Sighting frequency and group composition of the Ganges river dolphin (*Platanista gangetica gangetica*) in the National Chambal Sanctuary, India

Hari Singh[1] & R.J. Rao[2]

Abstract: The Chambal River is suspected to be an important dolphin habitat, but a dedicated seasonal survey had never been undertaken. Therefore, four surveys were carried during wet (November) and dry (February) seasons of 2007 and 2008 to fill the vacuum of knowledge on dolphin of the area, and together baseline data for management and conservation. This paper examines the sighting frequency and group composition of the Ganges river dolphin in National Chambal Sanctuary, Madhya Pradesh, India. The study was conducted along the 425 km stretch of the Chambal River, dolphin numbers were deduced based on maximum sighting per season. Due to low water depth and unsuitable habitat no dolphins were observed in zone I, II and III. A total of about 91 and 66 dolphins were recorded during 2007 and 86 and 55 dolphins were estimated during 2008 in dry and wet seasons respectively. The mean encounter rates of dolphins were 0.21/km±0.013 individuals/km in the dry season and 0.15/km±0.37 individuals/km in the wet seasons of each year. Single dolphin was observed more frequently than group size of 2 and 3. Of the total number of dolphins sighted adult were observed more frequently followed by sub-adult and calves in both dry and wet seasons. The encounter rates reported here (0.21/km) indicate the importance of continuing and expanding surveys in this area. However, a growing human population, associated with an increase in fishing activity, poses a future threat to dolphin and their habitats.

Key words: Ganges river dolphin; frequency; encounter rate; group size; Chambal River.

Introduction

The Ganges river dolphin, locally known as Susu, is restricted to the Ganga, Brahamputra, Karnaphuli-Sangu and Meghna river systems and their tributaries, from the foot hills of the Himalayas to the limits of the tidal zone in India, Bangladesh and Nepal Reeves & Brownell 1989; Sinha 1997 a,b). Despite being a "flagship" species, representing a freshwater ecosystem in need of conservation, its status has become a matter of grave concern over the past few decades Anonymous (2006). In the 19th century, dolphins were quite abundant in the entire distribution range, though no actual data on population of that time is available Anderson (1878). However, due to various pressures, the distributional range and abundance of this species has sharply declined to mere 1800 individuals in all the tributaries of its distribution in the early 2000's Behera *et al*. (2008).

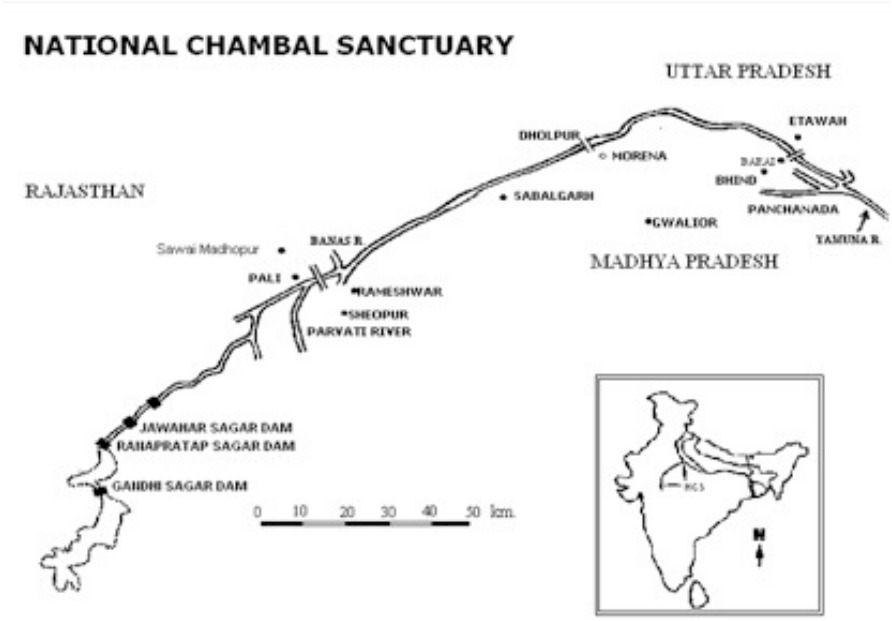

Figure 1: Map of Chambal River showing study area from Pali, 0 km (where Parvati river join Chambal) to Pachhnada, 425 km (where Kuwari, Pahuj and Sindh rivers form a confluence with the Yamuna).

