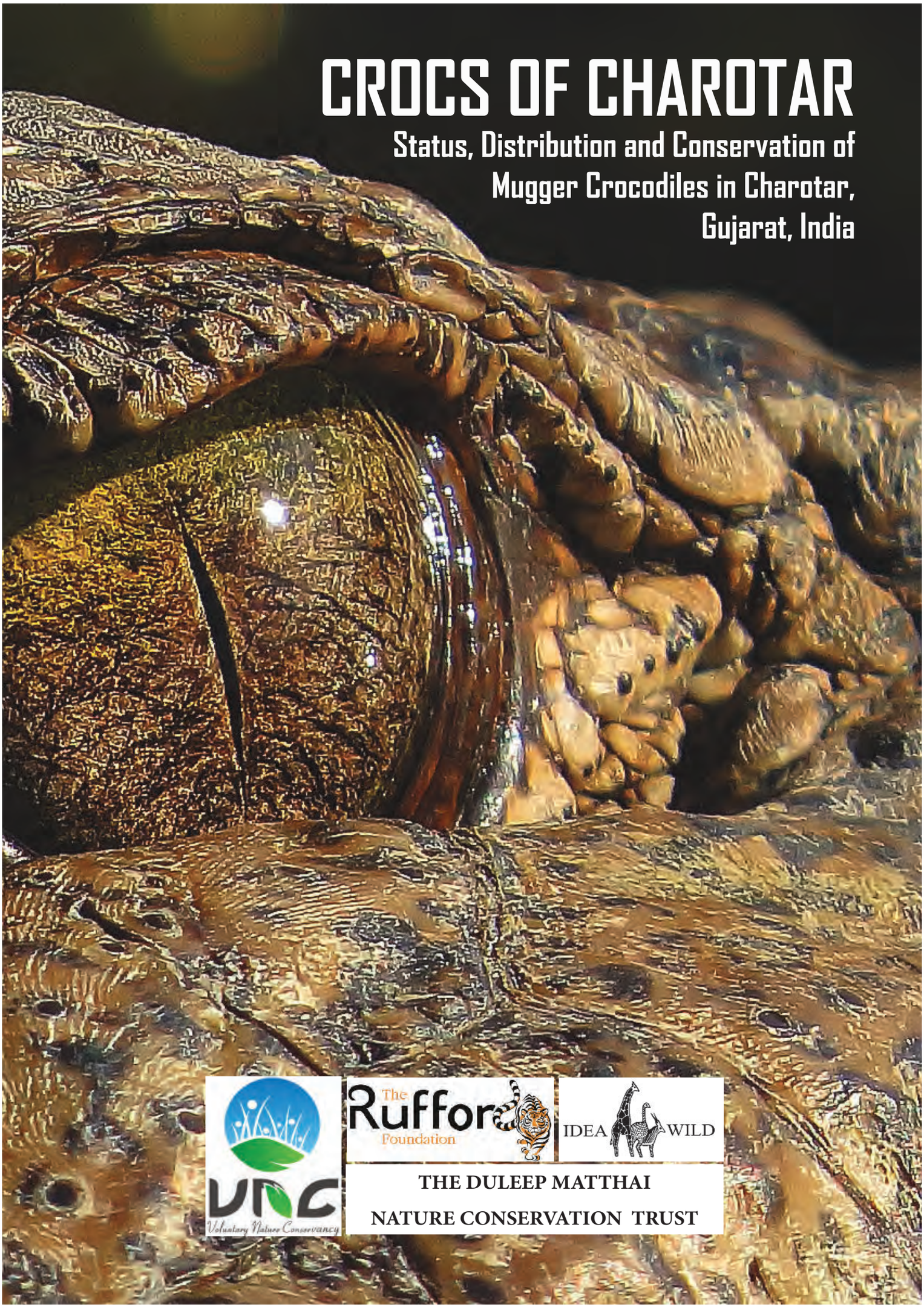


CROCS OF CHAROTAR

Status, Distribution and Conservation of Mugger Crocodiles in Charotar, Gujarat, India

VNC
Voluntary Nature Conservancy

The Rufford Foundation

IDEA WILD

THE DULEEP MATTHAI
NATURE CONSERVATION TRUST

Voluntary Nature Conservancy (VNC) acknowledges the support to this publication given by Rufford Small Grant Foundation, Duleep Matthai Nature Conservation Trust and Idea Wild.

Published by
Voluntary Nature Conservancy
101-Radha Darshan, Behind Union Bank,
Vallabh Vidyanagar-388120, Gujarat, India
(info@vncindia.org)

Designed by
Niyati Patel & Anirudh Vasava

Credits

Report lead: Anirudh Vasava, Dhaval Patel, Raju Vyas

Field work: Vishal Mistry, Mehul Patel, Kaushal Patel, Anirudh Vasava

Data analysis: Anirudh Vasava, Niyati Patel

Report Preparation: Anirudh Vasava

Administrative support: Dhaval Patel

Cover Photo: Mehul B. Patel

Suggested Citation: Vasava A., Patel D., Vyas R., Mistry V. & Patel M. (2015) Crocs of Charotar: Status, distribution and conservation of Mugger crocodiles in Charotar region , Gujarat, India. Voluntary Nature Conservancy, Vallabh Vidyanagar, India.

Crocs of Charotar

Status, Distribution and Conservation of Mugger Crocodiles in Charotar Region, Gujarat, India

Principle Investigators
Anirudh Vasava
Dhaval Patel

Co- Investigator
Raju Vyas (Ph. D.)

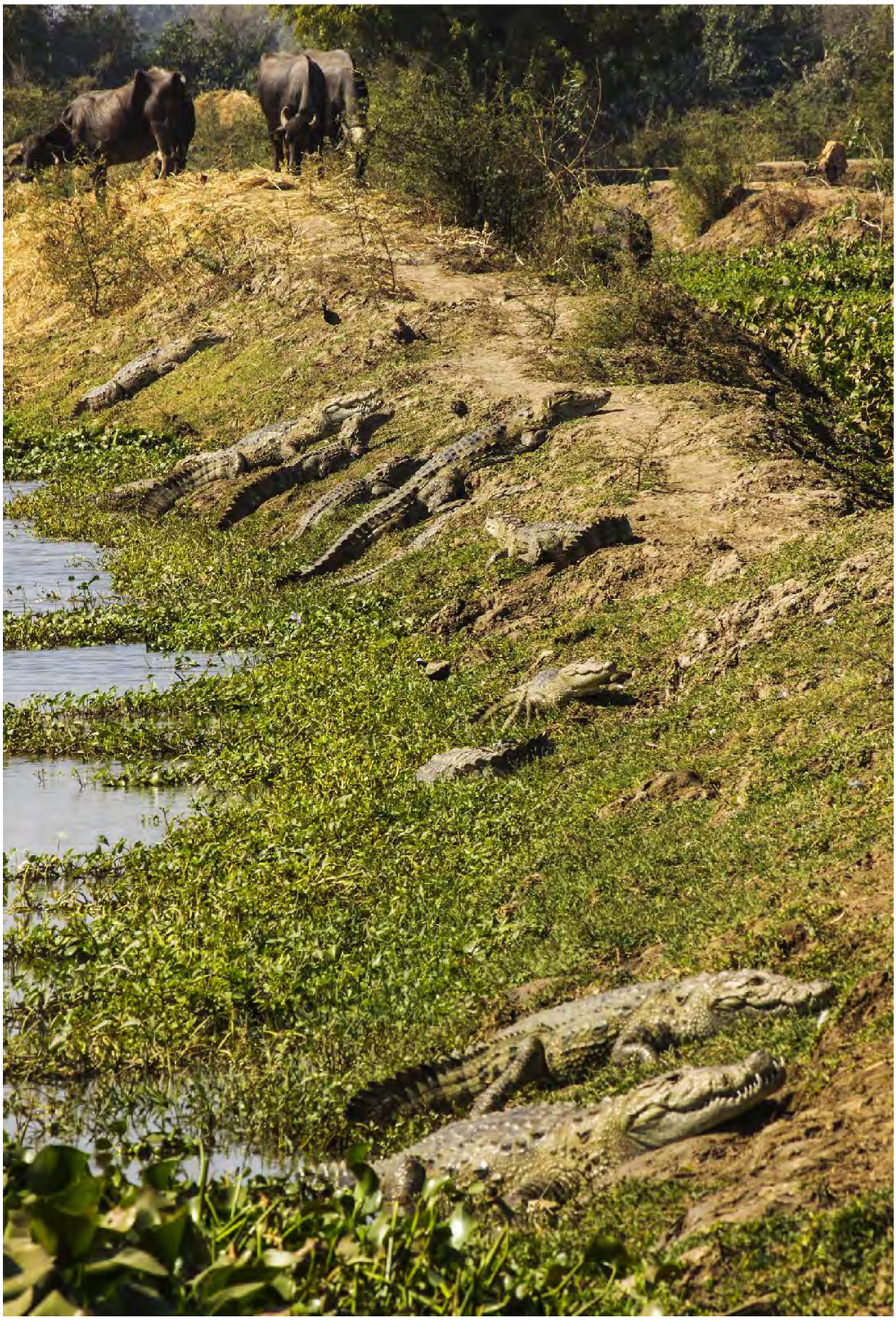
Researchers
Vishal Mistry & Mehul Patel

VNC Voluntary Nature Conservancy

The Rufford Foundation

IDEA WILD

THE DULEEP MATTHAI NATURE CONSERVATION TRUST



© Anirudh Vasava / VNC

ACKNOWLEDGEMENT

This study was made possible by financial support to Dhaval Patel and Anirudh Vasava from The Rufford Small Grants Foundation (RSGF, UK) and Duleep Matthai Nature Conservation Trust (Anand, Gujarat) respectively. We are thankful to Idea Wild for providing equipments to support our work.We are indebted to the foundation for extending their support and for showing confidence in our work. A special thanks to Jane Raymond at the RSGF who have been very patient and supportive during the tenure of our Project.

We are thankful to Dr. B. M Parasharya, Soham Mukherjee and Dhiresh Joshi for acting as referee for the Rufford Small Grant Program. We are grateful to them advisors for suggestions, comments and criticism at various stages.

We wish to thank the Chief Conservator of Forests, Social Forestry Circle, Ahmedabad, Divisional Forest Office (DFO), Anand and the Anand district forest department staff for their support.

We acknowledge the assistance of Sunetra Deshpande and Mansi Modi of VoxPopuli-India for their assistance with the data management and analysis.

Special thanks go to Kaushal Patel, who while working as project assistant at VNC helped in the initial phase of data collection. We sincerely thank the volunteers and interns at Voluntary Nature Conservancy; Bhargav Patel, Priti Patel, Megha Patel, Asfaq Kara, Bhargav Parekh, Arjun Vithlani, Jenis Patel, Mayukh Dey, Neel Talati, Neeraj Parmar, Pratha Brahmbhatt, Urvi Dave, Prathmesh Patel and Dhaval Mehta who assisted us in collecting data. We owe our gratitude to other volunteers and the staff of Voluntary Nature Conservancy for lending uninhibited support at all stages of this work. We also thank Jilesh Patel from Malataj, Ajay Mahida of Deva, Ajay Solanki, Ghanshyam Raval and Ashish Rana from Vaso, Harish Rathod of Dantali and Nagarbhai Tadpada from Heranj for acting as local contact and assist us in data collection.

We thank the Principal, VP & RPTP Science College, Vallabh Vidyanagar for allowing us to use the class room for conducting the workshop on human-crocodile conflict mitigation.

We would like to thank Sureshchandra Mistry and family at Vaso for the hospitality and delicious food they served us during the field work.

A word of thanks to all the participants who took time to answer our questionnaires.

Finally, we are warmly thankful to all villagers of Charotar region, who have faith in mugger conservation and believe that muggers should survive in their village's ponds.

© Mehul B. Patel

EXECUTIVE SUMMARY

Proper status of the mugger (*Crocodylus palustris*) population in Charotar region was not known until recently. Except the study conducted by Vyas (2013), there wasn't any comprehensive study on the population of muggers in charotar region. Upadhyay and Sahu (2013) provided mugger numbers from very few localities. However both these studies indicated that there exists significant population of muggers in charotar region. With numerous freshwater wetlands, Charotar harbours excellent habitats for the muggers. Muggers have existed in this region for a long, but with no proper historical records available, it is difficult to ascertain the earlier status of the muggers in the region. The muggers of Charotar region survive in the man-made communal water bodies within the rural agricultural dominated region, establishing an ideal example of man-animal co-existence. Humans and mugger crocodiles have been steadily increasing over the past years around these wetlands, which has resulted in different types of human-crocodile interactions in this region, varying from peaceful coexistence to conflict. Conserving muggers in these human dominated landscapes require a firm understanding of people's relationship with this species. This mugger population is under severe anthropogenic pressures and the conflict in the form of muggers being found in human habitation and creating panic amongst the local residents is increasing with time. Considering that these wetlands still provide suitable habitat for muggers, there was an urgent need for a systematic assessment of populations and the drivers affecting the populations. A study was carried out from June 2013 to Jan 2015 to find out the recent status of muggers in the charotar region. The objectives of the project were (1) to understand the status and distribution of muggers; (2) to identify the priority conservation areas; (3) to understand people's perception and attitude towards muggers; and (4) to understand mugger-human interaction.

Mugger population assessments, interview surveys and other project related activities were carried out from May 2013 to January 2015. Information on mugger occurrence, status and distribution were collected using both direct and indirect. Direct methods involved direct sightings through field survey whereas indirect methods included looking for mugger signs (den/burrow, fecal matter) and interview surveys. Both day count survey and night spotlight survey were employed to assess the status and distribution of muggers. Interviews with local residents were conducted to understand villagers' perceptions of, and attitudes towards muggers, and to assess the human-mugger interactions. A semi-structured survey instruction was prepared in the form of an interview-based questionnaire. Major mugger habitats identified were surveyed for collecting information on denning and nesting of muggers. Burrow measurements such as height, width, depth, distance from water level and height above water level were recorded.

67 potential localities were surveyed to enumerate the distribution and population status of muggers in Charotar region. Of these total villages surveyed, 36 belong to Kheda district and 32 villages belong to Anand district. We located muggers at 27 of these villages, ten of which were not previously known to be occupied by this species. Information about occurrence of muggers was reported from another 16 villages, based on indirect evidences and local people's interviews. However, animals could not be sighted in these villages. It seems that these villages do not have a permanent breeding population but are used temporarily by roaming muggers, especially during monsoons. Population surveys yielded 183 records of muggers. Of the total muggers observed among all sites, 71 % of the observations occurred in six localities; Deva, Vaso, Heranj, Marala-Naghrama, Traj and Malataj. Deva alone contributed about 29% (N=53) to the total population. Various sized muggers were noted by direct sighting during the day count, which included 89 (54.60 %) adults (> 2 m), 60 sub-adults (1 to 2 m) and only 13 juveniles (<1 m) (ratio of juvenile to sub adult to adult =1:5:7). The Juvenile: Sub Adult: Adult (J: SA: A) ratio was strongly adult biased. Both adults and sub adults represented 92.08 % (N=150) of the sighted Muggers. Juvenile were represented in only 7.97 % of the sightings.

Thirteen villages having significant mugger population were monitored for seasonal variation. Higher number of individuals were sighted in winter (Mean= 87.25±11.29 SE), with maximum number of muggers recorded in January 2014 (N=116), whereas lower

number of muggers were sighted during monsoon (Mean = 42.43± 2.37 SE) with lowest numbers recorded in the months of June 2014 (N=36) and October 2014 (N=37). Mugger nests were constructed starting from the dry season through the wet season with the earliest on around mid April. Egg laying seems to take place at the height of the dry season till the onset of the wet season, from end of April to end of June. Hatching was observed commencing at the start of the wet season in the month of June and were observed till August. A total of 52 dens/ burrows were recorded at five villages of which 31 were found to be actively used by muggers (Table 3). There was significant difference in the burrow height ($F_{6,22}= 3.1225$, $p<0.05$), distance from water-($F_{6,30}= 31.293$, $p<0.05$) and height above water level $F_{6,30}= 22.514$, $p<0.05$) between the sites. Whereas there was no significant difference in depth ($F_{6,28}= 2.2022$, $p>0.05$) and width ($F_{6,22}= 1.068$, $p>0.05$) of the burros amongst the various sites. Of the total 52 burrows observed, 29 (55.77%) were in open areas without any canopy cover, whereas 15 (28.84) of them were in open areas with little canopy cover and eight of them were under the canopy of trees.

We found an overall positive attitude toward the presence of muggers in the area. However, local residents indicated a low level of knowledge concerning muggers and their management. 44.75 % of the total respondent reported that the mugger population has increased over the last 10 years.11.61% reported that the population has remained stable, whereas only 3.6 % of the respondent reported a decrease in mugger numbers over these years.

Charotar holds a significant and health population of muggers and can provide long term survival to the species. The people have high positive attitudes towards muggers. Currently the mugger populations in Charotar region seems to be doing fine, however certain threats have been identified from present and earlier surveys. These problems need attentions from forest authorities, as this may pose danger to the muggers and their habitat. The Direct human influences such as poaching of muggers for their skin and collection of eggs for food or medicinal purpose are not reported. It is fortunate enough for muggers, that when most of the wild creatures are becoming victim of humans, it is somewhat safe from human's evil intentions. Certain threats such as inappropriate methods of fishing, habitat encroachment, food provisioning, road kills, flooding of burrows, negative portrayal of mugger in media and drying up of wetlands in summer were identified.

Recommendations developed from this study included: increasing the awareness of muggers through targeted education, facilitating of stakeholder involvement, developing of proactive mugger monitoring management strategies, and exploring different cost-effective conflict mitigation strategies.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

1.1 Background

The Marsh Crocodile or Mugger (*Crocodylus palustris*) is one of the common, widely spread and most adaptable crocodilian species in India (De Silva & Lenin 2010). It is a highly flexible species, occupying a variety of habitats including hill streams, manmade reservoirs, seasonal tanks, large rivers, small pools, irrigation channels and also urban drainages & sewage puddles. This species is a threatened reptile in India and legally protected under Schedule I in the Indian Wildlife (Protection) Act 1972 and categorized as 'Vulnerable' under the assessment criteria of IUCN for threaten species (Choudhary & De Silva 2013). In the late sixties, the species was depleted from its entire distribution range due to illegal hunting, fishing and habitat loss which brought muggers to the edge of extinction (Whitaker 1987, Bustard 1999). But now, the mugger population is flourishing well due to the legal protection and the success of ex situ programmes and release practices (De Silva & Lenin 2010).

