information included prior to 1995 has information missing for several years as the same is not available with the holding zoos.
- Data made available by Kamla Nehru Zoological Garden includes tagging details for 27 birds along with dates of hatch and death; however, information on parentages is not available.

Analysis

Kamla Nehru Zoological Garden, Ahmedabad acquired six birds in 1974 and an additional bird was acquired by Nehru Zoological Park in 1989 from private dealers. Records made available by holding zoos indicate movement of birds (Figure 4) from Kamla Nehru Zoological Garden, Ahmedabad to Alipore Zoological Garden, Kolkatta, Nehru Zoological Park, Hyderabad and Sakkarbaug Zoo, Junagadh. A review of movement pattern of birds between institutions indicates that while Nehru Zoological Park had acquired a specimen from a trader in 1989; however, it did not breed in captivity. The current captive specimens in Indian zoos are thus descendants of the six specimens acquired by Kamla Nehru Zoological Garden in 1974.

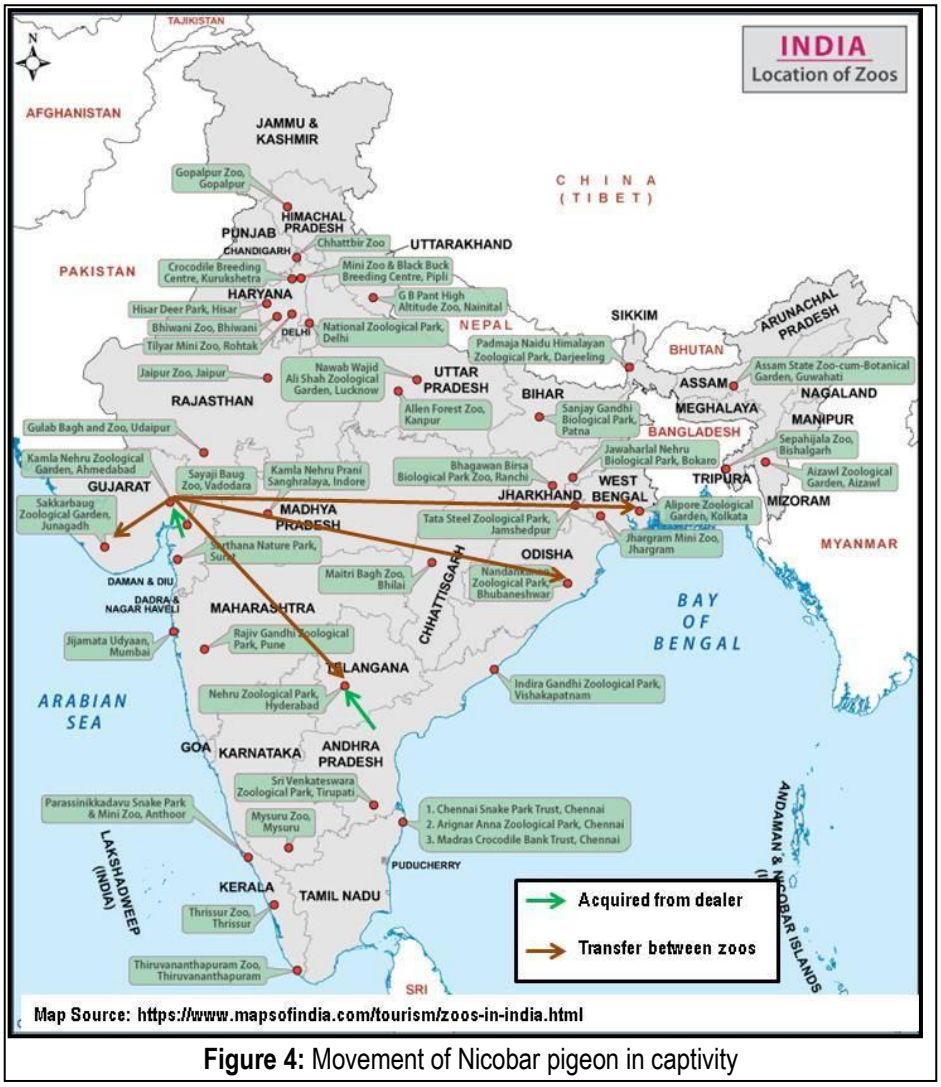

Figure 4: Movement of Nicobar pigeon in captivity

The population status of birds, including hatches and deaths at individual locations; however, is not available for the period 1974 – 1995 from both the CZA inventory and records made available by holding zoos. Census trends based on CZA inventory from 1995 were plotted using the populations for each financial year. Beginning of each financial year was considered as the time interval for each reporting cycle. The population

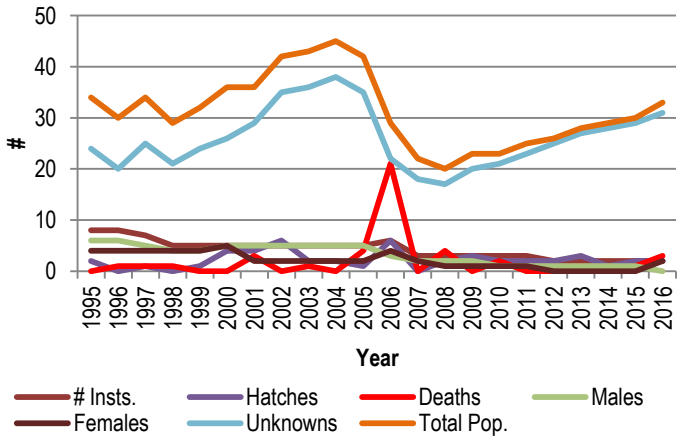

Figure 5: Census trends of Nicobar Pigeon in Indian Zoos

trends indicate that the captive population in Indian zoos was spread across eight zoos with a total population of 34 birds. The population reached a maximum of 45 birds in 2004 and showed a decline till 2008 with only 20 birds remaining. The population recovered subsequently and in 2016 the captive population included 33 birds based on records made available by Kamla Nehru Zoological Garden, Ahmedabad, while the CZA inventory records a total of 29 birds.