The subspecies is facing a series of threats to its survival including poaching, pollution, habitat loss due to construction of dams and barrages Smith & Reeves (2000), mining of sand and stones, and incidental catches in gill-nets (Singh 2001; Nair 2009).

Consequently, it has been placed in Schedule-I of Wildlife (Protection) Act of India (1972) and is in Appendix-1 of the Convention on International Trade in Endangered Species (CITES) (IUCN 1991). The species has also been listed as Endangered by the IUCN (2008).

Several authors have previously reported the population status of the Ganges river dolphin in the Chambal River (Singh & Sharma 1985; Rao *et al*.1989; Sharma *et al.*1993, 1995; Nair 2009). The present study was conducted with the aim to describe the sighting frequency and group composition of the Ganges river dolphins in the National Chambal Sanctuary.

Materials and Methods

Study area

The Chambal River originates from the Singar Chori peak of Janapav hill of the Vindhyan range at an altitude of 854 m above the msl at $22^0$27' N and $75^0$37' E near Mhow, district Indore, Madhya Pradesh, India. A 600km stretch of the Chambal River, between Jawahar Sagar Dam and Panchhnada, has been

[1&2]School of Studies in Zoology, Jiwaji University Gwalior, Madhya Pradesh, India
Email: [1]hsingh7wild@gmail.com (corresponding author);
[2]soszool@rediffmail.com

Table 1: Mean group size of dolphin sighted during dry and wet seasons of 2007

	DRY SEASON						WET SEASON					
Zone	Single	%	Pair	%	Three or more	%	Single	%	Pair	%	Three or more	%
I	0	0	0	0	0	0	0	0	0	0	0	0
II	0	0	0	0	0	0	0	0	0	0	0	0
III	0	0	0	0	0	0	0	0	0	0	0	0
IV	2	2.6	2	16.66	0	0	0	0	0	0	0	0
V	3	3.9	0	0	0	0	2	3.92	0	0	0	0
VI	4	5.2	0	0	0	0	3	5.88	0	0	0	0
VII	8	10.5	0	0	3	100	3	5.88	2	16.66	0	0
VIII	11	14.4	2	16.6	0	0	11	21.5	2	16.6	3	100
IX	17	22.3	4	33.3	0	0	8	15.6	4	33.3	0	0
X	20	26.3	4	33.3	0	0	11	21.5	4	33.3	0	0
XI	11	14.4	0	0	0	0	13	25.4	0	0	0	0
Total	**76±7.06**		**12±1.64**		**3±0.9**		**51±5.1**		**12±1.64**		**3±0.9**	
% age	**83.6**		**13.2**		**3.20**		**77.2**		**18.2**		**4.5**	

