

Indian National Studbook of
One Horned Rhinoceros
(Rhinoceros unicornis)



भारतीय वन्यजीव संस्थान
Wildlife Institute of India



केन्द्रीय चिड़ियाघर प्राधिकरण
Central Zoo Authority

August, 2009

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Studbook compiled and analysed by

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Supported by



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Kanpur Zoological Park, Kanpur
Lucknow Zoological Gardens, Lucknow
Nandankanan Biological Park, Bhubaneswar
Sanjay Gandhi Biological Park, Patna
Bhagwan Birsa Biological Park, Ranchi
Sepahijala Zoological Park, Agartala
Thiruvananthapuram Zoo, Thiruvananthapuram
Veermata Jijabai Bhosle Udyan, Mumbai

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One horned rhinoceros: Biology and Status

Taxonomy of One horned rhinoceros

Kingdom:	Animalia
Phylum:	Chordata
Class:	Mammalia
Order:	Perrisodactyla
Family:	Rhinocerotidae
Scientific Name:	<i>Rhinoceros unicornis</i>
Species Authority:	Linnaeus 1758
Common Name/s:	Gaında (Hindi)

Based on their large body sizes (>1000kg) and diet, Elephantidae (elephants), Rhinocerotidae (rhinoceroses), Hippopotamidae (hippopotamus) and Giraffidae (giraffes) comprise the four major families of mega-herbivores. Rhinocerotidae along with Equidae (horses) and Tapiridae (tapirs) each feature an odd number of toes with the middle toe being bigger. These families are a part of the order Perissodactyla (uneven-toed ungulates). The systematic relationships between rhinoceros species have been inferred using morphological, behavioural, geographical and, to a lesser degree, genetic data. The living Rhinocerotidae includes four genera that encompass five species and eleven subspecies.

There are two African species, each within a monotypic genus: the white rhinoceros (*Ceratotherium simum*) and the black rhinoceros (*Diceros bicornis*). The remaining two rhinoceros genera include three Asian rhino species: the Indian (*Rhinoceros unicornis*), Javan (*Rhinoceros sondaicus*) and Sumatran rhinos (*Dicerorhinus sumatrensis*). Recent studies dispute whether or not the Assam and Nepalese Indian rhino populations represent two distinct subspecies. The Indian rhinoceros is larger than the Javan rhinoceros, these two species are grouped into the single *Rhinoceros* genus based on a combination of geography, similar morphologic characteristics and feeding habits and inhabit a variety of habitats ranging from dense lowland forests to open flood-plains. Phylogenetic analyses based on mitochondrial DNA data, also support the grouping of the Javan and Indian rhinos into a single genus.

Biology

The one horned rhinoceros inhabits riverine grasslands of the Terai and Brahmaputra basins. The species prefers alluvial plain grasslands, but is also found in adjacent swamps and forests. The current populations are restricted to habitats surrounded by human-dominated landscapes, so that the species often strays into adjacent cultivated areas, pastures, and secondary forests. The one-horned rhinoceros is a grazer. They are associated with the water bodies for feeding, wallowing and resting. The diet includes mainly grasses, but also some fruit, leaves, shrub and tree branches, and cultivated crops. The species also utilizes mineral licks regularly.

Greater one-horned rhinos have a brownish-grey, hairless skin, which develops thick folds, resembling armour plating. Several prominent folds protect the neck. The skin has a maximum thickness of upto four cm; the subcutaneous fat is 2-5 cm thick and well supplied with blood, which helps thermo-regulation. Between the folds, around the stomach, the inner legs and the facial area, the skin is rather soft and thin. The tail lies embedded between the hind-leg folds. They weigh between 1,800 - 2,700 kg, shoulder height is 1.75 - 2 metres, and are 3- 3.8 metres long. Animals in the wild are in general lighter in colour than their captive counterparts. Greater one-horned rhinos have one horn, which is typically 20-61 cm long, and weighs up to three kg.

Females are sexually mature at 5-7 years of age; males at 8-10 years. Mating takes place throughout the year and there is no specific calving season. Their gestation period is approximately 16 months (465-490 days), and they give birth every three years. The interval between births ranges from 34–51 months. The birth weight ranges from 60-77 kg. A calf drinks on average 20-30 litres of milk per day and grows by 1-2 kg daily. They start nibbling / feeding on roughage at the age of 3-5 months and continue to suckle up to the age of 20 months. In the wild, youngsters are predated by tiger. Adults have no enemies other than humans. Calf stays with its mother for at least four years. Usually mother rhino keeps her calf away from other rhinos and is very aggressive. This period is crucial to new born calf as it is vulnerable to predation. The longevity or life span of a rhino in the wild is 30-35 years and in captivity 47 years. The

rhino wallows in lakes, rivers and temporary pools. Heat regulation and escape from flies is probably a major function of wallowing.

Behavior

The one horned rhinos have an activity peaks in the mornings and afternoons and prefer to rest or wallow in pools during the hot noon. The preferred habitats are grasslands riverine mixed forests and their ecotones. Foraging activity is carried out mainly in the grasslands while the mixed forests are used for resting.

One-horned rhinos are usually solitary animals, except for females with calves. Males defend loosely defined territories, which may overlap with territories of several other males. These territories are used to protect resources and the stronger males have territories which are resource rich, the lesser males occupy peripheral territories which are relatively poorer in resources. The females keep moving in between these territories and mate with the dominant males. The territories keep changing seasonally as resource availability changes. Excellent habitat patches may support many animals together without competition.

Mud pools (wallows) are places of socializing for rhinos. Various individuals congregate during noon in the mud wallows. After wallowing they separate again. Wallowing assists in thermo-regulation by cooling the animals. The mud layer formed on the skin serves to keep ecto-parasites away.

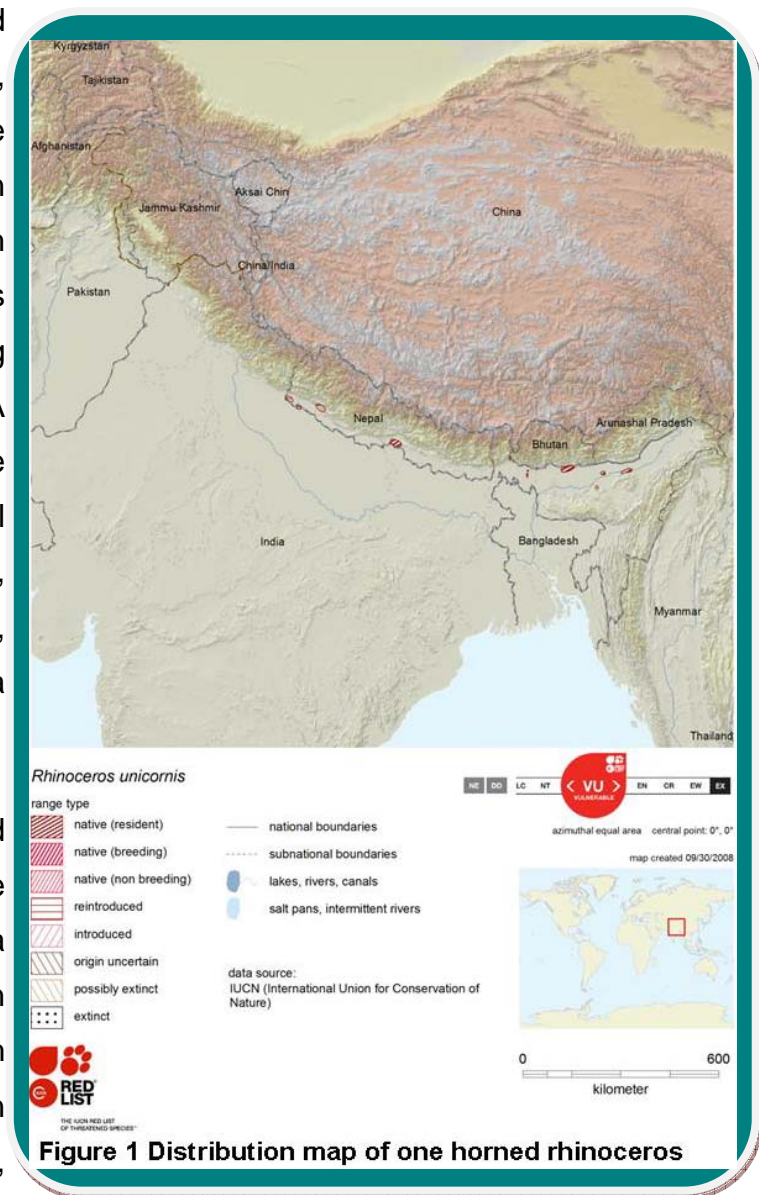
12 different sounds are frequently used for communication. Besides this dung heaps serves as communication points. One-horned rhinos prefer the use of same paths. These are scent marked by the secretions from the pedal gland of their feet, urine and dung. Several animals defecate at communal latrines. After defecating, greater one-horned rhinos rub their hind feet in the dung and continue to walk. By doing this they mark their own smell around the paths.

Mating in rhino is initiated by female which runs around the potential breeding male by making loud sounds and frequently squirting urine and occasionally pushing the male. The male rhino then takes over and chases female rhino for hours till the female rhino gets exhausted and stays in one place and mating then takes place.

Distribution

The earliest recorded historical distribution of One horned rhinoceros in the Indian subcontinent was along the flood plains from northwestern Burma, across the Gangetic Plain, to the Indus River Valley in northern Pakistan. From the nineteenth century onwards land clearings fragmented their habitat and hunting reduced the populations. A consequence of this was the elimination of the species from all areas except the Chitwan Valley, lowland Bhutan, the Teesta Valley, West Bengal, and the Brahmaputra Valley in Assam.

The species is presently distributed in several pockets with large populations occurring in Kaziranga National Park, India and Chitwan National Park, Nepal and much smaller populations occurring in Pobitora, Orang, Jaldapara,



Gorumara and Manas Wildlife Sanctuaries in India and. Reintroduced populations exist in Dudhwa National Park, Uttar Pradesh, India and Bardia National Park and Sukhlapanta Wildlife Sanctuary in Nepal.

Threats

Historically the major threats for the species were conversion of alluvial plain grasslands to agricultural lands and sports hunting. The present populations are threatened by poaching and decline in habitat quality.

Serious declines in habitat quality have occurred in some areas primarily due to

1. Invasion by alien plant species into grasslands.
2. Successional changes resulting in conversion of grasslands to woodlands and silting up of beels.
3. Grazing pressure of domestic livestock.

Status

The population of Indian one horned rhinoceros was severely threatened in the last century. The population in the Brahmaputra Valley, Assam, reached a low of 20 individuals in 1908, when hunting was banned in the area of today's Kaziranga National Park. In the Chitwan Valley in Nepal, a strong population persisted until about 1950; then, poaching and land clearing reduced the number to approximately 60–80 survivors in 1962. This led to the species being categorized as endangered in the IUCN Red List of Threatened species. Since then the species has recovered due to strict protection and expanded into neighboring areas. This has led to a decrease in threat perception from Endangered to Vulnerable in the version 2009.1 of the IUCN Red List of Threatened Species. The species is listed in Schedule 1 of the Wildlife Protection Act (1972) Government of India and in CITES Appendix I since 1975.

Scope of the Studbook

The present studbook of one horned rhinoceros has been compiled for the India region and the data used is current till July 31st 2009.

Methods Used

The data collected for the compilation of the studbook by was way of field visits to collect the data from the concerned zoos and through mailed questionnaire surveys. The data collected was entered in SPARKS 1.54 and studbook report was generated using the reports option. The SPARKS software was used to create ~.prn and ~.ped files for demographic and genetic analyses by PM2000. PM 2000 was used to produce the census report, life tables and population projections, as well as founder statistics, inbreeding coefficients, possible pairings and population planning.

Status in Captivity

The population status of the living one horned rhinoceros captive population in Indian zoos is presented below in table 1. There are 14 additional animals which have been transferred to zoos outside the country however; PM2000 uses these animals for analyses.

Table 1 Status of One horned rhinoceros in Indian Zoos

Sl. No.	Zoo Name	Male	Female	Total
1.	Assam State Zoo, Guwahati, Assam	4	2	6
2.	Alipore Zool. Garden	1	1	2
3.	National Zoological Park	0	2	2
4.	Nehru Zoological Park	0	1	1
5.	Kanpur Zoological Park	3	2	5
6.	Lucknow Zoological Gardens	1	0	1
7.	Nandankanan Biological Park	1	0	1
8.	Sanjay Gandhi Biological Park	4	6	10
9.	Bhagwan Birsa Biological Park	0	1	1
10.	Sepahijala Zoological Park	1	0	1
11.	Trivandrum Zoo	2	0	2
12.	Veer mata Jijabai Bhosle Udyan	1	0	1
	Total	18	15	33

Based on data provided by zoos

Table 2 Location wise listing of living one horned rhinoceros in Indian zoos

Assam State Zoo, Guwahati, Assam

Sl. No.	Home Name and Tag No.	National Studbook No.	International Studbook No.	Sex	Sire	Dam	Birth Date	Location	Event	Date	Remarks
1.	Laksman	44	168	Male	Wild	Wild	~1976	India Assam	Capture Transfer	~ 1980 27/01/1980	
2.	John/ Palit	58	170	Male	Wild	Wild	~ Apr1980	India Assam	Capture Transfer	~ 1980 23/08/1980	
3.	Bishnu	77	173	Male	44	50	11/05/1987	Assam	Birth	11/05/1987	
4.	Mahesh	82	176	Male	44	50	30/03/1989	Assam	Birth	30/03/1989	
5.	Baghekhaiti	89	192	Female	Wild	Wild	~1990	India Assam	Capture Transfer	~ 1991 10/08/1991	
6.	Pori	112		Female	77	89	4/06/2002	Assam	Birth	04/06/2002	

Total: 6(4.2)

Alipore Zool. Garden , Calcutta, West Bengal

Sl. No.	Home Name and Tag No.	National Studbook No.	International Studbook No.	Sex	Sire	Dam	Birth Date	Location	Event	Date	Remarks
1.	Mayuri/ Kadambini	32	95	Female	Wild	Wild	~1973	India Assam Calcutta	Capture Transfer Transfer	~ 1974 22/01/1974 11/03/1974	
2.	Ratul	76	174	Male	Wild	Wild	~ Jan1987	India Assam Gorumara Calcutta	Capture Transfer Transfer Transfer	~ 1987 25/08/1987 17/10/1995 02/01/2004	

Total: 2 (1.1)

National Zoological Park, New Delhi

Sl. No.	Home Name and Tag No.	National Studbook No.	International Studbook No.	Sex	Sire	Dam	Birth Date	Location	Event	Date	Remarks
1.	Maheswari	100	252	Female	26	65	27/11/1997	Delhi	Birth	27/11/1997	
2.	Anjuha	124		Female	93	100	10/11/2005	Delhi	Birth	10/11/2005	

Total: 2(0.2)

Nehru Zoological Park, Hyderabad, Andhra Pradesh

Sl. No.	Home Name and Tag No.	National Studbook No.	International Studbook No.	Sex	Sire	Dam	Birth Date	Location	Event	Date	Remarks
1.	Padma	13	77	Female	Wild	Wild	~1963	India Assam Hyderabad	Capture Transfer Transfer	???? ???? 26/06/1968	

Total: 1 (0.1)

Kanpur Zoological Park, Kanpur, U P

Sl. No.	Home Name and Tag No.	National Studbook No.	International Studbook No.	Sex	Sire	Dam	Birth Date	Location	Event	Date	Remarks
1.	Rohit	85	160	Male	37	34	20/06/1989	Kanpur	Birth	20/06/1989	
2.	Rani	108		Female	62	80	26/06/1994	Patna Kanpur	Birth Transfer	26/06/1994 06/10/1997	
3.	Manu CB-0378	118		Female	85	108	22/06/2003	Kanpur	Birth	22/06/2003	
4.	Nakul CB-0377	121		Male	Wild	Wild	~1997	India Kanpur	Capture Transfer	10/01/2005 12/01/2005	
5.	Harsh CB-0376	126		Male	85	108	28/03/2006	Kanpur	Birth	28/03/2006	

Total: 5 (3.2)

Lucknow Zoological Gardens, Lucknow, Uttar Pradesh

Sl. No.	Home Name and Tag No.	National Studbook No.	International Studbook No.	Sex	Sire	Dam	Birth Date	Location	Event	Date	Remarks
1.	Lohit	72	129	Male	37	34	6/08/1984	Kanpur Lucknow Dudhwa Lucknow	Birth Transfer Transfer Transfer	06/08/1984 27/04/1992 25/11/1992 06/04/1995	

Total:1 (1.0)

Nandankanan Biological Park, Bhubaneswar, Orrissa

Sl. No.	Home Name and Tag No.	National Studbook No.	International Studbook No.	Sex	Sire	Dam	Birth Date	Location	Event	Date	Remarks
1.	Nandan	47		Male	Wild	Wild	~1977	India Assam Nandankanan	Capture Transfer Transfer	~ 1977 22/08/1977 29/11/1979	

Total: 1(1.0)

Sanjay Gandhi Biol. Park, Patna, Bihar

Sl. No.	Home Name and Tag No.	National Studbook No.	International Studbook No.	Sex	Sire	Dam	Birth Date	Location	Event	Date	Remarks
1.	Kancha	49	156	Male	Wild	Wild	~ Apr1977	India Assam Patna	Capture Transfer Transfer	~ 1977 19/08/1977 25/05/1979	
2.	Hartali	80	159	Female	62	36	8/07/1988	Patna	Birth	08/07/1988	
3.	Chotki/ Rani	92	203	Female	62	36	6/07/1991	Patna	Birth	06/07/1991	
4.	Ayodhya	93	202	Male	26	65	27/12/1992	Delhi Patna	Birth Transfer	27/12/1992 20/10/2005	
5.	Akansha	114		Female	49	80	8/08/2002	Patna	Birth	08/08/2002	
6.	Gori	116		Female	Isb106	Isb209	23/07/2001	Sandiego Patna	Birth Transfer	23/07/2001 09/05/2007	
7.	Ganesh	120		Male	107	80	19/09/2004	Patna	Birth	19/09/2004	
8.	Suraj	123		Male	49	92	6/11/2005	Patna	Birth	06/11/2005	
9.	Lali	125		Female	190	278	3/12/2005	Sandiego Patna	Birth Transfer	03/12/2005 09/05/2007	
10.	Saraswati	127		Female	49	80	24/01/2007	Patna	Birth	24/01/2007	

Total: 10 (4.6)

Bhagwan Birsa Biological Park, Ranchi, Jharkhand

Sl. No.	Home Name and Tag No.	National Studbook No.	International Studbook No.	Sex	Sire	Dam	Birth Date	Location	Event	Date	Remarks
1.	Chitra Kanchi Kanchi	36	155	Female	Wild	Wild	~1974	India Assam Patna Ranchi	Capture Transfer Transfer Transfer	~ 1974 21/07/1974 25/05/1979 04/12/1996	

Total: 1 (0.1)

Sepahijala Zoological Park, Agartala, Tripura

Sl. No.	Home Name and Tag No.	National Studbook No.	International Studbook No.	Sex	Sire	Dam	Birth Date	Location	Event	Date	Remarks
1.	Pradeep	88	179	Male	Wild	Wild	~1990	India Assam Tripura	Capture Transfer Transfer	~ 1990 20/08/1990 14/10/1994	

Total: 1 (1.0)

Trivandrum Zoo, Thiruvananthapuram, Kerala

Sl. No.	Home Name and Tag No.	National Studbook No.	International Studbook No.	Sex	Sire	Dam	Birth Date	Location	Event	Date	Remarks
1.	Ramu	79	177	Male	Wild	Wild	~ Mar1988	India Assam Trivandrum	Capture Transfer Transfer	~ 1988 02/09/1988 19/05/1993	
2.	Jadu	81	177	Male	Wild	Wild	26/07/1988	India Assam Trivandrum	Capture Transfer Transfer	~ 1989 26/07/1989 19/05/1993	

Total: 2 (2.0)**Veermata Jijabai Bhosle Udyan, Mumbai, Maharashtra**

Sl. No.	Home Name and Tag No.	National Studbook No.	International Studbook No.	Sex	Sire	Dam	Birth Date	Location	Event	Date	Remarks
1.	Shiva	55		Male	Wild	Wild	~ Mar1978	India Assam Veermata	Capture Transfer Transfer	~ 1979 24/04/1979 25/02/1985	

Total: 1 (1.0)

Table 3 Historical listing of One horned rhinoceros in Indian zoos

Sl. No.	Home Name and Tag No.	National Studbook No.	International Studbook No.	Sex	Sire	Dam	Birth Date	Location	Event	Date	Remarks
1.	Mohan Sr	1		Male	Wild	Wild	~1940	India Assam Delhi	Capture Transfer Transfer Death	~ 1957 13/12/1957 05/04/1959 13/04/1970	
2.	Rajesh	2		Male	Wild	Wild	~1940	India Assam	Capture Transfer Death	~ 1978 03/03/1978 18/01/1987	
3.	Padmini Sr.	3	82	Female	Wild	Wild	~1948	India Assam	Capture Transfer Death	~ 1958 05/10/1958 28/10/1964	
4.	Mony	4		Male	Wild	Wild	~1950	India Assam Trivandrum	Capture Transfer Transfer Death	???? ???? 29/05/1956 16/02/1987	
5.	Geeta	5		Female	Wild	Wild	~1951	India Assam Paris	Capture Transfer Transfer	~ 1960 19/03/1960 ????	Lost to follow up
6.	Deepali Sr.	6	30	Female	Wild	Wild	~1952	India Assam NKP-Wash	Capture Transfer Transfer Death	~ 1962 29/10/1962 05/11/1963 28/12/1963	
7.	Shivaji	7	24	Male	Wild	Wild	~1955	India Assam	Capture Transfer Death	~ 1960 24/09/1960 23/09/1984	
8.	Padmini Jr.	8	25	Female	Wild	Wild	~1956	India Assam	Capture Transfer Death	~ 1965 29/09/1965 19/10/1982	
9.	Mohan Jr.	9	33	Male	Wild	5	7/04/1960	Assam Delhi	Birth Transfer Death	07/04/1960 01/12/1965 05/07/1988	
10.	Sneha	10	23	Female	Wild	105	12/06/1961	Calcutta	Birth Death	12/06/1961 14/08/1982	
11.	Rangi	11	43	Female	Wild	Wild	~1962	India Assam Delhi	Capture Transfer Transfer	???? ???? 28/03/1968	

Sl. No.	Home Name and Tag No.	National Studbook No.	International Studbook No.	Sex	Sire	Dam	Birth Date	Location	Event	Date	Remarks
									Death	10/11/1984	
12.	Rajkumar	12	76	Male	Wild	Wild	~1962	India Assam Hyderabad	Capture Transfer Transfer Death	~ 1962 28/06/1962 16/06/1964 19/08/1983	
13.	Padma	13	77	Female	Wild	Wild	~1963	India Assam Hyderabad	Capture Transfer Transfer	???? ???? 26/06/1968	
14.	Rajkumari	14	28	Female	Wild	6	10/04/1963	Assam NZIP-Wash	Birth Transfer Death	10/04/1963 16/12/1963 09/09/1980	
15.	Japari	15	29	Female	7	3	10/07/1963	Assam Sandiego Sd-Wap Gulf Bre	Birth Transfer Transfer Transfer Death	10/07/1963 28/02/1965 26/04/1972 07/11/1995 09/01/2004	
16.	Kosha	16		Male	Wild	Wild	~ Jun1964	India Assam	Capture Transfer Death	~ 1964 28/10/1964 13/11/1964	
17.	Rukmini	17	46	Female	Wild	Wild	~ Apr1967	India Assam Losangeles	Capture Transfer Transfer Death	~ 1967 23/12/1967 25/11/1969 10/11/1988	
18.	Lakhimi	18		Female	Wild	Wild	~1968	India Assam	Capture Transfer Death	~ 1968 28/02/1968 23/03/1970	
19.	Kalongmukhi	19		Female	Wild	Wild	~1968	India Assam Baroda Mysore	Capture Transfer Transfer lft Transfer	~ 1968 01/08/1968 13/04/1969 19/01/1990	Lost to follow up
20.	Kumar	20		Male	Wild	Wild	~ Jul1968	India Assam	Capture Transfer Death	~ 1969 23/07/1969 23/03/1970	
21.	Sasadev	21	73	Male	Wild	Wild	~1969	India Assam Antwerp Plancknd	Capture Transfer Transfer Transfer Death	~ 1970 30/07/1970 23/03/1971 24/11/1978 16/10/1988	

Sl. No.	Home Name and Tag No.	National Studbook No.	International Studbook No.	Sex	Sire	Dam	Birth Date	Location	Event	Date	Remarks
22.	Santu	22	81	Male	Wild	Wild	~1969	India Assam Brownsvi	Capture Transfer Transfer Death	~ 1971 28/06/1971 29/08/1973 03/12/1973	
23.	Meghnad	23		Male	Wild	Wild	~1969	India Assam Calcutta	Capture Transfer Transfer Death	~ 1974 12/02/1974 11/03/1974 13/01/2003	
24.	Bhishma	24		Male	Wild	Wild	~ May1969	India Assam	Capture Transfer Death	~ 1969 26/07/1969 27/12/1969	
25.	Kumari	25		Female	Wild	Wild	10/07/1969	India Assam	Capture Transfer Death	~ 1969 20/07/1969 24/07/1970	
26.	Dabbu/Agni	26	151	Male	Wild	Wild	~1970	India Assam Delhi	Capture Transfer Transfer Death	~ 1982 05/05/1982 23/03/1983 24/04/2001	
27.	Shakuntala/ Sundri	27		Female	Wild	Wild	~1971	India Assam Chatbir	Capture Transfer Transfer Death	~ 1978 15/06/1978 29/07/1978 25/05/1986	
28.	Roopa	28	51	Female	9	11	28/01/1971	Delhi Whipsnade	Birth Transfer	28/01/1971 06/02/1973	Lost to follow up
29.	Krishna	29	57	Male	7	8	12/09/1971	Assam Nagoya	Birth Transfer	12/09/1971 29/09/1974	Lost to follow up
30.	Rajesh.	30	58	Male	12	13	25/11/1971	Hyderabad	Birth Death	25/11/1971 11/08/1983	
31.	Ganesh	31	172	Male	Wild	Wild	~1972	India Assam Chatbir	Capture Transfer Transfer Death	~ 1982 15/07/1982 ???? 03/07/1993	
32.	Mayuri/ Kadambini	32	95	Female	Wild	Wild	~1973	India Assam Calcutta	Capture Transfer Transfer	~ 1974 22/01/1974 11/03/1974	
33.	Mayangkumari	33	66	Female	Wild	Wild	~ Apr1973	India Assam Ny Bronx	Capture Transfer Transfer	~ 1973 14/08/1973 25/09/1974	Lost to follow up

Sl. No.	Home Name and Tag No.	National Studbook No.	International Studbook No.	Sex	Sire	Dam	Birth Date	Location	Event	Date	Remarks
34.	Maya	34		Female	Wild	Wild	~ May1973	India Assam Kanpur Lucknow Hyderabad	Capture Transfer Transfer Transfer Transfer Death	~ 1973 11/08/1973 04/03/1977 30/04/1997 23/09/1999 13/01/2007	
35.	Radha	35	67	Female	Wild	Wild	16/06/1973	India Assam Ny Bronx	Capture Transfer Transfer Death	~ 1973 21/06/1973 30/01/1975 12/07/1976	
36.	Chitra Kanchi Kanchi	36	155	Female	Wild	Wild	~1974	India Assam Patna Ranchi	Capture Transfer Transfer Transfer	~ 1974 21/07/1974 25/05/1979 04/12/1996	
37.	Lachit	37	70	Male	7	8	23/05/1974	Assam Kanpur	Birth Transfer Death	23/05/1974 04/03/1977 08/08/1992	
38.	Numali	38	153	Female	Wild	Wild	~1972	India Assam Nandankanan	Capture Transfer Transfer Death	~ 1972 16/09/1972 08/06/1974 28/05/2007	
39.	Anjali	39		Female	Wild	Wild	~1975	India Assam	Capture Transfer Death	09/08/1975 10/08/1975 20/08/1977	
40.	Ram/ Munni	40	61	Male	Wild	Wild	~1975	India Assam Mysore	Capture Transfer Transfer Death	~ 1980 24/01/1980 23/01/1985 02/08/2002	
41.	None	41		Male	Wild	Wild	~1975	India Assam	Capture Transfer Death	~ 1976 02/02/1976 07/03/1976	
42.	Shayam	42		Male	Wild	Wild	~ May1975	India Assam Nandankanan On the Way	Capture Transfer Transfer Death	~ 1975 02/06/1975 04/04/1976 22/04/1976	
43.	Balram/ Ganesh	43		Male	Wild	Wild	17/10/1975	India Assam Chatbir	Capture Transfer Transfer	~ 1977 17/10/1977 14/12/1977	

Sl. No.	Home Name and Tag No.	National Studbook No.	International Studbook No.	Sex	Sire	Dam	Birth Date	Location	Event	Date	Remarks
									Death	03/07/1993	
44.	Laksman	44	168	Male	Wild	Wild	~1976	India Assam	Capture Transfer	~ 1980 27/01/1980	
45.	None	45		Female	Wild	Wild	~ Mar1976	India Assam Lucknow	Capture Transfer Transfer Death	~ 1976 06/04/1976 17/10/1979 19/12/1983	
46.	Sanjai	46	91	Male	Wild	Wild	1/11/1976	India Assam Lucknow	Capture Transfer Transfer Death	~ 1976 13/11/1976 17/10/1979 18/01/1980	
47.	Nandan	47		Male	Wild	Wild	~1977	India Assam Nandankanan	Capture Transfer Transfer	~ 1977 22/08/1977 29/11/1979	
48.	Kamal	48		Male	Wild	Wild	~1977	India Assam	Capture Transfer Death	~ 1982 06/02/1982 07/02/1982	
49.	Kancha	49	156	Male	Wild	Wild	~ Apr1977	India Assam Patna	Capture Transfer Transfer	~ 1977 19/08/1977 25/05/1979	
50.	Geeta/ Laxmi	50	168	Female	7	8	9/01/1978	Assam	Birth Death	09/01/1978 11/01/1998	
51.	Krishna Jr	51	92	Male	Wild	Wild	~1978	India Assam Kanpur Lucknow	Capture Transfer Transfer Transfer Death	~ 1978 24/03/1978 17/10/1979 23/05/1982 01/01/1985	
52.	Prabhat	52		Male	Wild	Wild	~ Aug1978	India Assam	Capture Transfer Death	~ 1978 09/11/1978 24/11/1978	
53.	Laddu/ Veer	53	96	Male	12	13	12/11/1978	Hyderabad	Birth Death	12/11/1978 06/08/2001	
54.	Gomoti	54	97	Female	23	10	9/01/1979	Calcutta Koln Singapore	Birth Transfer Transfer	09/01/1979 10/03/1986 02/05/1997	Lost to follow up
55.	Shiva	55		Male	Wild	Wild	~ Mar1978	India Assam Veermata	Capture Transfer Transfer	~ 1979 24/04/1979 25/02/1985	

Sl. No.	Home Name and Tag No.	National Studbook No.	International Studbook No.	Sex	Sire	Dam	Birth Date	Location	Event	Date	Remarks
56.		56		Female	43	27	9/03/1979	Chatbir	Birth Death	09/03/1979 09/03/1979	
57.	Parbati	57		Female	Wild	Wild	~ Jul1979	India Assam	Capture Transfer Death	~ 1980 20/01/1980 18/06/1983	
58.	John/ Palit	58	170	Male	Wild	Wild	~ Apr1980	India Assam	Capture Transfer	~ 1980 23/08/1980	
59.	Ramu Sr.	59		Male	Wild	Wild	~ May1980	India Assam Madras	Capture Transfer Transfer Death	~ 1980 03/09/1980 17/04/1985 07/07/1989	
60.	Gini/ Taral	60	171	Female	Wild	Wild	~1980	India Assam	Capture Transfer Death	~ 1980 23/08/1980 ????	
61.		61		Female	43	27	13/11/1980	Chatbir Delhi	Birth Transfer Death	13/11/1980 05/05/1982 02/06/1986	
62.	Raju	62	157	Male	Wild	Wild	~1981	India Patna	Capture Transfer Death	~ 1982 28/03/1982 02/04/1995	
63.	Srinivas	63	106	Male	12	13	15/05/1981	Hyderabad	Birth Death	15/05/1981 06/08/2001	
64.	Rupa	64		Female	Wild	Wild	~ Jun1981	India Assam	Capture Transfer Death	~ 1981 03/07/1981 11/10/1981	
65.	Mohini/ Ruby	65	194	Female	Wild	Wild	~1982	India Assam Delhi	Capture Transfer Transfer Death	~ 1982 04/06/1982 12/12/1990 25/03/2001	
66.	Dalimi	66		Female	Wild	Wild	~ Apr1982	India Assam	Capture Transfer Death	~ 1982 02/05/1982 27/10/1982	
67.	Shyam Jr.	67		Male	7	8	9/06/1982	Assam	Birth Death	09/06/1982 23/09/1998	
68.	Rashmi	68	122	Female	37	34	1/10/1982	Kanpur Yokohama	Birth Transfer Death	01/10/1982 31/03/1985 04/01/1995	
69.		69		Male	43	27	15/02/1983	Chatbir	Birth	15/02/1983	

Sl. No.	Home Name and Tag No.	National Studbook No.	International Studbook No.	Sex	Sire	Dam	Birth Date	Location	Event	Date	Remarks
									Death	02/03/1983	
70.	Sabitri	70		Female	Wild	Wild	~ Mar1983	India Assam	Capture Transfer Death	~ 1983 09/04/1983 30/04/1983	
71.	Debraj	71	150	Male	23	32	4/06/1984	Calcutta	Birth Death	04/06/1984 13/11/2000	
72.	Lohit	72	129	Male	37	34	6/08/1984	Kanpur Lucknow Dudhwa Lucknow	Birth Transfer Transfer Transfer	06/08/1984 27/04/1992 25/11/1992 06/04/1995	
73.		73		Male	43	27	11/12/1984	Chatbir	Birth Death	11/12/1984 21/12/1984	
74.	Suchila	74		Female	Wild	Wild	~ Dec1985	India Assam	Capture Transfer Death	~ 1986 27/02/1986 28/02/1986	
75.	Raja/ Prince	75		Male	43	27	9/05/1986	Chatbir	Birth Death	09/05/1986 14/04/2004	
76.	Ratul	76	174	Male	Wild	Wild	~ Jan1987	India Assam Gorumara Calcutta	Capture Transfer Transfer Transfer	~ 1987 25/08/1987 17/10/1995 02/01/2004	
77.	Bishnu	77	173	Male	44	50	11/05/1987	Assam	Birth	11/05/1987	
78.	Mohit	78	140	Male	37	34	17/06/1987	Kanpur Hyderabad	Birth Transfer Death	17/06/1987 01/03/2003 07/03/2009	
79.	Ramu	79	177	Male	Wild	Wild	~ Mar1988	India Assam Trivandrum	Capture Transfer Transfer	~ 1988 02/09/1988 19/05/1993	
80.	Hartali	80	159	Female	62	36	8/07/1988	Patna	Birth	08/07/1988	
81.	Jadu	81	177	Male	Wild	Wild	26/07/1988	India Assam Trivandrum	Capture Transfer Transfer	~ 1989 26/07/1989 19/05/1993	
82.	Mahesh	82	176	Male	44	50	30/03/1989	Assam	Birth	30/03/1989	
83.	Madu	83	178	Male	Wild	Wild	~ Jun1989	India Assam Jaldhpara	Capture Transfer Transfer	25/07/1989 26/07/1989 17/10/1995	Lost to follow up
84.	Dhan	84		Male	Wild	Wild	~1989	India	Capture	~ 1989	

Sl. No.	Home Name and Tag No.	National Studbook No.	International Studbook No.	Sex	Sire	Dam	Birth Date	Location	Event	Date	Remarks
								Assam	Transfer Death	26/07/1989 04/09/1989	
85.	Rohit	85	160	Male	37	34	20/06/1989	Kanpur	Birth	20/06/1989	
86.	Kanak	86		Male	Wild	Wild	~1989	India Assam	Capture Transfer Death	~ 1989 25/06/1989 26/06/1989	
87.	Prakash	87		Male	Wild	Wild	~ Mar1990	India	Capture Death	~ 1990 22/04/1990	
88.	Pradeep	88	179	Male	Wild	Wild	~1990	India Assam Tripura	Capture Transfer Transfer	~ 1990 20/08/1990 14/10/1994	
89.	Baghekhaiti	89	192	Female	Wild	Wild	~1990	India Assam	Capture Transfer	~ 1991 10/08/1991	
90.	Monomali	90		Female	Wild	Wild	30/04/1991	India Assam	Capture Transfer Death	~ 1991 06/08/1991 17/08/1991	
91.	Mudit	91	186	Male	37	34	5/07/1991	Kanpur	Birth Death	05/07/1991 31/12/2002	
92.	Chotki/ Rani	92	203	Female	62	36	6/07/1991	Patna	Birth	06/07/1991	
93.	Ayodhya	93	202	Male	26	65	27/12/1992	Delhi Patna	Birth Transfer	27/12/1992 20/10/2005	
94.		94		Female	58	60	25/11/1994	Assam	Birth Death	25/11/1994 25/11/1994	
95.	Hanuman	95		Male	Wild	Wild	~1995	India Assam	Capture Transfer Death	~ 1995 21/03/1995 27/11/1995	
96.	Rita	96	235	Female	44	50	22/01/1995	Assam Trivandrum	Birth Transfer Death	22/01/1995 06/11/2003 13/12/2004	
97.	Ranga	97		Male	Wild	Wild	~1995	India Assam India	Capture Transfer Death	~ 1995 11/06/1995 05/11/1995	
98.	Meghdoot	98	251	Male	26	65	28/08/1995	Delhi	Birth Death	28/08/1995 06/03/1999	
99.	Tarun	99		Male	78	34	29/04/1996	Kanpur Lucknow	Birth Transfer Death	29/04/1996 30/04/1997 19/05/1997	

Sl. No.	Home Name and Tag No.	National Studbook No.	International Studbook No.	Sex	Sire	Dam	Birth Date	Location	Event	Date	Remarks
100	Maheswari	100	252	Female	26	65	27/11/1997	Delhi	Birth	27/11/1997	
101		101		Female	58	60	15/06/1999	Assam	Birth Death	15/06/1999 15/06/1999	
102	Madan	102		Male	Unk	Unk	??? ?	Unknown Assam Los Angeles	Birth Transfer lft Transfer	???? ???? 04/12/1965	Lost to follow up
103	Baul	103		Male	Wild	Wild	??? ?	India Assam	Capture Transfer Death	~ 1988 16/09/1988 24/09/1988	
104	Lohamani	104		Male	Wild	Wild	~ Jul1998	India Assam	Capture Transfer Death	~ 1998 26/10/1998 15/03/2003	
105	Lauie/Rani	105	21	Female	Wild	Wild	~1955	India Assam Calcutta Hamura	Capture Transfer Transfer Transfer Death	???? ???? 06/06/1961 16/07/1961 13/12/1991	
106	Gotangi	106	48	Female	Wild	Wild	??? ?	India Assam Omaha	Capture Transfer Transfer Death	~ 1968 29/07/1968 23/01/1970 31/01/1970	
107	Raja	107		Male	49	36	19/12/1993	Patna Delhi	Birth Transfer Death	19/12/1993 22/03/2005 02/09/2007	
108	Rani	108		Female	62	80	26/06/1994	Patna Kanpur	Birth Transfer	26/06/1994 06/10/1997	
109	Bajarangi	109		Male	49	80	23/10/1997	Patna	Birth Death	23/10/1997 17/07/1999	
110		110		Male	26	65	2/07/2000	Delhi	Birth Death	02/07/2000 02/07/2000	
111	Bhopu	111		Male	49	80	29/09/2000	Patna Sandiego	Birth Transfer	29/09/2000 09/05/2007	
112	Pori	112		Female	77	89	4/06/2002	Assam	Birth	04/06/2002	Lost to follow up
113	Akansha	114		Female	49	80	8/08/2002	Patna	Birth	08/08/2002	
114	Goyona	115		Female	Unk	Unk	15/02/2000	Sandiego Delhi	Birth Transfer	15/02/2000 29/04/2007	

Sl. No.	Home Name and Tag No.	National Studbook No.	International Studbook No.	Sex	Sire	Dam	Birth Date	Location	Event	Date	Remarks
									Death	29/09/2007	
115	Gori	116		Female	Isb106	Isb209	23/07/2001	Sandiego Patna	Birth Transfer	23/07/2001 09/05/2007	
116	Rustam	117		Male	107	92	31/05/2003	Patna Sandiego	Birth Transfer	31/05/2003 09/05/2007	Lost to follow up
117	Manu CB-0378	118		Female	85	108	22/06/2003	Kanpur	Birth	22/06/2003	
118	Brahmputra	119		Male	93	100	10/11/2003	Delhi Sandiego	Birth Transfer	10/11/2003 07/05/2007	Lost to follow up
119	Ganesh	120		Male	107	80	19/09/2004	Patna	Birth	19/09/2004	
120	Nakul CB-0377	121		Male	Wild	Wild	~1997	India Kanpur	Capture Transfer	10/01/2005 12/01/2005	
121	Suraj	123		Male	49	92	6/11/2005	Patna	Birth	06/11/2005	
122	Anjuha	124		Female	93	100	10/11/2005	Delhi	Birth	10/11/2005	
123	Lali	125		Female	190	278	3/12/2005	Sandiego Patna	Birth Transfer	03/12/2005 09/05/2007	
124	Harsh CB-0376	126		Male	85	108	28/03/2006	Kanpur	Birth	28/03/2006	
125	Saraswati	127		Female	49	80	24/01/2007	Patna	Birth	24/01/2007	
126	Unm	128		Male	Unk	115	17/09/2007	Delhi	Birth Death	17/09/2007 17/09/2007	
127	Kasi	IN1	1	Male	Wild	Wild	??? ?	India Assam Mysore	Capture Transfer Transfer Death	???? ???? 24/04/1965 30/04/1979	
128	Rani	IN2	11	Female	Wild	Wild	??? ?	India Assam Mysore	Capture Transfer Transfer Death	???? ???? 04/08/1956 07/05/1992	
129	Vinu	IN3	53	Male	In1	In2	16/04/1971	Mysore Gelsnkrk Toronto Ny Bronx	Birth Transfer Transfer Transfer	16/04/1971 28/08/1975 28/07/1976 30/05/1990	Lost to follow up
130	Lacit	IN4	62	Male	Wild	Wild	??? ?	India Assam Veermata	Capture Transfer Transfer Death	???? ???? 14/04/1952 14/09/1980	
131	Jaya	IN5	64	Male	Wild	Wild	??? ?	India Assam	Capture Transfer	~ 1974 03/01/1974	Lost to follow up

Sl. No.	Home Name and Tag No.	National Studbook No.	International Studbook No.	Sex	Sire	Dam	Birth Date	Location	Event	Date	Remarks
								Nagoya	Transfer	02/10/1974	
132	Kushal	IN6	75	Female	Wild	Wild	~1953	India Madras	Capture Transfer Death	~ 1953 09/06/1953 15/06/1980	
133	Indira	IN7	79	Female	In1	In2	19/07/1975	Mysore Gelsnkrk Toronto	Birth Transfer Transfer	19/07/1975 25/06/1976 27/04/1979	Lost to follow up
134	Jaisingh	IN8	90	Male	Wild	Wild	???	India Lucknow	Capture Transfer Death	~ 1959 30/03/1959 06/05/1979	
135	Rosy	IN9	105	Female	Wild	Wild	???	India Lucknow	Capture Transfer Death	~ 1944 02/04/1944 02/04/1973	

TOTALS: 76.59.0 (135)

ISB: International Studbook Number

Location Glossary

Population Planning/ Recommendations

The species earlier listed as endangered in the IUCN Red List of Threatened Species has shown signs of recovery in the recent past, consequently it has been assigned to the vulnerable category in the 2009.1 listing. The decline in threat category is attributed to the recovery of populations in the Kaziranga and Chitwan National Parks. However, threats in other areas continue unabated also the population still occurs in fragmented pockets – a miniscule portion of its historic range. The maintenance of a genetically viable and demographically stable captive population is still an important component for the recovery of the species.

Table 4 Genetic Summary Table:

	Current	Potential
Founders	18	14 additional
Founder genome equivalent	7.18	26.96
Founder genome surviving	11.29	26.96
Gene diversity retained	0.93	0.982
Population mean kinship	0.07	0.018
Mean inbreeding	0.04	0.018
Ne / N	0.33	-----
% of pedigree known	91	-----

The Indian captive population is a part of the global effort towards this end. The captive population in India has 33 individuals distributed across 12 zoos. PM2000 has a total of 47 (26.21) individuals listed as alive in the studbook as it treats lost to follow up specimens as alive and a part of the population (14 animals listed as lost to follow up in table 3) which have been transferred out of the country. The total number of specimens in captivity across time in India is 135 (76.59.0). Of these 32 specimens are of wild origin and 18 of them have contributed to the gene pool of the captive population. The present population has high values for the various measures of genetic variability (Table – 4) and is suitable for further growth.

Management Goals:

Population modeling of the captive Indian one horned rhinoceros was carried out using PM2000. Based on this analysis, it is envisaged that a population of 100 individuals to be achieved over a span of 10 years for the Indian captive population would allow the maintenance of a genetically viable and demographically stable captive population. The demographic and genetic management strategy for the

population is summarized in table 5. It suggests that with a population growth rate of 1.013 and a generation length of 17.5 years the population can achieve the target of 100 specimens in the next 10 years. The maintenance of the desired level of genetic diversity in the captive population can be achieved by the addition of 1 founder each for the next 10 years. This would allow the maintenance of 90% genetic diversity at the end of 50 years (Figure 2).