Causes of concern as indicated by the census trends include the presence of a large proportion of unknown sex individuals in the population and low reproductive output leading to the small population size throughout its captive history. The population has 59 live hatches and 48 deaths reported since 1974 based on records made available by holding zoos and CZA inventory. Information provided by Kamla Nehru Zoological Garden, Ahmedabad includes information for 27 tagged birds; the same is presented in table 4.

Table 4: Tagging details of Nicobar Pigeon at Kamal Nehru Zoological Garden, Ahmedabad

Sl.	Tag No.	Date of Hatch	Date of Death	Date of Tagging
1.	266	18/06/1990	25/11/2008	21/10/2008
2.	267	16/07/1991		19/11/2008
3.	268	23/05/1992		19/11/2008
4.	269	28/05/1992		19/11/2008
5.	270	09/05/1993	13/12/2010	20/10/2008
6.	271	12/12/1996		20/10/2008
7.	272	25/05/1997	30/04/2013	20/10/2008
8.	273	09/06/1997	05/09/2014	19/11/2008
9.	274	29/06/1998		19/11/2008
10.	275	24/06/1999		19/11/2008
11.	276	21/05/2001		19/11/2008
12.	277	26/05/2001		19/11/2008
13.	278	18/042003		19/11/2008
14.	279	20/06/2003		19/11/2008
15.	280	12/6/2004		21/10/2008
16.	281	15/96/2004		21/10/2008
17.	282	06/06/2008		20/10/2008
18.	283	09/04/2009		15/07/2009
19.	284	17/05/2009		15/07/2009
20.	285	16/04/2010		18/11/2010
21.	286	27/05/2010	06/04/2015	18/11/2010
22.	287	13/06/2011		20/09/2011
23.	288	24/12/2011		21/03/2013
24.	289	28/06/2012		12/9/2012
25.	290	29/12/2012		21/03/2013
26.	291	11/04/2013		30/08/2013
27.	292	23/06/2013		30/08/2013

The above information indicates that the specimen bearing tag no. 266 had maximum recorded longevity of approximately 18.5 years for the species in captivity. Inferences for further demographic

attributes of the species in captivity could however not be obtained as dates of hatch and death are available for five specimens.