Mugger is known to inhabit many of the large fresh water bodies in the Gujarat (Vijaykumar et al. 1999, Vyas 2008, Vyas 2010). During the early 20th century, muggers were very common all over Gujarat (Acharya 1949, Vijaykumar 1997). Good populations occurred in major rivers such as Narmada, Tapi Mahi and Vatrak (Acharya 1949, Vyas 2013). Vatrak river (a tributary of Sabarmati) was reported to have highest concentration of muggers with a density of 50-75 individuals at every five kilometer (Acharya 1949). Earlier, a small population of mugger was also reported to occur in the Banas river of north Gujarat region (McCann 1938),in Sabarmati river (Kheda district) and in some of the village tanks in the same region (Acharya 1949, Vijaykumar et al 1999). In early seventies, mugger population in Gujarat was also reported to decline, along with the overall decline in mugger populations in India (Vyas 2013). But certain population survived in the state, which was reported very significant as compared to other parts of the country (Vyas 2013). The few available studies indicate, that the mugger population then was found mainly in Vadodara district (Oza 1975, Vyas & Bhatt 2004, Vyas 2002, 2004, 2005b, 2010, 2012), Gir forest in Junagadh (Joseph et al 1975, Whitaker 1977, Chavan 1979), surrounding Barda hills (Whitaker 1977, Vyas 2003, Whitaker & Andrews 2003). Rashid (1978) stated the mugger population in the state to be around 500, with a largest concentration mugger in Hiran lake (N=200) and smaller populations in rivers such as Saraswati, Banganga and Ranjitsagar lake in the Saurashtra region. The present status of mugger in Gujarat is not completely known. Data is available only in fragments and that too from a few places. Mugger population in Gujarat, which was put to nearly 1650 individuals, is based on the last state wide survey conducted in 1995-96 (Vijaykumar et al. 1997, Vyas 2010). Since then no state-wide survey was carried out, and so the present status of mugger in Gujarat remains obscure. Surveys earlier to 1995 were mostly restricted to few protected area only, and few were done on a regular basis. As such except for the Vadodara region (Vyas 2010, Vyas 2012, Vyas 2013) and recent surveyed in Anand and Kheda districts (Vyas 2013, Upadhyay & Sahu 2013), there is no updated information on crocodile populations from other regions of Gujarat.

Earlier studies (Vijaykumar et al. 1999) show few wetlands of Anand and Kheda districts to contain a small number of muggers. However recent surveys by Vyas (2013) and Upadhyay & Sahu (2013) have revealed that significant mugger population exists in Anand and Kheda districts (together they are known as Charotar) of Gujarat states, who share these wetlands for various ecosystem services (water, fish and space) with humans. This mugger population is one of oldest mugger populations in the state, which survived in the state, in the pre-independence and before the Indian Wildlife Preservation Act-1972 was declared (Vyas 2013). Muggers have been this region for a long, but with no proper historical records, it is difficult to ascertain the earlier status and distribution of the muggers in this region. Muggers of Charotar region survive in the man-made communal water bodies within the rural agricultural dominated region

(Upadhyay & Sahu 2013, Vyas 2013). These studies however, didn't provide informationon other ecological aspects such as seasonal fluctuations in population, denning and nesting ecology. Considering that these wetlands still provide suitable habitat for muggers, there was an urgent need for a systematic assessment of mugger populations. Therefore a study was carried out from May 2013 to Jan 2015 to find out the recent scenario of muggers in the Charotar region which consists of two districts namely Anand and Kheda Districts.

Most of the mugger population and its habitat in Gujarat are considered secure and safe, with few exceptions like Vishwamitri and Narmada rivers where the human-crocodile conflicts have been reported to increase, a phenomenon that is possibly the result of human encroachment into mugger habitat (Vyas, 1993, 2004, 2005b, 2010, Bhatt 2000, Vyas & Bhatt 2004). Some mugger population in the state is saturated and has dispersed resulting in increased human-crocodile interactions (Vyas 2010, 2012, 2013). Instances of crocodiles attack on humans and livestock have been very rarely reported in Charotar region compared to other parts of Gujarat (Upadhyay & Sahu 2013, Vyas 2013). Cases of mugger attacks reported in last few years in Charotar region, based on available evidences, seems to be to results of misidentification and provocation by humans (Upadhyay & Sahu 2013). However, the potential for mugger–human conflicts are likely to escalate with increasing populations of both humans and muggers in this agricultural landscape. Habitat destruction and sharing of the same habitat by humans and crocodiles are the major reasons for such conflict. But increasing human activities such as fishing and other daily activities without adequate awareness and protection also result in such conflicts. Managing and conserving muggers in these human dominated landscapes will require interdisciplinary approaches based on firm understanding of mugger ecology; human dimension; and the complex relationships among people, muggers, and their shared environment. In context to the human –wildlife interactions, how people perceive large predators and their conservation status is poorly understood in India. Likewise no research on public's attitudes towards muggers has been carried out yet from this region. Hence along with the population ecology, study of public opinion and knowledge becomes an important element of mugger conservation.

1.2 Aim & Objective

Overall aim of the study was to conduct an assessment of the status and distribution of mugger crocodile (*C. palustris*) inhabiting the Charotar region, investigate human-mugger interaction situation, promote activities for crocodile conservation and ultimately propose actions that should be taken to conserve the species in this region.

Broad objectives

1) To determine the status and distribution of muggers in Charotar region
2) To understand local people's attitudes towards mugger and their conservation
3) To promote public awareness and education for the conservation of muggers
4) To foster conservation through capacity building.

2. STUDY AREA

The study was conducted in the Charotar (or Charutar) region of Gujarat. Charotar consists of parts two districts namely Anand and Kheda (Figure 1). It is located (22°44'N, 72°21'E and 22°15'N, 73° 4'E) between the two major rivers; Sabarmati on the western side and Mahisagar rivers on the eastern in central Gujarat. Ahemdabad district is on its western side and Vadodara on the eastern side. The talukas which fall under Charotar region include Anand, Petlad, Borsad, Sojitra, Tarapur, Umreth, Anklav and Khambhat of Anand district, whereas Matar, Kheda, Mahudha, Nadiad, Thasara and Mahemdabad of Kheda District. The southern side is attached to the gulf of Khambhat. Major area is a plain land soil popularly known as "Goradu Soil" with loamy sand of alluvial origin, which is known for its productivity and hence intensive cropping farming is practiced throughout the year (Mukherjee 2000). Agriculture and dairying are the priority activities of the rural area. About three fourth of the population depends on agriculture. Large areas in this region are irrigated by Mahi Irrigation Project, and therefore irrigated farming is practices (Vyas 2013). 486 villages are directly benefitted through its 73.5 km long canal irrigation facility with a total cultivable area of 212694 hactors.

In Gujarati, the word "Charutar" means a pot full of gold. This was supposedly coined because of the agricultural fertility of the area. The most important crop of the region is tobacco (*Nicotiana tabacum*). Paddy (*Oryza sativa*) crop is another major crop of the area. Because of the unique mixture of landscape feature, this region also harbours one of the highest densities of sarus crane (*Grus antigone*) in the state (Parasharya et al. 1989, Mukherjee 2000, Mukherjee et al. 2002). Although Anand and Kheda district do not have significant forested areas, they have high density of trees in the state, and are considered green bowl of Gujarat (Singh 2013). The climate of the region is semi-arid, tropical monsoon type. South western currents in the summer bring monsoon rain from the late of June to September end or early October. Peak precipitation occurs in July and august. With the onset of summer by mid march, the temperature starts rising and reaches its peak in May.

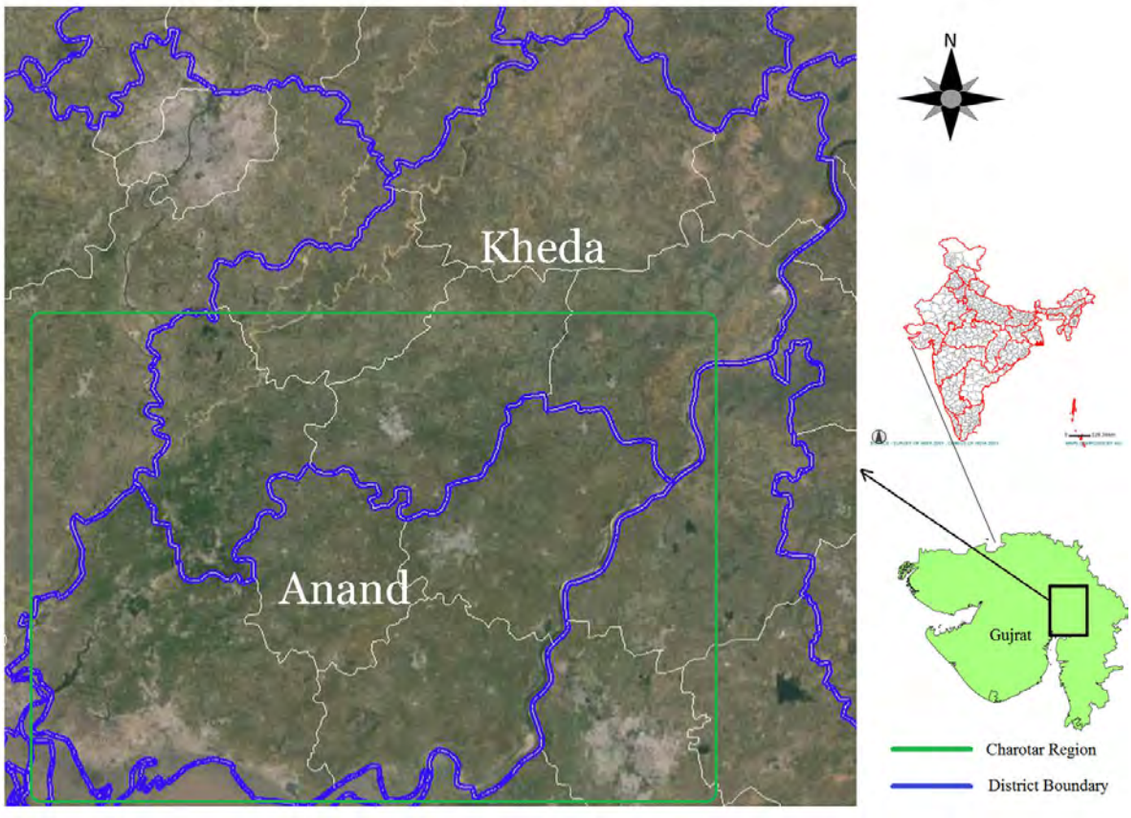


Figure 1. Map of the Charotar region. It consists of parts of Kheda and Anand districts of Gujarat, India.

© Dhaval Patel / VNC

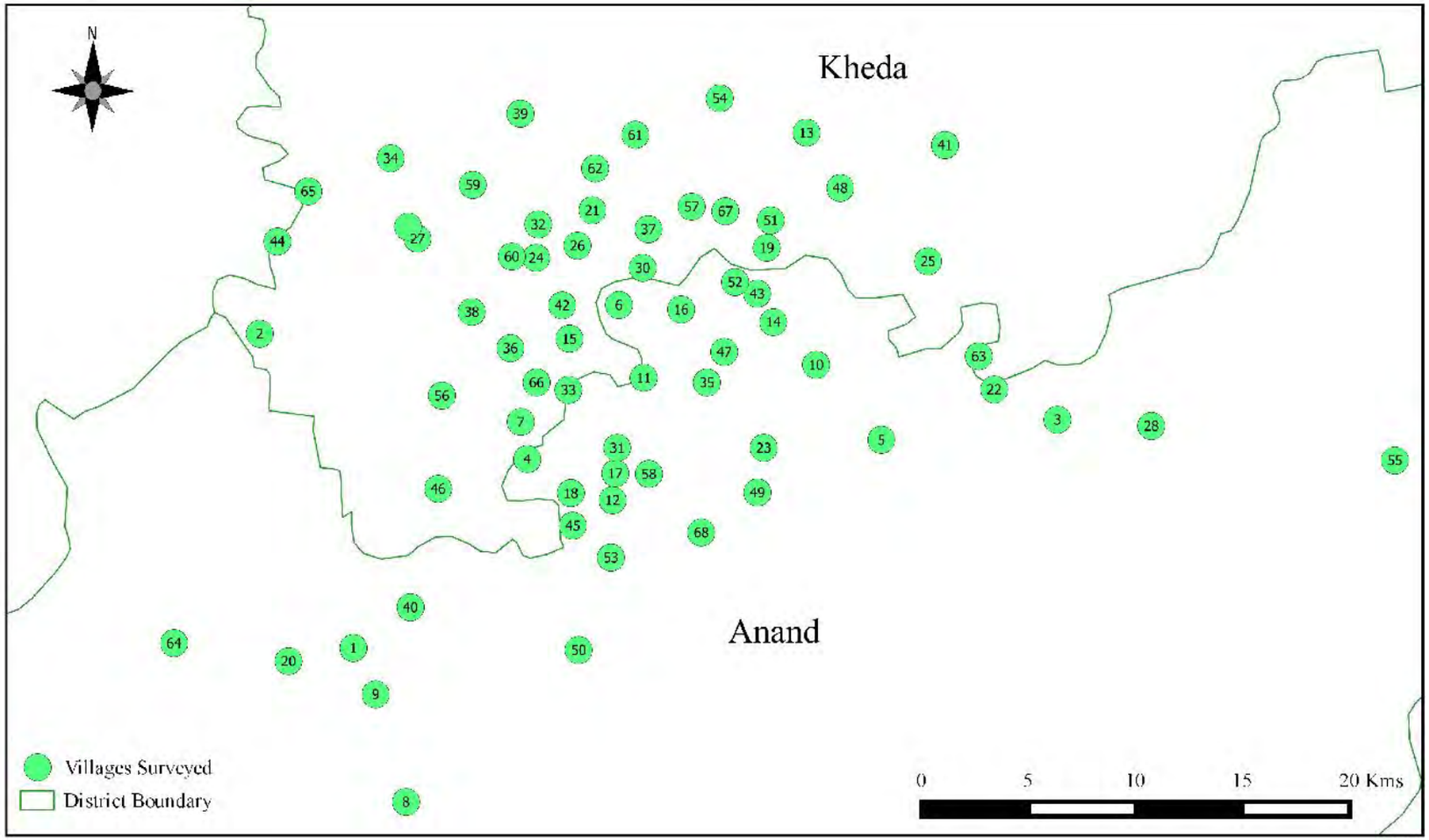
3. METHODS AND MATERIALS

3.1. Population count

Mugger population assessments, interview surveys and other project related activities were carried out from May 2013 to January 2015. Information on mugger occurrence, status and distribution were collected using different methods and sources, both direct and indirect. Direct methods involved direct sightings through field survey whereas indirect methods included looking for mugger signs such as den/burrow, signs, mugger fecal matter etc as well as interviewing local residents for mugger occurrence and abundance. Both day count survey (Upadhyay & Sahu 2013, Vyas 2013) and night spotlight survey (Bayliss 1987) were employed to assess the status and distribution of muggers in various wetlands and reservoirs of Charotar.

During the day count survey, it was difficult to sight some individuals, especially smaller ones, due to thick vegetation and disturbances caused by human activities. But the benefit of the day count was that you can easily estimate the size of the individuals due to good visibility and as the individuals extensively indulge in basking activity, especially in winter (Choudhary & Roy 1982), providing enough time to record size observation. Whereas night surveyed though yielding more accurate counts, with proper representation of small individuals, it was difficult to identify the size of many individuals due to low light conditions affecting observer's visibility as well as difficulty in approaching closer to the animals to estimate size. So both methods were used in supplementary to each other to conduct the assessment and to represent our findings. During present study, it was also observed that due to shortage of water in summer many of the reservoirs were in dry conditions and population of muggers were not recorded properly or were not seen at all at those places. In this case, we only used the data collected in winter season to represent the mugger population and data collected in summer and monsoon seasons were only used to represent seasonal fluctuations in mugger abundance.

Direct sighting counts have usually been used to estimate populations by providing the researcher with indices of population size (Vijaykumar et al. 1999, Letnic and Connors 2006, Upadhyay and Sahu 2013, Vyas 2013). Surveys (day counts/night spotlight) provide an index of abundance, rather than a total population count, because not all crocodiles present in the area are observed during a survey (Cherkiss et al. 2006). However, the relationship between the crocodile encountered and actual population size is assumed to remain constant over time, and any change in the crocodile encountered should reflect a proportionate change in the total population. The observation index is usually described as a density, that is, the number of crocodiles seen per kilometer traveled (crocodiles/km). But since most of the wetlands in Charotar are small village ponds, they can be seen from 1-2 vantage points and thus there was no need to walk any distance. So we used another approach to represent the data. We used crocodile encountered (direct sightings) per unit effort per locality as an estimate of relative abundance. A trained primary observer, assisted by 1-2 secondary observers used a binocular/spotlight to spot animals within and around the wetlands. We used the same team of observers to collect census data and size estimation in all surveys to avoid biases in size estimation. The primary observer placed animals into size classes using total length, and a second person recorded mugger locations, activity and habitat. For this study, muggers were classified in to one of four size classes: hatchlings (< 0.5 m), small/juveniles (0.5 m ≤ 1.00 m), medium/subadults (1.00 m ≤ 2.00 m)and large/adults (2.00 m ≤). Individuals that dived before size estimation or during night spotlight surveys were recorded as 'Eyes only'. We selected vantage points based on least disturbance, visibility, accessibility and wetland types. If the wetland was bigger than we chose more than 2-3 vantage points. We avoided conducting surveys during periods with heavy rain or high winds because these conditions could possibly affect the crocodile counts.



1.Amaliyara	9.Buddhej	16.Deva	24..Kathoda	32.Machhiel	40.Moraj	48.Pij	56.Sekhupur	64.Valli
2.Asamali	10.Changa	17.Devataj	25..Keriavi	33.Maghrol	41.Nadiyad	49.Piplav	57.Siholadi	65.Baroda
3.Bakrol	11.Dabhou	18.Gada	26..Khandhali	34.Mahelaj	42.Nandoli	50.Ramodadi	58.Sojitra	66.Vasai
4.Balinta	12.Dali	19.Gangapur	27.Khareti	35.Malataj	43.Navagam	51.Rampur	59.Traj	67.Vaso
5.Bandhani	13.Davda	20.Gorad	28.Kherda	36.Malavada	44.Palla	52.Roon	60.Tranja	68.Virol
6.Bhadkad	14.Demol	21.Heranj	29.Kunjara	37.Maliyataj	45.Parol	53.Runaj	61.Undhera	
7.Bhalada	15.Dethali	22.Jol	30. Laval	38.Marala-Nagrama	46.Pariyej	54.Sandhana	62.Utai	
8.Bhattalavdi		23.Kasor	31. Limbali	39.Matar	47.Petli	55.Sarsa	63.Vadtal	

Figure 2. Localities/ Villages surveyed for assessing mugger occurrence and distribution in Charotar region.