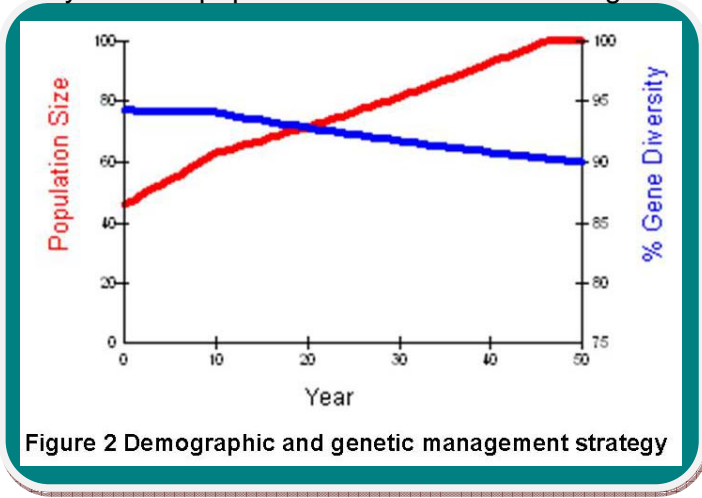


Figure 2 Demographic and genetic management strategy

Table 5 Management Strategy Table:

	Planned
Generation length	17.5
Population growth rate	1.013
Ne / N ratio	0.32
Initial gene diversity	0.944
Target population size	100
# New founders needed	1
Year to Stop Adding Founders	10
Years Between Addition Events	1
FGE Recruited per New Founder	0.40

Generation length: The average time elapsing from reproduction in one generation to the time the next generation reproduces. Also, the average age at which a female (or male) produces offspring. It is not the age of first reproduction. Males and females often have different generation times.

Effective Population Size (Ne / N ratio) -- The size of a randomly mating population of constant size with equal sex ratio and a Poisson distribution of family sizes that would (a) result in the same mean rate of inbreeding as that observed in the population, or (b) would result in the same rate of random change in gene frequencies (genetic drift) as observed in the population. These two definitions are identical only if the population is demographically stable (because the rate of inbreeding depends on the distribution of alleles in the parental generation, whereas the rate of gene frequency drift is measured in the current generation).

Founder Genome Equivalents (FGE) – The number wild-caught individuals (founders) that would produce the same amount of gene diversity as does the population under study. The gene diversity of a population is $1 - 1 / (2 * FGE)$.

Hypothetical pairings were carried out using the pairings options of PM 2000 from the ordered list of mean kinship of live individuals (table 6). The animals used for pairing are listed in table 7 and those not used for pairing are listed in table 8. In table 7, the column headed by “may be bred with” contains all those animals which can possibly be used for pairing. While the column headed by “may not be bred with”

contains animals which if used for pairing would produce inbred offspring. While carrying out the pairings due attention must be given to the facts that all founder animals get an equal chance of contributing to the gene pool and the animals have to be moved a minimal distance to implement such mating choices. Animals past their breeding age and animals that had been transferred out of India were excluded for pairing (table 8).

Table 6 Ordered Mean kinship of living individuals

Rank	Males					Females				
	Stbk#	MK	Known	Age	Location	Stbk#	MK	Known	Age	Location
1	IN5	0.0000	100.0	0	Nagoya	13	0.0000	100.0	47	Hyderabad
2	47	0.0000	100.0	33	Nandankanan	19	0.0000	100.0	42	Mysore
3	55	0.0000	100.0	32	Veerмата	33	0.0000	100.0	37	Ny Bronx
4	58	0.0000	100.0	30	Assam	32	0.0000	100.0	37	Calcutta
5	76	0.0000	100.0	23	Calcutta	5	0.0050	100.0	59	Paris
6	79	0.0000	100.0	22	Trivandrum	89	0.0100	100.0	20	Assam
7	81	0.0000	100.0	22	Trivandrum	28	0.0200	100.0	39	Whipsnade
8	83	0.0000	100.0	21	Jaldapara	54	0.0200	100.0	31	Singapore
9	88	0.0000	100.0	20	Tripura	IN7	0.0300	100.0	35	Toronto
10	121	0.0000	100.0	13	Kanpur	112	0.0413	100.0	8	Assam
11	44	0.0250	100.0	34	Assam	100	0.0600	100.0	12	Delhi
12	IN3	0.0300	100.0	39	Ny Bronx	36	0.0700	100.0	36	Ranchi
13	29	0.0475	100.0	38	Nagoya	124	0.0700	100.0	4	Delhi
14	82	0.0475	100.0	21	Assam	114	0.0925	100.0	8	Patna
15	49	0.0500	100.0	33	Patna	127	0.0925	100.0	3	Patna
16	72	0.0513	100.0	26	Lucknow	92	0.0950	100.0	19	Patna
17	77	0.0525	100.0	23	Assam	118	0.0981	100.0	7	Kanpur
18	93	0.0600	100.0	17	Patna	80	0.1150	100.0	22	Patna
19	85	0.0613	100.0	21	Kanpur	108	0.1175	100.0	16	Kanpur
20	119	0.0700	100.0	6	Sandiegozoo	116	---	---	9	Patna
21	123	0.0825	100.0	4	Patna	125	---	---	4	Patna
22	111	0.0925	100.0	9	Sandiegozoo					
23	117	0.0925	100.0	7	Sandiegozoo					
24	126	0.0981	100.0	4	Kanpur					
25	120	0.1025	100.0	5	Patna					
26	102	---	---	0	Losangeles					

Genetic Diversity (GD) The heterozygosity expected in a population if the population were in Hardy-Weinberg equilibrium. Gene diversity is calculated from allele frequencies, and is the heterozygosity expected in progeny produced by random mating. The proportional gene diversity (as a proportion of the wild or source population) is the probability that two alleles from the same locus sampled at random from the population will be identical by descent.

Mean kinship (MK) The mean kinship coefficient between an animal and all animals (including itself) in the living, captive-born population. The mean kinship of a population is equal to the proportional loss of gene diversity of the descendant (captive-born) population relative to the founders and is also the mean inbreeding coefficient of progeny produced by random mating. Mean kinship is also the reciprocal of two times the founder genome equivalents.

Table 7 Pairings used for determining breeding recommendations

Studbook No.	Location	Sex	Age	May be bred with	May not be bred with
44	Assam	M	34	127, 124, 125, 118, 114, 116, 100, 108, 92, 89, 80	112
47	Nandankanan	M	33	127, 124, 125, 118, 112, 114, 116, 100, 108, 92, 89, 80	
49	Patna	M	33	124, 125, 118, 112, 116, 100, 108, 92, 89, 80	127, 114
55	Veerмата	M	32	127, 124, 125, 118, 112, 114, 116, 100, 108, 92, 80	
58	Assam	M	30	127, 124, 125, 118, 112, 114, 116, 100, 108, 92, 89, 80	
72	Lucknow	M	26	127, 124, 125, 114, 116, 100, 108, 92, 89, 80	118, 112
76	Calcutta	M	23	127, 124, 125, 118, 112, 114, 116, 100, 108, 92, 89, 80	
77	Assam	M	23	127, 124, 125, 114, 116, 100, 108, 92, 89, 80	118, 112
79	Trivandrum	M	22	127, 124, 125, 118, 112, 114, 116, 100, 108, 92, 89, 80	
80	Patna	F	22	44, 47, 49, 55, 58, 72, 76, 77, 79, 81, 82, 85, 88, 93, 120, 121, 123, 126	
81	Trivandrum	M	22	127, 124, 125, 118, 112, 114, 116, 100, 108, 92, 89, 80	
82	Assam	M	21	127, 124, 125, 114, 116, 100, 108, 92, 89, 80	118, 112
85	Kanpur	M	21	127, 124, 125, 114, 116, 100, 108, 92, 89, 80	118, 112
88	Tripura	M	20	127, 124, 125, 118, 112, 114, 116, 100, 108, 92, 89, 80	
89	Assam	F	20	44, 47, 49, 58, 72, 76, 77, 79, 81, 82, 85, 88, 93, 120, 121, 123, 126	
92	Patna	F	19	44, 47, 49, 55, 58, 72, 76, 77, 79, 81, 82, 85, 88, 93, 120, 121, 123, 126	
93	Patna	M	17	127, 125, 118, 112, 114, 116, 108, 92, 89, 80	124, 100
100	Delhi	F	12	44, 47, 49, 55, 58, 72, 76, 77, 79, 81, 82, 85, 88, 93, 120, 121, 123, 126	
108	Kanpur	F	16	44, 47, 49, 55, 58, 72, 76, 77, 79, 81, 82, 85, 88, 93, 120, 121, 123, 126	
112	Assam	F	8	44, 47, 49, 55, 58, 72, 76, 77, 79, 81, 82, 85, 88, 93, 120, 121, 123, 126	
114	Patna	F	8	44, 47, 49, 55, 58, 72, 76, 77, 79, 81, 82, 85, 88, 93, 120, 121, 123, 126	
116	Patna	F	9	44, 47, 49, 55, 58, 72, 76, 77, 79, 81, 82, 85, 88, 93, 120, 121, 123, 126	
118	Kanpur	F	7	44, 47, 49, 55, 58, 72, 76, 77, 79, 81, 82, 85, 88, 93, 120, 121, 123, 126	
120	Patna	M	5	124, 125, 118, 112, 116, 100, 89	127, 114, 108, 92, 80
121	Kanpur	M	13	127, 124, 125, 118, 112, 114, 116, 100, 108, 92, 89, 80	
123	Patna	M	4	124, 125, 112, 116, 100, 89	127, 118, 114, 108, 92, 80
124	Delhi	F	4	44, 47, 49, 55, 58, 72, 76, 77, 79, 81, 82, 85, 88, 93, 120, 121, 123, 126	
125	Patna	F	4	44, 47, 49, 55, 58, 72, 76, 77, 79, 81, 82, 85, 88, 93, 120, 121, 123, 126	
126	Kanpur	M	4	127, 124, 125, 116, 100, 89	118, 112, 114, 108, 92, 80
127	Patna	F	3	44, 47, 49, 55, 58, 72, 76, 77, 79, 81, 82, 85, 88, 93, 120, 121, 123, 126	

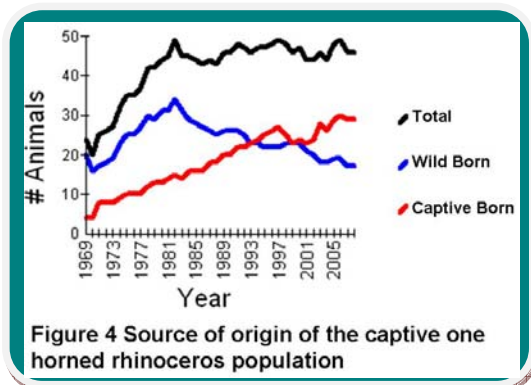
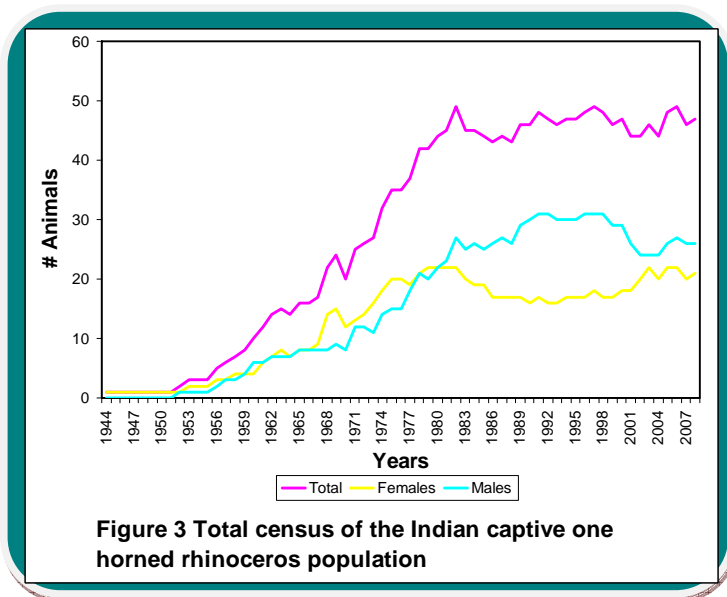
Table 8 Animals excluded from pairings

Studbook No.	Location	Sex	Age
5	Paris	F	59
13	Hyderabad	F	47
19	Mysore	F	42
28	Whipsnade	F	39
29	Nagoya	M	38
32	Calcutta	F	37
33	Ny Bronx	F	37
36	Ranchi	F	36
54	Singapore	F	31
83	Jaldapara	M	21
102	Losangeles	M	0
111	Sandiegozoo	M	9
117	Sandiegozoo	M	7
119	Sandiegozoo	M	6
IN3	Ny Bronx	M	39
IN5	Nagoya	M	0
IN7	Toronto	F	35

Demographic Analysis

Census

The current captive population of one horned rhinos in Indian zoos dates back to 1944 when the first specimen, a female was brought into captivity. The first male entered the captive population in 1952 and the first captive birth was recorded in 1960, by 1969 there were 24 animals in



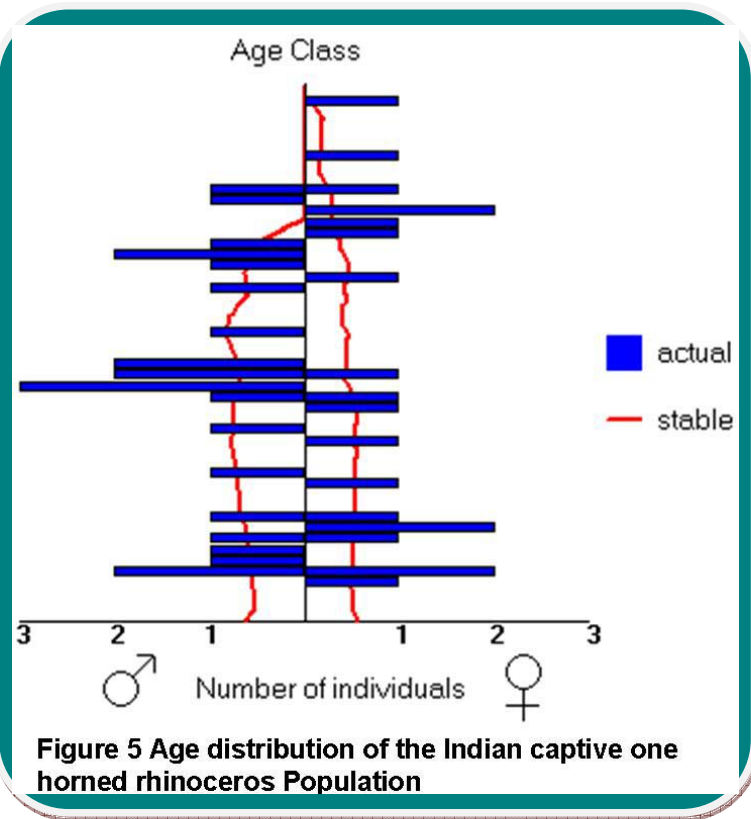
captivity of which only 4 were captive born. In 1979 the total population had risen to 42 individuals of which 13 were born in captivity. The present population of rhinos is 33 in Indian zoos and a total of 47 out of which 14 specimens were lost to follow up due to their transfer outside the country.

Table 9 – Census details of the captive Indian One horned rhinoceros Population

Year	Total	Males	Females	Wild Born	Captive Born
1969	24	9	15	20	4
1970	20	8	12	16	4
1971	25	12	13	17	8
1972	26	12	14	18	8
1973	27	11	16	19	8
1974	32	14	18	23	9
1975	35	15	20	25	10
1976	35	15	20	25	10
1977	37	18	19	27	10
1978	42	21	21	30	12
1979	42	20	22	29	13
1980	44	22	22	31	13
1981	45	23	22	31	14
1982	49	27	22	34	15
1983	45	25	20	31	14
1984	45	26	19	29	16
1985	44	25	19	28	16
1986	43	26	17	27	16
1987	44	27	17	26	18
1988	43	26	17	25	18
1989	46	29	17	26	20
1990	46	30	16	26	20
1991	48	31	17	26	22
1992	47	31	16	25	22
1993	46	30	16	23	23
1994	47	30	17	23	24
1995	47	30	17	22	25
1996	48	31	17	22	26
1997	49	31	18	22	27
1998	48	31	17	23	25
1999	46	29	17	23	23
2000	47	29	18	23	24
2001	44	26	18	21	23
2002	44	24	20	20	24
2003	46	24	22	18	28
2004	44	24	20	18	26
2005	48	26	22	19	29
2006	49	27	22	19	30
2007	47	26	21	17	29
2008	47	26	21	17	29

Age distribution

The age structure of the living population of one horned rhinoceros in captivity in Indian zoos was modelled using PM2000. The results obtained for stable age distribution (modelled data) suggest that the presence of individuals in each class is essential for a stable population. If rapid population growth is targeted then the number of individuals in the lower age classes should be



high i.e. a high birth rate is required. For the maintenance of a demographically stable population the distribution of individuals in each age class is necessary.

Table 10 Age distribution of the living captive one horned rhinoceros in Indian zoos

Age (x)	Males		Females	
	Actual	Stable	Actual	Stable
0	0	0.63	0	0.56
1	0	0.54	0	0.51
2	0	0.54	0	0.51
3	0	0.56	1	0.49
4	2	0.55	2	0.49
5	1	0.55	0	0.5
6	1	0.57	0	0.51
7	1	0.59	1	0.51
8	0	0.62	2	0.51
9	1	0.64	1	0.51
10	0	0.67	0	0.52
11	0	0.68	0	0.53
12	0	0.69	1	0.52
13	1	0.7	0	0.53
14	0	0.72	0	0.54
15	0	0.75	0	0.55
16	0	0.77	1	0.55
17	1	0.76	0	0.54
18	0	0.75	0	0.55
19	0	0.76	1	0.55

Age (x)	Males		Females	
	Actual	Stable	Actual	Stable
20	1	0.76	1	0.53
21	3	0.73	0	0.49
22	2	0.68	1	0.44
23	2	0.69	0	0.43
24	0	0.73	0	0.45
25	0	0.77	0	0.46
26	1	0.81	0	0.45
27	0	0.81	0	0.41
28	0	0.78	0	0.4
29	0	0.71	0	0.41
30	1	0.61	0	0.43
31	0	0.6	1	0.44
32	1	0.63	0	0.46
33	2	0.53	0	0.44
34	1	0.43	0	0.38
35	0	0.45	1	0.36
36	0	0.24	1	0.32
37	0	0	2	0.28
38	1	0	0	0.29
39	1	0	1	0.3
40	0	0	0	0.23
41	0	0	0	0.16
42	0	0	1	0.16
43	0	0	0	0.17
44	0	0	0	0.18
45	0	0	0	0.18
46	0	0	0	0.19
47	0	0	1	0.1
48	0	0	0	0

Life tables

The life table of male and female one horned rhinoceros in captivity in India are presented in table 11. The mortality rate (Q_x) for males and females peak in the first year of life. Additional peaks are observed once again in the 21st, 29th and 33rd years in males and 21st, 27th, 33rd, 34th, 36th and 40th year in females. Fecundity (M_x) in males peaks in the 10th year and in females in the 11th, 14th and 17th year of life. Special care must be taken in young calves to reduce the mortality rates in the 1st year of life. For breeding purposes attempts must be made to use the peak reproductive time in the lifespan of the captive individuals.

Table 11 Life Table data for males and females

Age Class	Males					Females				
	Qx	Px	Lx	Mx	Vx	Qx	Px	Lx	Mx	Vx
0	0.270	0.730	1.000	0.000	1.156	0.190	0.810	1.000	0.000	1.105
1	0.070	0.930	0.730	0.000	1.351	0.030	0.970	0.810	0.000	1.211
2	0.000	1.000	0.679	0.000	1.333	0.060	0.940	0.786	0.000	1.225
3	0.050	0.950	0.679	0.010	1.301	0.060	0.940	0.739	0.000	1.260
4	0.080	0.920	0.645	0.000	1.313	0.000	1.000	0.694	0.000	1.256
5	0.000	1.000	0.593	0.010	1.303	0.040	0.960	0.694	0.050	1.239
6	0.030	0.970	0.593	0.000	1.249	0.000	1.000	0.666	0.000	1.173
7	0.000	1.000	0.576	0.030	1.207	0.070	0.930	0.666	0.050	1.175
8	0.000	1.000	0.576	0.040	1.120	0.000	1.000	0.620	0.080	1.128
9	0.030	0.970	0.576	0.060	1.043	0.040	0.960	0.620	0.080	1.033
10	0.000	1.000	0.558	0.100	0.949	0.000	1.000	0.595	0.060	0.941
11	0.060	0.940	0.558	0.000	0.833	0.040	0.960	0.595	0.120	0.868
12	0.000	1.000	0.525	0.040	0.818	0.040	0.960	0.571	0.020	0.753
13	0.060	0.940	0.525	0.010	0.763	0.000	1.000	0.548	0.040	0.724
14	0.000	1.000	0.493	0.050	0.739	0.040	0.960	0.548	0.130	0.674
15	0.000	1.000	0.493	0.030	0.656	0.000	1.000	0.526	0.090	0.537
16	0.060	0.940	0.493	0.070	0.614	0.050	0.950	0.526	0.050	0.443
17	0.070	0.930	0.464	0.020	0.553	0.050	0.950	0.500	0.130	0.400
18	0.040	0.960	0.431	0.060	0.537	0.000	1.000	0.475	0.080	0.267
19	0.040	0.960	0.414	0.020	0.473	0.060	0.940	0.475	0.060	0.187
20	0.040	0.960	0.397	0.020	0.449	0.070	0.930	0.447	0.000	0.131
21	0.150	0.850	0.382	0.000	0.450	0.150	0.850	0.415	0.040	0.142
22	0.060	0.940	0.324	0.060	0.480	0.100	0.900	0.353	0.050	0.113
23	0.000	1.000	0.305	0.040	0.413	0.000	1.000	0.318	0.000	0.064
24	0.000	1.000	0.305	0.000	0.354	0.000	1.000	0.318	0.000	0.062
25	0.000	1.000	0.305	0.080	0.337	0.000	1.000	0.318	0.060	0.060
26	0.000	1.000	0.305	0.040	0.245	0.110	0.890	0.318	0.000	0.000
27	0.080	0.920	0.305	0.050	0.203	0.130	0.870	0.283	0.000	0.000
28	0.090	0.910	0.280	0.050	0.159	0.000	1.000	0.246	0.000	0.000
29	0.200	0.800	0.255	0.060	0.121	0.000	1.000	0.246	0.000	0.000
30	0.140	0.860	0.204	0.070	0.070	0.000	1.000	0.246	0.000	0.000
31	0.000	1.000	0.176	0.000	0.000	0.000	1.000	0.246	0.000	0.000
32	0.000	1.000	0.176	0.000	0.000	0.000	1.000	0.246	0.000	0.000
33	0.380	0.620	0.176	0.000	0.000	0.140	0.860	0.246	0.000	0.000
34	0.000	1.000	0.109	0.000	0.000	0.170	0.830	0.212	0.000	0.000
35	0.000	1.000	0.109	0.000	0.000	0.000	1.000	0.176	0.000	0.000
36	1.000	0.000	0.109	0.000	0.000	0.280	0.720	0.176	0.000	0.000
37	0.000	1.000	0.000	0.000	0.000	0.000	1.000	0.126	0.000	0.000
38	0.000	1.000	0.000	0.000	0.000	0.000	1.000	0.126	0.000	0.000
39	0.000	1.000	0.000	0.000	0.000	0.000	1.000	0.126	0.000	0.000
40	0.000	1.000	0.000	0.000	0.000	0.500	0.500	0.126	0.000	0.000
41	0.000	1.000	0.000	0.000	0.000	0.000	1.000	0.063	0.000	0.000
42	0.000	1.000	0.000	0.000	0.000	0.000	1.000	0.063	0.000	0.000
43	0.000	1.000	0.000	0.000	0.000	0.000	1.000	0.063	0.000	0.000
44	0.000	1.000	0.000	0.000	0.000	0.000	1.000	0.063	0.000	0.000
45	0.000	1.000	0.000	0.000	0.000	0.000	1.000	0.063	0.000	0.000
46	1.000	0.000	0.000	0.000	0.000	0.000	1.000	0.063	0.000	0.000
47	1.000	0.000	0.000	0.000	0.000	1.000	0.000	0.063	0.000	0.000
48	1.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000

The projected population growth rates of the population as determined by analysis of the life table are depicted in table 11. It shows that the captive one horned rhinoceros population in Indian zoos is declining. All the indices used to measure population growth show negative trends.

Table 12 Projected population growth rates

	Males	Females
r	-0.0499	-0.0342
lambda	0.9514	0.9664
R₀	0.368	0.602
T	20.05	14.86

Mortality Rate [Q_x] the proportion of individuals that die during an age class. It is calculated from the number of animals that die during an age class divided by the number of animals that were alive at the beginning of the age class (i.e. "at risk")

P_x, Age-Specific Survival – The probability that an individual of age x survives one time period; is conditional on an individual being alive at the beginning of the time period. Alternatively, the proportion of individuals which survive from the beginning of one age class to the next.

Fecundity Rate [M_x] The average number of same-sexed young born to animals in that age class. The fecundity rates provide information on the age of first, last, and maximum reproduction.

l_x, Age-Specific Survivorship – The probability that a new individual (e.g., age 0) is alive at the *beginning* of age x. Alternatively, the proportion of individuals which survive from birth to the beginning of a specific age class.

Mean V_x, Reproductive Value – The expected number of offspring produced this year and in future years by an animal of age x.

Intrinsic Rate of Increase [r] the exponential rate at which a population with a stable age distribution grows.

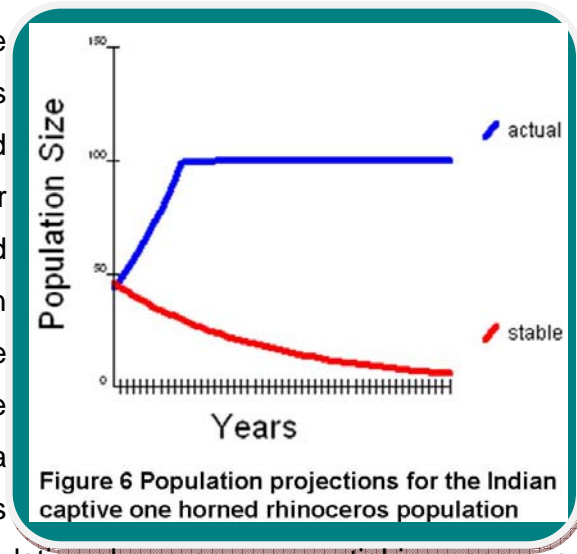
Population Growth Rate (Lambda, λ) -- The proportional change in population size from one year to the next. Lambda can be based on life-table calculations (the expected lambda) or from observed changes in population size from year to year. A lambda of 1.11 means a 11% per year increase; lambda of .97 means a 3% decline in size per year.

Net Reproductive Rate [R₀] if each animal were to replace itself each generation, the net reproductive rate would be 1.00 and the population would remain the same size. A growing population has an R₀ greater than 1.0 and a declining population less than 1.0.

Generation Time (T) -- The average time elapsing from reproduction in one generation to the time the next generation reproduces.

Population Projections

A population projection for a stable age distribution of the one horned rhinoceros in captivity in Indian zoos was generated using PM2000. It was assumed that for ensuring a genetically viable and demographically stable population an increase in the population from the current 47 specimens to 100 over the next 10 years would be required. For a stable population a steady decline is



observed in figure 6 while the actual population shows an exponential increase over the next 10 years and then stabilizes at 100 individuals for the next 40 years. Details of the number of individuals required for a stable population are presented in table 13. The first row # Born – represents the number of births required each year to achieve a stable population.

Table 13 Population projections for the captive one horned rhinoceros population for the next 50 years

	Years												
	0	1	2	3	4	5	6	7	8	9	10	11	12
# Born	0	10.72	8.46	9.84	10.85	11.06	11.60	11.88	12.75	13.34	14.60	6.73	5.50
0	0	9.49	7.49	8.71	9.61	9.78	10.27	10.51	11.29	11.81	12.92	5.96	4.87
1	0	0.00	8.05	6.35	7.39	8.15	8.30	8.71	8.92	9.58	10.02	10.97	5.06
2	0	0.00	0.00	7.73	6.10	7.09	7.82	7.97	8.36	8.56	9.19	9.61	10.52
3	1	0.00	0.00	0.00	7.39	5.83	6.78	7.48	7.62	7.99	8.18	8.79	9.19
4	4	0.97	0.00	0.00	0.00	7.04	5.56	6.47	7.13	7.26	7.62	7.80	8.38
5	1	3.88	0.95	0.00	0.00	0.00	6.83	5.39	6.27	6.91	7.04	7.39	7.56
6	1	0.99	3.81	0.93	0.00	0.00	0.00	6.71	5.29	6.16	6.79	6.92	7.26
7	2	0.98	0.97	3.71	0.90	0.00	0.00	0.00	6.53	5.15	6.00	6.61	6.74
8	2	1.96	0.98	0.97	3.64	0.87	0.00	0.00	0.00	6.41	5.06	5.88	6.49
9	2	1.96	1.93	0.97	0.96	3.58	0.85	0.00	0.00	0.00	6.30	4.97	5.78
10	0	1.96	1.92	1.90	0.96	0.94	3.52	0.83	0.00	0.00	0.00	6.18	4.88
11	0	0.00	1.92	1.88	1.85	0.93	0.91	3.43	0.81	0.00	0.00	0.00	6.03
12	1	0.00	0.00	1.85	1.81	1.78	0.90	0.88	3.31	0.78	0.00	0.00	0.00
13	1	0.98	0.00	0.00	1.80	1.77	1.74	0.87	0.86	3.22	0.77	0.00	0.00
14	0	0.97	0.96	0.00	0.00	1.75	1.73	1.69	0.84	0.83	3.14	0.75	0.00
15	0	0.00	0.97	0.94	0.00	0.00	1.74	1.70	1.68	0.84	0.83	3.11	0.73
16	1	0.00	0.00	0.94	0.92	0.00	0.00	1.69	1.66	1.63	0.82	0.81	3.02
17	1	0.95	0.00	0.00	0.88	0.87	0.00	0.00	1.59	1.57	1.54	0.77	0.75
18	0	0.94	0.93	0.00	0.00	0.83	0.85	0.00	0.00	1.53	1.53	1.47	0.72
19	1	0.00	0.91	0.90	0.00	0.00	0.80	0.82	0.00	0.00	1.47	1.49	1.42
20	2	0.94	0.00	0.87	0.84	0.00	0.00	0.77	0.77	0.00	0.00	1.40	1.39
21	3	1.80	0.83	0.00	0.79	0.75	0.00	0.00	0.69	0.69	0.00	0.00	1.26
22	3	2.67	1.59	0.73	0.00	0.70	0.65	0.00	0.00	0.62	0.60	0.00	0.00
23	2	2.89	2.59	1.52	0.69	0.00	0.68	0.62	0.00	0.00	0.60	0.57	0.00
24	0	2.00	2.89	2.59	1.52	0.69	0.00	0.68	0.62	0.00	0.00	0.60	0.57
25	0	0.00	2.00	2.89	2.59	1.52	0.69	0.00	0.68	0.62	0.00	0.00	0.60
26	1	0.00	0.00	2.00	2.83	2.59	1.48	0.65	0.00	0.68	0.58	0.00	0.00
27	0	0.96	0.00	0.00	1.92	2.65	2.49	1.36	0.57	0.00	0.65	0.52	0.00
28	0	0.00	0.88	0.00	0.00	1.76	2.44	2.28	1.26	0.53	0.00	0.60	0.48
29	0	0.00	0.00	0.75	0.00	0.00	1.51	2.19	1.95	1.16	0.53	0.00	0.51
30	1	0.00	0.00	0.00	0.62	0.00	0.00	1.25	1.94	1.61	1.06	0.53	0.00
31	1	0.92	0.00	0.00	0.00	0.58	0.00	0.00	1.15	1.85	1.49	1.02	0.53
32	1	1.00	0.92	0.00	0.00	0.00	0.58	0.00	0.00	1.15	1.85	1.49	1.02
33	2	0.81	0.93	0.75	0.00	0.00	0.00	0.47	0.00	0.00	0.93	1.59	1.21
34	1	1.53	0.62	0.79	0.57	0.00	0.00	0.00	0.36	0.00	0.00	0.71	1.27
35	1	1.00	1.53	0.62	0.71	0.57	0.00	0.00	0.00	0.36	0.00	0.00	0.71
36	1	0.86	0.50	0.77	0.31	0.61	0.29	0.00	0.00	0.00	0.18	0.00	0.00
37	2	0.84	0.72	0.00	0.00	0.00	0.51	0.00	0.00	0.00	0.00	0.00	0.00
38	1	2.00	0.84	0.72	0.00	0.00	0.00	0.51	0.00	0.00	0.00	0.00	0.00
39	2	0.00	2.00	0.84	0.72	0.00	0.00	0.00	0.51	0.00	0.00	0.00	0.00
40	0	0.75	0.00	1.50	0.63	0.54	0.00	0.00	0.00	0.39	0.00	0.00	0.00
41	0	0.00	0.50	0.00	1.00	0.42	0.36	0.00	0.00	0.00	0.26	0.00	0.00
42	1	0.00	0.00	0.50	0.00	1.00	0.42	0.36	0.00	0.00	0.00	0.26	0.00
43	0	1.00	0.00	0.00	0.50	0.00	1.00	0.42	0.36	0.00	0.00	0.00	0.26
44	0	0.00	1.00	0.00	0.00	0.50	0.00	1.00	0.42	0.36	0.00	0.00	0.00
45	0	0.00	0.00	1.00	0.00	0.00	0.50	0.00	1.00	0.42	0.36	0.00	0.00
46	0	0.00	0.00	0.00	1.00	0.00	0.00	0.50	0.00	1.00	0.42	0.36	0.00
47	1	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.25	0.00	0.50	0.21	0.18
48	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	44	48.00	52.12	56.60	61.44	66.60	72.18	78.20	84.70	91.68	99.23	99.32	99.39

Table 13 cont.

	Years											
	13	14	15	16	17	18	19	20	21	22	23	24
# Born	5.54	5.34	5.10	4.75	4.35	4.19	4.12	4.13	4.24	4.51	5.05	5.36
0	4.90	4.72	4.51	4.20	3.85	3.71	3.64	3.65	3.75	3.99	4.47	4.75
1	4.13	4.16	4.01	3.83	3.56	3.27	3.15	3.09	3.10	3.18	3.39	3.79
2	4.85	3.96	3.99	3.84	3.67	3.42	3.13	3.02	2.97	2.97	3.05	3.25
3	10.06	4.64	3.79	3.82	3.68	3.51	3.27	3.00	2.89	2.84	2.84	2.92
4	8.76	9.59	4.42	3.61	3.64	3.50	3.35	3.12	2.86	2.75	2.70	2.71
5	8.12	8.50	9.30	4.29	3.50	3.53	3.40	3.25	3.02	2.77	2.67	2.62
6	7.43	7.98	8.34	9.13	4.21	3.44	3.47	3.34	3.19	2.97	2.72	2.62
7	7.07	7.24	7.77	8.13	8.90	4.10	3.35	3.38	3.25	3.10	2.89	2.65
8	6.61	6.93	7.10	7.62	7.97	8.73	4.02	3.29	3.31	3.19	3.05	2.84
9	6.37	6.49	6.81	6.97	7.49	7.83	8.57	3.95	3.23	3.25	3.13	2.99
10	5.68	6.26	6.38	6.69	6.85	7.35	7.69	8.42	3.88	3.17	3.20	3.08
11	4.76	5.54	6.10	6.22	6.52	6.68	7.17	7.50	8.21	3.78	3.09	3.12
12	5.81	4.59	5.34	5.89	6.00	6.29	6.44	6.92	7.24	7.92	3.65	2.98
13	0.00	5.67	4.47	5.21	5.74	5.85	6.13	6.28	6.74	7.05	7.72	3.56
14	0.00	0.00	5.53	4.36	5.07	5.59	5.70	5.98	6.12	6.57	6.88	7.52
15	0.00	0.00	0.00	5.47	4.31	5.02	5.53	5.64	5.91	6.06	6.50	6.80
16	0.72	0.00	0.00	0.00	5.32	4.19	4.88	5.38	5.48	5.75	5.89	6.32
17	2.85	0.68	0.00	0.00	0.00	5.01	3.96	4.60	5.07	5.17	5.42	5.55
18	0.71	2.73	0.66	0.00	0.00	0.00	4.81	3.80	4.42	4.87	4.96	5.21
19	0.69	0.68	2.64	0.64	0.00	0.00	0.00	4.65	3.67	4.27	4.70	4.79
20	1.35	0.67	0.66	2.50	0.60	0.00	0.00	0.00	4.40	3.47	4.04	4.45
21	1.24	1.21	0.60	0.59	2.25	0.54	0.00	0.00	0.00	3.95	3.12	3.63
22	1.11	1.08	1.07	0.54	0.53	1.98	0.47	0.00	0.00	0.00	3.48	2.75
23	0.00	1.06	1.03	1.02	0.52	0.51	1.90	0.44	0.00	0.00	0.00	3.34
24	0.00	0.00	1.06	1.03	1.02	0.52	0.51	1.90	0.44	0.00	0.00	0.00
25	0.57	0.00	0.00	1.06	1.03	1.02	0.52	0.51	1.90	0.44	0.00	0.00
26	0.60	0.54	0.00	0.00	1.03	0.97	1.00	0.52	0.51	1.85	0.42	0.00
27	0.00	0.57	0.47	0.00	0.00	0.95	0.85	0.92	0.50	0.49	1.71	0.37
28	0.00	0.00	0.53	0.44	0.00	0.00	0.88	0.79	0.85	0.46	0.45	1.57
29	0.48	0.00	0.00	0.45	0.44	0.00	0.00	0.81	0.79	0.78	0.39	0.39
30	0.42	0.48	0.00	0.00	0.37	0.44	0.00	0.00	0.74	0.79	0.71	0.32
31	0.00	0.39	0.48	0.00	0.00	0.34	0.44	0.00	0.00	0.71	0.79	0.69
32	0.53	0.00	0.39	0.48	0.00	0.00	0.34	0.44	0.00	0.00	0.71	0.79
33	0.90	0.50	0.00	0.32	0.45	0.00	0.00	0.28	0.41	0.00	0.00	0.63
34	0.93	0.73	0.42	0.00	0.24	0.38	0.00	0.00	0.21	0.35	0.00	0.00
35	1.22	0.93	0.69	0.38	0.00	0.24	0.34	0.00	0.00	0.21	0.31	0.00
36	0.36	0.80	0.46	0.49	0.33	0.00	0.12	0.29	0.00	0.00	0.11	0.27
37	0.00	0.00	0.38	0.00	0.29	0.27	0.00	0.00	0.25	0.00	0.00	0.00
38	0.00	0.00	0.00	0.38	0.00	0.29	0.27	0.00	0.00	0.25	0.00	0.00
39	0.00	0.00	0.00	0.00	0.38	0.00	0.29	0.27	0.00	0.00	0.25	0.00
40	0.00	0.00	0.00	0.00	0.00	0.28	0.00	0.22	0.21	0.00	0.00	0.18
41	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.00	0.15	0.14	0.00	0.00
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.00	0.15	0.14	0.00
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.00	0.15	0.14
44	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.00	0.15
45	0.00	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.00
46	0.00	0.00	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19
47	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	99.48	99.57	99.65	99.72	99.76	99.79	99.81	99.84	99.86	99.88	99.90	99.93

Table 13 cont.

	Years												
	# Born	25	26	27	28	29	30	31	32	33	34	35	36
	5.40	5.35	5.47	5.67	5.81	5.91	6.00	6.01	5.47	5.18	5.48	5.72	6.24
0	4.78	4.74	4.84	5.02	5.14	5.23	5.31	5.32	4.84	4.58	4.85	5.06	5.53
1	4.03	4.05	4.02	4.11	4.26	4.37	4.44	4.51	4.51	4.11	3.89	4.11	4.29
2	3.64	3.86	3.89	3.86	3.94	4.09	4.19	4.26	4.32	4.33	3.94	3.73	3.95
3	3.11	3.48	3.70	3.72	3.69	3.77	3.91	4.01	4.07	4.13	4.14	3.77	3.57
4	2.78	2.96	3.31	3.52	3.54	3.51	3.59	3.73	3.82	3.88	3.94	3.94	3.59
5	2.63	2.70	2.87	3.21	3.42	3.44	3.41	3.49	3.61	3.70	3.76	3.82	3.82
6	2.58	2.58	2.65	2.82	3.16	3.35	3.37	3.35	3.42	3.55	3.64	3.70	3.75
7	2.55	2.51	2.52	2.58	2.75	3.07	3.27	3.29	3.26	3.34	3.46	3.54	3.60
8	2.60	2.51	2.46	2.47	2.53	2.69	3.02	3.21	3.22	3.20	3.27	3.39	3.47
9	2.79	2.55	2.46	2.42	2.42	2.49	2.65	2.96	3.15	3.17	3.14	3.21	3.33
10	2.94	2.74	2.51	2.42	2.37	2.38	2.44	2.60	2.91	3.09	3.11	3.09	3.16
11	3.00	2.87	2.67	2.45	2.36	2.32	2.32	2.38	2.54	2.84	3.02	3.03	3.01
12	3.01	2.89	2.76	2.57	2.36	2.27	2.23	2.24	2.30	2.45	2.74	2.91	2.93
13	2.91	2.93	2.82	2.69	2.51	2.30	2.22	2.18	2.18	2.24	2.38	2.67	2.84
14	3.47	2.84	2.86	2.75	2.63	2.45	2.24	2.16	2.12	2.13	2.18	2.32	2.60
15	7.44	3.43	2.80	2.83	2.72	2.60	2.42	2.22	2.14	2.10	2.10	2.16	2.30
16	6.62	7.24	3.34	2.73	2.75	2.65	2.53	2.35	2.16	2.08	2.04	2.05	2.10
17	5.96	6.24	6.83	3.15	2.57	2.59	2.49	2.38	2.22	2.03	1.96	1.93	1.93
18	5.33	5.72	5.99	6.55	3.02	2.47	2.49	2.40	2.29	2.13	1.95	1.88	1.85
19	5.03	5.15	5.53	5.78	6.33	2.92	2.38	2.40	2.31	2.21	2.06	1.88	1.82
20	4.54	4.76	4.87	5.23	5.47	5.99	2.76	2.26	2.27	2.19	2.09	1.95	1.78
21	4.00	4.07	4.28	4.38	4.70	4.92	5.38	2.48	2.03	2.04	1.97	1.88	1.75
22	3.20	3.53	3.59	3.77	3.86	4.14	4.34	4.74	2.19	1.79	1.80	1.73	1.66
23	2.63	3.06	3.38	3.44	3.61	3.70	3.97	4.15	4.54	2.10	1.71	1.73	1.66
24	3.34	2.63	3.06	3.38	3.44	3.61	3.70	3.97	4.15	4.54	2.10	1.71	1.73
25	0.00	3.34	2.63	3.06	3.38	3.44	3.61	3.70	3.97	4.15	4.54	2.10	1.71
26	0.00	0.00	3.24	2.56	2.98	3.28	3.35	3.51	3.59	3.86	4.04	4.42	2.04
27	0.00	0.00	0.00	2.99	2.36	2.74	3.02	3.08	3.23	3.31	3.55	3.72	4.07
28	0.34	0.00	0.00	0.00	2.75	2.17	2.53	2.79	2.84	2.98	3.05	3.28	3.43
29	1.45	0.34	0.00	0.00	0.00	2.55	2.01	2.34	2.58	2.63	2.76	2.82	3.03
30	0.32	1.32	0.34	0.00	0.00	0.00	2.34	1.84	2.15	2.37	2.41	2.53	2.59
31	0.30	0.30	1.28	0.34	0.00	0.00	0.00	2.26	1.78	2.08	2.29	2.33	2.45
32	0.69	0.30	0.30	1.28	0.34	0.00	0.00	0.00	2.26	1.78	2.08	2.29	2.33
33	0.74	0.60	0.24	0.24	1.12	0.32	0.00	0.00	0.00	1.99	1.57	1.83	2.01
34	0.51	0.62	0.49	0.19	0.18	0.91	0.27	0.00	0.00	0.00	1.62	1.28	1.49
35	0.00	0.48	0.57	0.46	0.19	0.18	0.86	0.25	0.00	0.00	0.00	1.53	1.20
36	0.00	0.00	0.34	0.49	0.33	0.09	0.09	0.61	0.21	0.00	0.00	0.00	1.10
37	0.23	0.00	0.00	0.21	0.41	0.20	0.00	0.00	0.36	0.18	0.00	0.00	0.00
38	0.00	0.23	0.00	0.00	0.21	0.41	0.20	0.00	0.00	0.36	0.18	0.00	0.00
39	0.00	0.00	0.23	0.00	0.00	0.21	0.41	0.20	0.00	0.00	0.36	0.18	0.00
40	0.00	0.00	0.00	0.17	0.00	0.00	0.16	0.31	0.15	0.00	0.00	0.27	0.13
41	0.12	0.00	0.00	0.00	0.11	0.00	0.00	0.10	0.20	0.10	0.00	0.00	0.18
42	0.00	0.12	0.00	0.00	0.00	0.11	0.00	0.00	0.10	0.20	0.10	0.00	0.00
43	0.00	0.00	0.12	0.00	0.00	0.00	0.11	0.00	0.00	0.10	0.20	0.10	0.00
44	0.14	0.00	0.00	0.12	0.00	0.00	0.00	0.11	0.00	0.00	0.10	0.20	0.10
45	0.15	0.14	0.00	0.00	0.12	0.00	0.00	0.00	0.11	0.00	0.00	0.10	0.20
46	0.00	0.15	0.14	0.00	0.00	0.12	0.00	0.00	0.00	0.11	0.00	0.00	0.10
47	0.09	0.00	0.07	0.07	0.00	0.00	0.06	0.00	0.00	0.00	0.06	0.00	0.00
48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	99.96	99.98	100.00	100.02	100.04	100.06	100.08	100.11	100.13	100.15	100.16	100.17	100.18

Table 13 cont.