Constraints

The development of studbook for development of an effective population management plan for the species is limited by the lack of pedigree information for the specimens hatched in captivity and lack of information on dates of life-history events for a large proportion of the birds. Information on gender and parentage for tagged specimens is also not available. The lack of above information limited further demographic and any genetic analysis to be performed. The studbook thus does not include sections on population management planning and pairing recommendations.

Conclusions and Recommendations

Nicobar pigeon is widely distributed across small islands in the Indian Ocean; however, their preference for undisturbed habitats and extensive trade are attributed as critical drivers for species declines. The species currently listed in Schedule I Part III of the Wildlife Protection Act of India, Near threatened in the IUCN Redlist and in Appendix I of CITES due to the extensive trade in live birds and bird parts. The extensive illicit trade and vulnerability of its preferred habitat to climate change and seismic activity necessitates its *ex-situ* conservation.

Effective *ex-situ* conservation of the species is dependent on the quality of information regarding events and parentage of individuals comprising it; however, the captive population is characterized by a lack of information of life history events and lineages of individuals/ groups from each location.

The limited sexual dimorphism exhibited by the species, presence of a large number of unknown sex individuals in the population has led to limited reproductive output of the species in captivity. It also indicates shortcomings in housing and husbandry practices for managing the species in captivity.

Populations established with small founder size result in result in significant loss of genetic heterozygosity from it. The population has contributions from only 6 individuals acquired from a dealer in 1974, this in conjunction with the lack of information on lineages in captivity indicates the presence of limited genetic heterozygosity in the captive population.

Ensuring effective ex-situ conservation of the species is thus dependent on:

- Maintenance of detailed records of life-history events of individuals/ groups through tagging of birds.
- Collection of biological samples at the time of tagging for molecular genetics studies for assessing:
    - The sex of individual specimens.
    - Relatedness between individuals and the heterozygosity retained by the existing population.
- The information obtained from the molecular genetic studies can be used for developing pairing recommendations for the species in captivity and the level of supplementation required for maintaining desired levels of genetic heterozygosity.

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Annexure - I

Status of Captive Population of Nicobar Pigeon in Indian Zoos

Year	Institution	Males	Females	Unknowns	Total	Acquisitions	Disposals	Hatches	Deaths
1974	Kamla Nehru Zoological Garden	0	0	6	6	6	0	0	0
1989	Sakkarbaug Zoo	1	1	0	2	2	0	0	0
1989	Nehru Zoological Park	1	0	0	1	1	0	0	0
1990	Kamla Nehru Zoological Garden	0	0	19	19	0	0	3	1
1990	Sakkarbaug Zoo	0	0	0	0	0	0	0	2
1990	Nehru Zoological Park	0	0	0	0	0	0	0	1
1991	Kamla Nehru Zoological Garden	0	0	17	17	0	10	5	1
1991	Sakkarbaug Zoo	2	2	0	4	4	0	0	0
1991	Alipore Zoological Garden	0	0	6	6	6	0	0	0
1992	Kamla Nehru Zoological Garden	0	0	20	20	0	0	3	0
1993	Kamla Nehru Zoological Garden	0	0	12	12	0	6	0	2
1993	Alipore Zoological Garden	0	0	4	4	0	0	0	2
1994	Kamla Nehru Zoological Garden	0	0	12	12	1	1	0	0
1994	Alipore Zoological Garden	0	0	3	3	0	0	0	0
1994	Nehru Zoological Park	1	1	0	2	2	0	0	0
1995	Alipore Zoological Garden	0	0	6	6			0	0
1995	Biological Park, Chidiyatapu, Andaman & Nicobar	0	0	1	1			0	0
1995	Indroda Nature Park, Gujarat	0	0	2	2			0	0
1995	Kamla Nehru Zoological Garden	0	0	14	14			2	0
1995	Nandankanan Biological Park	3	2	0	5			0	0
1995	Nehru Zoological Park	1	1	0	2			0	0
1995	Sakkarbaug Zoo	2	1	0	3			0	0
1995	Sayaji Baug Zoo	0	0	1	1			0	0
1996	Alipore Zoological Garden	0	0	3	3			0	0
1996	Biological Park, Chidiyatapu, Andaman & Nicobar	0	0	1	1			0	0
1996	Indroda Nature Park, Gujarat	0	0	2	2			0	0
1996	Kamla Nehru Zoological Garden	0	0	14	14			0	0
1996	Nandankanan Biological Park	3	2	0	5			0	0
1996	Nehru Zoological Park	1	1	0	2			0	0