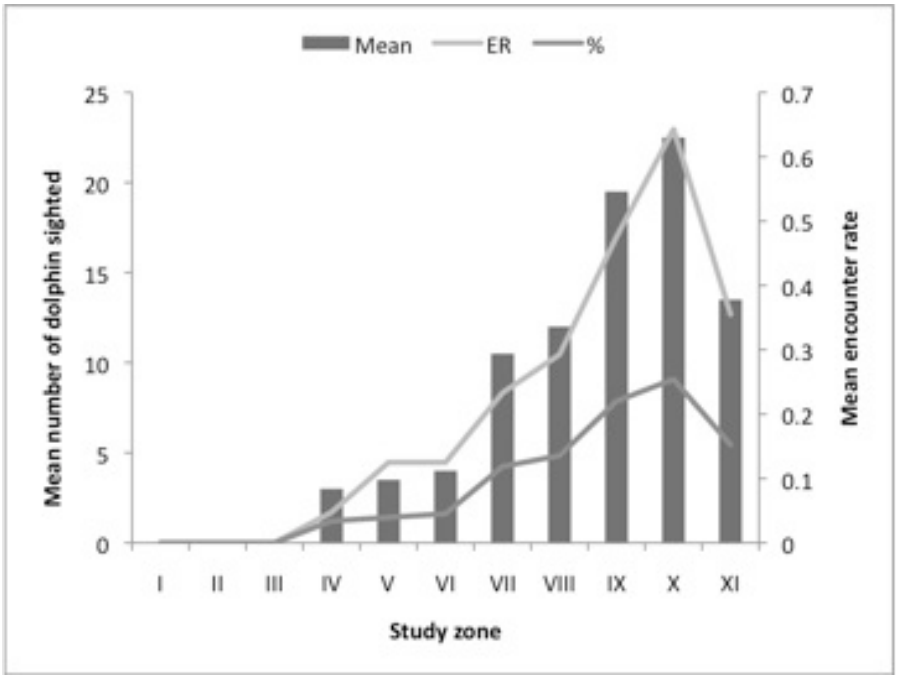

Figure 2: Mean encounter rate and number of dolphin sighted in each segment of the Chambal River during 2007 and 2008 dry season.

protected as the National Chambal Sanctuary. The main study area lies between Pali (km 0) and Panchhnada (km 425) within the Sanctuary (Figure 1). The area lies within the semi-arid zone of north-western India at the border of Madhya Pradesh, Rajasthan and Uttar Pradesh States. The main tributaries of the Chambal River are Siwana, Retam, Shipra and Choti Kalisindh, Kuno and Kuwari in Madhya Pradesh; Kalisindh, Parvati, Parwan and Banas in Rajasthan. The climate of the basin is influenced by its location with respect to the Tropic of Cancer and the presence of lofty Vindhyan ranges in the upper reaches. The area is semi arid and the temperature in the region varies from 2^0C to 46^0C during winter and summer respectively. The southwest monsoon is the major source of rainfall. The mean annual rainfall over the Chambal basin was 797 mm Hussain & Choudhury (1992). Unlike many rivers of the greater Ganges river system, the Chambal River is relatively unpolluted (Hussain & Singh 1999; Saksena *et al*. 2008).

Survey method

To record dolphin distribution, four boat-based surveys were conducted during November (Wet) and February (Dry) of 2007 and 2008. The entire river was segmented into eleven different zones, ranging in length from 22 to 63 km (mean length 38.63 km, SD ±10.70). All the zones were separated from each other by rapids and shallow water and the end points were located at significant landmarks. The surveys were carried out from upstream to downstream by boat using a 40hp outboard engine with an average speed of 4-5 km/hr. Three trained observers (two on the sides and one in the centre of the boat) recorded number and age class (adult, sub adult, calf) of dolphins sighted. Observers were the staff of Madhya Pradesh forest department and were familiar with river dolphins, and responsible for conducting annual surveys of dolphin in the area. Dolphin measuring 0.8 to 1m (0–2 year) was considered as calf, 1 to 1.50 m (2–6 year) as sub-adult and more than 1.50 m (more than 6 year) as adults (Mohan *et al.*1997; Behera & Rao 1999). When the body size of the dolphin could not be discerned it was classified as 'unidentified'. No attempt was made to sex individuals.

For the purposes of this study, a dolphin group was defined as dolphins no more than 500 m apart, within an area of similar hydrological characteristics Smith & Reeves (2000). Group sizes were evaluated with a best, high and low estimate of numbers to incorporate a degree of uncertainty Smith (1994). The low group size estimate was considered a minimum count and the high estimate a maximum count. Estimates of the total number of individuals and of group size were calculated from the "best" estimates of group size, while the high and low estimates were used to evaluate the uncertainty of the observers about the accuracy of their best estimates Smith *et al.* (2006). Encounter rate of dolphin per km was calculated by applying the following formula:

$$\text{Density km}^{-1} = \frac{\text{Sum of best estimates}}{\text{Km covered}}$$