	Years												
	38	39	40	41	42	43	44	45	46	47	48	49	50
# Born	6.54	6.49	6.50	6.52	6.65	6.89	6.94	6.65	6.55	6.25	6.01	6.11	6.13
0	5.79	5.74	5.75	5.77	5.89	6.10	6.14	5.88	5.80	5.53	5.32	5.40	5.42
1	4.69	4.91	4.87	4.88	4.90	5.00	5.18	5.21	4.99	4.92	4.70	4.52	4.59
2	4.12	4.50	4.71	4.67	4.68	4.70	4.79	4.97	5.00	4.79	4.72	4.51	4.33
3	3.78	3.94	4.30	4.51	4.47	4.48	4.49	4.58	4.75	4.78	4.58	4.52	4.31
4	3.40	3.60	3.75	4.10	4.29	4.26	4.27	4.28	4.37	4.53	4.56	4.37	4.30
5	3.49	3.30	3.49	3.64	3.98	4.16	4.13	4.14	4.15	4.24	4.39	4.42	4.23
6	3.76	3.42	3.24	3.43	3.58	3.91	4.09	4.06	4.06	4.08	4.16	4.31	4.34
7	3.65	3.66	3.33	3.16	3.34	3.48	3.80	3.98	3.95	3.96	3.97	4.05	4.20
8	3.53	3.58	3.59	3.27	3.10	3.27	3.42	3.73	3.91	3.88	3.88	3.90	3.98
9	3.41	3.47	3.52	3.53	3.21	3.04	3.22	3.36	3.67	3.84	3.81	3.82	3.83
10	3.27	3.35	3.41	3.46	3.46	3.16	2.99	3.16	3.30	3.60	3.77	3.74	3.75
11	3.08	3.19	3.27	3.32	3.37	3.38	3.08	2.91	3.08	3.21	3.51	3.68	3.65
12	2.90	2.97	3.08	3.15	3.21	3.25	3.26	2.97	2.81	2.97	3.10	3.39	3.55
13	2.85	2.83	2.89	3.00	3.07	3.13	3.17	3.18	2.89	2.74	2.90	3.02	3.30
14	2.76	2.78	2.76	2.82	2.92	3.00	3.05	3.09	3.10	2.82	2.67	2.82	2.95
15	2.57	2.73	2.75	2.73	2.79	2.89	2.96	3.01	3.06	3.06	2.79	2.64	2.79
16	2.24	2.50	2.66	2.68	2.65	2.71	2.81	2.88	2.93	2.97	2.98	2.71	2.57
17	1.98	2.11	2.36	2.51	2.52	2.50	2.56	2.65	2.72	2.76	2.80	2.81	2.56
18	1.85	1.90	2.02	2.26	2.41	2.42	2.40	2.46	2.55	2.61	2.65	2.69	2.70
19	1.78	1.79	1.84	1.95	2.19	2.32	2.34	2.32	2.37	2.46	2.52	2.56	2.60
20	1.72	1.69	1.69	1.74	1.85	2.07	2.20	2.21	2.20	2.25	2.33	2.38	2.42
21	1.60	1.55	1.52	1.52	1.56	1.66	1.86	1.98	1.99	1.97	2.02	2.09	2.14
22	1.54	1.41	1.36	1.34	1.34	1.38	1.47	1.64	1.74	1.75	1.74	1.78	1.84
23	1.59	1.48	1.35	1.31	1.28	1.28	1.32	1.40	1.57	1.67	1.68	1.67	1.70
24	1.66	1.59	1.48	1.35	1.31	1.28	1.28	1.32	1.40	1.57	1.67	1.68	1.67
25	1.73	1.66	1.59	1.48	1.35	1.31	1.28	1.28	1.32	1.40	1.57	1.67	1.68
26	1.66	1.68	1.61	1.54	1.44	1.32	1.27	1.25	1.25	1.28	1.36	1.53	1.62
27	1.87	1.53	1.54	1.49	1.42	1.32	1.21	1.17	1.15	1.15	1.18	1.26	1.41
28	3.75	1.73	1.41	1.42	1.37	1.31	1.22	1.12	1.08	1.06	1.06	1.09	1.16
29	3.17	3.47	1.60	1.31	1.32	1.27	1.21	1.13	1.03	1.00	0.98	0.98	1.01
30	2.78	2.91	3.18	1.47	1.20	1.21	1.16	1.11	1.03	0.95	0.91	0.90	0.90
31	2.50	2.69	2.81	3.08	1.42	1.16	1.17	1.12	1.07	1.00	0.92	0.88	0.87
32	2.45	2.50	2.69	2.81	3.08	1.42	1.16	1.17	1.12	1.07	1.00	0.92	0.88
33	2.05	2.15	2.20	2.37	2.48	2.71	1.25	1.02	1.03	0.99	0.95	0.88	0.81
34	1.64	1.67	1.75	1.80	1.93	2.02	2.21	1.02	0.83	0.84	0.81	0.77	0.72
35	1.40	1.54	1.57	1.65	1.69	1.81	1.90	2.08	0.96	0.78	0.79	0.76	0.72
36	0.87	1.01	1.12	1.14	1.19	1.22	1.31	1.37	1.50	0.69	0.57	0.57	0.55
37	0.68	0.53	0.62	0.69	0.70	0.73	0.75	0.81	0.84	0.92	0.43	0.35	0.35
38	0.00	0.68	0.53	0.62	0.69	0.70	0.73	0.75	0.81	0.84	0.92	0.43	0.35
39	0.00	0.00	0.68	0.53	0.62	0.69	0.70	0.73	0.75	0.81	0.84	0.92	0.43
40	0.00	0.00	0.00	0.51	0.40	0.47	0.51	0.52	0.55	0.56	0.60	0.63	0.69
41	0.09	0.00	0.00	0.00	0.34	0.27	0.31	0.34	0.35	0.37	0.38	0.40	0.42
42	0.18	0.09	0.00	0.00	0.00	0.34	0.27	0.31	0.34	0.35	0.37	0.38	0.40
43	0.00	0.18	0.09	0.00	0.00	0.00	0.34	0.27	0.31	0.34	0.35	0.37	0.38
44	0.00	0.00	0.18	0.09	0.00	0.00	0.00	0.34	0.27	0.31	0.34	0.35	0.37
45	0.10	0.00	0.00	0.18	0.09	0.00	0.00	0.00	0.34	0.27	0.31	0.34	0.35
46	0.20	0.10	0.00	0.00	0.18	0.09	0.00	0.00	0.00	0.34	0.27	0.31	0.34
47	0.05	0.10	0.05	0.00	0.00	0.09	0.04	0.00	0.00	0.00	0.17	0.13	0.16
48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	100.20	100.23	100.25	100.26	100.27	100.28	100.28	100.29	100.30	100.30	100.29	100.28	100.27

Genetic Analysis

Species with small and declining populations are faced in with the loss of genetic variability due to the limited mating choices available and the small sample of the original gene pool being represented. In captive populations of these species the problem is further exacerbated by the much reduced sample size of the original gene pool of the species. It therefore becomes imperative to genetically manage captive populations of threatened species.

The genetic summary of the captive one horned rhinoceros Indian population is presented in table 5. The table suggests that the genetic variability of the population could be much higher than that at present.

Founder Statistics

An analysis of the founder statistics of the Indian captive one horned rhinoceros population presented in table 14 and figure 7 depict the contribution made by each specimen of wild origin to the captive population. It is inferred that a few

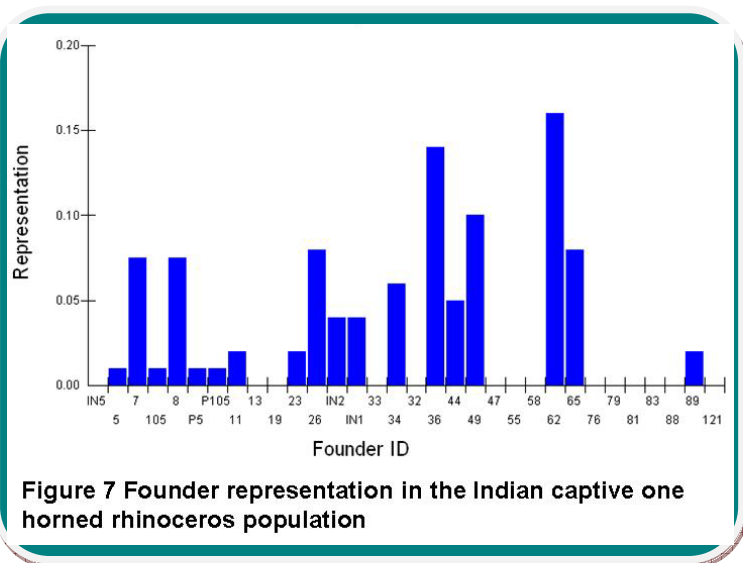


Figure 7 Founder representation in the Indian captive one horned rhinoceros population

individuals (studbook numbers – 7, 8, 26, 34, 36, 49, 62 and 65) are over represented while others are underrepresented or not represented at all. An equal representation of all founder animals could have significantly enhanced the genetic variability of the current population.

Table 14 Founder Statistics

Studbook #	Sex	Age	Representation	Contribution	Allele Retent.	Potential Ret.	Descendants
IN5	M	-1	0.0000	0.0000	0.0000	1.0000	0.00
P5	M	D	0.0100	0.2500	0.2350	0.2350	1.00
P105	M	D	0.0100	0.2500	0.2500	0.2500	1.00
IN2	F	D	0.0400	1.0000	0.7550	0.7550	2.00
IN1	M	D	0.0400	1.0000	0.7650	0.7650	2.00

Studbook #	Sex	Age	Representation	Contribution	Allele Retent.	Potential Ret.	Descendants
5	F	59	0.0100	0.2500	0.2650	1.0000	1.00
7	M	D	0.0750	1.8750	0.8100	0.8100	8.00
8	F	D	0.0750	1.8750	0.8150	0.8150	8.00
11	F	D	0.0200	0.5000	0.5000	0.5000	1.00
13	F	47	0.0000	0.0000	0.0000	1.0000	0.00
19	F	42	0.0000	0.0000	0.0000	1.0000	0.00
23	M	D	0.0200	0.5000	0.5000	0.5000	1.00
26	M	D	0.0800	2.0000	0.7250	0.7250	4.00
32	F	37	0.0000	0.0000	0.0000	1.0000	0.00
33	F	37	0.0000	0.0000	0.0000	1.0000	0.00
34	F	D	0.0600	1.5000	0.7300	0.7300	4.00
36	F	36	0.1400	3.5000	0.8400	1.0000	11.00
44	M	34	0.0500	1.2500	0.7750	1.0000	3.00
47	M	33	0.0000	0.0000	0.0000	1.0000	0.00
49	M	33	0.1000	2.5000	0.9450	1.0000	6.00
55	M	32	0.0000	0.0000	0.0000	1.0000	0.00
58	M	30	0.0000	0.0000	0.0000	1.0000	0.00
62	M	D	0.1600	4.0000	0.8550	0.8550	11.00
65	F	D	0.0800	2.0000	0.7700	0.7700	4.00
76	M	23	0.0000	0.0000	0.0000	1.0000	0.00
79	M	22	0.0000	0.0000	0.0000	1.0000	0.00
81	M	22	0.0000	0.0000	0.0000	1.0000	0.00
83	M	21	0.0000	0.0000	0.0000	1.0000	0.00
88	M	20	0.0000	0.0000	0.0000	1.0000	0.00
89	F	20	0.0200	0.5000	0.5000	1.0000	1.00
105	F	D	0.0100	0.2500	0.2500	0.2500	1.00
121	M	13	0.0000	0.0000	0.0000	1.0000	0.00

Individual statistics

The genetic details of the living specimens in the Indian captive one horned rhinoceros population are presented in table 15. The information contained in the table can be used to manage pairings. Specimens with low inbreeding coefficients and mean kinship values are suitable for breeding purposes than those with higher values. Similarly individuals with a large number of offspring (progeny) are less preferred over those with no offspring or a few offspring. The selection of individuals with no offspring or few offspring brings their gene pool into the population which would otherwise go unrepresented or underrepresented.

Table 15 Individual Statistics

Stbk	Sex	Sire	Dam	Age	Location	Known	F	MK	KV	FOKE	Progeny	House name
IN5	M	Wild	Wild	0	Nagoya	100	0	0	0	0	0	Jaya
IN3	M	In1	In2	39	Ny Bronx	100	0	0.03	0	26.6	0	Vinu
IN7	F	In1	In2	35	Toronto	100	0	0.03	0	26.6	0	Indira
5	F	Wild	Wild	59	Paris	100	0	0.005	0	4.4	1	Geeta
13	F	Wild	Wild	47	Hyderabad	100	0	0	0	0	3	Padma
19	F	Wild	Wild	42	Mysore	100	0	0	0	0	0	Kalongmukhi
28	F	9	11	39	Whipsnade	100	0	0.02	0	17.8	0	Roopa
29	M	7	8	38	Nagoya	100	0	0.047	0.025	42.2	0	Krishna/samber
32	F	Wild	Wild	37	Calcutta	100	0	0	0	0	1	Mayuri/kadambini
33	F	Wild	Wild	37	Ny Bronx	100	0	0	0	0	0	Mayangkumari
36	F	Wild	Wild	36	Ranchi	100	0	0.07	0.089	62.2	3	Chitrlekha/kanc
44	M	Wild	Wild	34	Assam	100	0	0.025	0.021	22.2	3	Laksman
47	M	Wild	Wild	33	Nandankanan	100	0	0	0	0	0	Nandan
49	M	Wild	Wild	33	Patna	100	0	0.05	0.088	44.4	6	Kancha\bijoy
54	F	23	10	31	Singapore	100	0	0.02	0	17.8	0	Gomoti
55	M	Wild	Wild	32	Veermata	100	0	0	0	0	0	Shiva
58	M	Wild	Wild	30	Assam	100	0	0	0	0	2	John\palitra
72	M	37	34	26	Lucknow	100	0	0.051	0.037	45.5	0	Lohit
76	M	Wild	Wild	23	Calcutta	100	0	0	0	0	0	Ratul
77	M	44	50	23	Assam	100	0	0.052	0.043	46.6	1	Bishnu
79	M	Wild	Wild	22	Trivandrum	100	0	0	0	0	0	Ramu
80	F	62	36	22	Patna	100	0	0.115	0.141	102.1	6	Hartali
81	M	Wild	Wild	22	Trivandrum	100	0	0	0	0	0	Jadu
82	M	44	50	21	Assam	100	0	0.047	0.035	42.2	0	Mohesh
83	M	Wild	Wild	21	Jaldapara	100	0	0	0	0	0	Madu
85	M	37	34	21	Kanpur	100	0	0.061	0.059	54.4	2	Rohit
88	M	Wild	Wild	20	Tripura	100	0	0	0	0	0	Pradeep/sunder
89	F	Wild	Wild	20	Assam	100	0	0.01	0.017	8.9	1	Baghekhati
92	F	62	36	19	Patna	100	0	0.095	0.113	84.4	2	Chotki/rani
93	M	26	65	17	Patna	100	0	0.06	0.083	53.3	2	Ayodhya/amar
100	F	26	65	12	Delhi	100	0	0.06	0.086	53.3	2	Maheswari
102	M	Unk	Unk	0	Losangeles	0	---	---	---	---	0	Madan

Stbk	Sex	Sire	Dam	Age	Location	Known	F	MK	KV	FOKE	Progeny	House name
108	F	62	80	16	Kanpur	100	0.25	0.117	0.143	104.3	2	Rani
111	M	49	80	9	Sandiegozoo	100	0	0.093	0.13	82.1	0	Bhopo
112	F	77	89	8	Assam	100	0	0.041	0.046	36.6	0	Pari
114	F	49	80	8	Patna	100	0	0.093	0.131	82.1	0	Akansha
116	F	Isb106	Isb209	9	Patna	0	---	---	---	---	0	
117	M	107	92	7	Sandiegozoo	100	0.125	0.093	0.128	82.1	0	Rustam
118	F	85	108	7	Kanpur	100	0	0.098	0.116	87.1	0	Cb-0378
119	M	93	100	6	Sandiegozoo	100	0.25	0.07	0.103	62.2	0	
120	M	107	80	5	Patna	100	0.125	0.102	0.143	91	0	
121	M	Wild	Wild	13	Kanpur	100	0	0	0	0	0	Cb-0377
123	M	49	92	4	Patna	100	0	0.083	0.12	73.3	0	
124	F	93	100	4	Delhi	100	0.25	0.07	0.103	62.2	0	
125	F	0190	0278	4	Patna	0	---	---	---	---	0	
126	M	85	108	4	Kanpur	100	0	0.098	0.118	87.1	0	Cb-0376
127	F	49	80	3	Patna	100	0	0.093	0.133	82.1	0	

Inbreeding Statistics

The inbreeding statistics of the Indian captive one horned rhinoceros are presented in table 16. Specimens with studbook numbers 108, 109, 117, 119, 120 and 124 have significant levels of inbreeding coefficient and they or their offspring would carry a smaller portion of the gene pool that can be represented in individual specimens. These individuals should be used with caution for breeding purposes only when absolutely necessary.

Table 16 Inbreeding Statistics

Studbook #	Sex	Age	Location	% Known	Inbreeding coefficient (F)
IN5	M	0	Nagoya	100	0
IN6	F	27	Madras	100	0
IN2	F	0	Mysore	100	0
IN1	M	0	Mysore	100	0
IN3	M	39	Ny Bronx	100	0
IN7	F	35	Toronto	100	0
1	M	30	Delhi	100	0
2	M	47	Assam	100	0
3	F	16	Assam	100	0
4	M	37	Trivandrum	100	0
5	F	59	Paris	100	0
6	F	11	NZP-Wash	100	0
7	M	29	Assam	100	0
8	F	26	Assam	100	0
9	M	28	Delhi	100	0
10	F	21	Calcutta	100	0
11	F	22	Delhi	100	0
12	M	21	Hyderabad	100	0
13	F	47	Hyderabad	100	0
14	F	17	Nzp-Wash	100	0
15	F	41	Gulf Brez	100	0
16	M	0	Assam	100	0
17	F	21	Losangeles	100	0
18	F	2	Assam	100	0
19	F	42	Mysore	100	0
20	M	2	Assam	100	0
21	M	19	Planckndl	100	0
22	M	4	Brownsvil	100	0
23	M	34	Calcutta	100	0
24	M	0	Assam	100	0
25	F	1	Assam	100	0
26	M	31	Delhi	100	0
27	F	15	Chatbir Z	100	0
28	F	39	Whipsnade	100	0
29	M	38	Nagoya	100	0
30	M	12	Hyderabad	100	0
31	M	21	Chatbir Z	100	0
32	F	37	Calcutta	100	0
33	F	37	Ny Bronx	100	0
34	F	34	Hyderabad	100	0
35	F	3	Ny Bronx	100	0

36	F	36	Ranchi	100	0
37	M	18	Kanpur	100	0
38	F	35	Nandankanan	100	0
39	F	2	Assam	100	0
40	M	27	Mysore	100	0
41	M	1	Assam	100	0
42	M	1	Onthe Way	100	0
43	M	18	Chatbir Z	100	0
44	M	34	Assam	100	0
45	F	7	Lucknow	100	0
46	M	4	Lucknow	100	0
47	M	33	Nandankanan	100	0
48	M	5	Assam	100	0
49	M	33	Patna	100	0
50	F	20	Assam	100	0
51	M	7	Lucknow	100	0
52	M	0	Assam	100	0
53	M	23	Hyderabad	100	0
54	F	31	Singapore	100	0
55	M	32	Veer mata	100	0
56	F	0	Chatbir Z	100	0
57	F	4	Assam	100	0
58	M	30	Assam	100	0
59	M	9	Madras	100	0
60	F	21	Assam	100	0
61	F	6	Delhi	100	0
62	M	14	Patna	100	0
63	M	20	Hyderabad	100	0
64	F	0	Assam	100	0
65	F	19	Delhi	100	0
66	F	0	Assam	100	0
67	M	16	Assam	100	0
68	F	13	Yokohama	100	0
69	M	0	Chatbir Z	100	0
70	F	0	Assam	100	0
71	M	16	Calcutta	100	0
72	M	26	Lucknow	100	0
73	M	0	Chatbir Z	100	0
74	F	1	Assam	100	0
75	M	18	Chatbir Z	100	0
76	M	23	Calcutta	100	0
77	M	23	Assam	100	0
78	M	22	Hyderabad	100	0
79	M	22	Trivandrum	100	0
80	F	22	Patna	100	0
81	M	22	Trivandrum	100	0
82	M	21	Assam	100	0
83	M	21	Jaldapara	100	0
84	M	0	Assam	100	0
85	M	21	Kanpur	100	0
86	M	0	Assam	100	0
87	M	0	India	100	0
88	M	20	Tripura	100	0
89	F	20	Assam	100	0
90	F	0	Assam	100	0
91	M	11	Kanpur	100	0
92	F	19	Patna	100	0
93	M	17	Patna	100	0

94	F	0	Assam	100	0
95	M	0	Assam	100	0
96	F	9	Trivandrum	100	0
97	M	0	India	100	0
98	M	4	Delhi	100	0
99	M	1	Lucknow	100	0.25
100	F	12	Delhi	100	0
101	F	0	Assam	100	0
102	M	0	Losangeles	0	0
104	M	5	Assam	100	0
105	F	36	Hamura	100	0
107	M	14	Delhi	100	0
108	F	16	Kanpur	100	0.25
109	M	2	Patna	100	0
110	M	0	Delhi	100	0
111	M	9	Sandiegozoo	100	0
112	F	8	Assam	100	0
114	F	8	Patna	100	0
115	F	7	Delhi	0	0
116	F	9	Patna	0	0
117	M	7	Sandiegozoo	100	0.125
118	F	7	Kanpur	100	0
119	M	6	Sandiegozoo	100	0.25
120	M	5	Patna	100	0.125
121	M	13	Kanpur	100	0
123	M	4	Patna	100	0
124	F	4	Delhi	100	0.25
125	F	4	Patna	0	0
126	M	4	Kanpur	100	0
127	F	3	Patna	100	0

Conclusion

One horned rhinoceros are mega herbivores inhabiting the riverine grasslands in the Himalayan foothills. The species earlier listed as endangered has shown recent signs of recovery and is currently listed as vulnerable in the IUCN Red List of Threatened species. The species is currently managed as part of an international effort and has several zoos holding the species outside India.

Indian zoos currently have 33 (18.15) specimens in captivity. Analysis of the captive Indian population suggests that the current population has a high level of genetic diversity but is threatened by low numbers. A target population size for Indian zoos of 100 individuals to be achieved over 10 years is suggested for maintaining a genetically viable and demographically stable population. The current population has several animals of wild origin whose genes are not represented or underrepresented in the captive population. A more equitable representation of the founder gene pool would enhance the genetic stability of the captive population.

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Glossary of Terms

Demographic Terms

Age Distribution -- A two-way classification showing the numbers or percentages of individuals in various age and sex classes.

Population Growth Rate (Lambda, λ) -- The proportional change in population size from one year to the next. Lambda can be based on life-table calculations (the expected lambda) or from observed changes in population size from year to year. A lambda of 1.11 means a 11% per year increase; lambda of .97 means a 3% decline in size per year.

P_x, Age-Specific Survival – The probability that an individual of age x survives one time period; is conditional on an individual being alive at the beginning of the time period. Alternatively, the proportion of individuals which survive from the beginning of one age class to the next.

Q_x, Mortality – Probability that an individual of age x dies during time period. $Q_x = 1 - P_x$

The proportion of individuals that die during an age class. It is calculated from the number of animals that die during an age class divided by the number of animals that were alive at the beginning of the age class (i.e.-at risk).

I_x, Age-Specific Survivorship – The probability that a new individual (e.g., age 0) is alive at the *beginning* of age x . Alternatively, the proportion of individuals which survive from birth to the beginning of a specific age class.

M_x, Fecundity – The average number of same-sexed young born to animals in that age class. Because SPARKS is typically using relatively small sample sizes, SPARKS calculates M_x as 1/2 the average number of young born to animals in that age class. This provides a somewhat less noisy estimate of M_x, though it does not allow for unusual sex ratios. The fecundity rates provide information on the age of first, last, and maximum reproduction.

V_x, Reproductive Value – The expected number of offspring produced this year and in future years by an animal of age x .

E_x, Life Expectancy – Average years of further life for an animal in age class x .

Risk (Q_x or M_x) – The number of individuals that have lived during an age class. The number at risk is used to calculate M_x and Q_x by dividing the number of births and deaths that occurred during an age class by the number of animals at risk of dying and reproducing during that age class.

Genetic Terms

(Founder) Contribution -- Number of copies of a founder's genome that are present in the living descendants. Each offspring contributes 0.5, each grand-offspring contributes 0.25, etc.

Current Gene Diversity (GD) -- The proportional gene diversity (as a proportion of the source population) is the probability that two alleles from the same locus sampled at random from the population will be identical by descent. Gene diversity is calculated from allele frequencies, and is the heterozygosity expected in progeny produced by random mating, and if the population were in Hardy-Weinberg equilibrium.

Effective Population Size (Inbreeding N_e) -- The size of a randomly mating population of constant size with equal sex ratio and a Poisson distribution of family sizes that would (a) result in the same mean rate of inbreeding as that observed in the population, or (b) would result in the same rate of random change in gene frequencies (genetic drift) as observed in the population. These two definitions are identical only if the population is demographically stable (because the rate of inbreeding depends on the distribution of alleles in the parental generation, whereas the rate of gene frequency drift is measured in the current generation).

FOKE, First Order Kin Equivalent -- The number of first-order kin (siblings or offspring) that would contain the number of copies of an individual's alleles (identical by descent) as are present in the captive-born population. Thus an offspring or sib contributes 1 to FOKE; each grand-offspring contributes 1/2 to FOKE; each cousin contributes 1/4 to FOKE. $FOKE = 4 * N * MK$, in which N is the number of living animals in the captive population.

Founder -- An individual obtained from a source population (often the wild) that has no known relationship to any individuals in the derived population (except for its own descendants).

Founder Genome Equivalent (FGE) -- The number wild-caught individuals (founders) that would produce the same amount of gene diversity as does the population under study. The gene diversity of a population is $1 - 1 / (2 * FGE)$.

Founder Genome Surviving -- The sum of allelic retentions of the individual founders (i.e., the product of the mean allelic retention and the number of founders).

GU, Genome Uniqueness -- Probability that an allele sampled at random from an individual is not present, identical by descent, in any other living individual in the population. GU-all is the genome uniqueness relative to the entire population. GU-Desc is the genome uniqueness relative to the living non-founder, descendants.

Inbreeding Coefficient (F) -- Probability that the two alleles at a genetic locus are identical by descent from an ancestor common to both parents. The mean inbreeding coefficient of a population will be the proportional decrease in observed heterozygosity relative to the expected heterozygosity of the founder population.

KV, Kinship Value – The weighted mean kinship of an animal, with the weights being the reproductive values of each of the kin. The mean kinship value of a population predicts the loss of gene diversity expected in the subsequent generation if all animals were to mate randomly and all were to produce the numbers of offspring expected for animals of their age.

Mean Generation Time (T) -- The average time elapsing from reproduction in one generation to the time the next generation reproduces. Also, the average age at which a female (or male) produces offspring. It is not the age of first reproduction. Males and females often have different generation times.

Mean Kinship (MK) -- The mean kinship coefficient between an animal and all animals (including itself) in the living, captive-born population. The mean kinship of a population is equal to the proportional loss of gene diversity of the descendant (captive-born) population relative to the founders and is also the mean inbreeding coefficient of progeny produced by random mating. Mean kinship is also the reciprocal of two times the founder genome equivalents: $MK = 1 / (2 * FGE)$. $MK = 1 - GD$.

Percent Known -- Percent of an animal's genome that is traceable to known Founders. Thus, if an animal has an UNK sire, the % Known = 50. If it has an UNK grandparent, % Known = 75.

Prob Lost – Probability that a random allele from the individual will be lost from the population in the next generation, because neither this individual nor any of its relatives pass on the allele to an offspring. Assumes that each individual will produce a number of future offspring equal to its reproductive value, V_x .

(Founder) Representation – Proportion of the genes in the descendant population that derives from that founder. I.e., proportional Founder Contribution.

Allele Retention – The probability that a gene present in a founder individual exists in the living, descendant population.

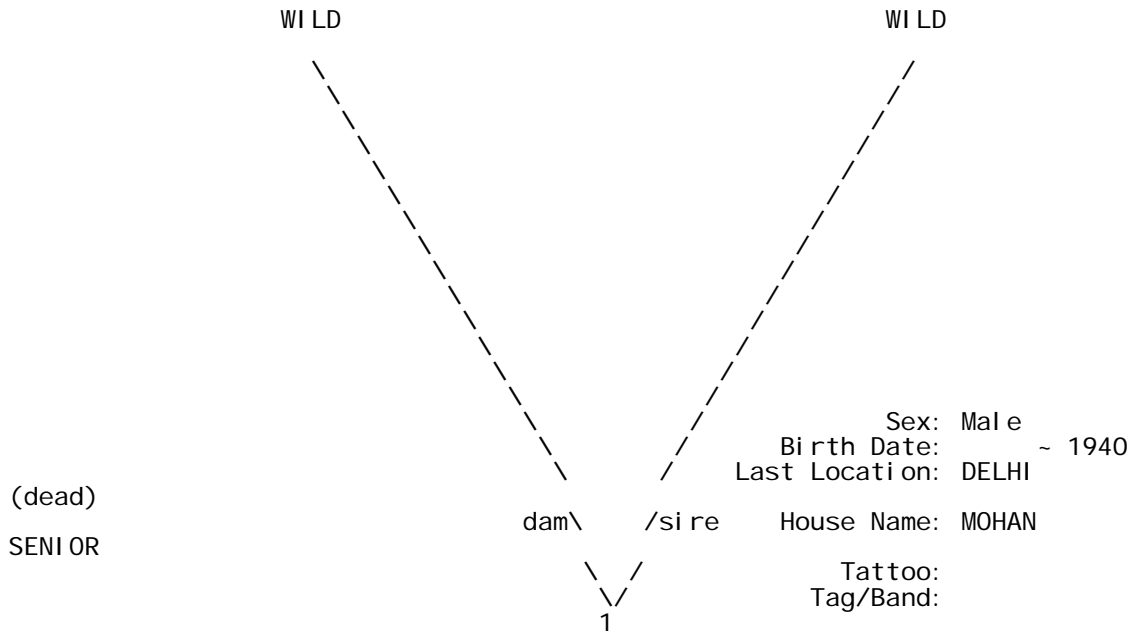
Appendix 1

Pedigree Chart Report
ONE-HORNED RHINOCEROS - ARCHIVE Studbook

=====

Taxon Name: RHINOCEROS UNICORNIS Studbook Number: 1

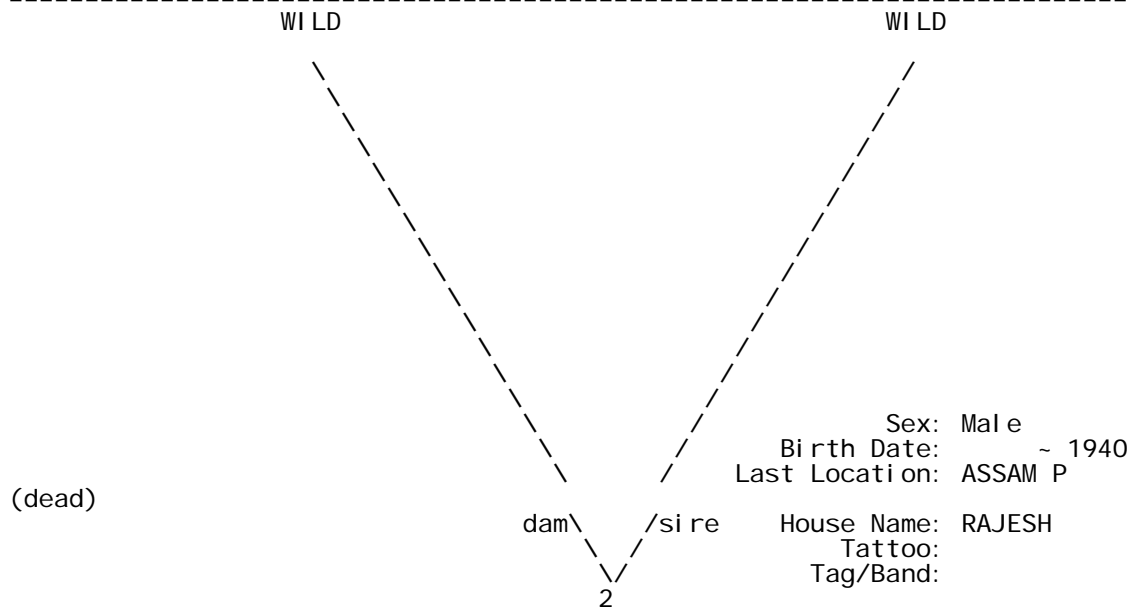
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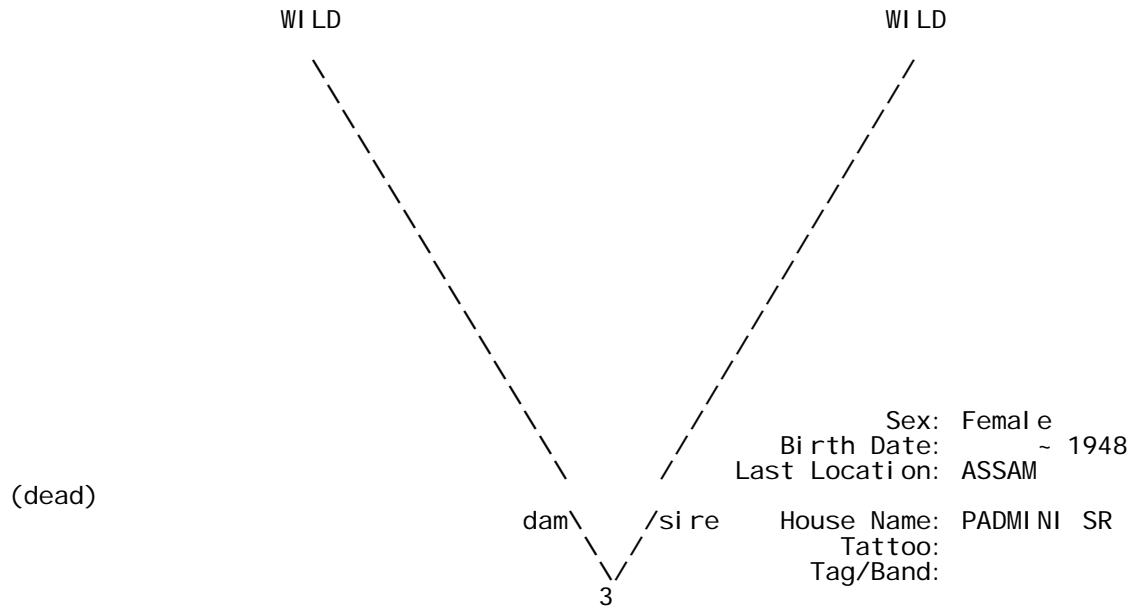
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Taxon Name: RHINOCEROS UNICORNIS Studbook Number: 2

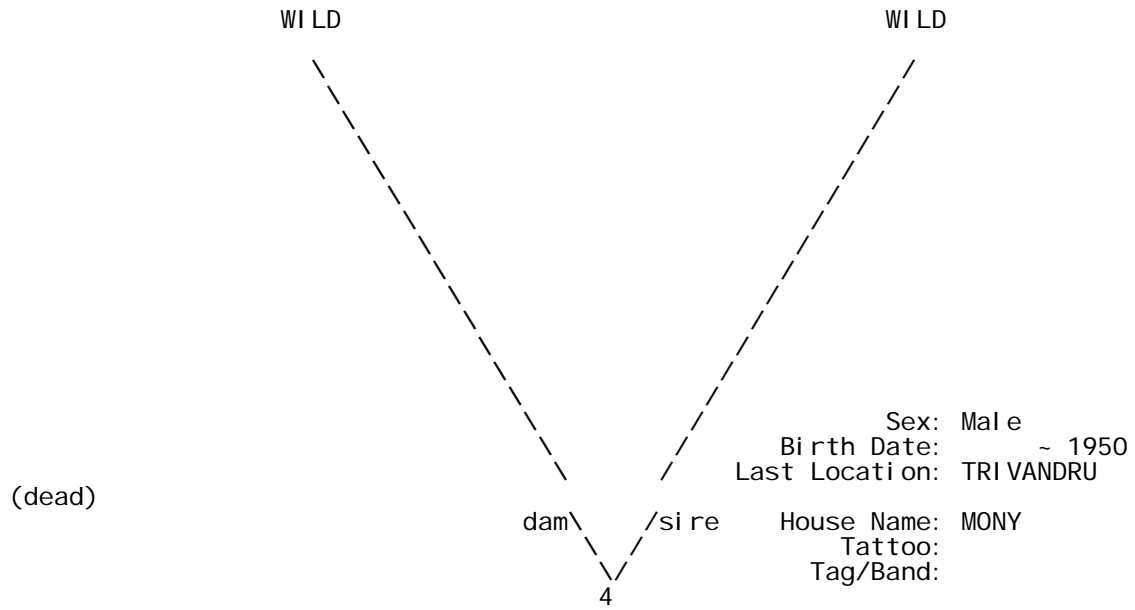
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=====
Taxon Name: RHINOCEROS UNICORNIS Studbook Number: 3
=====



=====
Taxon Name: RHINOCEROS UNICORNIS Studbook Number: 4
=====



=====
Taxon Name: RHI NOCEROS UNI CORNIS
=====

=====
Studbook Number: 5
=====

WILD

WILD

dam \ / si re

5

Sex: Female
Birth Date: ~ 1951
Last Location: PARIS
House Name: GEETA
Tattoo:
Tag/Band:

=====
Taxon Name: RHI NOCEROS UNI CORNIS
=====

=====
Studbook Number: 6
=====

WILD

WILD

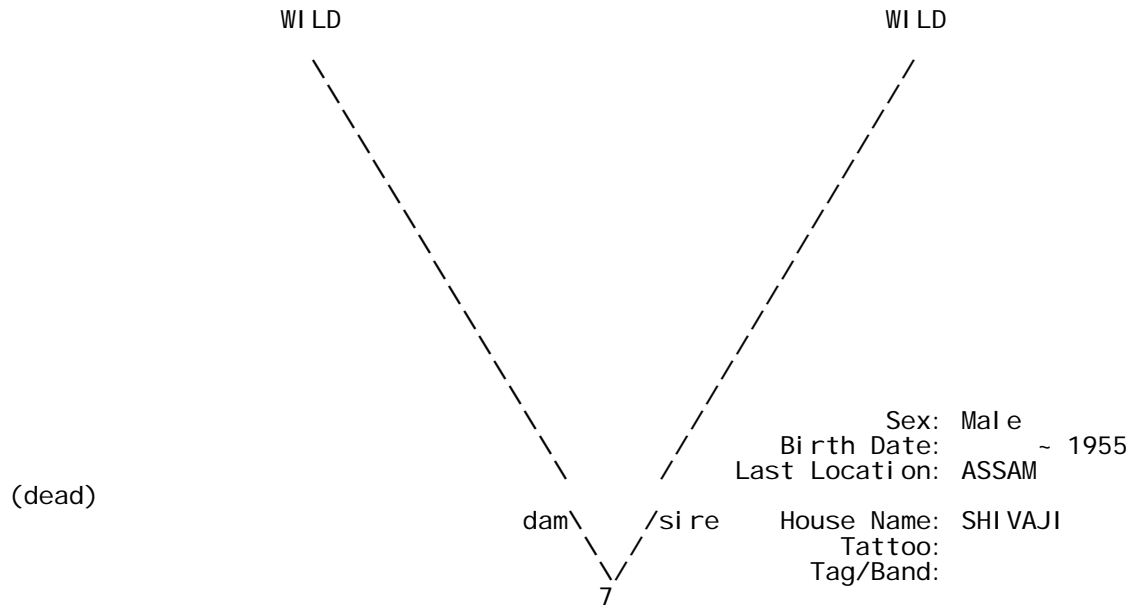
dam \ / si re

6

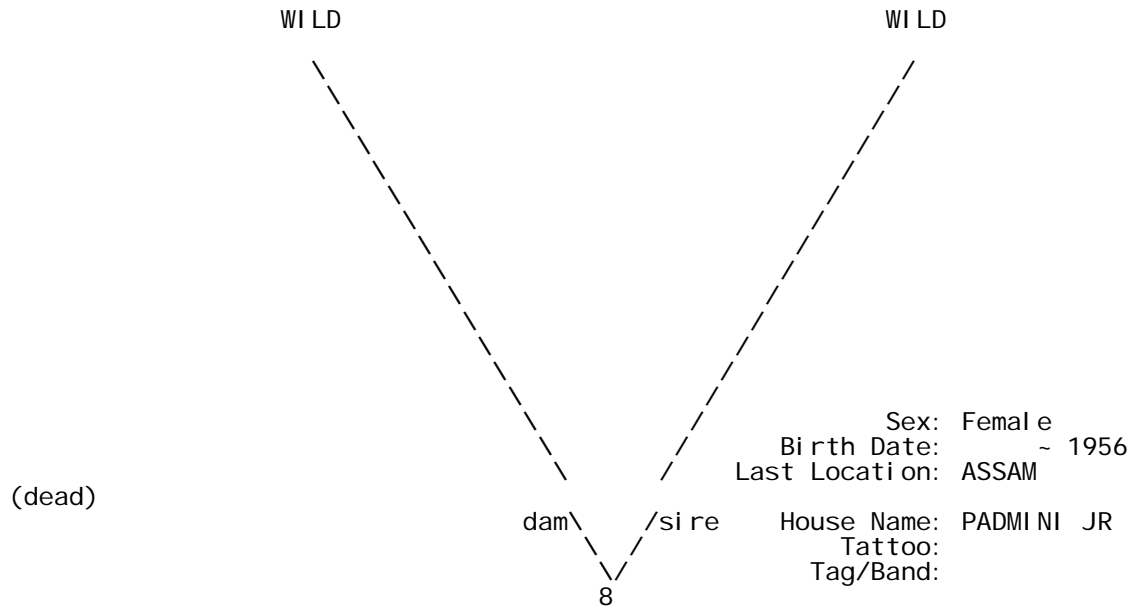
Sex: Female
Birth Date: ~ 1952
Last Location: NZP-WASH
House Name: DEEPALI SR
Tattoo:
Tag/Band:

(dead)