3.1.1 Day count survey

It is easier to count the number and estimate the size of crocodiles on land during day time particularly in winter and post-winter when the crocodiles extensively engage in basking (Choudhary & Roy 1982). Winter months, therefore are good times for counting crocodiles in day time. The elevated edges and exposed surface of the village ponds provide nice basking spots for the muggers. Direct observations were made to count the population of mugger crocodile using binoculars and spotting scopes. All surveys were conducted between 09:00 AM and 02:00 PM, in order to maximize visibility of basking crocodiles. Individuals sighted during the daytime survey, whether basking or swimming, were recorded with their approximate size.

3.1.2. Night spotlight survey

Standard spotlight techniques were used to carry out surveys during this survey régime (Messel et al. 1981, Bayliss 1987, Lentic and Connors 2006). Night spotlight surveys were conducted from the banks of ponds using a hand-held narrow beam LED flashlights/torches. The observer/spotter made slow rhythmic sweeps over the water surface and towards the water's edge, constantly checking for the characteristic eye shine from the reflective layer in the crocodile's eyes. When a light source was shined at a crocodile under low light conditions, the eye shine was distinctive red, fire-red or white color (depending on the angle and intensity of the light) due to the reflec ion of the light off the retina, which could be seen from beyond a hundred meters away under ideal conditions. Since we could not approach the animal very close and visibility was limited, it was difficul to estimate the body size of many individuals specially those far away in water, so only numbers of crocodiles were counted. The main objective of the spotlight counts was to augment data from day counts and to obtain a better representation of the smaller size classes overlooked or not visible during day basking counts. We began night surveys after 08:00 PM to 12:00 AM, when no human activity occurred at the water body. We conducted night count surveys once a month and at least 14 days apart to achieve independent counts.

3.2. Denning and nesting

Major mugger occupied localities (Deva, Heranj, Vaso, Malataj, Traj, Marala-Naghrama) were surveyed for collecting information on denning and nesting of muggers. Height, width and depth of burrows were recorded along with distance from water level and height above water level. We used laser range finder (Bushnell Scout DX 1000 ARC) to measure the depth of the burrow/den. The structure of the mugger's burrow is complex and sometimes curved to right/left and even upwards. So the results of this assessment, especially the burrow depth measurements should be views carefully taking account in the difficultie we faced. Active nesting areas were identified by the presence of excavated nests and remains of eggshells and presence of hatchlings and yearlings. Indirect evidence such as tracks, imprints in mud, inactive nests, fecal matter and remains of kill were also recorded to assist the data collection. GPS (Global Positioning System, Garmin 64S) device with mapping software was used to record den locations.

3.3. Charotar Crocodile Count (3C) program

Under the broader aim of creating awareness for crocodile conservation VNC initiated citizen's participation in crocodile monitoring program and was called as "Charotar Crocodile Count" Program (3C Program) so as to provide the citizens a firsthand experience in crocodile monitoring and conservation. The first "3C Program" was organized on 14th-15th December 2013 and the second one was organized on 10th - 11th January 2015. During the first "3C Program", 18 villages were surveyed with the help of 46 volunteers where as during the second "3C Program"26 villages were surveyed with the help of 61 volunteers. Volunteers came from varied walks of occupations and different areas of Gujarat and included school students, businessmen, teachers, college students, lecturers, engineers and other NGO members. All the participants were first trained for spotting and counting muggers in different size classes. Then teams of 2-7 volunteers, depending on the size of the water body to be surveyed, were sent to respective places to count the muggers. To avoid double counting in a large wetland

where more time was needed to count muggers, team members spaced them across the corners of wetland into their defined areas and then carried out mugger counting simultaneously within a fixed time span.

3.4. Interview Survey

Interviews with the local residents were conducted to understand villagers' perceptions of, and attitudes towards muggers and to assess the human-mugger interactions. Survey instruction was prepared in the form of a semi-structured interview-based questionnaire (Appendix II). Interviews were informally carried out by 1-2 team members/volunteers. The questionnaire included questions on demographic variables, household characteristics, livelihood, perceptions towards muggers, knowledge regarding mugger, dependency on the wetlands and mugger-human interactions. Target group of the interview surveys were those who live near the water bodies. By using value-based questions, we wanted to find out why and to what extent muggers are disliked and how we can transform these negative attitudes.

Team member conducting day count / basking surveys

© Dhaval Patel / VNC

Team member conducting night surveys using flash lights

© Mehul A. Patel / VNC

Volunteers conducting interview surveys.

© Niraj Parmar / Mehul A. Patel

Research team monitoring the burrow.

© Mehul A. Patel / VNC

Volunteers conducting daycount / basking surveys as a part of the Charotar Crocodile Count Program

© Niyati Patel

© Soham Mukherjee

4. RESULTS

To understand the field more critically and for primary data collection, reconnaissance field visits were conducted. This also included informal interview with key informants, local leaders, local people and direct observation. General information about the study sites was obtained during reconnaissance visit. This visit was useful for establishing rapport with local people. Simultaneously, it was beneficial for planning the population assessments.

4.1. Status and distribution of muggers

This is the first comprehensive study on the status and distribution of mugger and their habitats in Charotar. 67 potential localities (village reservoirs/ponds, lakes, canals) were surveyed to enumerate the distribution and population status of muggers in Charotar (See Appendix I). Of these total villages surveyed, 36 belong to Kheda district and 32 villages belong to Anand district. We located muggers at 27 of these localities, ten of which were not previously known to be occupied by this species (Table 1). Information about occurrence of muggers was reported from another 16 villages (See Appendix I), based on indirect evidences (signs: burrow, mugger slides, tracks, scats, markings on grounds) and local people's interviews. However, animals could not be sighted in these villages. It seems that these villages do not have a permanent breeding population but are used temporarily by roaming muggers, especially during monsoons. The extent of the range of muggers in Charotar region (i.e., minimum convex polygon encompassing sites) is estimated at 1299 sq km based on the earlier (Vyas 2013, Upadhyay & Sahu 2013) plus new localities, and the maximum linear distance is estimated to be 111.37 km. Population surveys were conducted over a period of 39 surveys days in the winter months of 2014 which yielded 183 records of muggers. Muggers recorded when put over the estimated range, resulted into a density of 14.31 individuals/ 100 sq km. The number of muggers observed at the 27 sites varied widely, from one to 53 individuals (Table 1). Of the total muggers observed among all sites, 71 % of the observations occurred in six localities; Deva, Vaso, Heranj, Marala-Naghrama, Traj and Malataj. Deva alone contributed about 29% (N=53) to the total population.

4.1.1.Population structure

We were able to determine the age class of the muggers based on their size. Various sized muggers were noted by direct sighting during the day count, which included 89 (54.60 %) adults (> 2 m), 60 sub-adults (1 to 2 m) and only 13 juveniles (<1 m) (ratio of juvenile to sub adult to adult =1:5:7). The Juvenile: Sub Adult: Adult (J: SA: A) ratio was strongly adult biased. Both adults and sub adults represented 92.08 % (N=150) of the total sighted Muggers. Juvenile were represented in only 7.97 % of the sightings. The ratios of age classes varied among the various villages (Table 1). During present study, the highest population was recorded in the wetlands of Deva (N=53), followed by Marala-Naghrama wetland (N=21). More numbers of individuals were recorded in each size/age classes in the present study than Vyas (2013), whereas more or less similar numbers of muggers were noted in each size classes in present study and the one conducted by Upadhyay & Sahu (2013). However age/size class ratio (J: SA: A) established in present study (1:5:7) did not differ significantly from both of these earlier studies ($F_{2, 8} = 1.54$, $p>0.05$).

4.1.2. Seasonal changes in the mugger's population

Thirteen villages having significant mugger population were monitored for seasonal variation. Table no 2 shows the recorded mugger population from November 2013 to October 2014. Although we expected to see a large difference in populations between various seasons- (winter, summer and monsoon), because of the local disparsal by muggers between the wetlands during various seasons, but there were no significant

Figure 3: Villages where mugger occurrence was recorded during our field survey from May 2013 to Jan 2015 (to see village name refer Figure 2)

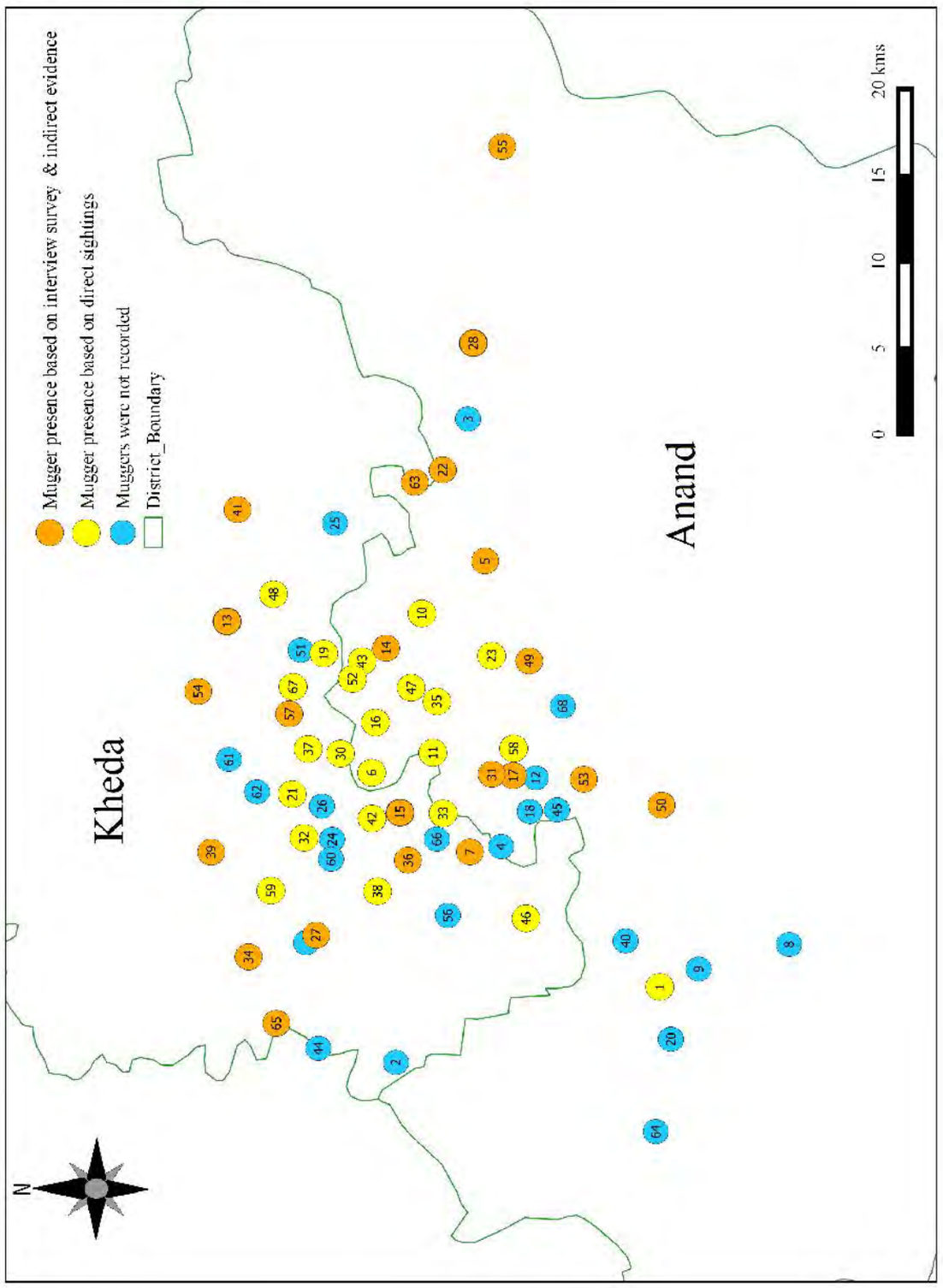


Table.1: List of the localities/villages where muggers were recorded

Sr. No	Villages	Mugger Sighted	Juvenile (<1mts)	Sub Adult (1mt -2 mts)	Adult (3mts<)
1	Amaliyara	1		1	
2	Bhadkad	2		2	
3	Changa	2		1	1
4	Dabhou	2		1	1
5	Davda	1			1
6	Dethali	2		2	
7	Deva	49 (53*)	5	19	25
8	Gangapur	2		0	2
9	Heranj	14 (18*)	3	5	6
10	Jol	1		1	
11	Kasor	2			2
12	Laval	5		3	2
13	Machhiel	3			3
14	Maghrol	2		2	
15	Malataj	14 (16*)	1	6	7
16	Maliyataj	2			2
17	Marala-Nagrama	13 (21*)	1	4	8
18	Nandoli	2		1	1
19	Navagam	5		1	4
20	Pariyej	4		2	2
21	Petli	4			4
22	Pij	2		2	
23	Roon	1		1	
24	Sojitra	2			2
25	Traj	11 (14*)	2	2	7
26	Tranja - Kathoda	4			4
27	Vaso	10	1	4	5
		162 (183*)	13	60	89

* Muggers counted during night spotlight survey. These were not included in population age size analysis.

differences in population between winter and summer seasons (t= 0.24, df =20, P= 0.80), between summer and monsoon seasons (t= 0.79, df = 23, P = 0.43) or between winter and monsoon seasons (t= 0.80, df =18, P = 0.41). However, higher number of individuals were sighted in winter (Mean= 87.25±11.29 SE), with maximum number of muggers recorded in January 2014 (N=116) followed by December 2013 (N=91), whereas lower number of muggers were sighted during monsoon (Mean = 42.43± 2.37 SE) with lowest numbers recorded in the months of June 2014 (N=36) and October 2014 (N=37) (Figure 4).

		Winter		Summer		Monsoon	
	Villages	Mean±SE	Min-Max	Mean±SE	Min- Max	Mean±SE	Min-Max
1	Bhadkad	1.25±0.25	1-2	0.60±0.24	0-1	0.86±0.15	0-1
2	Deva	32.50±9.37	17-53	21.60±3.37	11-30	17.86±3.07	10-30
3	Heranj	11.00±2.34	8-18	7.80±2.97	2-19	4.29±0.73	3-8
4	Laval	1.75±1.11	0-5	0.40±0.24	0-1	0.29±0.20	0-1
5	Machhiel	1.00±0.41	0-2	1.20±0.58	0-3	0.71±0.20	0-1
6	Malataj	8.00±2.42	4-16	7.20±1.46	3-12	3.00±2.25	2-14
7	Marala-Nagrama	12.26±3.25	6-21	10.00±3.21	3-20	4.14±0.68	1-6
8	Pij	1.75±0.25	1-2	0.80±0.20	0-1	0.71±0.20	0-1
9	Petli	2.00±0.91	0-4	0.80±0.37	0-2	0.57±0.22	0-1
10	Sojitra	1.75±0.25	1-2	0.60±0.24	0-1	1.29±0.31	0-2
11	Traj	8.50 ±1.94	5-14	6.80±1.39	3-10	3.14±0.44	2-5
12	Vaso	5.50±0.65	4-7	7.60±1.47	5-13	4.71±0.56	3-7
13	Changa	1.50±0.29	1-2	0.80±0.20	0-1	0.86±0.15	0-1
	Total	**87.25±11.29**	**48-147**	**66.20±5.74**	**27-114**	**42.43±2.37**	**19-78**

Table 2: Seasonal variation in mugger sighted (*Crocodylus palustris)* (Mean±SE) in localities having significant mugger population in Charotar region, Gujarat, India, Nov 2013–Oct 2014.

4.1.3 Nesting and breeding observations

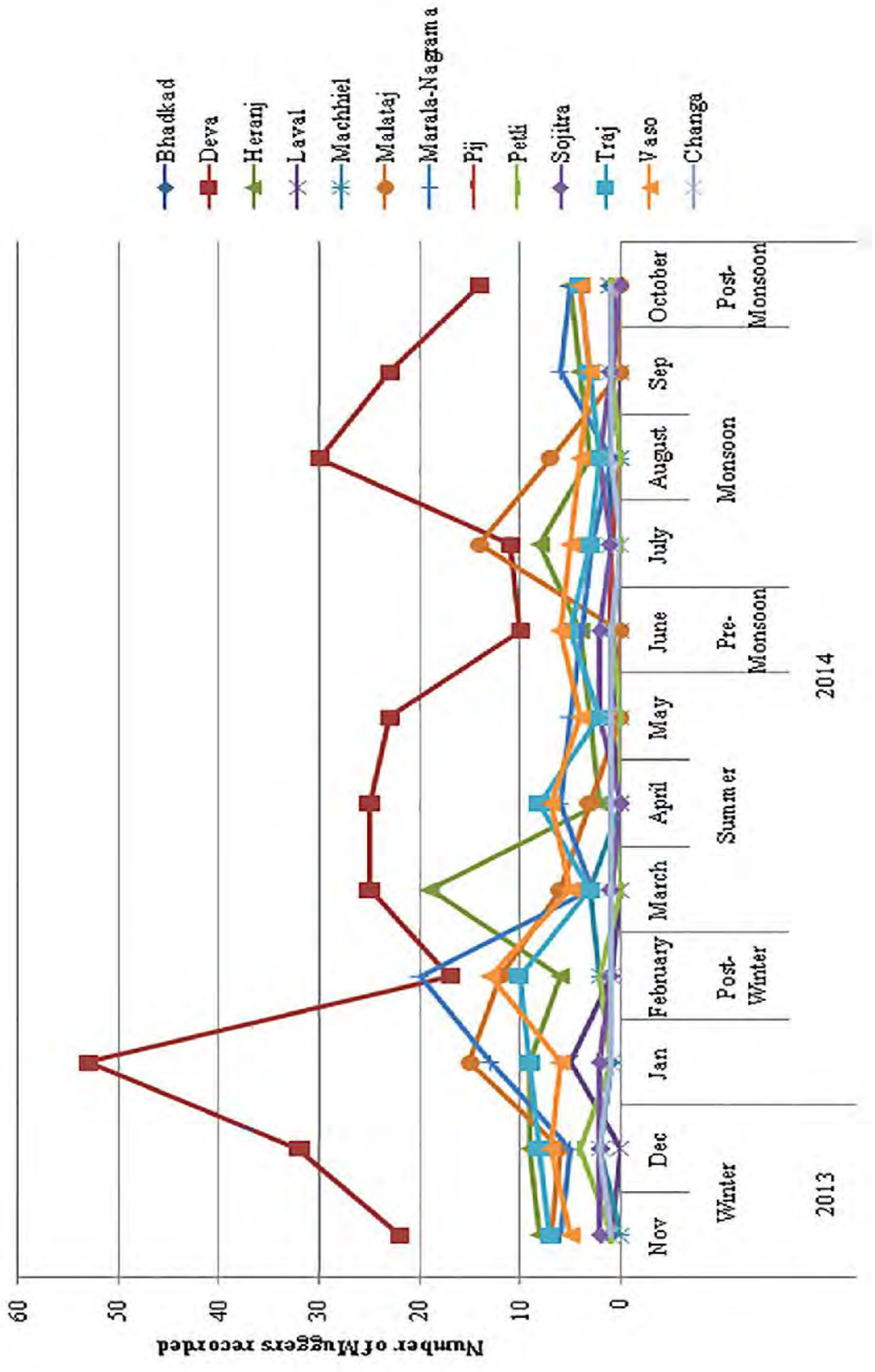
The breeding activities were recorded in water bodies by direct and indirect evidences such as empty egg shells, hatchlings and juveniles. Mugger nests were constructed starting from the dry season through the wet season with the earliest on around mid April. Egg laying was observed to take place at the height of the dry season till the onset of the wet season, from end of April to end of June. Hatching was observed commencing at the start of the wet season in the month of June and were observed till August. There was a considerable increase in the activity by the female at the den site, just prior to nest buildings. This activity involved mashing down vegetation and flattening of the ground. Well worn trails would begin to take shape leading from the den site to water. This activity was usually observed about one week before actual nest construction began. During the surveys we observed successful nesting and egg hatching at following villages.

