Humans Sharing Space and Crocodiles Adaptations: A Case Study in Bhitarkonika Wildlife Sanctuary, Kendrapara, Odisha

Dr. Jyotirmoy Pandit*

*Assistant Professor and HoD, Department of Geography, Ramnagar College, Depal, Purba Medinipur, West Bengal, India, Email: jyotirmoy19820@gmail.com

ABSTRACT

The instance between human-crocodile conflict is a very serious issue in the present era. This accident is gradually increased with the progress of human civilization. By the process of human explosion and minimizing the natural resources, human beings appear to a natural habitat area. So, the term comes human-wildlife conflict that refers to the negative interaction between humans and wild animals, leading to adverse impacts such as injury or loss of human lives, crops, livestock and other properties and at the same time equally negative impacts to the wild animals or their habitats. Our study about human crocodile conflict in BhitarKanika Wildlife Sanctuary, Odisha. The number of semi-structured interviews with households are 50 which is involved with age, gender, education, perception and attitude of the inhabitants about saltwater crocodiles. Some secondary information collected from govt. office of Odisha, journals related to season wise victim rate, activities of the people when attack with fatal and non-fatal, male-female wise victim rate etc. The study about human crocodile conflict is very significant because it includes an increase in the human population close to crocodile habitants, changing lifestyles and economic aspirations; reduced appreciation of wildlife, land use changes; tourism policies, aquaculture, fishing and wet land habitat fragmentation, loss and degradation (**MOEFCC, 2023**). The conservation and management strategy of saltwater crocodiles in BhitarKanika Wildlife Sanctuary is very much essential for maintaining the balance of bio-diversity by creating awareness among people, minimizing the use of natural resources, development of alternative livelihood of the local people, setting more bath huts in the sanctuary. These comprehensive management plan reduce the dependency on forest resources and minimize the human crocodile conflict.

1. INTRODUCTION

Crocodile specially in saltwater are widely distributed over the South East Asia. In India, they are observed in the eastern states and also in Andaman Islands (**Singh and kar; 2006**). The number of saltwater crocodiles in the Bhitarkonika area was estimated to be 95 in 1976 and in 2020, this number had seen increased at 1740. The growth of estimated numbers of this species indicates that it is a place where the crocodiles' growth in a favourable environment. In the same, the growth of human population is increased day by day specially in the coastal area, availing the huge natural resource. As a result, the relationship between human beings and wildlife is very complexity and when increasing of number of people in particular limited place, then a conflicts environment appears between human beings and wildlife. For instance, when wildlife damaged agricultural practice frequently attacks the village livestock and moreover at a time the human beings do not escape from this kind of attacks (Inskip & zimmermann, 2009). In terms of eco- tourism, the interaction between human beings and crocodiles are rarely positive (Me Gregor, 2005) and it is too much essential to reduce the conflict for mitigate both the loss of human beings and livestock (Fergusson, 2002). Here, the management procedure is the proper way between human beings and crocodile conflict regarding capture, relocation, fatal control of crocodile. These actions need to be carefully monitored as crocodiles are an economically important species (Mac Gregor, 2002).

In India three kinds of crocodile species are seen. They are estuarine or saltwater crocodiles, the marsh or freshwater crocodiles and the gharial crocodile. But in this study area only estuarine or saltwater crocodiles' area seen only (Vyas 2012). Moreover, the estuarine crocodile is the largest marine reptile in India and this species decreases gradually due to indiscriminate poaching for its valuable skin (Mandal and Nandi, 1989), loss of habitat and water pollution (Das & Bandyopadhyay, 2012). Crocodiles in this particular area are going to extinct due to the growing human activity in the rivers (J. B. Thorbjarnarson etc, all, 1992). Moreover, the survival rate of the Crocodile hatchlings is low because of predation. In the year 1975, the Union Ministry of Forest and Environment, in Collaboration with the United Nations Development Programme had started a crocodile breading and rearing project in Daugamala with in the Bhitarkonika Wildlife Sanctuary for crocodile conservation (S. Kar, 2007). After the analysis of current data, it is stated that damage caused by crocodiles' attack on human beings and its surroundings. So, it is a negative consequence for both humans and crocodiles (A.J. Eyebe et.al, 2012). However, it is a challenging issue's that human beings should conserve the species and the rate of attacks will decrease to their livelihoods and lives (P.W. Aust, 2009).

The present study highlights to determine the nature, extent and causes of conflict between human beings and estuarine crocodiles in Bhitarkonika Wildlife Sanctuary by reviewing secondary records of the Odisha Forest Department. It is also taken about the mentality and attitude of the local people for conservation of saltwater crocodile in this area. Both primary and secondary any data will provide us better decisions making, appropriate management techniques and mitigation strategies to reduce conflict.

2. STATEMENT OF PROBLEMS

BhitarKanika, a store house of nature's charity and rich unique bio-diversity. This unique ecosystem of Orissa is surrounded by rivers Baitarani, Brahmani, Dhamara, and is crisscrossed by several creeks-creek lets. The delta, river mouth, the sea, estuarine forest, mangroves, avifauna, reptiles, amphibians, varieties of fauna and phylodiversity are various aspects which contribute to the richness of its biological. But recently the various illegal activities created by human beings are gradually detreated day by day in biodiversity of BhitarKanika Wildlife Sanctuary. There are illegal hunting poses a threat to crocodile populations in the intertidal zone and decreasing prey availability can impact crocodile survival and health. From the perspective of water pollution, the contaminated water negatively affects crocodile habitats and can harm their well-being. Human activities related to tourism may disrupt crocodile habitats and behavior. By the processes of human civilization, the condition of environment is changing that can impact to crocodile reproductive system and also loss of suitable nesting and resting sites affects crocodile populations. The construction of new settlements or shops, markets, timber harvesting, etc. leads to the destruction of a large amount of forest land, resulting in the gradual loosening of the soil adjacent to the river, increasing the level of erosion considerably.