=====
Taxon Name: RHI NOCEROS UNI CORNI S Studbook Number: 7
=====

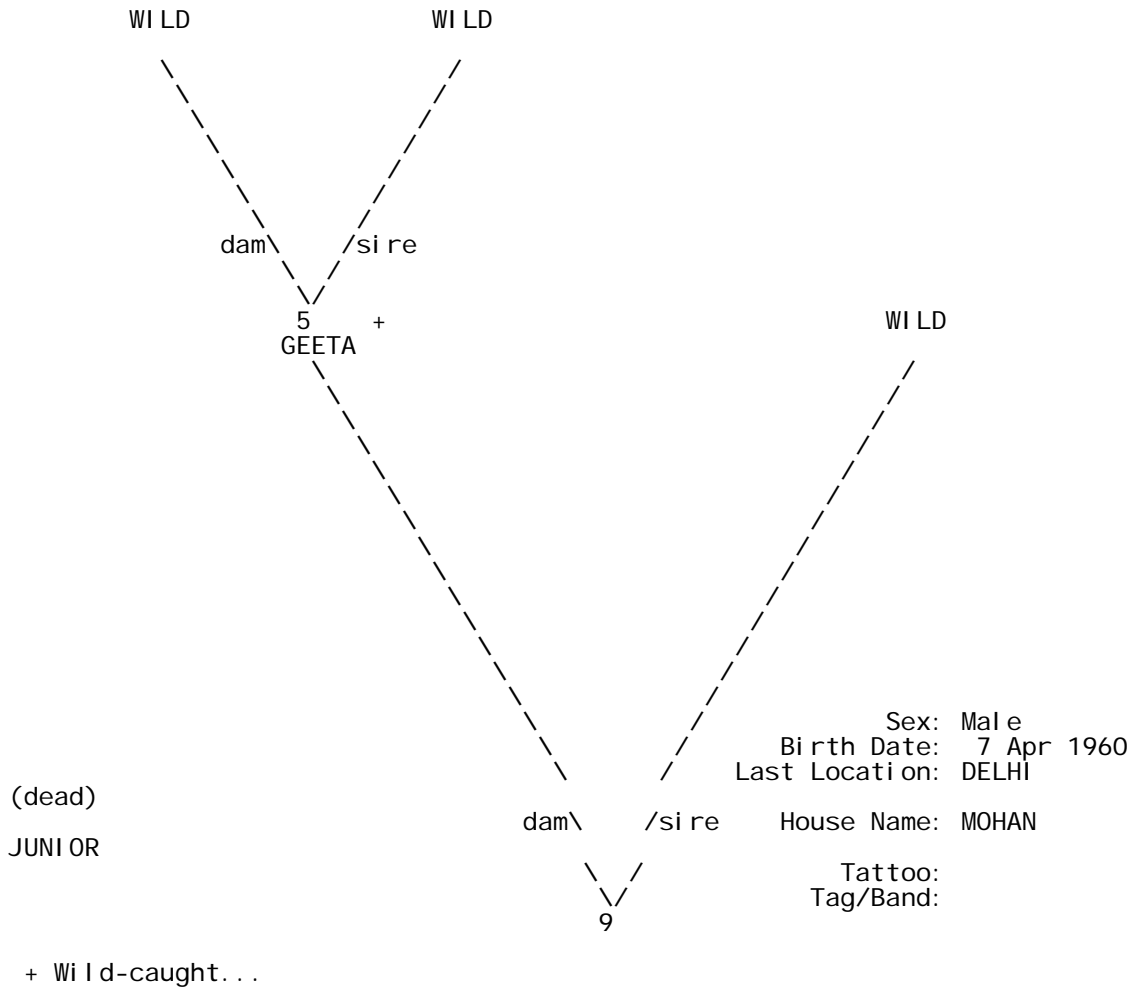


=====
Taxon Name: RHI NOCEROS UNI CORNI S Studbook Number: 8
=====

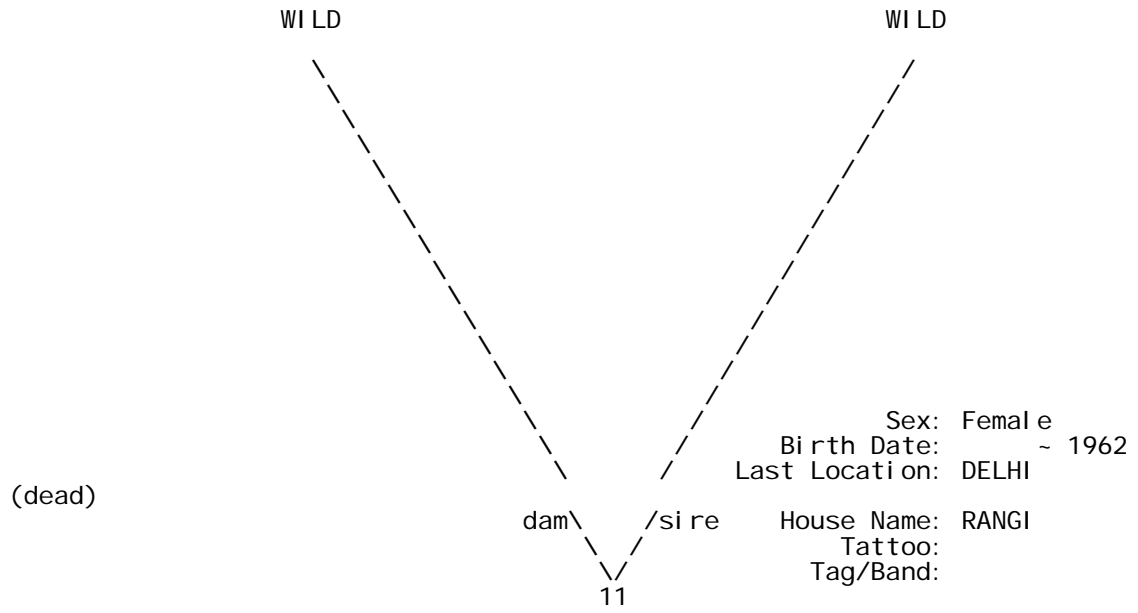


=====
Taxon Name: RHINOCEROS UNICORNIS
=====

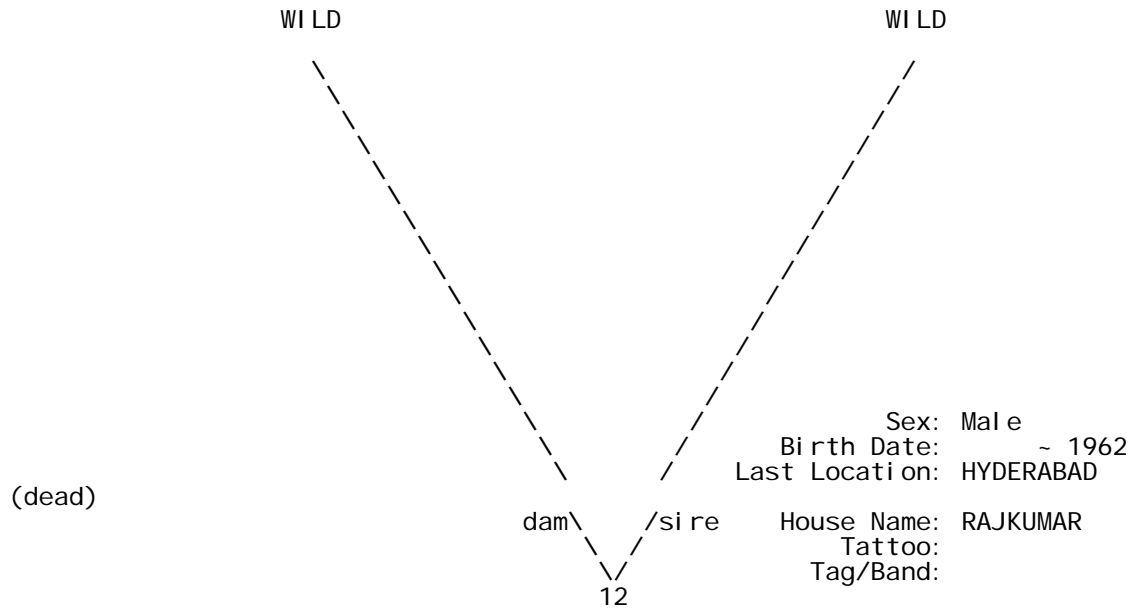
Studbook Number: 9
=====



=====
Taxon Name: RHINOCEROS UNICORNIS Studbook Number: 11
=====



=====
Taxon Name: RHINOCEROS UNICORNIS Studbook Number: 12
=====



=====
Taxon Name: RHINOCEROS UNICORNIS
=====

=====
Studbook Number: 13
=====

WILD

WILD

dam \

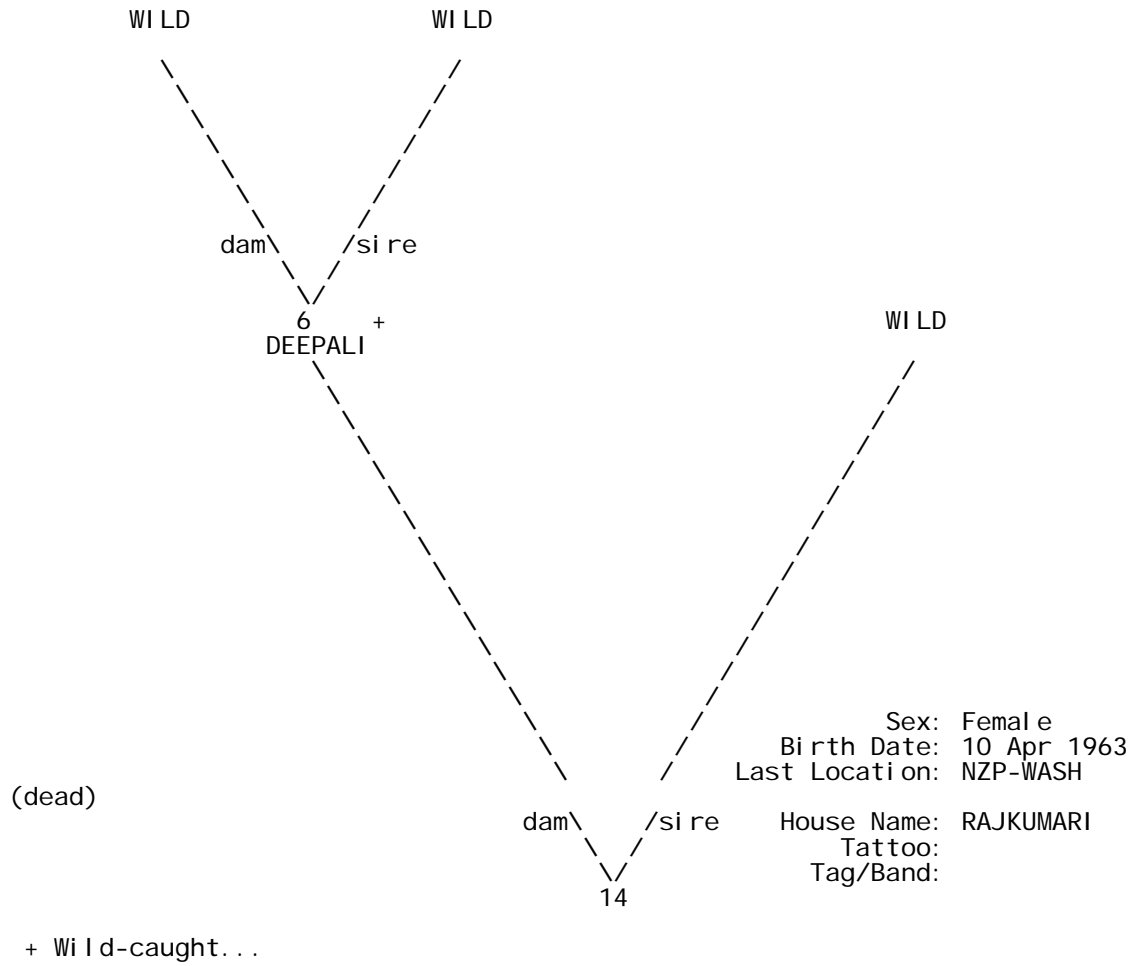
/ sire

13

Sex: Female
Birth Date: ~ 1963
Last Location: HYDERABAD
House Name: PADMA
Tattoo:
Tag/Band:

=====
Taxon Name: RHINOCEROS UNICORNIS
=====

=====
Studbook Number: 14
=====



=====
Taxon Name: RHINOCEROS UNICORNIS
=====

=====
Studbook Number: 15
=====

WILD

WILD

WILD

WILD

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/ si re

dam \

/ si re

3

PADMI NI +

7

SHI VAJI +

(dead)

dam \

/ si re

15

Sex: Female
Birth Date: 10 Jul 1963
Last Location: GULF BREZ

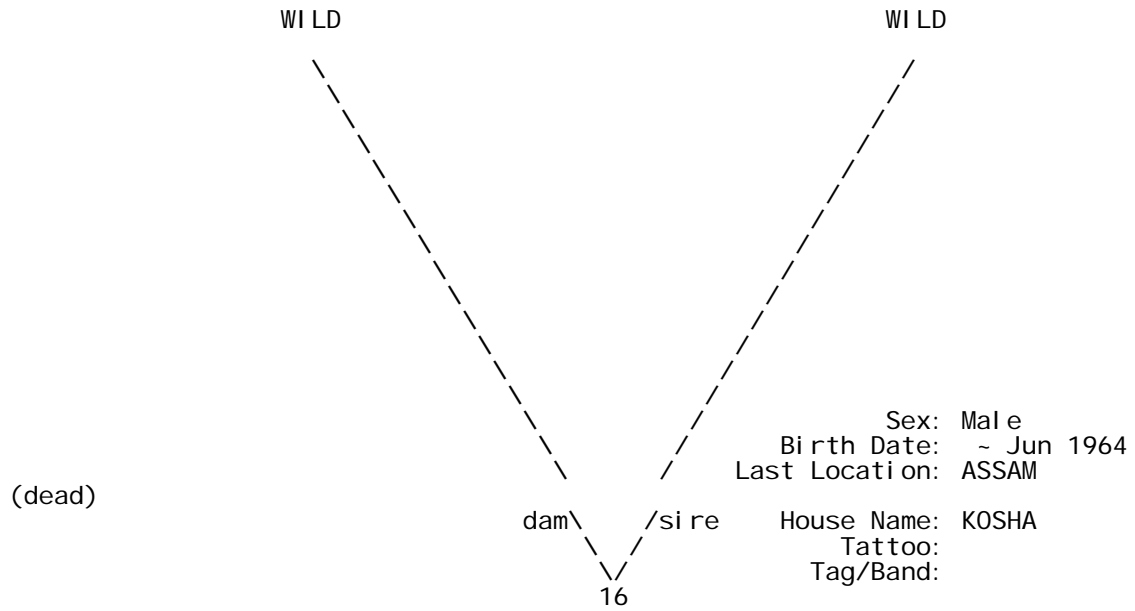
House Name: JAPARI

Tattoo:

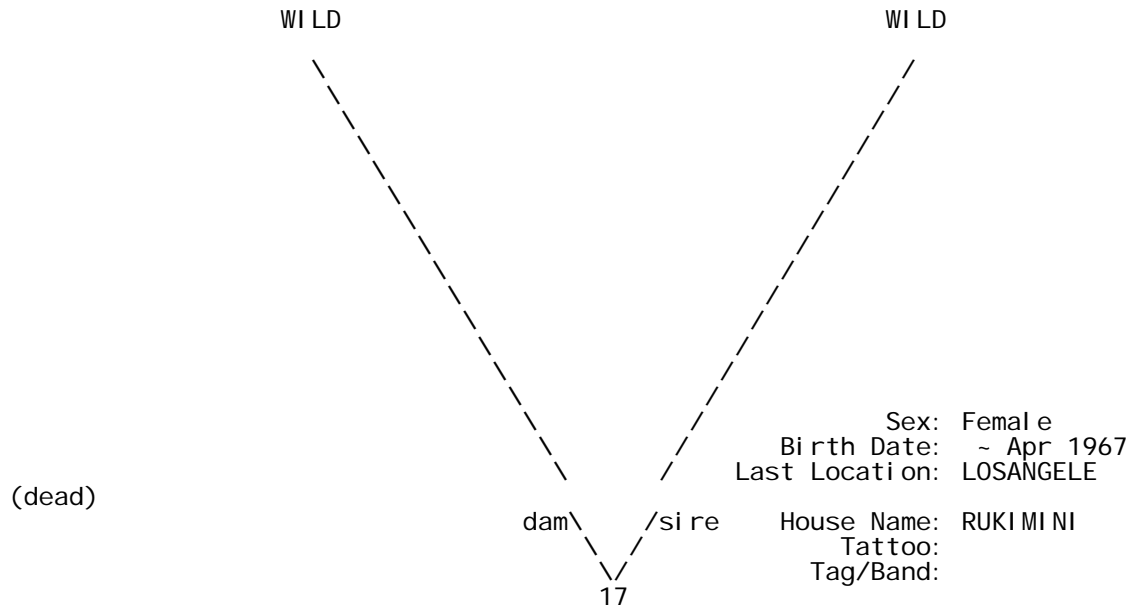
Tag/Band:

+ Wild-caught...

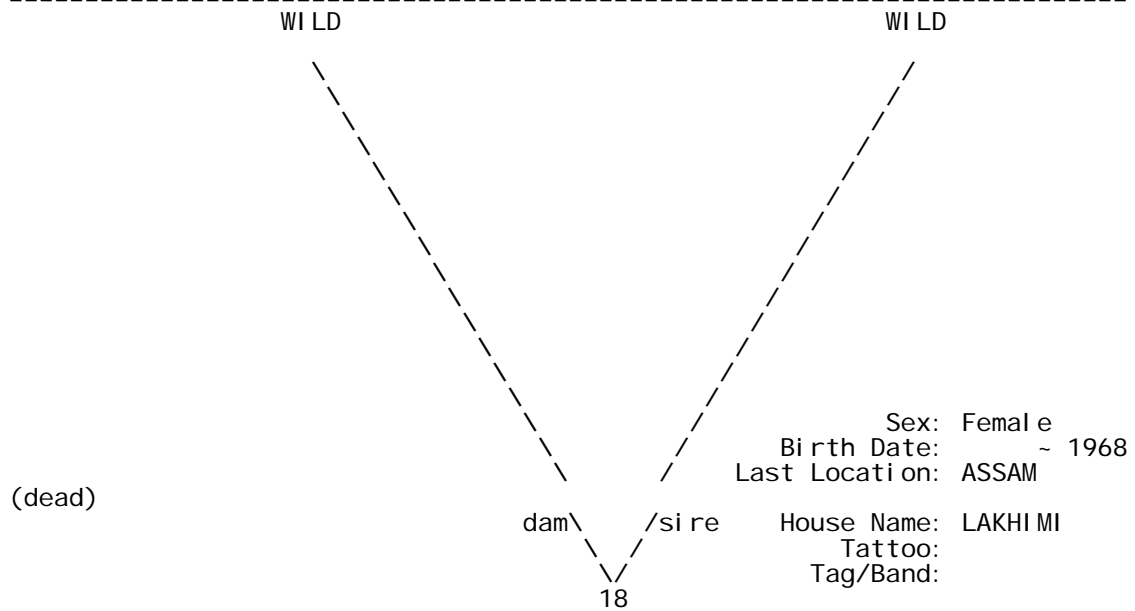
=====
Taxon Name: RHINOCEROS UNICORNIS Studbook Number: 16
=====



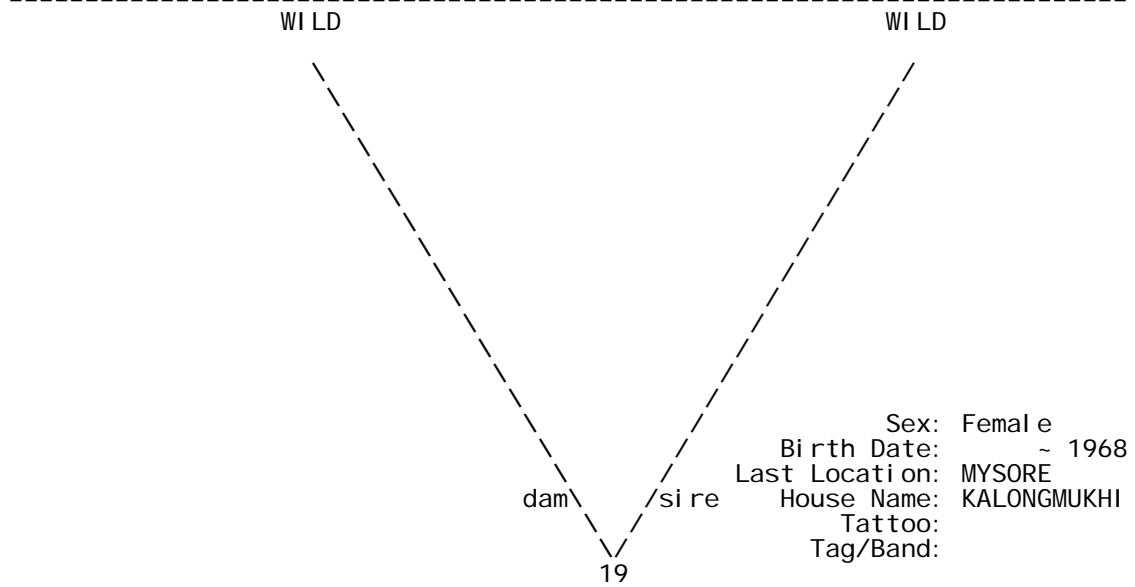
=====
Taxon Name: RHINOCEROS UNICORNIS Studbook Number: 17
=====



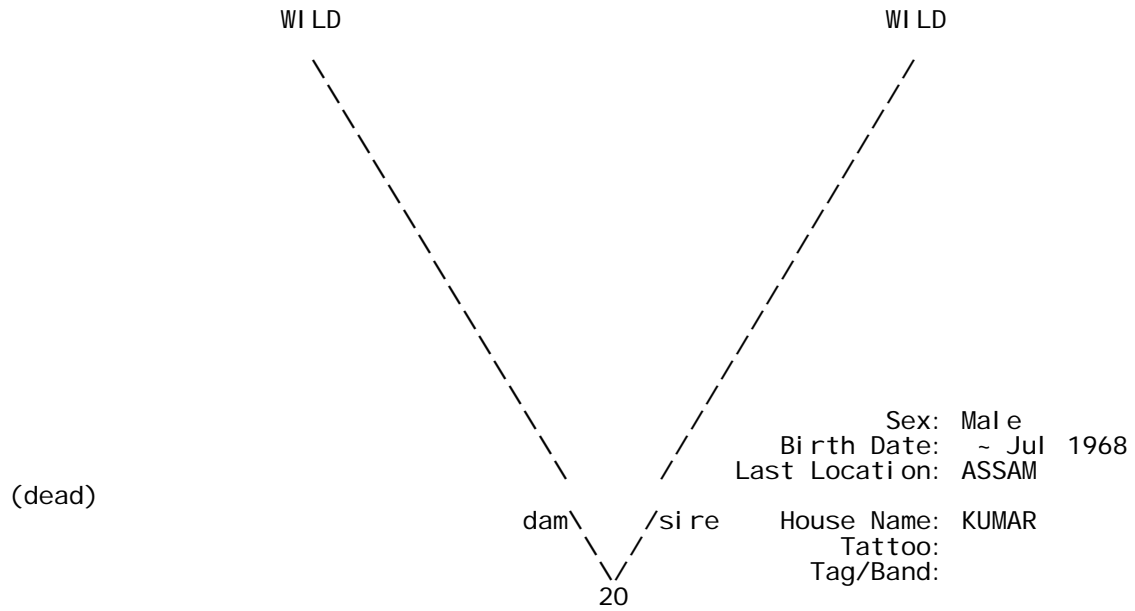
=====
Taxon Name: RHINOCEROS UNICORNIS Studbook Number: 18
=====



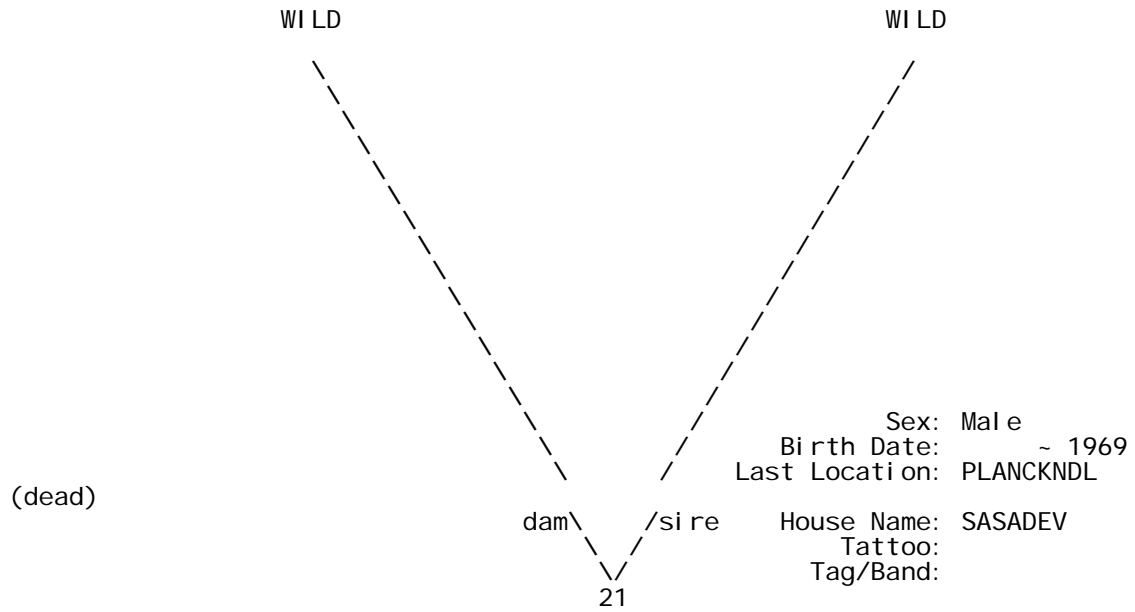
=====
Taxon Name: RHINOCEROS UNICORNIS Studbook Number: 19
=====



=====
Taxon Name: RHI NOCEROS UNI CORNI S Studbook Number: 20
=====



=====
Taxon Name: RHI NOCEROS UNI CORNI S Studbook Number: 21
=====



=====
Taxon Name: RHI NOCEROS UNI CORNI S Studbook Number: 22
=====

W I L D

W I L D

(dead)

dam\
22
/si re

Sex: Male
Birth Date: ~ 1969
Last Location: BROWNSVI L
House Name: SANTU
Tattoo:
Tag/Band:

=====
Taxon Name: RHI NOCEROS UNI CORNI S Studbook Number: 23
=====

W I L D

W I L D

(dead)

MEGHNAD/BI HUA

dam\
23
/si re

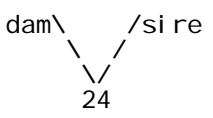
Sex: Male
Birth Date: ~ 1969
Last Location: CALCUTTA
House Name:
Tattoo:
Tag/Band:

=====
Taxon Name: RHI NOCEROS UNI CORNI S Studbook Number: 24
=====

W I L D

W I L D

(dead)



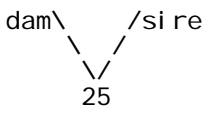
Sex: Male
Birth Date: ~ May 1969
Last Location: ASSAM
House Name: BHI SMA
Tattoo:
Tag/Band:

=====
Taxon Name: RHI NOCEROS UNI CORNI S Studbook Number: 25
=====

W I L D

W I L D

(dead)



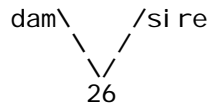
Sex: Female
Birth Date: 10 Jul 1969
Last Location: ASSAM
House Name: KUMARI
Tattoo:
Tag/Band:

=====
Taxon Name: RHI NOCEROS UNI CORNIS Studbook Number: 26
=====

WILD

WILD

(dead)



Sex: Male
Birth Date: ~ 1970
Last Location: DELHI

House Name: DABBU/AGNI
Tattoo:
Tag/Band:

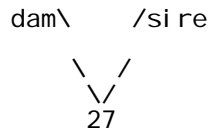
=====
Taxon Name: RHI NOCEROS UNI CORNIS Studbook Number: 27
=====

WILD

WILD

(dead)

SHAKUNTALA/SUND

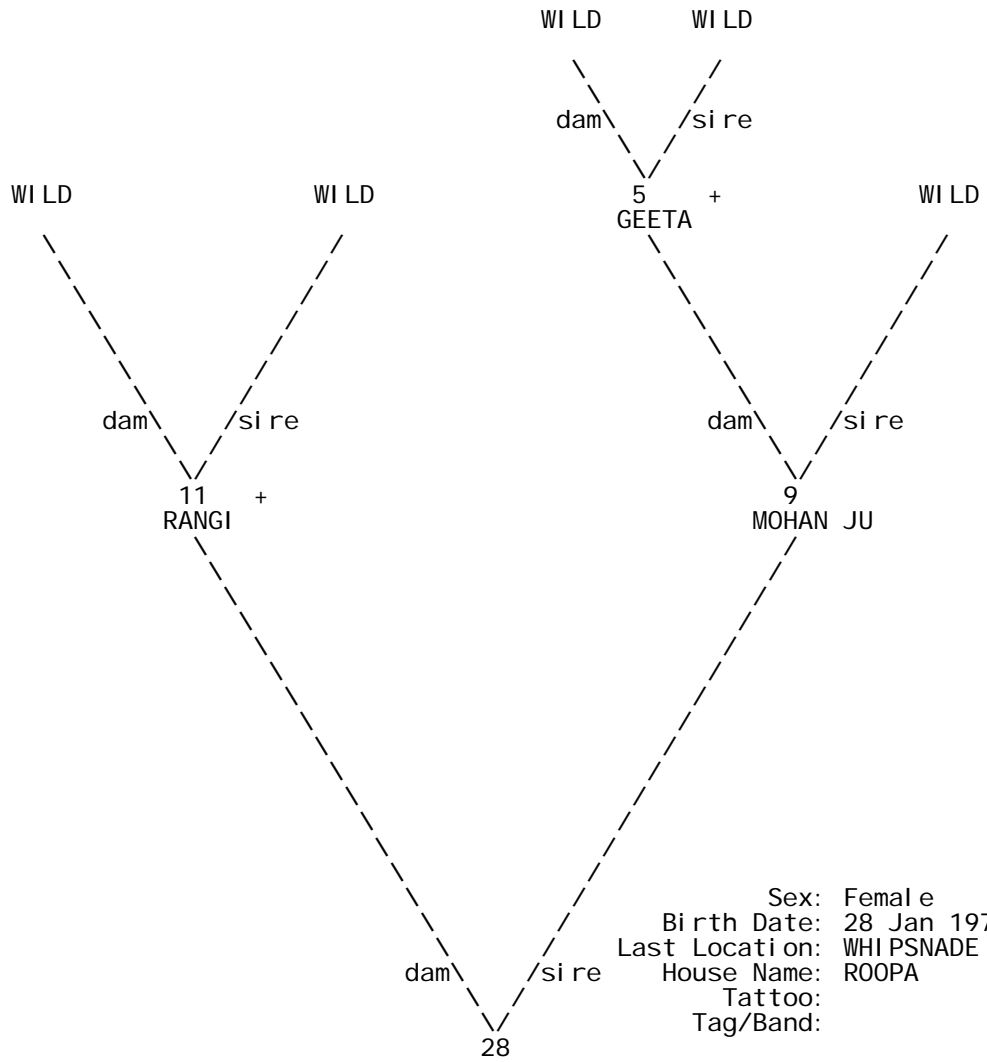


Sex: Female
Birth Date: ~ 1971
Last Location: CHATBIR Z

House Name:
Tattoo:
Tag/Band:

=====
Taxon Name: RHINOCEROS UNICORNIS
=====

=====
Studbook Number: 28
=====



Sex: Female
Birth Date: 28 Jan 1971
Last Location: WHI PSNADE
House Name: ROOPA
Tattoo:
Tag/Band:

+ Wild-caught...

=====
Taxon Name: RHINOCEROS UNICORNIS
=====

=====
Studbook Number: 29
=====

WILD

WILD

WILD

WILD

dam \

/ si re

dam \

/ si re

8

PADMI NI +

7

SHI VAJI +

dam \

/ si re

Sex: Male
Birth Date: 12 Sep 1971
Last Location: NAGOYA
House Name:

Tattoo:
Tag/Band:

29

KRISHNA/SAMBER

+ Wild-caught...

=====
Taxon Name: RHINOCEROS UNICORNIS
=====

=====
Studbook Number: 30
=====

WILD

WILD

WILD

WILD

dam

/sire

dam

/sire

13
PADMA

+

12
RAJKUMAR

+

(dead)

dam

/sire

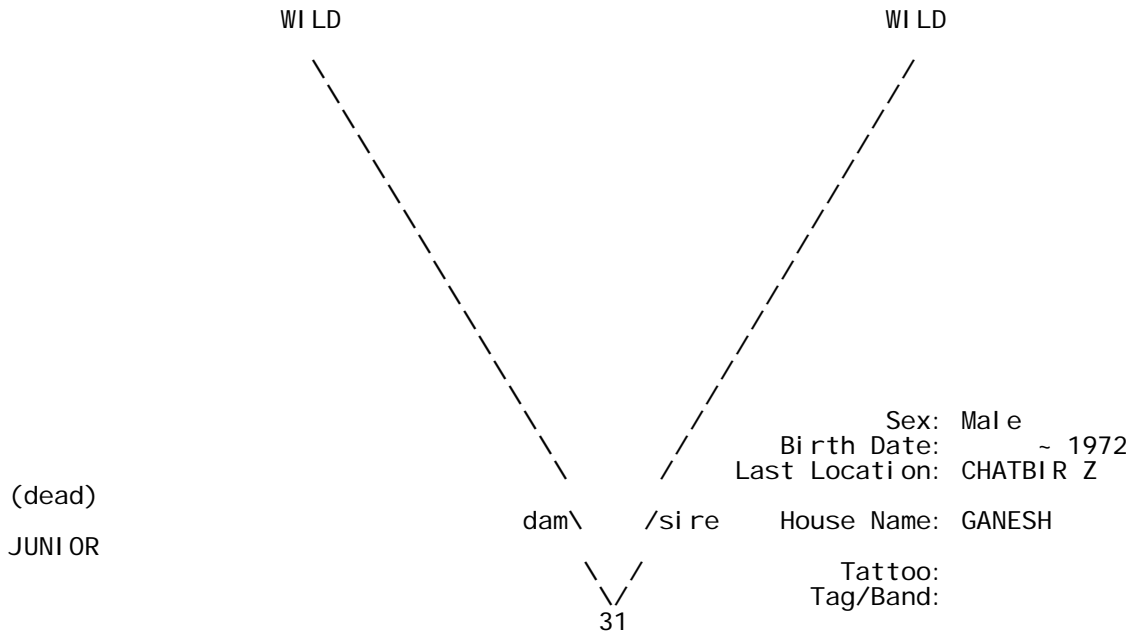
30

Sex: Male
Birth Date: 25 Nov 1971
Last Location: HYDERABAD

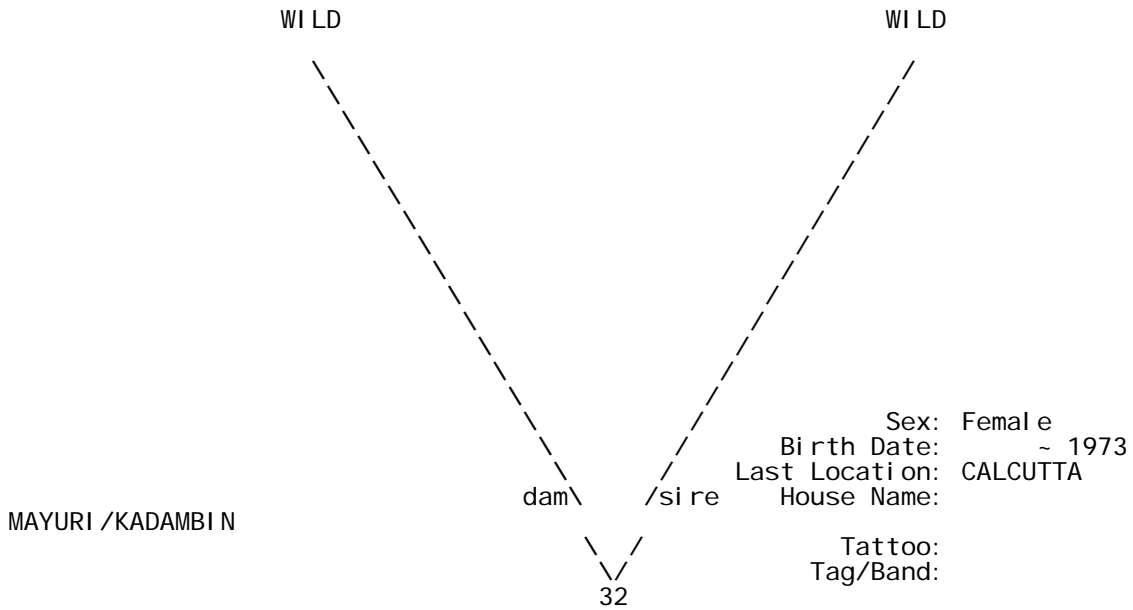
House Name: RAJESH
Tattoo:
Tag/Band:

+ Wild-caught...

=====
Taxon Name: RHI NOCEROS UNI CORNIS Studbook Number: 31
=====



=====
Taxon Name: RHI NOCEROS UNI CORNIS Studbook Number: 32
=====



=====

Taxon Name: RHI NOCEROS UNI CORNI S Studbook Number: 33

=====

W I L D

W I L D

MAYANGKUMARI

dam \

/ si re

Sex: Female
Birth Date: ~ Apr 1973
Last Location: NY BRONX
House Name:

Tattoo:
Tag/Band:

33

=====

Taxon Name: RHI NOCEROS UNI CORNI S Studbook Number: 34

=====

W I L D

W I L D

(dead)

dam \

/ si re

Sex: Female
Birth Date: ~ May 1973
Last Location: HYDERABAD

House Name: MAYUNG
Tattoo:
Tag/Band:

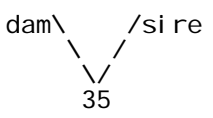
34

=====
Taxon Name: RHI NOCEROS UNI CORNI S Studbook Number: 35
=====

W I L D

W I L D

(dead)



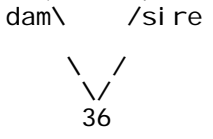
Sex: Female
Birth Date: 16 Jun 1973
Last Location: NY BRONX
House Name: RADHA
Tattoo:
Tag/Band:

=====
Taxon Name: RHI NOCEROS UNI CORNI S Studbook Number: 36
=====

W I L D

W I L D

CHI TRALEKHA/KAN



Sex: Female
Birth Date: ~ 1974
Last Location: RANCHI
House Name:
Tattoo:
Tag/Band:

=====
Taxon Name: RHINOCEROS UNICORNIS
=====

=====
Studbook Number: 37
=====

WILD

WILD

WILD

WILD

dam \

/ si re

dam \

/ si re

8

PADMI NI +

7

SHI VAJI +

(dead)

dam \

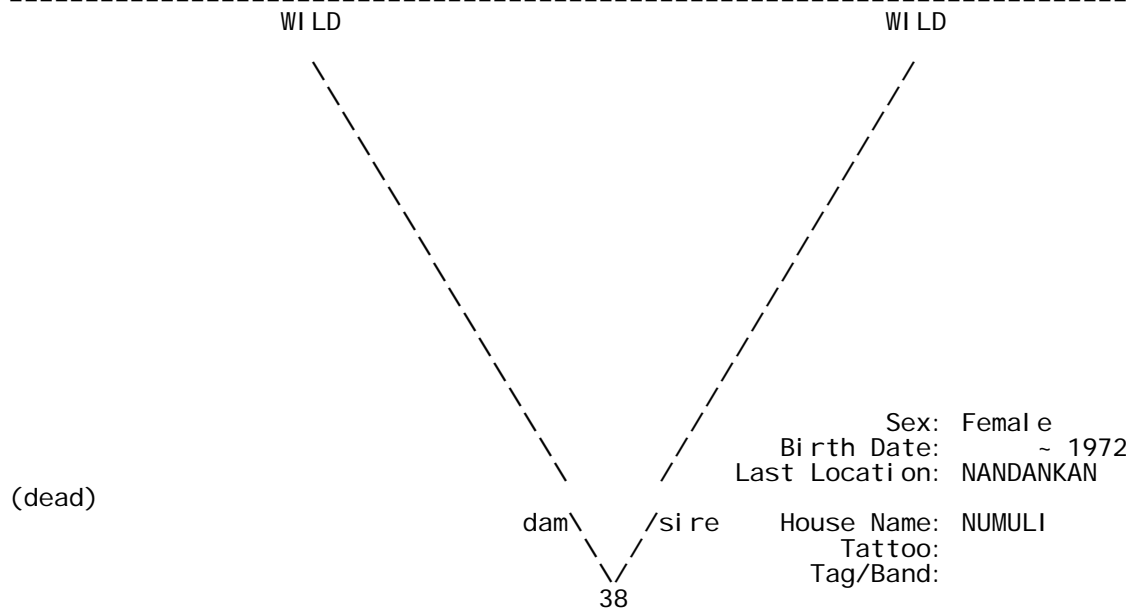
/ si re

37

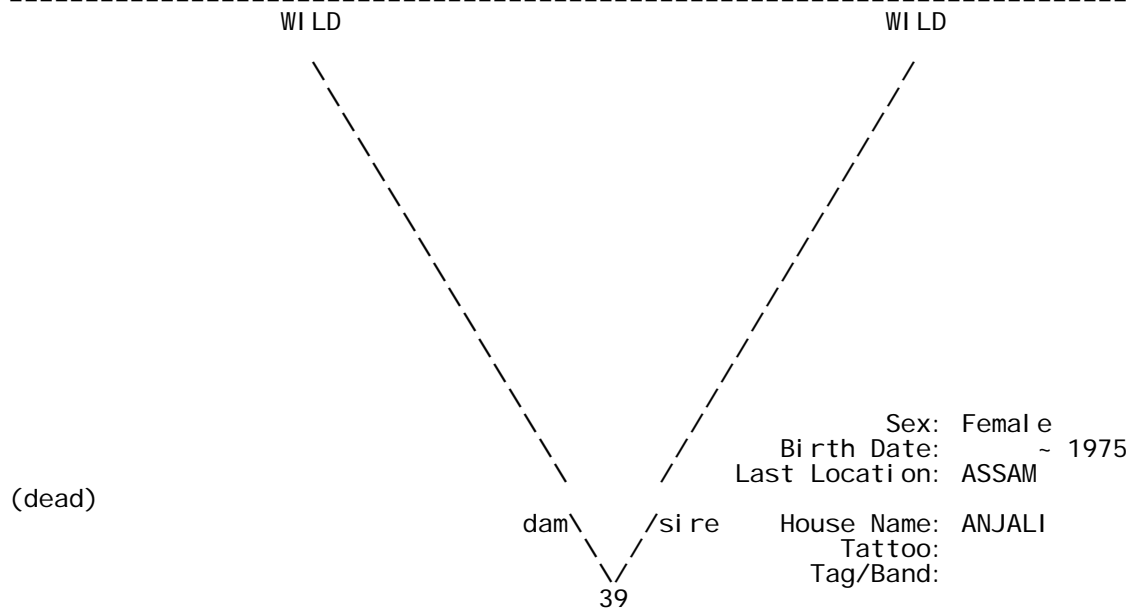
Sex: Male
Birth Date: 23 May 1974
Last Location: KANPUR
House Name: LACHIT
Tattoo:
Tag/Band:

+ Wild-caught...

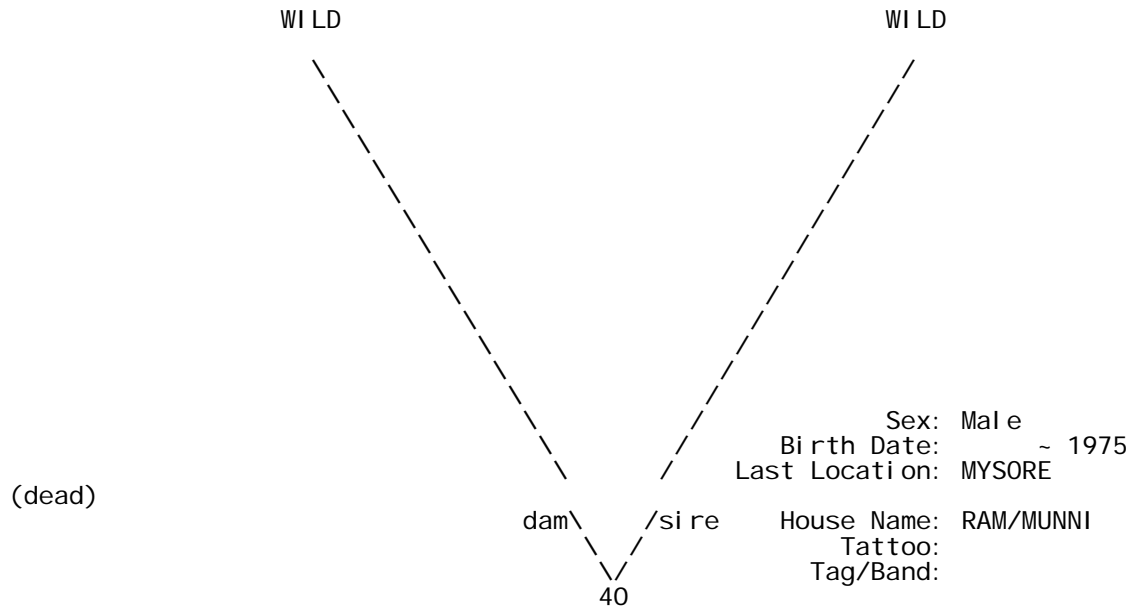
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Taxon Name: RHINOCEROS UNICORNIS Studbook Number: 38
=====



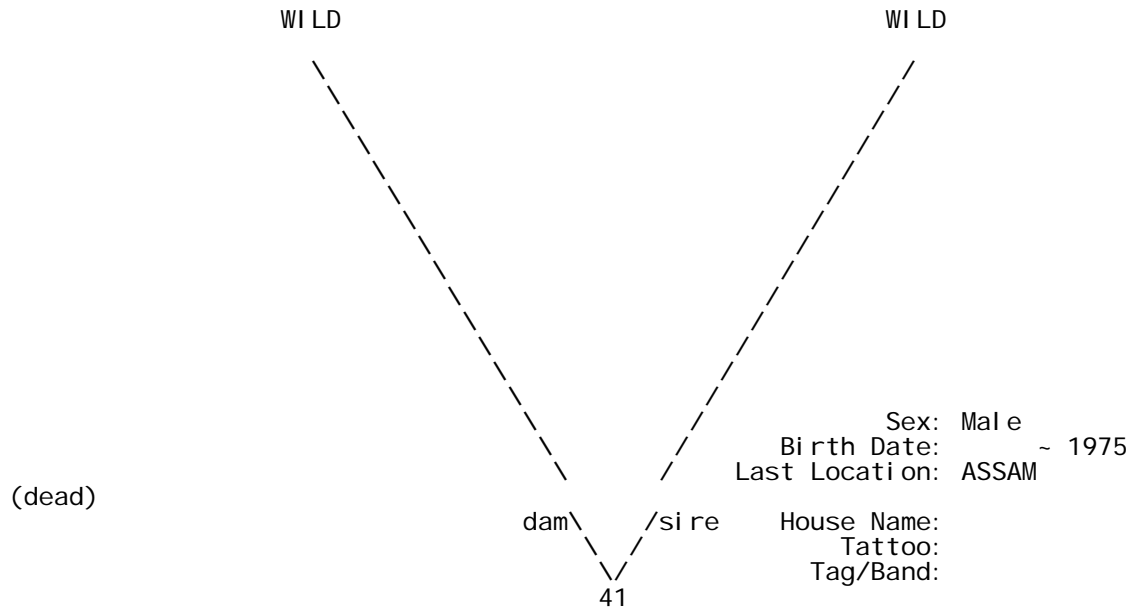
=====
Taxon Name: RHINOCEROS UNICORNIS Studbook Number: 39
=====



=====
Taxon Name: RHINOCEROS UNICORNIS Studbook Number: 40
=====



=====
Taxon Name: RHINOCEROS UNICORNIS Studbook Number: 41
=====



=====
Taxon Name: RHI NOCEROS UNI CORNI S Studbook Number: 42
=====

W I L D

W I L D

(dead)

dam\ /si re

42

Sex: Male
Birth Date: ~ May 1975
Last Location: ONTHE WAY

House Name: SHAYAM
Tattoo:
Tag/Band:

=====
Taxon Name: RHI NOCEROS UNI CORNI S Studbook Number: 43
=====

W I L D

W I L D

(dead)

BALRAM\GANESH

dam\ /si re

43

Sex: Male
Birth Date: 17 Oct 1975
Last Location: CHATBIR Z

House Name:
Tattoo:
Tag/Band:

=====
Taxon Name: RHI NOCEROS UNI CORNI S Studbook Number: 44
=====

W I L D

W I L D

dam \ / si re
44

Sex: Male
Birth Date: ~ 1976
Last Location: ASSAM
House Name: LAKSMAN
Tattoo:
Tag/Band:

=====
Taxon Name: RHI NOCEROS UNI CORNI S Studbook Number: 45
=====

W I L D

W I L D

dam \ / si re
45

Sex: Female
Birth Date: ~ Mar 1976
Last Location: LUCKNOW
House Name:
Tattoo:
Tag/Band:

(dead)

=====
Taxon Name: RHINOCEROS UNICORNIS
=====

=====
Studbook Number: 46
=====

WILD

WILD

(dead)

dam \ / si re
46

Sex: Male
Birth Date: 1 Nov 1976
Last Location: LUCKNOW

House Name: SANJAI
Tattoo:
Tag/Band:

=====
Taxon Name: RHINOCEROS UNICORNIS
=====

=====
Studbook Number: 47
=====

WILD

WILD

dam \ / si re
47

Sex: Male
Birth Date: ~ 1977
Last Location: NANDANKAN
House Name: NANDAN
Tattoo:
Tag/Band:

=====
Taxon Name: RHINOCEROS UNICORNIS
=====

=====
Studbook Number: 48
=====

WILD

WILD

(dead)

dam \ / si re

48

Sex: Male
Birth Date: ~ 1977
Last Location: ASSAM

House Name: KAMAL
Tattoo:
Tag/Band:

=====
Taxon Name: RHINOCEROS UNICORNIS
=====

=====
Studbook Number: 49
=====

WILD

WILD

KANCHA\BIJOY

dam \ / si re

49

Sex: Male
Birth Date: ~ Apr 1977
Last Location: PATNA
House Name:

Tattoo:
Tag/Band:

=====
Taxon Name: RHINOCEROS UNICORNIS
=====

=====
Studbook Number: 50
=====

WILD

WILD

WILD

WILD

dam \

/ si re

dam \

/ si re

8

PADMI NI +

7

SHI VAJI +

(dead)

dam \

/ si re

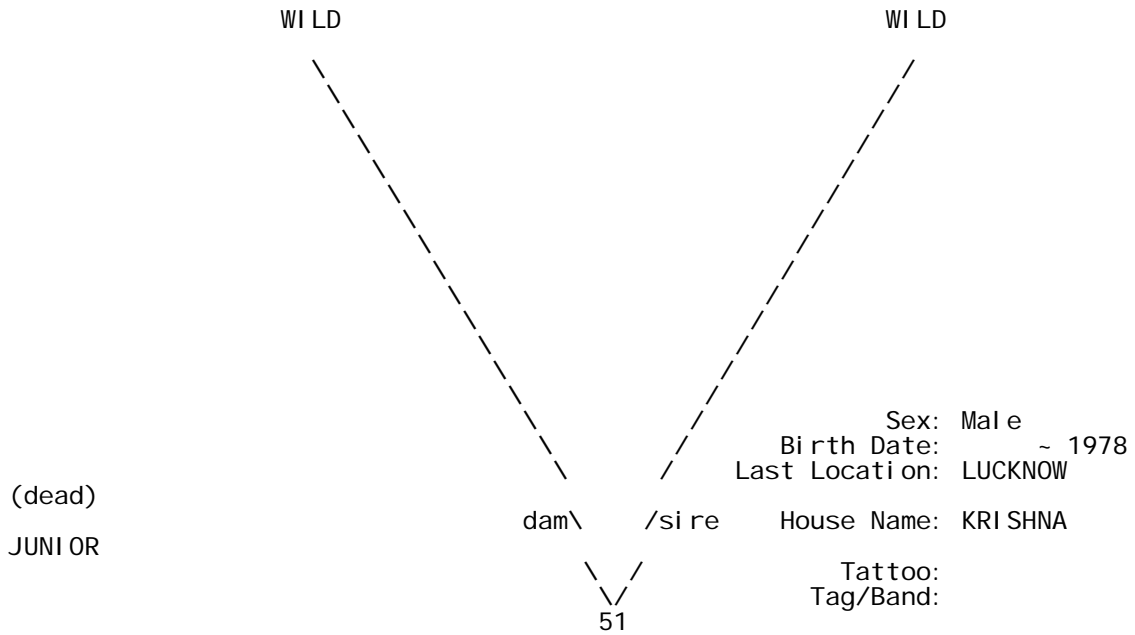
50

Sex: Female
Birth Date: 9 Jan 1978
Last Location: ASSAM

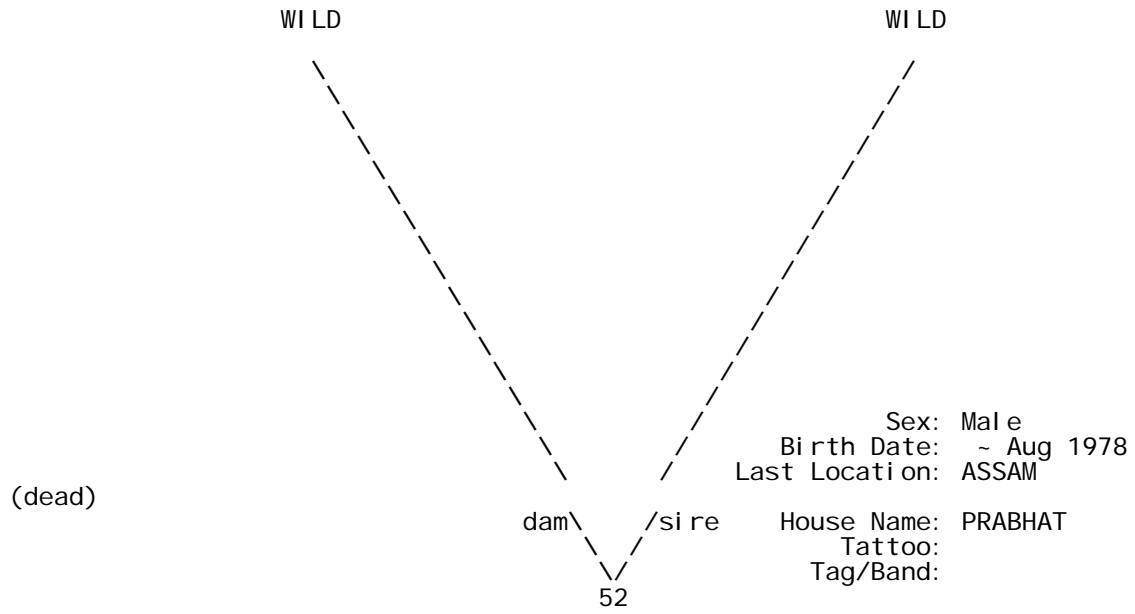
House Name: GEETA/LAXMI
Tattoo:
Tag/Band:

+ Wild-caught...