1) Bakrol: One hatchling and five eggs were recorded at Bakrol pond on 10-06-2013, however the female was not seen nearby. This could be because of the large gathering of the villagers around the nest which might have startled the female.

2) Malataj: Six hatchlings were observed near a nest on 12-06-2013. The mother couldn't be seen nearby. On close inspection of the nest, we could retrieve 16 empty egg shells, of which 3 failed to hatch. The other hatchings after successful hatching must have moved into the water. Again 5 hatchlings were observed on 06-06-2014. However empty egg shells could not be located.

3) Heranj: Nearly 26 hatchlings were observed at a nest in Heranj on 07-07-2013. We also found three dead hatchlings and two failed eggs. The mother could not be seen around. This day was followed by two days of heavy rain. On the third day, we visited the place again and found that two hatchlings had died inside the burrow which was flooded with water. Since the burrow remained filled with water for some more days, we could not estimate the exact mortality occurred. Three active nests were located on 20-07-2014 where hatchlings and empty eggshells were observed. 11 empty eggshells and two failed eggs were observed at a nest. When we looked inside the burrow seven hatchlings were recorded. At another nest six empty egg shells and one failed egg were observed. The juveniles were nowhere near the burrow. At the last active nest 16 empty shells were recorded. When we looked inside the burrow 6 hatchlings were present along with the female. Two juveniles of 2-3 feet were also observed in that burrow.

Figure 4 – Monthly variation in direct sighting of muggers at thirteen localities of Charotar



4) Deva: Four juveniles (< 0.5 m) were observed at Deva during a night survey on 05-08-2013.

5) Vaso: Three hatchlings were observed at Vaso on 24-07-2014. 11 empty egg shells were also recorded at a mound nest on the same date.

6) Traj: Two juveniles (<0.5 m) were see during a night survey on 09-08-2014.

7) Marala Naghrama: Two juveniles were observed among vegetation in shallow water during night survey on 11-08-2014.

4.1.4. Burrow dimensions

A total of 52 burrows/dens were recorded at five villages of which 31 were found to be actively used by muggers (Table 3). Some places such as Marala-Naghrama having significant mugger population could not be assessed for burrows due to extensive *Ipomoea* vegetation on the banks of the pond. Burrows were located prior to the onset of nesting between April and May and notes were made regarding the measurements of the burrows and a close watch was kept on breeding activity. Since the data was collected in summer, the water level was law and so certain measurements of the burrow such as distance form water level and height above water level should be seen in context to summer season and could vary significantly with respect to other seasons. There was great variation in the dimensions of the nest found during this study. There was significant difference in the burrow height ($F_{6,22}= 3.1225$, $p<0.05$), distance from water-DFW ($F_{6,30}= 31.293$, $p<0.05$) and height above water (HAW) level $F_{6,30}= 22.514$, $p<0.05$) between the sites. Whereas there was no significant difference in depth ($F_{6,28}= 2.2022$, $p>0.05$) and width ($F_{6,22}= 1.068$, $p>0.05$) of the burros amongst the various sites. The DFW (Mean±SE = 36.16±2.17) and HAW (Mean±SE = 12.33 ±0.92) of burrows at Traj were quite higher as compared to other villages. Likewise similar trend was seen as at Heranj (Chokadiya pond) where in large DFW of burrows was observed (Mean±SE =28.4 ±1.44) where the largest recorded DFW was 42 feet. Of the total 52 burrows observed, 29 (55.77%) were in open areas without any canopy cover, whereas 15 (28.84) of them were in open areas with little canopy cover and eight of them were under the canopy of trees.

4.1.5. Charotar Crocodile Count Program (3CP)

The first Charotar Crocodile Count Program (3C Program) was conducted on 14th-15th December 2013 and the second 3C program was conducted on 10th-11th January 2015. 46 volunteers participated in Dec 2013 3C Program which resulted in the direct sightings of 98 individual muggers, whereas 61 volunteers participated in Jan 2014 resulting in the direct sightings of 131 individual muggers. The information of mugger population recorded during these two 3C Program has been presented for general comparison (Table 4). Most of the participants were first timers and had no previous experience in mugger counting and thus considering that they might have made mistakes in estimating the size of the individuals, we here present only the total counts of muggers. Also selected numbers of villages were included in the survey so these basking counts therefore do not represent an absolute population in the region. As expected, since more numbers of villages were covered in Jan 2015 (N=26) than in Dec 2013 (N=18), more individuals were recorded in Jan 2015, and thus does not represent an increase in population. When comparing the overall population counts between both periods there was no significant difference in the muggers recorded ($t= -0.44$, $df= 27$, $P=0.65$) between the years. Although muggers were recorded in much higher number at Deva village in Jan 2015(N=59) than in Dec 2013 (N=33). Some of the villages namely Gangapur, Maghrol and Nandoli which were not surveyed during Dec 2013 also had presence of muggers in Jan 2015. In contrast to this trend, four muggers were recorded in Dec 2013 in Petli, but not a single mugger was sighted in Jan 2015. At places like Heranj, which hold more number of muggers, less number of muggers were reported. This could be because of the high water level and extensive presence of floating vegetations, which hindered the sightings of muggers. Higher numbers were observed in Jan 2015 at villages- Laval, Malataj and Marala-Naghrama than in Dec 2013.

Table 3: Measurements of the burrows recorded during the survey (All the measurements are in 'feet')

Sr. No	Villages	Burrows Recorded	Active	Inactive	Height Mean±SE	Width Mean±SE	Depth Mean±SE	Distance from Water (DFW) level Mean±SE	Height above water (HAW) level (Mean±SE)
1	Traj	6	4	2	1.8±0.20	2.7±0.34	10.4±2.84	36.16±2.17	12.33 ±0.92
2	Deva (Mahi Canal)	8	6	2	1.8125±0.33	2.75±0.51	12±2.30	12.25±2.55	2.5 ±0.46
3	Deva (Village Pond)	19	9	10	2.75±0.14	2.75±0.25	18.7±2.43	12.6±1.01	4.4 ±0.48
4	Vaso	5	3	2	2.3±0.24	2.5±0.29	8.25± 2.39	11.5±1.66	3.75 ±0.48
5	Malataj	7	4	3	2.4±0.19	3.6±0.40	15.2±1.07	15.6 ±2.18	4.8±1.11
6	Heranj (Chokadiyu Pond)	5	4	1	1.64±0.30	2.96±0.36	14.6±2.68	28.4 ±1.44	7.8 ±0.58
7	Heranj (Village Pond)	2	1	1	1.65±0.65	3.00±1.00	10.50±1.50	15.25±2.25	7.25±1.25
	Total	**52**	**31**	**21**					

Table 4 Muggers recorded during Charotar Crocodile Count Program in Dec 2013 and Jan 2015

Sr. No	Village	December(2013)	January (2015)
1	Bhadkad	2	1
2	Changa	1	1
3	Dabhou	2	2
4	Dali	**Not Surveyed**	**0**
5	Deva	33	59
6	Devataj	Not Surveyed	0
7	Gangapur	Not Surveyed	1
8	Heranj	14	9
9	Kathoda	0	0
10	Khandhali	Not Surveyed	0
11	Ladkui	Not Surveyed	0
12	Laval	1	5
13	Machhiyel	2	1
14	Maghrol	Not Surveyed	2
15	Malataj	10	15
16	Maliyataj	1	2
18	Matrala-Nagrama	9	13
19	Nandoli	Not Surveyed	2
20	Petli	4	0
21	Pij	2	2
22	Sojitra	1	2
23	Traj	10	8
24	Tranja	0	0
25	Vaso	6	6
26	Virol	Not Surveyed	0
	Total Sightings	**98**	**131**

4.2. Human- mugger interactions

A total of 360 interviews were conducted, which included 136 females and 224 male respondents from 43 villages in the study area, through key informant interviews to collect the data. The respondent belonged to different age groups, varied class of occupation and had different literacy levels. As expected agriculture (35.56%) was the prominent way of livelihood in the study area, followed by labor work (13.61%).

4.2.1. Dependence on the water bodies

All the mugger occupied wetlands were majorly used for activities like bathing, washing purpose and drinking. Only seven respondents answered that the wetlands are used for fishing too. However when we asked the question “do you go fishing”, more responded (23%) answered that they do occasional fishing. 71.66% of the interviewed people also reported that fishing in these wetlands is carried out by fishermen coming from outside the village. Majority of the wetlands are given on lease by the Panchayat (village authority) for fishing. Very few respondents said that the wetlands are also used for farming. People also use some of this wetland to grow Indian water chestnut (*Trapa bispinosa*) and Lotus (*Nelumbo nucifera*).

4.2.2. Local people's knowledge regarding mugger

63.33% of the respondent said that the sole food of these muggers in this region is fish only. 16.11% (n=58) respondent also included other prey species such as birds, pigs, dogs and insects. Bird species reported included peafowl, ducks, crane and water hens. Only 8 respondents reported that muggers also prey on livestock in addition to fishes. Interestingly some of the respondent (n=25) also reported that the muggers in this region also eat cow dung, and the muggers are referred as "Chhaniya mugger" means Dung Muggers. 44.75 % of the total respondent reported that the mugger population has increased over the last 10 years. 11.61% reported that the population has remained stable, whereas only 3.6 % of the respondent reported a decrease in mugger numbers over these years. 48.38 % of the responded knew that muggers are protected species under the Indian Wildlife Protection Act (1972). The awareness that the mugger is a protected species was more among the males (54.91%) than females (30.16%).

4.2.3. Local people's attitude and perception regarding muggers

81 % (n=210) of the respondent said that they like mugger, of which 67.61 % were males and 32.39 % were females. Among those who said they didn't like mugger, majority were males (68.57%). Male respondents who liked mugger majorly belonged to 31-40 (23.94%) and 41-50 (26.06%) age groups. Similar trend was observed with females too. Unexpectedly, "beautiful animal" (41.87%) followed by "religious reasons" (33%) emerged as the major reason for liking the muggers. "Beautiful animal" (47.90%) was the major reason why most males liked the mugger, on the contrary females liked the species because of its religious sentiments (37.50). 6.90% said that they like the species because it is an endangered species and need protection. 13.30 % liked mugger because of their ecological importance in the ecosystem. 81.82% of the total respondents who replied to the question "Should these muggers be conserved?", agreed that the mugger should be conserved. Only 4.90% respondents replied that the muggers should not be conserved. Among the positive respondent 69.70% were males and 30.30% were females. Among those who were in favor of mugger conservation belonged to the younger 18-30 age group (30.81%), followed by 41-50 age group (23.74%). Mugger should be conserved was represented majorly among all the age groups and literacy level. Irrespective of age groups and literacy levels, majority of the respondent (67.52%) who wanted to conserve muggers replied that the muggers should be conserved where they are presently occurring. 15.81% also suggested that the mugger should be conserved in the protected areas and not there near the villages. To test the intensity of the positive attitudes of the people we asked the question "Will you support mugger conservation, even if any of your family member is attacked", we received mixed results. 28.71% of the respondents still agreed to conserve the mugger, whereas 27.75% replied they will not conserve mugger in case their family member is attacked. 37.32% of the respondent remained neutral to the query. Of the entire respondent, who didn't like mugger, 33.33% of the respondent attributed the reason to the scary look of the mugger, while 31.58% said that they don't like mugger because it is a threat to livestock. 24.56% of the respondent also said that since muggers are a threat to humans, they don't like them. Interestingly, scary appearance of mugger was the major reason (50%) why females don't like them, followed by threat to humans (27.78%). Contrary to women, threat to livestock emerged as the major reason why male respondent do not like them.

4.2.4. Human-Crocodile Conflict (HCC) in Charotar

Although, at present, muggers in Charotar does not in itself appear to be a problem, but the wild populations are increasing in the region (Vyas 2013; Upadhyay and Sahu 2013) and although fewer, there are cases of mugger attacking human and their livestock. A total of eleven cases of Mugger attacks (2009-2014) were reported during the interview survey (Table 5). Among this four attacks were reported on humans and seven attacks on domestic animals (2 on goats, 4 on buffalos and 1 on dog) (Table 5). Among the four cases of attacks on humans only one was fatal. Although details of the

two mugger attacks on humans have been already provided by Upadhyay and Sahu (2013) and Vyas (2013), we again represent it here in Table 5 for reference. The third case of attack on human came in light during the interview survey, wherein a woman in Deva while washing the clothes in the pond was attacked and her hand was caught by the mugger. She received minor injuries as the mugger released her hand within seconds of the attack. The last incidents recorded by us comes from Heranj Village, wherein a male (~30 years) while attending the nature's call was attacked by mugger and caught the man's right leg. He was able to escape with minor injuries. There could be few more instances of Mugger's attacks on humans/animals (livestock/pets) in this region which might have been unreported and thus remains unnoticed.

Table 5 .Records of Mugger (*Crocodylus palustris*) attack recorded in Charotar region during the project duration from May 2013-Jan 2015

Sr. No	Date/Month	Villages	Victim	Details
1	Aug-2009	Traj	Female	This incident occurred in the first week of August 2009. A nine year old girl named Hetal Ode was attacked by a mugger, who was standing on the bank of village pond. The girl was dragged by mugger into the water and was taken to a small island in the lake. People came chasing the mugger, who by now had left the girl and fled in to the water. Girl was taken to hospital and was declared dead.
2	Mar-2012	Traj	Male	A mugger was captured in a fishing net and was tied and kept on the bank of the pond. One of the kids (11 year) playing nearby went too close to the animal and was caught by the crocodile. Although the boy was rescued timely, he was injured badly on legs.
3	Dec-2012	Laval	Buffal	Local residents informed us of a buffalo attacked by a mugger while the buffalo was insight water. However the buffalo was able to escaped.
4	Jan-2013	Malataj	Buffal	Mugger attacked a buffalo while it was inside the water, however the animal escaped and suffered minor injuries on legs.
5	Jan-2013	Deva	Female	A woman's (Aprox 34 year) hand was caught by a mugger while she was washing clothes at the pond; however the animal released the hand within few seconds. She suffered minor injuries
6	Mar-2013	Traj	Cow	A cow while drinking water in the evening time was attacked by a mugger. The mugger tried to capture cow's head first, but could not do that, then caught the cow's leg. However the cow was able to Suffered minor injuries on leg, ears and near jaw.
7	Apr-2013	Changa	Dog	Local villagers reported that a dog was eaten away.
8	Apr-2013	Heranj	Goat	Local villagers reported a goat was attacked and dragged into away into water.
9	Apr-2013	Dabhou	Buffal	Mugger attacked a buffalo (Juvenile) while the, however the animal Suffered minor injuries onl
11	12/04/2013	Dali	Goat	Local villagers reported a goat went missing. People assumed that the mugger has taken the goat. The carcass could not be retrieved.
12	15/08/2014	Heranj	Male	A man (approx. 30 years) while attending the nature's call was attacked by a mugger. He suffered injuries on right leg.

A number of crocodiles are rescued every year from human habitation. These muggers then are reported to local forest authorities or local NGO's, who then capture these animals from the human habitation and release at the destined reservoirs. During this project duration nearly 16 muggers were rescued from different villages (Table 6). There could have been few more rescued muggers, which might have gone unnoticed by us. The month-wise data show that the more number of animals were rescued during the monsoon months August and September. This rescue data indicates that rescue events are directly correlated with the monsoon season. With the onset of monsoon, the number of muggers entering human habitation is found to increase, whereas it decreases in winter, and up to the dry seasons. Contrary to the rescue trend seen in and around Vadodara (Vyas 2010), comparatively more muggers were also rescued

in the month of April, which is the summer month. This trend could be attributed the fact that during summer and rainy seasons, muggers indulge in local dispersal searching for good nesting habitat or due to rise in water. During this dispersal they enter into human settlements and create panic among the local residents (Vyas and Bhatt, 2004). Most of the rescued crocodiles, which are caught from the Charotar region (Anand-Kheda) district are transferred and released in Pariej reservoir, Malataj

Table 6 Incidents of Mugger (*Crocodylus palustris*) rescued in Charotar region from May 2013 - Jan 2015

Sr. No	Date	District	Taluka	Locality/ Village	Details
1.	04-08-2013	Anand	Anand	Sarsa	6 feet long mugger found in the canal near poultry farm. After three days the forest staff with the help of Nature Help Foundation staff captured it from canal
2.	21-11-2013	Anand	Petlad	Ramodadi	A mugger was sighted in a housing society. Local reptile rescue team (Akshit Suthar & team) captured the mugger. The size of the animal was nearly 7.5 feet. It was released at Pariej Reservoir.
3.	01-04-2014	Kheda	Vaso	Vaso	5.2 feet muggers captured from house. It was released in Malataj
4.	04-04-2014	Anand	Khambhat	Navagam	5-6 feet long mugger was captured from a house by local forest department and VNC team, and was then released in Pariej reservoir.
5.	08-04-2014	Anand	Tarapur-	Moraj	7 feet long mugger was captured by forest department.
6.	08-06-2014	Kheda	Matar	Maliyataj	4-4.5 feet muggers recued by local forest department and VNC team member and was released in Pariej
7.	30-06-2014	Anand	Anand	Bakrol	9.5 feet mugger was captured from Goya Talav by the Nature Help Foundation (NHF) team and was released in Malataj.
8.	09-07-2014	Kheda	Matar	Matar-Patel Talavadi	6 feet long mugger rescued by forest department.
9.	25-07-2014	Kheda	Vaso	Vaso	2.15 feet long juvenile mugger was found inside a house. VNC team captured it and put back in the main pond of Vaso.
10.	04-08-2014	Anand	Tarapur	Moraj	7 feet long was captured from an agricultural field. It was taken at Pariej.
11.	25-08-2014	Anand	Petlad	Sojitra	3 feet long Juvenile was captured from near the railway colony and was released in the village pond nearby
12.	26-08-2014	Anand	Tarapur	Amaliyara	6 feet long was rescued. The mugger was taken to Pariej for release
13.	18-09-2014	Kheda	Nadiad	Nadiad	5 feet long mugger was sighted near the entrance of Shivshakti society. A cage was put up by Forest department. The mugger was caught after four days with the help of NHF and Rescue team from Gandhinagar, which then was released into Pariej reservoir.
14.	17-09-2014	Kheda	Nadiad	Davda	A six feet long mugger was caught near Bhathiji Temple (near canal) in Davda. The animal was captured with the help of local NGO rescue teams. It was released at Pariej reservoir
15.	23-09-2014	Anand	Sojitra	Malataj	7 feet long mugger was found in school ground of Malataj. The animal was chased back into the village pond.
16.	19-11-2014	Kheda	Kathlal	Ladvel	6 feet long mugger was captured

© Vishal Mistry / VNC

5. DISCUSSIONS

5.1 Status and distribution of muggers in Charotar

Many studies have indicated that spotlight surveys or day count surveys typically under-estimate crocodile populations because these methods suff rs from a number bias caused due to factors such as vegetation density, vegetation types, position of the crocodile (submerged, on land, between vegetation etc), orientation or the angle of the crocodile in relation to the observer, wariness of the crocodile and most importantly the experience and knowledge of the observers (Bayliss et al. 1986, Cherkiss et al. 2006). Many of the survey areas were inaccessible as the surrounding soils were waterlogged or had poor visibility, owing to the presence of dense emergent and fringing vegetation. Given these constraints, it is likely that the number of muggers sighted during the survey does not represent the true estimates of the total populations existing in this landscape, and should be seen keeping in mind the associated constrains. However, the relationship between the mugger encountered and actual population size is assumed to remain constant over time, and any change in the mugger encountered should reflect a proportionate change in the total population. Although the present study reports several new localities for muggers and provides a basis for re-evaluation of the conservation status of the species, further study is required to determine whether there are additional mugger localities within the adjacent areas.