Results

Distribution and encounter rate

On the basis of a simple calculation of direct count method a total best estimate of 91 and 66 dolphins were recorded during 2007 and 86 and 55 during 2008 in the dry and wet seasons respectively. No dolphin was recorded upstream from Pali to Atar (zone I-III) during dry season and from Pali to Barwasin (zone I-IV) during the wet season of each year. The distribution of dolphin was recorded from Bharra (130km downstream of Pali, zone IV) with an encounter rate of 0.05±0.047 during the dry season and no dolphin was recorded in this zone during wet season of each year. The distribution of dolphin was recorded from Barwasin (185 km downstream of Pali, zone V) in both dry and wet season with an encounter rate of 0.13 individuals/km ±0.023 in the dry season and 0.06 individuals/km ±0.06 during wet season of each year. After Barwasin (185km from Pali) the distribution of dolphin was continuous up to Barhee village (410km, downstream of Pali, Chambal/ Yamuna confluence). The mean encounter rates of dolphin during each year dry season was 0.21 individuals/km and 0.15 individuals/ km in wet season. The highest encounter rate was observed from Ater to Barhi (zone IX) 0.48 individuals/km±0.016 and Barhi to Chakernagar (zone X) 0.65 individuals/km±0.015 during dry season (Fig.2). Whereas, the encounter rate of 0.31±0.41 and 0.45 individuals/km±0.60 were observed at the same zone during wet season of each year (Fig.3). In general, encounter rate decreased with distance from the confluence with the Yamuna River.

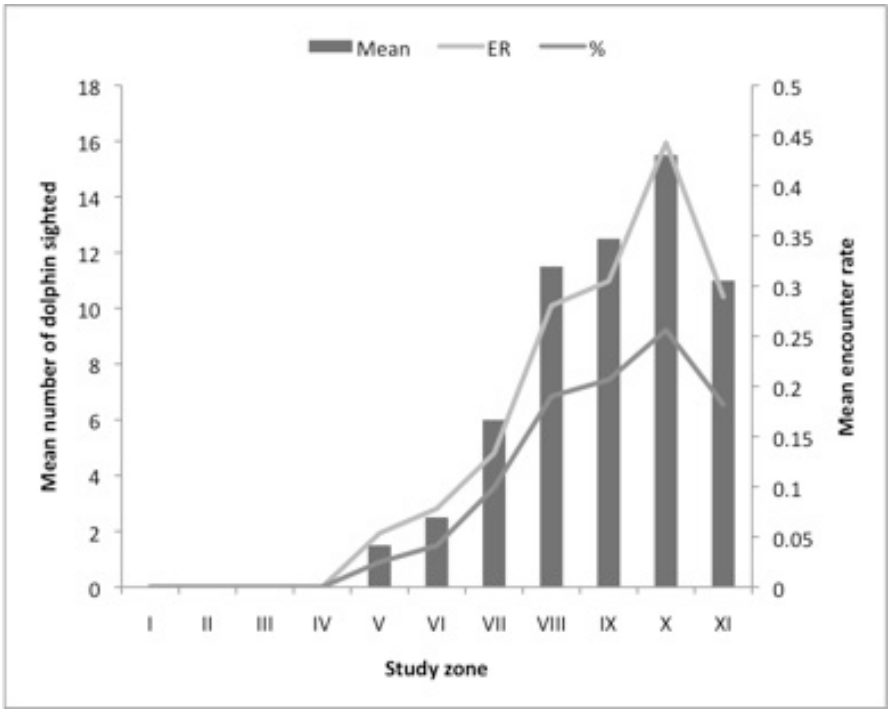

Figure 3: Mean encounter rate and number of dolphin sighted in each segment of the Chambal River during 2007 and 2008 wet season.