=====
Taxon Name: RHINOCEROS UNICORNIS Studbook Number: 51
=====



=====
Taxon Name: RHINOCEROS UNICORNIS Studbook Number: 52
=====



=====
Taxon Name: RHINOCEROS UNICORNIS
=====

=====
Studbook Number: 53
=====

WILD

WILD

WILD

WILD

dam \

/ si re

dam \

/ si re

13 +
PADMA

12 +
RAJKUMAR

(dead)

dam \

/ si re

53

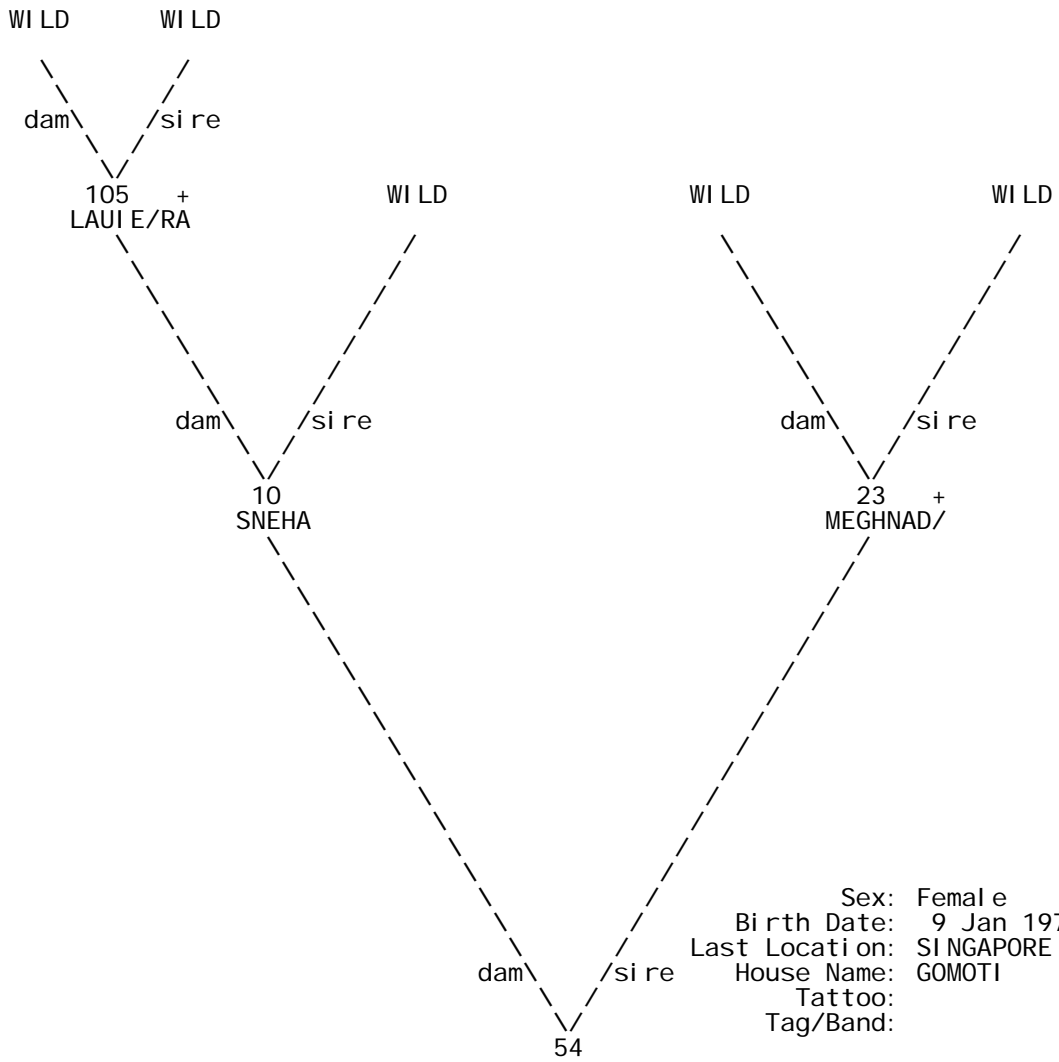
Sex: Male
Birth Date: 12 Nov 1978
Last Location: HYDERABAD

House Name: LADDU/VEERU
Tattoo:
Tag/Band:

+ Wild-caught...

=====
Taxon Name: RHINOCEROS UNICORNIS
=====

Studbook Number: 54
=====



Sex: Female
Birth Date: 9 Jan 1979
Last Location: SINGAPORE
House Name: GOMOTI
Tattoo:
Tag/Band:

+ Wild-caught...

=====
Taxon Name: RHINOCEROS UNICORNIS
=====

=====
Studbook Number: 55
=====

WILD

WILD

dam

sire

55

Sex: Male
Birth Date: ~ Mar 1978
Last Location: VEERMATA
House Name: SHIVA
Tattoo:
Tag/Band:

=====
Taxon Name: RHINOCEROS UNICORNIS
=====

=====
Studbook Number: 56
=====

WILD

WILD

WILD

WILD

dam \

/ si re

dam \

/ si re

27 +
SHAKUNTA

43 +
BALRAM\G

(dead)

dam \

/ si re

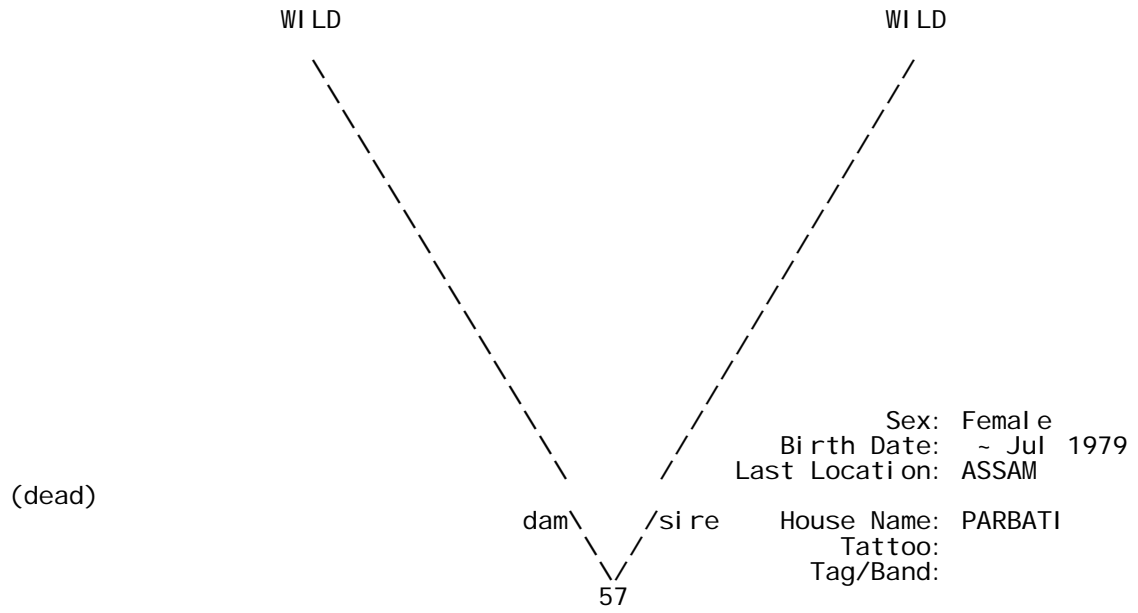
56

Sex: Female
Birth Date: 9 Mar 1979
Last Location: CHATBIR Z

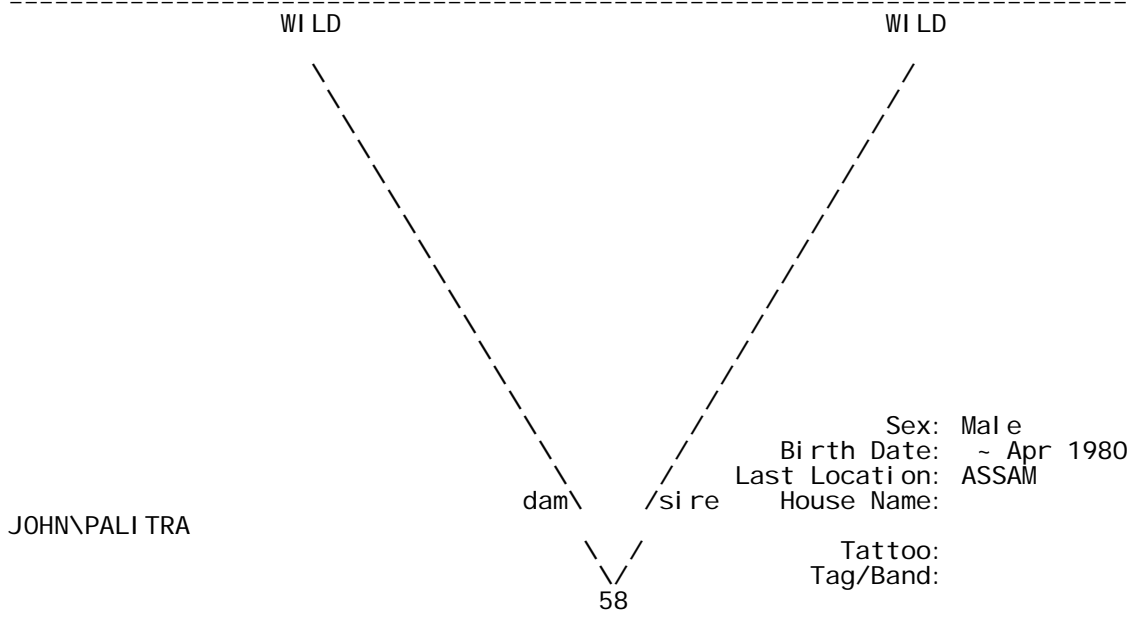
House Name:
Tattoo:
Tag/Band:

+ Wild-caught...

=====
Taxon Name: RHI NOCEROS UNI CORNI S Studbook Number: 57
=====



=====
Taxon Name: RHI NOCEROS UNI CORNI S Studbook Number: 58
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=====

Taxon Name: RHINOCEROS UNICORNIS

=====

Studbook Number: 59

=====

WILD

WILD

(dead)

dam \ / si re
59

Sex: Male
Birth Date: ~ May 1980
Last Location: MADRAS

House Name: RAMU SENIOR
Tattoo:
Tag/Band:

=====

Taxon Name: RHINOCEROS UNICORNIS

=====

Studbook Number: 60

=====

WILD

WILD

(dead)

dam \ / si re
60

Sex: Female
Birth Date: ~ ~ 1980
Last Location: ASSAM

House Name: GINI \ TARALI
Tattoo:
Tag/Band:

=====
Taxon Name: RHINOCEROS UNICORNIS
=====

=====
Studbook Number: 61
=====

WILD

WILD

WILD

WILD

dam \

/ si re

dam \

/ si re

27 +
SHAKUNTA

43 +
BALRAM\G

(dead)

dam \

/ si re

61

Sex: Female
Birth Date: 13 Nov 1980
Last Location: DELHI

House Name:
Tattoo:
Tag/Band:

+ Wild-caught...

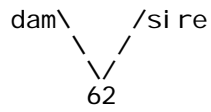
=====
Taxon Name: RHINOCEROS UNICORNIS
=====

=====
Studbook Number: 62
=====

WILD

WILD

(dead)



Sex: Male
Birth Date: ~ 1981
Last Location: PATNA
House Name: RAJU
Tattoo:
Tag/Band:

=====
Taxon Name: RHINOCEROS UNICORNIS
=====

=====
Studbook Number: 63
=====

WILD

WILD

WILD

WILD

dam \

/ si re

dam \

/ si re

13 +
PADMA

12 +
RAJKUMAR

(dead)

dam \

/ si re

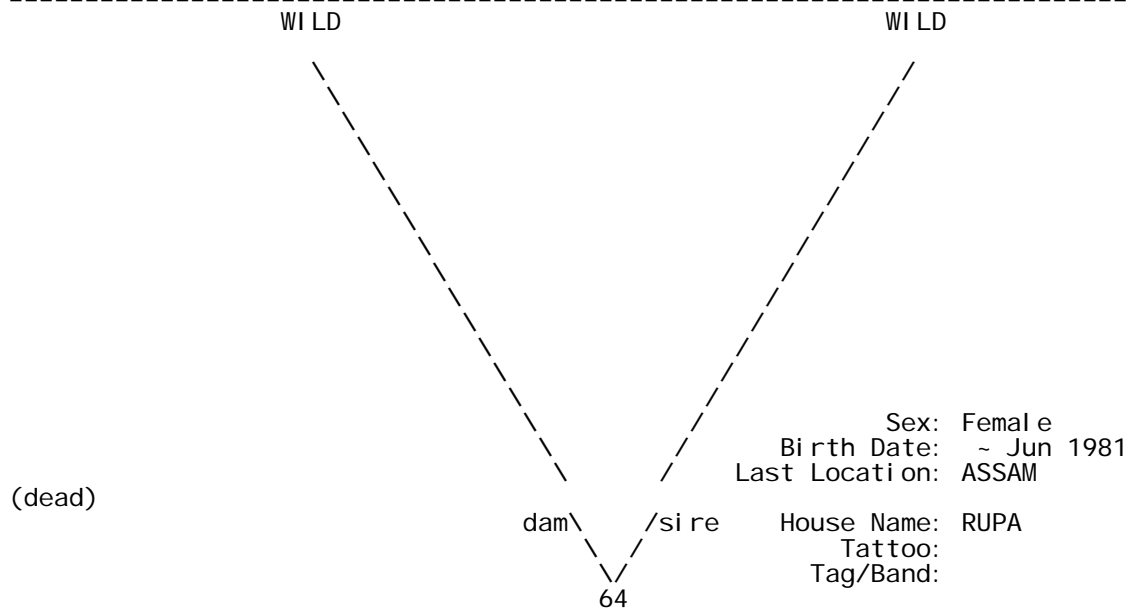
63

Sex: Male
Birth Date: 15 May 1981
Last Location: HYDERABAD

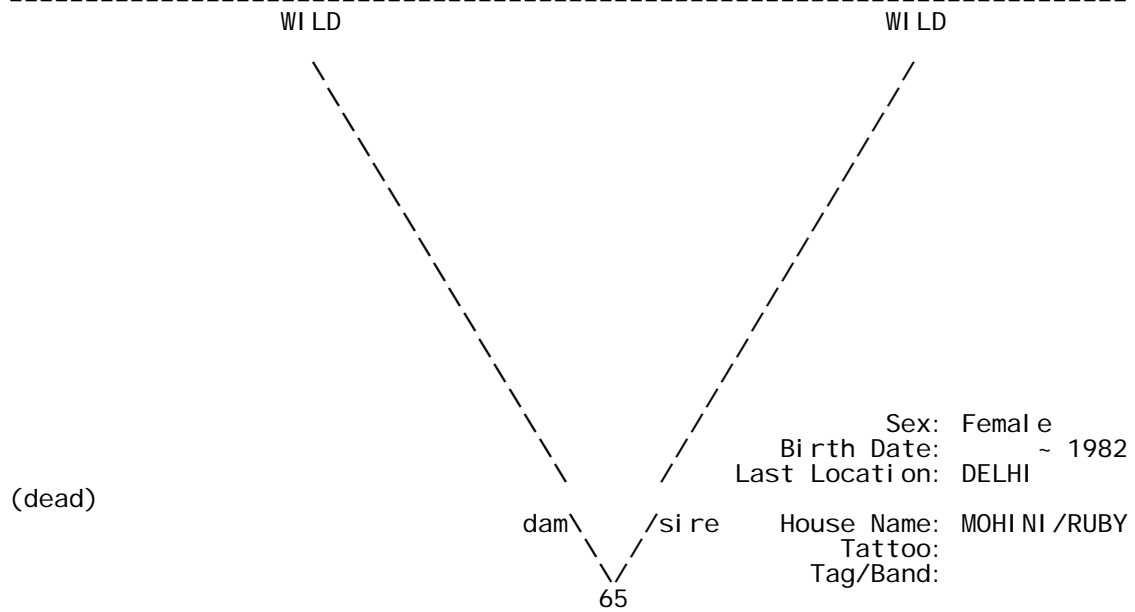
House Name: SRINIVAS
Tattoo:
Tag/Band:

+ Wild-caught...

=====
Taxon Name: RHINOCEROS UNICORNIS Studbook Number: 64
=====



=====
Taxon Name: RHINOCEROS UNICORNIS Studbook Number: 65
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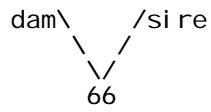
=====
Taxon Name: RHINOCEROS UNICORNIS
=====

=====
Studbook Number: 66
=====

WILD

WILD

(dead)



Sex: Female
Birth Date: ~ Apr 1982
Last Location: ASSAM
House Name: DALIMI
Tattoo:
Tag/Band:

=====
Taxon Name: RHINOCEROS UNICORNIS
=====

=====
Studbook Number: 67
=====

WILD

WILD

WILD

WILD

dam\

/si re

dam\

/si re

8

PADMI NI +

7

SHI VAJI +

(dead)

JUNIOR

dam\

/si re

Sex: Male
Birth Date: 9 Jun 1982
Last Location: ASSAM

House Name: SHYAM

Tattoo:
Tag/Band:

67

+ Wild-caught...

=====
Taxon Name: RHI NOCEROS UNI CORNI S
=====

=====
Studbook Number: 68
=====

W I L D

W I L D

W I L D

W I L D

/

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/

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/si re

dam\
8

/si re
+

dam\
7

+

W I L D

W I L D

PADMI NI

SHI VAJI

dam\
34

/si re
+

MAYUNG

dam\
37

/si re
+

LACHI T

(dead)

RASHMI /SAWAKO

dam\
68

/si re
+

68

Sex: Female
Birth Date: 1 Oct 1982
Last Location: YOKOHAMA

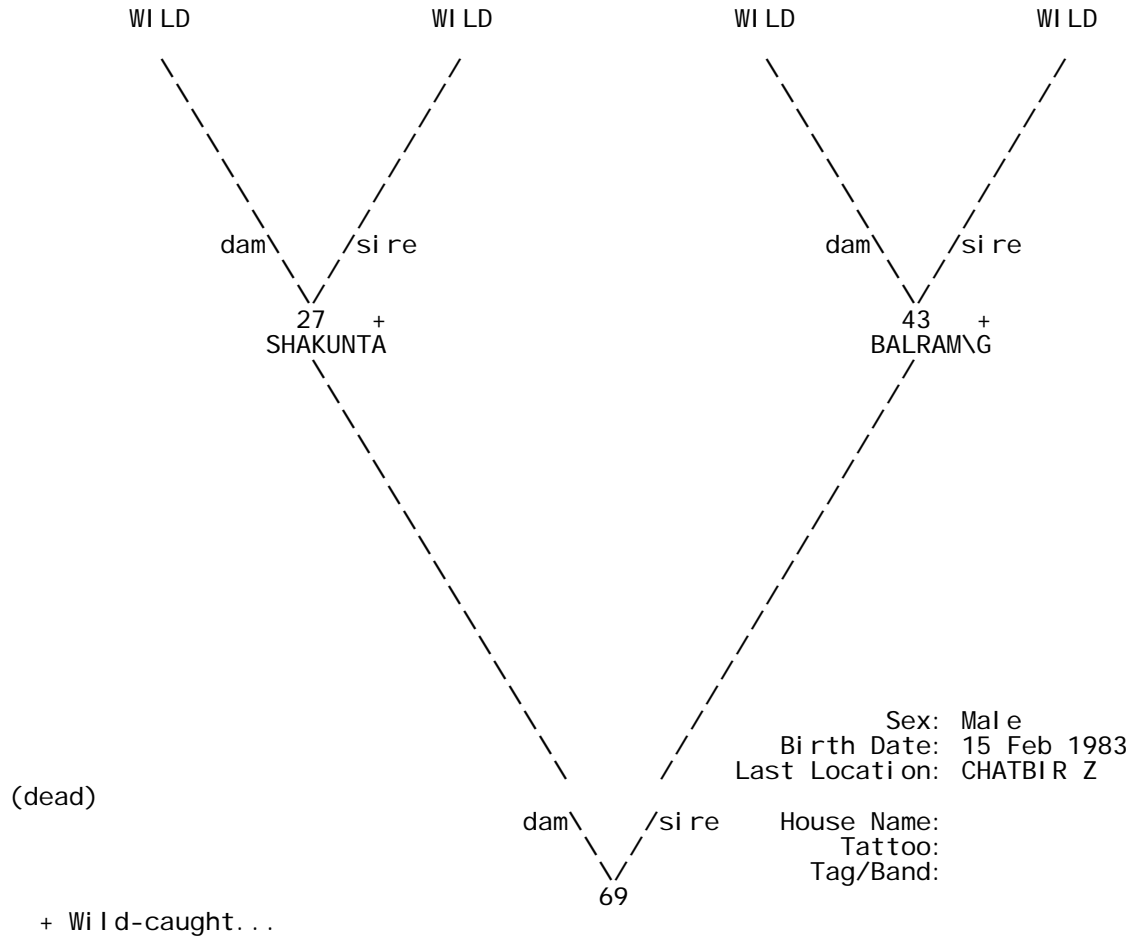
House Name:

Tattoo:
Tag/Band:

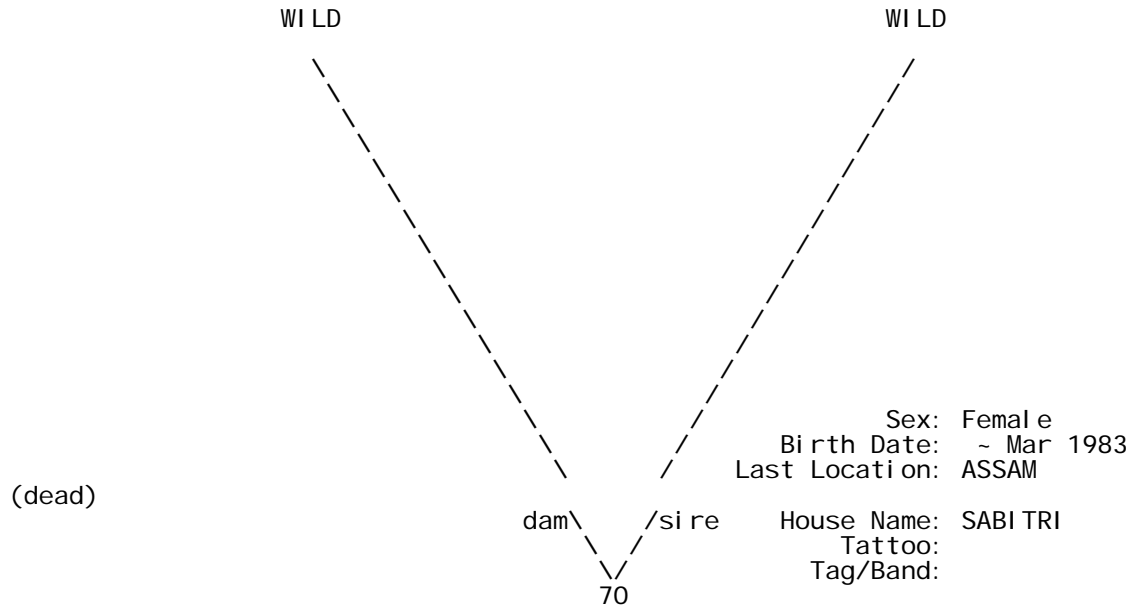
+ Wild-caught...

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Taxon Name: RHI NOCEROS UNI CORN I S
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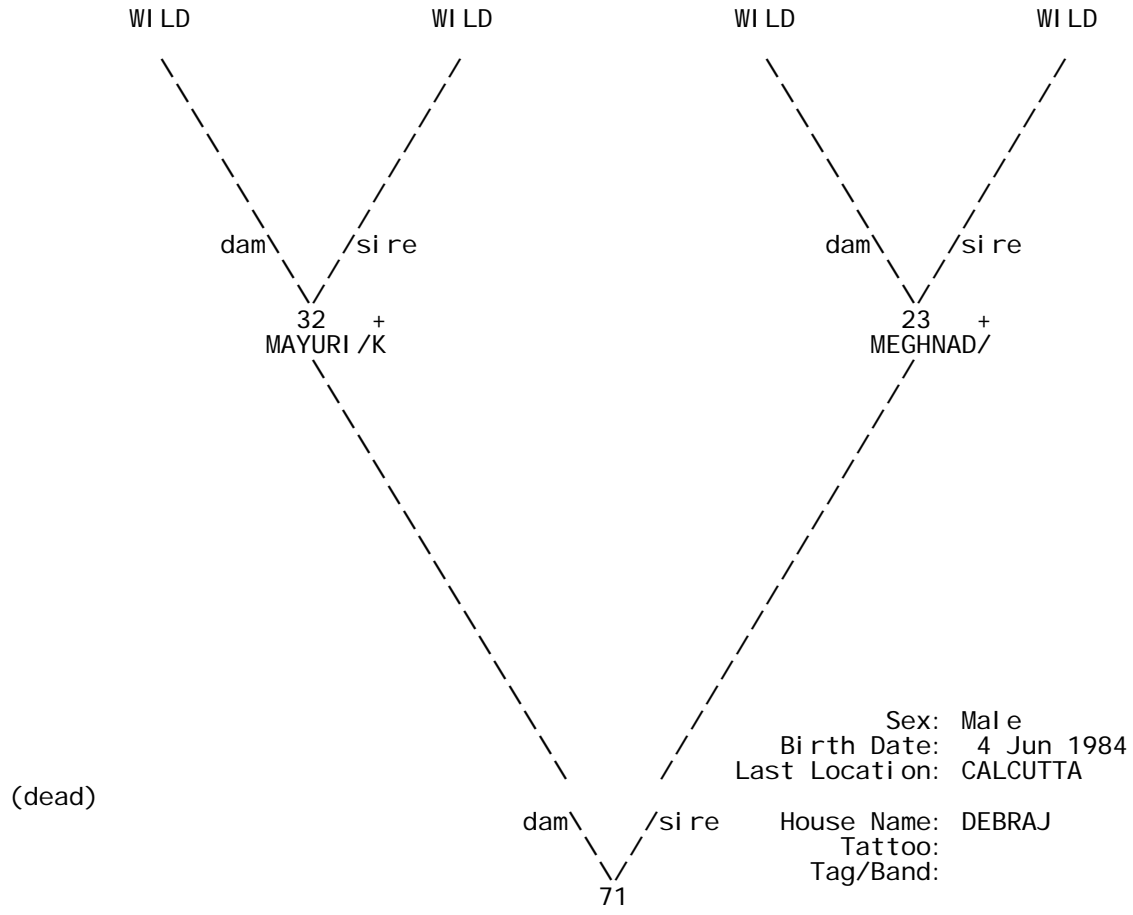
Studbook Number: 69



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Taxon Name: RHI NOCEROS UNI CORNIS Studbook Number: 70
=====
===

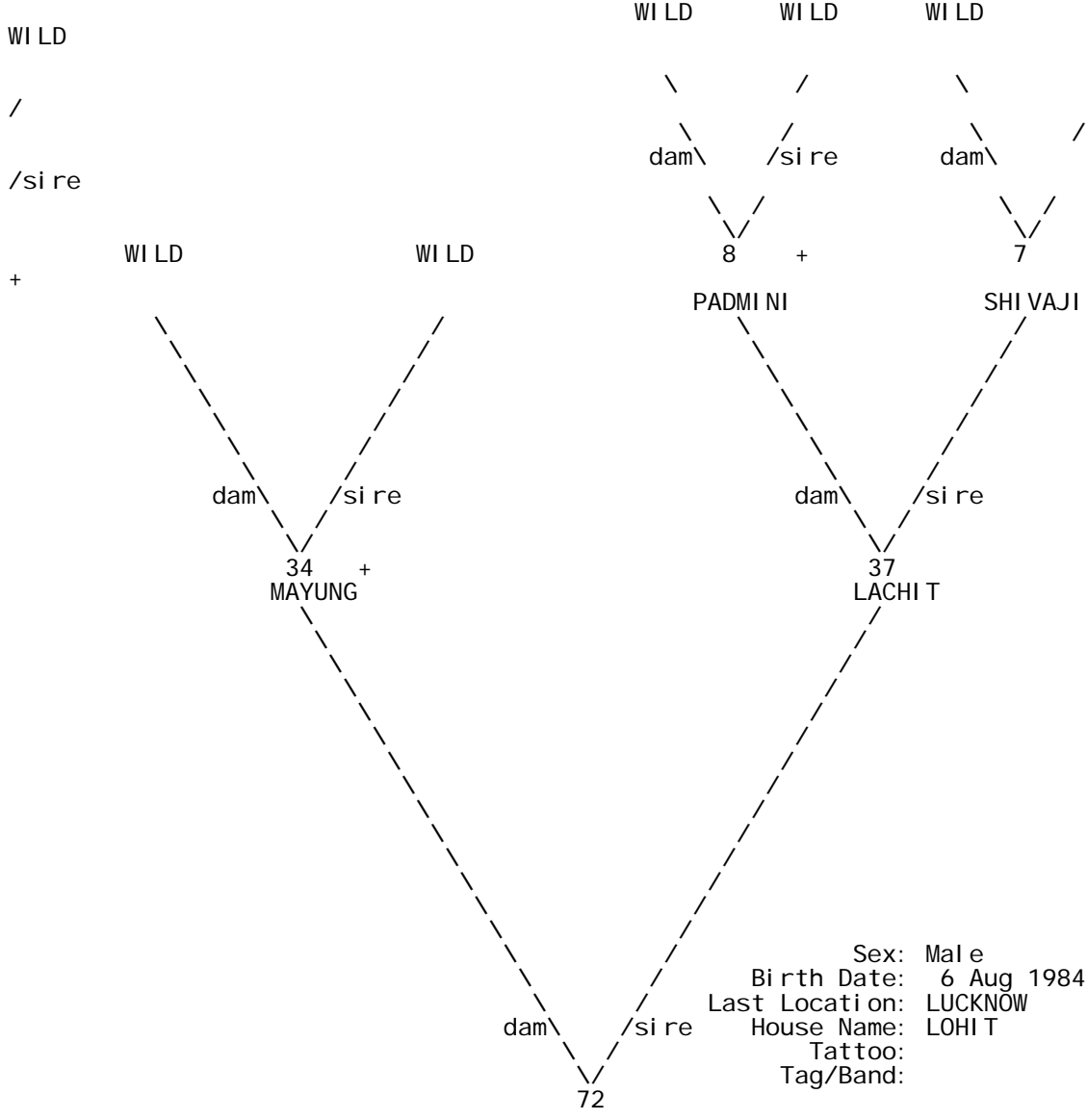


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 Taxon Name: RHI NOCEROS UNI CORNIS Studbook Number: 71
 =====



+ Wild-caught...

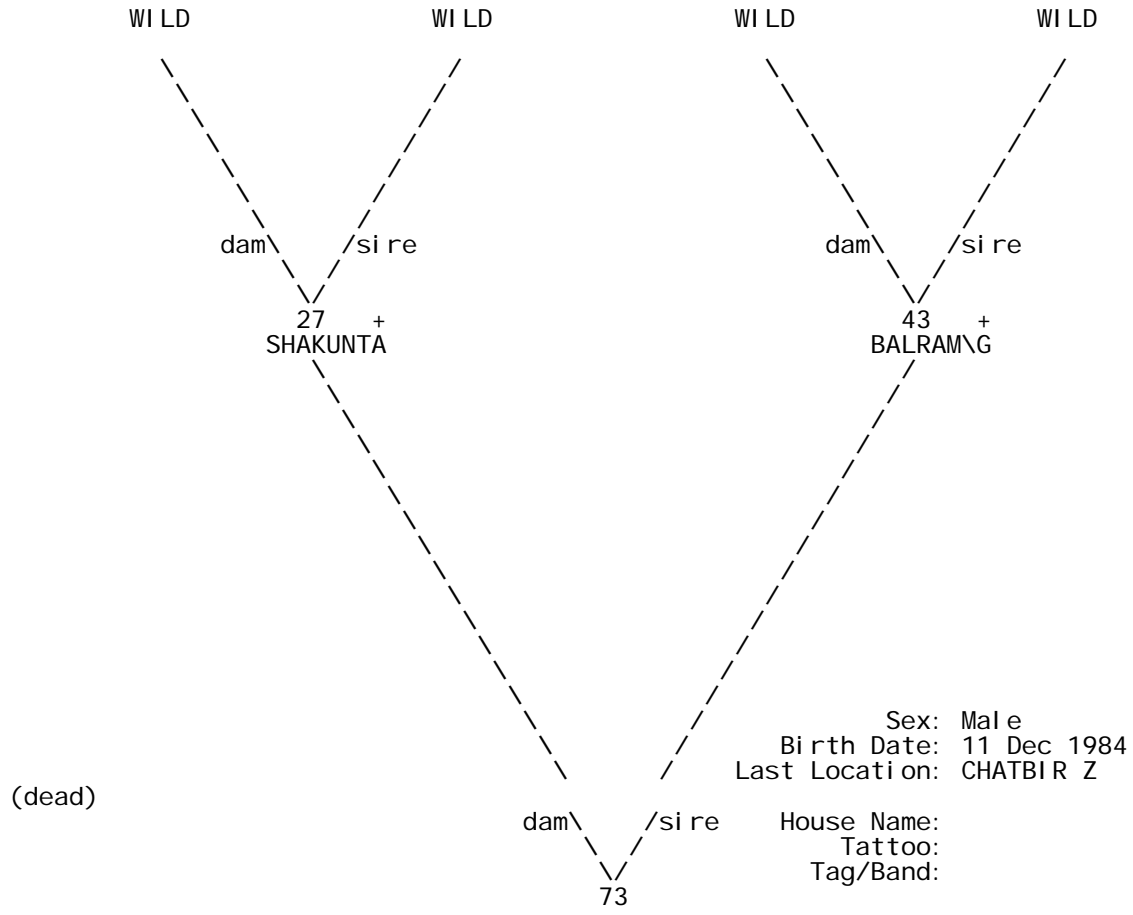
=====
 ===
 Taxon Name: RHI NOCEROS UNI CORNIS Studbook Number: 72
 =====
 ===



Sex: Male
 Birth Date: 6 Aug 1984
 Last Location: LUCKNOW
 House Name: LOHIT
 Tattoo:
 Tag/Band:

+ Wild-caught...

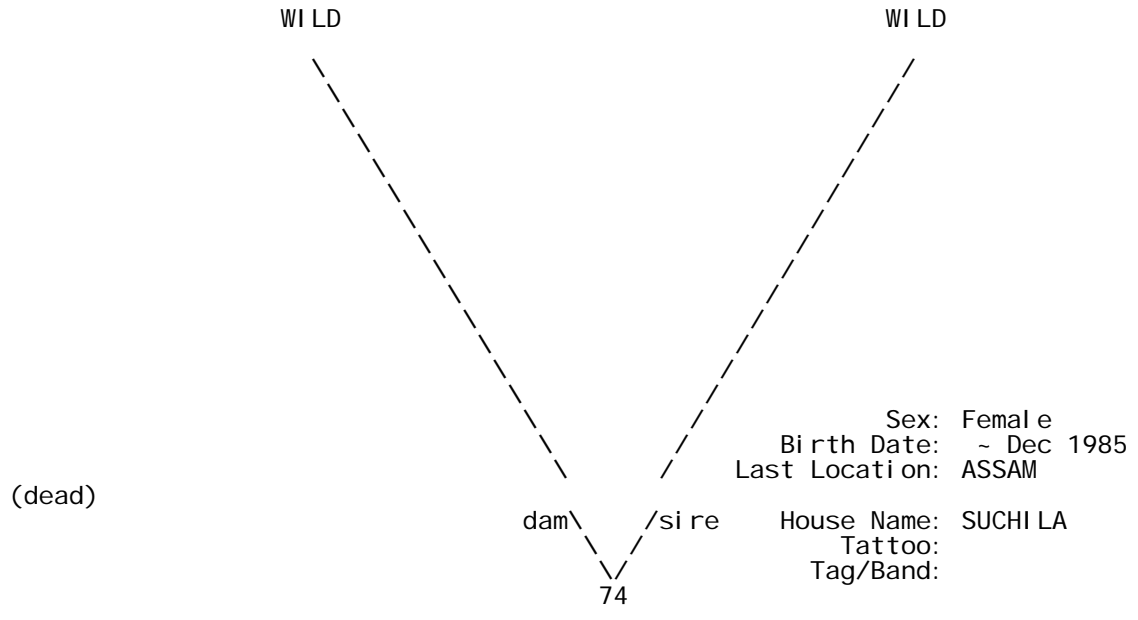
=====
 ===
 Taxon Name: RHI NOCEROS UNI CORNIS Studbook Number: 73
 =====



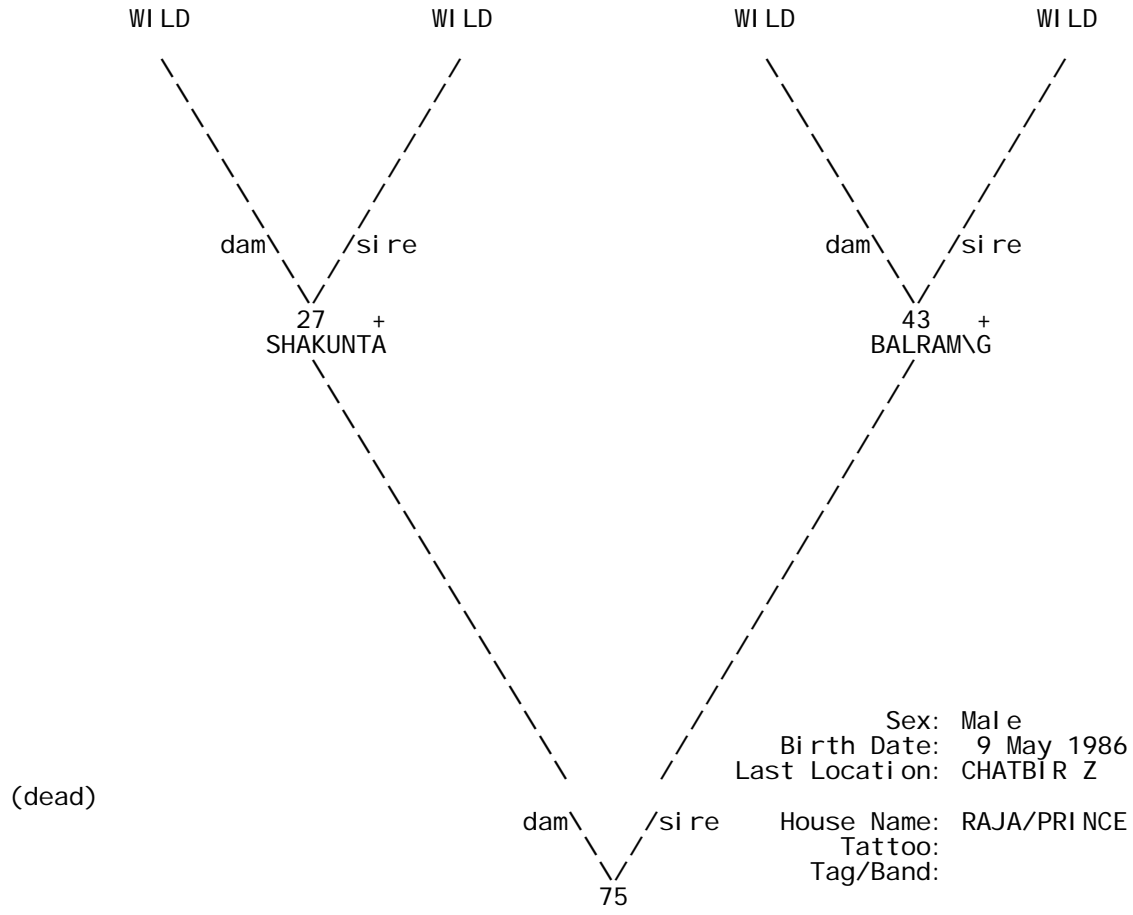
Sex: Male
 Birth Date: 11 Dec 1984
 Last Location: CHATBIR Z
 House Name:
 Tattoo:
 Tag/Band:

+ Wild-caught...

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Taxon Name: RHINOCEROS UNICORNIS Studbook Number: 74
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 Taxon Name: RHI NOCEROS UNI CORNIS Studbook Number: 75
 =====

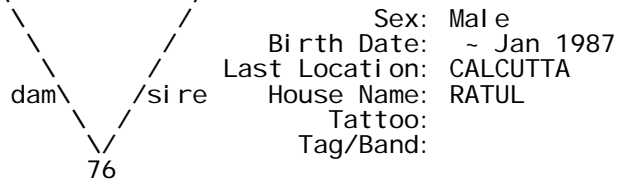


+ Wild-caught...