This is the first comprehensive study on the status and distribution of mugger and their habitats conducted in Charotar. Out of the 68 potential localities surveyed, we could directly record the presence of muggers in 27 villages, ten of which were not previously known to be occupied by this species (Table 1). Many of the villages had mugger presence only in monsoon (Appendix I). This can be attributed to the local dispersal between different water bodies. The mugger population in Charotar is very dynamic and keeps on changing with fluctuation in water and change in seasons. This is because of the extensive network of canals and Kans (small mud walled canals) connecting most of the wetlands in the region, through which individuals constantly move. These networks help in maintaining dispersal and hence a healthy metapopulation structure. Hence, it is recommended that these villages should also be duly searched for the evidence of mugger during future monitoring programs. There is significant increase in species‘ range than observed in earlier studies (Upadhyay & Sahu 2013, Vyas 2013).

The reasons behind high concentration of muggers in Deva village are unclear. Perhaps we counted more muggers in Deva compared to other places because Deva has better and large basking areas (where we can easily see the muggers) as well as have less floating or emergent vegetation (*Eichhornia crassipes* are removed regularly by village authorities), which might have improved out sighting chances. Additionally the water in Deva village do not completely dry up even in summer and pond acted as water reservoirs that provide suitable habitat during the entire dry season, when many of the other wetlands dry up. Moreover, count data suggest that places like Deva, Heranj, Marala-Naghrama; Malataj and Traj contains a relatively large population that may act as a source population for other wetlands.

These results are similar to those of Upadhyay and Sahu (2013) and Vyas (2013), who reported a significa t difference in the abundance of mugger in the wetlands of Charotar surveyed (Table 7). Many factors have affected the numbers of muggers recorded in the present studies and the studies conducted by Upadhyay & Sahu (2013) and Vyas (2013). These factors have not been constant for all these studies and thus restrict comparing the mugger population between all these studies. However for the convenience, we have presented the data in Table 7. In the earlier surveys conducted, Vyas (2013) covered more localities (N=22) than Upadhyay and Sahu (2013) (N=8) and thus provide more comprehensive data on mugger distribution. Upadhyay and Sahu (2013) reports a higher number of individuals (N=41) in and around Heranj village, than reported in parallel study conducted Vyas (2013) (N=16) as well as in the present study (N=18).

Table 7: Muggers recorded during present study (2015), Vyas (2013) and Upadhyay & Sahu (2013)

Sr. No	Places	Present study 2015	Vyas 2013	Upadhyay & Sahu 2013
1	Amaliyara	1		
2	Bhadkad	2	0	
3	Bhadran		1	
4	Changa	2		
5	Dabhou	2	1	2
6	Davda	1		
7	Dethali	2		
8	Deva	49 (53*)	30	58
9	Dundel		0	
10	Gangapur	2	2	
11	Heranj	14 (18*)	9	41
12	Jol	1	2	
13	Kanewal		1	
14	Kasor	2		
15	Kherda	1		
16	Kuni	0		
17	Laval	5	4	
18	Machhiyel	3	1	
19	Maghrol	2	3	2
20	Malataj	14 (16*)	6	19
21	Maliyataj	2		
22	Marala-Naghrama	13 (21*)	9	15
23	Nandoli	2		
24	Navagam	5		
25	Pariej	4	6	
26	Petali	4	1	
27	Pij	2	0	
28	Roon	1	0	
29	Sejava-Deva		0	
30	Sojitra	2		
31	Traj	11 (14*)	2	12
32	Tranja - Kathoda	4	2	8
33	Vaso	10	2	
	Total	162 (186*)	82	157
	Localities	27	22	8

* Muggers counted during night spotlight survey.

We are not clear of the reasons of these differences in the crocodile recorded, but it seems that Vyas (2013) provided more conservative counts whereas Upadhyay & Sahu (2013) provided more of a speculated one. As the exact periods of survey are not mentioned in the former studies, it is difficult to ascertain the factors which could have lead to this differenc

Earlier records show that there were very few muggers (only eight were sighted directly) in the wetlands of Charotar (Vijay Kumar, 1997). Comparing this study with the present study and other recent studies (Upadhyay & Sahu 2013, Vyas 2013), we can interpret that not only the mugger population has flourished, but also has significantly extended its distribution area.

In addition, the density levels of almost 14.31 muggers per/100 sq km recorded during this study suggests that this population might be an exceptional population, contributing significantly to the whole country population.

5.2 Population size

Significant records of sub adults and adults suggest that there is a healthy breeding population of mugger inhabiting the Charotar region in Gujarat. Our study shows that adult muggers over two meters contributed about 50% (N=88) of the total mugger population which indicates existence of a healthy population of this species in Charotar. According to Cott (1961), in an environment unaffected by human influences a normal crocodile population should be dominated by adults and juveniles should be represented in comparatively low numbers. It would be necessary to monitor the population through several more seasons to determine if these trends in size were random or if they truly represent demographic and reproductive patterns. We recommend that future studies increase the number of surveys at each site during each monitoring period. In the present study, a juvenile-sub adult-adult ratio of 1:4:6 was observed, which slightly differed from earlier studies by Upadhyay and Sahu (2013) (1:5:9) and Vyas (2013) (1:2:2). We cannot explain the seasons behind this ratio difference. But possibly factors such as visibility, survey period and observer experience must have contributed towards this difference. The mugger population in the area of the Charotar is strongly skewed towards adults and sub adults and there was very less representation of juveniles in our study. I believe that the data presented in Table 1 do not reflects the actual proportion of muggers in the different size classes. We suggest two possible explanations for this change. During the study we noticed that juveniles were more difficul to see than sub adults and adults, and that they moved faster across water body when escaping. Frankly, it seems possible that hatchlings and small muggers develop a high degree of wariness and are thus less encounter.

5.3 Seasonal variation in mugger population

Although there could be a number of factors responsible for the fluctuation of mugger population namely the seasons, rise in water level, local dispersal, disturbances caused by fishing activities, farming of Indian water chestnut and Lotus, and water drainage for irrigation. Most of the village ponds surveyed are given on lease to fishing folks for fishing, which come from outside of the village. Fishing is performed 2-3 times a year, mostly in summer months (April & May) and winter months (Oct-Dec). It was observed that whenever fishing activity is going at any wetland, the mugger population will move in to the dens or thick vegetation, to escape the disturbance. Some of the indivuals even move a bit longer to reach other nearby wetlands. Once the fishing has finished, which generally lasts for 2-4 days, the muggers move back into the original ponds. Thus it seems that fishing has little effect on the fluctuation of mugger population. Farming of lotus and Indian water chestnut also do not have much significant effect on population fluctuation, except when harvesting the crop. During this harvesting period people walk inside these wetlands (if the water body is small and shallow) or use a boat to harvest these crops , which causes disturbances to muggers. This leads them to find a refuge in thick vegetation, Kans (small mud walled canals) or other nearby pond. This dispersal is temporary and very short spanned. This although affecting our on the day sighting results, do not contribute to the seasonal changes in muggers populations. The most important factor which contributed significantly towards the population fluctuation was the changes in water levels. Our study showed decreasing trends in mugger sightings with increasing water level. Other studies on mugger provide support for these observations (Vyas 2010, 2012). We found that some muggers move into wetlands having fewer water levels during the wet monsoon season and remain there until the end of monsoon or up to start of the winter when the water levels in large wetlands (such as Deva, Marala-Naghrama, Heranj, and Traj) decrease. During periods of high water, muggers are able to disperse throughout the area, via the network of connecting canals. It is mostly during the monsoon that mugger starts appearing at places never seen before and creates panic among the local public. Also, muggers are more likely to submerge in response to disturbance when the water level is relatively higher, and the movement is considered to increase in deeper water. Large animals have greater potential for longer dives due to their mass-dependent rate of oxygen consumption (Wright 1987). These behavioral changes are likely to result in lower detection of the muggers under higher water levels.

Lower detection of small size class compared to medium and large size classes may be because of the smaller animals move into cover to reduce mortality (Woodward et al. 1987). Our results also showed great variability in mugger detection by observers and places. Such factors cannot be controlled over the course of long-term surveys like ours. It was also observed that mugger were less sighted or were altogether not seen in small wetlands in summer. The reason for this concentration of mugger in large wetlands was purportedly immigration into the large wetlands from drying small ponds. The number of muggers present in wetlands during the late dry season is likely to vary from year to year due to variations in rainfall, the extent of water released in the canals and consequently the longevity of water level in this wetlands.

5.4 Nesting and breeding of muggers

Successful records of nesting and hatching records point out that there exists a healthy and breeding mugger population in Charotar region. The number of burrows and nests observed positively correlates with the number of muggers sighted in different nesting areas as reported by Vyas (2010b) in Vadodara region on River Vishwamitri, Gujarat. Although the reasons why mugger selects any habitats for nesting are not readily clear, it has been suggested that habitat complexity may impart an advantage for nesting and benefits to hatchlings. Aggregation of nest and burrows in some places such as Deva and scattered nest in other places may have occurred due to differences in habitat quality. It should be noted that the occurrence of a significant number of active mugger burrows/nests in Deva village, is explained by observations indicating substantial water level even during dry summers which gives advantage to the hatchlings once they hatch and thus provide good refuge from predators. Additionally Deva possesses good habitat for basking areas. Even village people are tolerant of their presence. On one instance we were invited by a villager to see a burrow in his house backyard. The animal was present inside the burrow. He reported that the burrow has been in his backyard for more than four year now and is occupied every year by muggers and that he had no problem with animal living there. It is very likely that multi factors have favored high number of active burrows in Deva compared to other places. Also places such as Traj and Heranj have dense vegetation along the bank of the whole wetlands which hurdled our search for the burrows and thus fewer burrows were recorded at these places. It could be expected that improvements in scale and refinement of vegetation association within the expected mugger habitat range may result in a higher proportion of nests being located. It should be noted that our nest records do not represent all the nesting habitats available in the study area. Search effort for nests was not sta - dardized among the sites and observers. It is possible that anthropologic factors contributed to the heterogeneous distribution and abundance of the nests. Nevertheless, the surveyed were conducted in most of the source population in Charotar, with the exception of Marala- Naghrama, which could not be surveyed for burrows and nests because of the extensive *Ipomoea spp*. growth along the bank. However villagers do report many sightings of hatchlings and juveniles. Despite some limitations in the interpretation of the data, our results indicate that the most commonly used nesting habitats can be characterized by least disturbance, access to water regimes at the time of nesting and vegetation associations. The suitability of ground layer vegetation for constructing their mound-like nests is also important. These factors may be used to assess the suitability of nesting habitat for management and conservation purposes. These nesting habitats should have high conservation value and the monitoring of nests should continue. Management decisions for the species as a top predator in these wetland habitats should be based on evidence from such long-term monitoring programs.

5.5 People's attitude, perception and knowledge of muggers

Our samples were not equal, with male respondents almost double the number than females across age group, but our response rate was high across. Females in rural India do not interact much with males other than her family members. We tried to conduct more interviews from females, but they were reluctant to talk to us, even to our female team members. We also had less number of student respondents. So our results must be analyzed with caution because of potential biases. The overall conclusion from implementing sampling procedures is the importance of personal contact with authorities. In villages contacting the village head prior to contacting individual respondents were incredibly important and certainly an important reason behind the high response rates.

The respondents' views of muggers were surprisingly favorable in our study area, considering that muggers were feared for threatening human lives and livestock. This can have important implications for the conservation of muggers in this region, as these mugger populations are surviving outside the protected area and needs immediate conservation and management measure. Our study allows identification of certain target groups important for conservation and management of muggers. We found that the acceptability of mugger population in Charotar depended majorly on the literacy level and to certain extent age of respondents. We hypothesized that women would express more concerns about muggers than men would. In fact, overall men and women had similar concerns. We found some support for our hypothesis, however, in that more women than men were concerned about the danger posed by mugger to human life. By contrast, women and men showed almost equal tolerance toward mugger. Age differences were also limited and mostly concerned contrasts between those in the young and old age groups. We hypothesized that older people would express more concerns about mugger than younger people would. Consistent with this hypothesis, less tolerance of mugger was shown by older than by younger people. Younger people also consider mugger a "Beautiful species" than older people did. By contrast, older people saw mugger as more of a danger to domestic animals and had more knowledge about mugger than younger people did. Older persons' concerns may have been leavened with more knowledge of the animals than younger people had. Although the main variable accounting for negative attitudes towards muggers was concern for safety, many other complex variables are also involved.

Certain key findings emerge from this study, these being relevant to both the social understanding of mugger perception, and knowledge of human-mugger relations in Charotar region. Age, education and gender were relevant to attitude and perception of mugger, but their influence varied according to the topic discussed. Our results indicated an education-biased attitude regarding the mugger. Mugger, although to lesser extent, were also seen negatively, based more on their intrusion into human spaces, livestock depredation and fear of attacks on humans than their natural behavior in "natural" areas. Despite pronounced urbanization and reduction of habitats, muggers played an important role in people's consciousness. Despite some mugger attacks, tolerance for these animals persists, though more among the younger generation and literate than among older people and illiterate.

5.6 Threats

Currently the mugger populations in Charotar region seems to be doing fine, however certain threats have been identified from present and earlier surveys (Upadhyay and Sahu 2013; Vyas 2013). These problems need attentions from forest authorities, as this may pose danger to the muggers and their habitat in the long term. The Direct human influences such as poaching of muggers for their skin and collection of eggs for food or medicinal purpose are not reported. It is fortunate enough for muggers, that when most of the wild creatures are becoming victim of humans, it is somewhat safe from human's evil intentions.

(a) Inappropriate fishing practices:- The local villagers are not involved in fishing, and pose no threat to the muggers or to the wetlands. Most of the wetlands have been leased out by the village Panchayat (village authority) to fishing contractors. During their fishing season they put large fishing nets in the wetlands, wherein sometime the muggers get caught. Extensive network of gill net spread over the area of a pond can only increase the vulnerability of this species to injury, especially the smaller ones. If not removed at the appropriate time, the animal might suffocate to death. Also these fishermen, who mostly come outside Gujarat, intentionally capture the mugger, tie them up and keep outside the water till they finish fishing, so as to protect their fishing nets from breaking by muggers. Such fishing practice may injure the animal while capturing and keeping them tied up. It was during such fishing event at Traj village that a mugger was captured in nets, which was then tied up and kept at the bank. One of the kids playing nearby approached too close to the animal and was attacked by mugger (Upadhyay and Sahu 2013). The boy was rescued but was injured badly.

(b) Spraying of pesticides:- Villagers also use some of this wetland to grow Indian water chestnut (*Trapa bispinosa*) and Lotus (*Nelumbo nucifera)*.Pesticides are used regularly for these

crops. Although we do not have much information about this threat, an excessive pesticide use can affect the various trophic levels in these wetland ecosystems, including top predator, the mugger.

(c) Encroachment:- Encroachment in to the mugger habitat was also found to be a serious threat to their survival. In April 2014, many mugger burrows were destroyed while reconstruction the side of the canal at Deva village, which harbours significant muggers populations in the area. Excavation activity was also seen at Heranj.

(d) Artificial feeding/Food provisioning:- The authors (Upadhyay and Sahu 2013) rightly pointed out that another reason for the minimal conflict in this region is that people do not offer anything to these muggers, due to which the muggers do not come out from their territories in to the human settlements. However during our surveys we found that in Deva village, which holds one of the highest mugger numbers in Charotar, animal skinners of the village leave remains of the skinned animals near the pond for the muggers. Muggers are attracted by this opportunity of easy food. In doing so they approach very close to the human habitation. This could encourage muggers to lose the fear of humans, leading to a close encounters with humans. And that scenario is neither beneficial to mugger or humans as it can be observed in Vadodara around Vishwamitri River (Vyas 2010a, 2010b, 2012) where human attacks have increased over time.

(e) Road kill:- Road kill is another threat which has been identified in this region. One incidents of mugger death on road was recorded during our study. One mugger (5.38 ft) was killed near Deva village while crossing the road. During monsoon, when water rise in the village ponds and canals connecting them, muggers in this region engage in local migration/dispersal moving from one place to another. During such movements they have to cross roads and railway tracks. It was during such movement that this animal was run over by some vehicle. Such incidents of mugger road kill have been also reported in Vadodara region (Vyas 2010b, 2014).

(f) Harassment of Muggers:- Although to a lesser extent, muggers were being harassed by local villagers at some localities. During winters, when muggers indulge in basking, village kids at Deva, Heranj and Malataj were seen disturbing muggers by throwing stones at them. A female mugger, who occupied a burrow at Heranj village, was harassed by villagers, wherein the villagers will poke the animal using long stick. Sometimes they would tie a rope around its snout and play tug-war kind of game. Manytimes the vegetation around the burrow was burned down to expose the burrow.

(g) Flooding of burrows:- These wetlands are connected by Canals and Kans and so when the water is released into the canals from the Mahi river, the water level rise in wetlands and flood some burrows. Abnormal inundation occurs during the monsoon that floods many of the burrows thereby hindering hatching from nests. Flooding of den was observed at Deva and Heranj. We observed two juveniles dead due to monsoon flooding of burrows in Heranj.