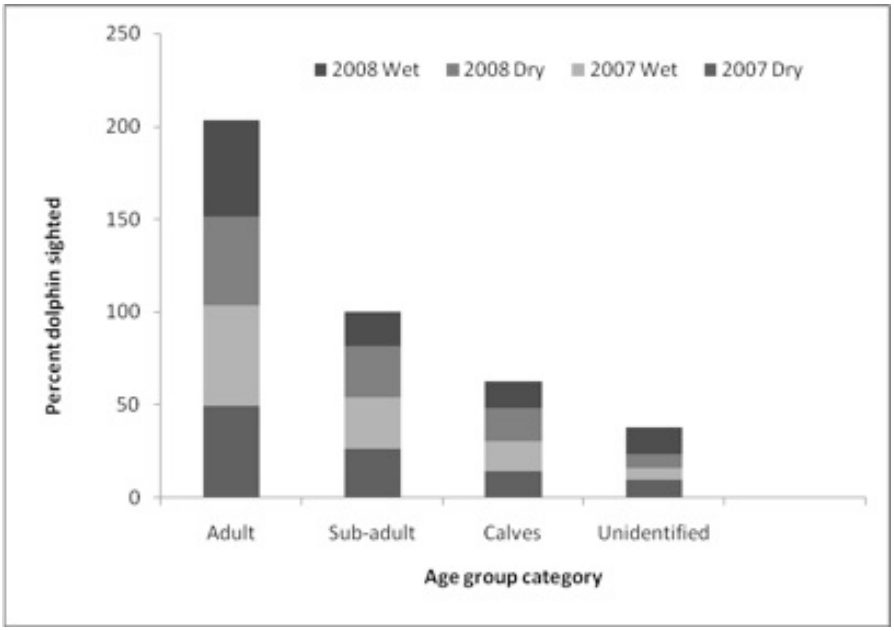

Figure 4: Percentage group category and unidentified dolphin during 2007 and 2008 dry and wet seasons.

Group sizes and group formations

The largest group size of 3 dolphins was observed during the present study. Solitary dolphins were observed more frequently than group size of 2 and 3 dolphins. During the dry season of 2007, maximum number of 20 solitary (26.3%) dolphin was observed at zone X followed by 17 (22.3%) dolphins in zone IX. Similarly, in the group size of two maximum numbers of 4 dolphins (33.3%) were observed in zone IX and X each. whereas, group size of 3 dolphins (100%) was observed only in zone VII. Similarly, in the wet season of 2007, maximum number of 13 solitary dolphins (25.4%) was observed at zone XI, followed by 11 dolphins (21.5%) in zone VIII and X each. Similarly, in the group size of 2 maximum numbers of 4 dolphins (33.3%) were observed at zone IX and X each. whereas, group sizes of 3 dolphins (100%) were observed only at zone VII (Table 1). During the dry season of 2008, maximum number of 16 solitary dolphins (23.8%) was observed in zone XI, followed by 15 dolphins (22.3%) in zone X. In the group size of 2 maximum numbers of 6 dolphins (37.5%) were observed in zone X, followed by 4 dolphins (25.0%) in zone VIII and the group size of 3 dolphins (100%) were observed in zone IX. Similarly, in the wet season of 2008, maximum number of 13 solitary dolphins (30.9%) were observed in zone X, followed by 9 dolphins (21.4%) in zone IX. In the group size of 2

Table 2: Mean group size of dolphin sighted during dry and wet seasons of 2008

	DRY SEASON						WET SEASON					
Zone	Single	%	Pairs	%	Three or more	%	Single	%	Pair	%	Three or more	%
I	0	0	0	0	0	0	0	0	0	0	0	0
II	0	0	0	0	0	0	0	0	0	0	0	0
III	0	0	0	0	0	0	0	0	0	0	0	0
IV	2	2.9	0	0	0	0	0	0	0	0	0	0
V	2	2.9	2	12.5	0	0	1	2.3	0	0	0	0
VI	4	5.97	0	0	0	0	2	4.7	0	0	0	0
VII	8	11.9	2	12.5	0	0	5	11.9	2	20	0	0
VIII	7	10.4	4	25	0	0	5	11.9	2	20	0	0
IX	13	19.4	2	12.5	3	100	9	21.4	4	40	0	0
X	15	22.3	6	37.5	0	0	13	30.9	0	0	3	100
XI	16	23.8	0	0	0	0	7	16.6	2	20	0	0
Total	**67±6.1**		**16±2.1**		**3±0.9**		**42±4.4**		**10±1.3**		**3±0.9**	
%age	**78**		**18.7**		**3.5**		**76.4**		**18.2**		**5.5**	

maximum numbers of 4 dolphins (40.0%) were observed in zone IX, and group sizes of 3 dolphins (100%) were observed in zone X (Table 2).