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===
Taxon Name: RHI NOCEROS UNI CORNIS Studbook Number: 76
=====
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WILD

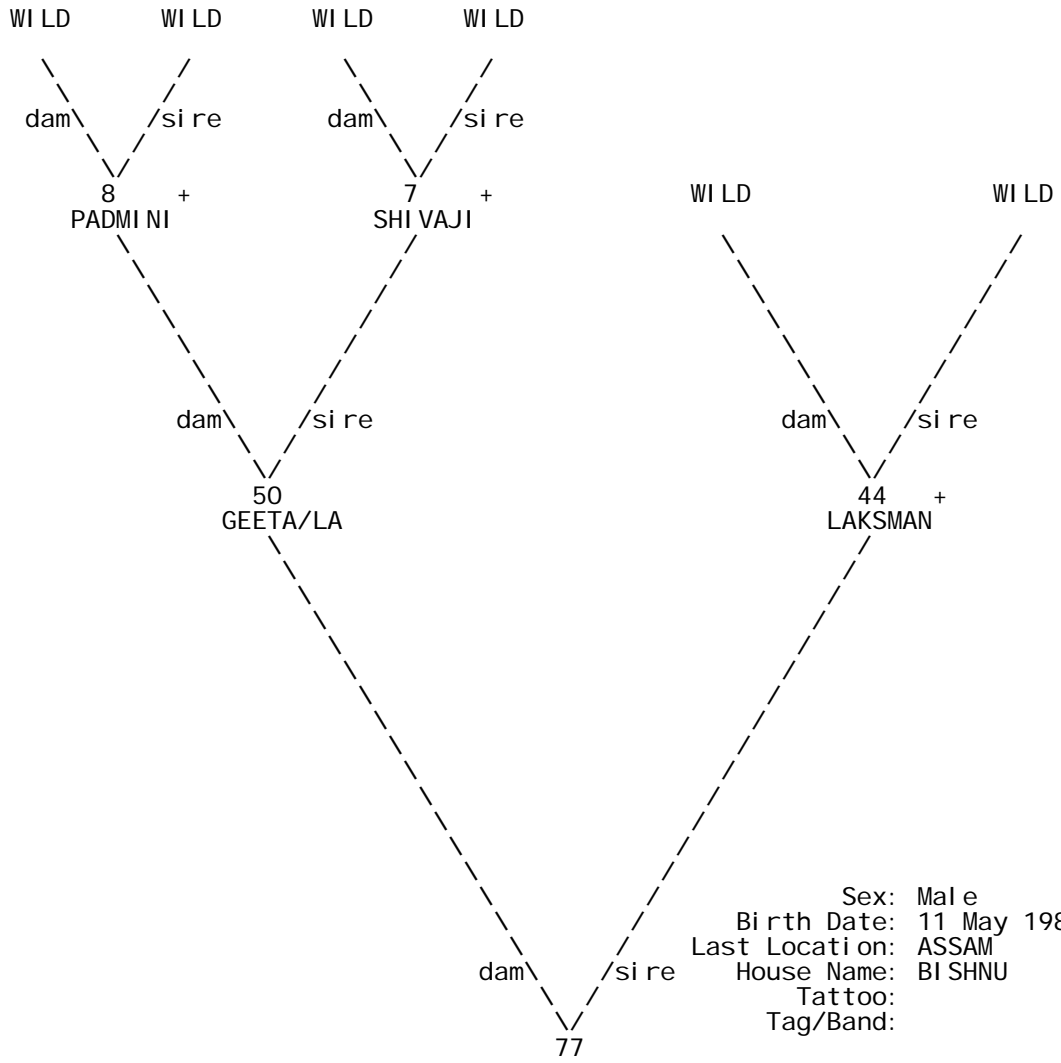
WILD



Sex: Male
Birth Date: ~ Jan 1987
Last Location: CALCUTTA
House Name: RATUL
Tattoo:
Tag/Band:

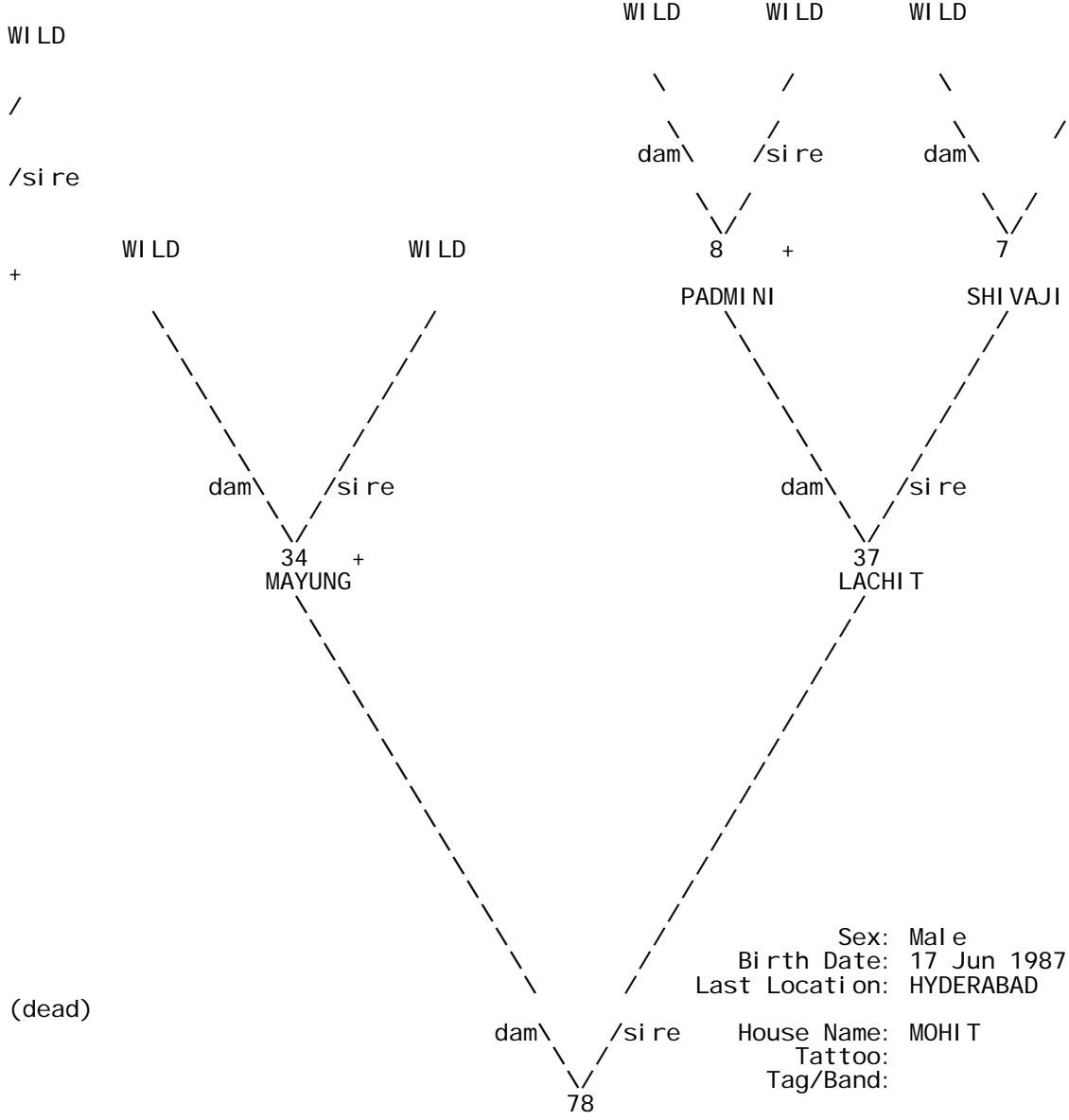
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Taxon Name: RHI NOCEROS UNI CORNI S
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===

Studbook Number: 77



+ Wild-caught...

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 Taxon Name: RHI NOCEROS UNI CORNIS Studbook Number: 78
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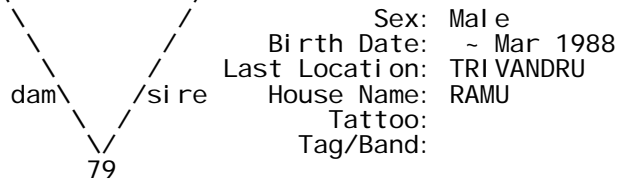


+ Wild-caught...

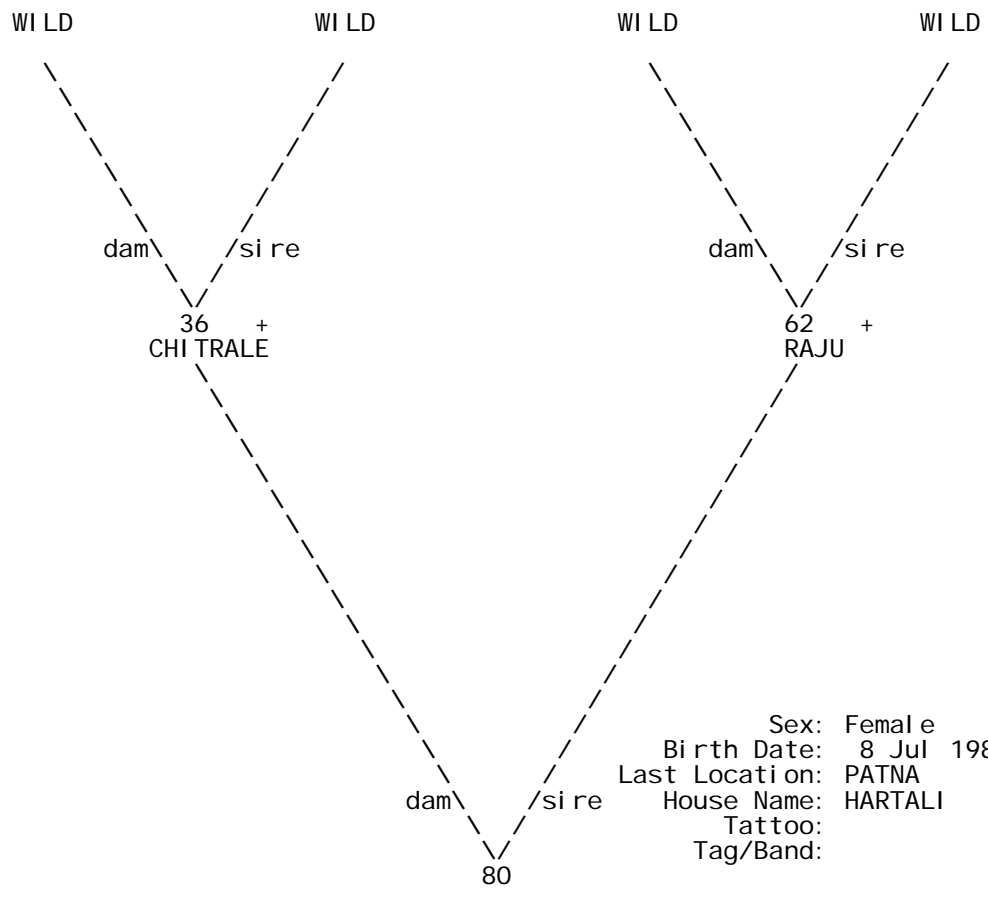
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Taxon Name: RHI NOCEROS UNI CORNIS Studbook Number: 79
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WILD

WILD



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 Taxon Name: RHI NOCEROS UNI CORNIS Studbook Number: 80
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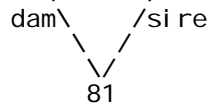
Sex: Female
 Birth Date: 8 Jul 1988
 Last Location: PATNA
 House Name: HARTALI
 Tattoo:
 Tag/Band:

+ Wild-caught...

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===
Taxon Name: RHI NOCEROS UNI CORNIS Studbook Number: 81
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===

WILD

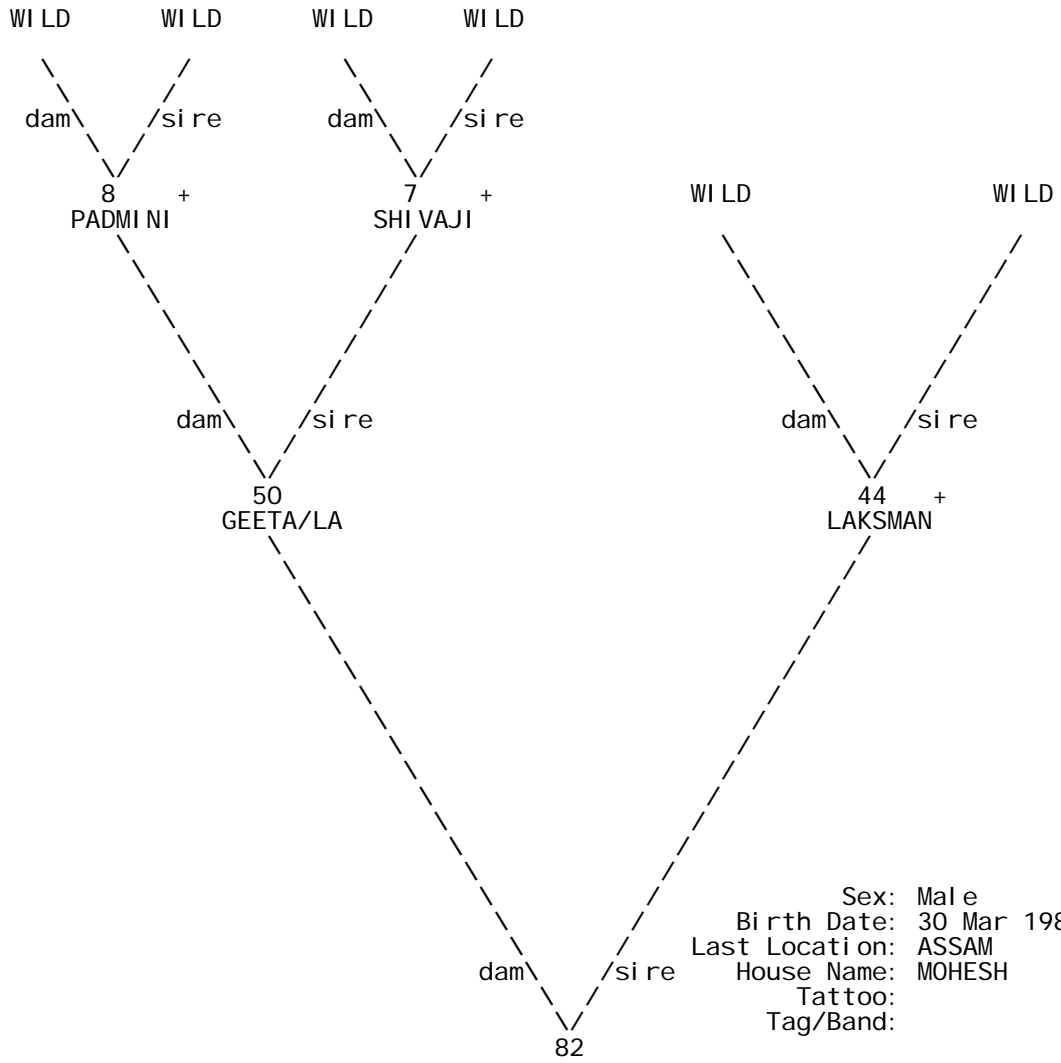
WILD



Sex: Male
Birth Date: 26 Jul 1988
Last Location: TRI VANDRU
House Name: JADU
Tattoo:
Tag/Band:

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===
Taxon Name: RHI NOCEROS UNI CORNI S
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===

Studbook Number: 82

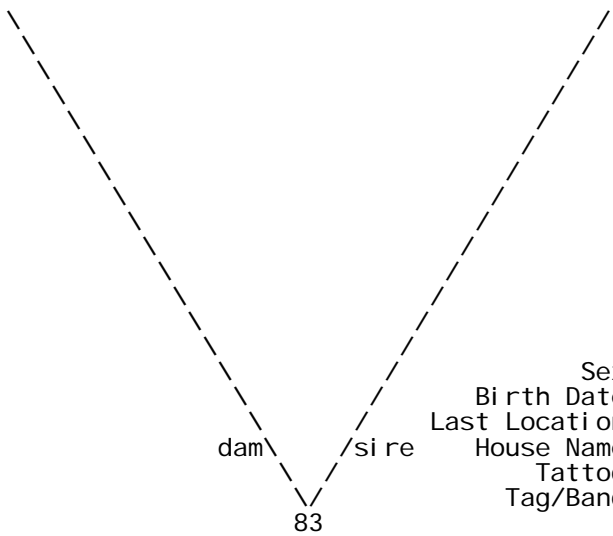


Sex: Male
Birth Date: 30 Mar 1989
Last Location: ASSAM
House Name: MOHESH
Tattoo:
Tag/Band:

+ Wild-caught...

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 Taxon Name: RHI NOCEROS UNI CORNI S Studbook Number: 83
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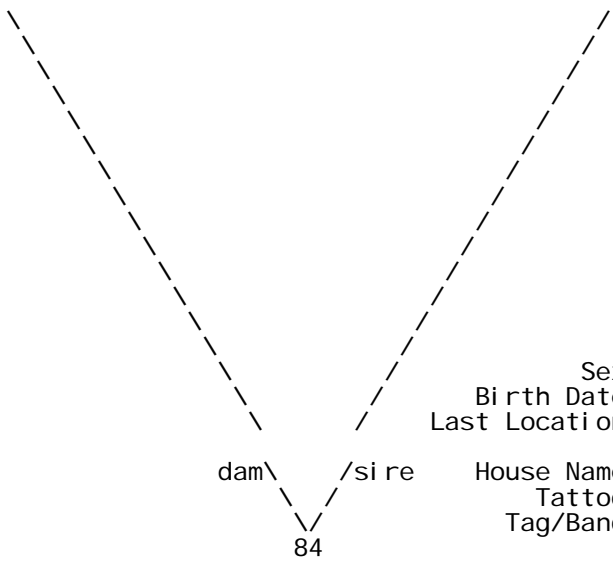
W I L D W I L D



Sex: Male
 Birth Date: ~ Jun 1989
 Last Locati on: JALDAPARA
 House Name: MADU
 Tattoo:
 Tag/Band:

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 Taxon Name: RHI NOCEROS UNI CORNI S Studbook Number: 84
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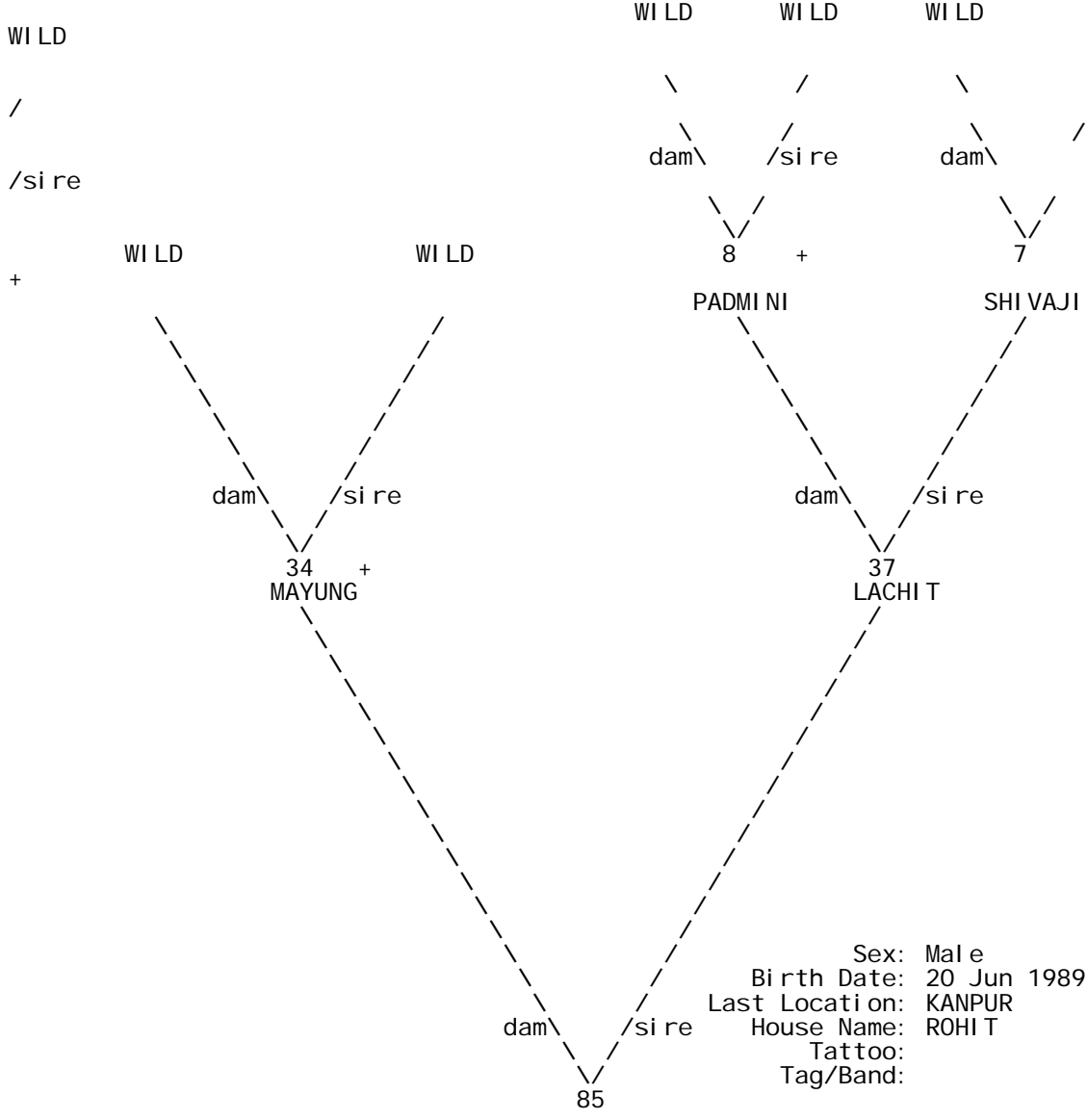
W I L D W I L D



Sex: Male
 Birth Date: ~ 1989
 Last Locati on: ASSAM
 House Name: DHAN
 Tattoo:
 Tag/Band:

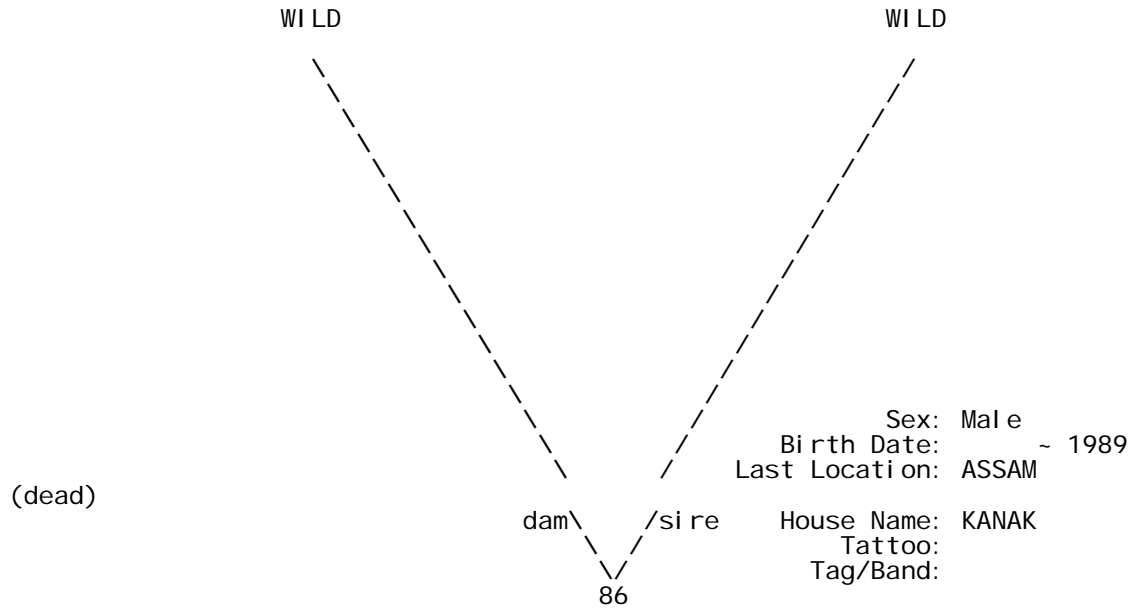
(dead)

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 Taxon Name: RHI NOCEROS UNI CORNIS Studbook Number: 85
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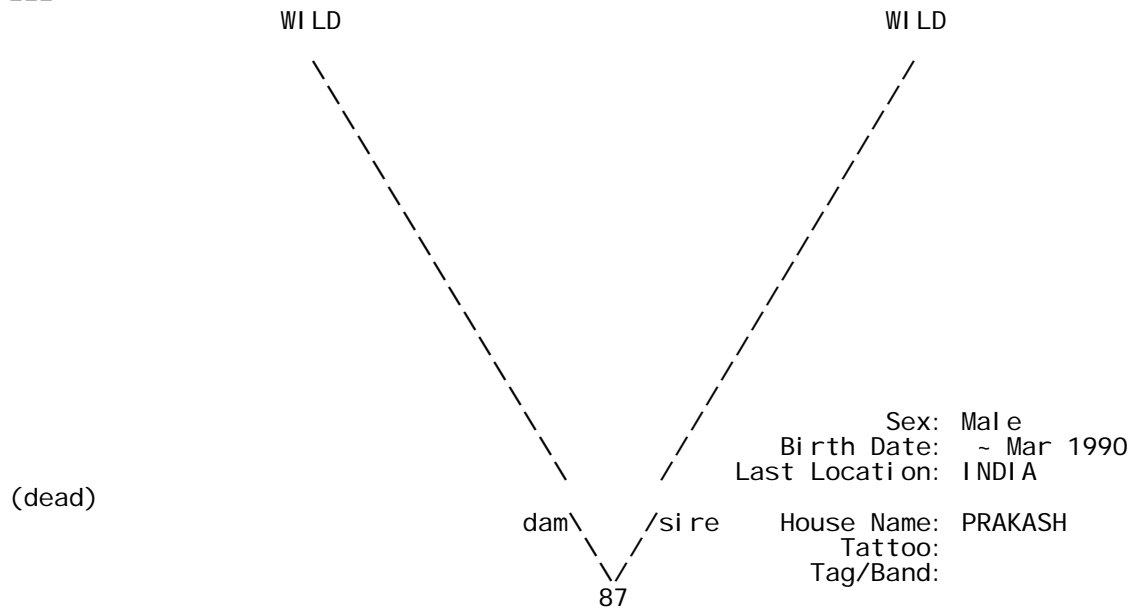


+ Wild-caught...

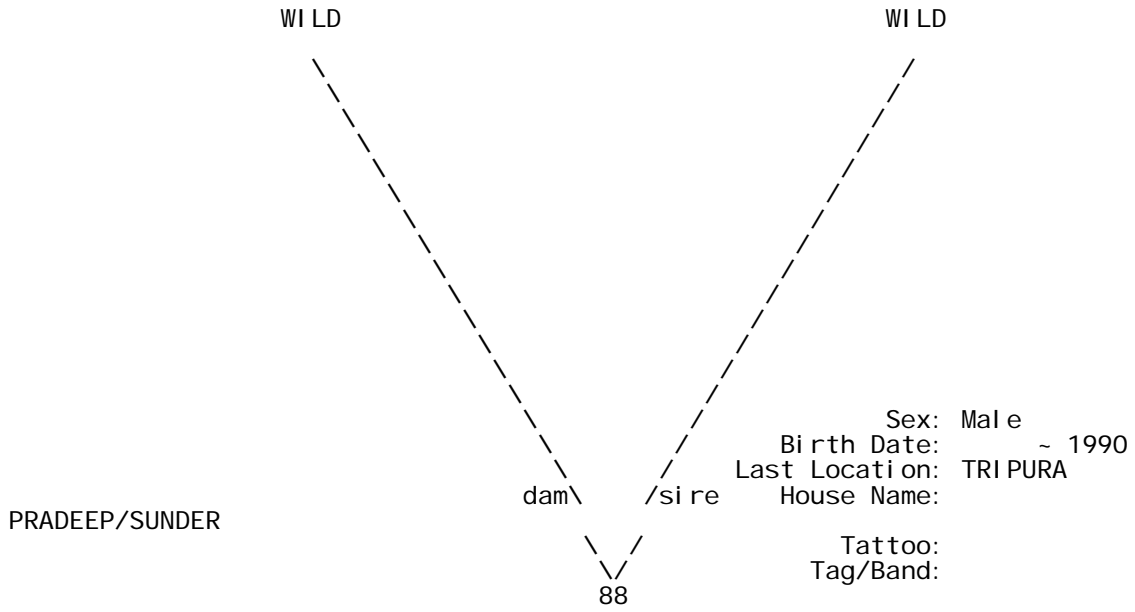
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Taxon Name: RHI NOCEROS UNI CORNI S Studbook Number: 86
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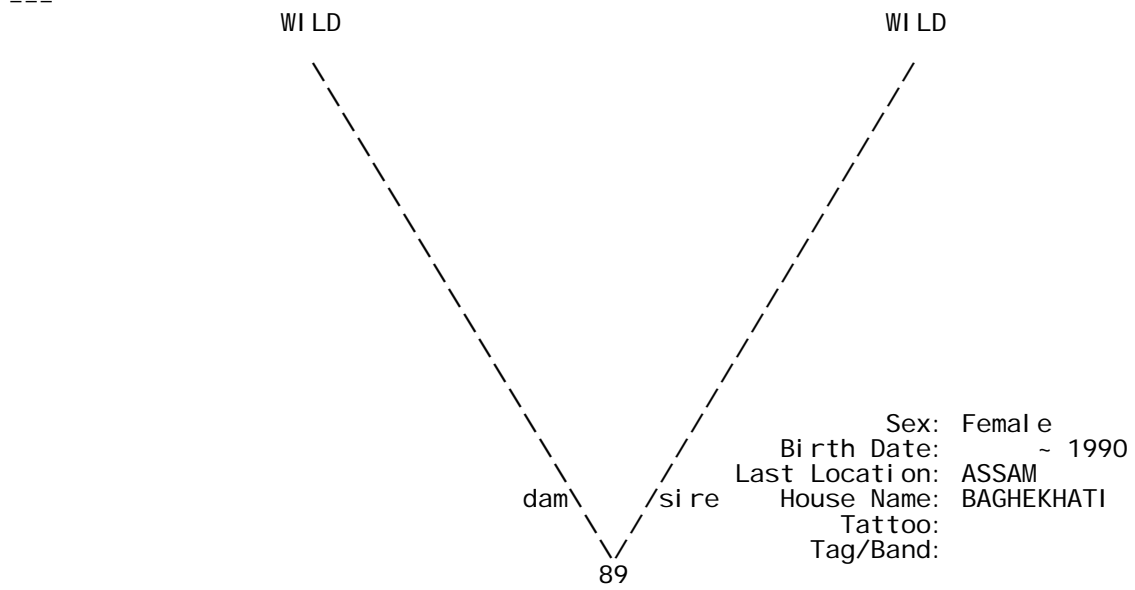
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Taxon Name: RHI NOCEROS UNI CORNI S Studbook Number: 87
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 Taxon Name: RHINOCEROS UNICORNIS Studbook Number: 88
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 Taxon Name: RHINOCEROS UNICORNIS Studbook Number: 89
 =====
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===
Taxon Name: RHI NOCEROS UNI CORNIS Studbook Number: 90
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===

WILD

WILD

(dead)

dam \

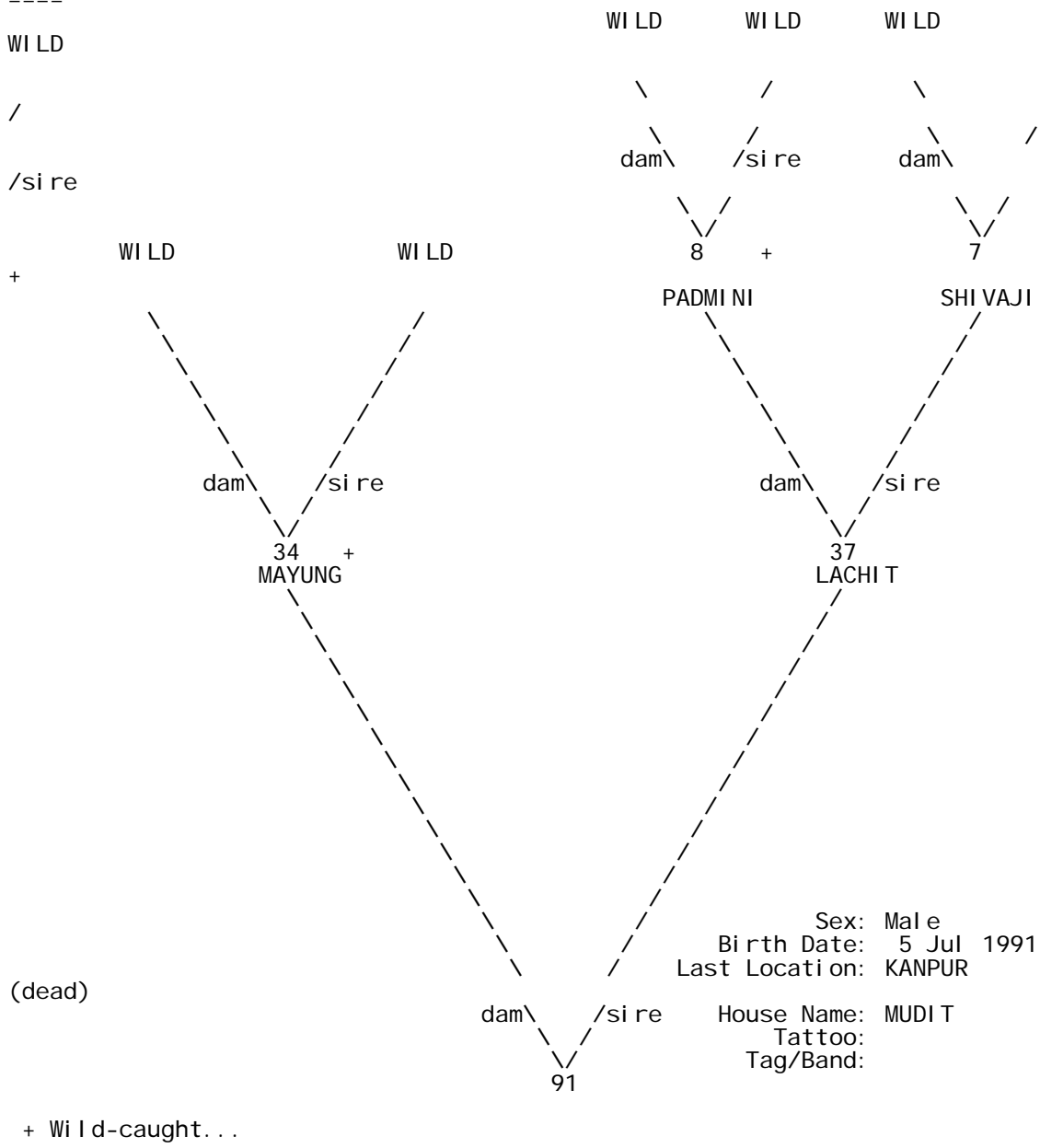
/ si re

90

Sex: Female
Birth Date: 30 Apr 1991
Last Location: ASSAM

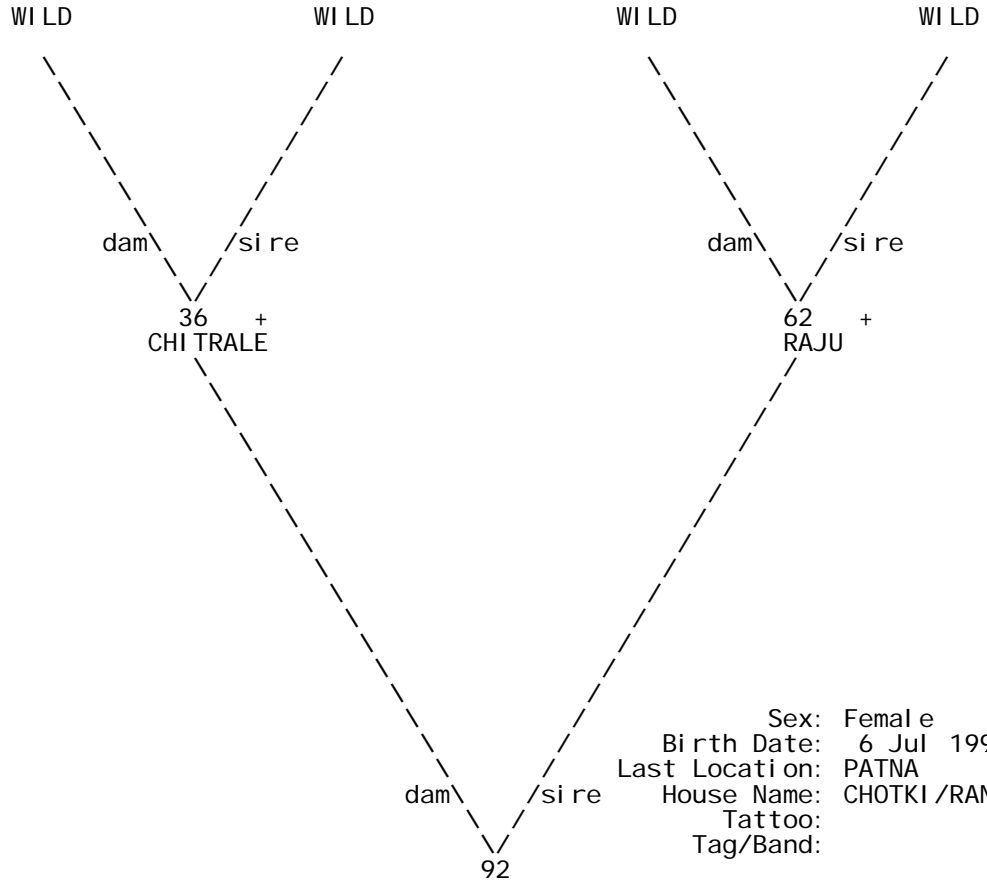
House Name: MONOMALI
Tattoo:
Tag/Band:

=====
 Taxon Name: RHI NOCEROS UNI CORNIS Studbook Number: 91
 =====



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===
Taxon Name: RHI NOCEROS UNI CORNIS
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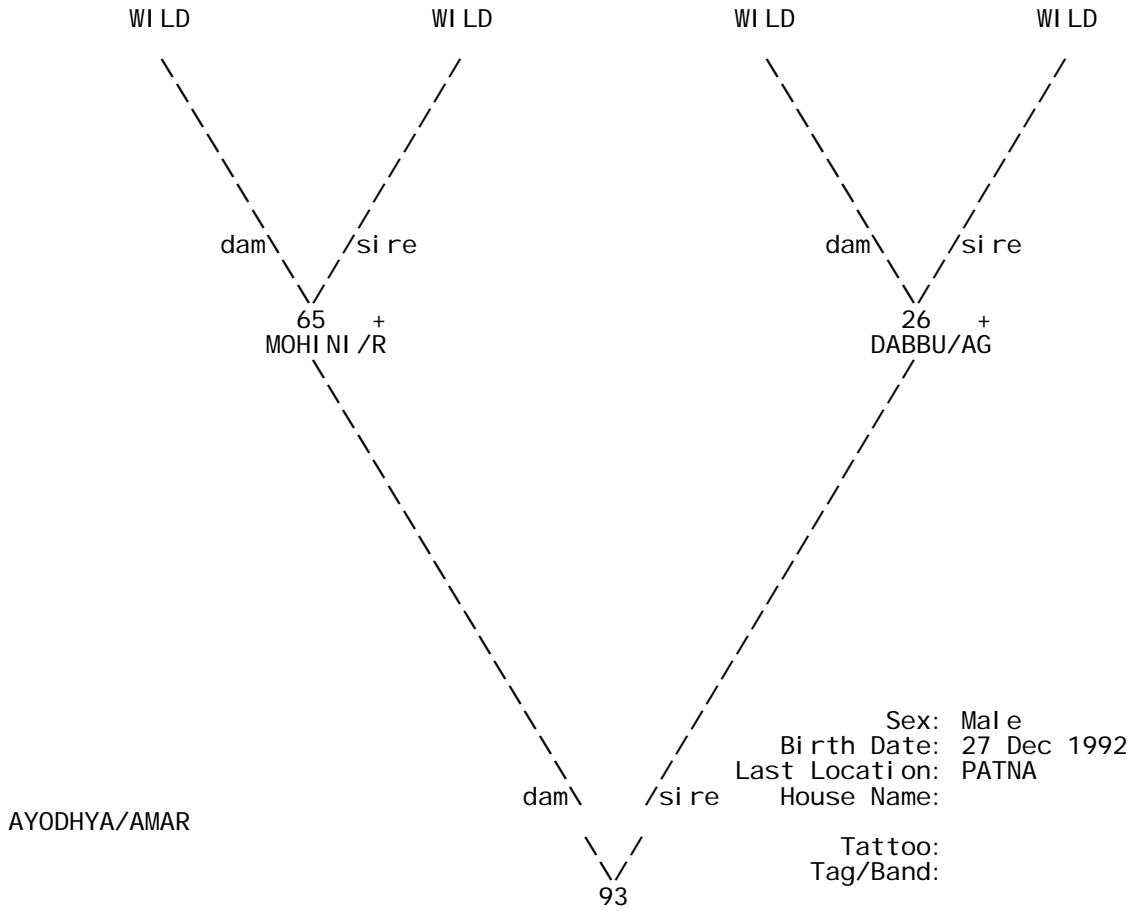
Studbook Number: 92
=====



Sex: Female
Birth Date: 6 Jul 1991
Last Location: PATNA
House Name: CHOTKI /RANI
Tattoo:
Tag/Band:

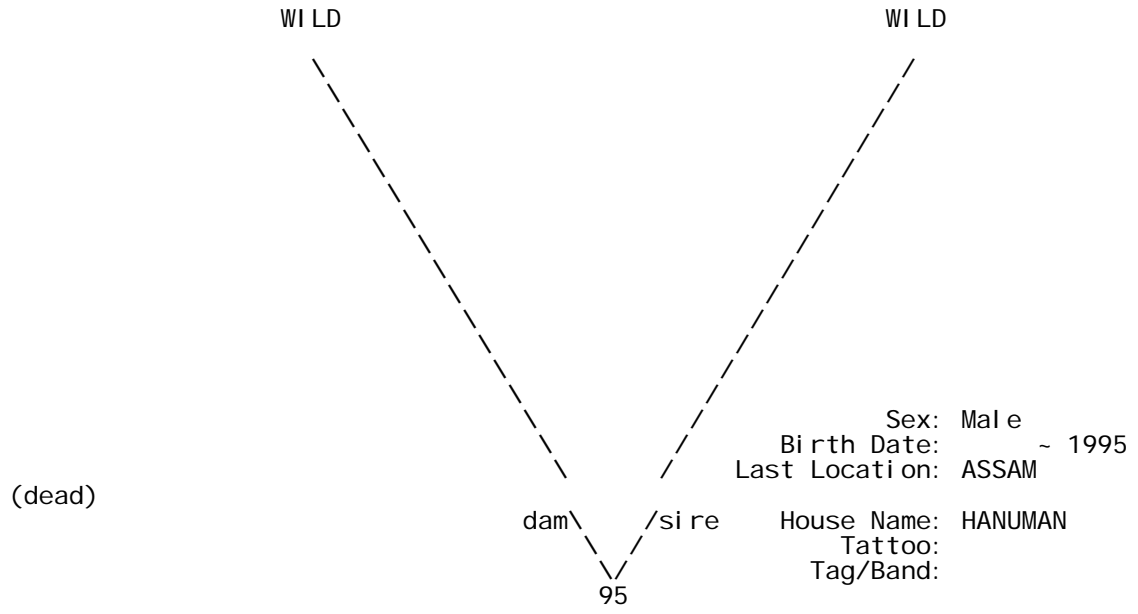
+ Wild-caught...

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 ===
 Taxon Name: RHI NOCEROS UNI CORNIS Studbook Number: 93
 =====



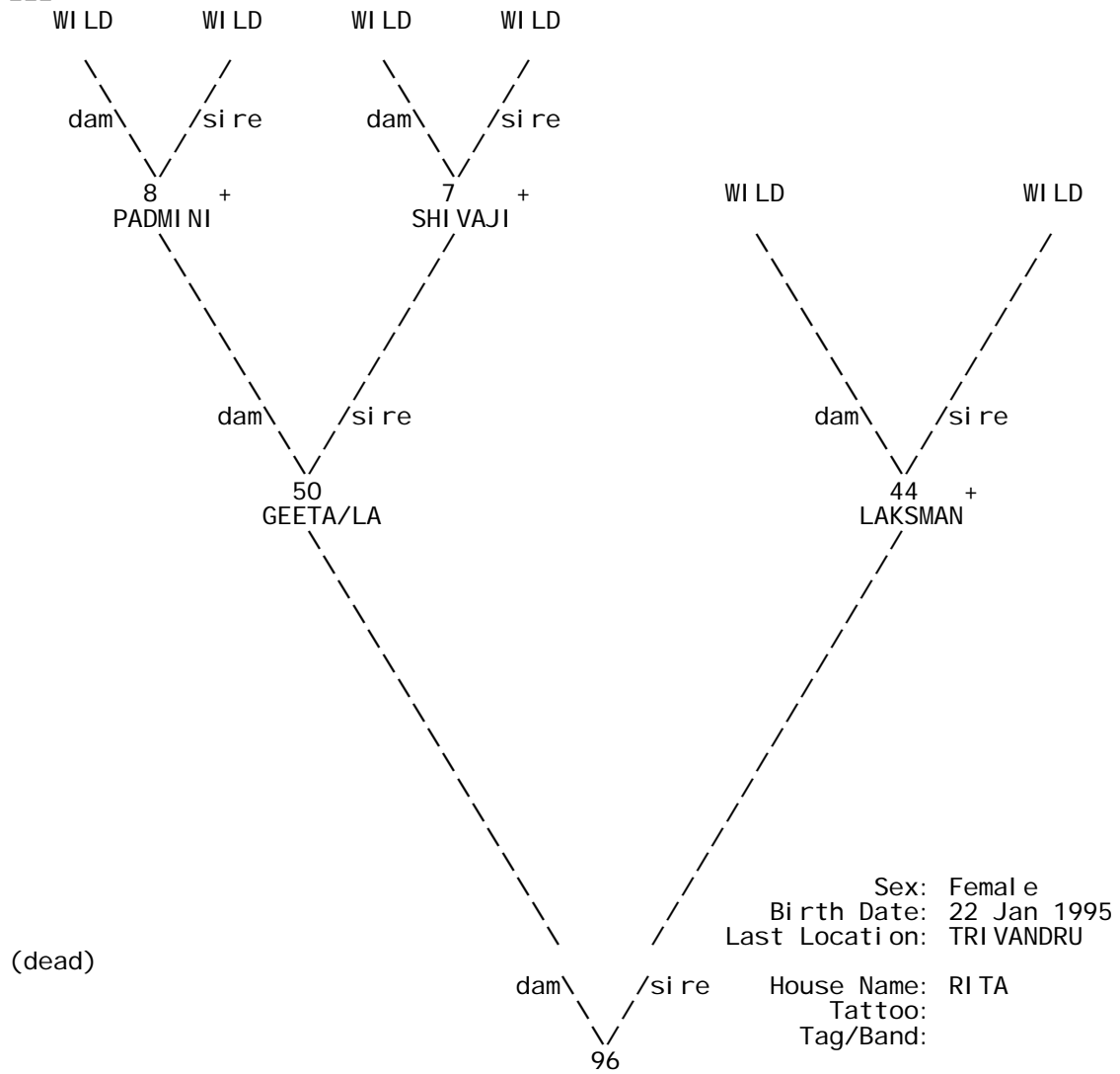
+ Wild-caught...