(h) Drying up of water bodies in summer:- Reduced availability of aquatic prey in summer is likely to affect the feeding opportunities of small muggers to a greater extent than those of large muggers because smaller animals rely more heavily on aquatic organisms, such as macro invertebrates, as food sources whereas large muggers consume more diverse prey, including reptiles, birds, and mammals. The drying up of ponds causes fish populations to die out, thus affecting the larger animals as well. Dispersal of muggers to unfavorable habitats, in some cases human habitation, where their chances of survival is further reduced, poses another problem (Arumugam & Andrews , 1993). In addition, cannibalism (i.e., large muggers eating small muggers) may occur under prolonged drought situations as observed in American alligator (Schmidt 1924; Cott 1961).

(i) Negative portrayal of muggers in media:- The media seems to play a major role in influen - ing the attitudes of the people. During monsoon when the water rises in wetlands and the interconnecting canals, muggers move from one wetland to another, sometimes reaching places where they have not been seen people. Such incidents are negatively highlighted by the media. We can't ignore the fact that, the people do fear of the mugger attacks, and that such negative

publicity may, while increasing the negative attitude, will hinder the conservation of muggers in Charotar and adjoining areas.

5.7 Recommendations

1) In view of ecological and biological importance of the Charotar, it is necessary to enhance protection to the wetland ecosystem in general and muggers in particular. This will assure a safer home for this species on a long-term basis. Mugger conservation efforts must be guided by species and habitat specific action plan. Fishing should be regularized and regulation strictly enforced in all the major mugger habitats by the concerned authority.

2) There is also an urgent need for the Forest Department to establish a ground staff for protection, law enforcement and monitoring of the muggers in the region. The guards are needed to be posted at important muggers habitats (source population). Forest guards and other frontline staff should be posted in sufficient numbers at vulnerable plac

3) Regular, planned and systematic monitoring of muggers, associated species and their habitat is essential for updating the information on the status of muggers, and must be done on a yearly basis. All monitoring should follow uniform study techniques to make scientific inferences and as far as possible all census should be based on direct observation. Indirect sightings should be validated by cross checking the information obtained before including it in to the population.

4) The critical habitat for feeding and nesting of mugger should be identified and protected. We feel that immediate measures need to be undertaken to ensure enough undisturbed stretches of pond bank for successful nesting, breeding and long term survival of mugger.

5) Relocation of muggers captured should be the final resolution. The release of captured individuals and site for releasing muggers should be determine with adequate scientific justification of overall schedule and actions under the supervision of experienced persons.

6) Although frequency of interaction between humans and mugger has been increasing throughout Gujarat (Vyas 2010), public awareness of this ubiquitous species has generally been overshadowed by other species in Gujarat. Long term conservation of muggers in this region will depend on the ability of wildlife professionals and managers to develop effective education strategies and increase the awareness of locals to maintain and improve human attitudes toward these species. The effectiveness of education strategies will depend on the implementation of educational program strategies by multi-disciplinary groups. A better appreciation by local people of the role of this prehistoric animal as “manager of the wetlands” should be emphasized in educational programs. Acceptance of predators not only depends on animal characteristics, but also on people’s demographic and personal variables, which implies that sociologists, educators, and other professional involved in rural development should be involved in mugger conservation actions. It is also crucial to develop strategies to reduce problems between muggers and human, otherwise increasing positive attitude would be an almost impossible goal.

5.8 Mugger conservation in Charotar

This population of mugger in Charotar, Gujarat, India is a unique example of co-existence between humans and mugger, with no visible or significant conflict. This unique agricultural landscape have the capability of providing long term survival to muggers. However, continuous increase of this large predator in close proximity to human habitation is worth a concern (Vyas 2010). Every year muggers are being rescued from many areas of Charotar region and translocated. Muggers in Charotar live in very close proximity to the humans. This kind of close proximity can be particularly controversial when there is a question of human life or of the resources that have economic value such as livestock and the predators involved have a high conservation profile. Although religious beliefs might be one of the factor for the low level of conflict (Vyas 2003), but is clearly not the major one.

Their existences have been positively accepted majorly because of the fact that there have been very few attacks in this region. In other words the acceptance of mugger by local people in this area depends on the degree of their contacts with muggers. So incident of few attacks could possibly lead to the rise in negative attitudes. Upadhyay and Sahu (2013) have reported one incident, wherein one girl was attacked and killed by a mugger in Traj Village in the study region. Agitated people demanded removal of muggers from that village and as a result 7-8 muggers were captured and removed somewhere else. While the interest of locals in crocodilian conservation is appreciable, lack of appropriate 'rescue and release' protocols is a matter of concern (Vyas 2012). Translocation of animals is not a viable option as many translocated animals returned to the same place where they had been rescued earlier (Bhatt 2000, Vyas 2010b, Vyas 2012). It is high time to design an action plan for this species at the state level and to evaluate the existing conservation strategy and reformulate the policies (Vyas 2010a). The best solution is to change people's behaviour so that they are unlikely to encounter muggers. The provision of enclosures within which people can access the water's edge in safety to use the pond has been already implemented in many villages in Charotar region. This initiative will significantly reduce any possible conflict in this region

Fishing activities carried out at Deva village

© Vishal Mistry / VNC

Villagers spraying pesticides in Indian water chestnut (*Trapa bispinosa*)

© Dhaval Patel / VNC

Mud excavation in progress in village pond at Heranj village

© Anirudh Vasava / VNC

Artificial food provisioning at Deva village where skinners leave remains of the skinned animal near the pond.

© Anirudh Vasava / VNC

A mugger run over and killed by a speeding vehicle on road near Deva village.

© Vishal Mistry / VNC

Villagers harrsing a female mugger in its burrow at Heranj village

© Vishal Mistry / VNC

Flooding of a burrow at Heranj village in monsoon led to the death of few juveniles (one of them can be seen in the picture)

© Vishal Mistry / VNC

Injury marks on a person's right leg caused due to a mugger's attack at Heranj village

© Vishal Mistry / VNC

Injury marks on a cow's right leg, jaw and ears due to a mugger's attack

© Vishal Mistry / VNC

Mugger rescued from human habitation at Keriyavi village on 16-04-2014

© Vishal Mistry / VNC

Mugger rescued from human habitation at Davda village on 17-09-2014

© Vishal Mistry / VNC

© Anirudh Vasava / VNC

6. PROMOTING PUBLIC AWARENESS AND EDUCATION FOR MUGGER CONSERVATION

Conservation Awareness Programme for school children and local communities with their active participation were carried out through audiovisual shows and presentations followed by interactive discussion in order to develop a model for future conservation activities. Information on mugger behaviour and issues of human–mugger conflicts were discussed and mitigation measures were suggested. We covered 25 schools and around 15 villages around the potential mugger habitats under this initiative. Nearly 5000 students and around 100 teachers have benefitte from these workshops (Table 8). Students were provided information (through presentation) on the basic biology and behavior of the mugger, as well as the prevailing threats, followed by on how to co-exist with this species. More than 300 school students from urban regions were taken to visit mugger occupied villages (Deva, Traj, and Malataj) to provide them with onsite experience of mugger observation and understand the importance of such top predator in maintaining an aquatic ecosystem.The participants were very happy and appreciated this opportunity of interacting with our team personnel.

Education material (posters, brochures) were prepared in Gujarati language for distribution to schools, villagers, Forest Departments and other NGO's to raise awareness on conservation importance of the species. 10000 brochures containing information on how to co-exist with muggers have already been distributed among students and local community. Posters (~1000) informing basic information about mugger and their conservation were also put up in school classroom and notice board to create awareness. We are hoping that the poster would inspire children and the adults alike and be on display for more number of years in the classrooms. A research programme is recommended, to monitor the effectiveness of policies and human-mugger relationships in the Charotar region, in order to minimise human-mugger conflict in the future

Conducting mugger awareness program in a school

© Vishal Mistry / VNC

Table 8. Schools where mugger awareness programs where conducted

Sr. No	Name of School	Village	Standard	Students
1	A J Primary School	Vaso	5th to 8th	300
2	G D Girls School	Vaso	5th To 8th	66
3	M N Boys School	Vaso	5th To 8th	100
4	Primary School	Rampur	5th to 8th	125
5	Saraswati Vidyalaya	Vaso	5th To 8th	225
6	Secondary School	Rampur	9th	55
7	Primary School	Shiholdi	5th To 8th	150
8	Pay Centre School	Matar	5th To 8th	500
9	Pay Centre School	Traj	5th To 8th	325
10	Anandalaya	Anand	3th to 5th	130
11	Pinto's School	Lambhvel	3th to 5th	110
12	Primary School	Petli	5th To 8th	300
13	Vidyan Vinay Mandir School	Petli	5th To 8th	172
14	Roon Primary school	Roon	5th To 8th	193
15	Uttar Buniyadi Anya Vidyalaya	Roon	5th To 8th	250
16	Changa Boys School	Changa	5th To 8th	120
17	Changa Boys School	Changa	5th To 8th	150
18	Shri Sasarvati Vidyalaya	Maliayataj	5th To 8th	145
19	Primary School	Maliayataj	5th To 8th	460
20	Secondary School	Deva	9th & 11th	100
21	Boys School	Deva	5th To 8th	300
22	Girls School	Deva	5th To 8th	200
23	Girls School	Dabhou	5th to 8th	275
24	Girls School	Dabhou	5th to 8th	200
25	SSRV	Bakrol	3th to 5th	125
	Total Student Participants			**5076**

Conducting mugger awareness program in a school

© Vishal Mistry / VNC

Students participants going through educational material provided to them during awareness program

© Vishal Mistry / VNC

Onsite mugger observation experience for school students

© VNC

7. MUGGER CONSERVATION THROUGH TRAINING AND CAPACITY BUILDING

We conducted training cum monitoring program called as “Charotar Crocodile Count Program (3CP)” for the mugger enthusiasts and interested college students (Details have been already provided in result scetion). One of the main motives behind this exercise was to provide first hand training and experience in mugger monitoring and conservation to the interested persons, especially students. Till now more than 100 volunteers have partcipated in VNC’s 3C program. They came from different disciplines, occupations and places from over the state .In fact, this survey was first of its kind and for the first time so many volunteers gathered together to assess the situations of muggers in this region. Along with the population survey they also collected data on attitudes and perception of the people about muggers and their conservation. The 3C program is a huge success and we plane to continue this event every year.

Very fruitful responses have been received by the project in terms of volunteers interested in becoming a part of the project. More than ten collge students have voluntered with us on this project spending more than a week collecting data on population and human-mugger intercations. Some of them has already chosen zoology or biology for further study and are determined to make a carrer in wildlife conservation, especilly herperological reserch and conservation.

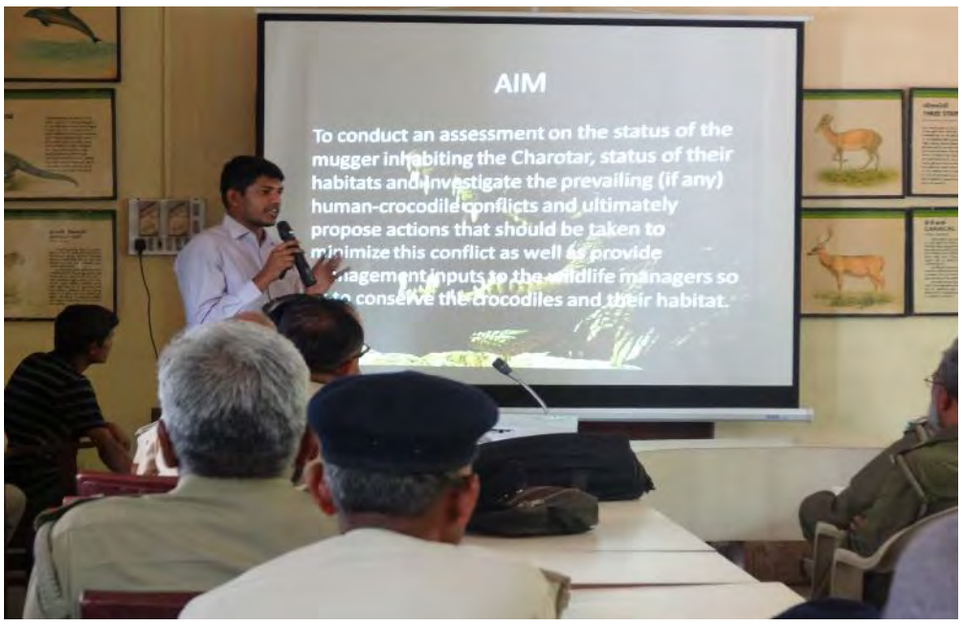
On 21st February 2014, VNC conducted a training program “Rescue and Rehabilitation methods for Muggers”. Participants included delegates from Gujarat forest department (RFOs), members of local communities, members of NGO, personnel’s involved in rescue and rehabilitation, mugger enthusiasts, interested zoology students, lectures and other academicians. 41 participants took advantage of this workshop. Interactive sessions were held to provide information on mugger ecology, their status, mugger-human conflict and conservation prospects and then they were provided information on conducting population estimation, rescue and rehabilitation methods.

We have thrice invited by the Vadodara forest department to imaprt training on mugger monitoring and human-crocodile conflict mitigation strategies, and share experience about our mugger reserch and conservation work in Charotar. More than 100 forest staff members from various levels (Guards, Foresters and Range Forest Officers have taken advantage of this training and workshop.

Workshop on crocodile rescue and rehabilitation methods organised on 21-02-2014

© VNC

Providing training on crocodile monitoring and management to the forest department staff at Vadodara, Gujarat



© Jigar Upadhyay

Participants after receiving certificates for attending the first Charotar Crocodile Count Program oraganised on 14-15 Dec, 2014

© Anuj Patel

Participants who attended the second Charotar Crocodile Count Program oraganised on 10-11 Jan, 2015

© Anuj Patel

REFERENCES

Acharya, H. N. (1949). List of reptiles from Gujarat state. *Prakurti* 8:156-178. (In Gujarati).

Arumugam, A. and Andrews, H. (1993). Status of the mugger crocodile (*C. palustris*) in the Sathanur Reservoir, Tamil Nadu. Report C-1/93. Tamil Nadu: Centre for Herpetology, Madras Crocodile Bank.

Bayliss, P. (1987). Survey methods and monitoring within crocodile management programmes. In: Webb, G.J.W., Manolis, S.C., Whitehead, P.J. (Eds.), Wildlife Management: Crocodiles and Aligators. Surrey Beatty and Sons Pty, Sydney. Pp. 157-175.

Bhatt, S. (2000). Croc recaptured in Gujarat. *CSG Newsletter*, 19(1): 9–10.

Bustard, H. R. (1999). Indian Crocodile Conservation Project. In: Indian Crocodiles. Envis (Wildlife and Protected Areas). Vol.2, No.1, Wildlife Institute of India, Dehra Dun, June 1999. ISBN 0972-088X: Pp. 5-9.

Chavan, S. A. (1979). Distribution and conservation of crocodiles in and around Gir wildlife sanctuary. *Indian Journal of Forestry*, 2 (3): 266-268.

Cherkiss, M.S., Mazzotti, F.J. and Rice, K.G. (2006). Effects of shoreline vegetation on visibility of American crocodiles (*Crocodylus acutus*) during spotlight surveys. *Herpetological Review*, 37:37-40.

Choudhary, B.C. and Roy, R.K. (1982). Status survey of the crocodile population. A field guide, Central Crocodile Breeding and Management Training Institute, Hyderabad, Andhra Pradesh, India.

Choudhury, B.C. and de Silva, A. (2013). *Crocodylus palustris*. The IUCN Red List of Threatened Species. Version 2015.1. <www.iucnredlist.org>. Downloaded on 03 June 2015.

Cott, H.B (1961). Scientific results of an inquiry into the ecology and economic status of the Nile crocodile (*Crocodylus niloticus*) in Uganda and Northern Rhodesia. *Transactions of the Zoological Society of London*, 29:211-356.

de Silva, A. and Lenin, J. (2010). Mugger Crocodile (*Crocodylus palustris*). In Crocodiles Status Survey and Conservation Action Plan. Third Edition, ed. by S.C. Manolis and C. Stevenson. Crocodile Specialist Group: Darwin, Pp. 94-98.

Joseph, A., Chauhan, E., Khanna, K. and Whitaker, R. (1975). Marsh crocodile *Crocodylus palustris* in the Gir. *Journal of Bombay Natural History Society*, 72(3):862-863.

Lentic, M. and Connors, G. (2006). Changes in the distribution and abundance of saltwater crocodiles (*Crocodylus porosus*) in the upstream, freshwater reaches of rivers in the Northern Territory, Australia. *Wildlife Research*, 33:529-538

McCann, C. (1939). The reptiles and amphibia of Kutch state. J*ournal of Bombay Natural History Society*, 40: 425 427.

Messel, H., Vorlicek, G.C., Wells, A.G. and Green, W.J., (1981). Surveys of Tidal River Systems in the Northern Territory of Australia and their Crocodile Populations. Monograph No. 1, Pergamum Press Sydney.

Mukherjee, A. (2000). Ecology of the Indian Sarus Crane *Grus antigone antigone*. Ph.D. thesis. Submitted to Saurashtra University. Rajkot, Gujarat, India.

Mukherjee, A., Borad, C. K. and Parasharya, B. (2002). Comparative account of population and breeding pair density of the Indian Sarus Crane (*Grus antigone antigone*) in Kheda district, Gujarat. *Zoos' Print Journal,* 17(8): 839-843.

Oza, G. M. (1975). Conservation of the crocodile in the Sayaji Sarovar lake, Baroda, India. *Biological Conservation*, 7: 235 –236.

Parasharya, B. M., Mathew, K. L. and Yadav, D. N. (1989). Status and habitat preference of Indian Sarus Crane in Gujarat, India. Paper presented in the Asian Crane Congress at Rajkot, Gujarat, India.

Platt, S.G. and Thorbjarnarson, J. B. (2002). Population status and conservation of Morelet's crocodile, *Crocodylus moreletii*, in northern Belize, Biological Conservation, 96: 21-29.

Rashid, M. A. (1978). A note on the status and management of crocodiles in Gujarat state. IUCN/SSC/CSG. (Unpublished Report).

Schmidt, K.P. (1924). Notes on Central American crocodiles. *Fieldiana,* 12:79-92.

Singh, H. S. (2013). Tree wealth in the non-forest areas of Gujarat. Trees Outside Forest (TOF) - Third Tree Counting-2013. Gujarat Forest Department, Gandhinagar.

Upadhyay, J.N. and Sahu, R.K. (2013). Study on *Crocodylus palustris*: co-existence of men, animal and population survey at Kheda Anand district in Gujarat, India. In World Crocodile Conference. Proceedings of the 22nd Working Meeting of the IUCN-SSC Crocodile Specialist Group. IUCN: Gland, Switzerland. Pp. 116 – 122.