Out of the total dolphin sighted in the dry seasons of 2007, 45 were adult, (54.5%) 24 sub-adult (22.7%), 13 calves (16.7%), and 9 unidentified (7.5%). Similarly, in the wet season 36 adult (49.4%), 15 sub-adults (27.9%), 11 calves, (17.4%) and 6 unidentified (7.2%) dolphins were observed. In the dry season of 2008, 41 adult (52.7%), 24 sub-adult (18.1%), 15 calves (14.4%) and 6 unidentified (14.4 %) dolphins were observed. Similarly, in the wet season 29 adult (47.6%), 10 sub-adult (27.9%) 8 calves, (17.4%) and 8 unidentified, (7.2%) dolphins were observed (Fig.4).

DISCUSSION

It appears that population of dolphin in the Chambal River has not undergone drastic change based on superficial comparison with earlier studies. Although, comparison of the result of the earlier surveys and the present one though not fully valid due to difference in survey bias and study site selection. It is felt to safely indicate that the population of dolphins in the Chambal River has not undergone drastic reduction in the intervening period. Which was 93 in 2002 and 81 dolphins during 2005 (WWF unpublished).

Enumeration based on direct count the total population of Ganges river dolphins in the Chambal River was assumed to be 91 individuals. The population of dolphin in the Chambal River remained relatively consistent over years, as did the proportion of adult to calves (WWF unpublished). A little variation (qualify- less/ more) in calves during dry season 2007 may be is due to parturition or due to upstream migration of young animals in the monsoon. During the dry season, dolphins disappeared from certain places may be in order to avoid shallow depth or to join some other dolphin group for breeding. During the present survey the distribution range of dolphins was recorded from Bharra (130km downstream from Pali) to Chambal-Yamuna confluence (410km downstream from Pali). Which was from Batesura (305km upstream from Chambal-Yamuna confluence) to Pachhnada (15km downstream from confluence) during 1982-1984 Singh & Sharma (1985) and from Rancholi (110km downstream from Pali) to Pachnada (425km downstream from Pali) during 2005 (WWF unpublished). Because of low flow and unsuitable habitat no dolphins were recorded in Zone I, II and III Singh (2008).

The highest encounter rate between Barhi to Chakernager indicates that this stretch is good habitat for dolphins. Increase in abundance in peak dry season was likely due to congregation of dolphins in the main channel, where there was sufficient depth and flow volume Smith *et al.* 1998; Sinha 2006. The lowest encounter rate from Atar to Sarsaini is likely to be because in that upstream section the river is very shallow and rocky habitat. Reduced upstream and tributary water volume, through diversion of water for agricultural use, may cause immigration of dolphins into larger main channels Singh (2008). The range of encounter rates recorded during the present study (0.05 to 0.65/km and 0.06 to 0.45/km) was found to be within the range of the encounter rates in other segment of the Ganges River for the same subspecies. In the Upper Ganges River Uttar Pradesh the encounter rate for this species was 0.52 individuals/ km Bashir *et al.* (2007). In the Brahmaputra River Assam the encounter rate was 0.44 individuals/ km Mohan *et al.* (1997). In the Vikramshila Gangetic Dolphin Sanctuary the encounter rate was 1.8 individuals/km Choudhary *et al*. (2006), while in the Lohit River, Eastern Assam the encounter rate was 0.23 individuals/km Wakid (2005). However in the Chambal River the encounter rate estimated during the present study was higher than the previous studies conducted by different workers. In 1982–1984 a total of 45 dolphins were reported with an encounter rate was 0.15 individuals/km in a stretch of 305km reported from Batesura (125km) to the Chambal-Yamuna confluence (415km) Singh & Sharma (1985).