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Taxon Name: RHI NOCEROS UNI CORNIS Studbook Number: 95
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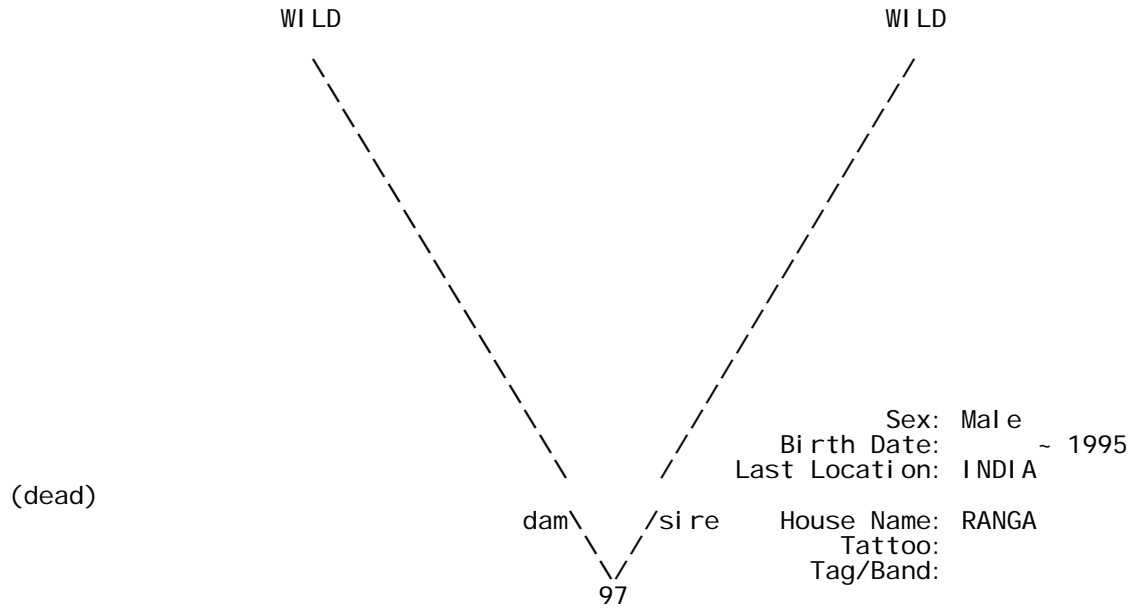
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===
Taxon Name: RHI NOCEROS UNI CORNIS
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Studbook Number: 96

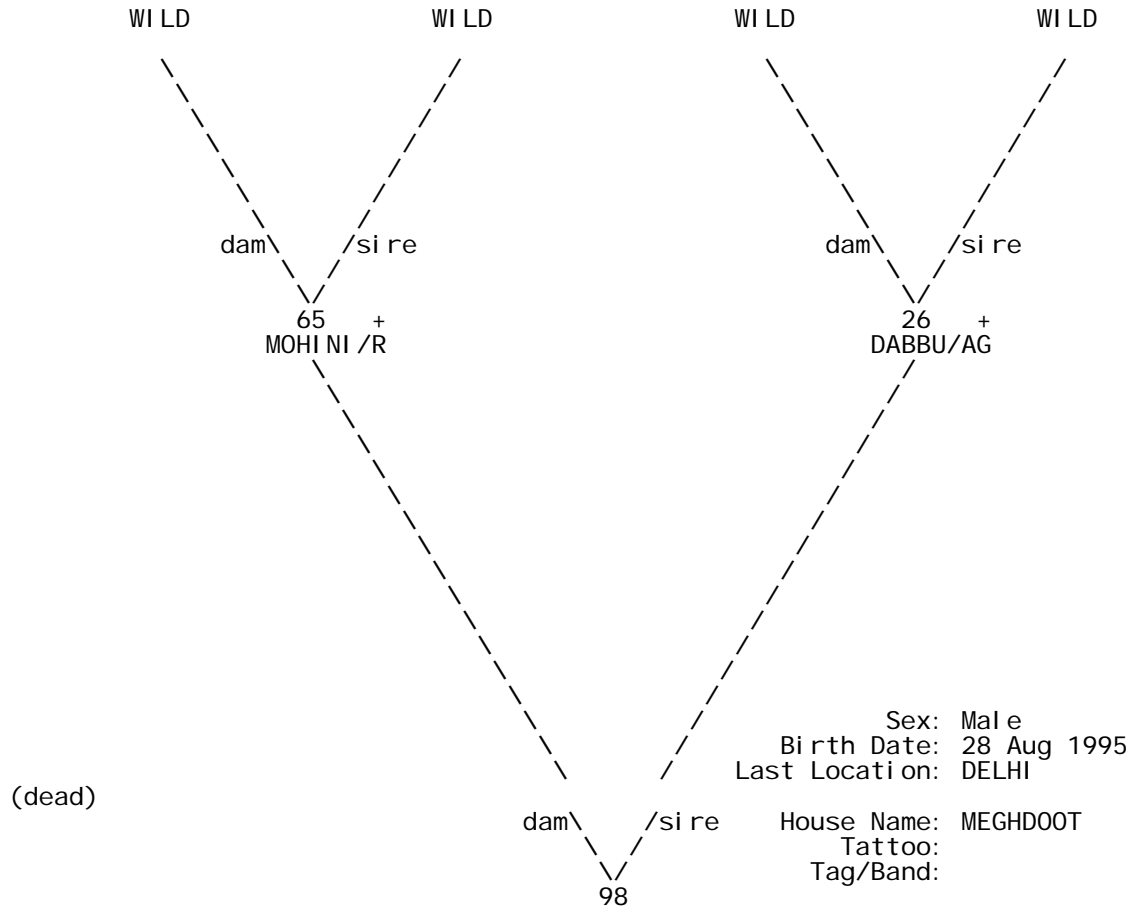


+ Wild-caught...

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===
Taxon Name: RHI NOCEROS UNI CORNIS Studbook Number: 97
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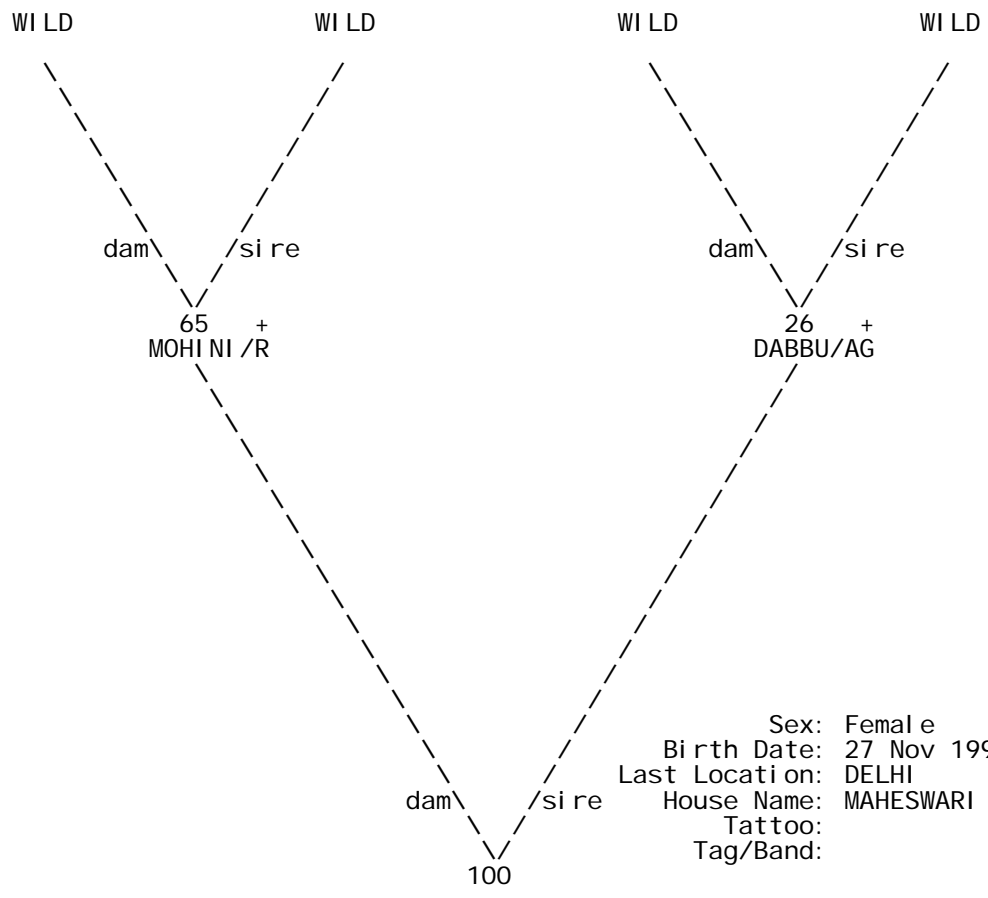


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 ===
 Taxon Name: RHI NOCEROS UNI CORNI S Studbook Number: 98
 =====



+ Wild-caught...

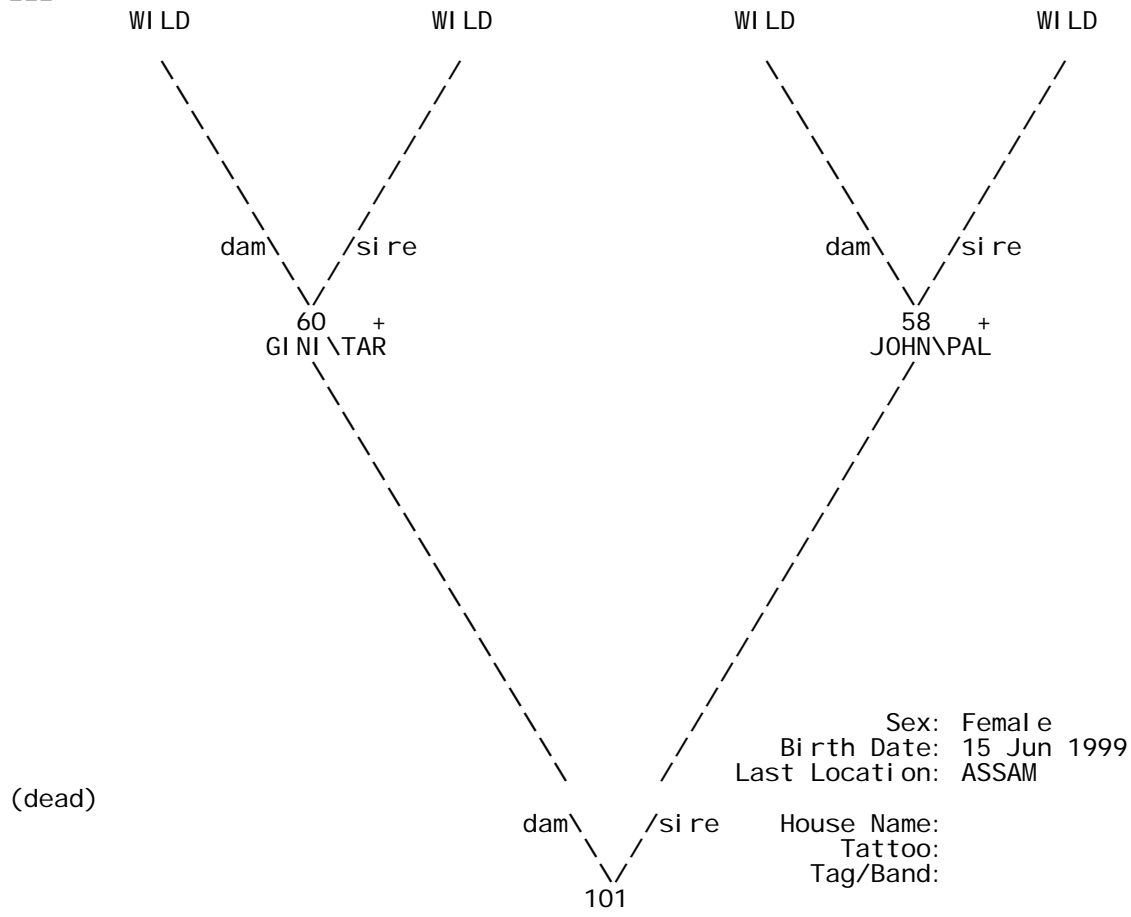
=====
 ===
 Taxon Name: RHI NOCEROS UNI CORNI S Studbook Number: 100
 =====
 ===



Sex: Female
 Birth Date: 27 Nov 1997
 Last Location: DELHI
 House Name: MAHESWARI
 Tattoo:
 Tag/Band:

+ Wild-caught...

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 ===
 Taxon Name: RHI NOCEROS UNI CORNI S Studbook Number: 101
 =====
 ===



+ Wild-caught...

=====
 ===
 Taxon Name: RHI NOCEROS UNI CORNI S Studbook Number: 102
 =====
 ===

UNK UNK

Sex: Male
 Birth Date: ????
 Last Location: LOSANGELE
 House Name: MADAN
 Tattoo:
 Tag/Band:

dam \ / si re
 102

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 ===
 Taxon Name: RHI NOCEROS UNI CORNI S Studbook Number: 103
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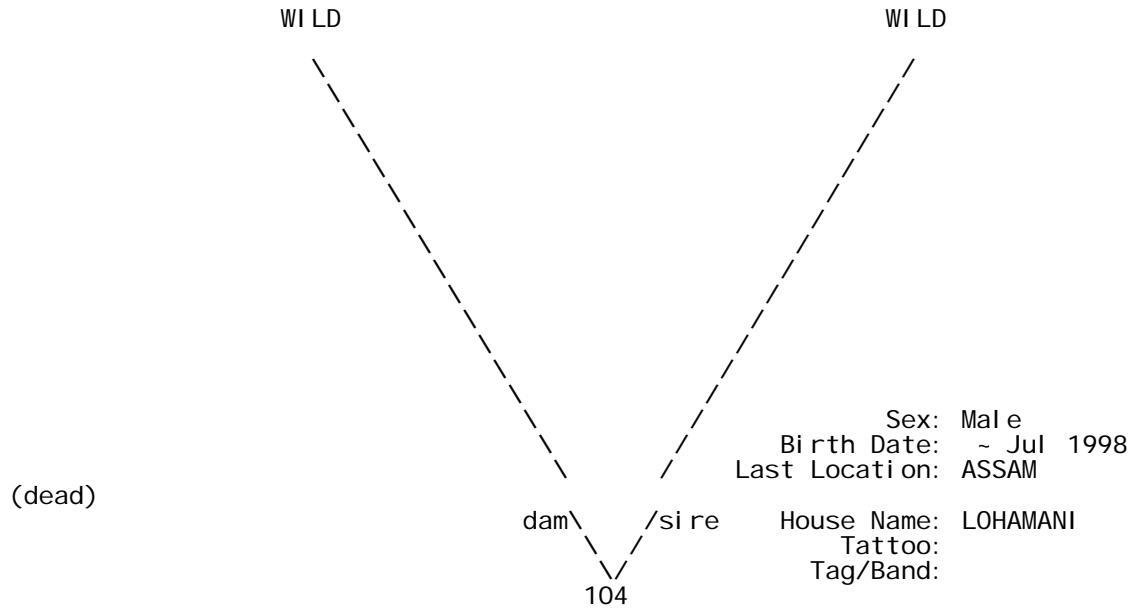
WILD WILD

(dead)

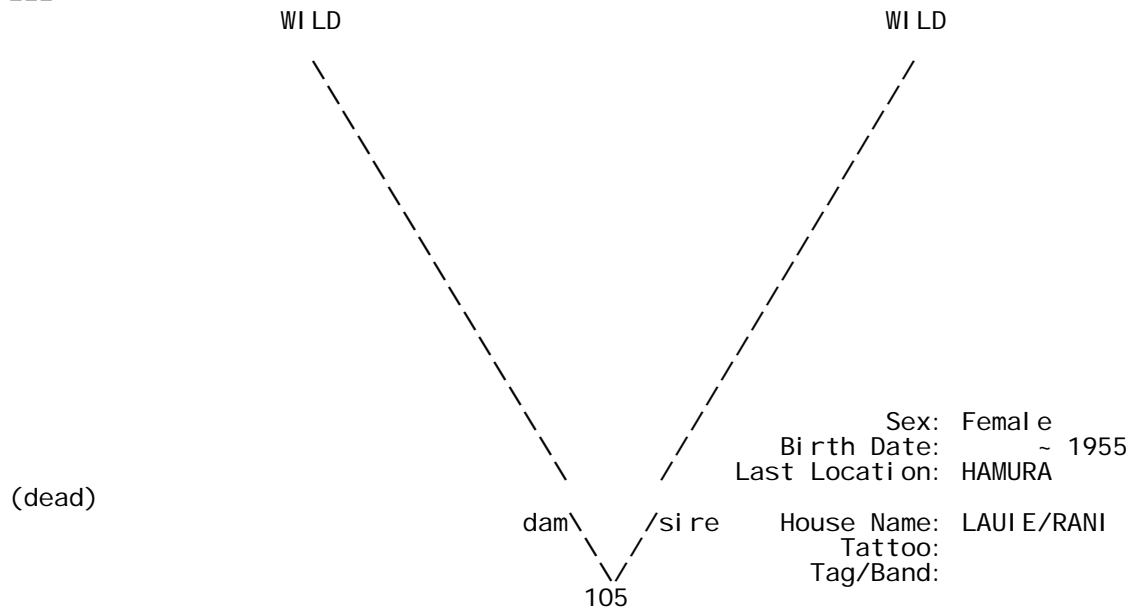
Sex: Male
 Birth Date: ????
 Last Location: ASSAM
 House Name: BAUL
 Tattoo:
 Tag/Band:

dam \ / si re
 103

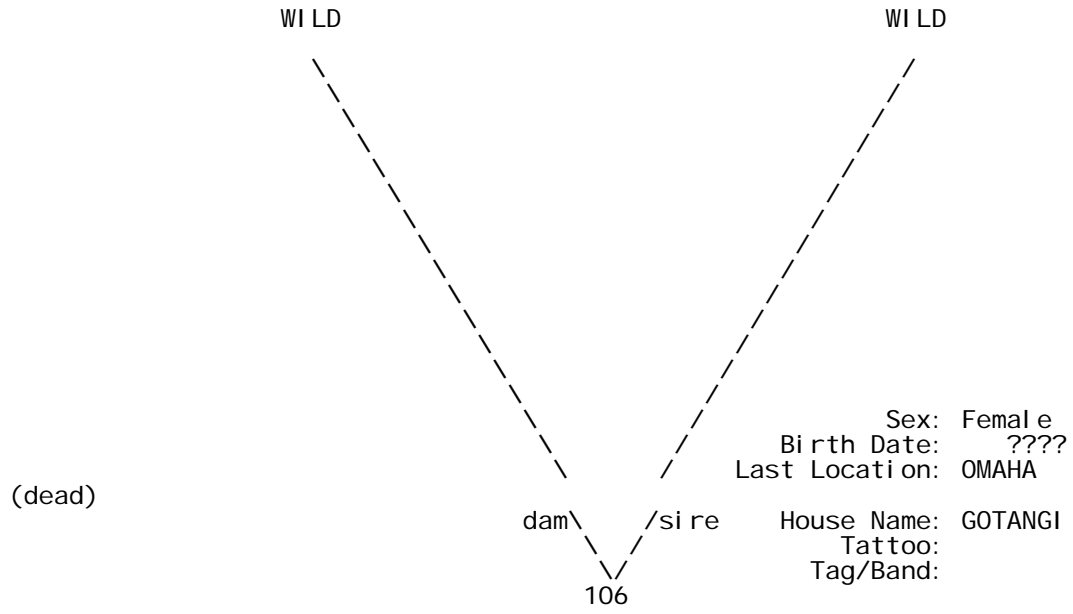
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Taxon Name: RHI NOCEROS UNI CORNI S Studbook Number: 104
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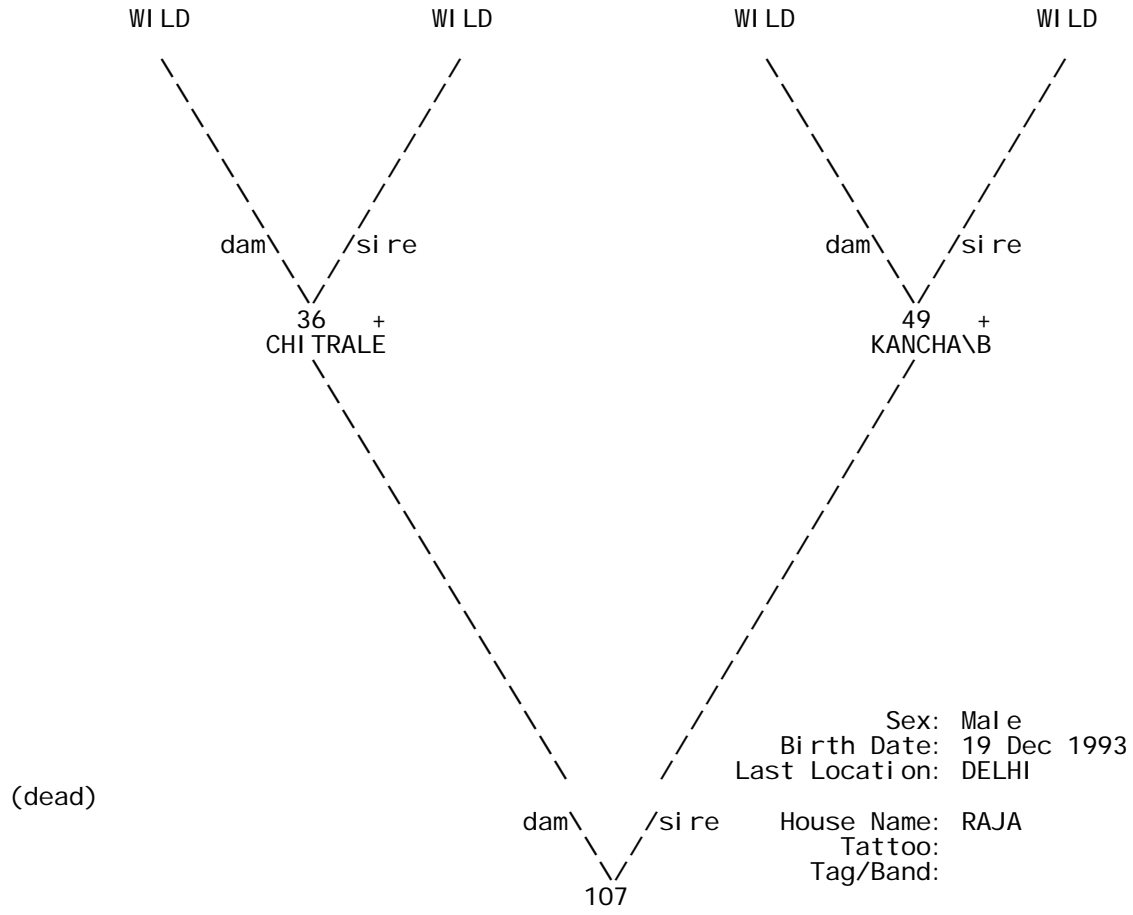
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Taxon Name: RHI NOCEROS UNI CORNI S Studbook Number: 105
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Taxon Name: RHI NOCEROS UNI CORNI S Studbook Number: 106
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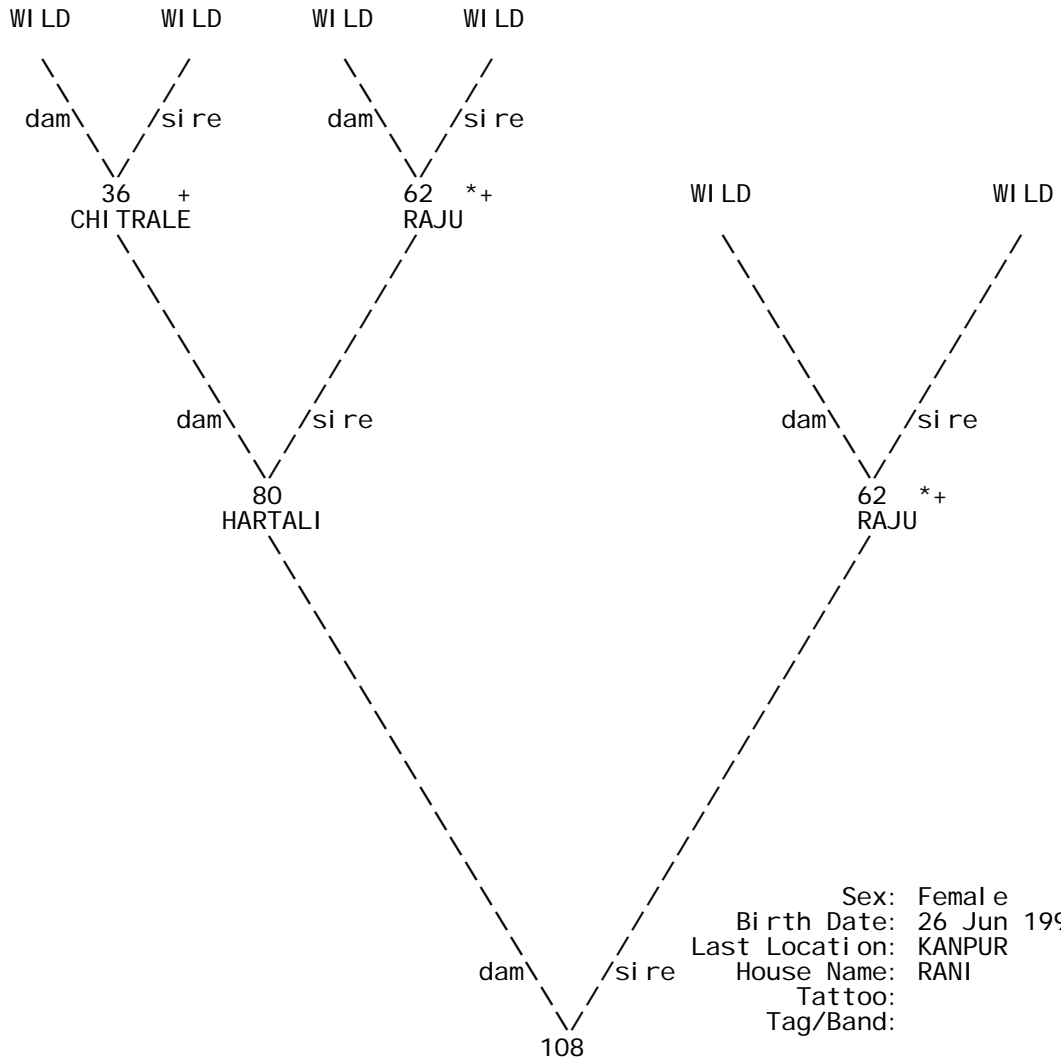
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 ===
 Taxon Name: RHI NOCEROS UNI CORNIS Studbook Number: 107
 =====



+ Wild-caught...

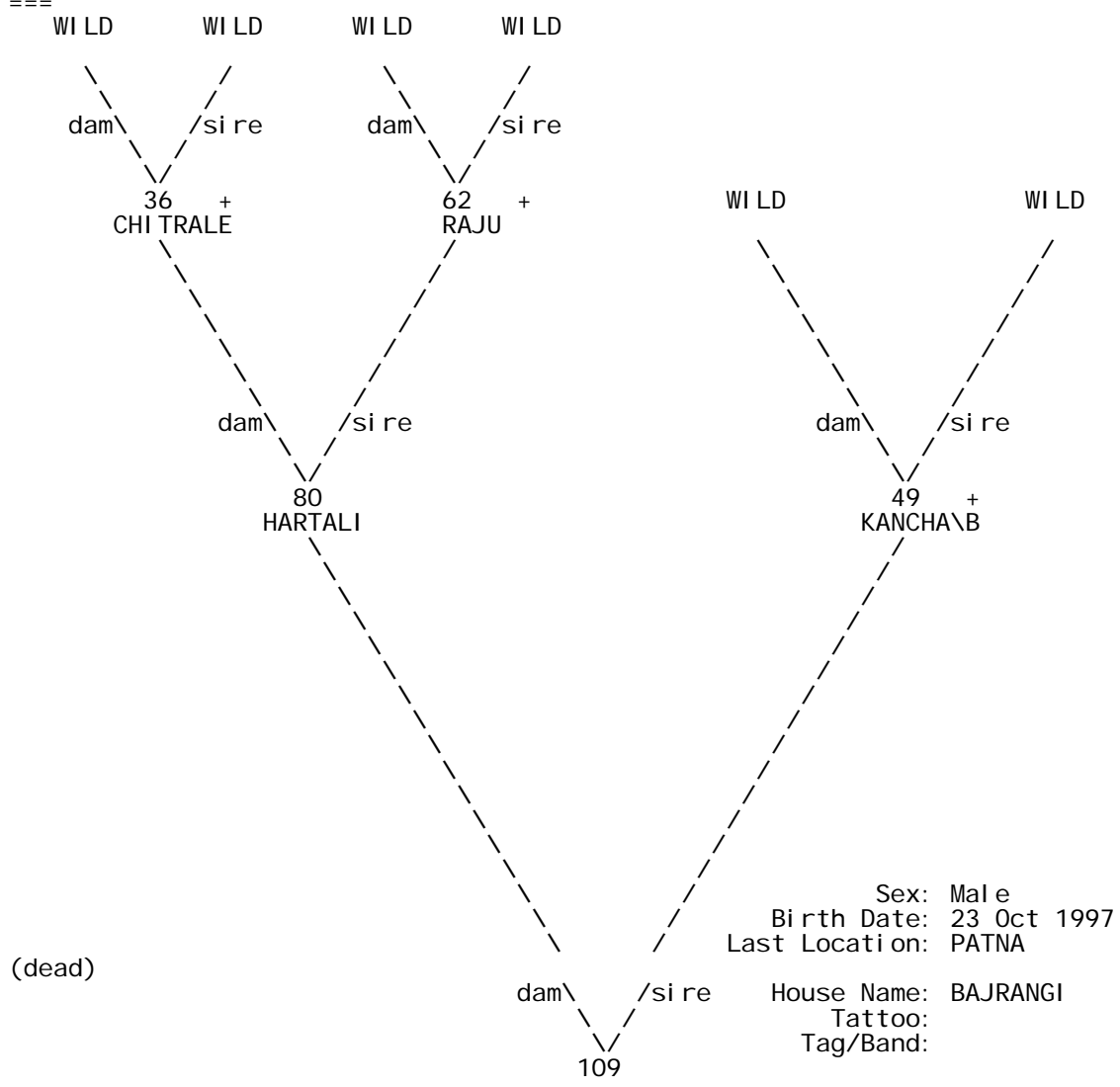
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===
Taxon Name: RHI NOCEROS UNI CORNIS
=====
===

Studbook Number: 108
=====
===



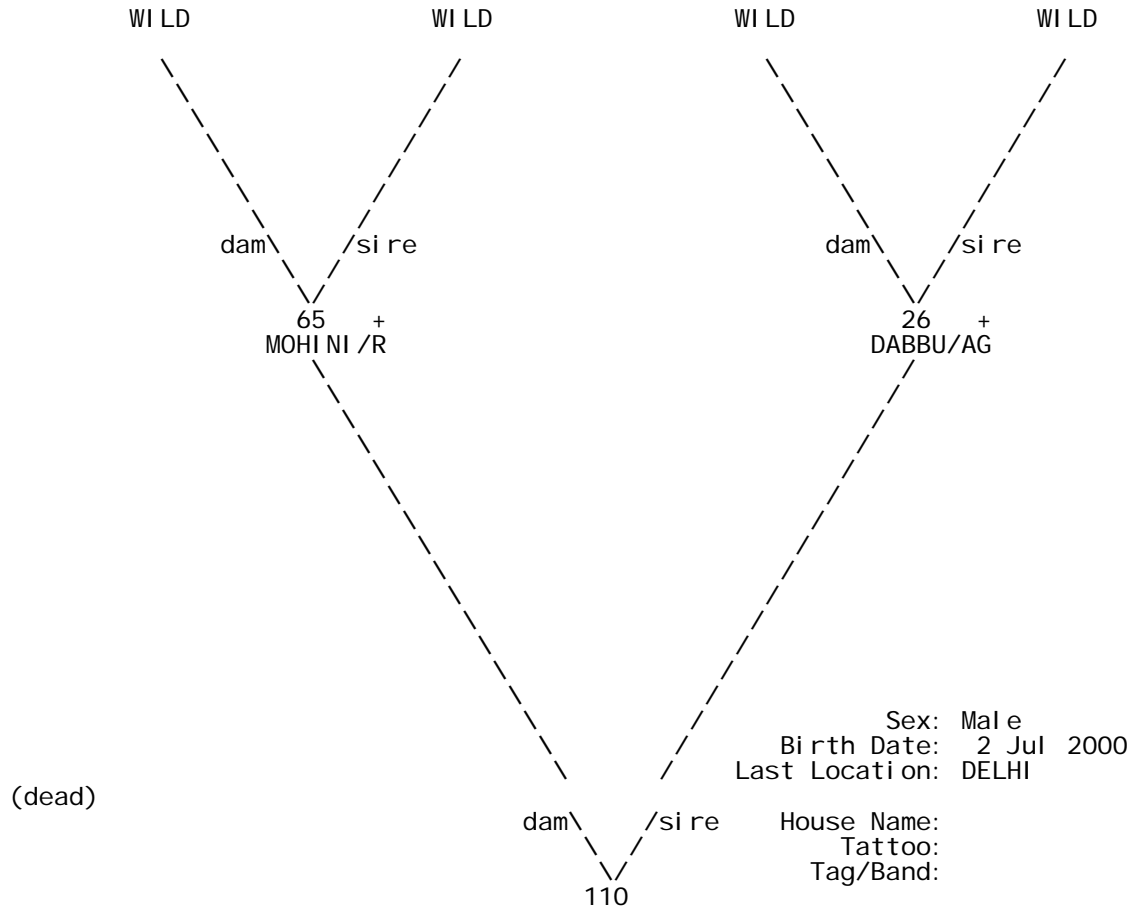
+ Wild-caught... * Appear more than once...

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 Taxon Name: RHINOCEROS UNICORNIS Studbook Number: 109
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 ===



+ Wild-caught...

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 ===
 Taxon Name: RHI NOCEROS UNI CORNIS Studbook Number: 110
 =====
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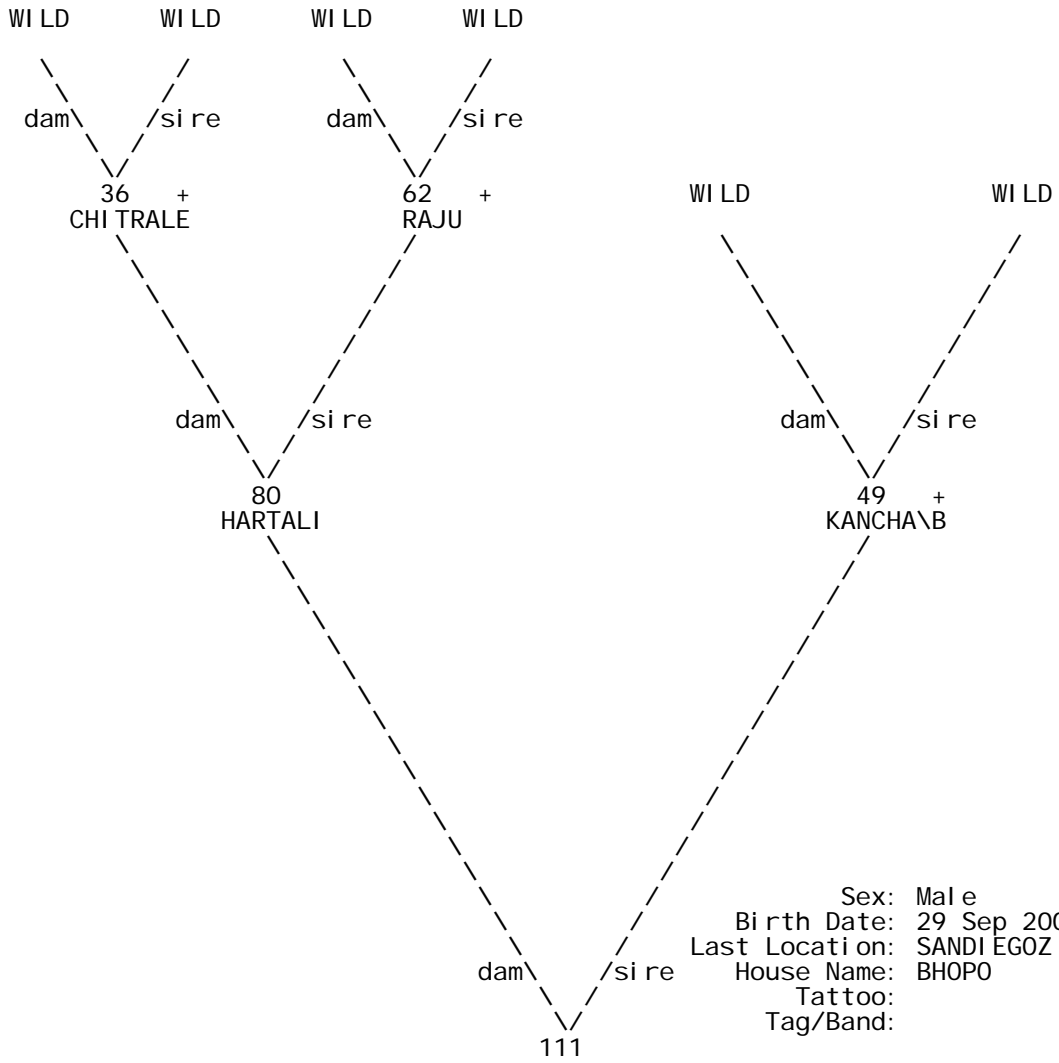


Sex: Male
 Birth Date: 2 Jul 2000
 Last Location: DELHI
 House Name:
 Tattoo:
 Tag/Band:

+ Wild-caught...

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===
Taxon Name: RHI NOCEROS UNI CORNIS
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===

Studbook Number: 111

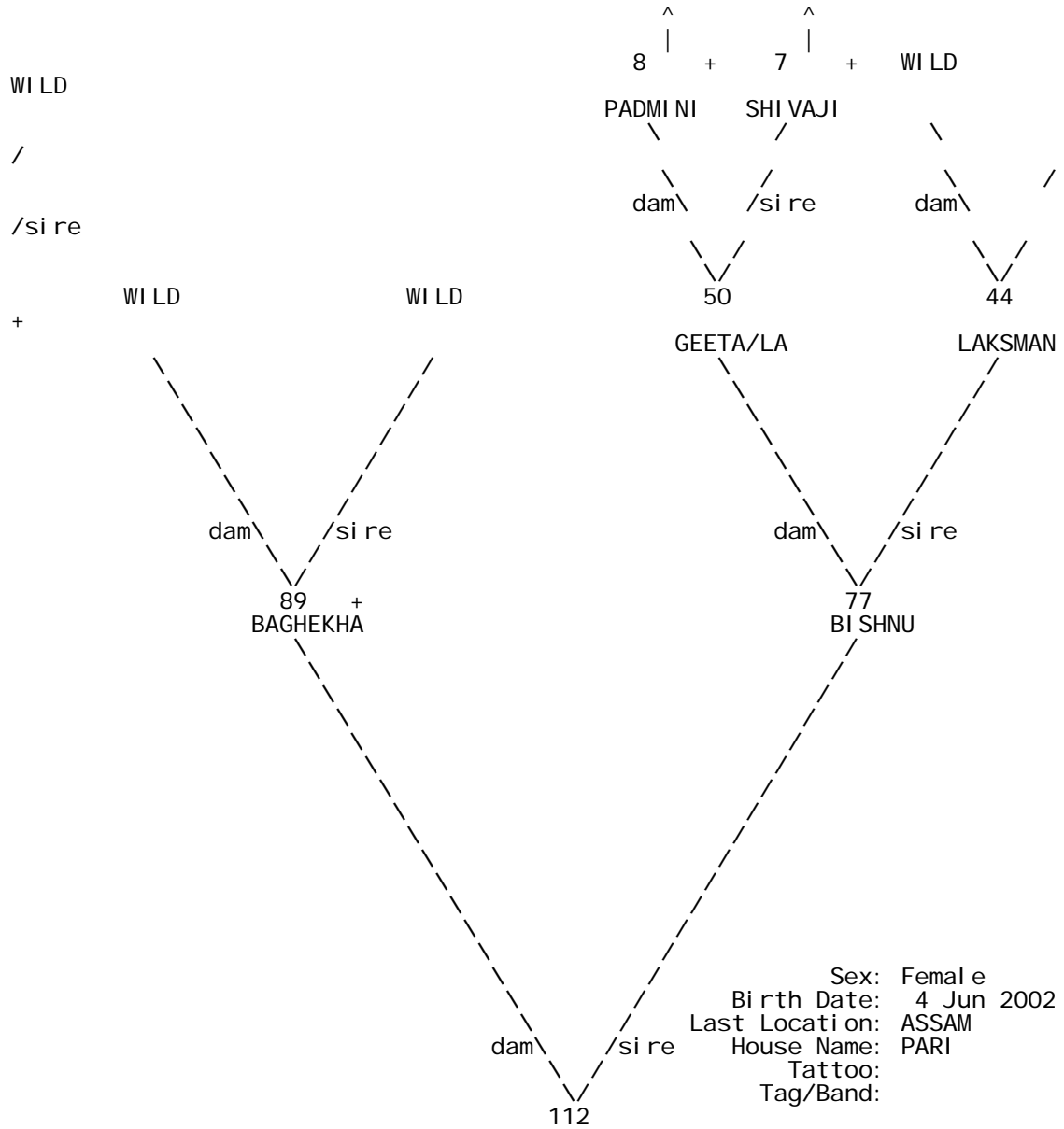


Sex: Male
Birth Date: 29 Sep 2000
Last Location: SANDI EGOZ
House Name: BHOPO
Tattoo:
Tag/Band:

+ Wild-caught...

=====
===
Taxon Name: RHI NOCEROS UNI CORNIS
=====
===

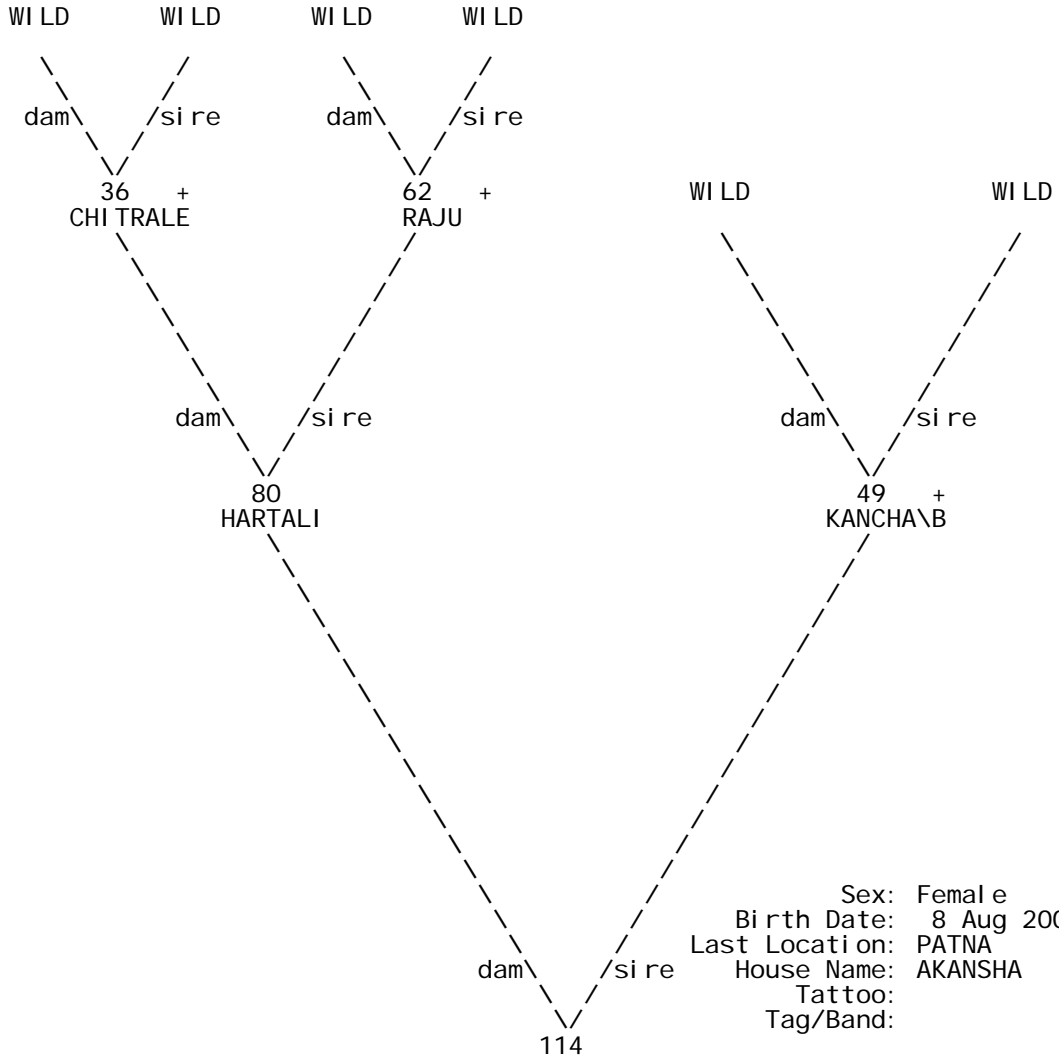
Studbook Number: 112



+ Wild-caught...
^ Pedigree continues beyond top of page...