Vijaykumar, V. (1997). Evaluation of restocked mugger crocodiles and its implication in long-term conservation and management of the species in Gujarat, India, Gujarat Institute of Desert Ecology, Bhuj-Kachchh, Gujarat, 65 pp. (Unpublished Report).

Vijay Kumar, V.R., Vyas, R. and Choudhury, B.C. (1999).Status of mugger and its conservation problems in Gujarat. ENVIS (Wildlife & Protected Area), 2(1): 69-76.

Vyas, R. (1993). Recent cases of man-eating by the mugger (*Crocodylus pulustris*) in Gujarat state. *Hamadryad*, 18:48-49.

Vyas, R. (1994). Mugger crocodiles in the vicinity of human settlements in south Gujarat. *Hamadryad*, 19: 94–96.

Vyas, R. (2003). Crocodile survey in and around the Barada Wildlife Sanctuary, Gujarat, India. *CSG Newsletter*, 22(2): 14 – 17.

Vyas, R. (2005a). Recent notable incidences of conflict between mugger and humans in Gujarat. *CSG Newsletter*, 24(2):7–8.

Vyas, R. (2005b). Mugger crocodiles of Vadodara city, Gujarat State, India. *CSG Newsletter*, 24(4): 15 – 16.

Vyas, R. (2007). Present conservation scenario of reptile fauna in Gujarat State, India. *The Indian Forester*, 33(10): 1381 – 1394.

Vyas, R. (2008). Why muggers (*Crocodylus palustris*) are found at some of water bodies of Gujarat State? *CSG Newsletter*, 27(1), 14 – 16.

Vyas, R. (2010a). Mugger (*Crocodylus palustris*) population in and around Vadodara City, Gujarat State, India. *Russian Journal of Herpetology*, 17(1): 43-50.

Vyas, R. (2010b).The Muggers (*Crocodylus palustris*) of Vishwamitri River: Past and Present. Herpetology & Environmental Research Project (HERP), Vadodara, Gujarat State, Pp. 32.

Vyas, R. (2012). Current status of Marsh Crocodiles *Crocodylus palustris* (Reptilia: Crocodylidae) in Vishwamitri River, Vadodara City, Gujarat, India. *Journal of Threatened Taxa*, 4 (14):3333-3341.

Vyas, R. (2013). Recent scenario of mugger (*Crocodylus palustris*) population in three districts of Gujarat State, India. In World Crocodile Conference. Proceedings of the 22nd Working Meeting of the IUCN-SSC Crocodile Specialist Group. IUCN: Gland, Switzerland. Pp. 220 – 226.

Vyas, R. (2014). Roads and Railway: Cause for mortality of muggers (*Crocodylus palustris*) Gujarat State, India. *Russian Journal of Herpetology,* 21(3):237-240.

Vyas, R. and Bhatt, S. (2004). The mugger (*Crocodylus palustris*) population, problems, panic and rescue operation in and around Vadodara City. *CSG Newsletter*, 23(3):6–9.

Vyas, R. and Bhavsar, S.R. (2009). Movement of an individual mugger into urban areas of Vadodara City, Gujarat State, India. *CSG Newsletter*, 28(3): 5–7.

Vyas, R. and Vyas, R. (2002). Mugger survey in the Vishwamitri river of Gujarat, India. *CSG Newsletter*, 21(3): 9–110.

Whitaker, R. (1977). Notes on the status of Gir crocodiles, *Journal of Bombay Natural History Society*, 75(1):224-227.

Whitaker, R. (1987). The management of crocodilians in India. In: Wildlife management: Crocodiles and Alligators (Eds. Webb, G.J.W; S.C. Manoli & P.J. Whitehead). Surrey Beatty and Sons, Sydney. Pp. 63-72.

Whitaker, R. and Andrews, H. (2003). Crocodile conservation, Western Asia region: An update. *Journal of the Bombay Natural History Society*, 100(2&3): 432–445.

Whitaker, R. and Whitaker, Z. (1989). Ecology of mugger crocodile. In: Crocodiles: Their Ecology, Management and Conservation. A special publication of the Crocodile Specialist Group. IUCN, Gland, Switzerland. Pp. 276-297.

Woodward, A.R., Hines, T.C., Abercrombie, C.L. and Nichols, J.D. (1987). Survival of young American alligators on a Florida lake. *Journal of Wildlife Management*, 51:931-937

Wright, J.C. (1987). Energy metabolism during unrestrained submergence in the saltwater crocodile *Crocodile porosus*. *Physiological Zoology*, 60:515-523.

© Mehul B. Patel

APPENDIX-I

Localities surveyed to assess mugger occurance in Charotar region

Sr. No.	District	Taluka	Villages	Latitude	Longitude	Mugger Sighted	Mugger Presence	Wetland Size	* Uses (Fishing/ Domestic/farming)
1	Anand	Tarapur	Amaliyara	22.457221	72.581961	1	Seasonal	Small	D
2	Anand	Anand	Bakrol	22.563797	72.910892	0	Seasonal	Medium	FD
3	Anand	Sojitra	Balinta	22.545385	72.663254	0	No	Small	D
4	Anand	Petlad	Bandhani	22.554385	72.828652	0	No	Small	D
5	Anand	Sojitra	Bhadkad	22.61735	72.706037	2	Permanent	Medium	FD
6	Anand	Khambhat	Bhattalavdi	22.385406	72.606612	0	Yes	Canal	D
7	Anand	Tarapur	Budhej	22.43562	72.592366	0	No	Medium	D
8	Anand	Petlad	Changa	22.589448	72.79819	2	Permanent	Small	FD
9	Anand	Sojitra	Dabhou	22.583373	72.717616	2	Permanent	Medium	FDFr
10	Anand	Sojitra	Dali	22.526187	72.70307	0	Seasonal	Medium	FD
11	Anand	Petlad	Demol	22.609318	72.778176	0	No	Medium	D
12	Anand	Sojitra	Deva	22.61527	72.735136	53	Permanent	Medium	FD
13	Anand	Sojitra	Devataj	22.538751	72.704344	0	No	Large	D
14	Anand	Sojitra	Gada	22.52951	72.683564	0	No	Small	D
15	Anand	Tarapur	Gorad	22.451072	72.55169	0	Yes	Medium	D
16	Anand	Anand	Jol	22.577919	72.881384	1	Seasonal	Medium	D
17	Anand	Sojitra	Kasor	22.550676	72.773701	2	Permanent	Medium	FDFr
18	Anand	Anand	Kherda	22.560875	72.954767	1	Seasonal	Medium	D
19	Anand	Sojitra	Limbali	22.550644	72.705196	0	No	Medium	D
20	Anand	Sojitra	Malataj	22.581148	72.747199	16	Permanent	Medium	FDFr
21	Anand	Tarapur	Moraj	22.476216	72.608646	0	Seasonal	Medium	FD
22	Anand	Khambhat	Navagam	22.622596	72.770661	5	Permanent	Medium	FD
23	Anand	Sojitra	Palol	22.514326	72.684493	0	No	Medium	D
24	Anand	Sojitra	Petli	22.595451	72.755252	4	Permanent	Small	FD
25	Anand	Sojitra	Piplav	22.529807	72.770789	0	No	Medium	FDFr

* F=Fishing, Domest use= D, Fr=Farming

Sr. No.	District	Taluka	Villages	Latitude	Longitude	Mugger Sighted	Mugger Presence	Wetland Size	Uses (Fishing/Domestic /farming)
26	Anand	Petlad	Ramodadi	22.4563	72.687226	0	Seasonal	Small	D
27	Anand	Sojitra	Roon	22.628013	72.760304	1	Seasonal	Small	FDFr
28	Anand	Sojitra	Runaj	22.499456	72.702327	0	No	Small	DF
29	Anand	Anand	Sarsa	22.544821	73.068579	0	Yes	Small	D
30	Anand	Sojitra	Sojitra	22.538478	72.720059	2	Yes	Medium	FD
31	Anand	Tarapur	Valli	22.459494	72.498201	0	Yes	Small	FD
32	Anand	Sojitra	Virol	22.511153	72.744541	0	No	Medium	FD
33	Kheda	Matar	Asamali	22.603908	72.538272	0	No	Small	D
34	Kheda	Matar	Bhalada	22.562801	72.66019	0	Seasonal	Small	D
35	Kheda	Nadiad	Davda	22.697752	72.793678	1	Seasonal	Canal	FD
36	Kheda	Matar	Dethali	22.601594	72.682943	2	Seasonal	Small	FD
37	Kheda	Nadiad	Gangapur	22.644033	72.775098	2	Permanent	Small	FD
38	Kheda	Matar	Heranj	22.66153	72.69363	18	Permanent	Large	FD
39	Kheda	Matar	Kathoda-Tranja	22.639337	72.667428	4	Permanent	Large	FD
40	Kheda	Nadiad	Keriavi	22.637752	72.85045	0	Seasonal	Small	FD
41	Kheda	Anand	Khandhali	22.645036	72.686674	0	Yes	Medium	FD
42	Kheda	Matar	Kharenti	22.648278	72.61193	0	No	Small	DF
43	Kheda	Matar	Kunjara	22.653837	72.607569	0	No	Medium	D
44	Kheda	Matar	Laval	22.634652	72.717128	5	Permanent	Medium	FD
45	Kheda	Matar	Machhiel	22.654963	72.668381	3	Permanent	Medium	FD
46	Kheda	Sojitra	Maghrol	22.57767	72.682484	2	Permanent	Medium	DFr
47	Kheda	Matar	Mahelaj	22.685793	72.599384	0	Seasonal	River	D
48	Kheda	Matar	Malavada	22.59718	72.65535	0	No	Small	FD
49	Kheda	Matar	Maliyataj	22.652707	72.719817	2	Permanent	Small	FD
50	Kheda	Matar	Marala-Nagrama	22.614127	72.637308	21	Permanent	Large	FD

Sr. No.	District	Taluka	Villages	Latitude	Longitude	Mugger Sighted	Mugger Presence	Wetland Size	Uses (Fishing/Domestic /farming)
51	Kheda	Matar	Matar	22.706645	72.660043	0	Seasonal	Small	FD
52	Kheda	Nadiad	Nadiyad	22.691958	72.858392	0	Seasonal	Small	FD
53	Kheda	Matar	Nandoli	22.617161	72.679543	2	Permanent	Small	FD
54	Kheda	Matar	Palla	22.646967	72.546454	0	No	River	D
55	Kheda	Matar	Pariyej	22.531576	72.621644	4	Permanent	Large	FDFr
56	Kheda	Nadiad	Pij	22.671938	72.809432	2	Permanent	Medium	FDFr
57	Kheda	Kathlal	Rampur	22.656853	72.776948	0	No	Small	FD
58	Kheda	Matar	Sandhana	22.713799	72.753143	0	No	Medium	FD
59	Kheda	Matar	Sekhupur	22.575033	72.623348	0	No	Medium	D
60	Kheda	Matar	Siholadi	22.663211	72.740029	0	No	Kans	FD
61	Kheda	Matar	Traj	22.673402	72.637742	14	Permanent	Large	FD
62	Kheda	Matar	Undhela	22.696763	72.713745	0	No	Canal	FD
63	Kheda	Matar	Untai	22.681095	72.694969	0	Seasonal	Medium	FD
64	Kheda	Nadiad	Vadtal	22.593379	72.874172	0	Seasonal	Small	D
65	Kheda	Kheda	Varsang-Baroda	22.670379	72.560954	0	Seasonal	River	D
66	Kheda	Matar	Vasai	22.581156	72.66758	0	No	Small	D
67	Kheda	Nadiad	Vaso	22.661097	72.755769	10	Permanent	Medium	FD

APPENDIX-II

Questionnaire used for conducting interview surveyes

A. Basic information

1) Age and sex
2) Education:
3) Occupation:
4) How long you have lived in this place?

B. Dependence on water body

5) How do you depend on the near water body? (Drinking, bathing & washing clothes, washing of household materials etc.)
6) Time of utilization of water body by humans
7) Time of utilization of water body by livestock
8) Do you go fishing? (yes/no, if yes, specify mode of fishing)
9) Do the people from outside village come for fishing? (if yes, specify the place & time of the year)
10) Any other products that you collect from nearby water bodies?

C. Local people's knowledge on mugger

11) Have you seen crocodiles in the wild/near you? Yes/No, (if yes, where and how many?)
12) How often do you see them?
13) What do they eat?
14) Do they nest here?
15) Did you see the mugger eggs/hatchlings? Yes/No (If yes, how much and when?)
16) Has number of crocodiles on nearby wetland/water body/property increased in the last 10 years?
17) Do you know that crocodiles are protected? Yes/No

D. Attitude and tolerance to Muggers

18) Do you like Muggers? (Yes/ No)
19) If yes, why do you like them? (If no, skip to question No. 24)
(a) Beautiful Animal (b) endangered species (c) maintains ecosystem
(d) religious
20) Do you like mugger near you? (Yes/No)
21) Should these muggers be conserved? (Yes/No)
22) Where these muggers should be conserved?
23) Will you support mugger conservation even if a family member is attacked and injured?
(a) Agree (b) Neutral (c) Disagree
24) Why don't you like muggers?

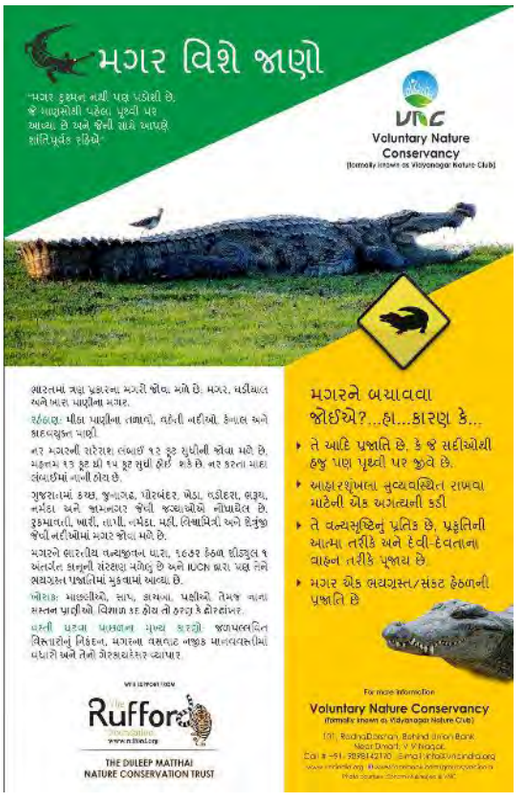
E. Crocodile conflict

25) Any incidence of crocodile attack on livestock/poultry/pets? (If yes, then when and where?) (If no , skip to question no.27)
26) Do you guard your livestock near water bodies? Yes/No
27) Any incidence of crocodile attack on humans? Yes/No (if yes provide details/If no, don't ask further question)
28) Why do you think they attack?
29) Have people ever tried to control/kill these problematic muggers? Y/N
30) If Yes, then how?
31) What steps the forest department takes to solve this problem?
32) Are you satisfied with current problem-mugger management by forest depart ment? (Yes/No)
33) If no, what should be the problem mugger management strategy?

APPENDIX-III

Educational material used during mugger awareness program
(A) Poster: Know the mugger; (B1 and B2) Brochure –Human & Muggers: How to co-exist with muggers

A



B1

B2

APPENDIX-IV

Media coverage of VNC's crocodile conservation project

ચરોતરમાં પ્રથમવાર મગરોનો સર્વે થશે

Bhaskar News, Anand | Dec 14, 2013, 00:05 AM IST

વોલેન્ટરી નેચર કન્ઝર્વન્સી દ્વારા ૧૪મી અને ૧૫મી ડિસે.ના રોજ સર્વે હાથ ધરાશે

ચરોતર પંથકમાં ઘણા ગામડાઓના તળાવમાં મગર જોવા મળે છે. પરંતુ કયા ગામમાં કેટલી સંખ્યામાં મગરનો વસવાટ છે તેની માહિતી કોઇની પાસે નથી. જેથી ચરોતરમાં પ્રથમવાર મગરનો સર્વે કરવામાં આવનાર છે. વોલેન્ટરી નેચર કન્ઝર્વન્સી દ્વારા મગર સંરક્ષણ કાર્યક્રમ હેઠળ ૧૪મી અને ૧૫મી ડિસે.ના રોજ ચરોતરના ગામડાઓમાં મગરનો સર્વે હાથ ધરવામાં આવનાર છે.

મગર સંરક્ષણ કાર્યક્રમ વિશે વોલેન્ટરી નેચર કન્ઝર્વન્સીના ધવલ પટેલે જણાવ્યું હતું કે 'ચરોતર પંથકના ૩૦ ઉપરાંત ગામોમાં મગર જોવા મળે છે, પરંતુ કોઇ કારણોસર ચરોતરના ગામડાઓમાં વસતા મગરોની વિગતોનો રેકર્ડ કરાયો નથી. ભારતમાં મગરની સંખ્યા વિશેના રેકર્ડમાં પણ ચરોતરના મગરોનો સમાવેશ થયેલો નથી. વાસ્તવમાં અભ્યારણ્ય કરતાં પણ સારી સંખ્યામાં મગર ચરોતરના ગામડામાં જોવા મળે છે.

આ અંગે વધુ વાંચવા તસવીર પર ક્લિક કરો...

Green Media E-Newsletter is brought to you by CMS ENVIS Centre on Media & Environment

Green Media

ENVIRONMENTAL REPORTING IN NEWSPAPERS

Print this page | Feedback

Wednesday, December 10, 2014

India's wildlife lovers count themselves in for crocodile count

Correspondent : Prashant Rupera

VADODARA:Wildlife lovers from across the country will participate in a unique survey 'Charotar Crocodile Count' to study the population and survival rate of the reptiles in lush green Charotar heartland of central Gujarat.

This will be a first-of-its-kind survey of crocodiles that will be carried out by a non-government organization.

According to nature lovers, India is home to an estimated 2,500 mugger crocodiles also known as 'crocodile of the marsh' of which Gujarat has maximum population. It is estimated that Gujarat has largest population of an estimated 1,500 mugger crocodiles.

The wetlands of Charotar and perception of people towards crocodiles in the twin districts of Anand and Kheda have ensured that crocodiles have a healthy population in the region.

"In the last 30 years, there have been only three instances of human-crocodile conflict in Charotar of which only one had turned fatal for the reptile. This reflects that perception of people towards crocodile is positive in Charotar," says Dhaval Patel, managing trustee of Vidyanagar Nature Club (VNC), which will do the count on December 20 and December 21.

Last year, a similar survey by VNC had revealed that around 180 crocodiles had made 18 wetlands of Charotar their home.

This time, VNC is roping in over 50 nature enthusiasts, professionals, amateurs, students of zoology and environment science from Madhya Pradesh, Delhi, Junagadh, Jamnagar, Vadodara, Ahmedabad and Gandhinagar apart from Anand to do the count that will cover 21 wetlands of Charotar.