In 1985–1986, 43 dolphins were reported from Batesura (125km) to Chakernagar (390km) with an encounter rate of 0.8 individuals /km in a stretch of 370km Rao *et al.* (1989). In 1993 and 1994 a total of 29 and 30 dolphins were reported from Pali (0 km) to the Yamuna confluence (415 km) with an encounter rate of 0.16 individuals/km in a stretch of 265km, Sharma *et al.* (1993,1995). During, February–March, 2005, a total 81 dolphin were reported from Pali (0km) to Pachhnada (425km) with an encounter rate of 0.19 individuals/km (WWF unpublished).

In the Chambal River the maximum group size of 1–3 dolphins was observed during the present survey. The same group size of 1–3 dolphins was observed in the River Kosi during

March, 2001, Sinha & Sharma (2003). This was 3–7 dolphins in the Chambal River during February–March 2005 (WWF unpublished 2005). Of the total dolphin sighted solitary dolphins comprise 83.6% and 78% during dry season and 77.2% and 76% during wet season of each year. This was 57% during February–March 2005 WWF (unpublished 2005). The results of the present study are similar to the findings of Kasuya & Haque (1972), as they reported 90% of the individuals to be solitary. Dolphins of all age classes (i.e. adults, sub-adults and calves) were observed in the Chambal River. In the dry season the age group of dolphin comprises 54.5% adult, 22.7% sub-adult and 16.7 % calves in the first year and in the second year 52.7% adult, 18.1% sub-adult and 14.4% calves. Which were 53% adult, 29.7 % sub-adult and 17.3% calves in the Chambal River during 2005, WWF (unpublished 2005). This was the first survey in recent time that an attempt was made to objectively assess the status of this species in this river. Smith & Reeves (2000) have clearly explained why it is necessary to adopt a timely and comprehensively adequate survey program in order to detect population trends of the Ganges river dolphin that can contribute to its conservation planning. Clearly there is a case to implement a regular, if not frequent program of field activity by conservation agencies to acquire more detailed information about the species biology.

CONCLUSION

The Ganges river dolphin is distributed in the Ganges, Brahmaputra and Meghna river system and its tributaries. The study shows that River Chambal is a good potential for dolphin habitat but habitat exploitation is the factor responsible for the declining cause of this species. Upstream the point 130km neither any dolphin sighted nor a confirm report received. In the downstream beyond 410km, in all other stretches dolphins were recorded. Although, dolphins are known to occur downstream of 425km in Yamuna, extensive fishing and low water depth may be posing a situation of harassment for free movement of the animals. In contrast, the Ganges river dolphins have been eliminated from much of their historic range. The range shrinkage and numerical decline of river dolphins appear to be largely a result of water development projects that have dramatically altered environmental conditions. Empirical studies are needed on the ecology of freshwater dolphin, both to inform conservation efforts on behalf of these endangered animals and to help address broader concerns related to biodiversity conservation.

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Tokay Geckos released to the wild

The Sangai Express, Imphal, August 3, 2012

Imphal, Aug 2: All the eight Tokay Geckos rescued from Kangmong, Bishnupur District were released today at Keibul Lamjao National Park. Meanwhile, two individuals who were rearing the Tokay Geckos have surrendered before the Court.

On the other hand, it is reported that encroachers and lack of cooperation from the surrounding people have turned out to be big obstacles in the effort to make KLNP a World Heritage Site.

Eight Tokay Geckos rescued by a combined team of Nambol police and DFO Bishnupur from Kangmong Meisnam Maning Leikai a few days back were released today at KLNP in accordance to an order of the CJM Bishnupur. Of the eight Tokay Geckos released today, two were females and six males. The lizards were rescued from the custody of Sinam Ranjit Khuman and M.Puhanba on July 30. According to DFO L.Lukhoi, Sinam Ramjit and M.Puhanba surrendered before a Court on July 31 and they are currently under judicial custody.