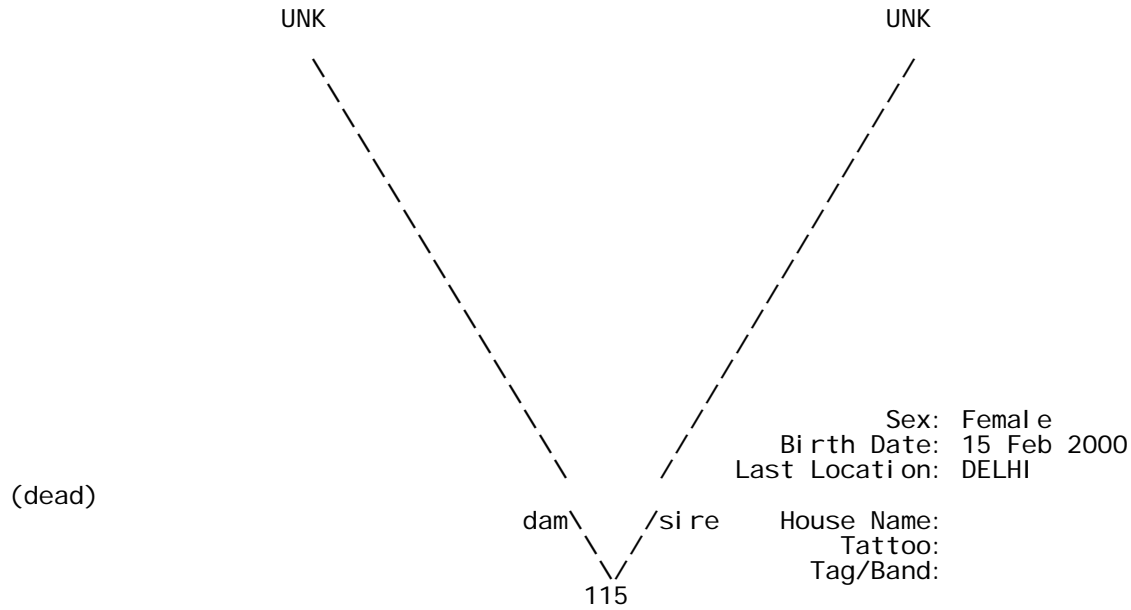
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===
Taxon Name: RHI NOCEROS UNI CORNI S
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===

Studbook Number: 114

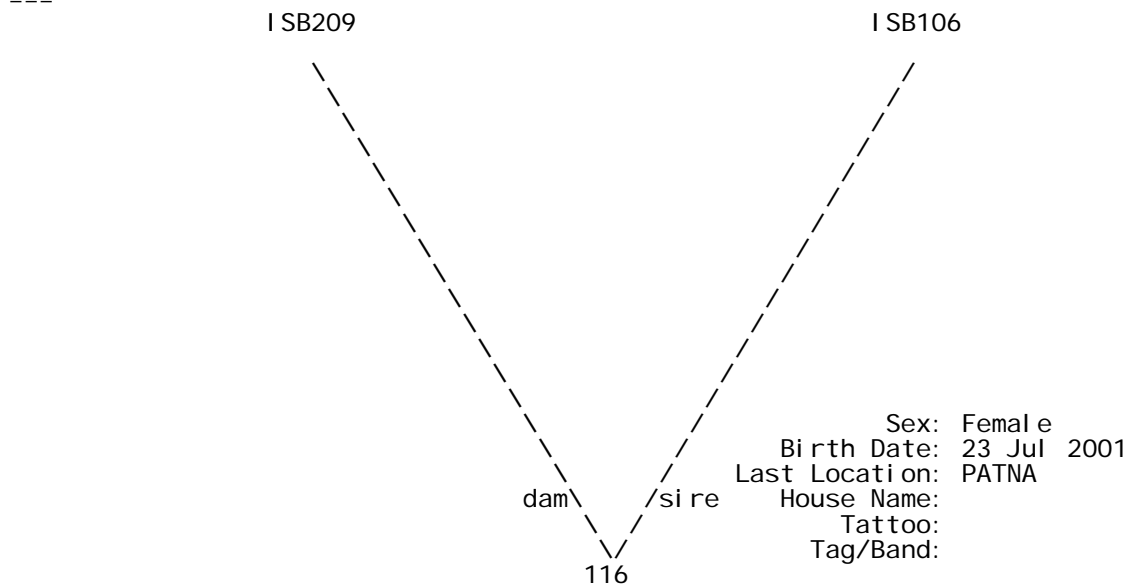


+ Wild-caught...

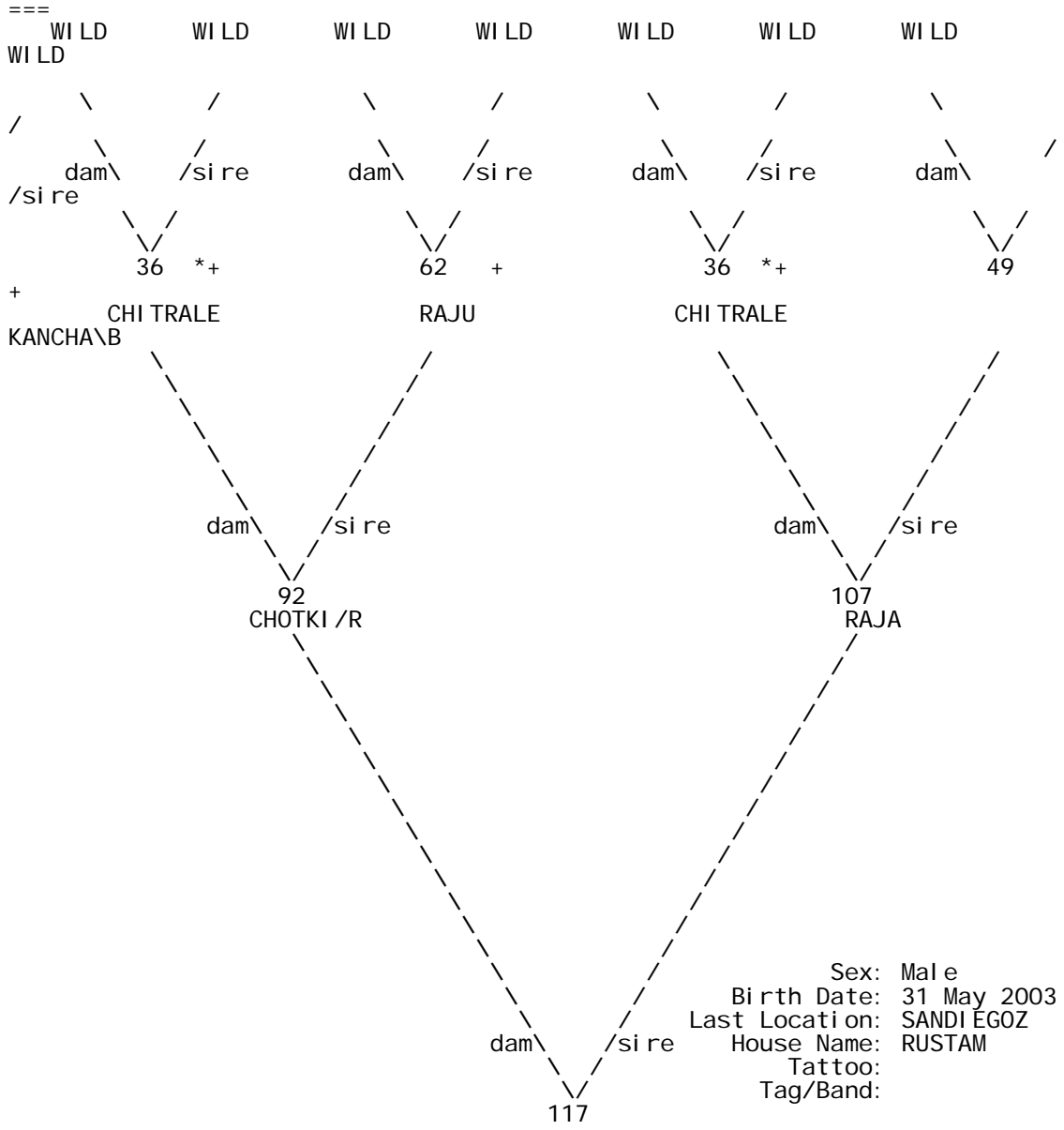
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Taxon Name: RHI NOCEROS UNI CORNI S Studbook Number: 115
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Taxon Name: RHI NOCEROS UNI CORNI S Studbook Number: 116
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 ===
 Taxon Name: RHI NOCEROS UNI CORNIS Studbook Number: 117
 =====

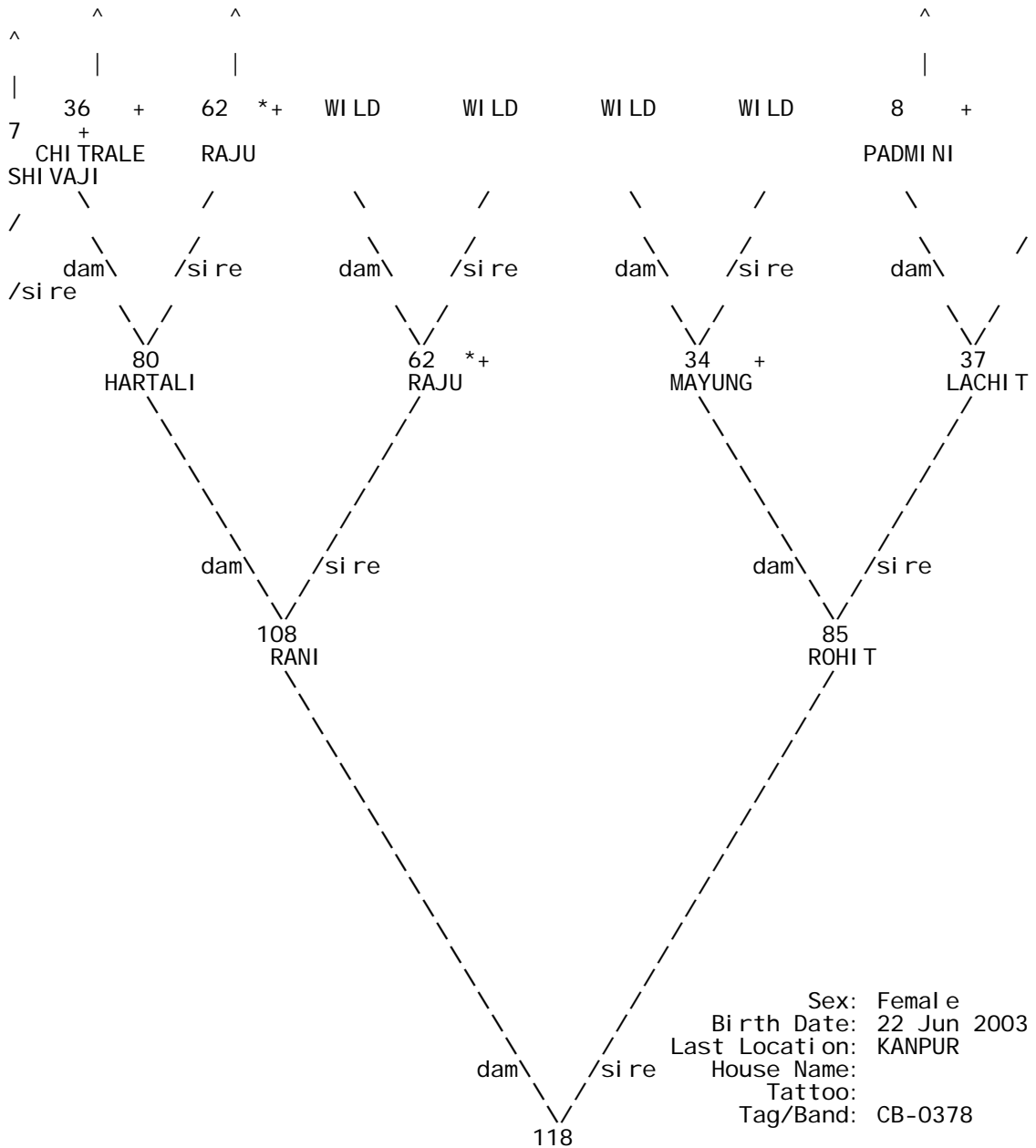


Sex: Male
 Birth Date: 31 May 2003
 Last Location: SANDI EGOZ
 House Name: RUSTAM
 Tattoo:
 Tag/Band:

+ Wild-caught... * Appear more than once...

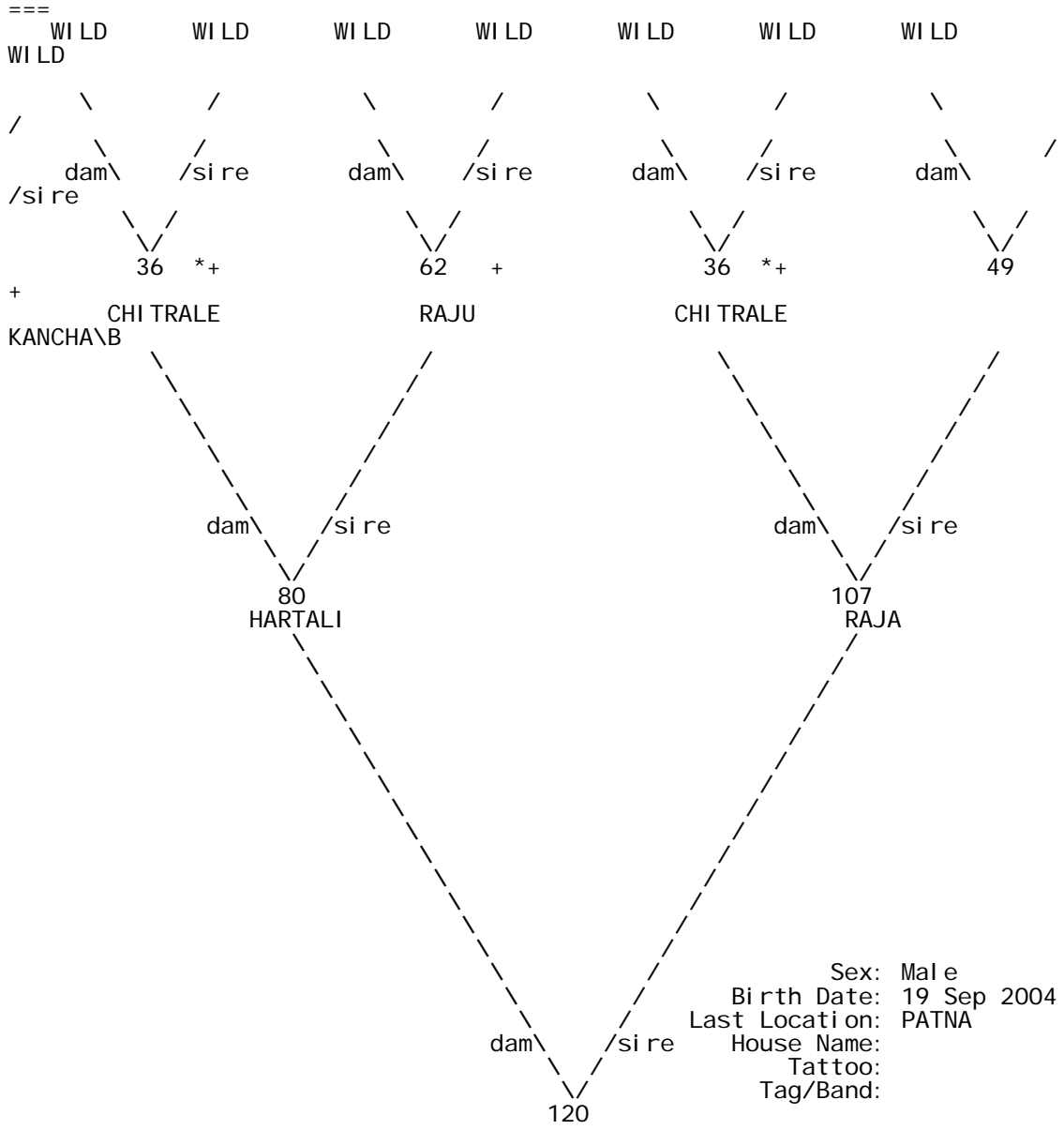
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Taxon Name: RHI NOCEROS UNI CORNIS
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Studbook Number: 118
=====
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^



+ Wild-caught... * Appear more than once...
^ Pedigree continues beyond top of page...

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 Taxon Name: RHI NOCEROS UNI CORNIS Studbook Number: 120
 =====

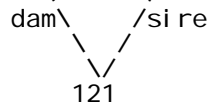


+ Wild-caught... * Appear more than once...

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===
Taxon Name: RHI NOCEROS UNI CORNIS Studbook Number: 121
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===

W I L D

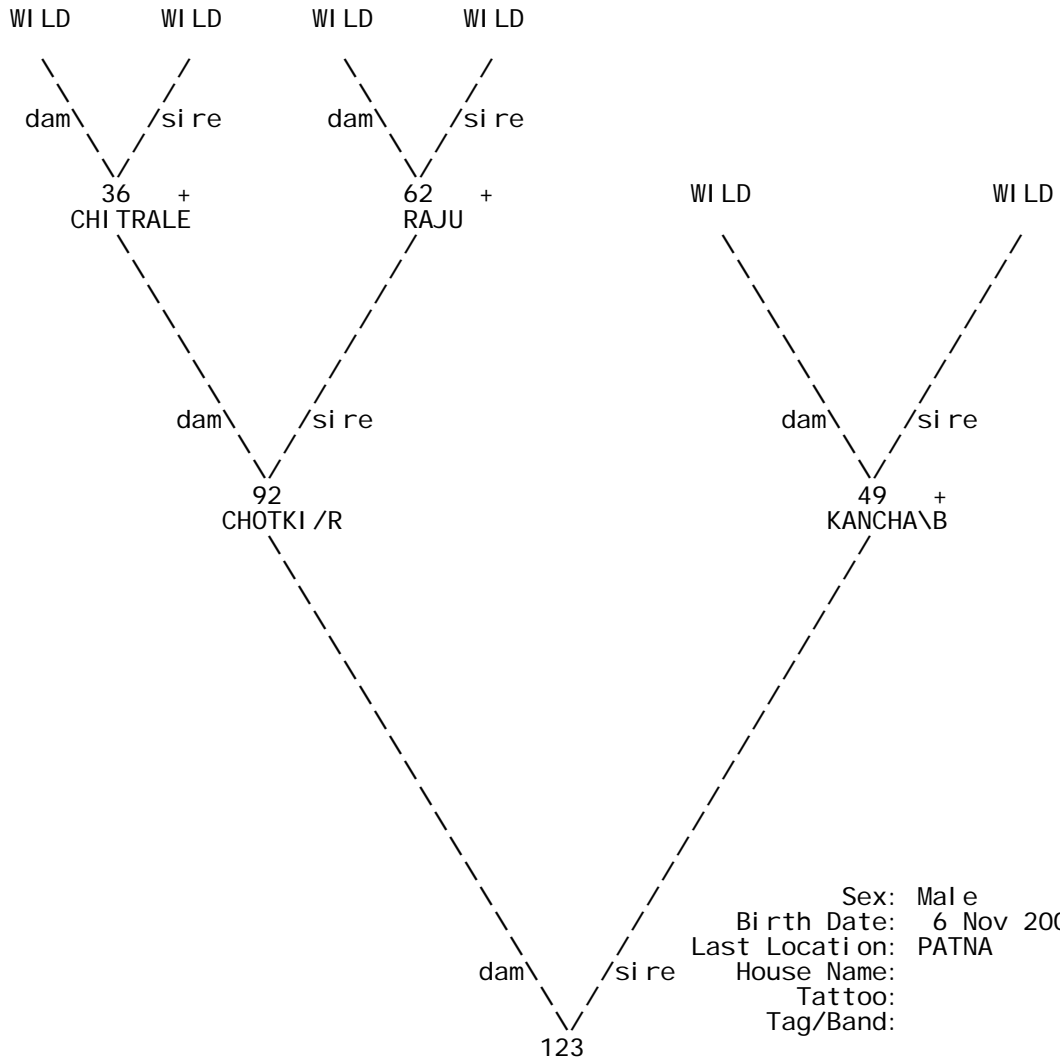
W I L D



Sex: Male
Birth Date: ~ 1997
Last Location: KANPUR
House Name:
Tattoo:
Tag/Band: CB-0377

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===
Taxon Name: RHI NOCEROS UNI CORNIS
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Studbook Number: 123



Sex: Male
Birth Date: 6 Nov 2005
Last Location: PATNA
House Name:
Tattoo:
Tag/Band:

+ Wild-caught...

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Taxon Name: RHI NOCEROS UNI CORNIS Studbook Number: 125
=====
===

0278

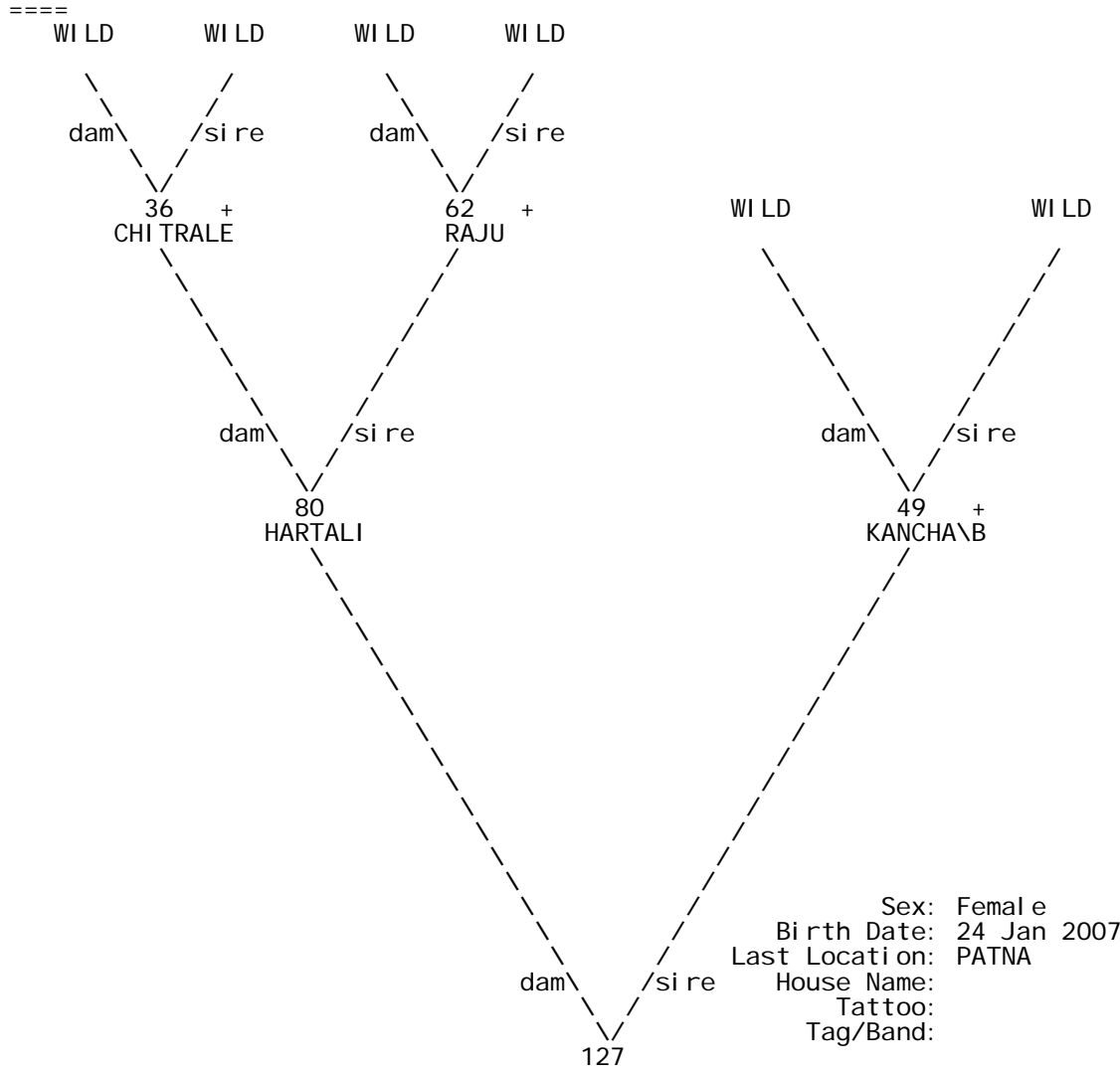
0190

dam \ / si re

125

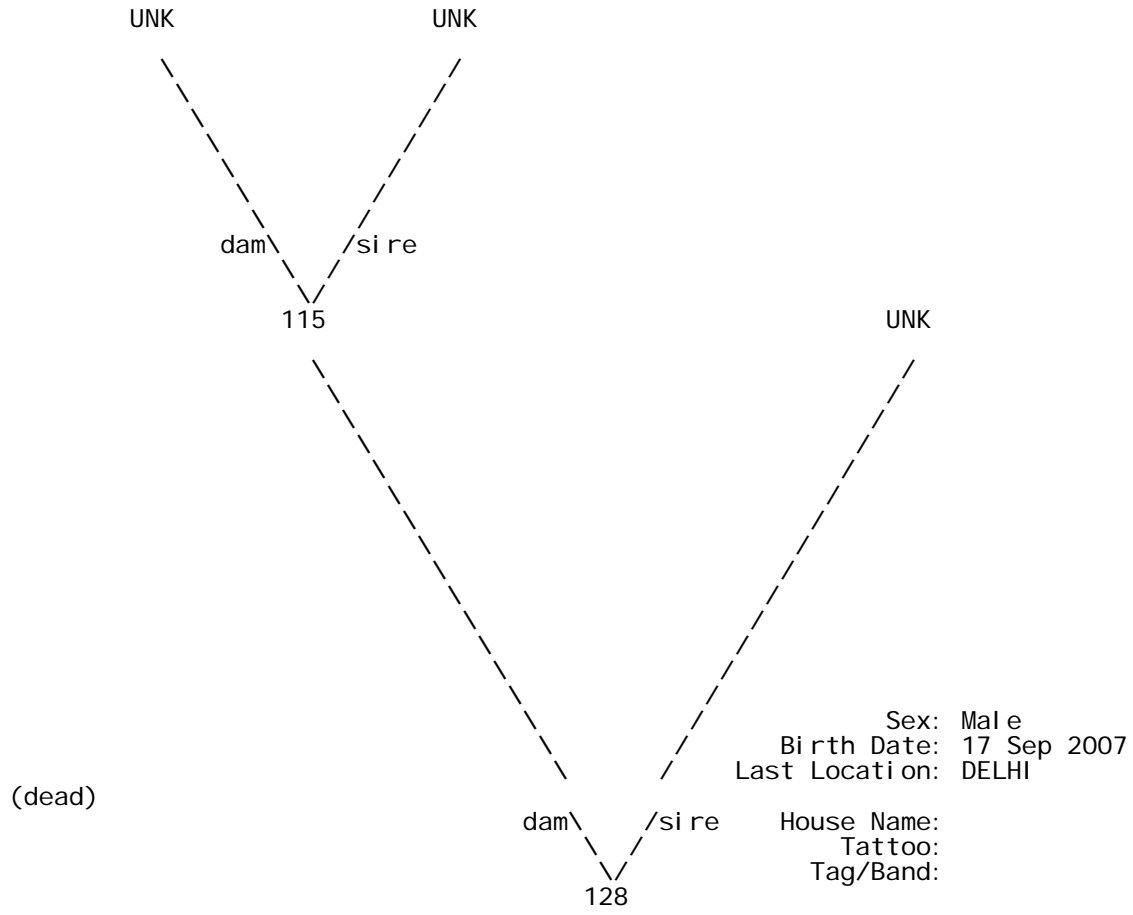
Sex: Female
Birth Date: 3 Dec 2005
Last Location: PATNA
House Name:
Tattoo:
Tag/Band:

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 ===
 Taxon Name: RHINOCEROS UNICORNIS Studbook Number:
 127
 =====

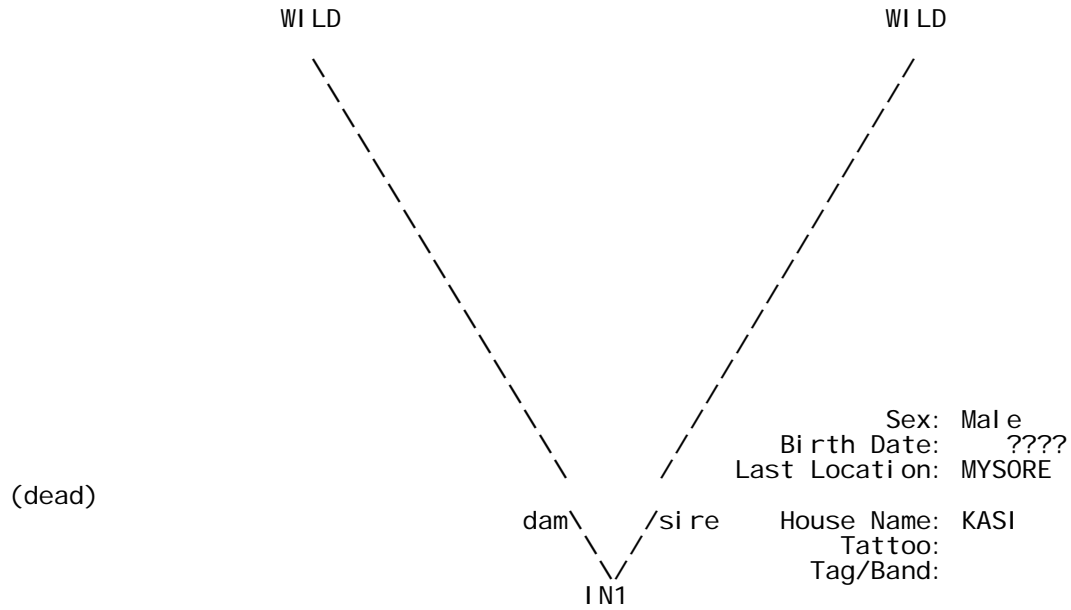


+ Wild-caught...

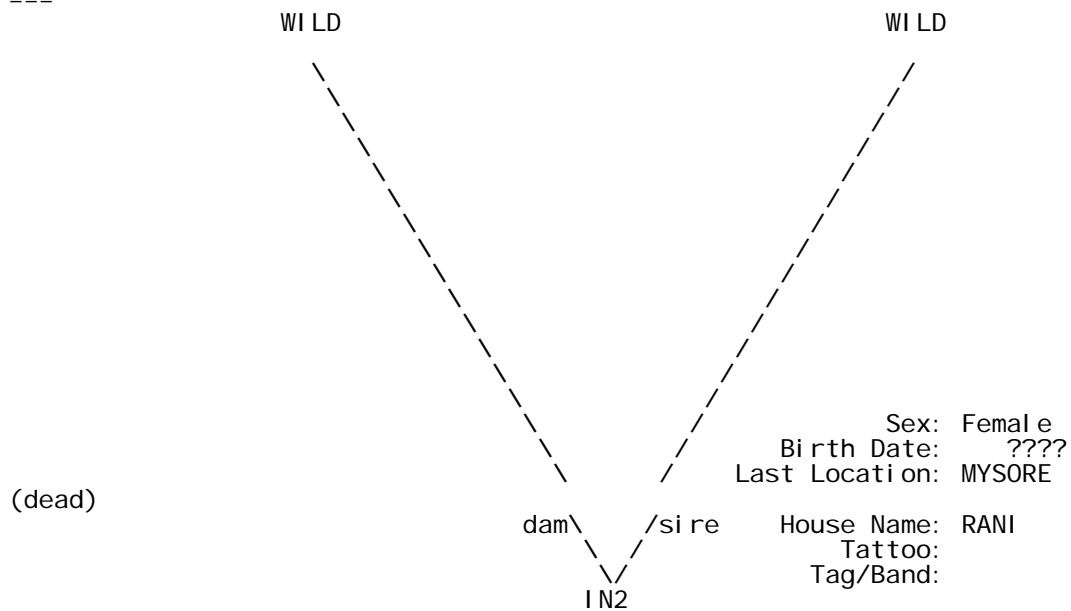
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 Taxon Name: RHI NOCEROS UNI CORNI S Studbook Number: 128
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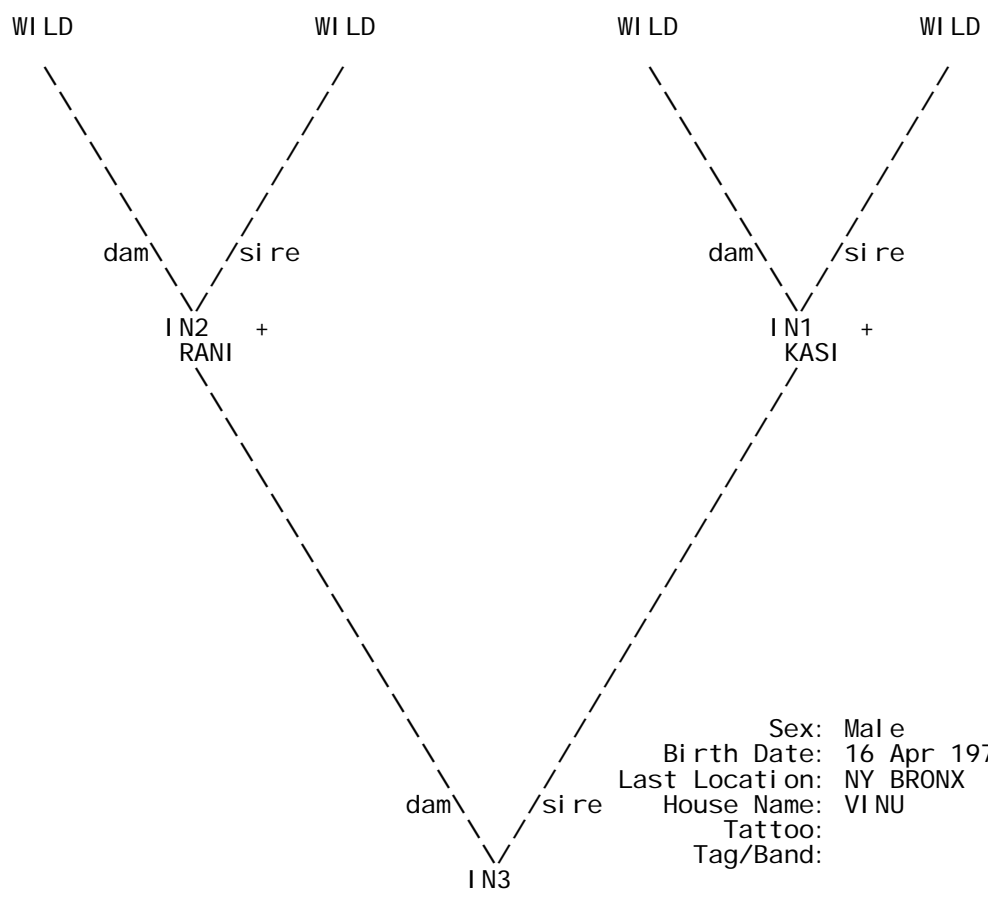
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 Taxon Name: RHI NOCEROS UNI CORNI S Studbook Number: I N1
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 Taxon Name: RHI NOCEROS UNI CORNI S Studbook Number: I N2
 =====
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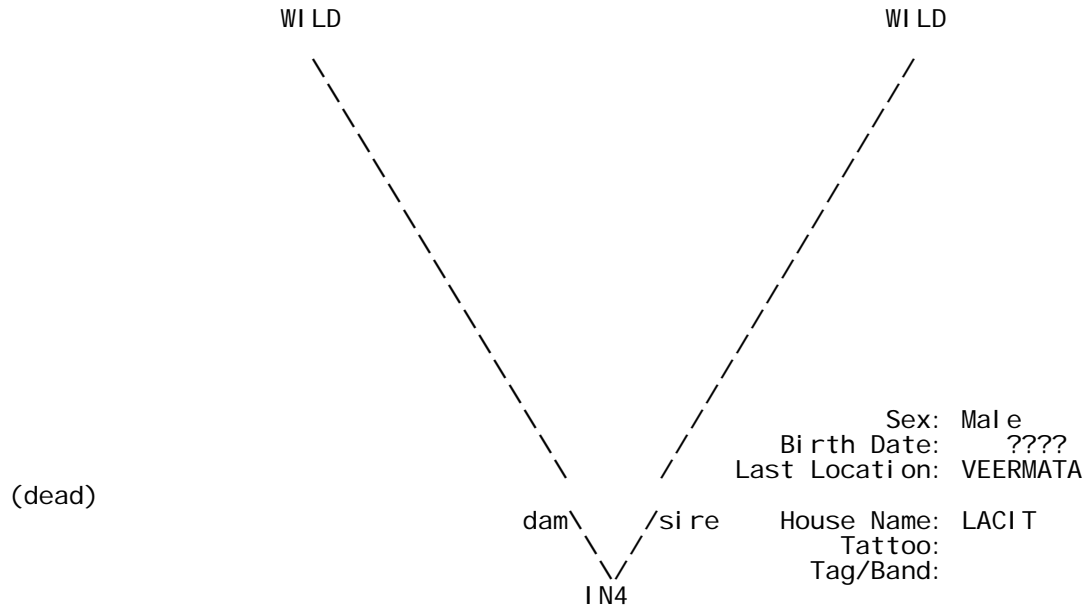
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 ===
 Taxon Name: RHINOCEROS UNICORNIS Studbook Number:
 IN3
 =====



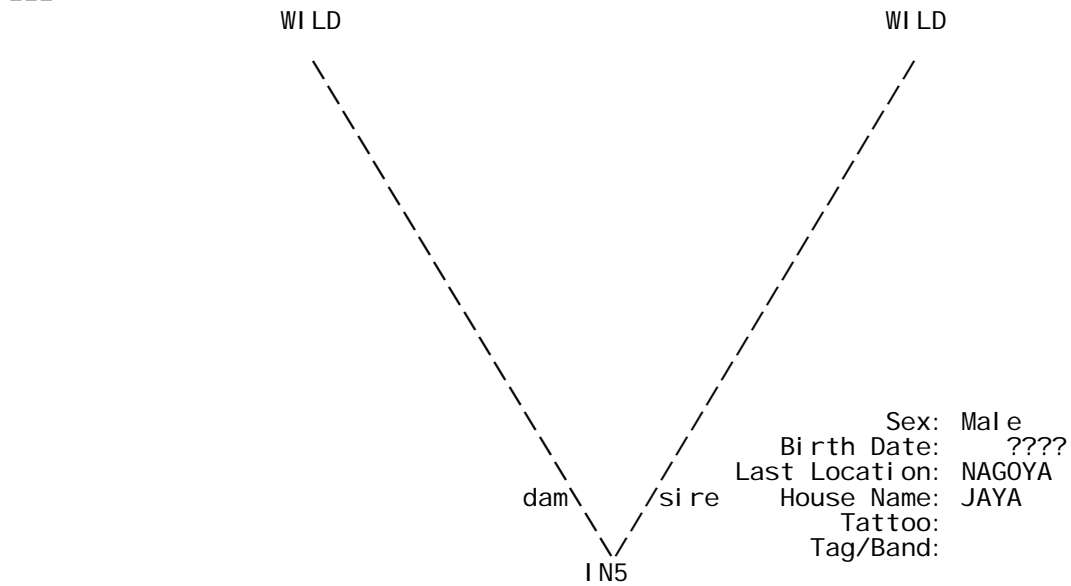
Sex: Male
 Birth Date: 16 Apr 1971
 Last Location: NY BRONX
 House Name: VINU
 Tattoo:
 Tag/Band:

+ Wild-caught...

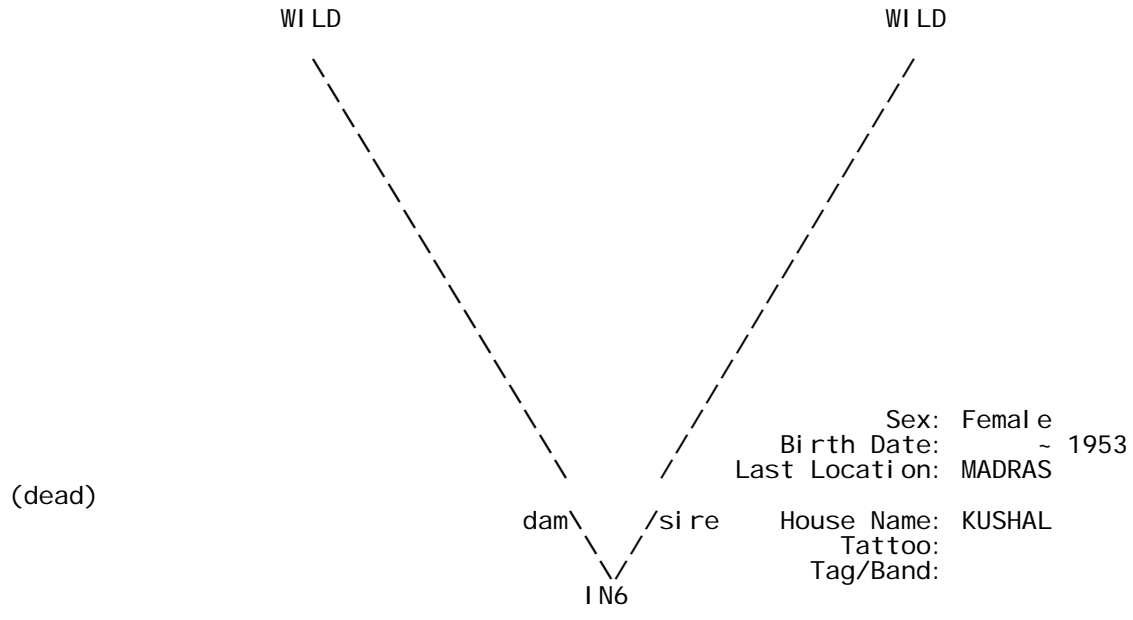
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 Taxon Name: RHI NOCEROS UNI CORN I S Studbook Number: I N 4
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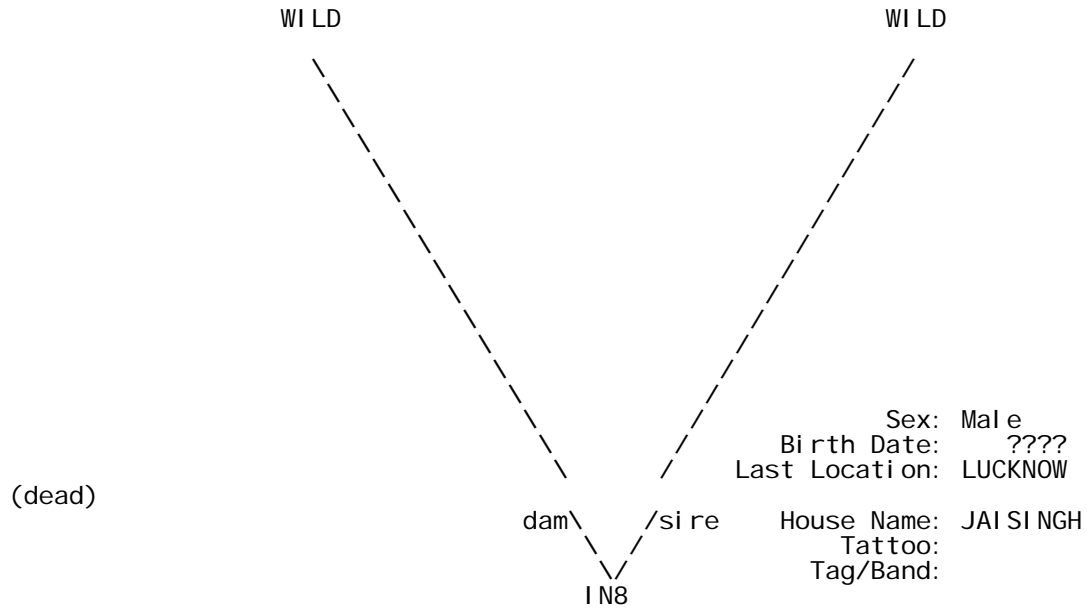
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 ===
 Taxon Name: RHI NOCEROS UNI CORN I S Studbook Number: I N 5
 =====
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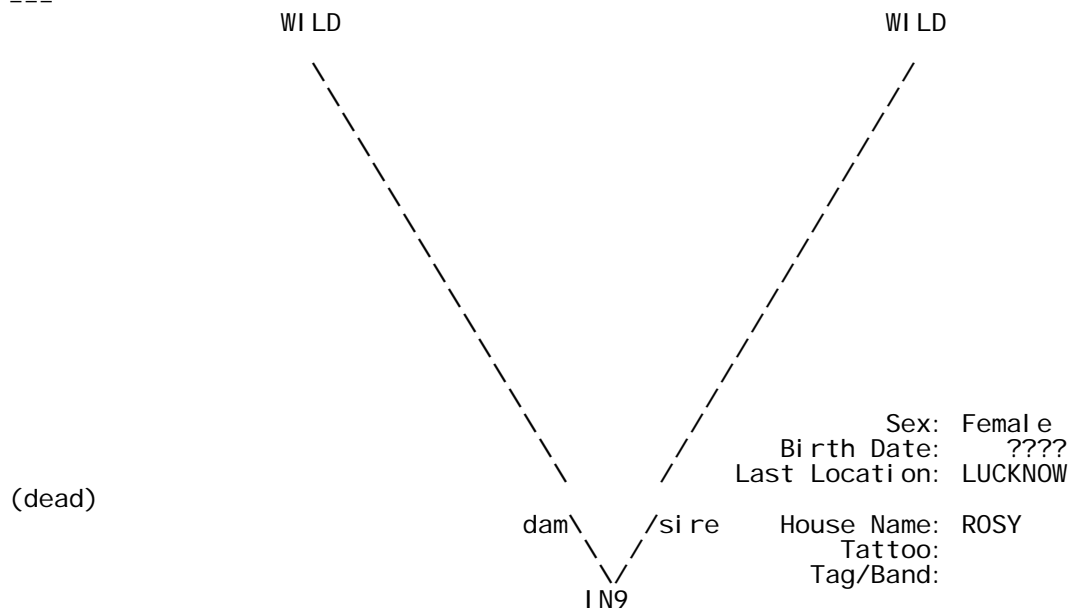
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Taxon Name: RHINOCEROS UNICORNIS Studbook Number: IN6
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 Taxon Name: RHI NOCEROS UNI CORNI S Studbook Number: I N8
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 Taxon Name: RHI NOCEROS UNI CORNI S Studbook Number: I N9
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Compiled by: Anupam Srivastav thru Wildlife Institute of India
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