It was in 1994-95 that the Gujarat Institute for Desert Ecology that had conducted the last state-wide survey of crocodiles.

"Unlike Vadodara, where Vishwamitri is infested with crocodiles, Charotar isn't blessed with any such river. But the pressure of population on both humans and crocodiles is much lower in Charotar compared to that on the banks of Vishwamitri," says Patel, adding that apart from Vadodara and Charotar, banks of Narmada river, Gir and Kutch are the five regions which have maximum population of mugger crocodiles.

"We have selected this period for the count because water levels in wetlands are stable, crocodiles usually do not migrate in this period and being cold blooded animal, they come out of water for basking in the sun " he says.

SOURCE : http://timesofindia.indiatimes.com/City/Vadodara/Indias-wildlife-lovers-count-themselves-in-for-crocodile-count/articleshow/45448289.cms

Back to pevious page

CMS is an independent, national level multi-disciplinary development research and facilitative body of eminent professionals. The Centre has been set up with an objective to tap and integrate various sources of information, analysis and initiate research towards a more informed opinion.

VISION

Research is not an end in itself, rather it is a means for change, for the betterment of society and to promote equity in people.

CMS Centre for Media Studies

Environmental Information System INDIA

CMS ENVIS Centre on Environment and Media

Collects, classify, retrieve and disseminate information to decision-makers, policy-planners, scientists, research community, students, etc. all over the country

Advertise with Green Media

Be a part of this succe campaign and advertise events, semi conferences, festivals services, job requirem etc. "GREEN MEDIA" unique E-newsletter D reaches to more than 3 environmentalists, wi experts, activists, filmma and media professionals. Advertisement cont cmsenvis@cmsindia.org

Print Media Trends and Analysis: Co? 11/Mar

PRINT MEDIA TRENDS AND ANALYSIS

Assessment of Using So Media to Raise environm Awareness

Assessment of Using SOCIAL MEDIA to Raise Environmental Awareness

Trends in the coverage environment by news channels

મગર વિશે વર્કશોપ યોજાયો

આણંદ. વોલેન્ટરી કન્ઝર્વન્સી (વીએનસી)ના ઉપક્રમે મગર વિશે જાગૃતતા કેળવવા વર્કશોપ યોજવામાં આવ્યો હતો વર્કશોપમાં મદ્રાસના સોહમ મુખરજી અને વિદ્યાનગરના અનિરુદ્ધ વસાવાએ માર્ગદર્શન પુરુ પાડ્યું હતું. વીએનસીના ધવલ પટેલે જણાવ્યું હતું કે 'ચરોતર પંથકના ઘણા ગામડાઓમાં મગરનો વસવાટ છે. કયારેક મગર અન્ય ગામમાં આવીજતાં ઢાંઢાકાર મચી જાય છે. વન વિભાગને મગર પકડવા જહેમત ઉઠાવવી પડે છે. ત્યારે મગર પકડવા માટે પૂરતો અનુભવ અને જ્ઞાન ન હોય તો તકલીફ વધી જાય છે. જેથી મગરને પકડતી વખતે ધ્યાનમાં રાખવા જેવી બાબતોનું માર્ગદર્શન પુરું પાડવા વર્કશોપ યોજવામાં આવ્યો હતો.' વર્કશોપમાં વન વિભાગના અધિકારીઓ કર્મચારીઓ અને એનજીઓના સ્વયંસેવકોએ ભાગ લીધો હતો.મુખ્ય વકતા સોહમ મુખરજીએ જણાવ્યું હતું કે 'મગરને પકડતી વખતે તે તાણ ન અનુભવે તેની વિશેષ કાળજી લેવી જોઇએ. મગર તાણ અનુભવે તો હોર્મોન્સ ઉત્પન્ન થતાં તેનું મૃત્યુ પણ થઇ શકે છે. તેમજ મગર દેખાય તો તેનાથી દુર રહેવું જોઇએ. પ્રજનનો સમયગાળો હોય કે બચ્ચા થયા હોય તો મગર વધુ આક્રમક થઇ શકે છે.' મગરને પકડવાની

Wildlife lovers count selves in for croc count

First-Of-Its-Kind Mugger Census In Charotar

Prashant.Rupera@timesgroup.com

Last year, a similar survey by VMC had revealed that around 180 crocodiles had made 18 wetlands of Charotar their home

Vadodara: Wildlife lovers from across the country will participate in a unique survey 'Charotar Crocodile Count' to study the population and survival rate of the reptiles in lush green Charotar heartland of central Gujarat.

This will be a first-of-its-kind survey of crocodiles that will be carried out by a non-government organization.

According to nature lovers, India is home to an estimated 2,500 mugger crocodiles also known as 'crocodile of the marsh' of which Gujarat has maximum population. It is estimated that Gujarat has largest population of an estimated 1,500 mugger crocodiles.

The wetlands of Charotar and perception of people towards crocodiles in the twin districts of Anand and Kheda have ensured that crocodiles have a healthy population in the region.

"In the last 30 years, there have been only three instances of human-crocodile conflict in Charotar of which only one had turned fatal for the reptile. This reflects that perception of people towards crocodile is positive in Charotar," says Dhaval Patel, managing trustee of Vidyanagar Nature Club (VNC), which will do the count on December 20 and December 21.

Last year, a similar survey by VNC had revealed that around 180 crocodiles had made 18 wetlands of Charotar their home.

This time, VNC is roping in over 50 nature enthusiasts, professionals, amateurs, students of zoology and environment science from Madhya Pradesh, Delhi, Junagadh, Jamnagar, Vadodara, Ahmedabad and Gandhinagar apart from Anand to do the count that will cover 21 wetlands of Charotar.

It was in 1994-95 that the Gujarat Institute for Desert Ecology that had conducted the last state-wide survey of crocodiles.

"Unlike Vadodara, where Vishwamitri is infested with crocodiles, Charotar isn't blessed with any such river. But the pressure of population on both humans and crocodiles is much lower in Charotar compared to that on the banks of Vishwamitri," says Patel, adding that apart from Vadodara and Charotar, banks of Narmada river, Gir and Kutch are the five regions which have maximum population of mugger crocodiles.

"We have selected this period for the count because water levels in wetlands are stable, crocodiles usually do not migrate in this period and being cold blooded animal, they come out of water for basking in the sun," he says.

divyabhaskar.com Gujarat

Home » Madhya Gujarat » Latest News » Anand » More Than 59 Crocodile Seen At Deva In Sojitra Near Anand

સોજિત્રાના દેવામાં સૌથી વધુ ૫૯ મગર દેખાયાં

Bhaskar News, Anand Jan 16, 2015, 02:25 AM IST

COMMENTS

વિદ્યાનગર નેચર ક્લબ દ્વારા આણંદ ખેડા જિલ્લાના ગામના તળાવોમાં રહેતાં મગરોનો સર્વે કરાયો

આણંદ: વીએનસી (વિદ્યાનગર નેચર ક્લબ) દ્વારા આણંદ ખેડા જિલ્લાના ગામના તળાવોમાં રહેતાં મગરનો સર્વે કરવામાં આવ્યો હતો. સર્વે દરમિયાન સૌથી વધુ સોજિત્રા તાલુકાના દેવા ગામના તળાવમાં 59 મગર દેખાયા હતાં. વીએનસી દ્વારા મગરની ગણતરી ઉપરાંત સોશ્યો ઇકોનોમિક સર્વે પણ કરવામાં આવ્યો હતો. આણંદ ખેડા જિલ્લાના 23 ગામોમાં વીએનસીના 50 વોલિન્ટિયર્સ દ્વારા સર્વે કરવામાં આવ્યો હતો.

વિદ્યાનગર નેચર ક્લબના ધવલ પટેલે જણાવ્યું હતું કે 'આણંદ-ખેડા જિલ્લાના ઘણા ગામોના તળાવમાં મગર જોવા મળે છે. દિવસે દિવસે મગરની સંખ્યામાં વધારો થઇ રહ્યો છે કે ઘટાડો તેની જાણકારી મેળવવા છેલ્લા બે વર્ષથી મગરનો સર્વે કરવામાં આવી રહ્યો છે. તેમજ મગરોનો વસવાટ છે તેની આસપાસ રહેણાંક વિસ્તાર હોવા સાથે લોકોની અવરજવર રહેતી હોવાથી કોઇ આકસ્મિક ઘટનાની સંભાવનાઓ પણ ચકાસવામાં આવી હતી.
સર્વે દરમિયાન સૌથી વધુ સોજિત્રા તાલુકાના દેવા ગામના તળાવમાં 59 મગર દેખાયાં હતાં. આ ઉપરાંત મલાતજમાં 15, હેરંજમાં 9, ત્રાજમાં 8, મરાલા નગરામાં 12 અને ડવાલમાં 5 મળીને 23 ગામમાં કુલ 123 મગર નોંધાયા હતા. ત્રણ દિવસ દરમિયાન મગરની ગણતરી સાથે સોશ્યો ઇકોનોમી સર્વે પણ કરવામાં આવ્યો હતો. જેમાં મગરોની આસપાસના રહેણાંક વિસ્તારમાં અને અવરજવર કરતાં લોકોને જોખમની સંભાવના પણ ચકાસવામાં આવી હતી.'

આ કાર્યમાં આઇયુસીએનના મગરના તજજ્ઞ ડૉ. રાજેન્દ્ર વ્યાસનો પણ સહયોગ સાંપડ્યો હતો. વિદ્યાનગર નેચર ક્લબના 50 વોલિન્ટિયર્સ દ્વારા 23 ગામમાં સર્વેની કામગીરી હાથ ધરવામાં આવી હતી.

ગત વર્ષે ૯૮ મગર નોંધાયેલા

વીએનસીના ધવલ પટેલે જણાવ્યું હતું કે 'ગત વર્ષે આણંદ-ખેડા જિલ્લાના 18 ગામોના તળાવમાં મગરોનો સર્વે કરવામાં આવ્યો હતો. 18 ગામમાં 98 મગર જોવા મળ્યા હતાં. આ વર્ષે 26 ગામમાં સર્વે કરવામાં આવતાં 131 મગર નોંધાયા છે.'

પાણી વધુ હોવાથી તકલીફ પડી

વિદ્યાનગર નેચર ક્લબના ધવલ પટેલે જણાવ્યું હતું કે 'મગરની ગણતરી દરમિયાન તળાવમાં પાણીનું લેવલ વધુ હોવાથી લીલી જાળો છવાયેલી હતી, જેના કારણે મગરની ગણતરીમાં તકલીફ પડી હતી. જેના કારણે મગર ઓછા દેખાયા હોવાનું માની રહ્યા છીએ.'

APPENDIX-V

Negative potrayal of mugger in media

આણંદ-નડિયાદ 15/9/14 દિવ્ય ભાસ્કર

મગર દેખાયો | નડિયાદમાં મગર પકડાયાંનાં બીજા દિવસે ફરી 6 ફૂટનો મગર મળતાં ફફડાટ

દાવડા મંદિર પાસેથી મગર પકડાયો

રાત્રિનાં ત્રણ વાગ્યે વન વિભાગે સ્થાનિક રહીશોની મદદથી ભારે જહેમત બાદ મગરને પાંજરામાં પૂર્યો

સીમમાંથી સવા 6 ફૂટ લાંબો મગર પકડાયો

ત્રણની રાત જાગી રેસ્ક્યૂ ઓપરેશન પાર પાડ્યું

નડિયાદ શિવ શક્તિ સોસાયટીમાં મગર દેખાતાં લોકોનો ઉજાગરો

15/9/14

મગર પકડવા રમાદાવાદની ટીમ બોલાવાઇ

નડિયાદ પીજ રોડ પર આવેલ શિવશક્તિ સોસાયટી પાસે શનિવારે દેખાયેલા મગરના કારણે વનવિભાગ દ્વારા પાંજરૂ મૂકવામાં આવ્યું હતું અને વનવિભાગની ટીમ દ્વારા મગરની શોધખોળ આરંભાઈ હતી, પરંતુ 48 કલાકનો સમય વિતી ગયો હોવા છતાં મગર નહીં પકડાતાં સ્થાનિક રહીશોમાં ભય સાથે હજુ પણ ઉચાટની લાગણી અનુભવી રહ્યા છે.

નડિયાદમાં પાંજરું મુકાયું મગર નહીં પકડાતાં સ્થાનિકોમાં ઉચાટ

18-9-14

48 કલાક પછી પણ વન વિભાગ મગર પકડવામાં નિષ્ફળ

મગરની શોધખોળ ચાલુ છે : ડી.એફ.ઓ

આ સંદર્ભે જિલ્લા વન સંરક્ષક અધિકારી બી.જે.પ્રજાપતિએ જણાવ્યું હતું કે, બે દિવસથી સા વિસ્તારમાં વનવિભાગની ટીમ દ્વારા મગરની શોધખોળ કરવામાં આવી રહી છે. સોમવાર મોડી રાત સુધી મગર પકડાયો ન હતો. જેથી મંગળવારે અમદાવાદની સ્પેશ્યલ ટીમ દ્વારા પુનઃ આ વિસ્તારમાં તપાસ હાથ ધરાશે.

મલાતજની શાળાનાં તળાવમાંથી મગર નીકળતાં સનસનાટી મચી

કુમાર શાળાની પાછળ આવેલાં મેદાનમાં ભરાયેલાં પાણીમાં મહાલતો જોવા મળતાં ગ્રામજનો ચોંકી ગયાં: પકડી તળાવમાં પાછો મોકલી દીધો

શાળા બંધ હોવાથી ગ્રામજનોને હાશકારો

તળાવ અને કાંસમાં ફરતાં મગર

વસોમાં સવા બે ફૂટનું મગરનું બચ્ચું ઘરમાંથી મળતાં ચકચાર

25/7/14

પ્રાપ્ત વિગતો જોઈએ તો, વસોના નવાઘરા વિસ્તારની પટેલ ખડકીમાં રહેતા પીન્ટુભાઈ શાંતાભાઈ પટેલના ઘરમાં આજે સવારે ૧૦ વાગે એક મગરના બચ્ચાને નીહાળતાં જ ઘરના સભ્યો સૌ ગભરાઈ ગયા હતા. તેઓએ બુમાબુમ કરતાં આસપાસના સૌ રહીશો ઘરમાં દોડી આવ્યા હતા અને તેઓએ આ મગરના બચ્ચાને ઓતરી રાખ્યું હતું.

આ સંદર્ભે વિદ્યાનગર નેચર ક્લબના સભ્યોને જાણ કરતાં તેઓ ઘટનાસ્થળે દોડી આવ્યા હતા. તેઓએ આ બચ્ચાને સીફતપૂર્વક જીવતું ઝડપી પાડીને ગામના જ વડાતળાવમાં જીવતું છોડી દીધું હતું ત્યારે સૌએ રાહતનો શ્વાસ લીધો હતો.

આજદિન સુધીમાં ઘરમાંથી સાપ નીકળતાં હોવાથી ઘટનાઓ સહજ બનતી હોય છે, પરંતુ તાજેતરમાં રોજીદ્રાના એક ઘરના બાથરૂમમાંથી પાંચ ફૂટનો મગર મળ્યા બાદ આજે વસોમાંથી સવા બે ફૂટનું મગર બચ્ચું મળી આવ્યું હતું. પરિણામે પ્રજાજનોમાં કુતૂહલ સાથે ભય ફેલાઈ ગયું હતું.

PROJECT TEAM

Dr. Raju Vyas (right to the middle): Dr. Vyas has 30 year's extensive research and field experience in various herpetological projects and has published extensively on the subject. He has been carrying out extensive assessment and mitigation of human mugger conflicts in state. He is a member of IUCN/SSC South Asian Amphibian and Reptile Specialist Group, IUCN/SSC/ Conservation Breeding Specialist Group, IUCN/SSC/ Crocodile Specialist Group - South Asia and Iran.

Dhaval Patel (in the middle): He is the founder and managing trustee of Voluntary Nature Conservancy (also known as Vidyanagar Nature Club). Since 1988, he has been actively involved in environment education, awareness and protection and has more than 20 years of experience in mitigating urban human-wildlife conflicts (HWC). He is co-opted member of Animal Welfare Board of India and is also appointed as Honorary Wildlife Warden for Anand district.

Anirudh Vasava (extream right): He works as project coordinator with VNC where he develops research and conservation projects. He has broad interest in large predator ecology and human-wildlife conflicts and has more than seven years of experience in wildlife research field. He was associated with Wildlife Institute of India for more than two years and has been well trained in advanced wildlife techniques like capture-mark-recapture, distance sampling, occupancy modelling and radio telemetry at WII. His current research integrates ecological studies (large predators) with geospatial analysis to develop spatial models for management and conservation needs.

Vishal Mistry (extreame left): Vishal has been involved in wildlife rescue and rehabitation for more than ten years and has broad experience as research assistance in various research projects. He has assisted in surveys of carnivores in and vulture population in various parts of Gujarat. Currently he works for Bombay Natural History Society (BNHS) in the Vulture Safe Zone Program.

Mehul A. Patel (left to the middle): Mehul Patel coordinates education as well as wildlife rescue and rehabilitation programme of VNC and is actively involved in mitigation of urban HWC since 2009. He has provided reptile education to more than a lakh people in both urban and rural region of Charotar.

VOLUNTARY NATURE CONSERVANCY

Voluntary Nature Conservancy (VNC), also known as Vidyanagar Nature Club (registered as Public Charitable Trust No: E/2659/Anand), is one of the leading grass root NGOs working for the cause of environment awareness and protection in Gujarat. Located in Vallabh Vidyanagar town of Charotar region, VNC has been active at grass-root level since its inception in 1988, nurturing nature for a better future. VNC stands tall due to a committed team of volunteers who are the back bone of the activities and hence it's aptly gets its name as 'Voluntary Nature Conservancy'. The team at VNC is dedicated to conserve environment and make sustainable efforts towards the same. VNC has been actively involved in nature conservation through education and awareness. Its working areas are inclusive of community based environmental programs, education programs at grass root levels and schools, close to nature hobby development efforts and programs for reducing pollution, eco-friendly drives, tree plantation programs and much more. VNC has successfully carried out campaigns to save the Whale shark (in collaborations with Wildlife Trust of India) and vulture in Gujarat. Recent initiatives include carnivore conservation in Kutch, mugger conservation in Gujarat and human-wildlife conflict mitigation. Today VNC is accredited by GEF, (Global Environment Facility) and is a member of GEA (Global Environmental Action) & SAYEN (South Asia Youth & Environment Network). VNC is also registered Non Profit foundation as Voluntary Nature Conservancy in USA

For more information visit
www.vncindia.org

© Anirudh Vasava / VNC

Voluntary Nature Conservancy

101-Radha Darshan, Behind Union Bank,
Vallabh Vidyanagar-388120, Gujarat, India
Mobile No.- 9898142170 (info@vncindia.org)