Year	Institution	Males	Females	Unknowns	Total	Acquisitions	Disposals	Hatches	Deaths
1996	Sakkarbaug Zoo	2	1	0	3			0	0
1996	Sayaji Baug Zoo	0	0	0	0			0	1
1997	Alipore Zoological Garden	0	0	3	3			0	0
1997	Biological Park, Chidiyatapu, Andaman & Nicobar	0	0	1	1			0	0
1997	Indroda Nature Park, Gujarat	0	0	2	2			0	0
1997	Kamla Nehru Zoological Garden	0	0	19	19			1	0
1997	Nandankanan Biological Park	2	2	0	4			0	1
1997	Nehru Zoological Park	1	1	0	2			0	0
1997	Sakkarbaug Zoo	2	1	0	3			0	0
1998	Alipore Zoological Garden	0	0	3	3			0	0
1998	Kamla Nehru Zoological Garden	0	0	18	18			0	1
1998	Nandankanan Biological Park	1	2	0	3			0	0
1998	Nehru Zoological Park	1	1	0	2			0	0
1998	Sakkarbaug Zoo	2	1	0	3			0	0
1999	Alipore Zoological Garden	0	0	3	3			0	0
1999	Kamla Nehru Zoological Garden	0	0	19	19			1	0
1999	Nandankanan Biological Park	1	2	0	3			0	0
1999	Nehru Zoological Park	1	1	2	4			0	0
1999	Sakkarbaug Zoo	2	1	0	3			0	0
2000	Alipore Zoological Garden	0	0	3	3			0	0
2000	Kamla Nehru Zoological Garden	0	0	23	23			4	0
2000	Nandankanan Biological Park	1	2	0	3			0	0
2000	Nehru Zoological Park	2	2	0	4			0	0
2000	Sakkarbaug Zoo	2	1	0	3			0	0
2001	Alipore Zoological Garden	0	0	2	2			0	1
2001	Kamla Nehru Zoological Garden	0	0	27	27			4	0
2001	Nandankanan Biological Park	1	2	0	3			0	0
2001	Nehru Zoological Park	2	0	0	2			0	1
2001	Sakkarbaug Zoo	2	0	0	2			0	1
2002	Alipore Zoological Garden	0	0	2	2			0	0
2002	Kamla Nehru Zoological Garden	0	0	33	33			6	0
2002	Nandankanan Biological Park	1	2	0	3			0	0