Though this species of lizard is not included among the scheduled animals, any one found hunting or trading the same species can be imprisoned for three years or fined up to Rs. 25,000 under the Wildlife Protection Act.

ফোঙদোকপা লেম্ব্রবা।

জিরিবামদা 'হঙকোক' থিবদা পূমঙাও ঙাওনরে

লুখোই অতোম

জিরিবাম, অগস্ত ২ঃ ইম্ফাল ইস্ত দিস্ত্রিক্তকী জিরিবামদা মতম খরগী মমাঙদা চেঙ নপ্পা শেন ময়েক অরিবা কোইন, অহীংদা মখোল থোক্লা খোংবা অরিবা প্রিথাইগী কোল-লীক অমসুং মহাত্মা গান্ধীগী শক্তম য়াওদবা লুপা মঙা চৎপী চেগী নোত থিবগী থবক্তা মাঙবা য়াবা মতম অমদি পৈশা মাঙন-খ্রবা মতুংদা হৌজিক অমুক লৈকং 'হঙকোক' লল্লোম্নবগীদমক থিবদা পূমঙাও ঙাওনরে।

জিরিবামগী য়ুমথোঙ খুদীং, দুকান অমসুং হোতেলশিং হঙকোক্কী ৱারী ঙাক্তা ঙাইরে। গ্রাম ২০০/৩০০ লোম লুম্না অমসুং ঈঞ্চি ১০-১২ গী মথক্তা শাংবা হঙকোক অমগী মমল লুপা

লাক্ষ/লাক্ষনি হায়বসিদা জিরিবামগী মীওই কয়ামরুম লোন্না লোন্না হঙকোক ফারগা য়োক্লুনা থম্লবসু য়াওরি। হঙ-কোক ললোনবা মীওই কয়া জিরিগী হোতেলশিংদা থুংলরে হায়বা পাউসু তত্তনা তানরি।

লায়না মখল কয়া লায়েংবদা শীজি-ন্নৈ হায়না থাজনরিবা অদুবু লায়েংলগা অনাবা ফরে হায়বগী চপ চাবা প্রমাণমক্তি লৈত্রিবা হঙকোক অসি চুম্ম গী জিরিবামদা নত্তনা তমেংলোংগী খুনশিংদা অঙকপা মওংদা থিবগী থবক চথনরি। লোয়ননা য়ুমথংনরিবা আ-সাম স্তেতকী মফমশিংদসু হঙকোক থিবগী থবক তৌনরি। অদুবু লুরিবদি হঙকোক ফারুরবা মতুংদা কনাদা য়োনগনি খঙদবা অমসুং ফারবা হঙ-কোক্তা করি মচীঞ্জাক পীজগনি খঙদবদগী জীব অদু শিবগী থৌদোক কয়া থোকপা অসিনি। মসিনা হঙকোক মখল অসি মুৎখিনবা মচাক ওইরক্লি।

হঙকোক থিবগী থবক্তা থৌদোক কয়াসু থোক্লি। গ্রাম ২০০/৩০০ গী মথক্তা লুম্না অমসুং ঈঞ্চি ১০-১২ গী মথক্তা শাংবা হঙকোক থিয়ু হায়না থিরবা, ফংলবা মতুংদা অরূম্বা শুই/শুদে হায়না খৎন-টৈনবা, হঙকোক্কী অরূম্বা হেনগৎহন্নবা হঙকোক্তা নম্মুদা মিশি অমসুং য়োৎনচিংবা অরূম্বা পোৎশক ইনশিনবনচিংবগী থৌওং কয়াসু চথনরি।

জিরি মায়কৈদা অকনবা মওংদা থিবগী থবক চথরিবা হঙকোক মখল অসি নেপাল, বাংলাদেশ, নোর্থ ইস্ত য়াওনা সাউথ ইস্ত এসিয়াদা ফংবগী রিপোর্ত লৈবা 'তোকে গেকো' হায়-রিবা মখল অসিনি। 'তোকে গেকো'

মখা লামায় ৫, কলম ৫ দা