Year	Institution	Males	Females	Unknowns	Total	Acquisitions	Disposals	Hatches	Deaths
2002	Nehru Zoological Park	2	0	0	2			0	0
2002	Sakkarbaug Zoo	2	0	0	2			0	0
2003	Alipore Zoological Garden	0	0	2	2			0	0
2003	Kamla Nehru Zoological Garden	0	0	34	34			2	1
2003	Nandankanan Biological Park	1	2	0	3			0	0
2003	Nehru Zoological Park	2	0	0	2			0	0
2003	Sakkarbaug Zoo	2	0	0	2			0	0
2004	Alipore Zoological Garden	0	0	2	2			0	0
2004	Kamla Nehru Zoological Garden	0	0	36	36			2	0
2004	Nandankanan Biological Park	1	2	0	3			0	0
2004	Nehru Zoological Park	2	0	0	2			0	0
2004	Sakkarbaug Zoo	2	0	0	2			0	0
2005	Alipore Zoological Garden	0	0	1	1			0	1
2005	Kamla Nehru Zoological Garden	0	0	34	34			1	3
2005	Nandankanan Biological Park	1	2	0	3			0	0
2005	Nehru Zoological Park	2	0	0	2			0	0
2005	Sakkarbaug Zoo	2	0	0	2			0	0
2006	Alipore Zoological Garden	0	0	0	0			0	1
2006	Kamla Nehru Zoological Garden	0	0	22	22			6	18
2006	Marble Palace Zoo, West Bengal	1	1	0	2			0	1
2006	Nandankanan Biological Park	1	2	0	3			0	1
2006	Nehru Zoological Park	0	0	0	0			0	0
2006	Sakkarbaug Zoo	1	1	0	2			0	0
2007	Kamla Nehru Zoological Garden	0	0	18	18			0	0
2007	Nandankanan Biological Park	1	1	0	2			0	0
2007	Sakkarbaug Zoo	1	1	0	2			0	0
2008	Kamla Nehru Zoological Garden	0	0	17	17			2	3
2008	Nandankanan Biological Park	1	0	0	1			0	1
2008	Sakkarbaug Zoo	1	1	0	2			0	0
2009	Kamla Nehru Zoological Garden	0	0	20	20			3	0
2009	Nandankanan Biological	1	0	0	1			0	0

Year	Institution	Males	Females	Unknowns	Total	Acquisitions	Disposals	Hatches	Deaths
	Park								
2009	Sakkarbaug Zoo	1	1	0	2			0	0
2010	Kamla Nehru Zoological Garden	0	0	21	21			2	1
2010	Nandankanan Biological Park	1	0	0	1			0	0
2010	Sakkarbaug Zoo	0	1	0	1			0	1
2011	Kamla Nehru Zoological Garden	0	0	23	23			2	0
2011	Nandankanan Biological Park	1	0	0	1			0	0
2011	Sakkarbaug Zoo	0	1	0	1			0	0
2012	Kamla Nehru Zoological Garden	0	0	25	25			2	0
2012	Nandankanan Biological Park	1	0	0	1			0	0
2013	Kamla Nehru Zoological Garden	0	0	27	27			3	1
2013	Nandankanan Biological Park	1	0	0	1			0	0
2014	Kamla Nehru Zoological Garden	0	0	28	28			1	0
2014	Nandankanan Biological Park	1	0	0	1			0	0
2015	Kamla Nehru Zoological Garden	0	0	29	29			2	1
2015	Nandankanan Biological Park	1	0	0	1			0	0
2016	Kamla Nehru Zoological Garden	0	2	31	33			2	2
2016	Nandankanan Biological Park	0	0	0	0			0	1

Annexure - II

Location Glossary

Sl.	Zoo Name	Location
1.	Kamla Nehru Zoological Garden	Ahmedabad
2.	Nehru Zoological Park	Hyderabad
3.	Sakkarbaug Zoo	Junagadh
4.	Nandankanan Biological Park	Bhubaneswar
5.	Alipore Zoological Garden	Kolkata
6.	Biological Park, Chidiyatapu	Andaman & Nicobar
7.	Indroda Nature Park	Gandhinagar
8.	Sayaji Baug Zoo	Vadodra