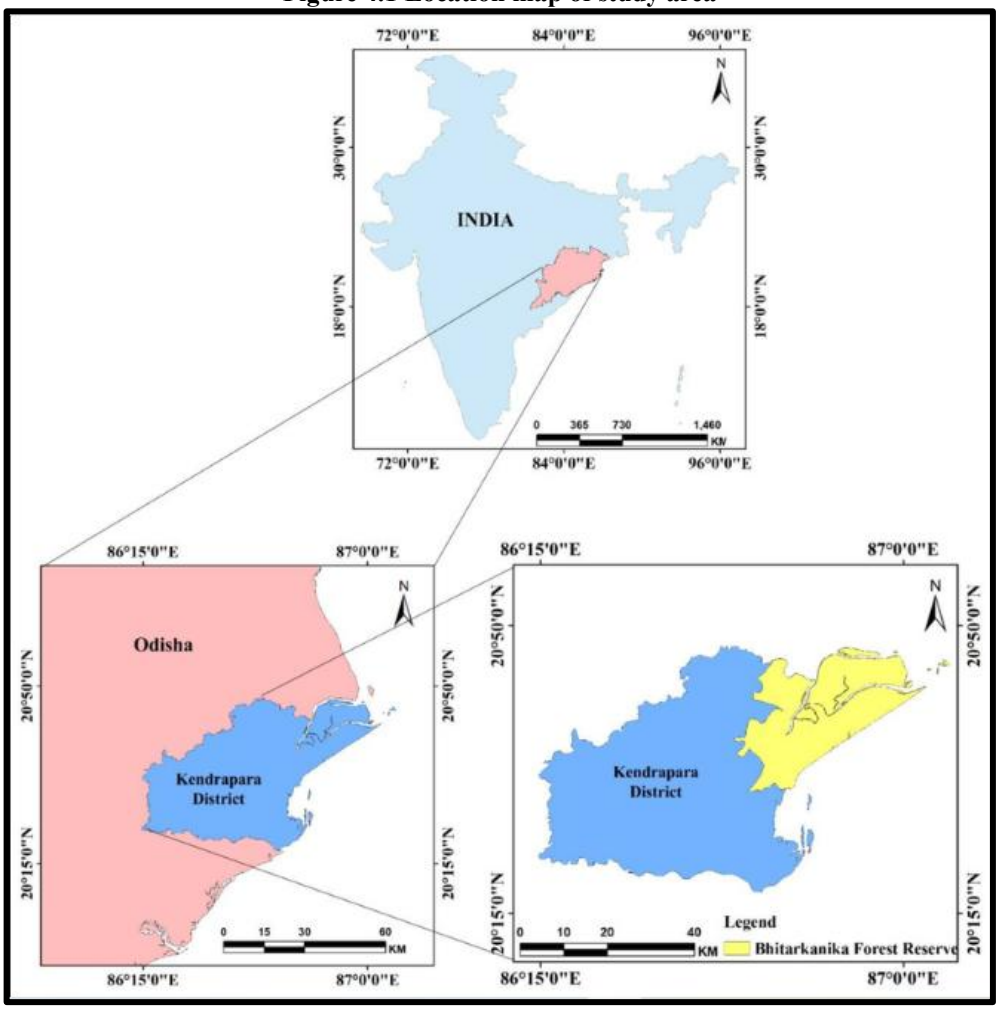
3. OBJECTIVES

The main objectives of the present study are as follows:

- To determine the nature, extent and cause of conflict between people and crocodile.
- To study the spatio - temporal changes of salt-water crocodile species.
- To identify and documents specific features that organisms in the habits exhibit as adaptive response to environmental conditions.
- To gain the potential conservation to protect and sustain the habitat, considering the adaptive capabilities of its resident species.

4. STUDY AREA

Figure 4.1 Location map of study area



Source: Prepared by the Author

Bhitarkonika Wildlife Sanctuary is located under Kendrapara district of Odisha state (Figure 4.1). This study area extent from 20°4' N to 20°8' N latitude and 86°45' E to 87°50' E longitude, covering an area of about 650 sq. km. (Nayak et al., 2009). Mainly the mangrove delta portion of Brahmani and Baitarani River are exposed as wildlife sanctuary in April 1975. But, out of this core area of 145 sq. km. is a Bhitarkonika National Park in 1998. Summer, winter and monsoon are very prominent in this area. Annual rainfall 1670 mm occur mainly in monsoon seasons. The mean monthly temperature is 20°c to 30°c in summer season and the winter season is very short and mean temperature is 15°c-20°c (S.A. Hussain, et. Al. 2010). This mangrove sanctuary consists of 62 types mangrove species, 28 types mammals, 280 special of birds, 47 species of amphibians and reptiles and a large quantity of saltwater crocodiles. Approximate 410 villages are located inside this sanctuary and these villages are mainly depended on agriculture, aquaculture and fishing (C. Pattanaik, et. Al., 2008).

5. PHYSICAL ASPECT

5.1 Topography

The landscape of Bhitarkonika Wildlife Sanctuary contains varied environments, including mangrove swamps, cheeks, estuaries, mashes, inland flood plains, forested beaches, and mudflats. The main feature of this area is grown-up of mangrove poorest on Brahmani & Baitarani River delta.

5.2 Climate

The concerned region comes under the tropical monsoon climate with three pronounced seasons: winter, summer and rainy. The maximum temperature is recorded in the month of April and May and the minimum temperature in winter during the month of January. The ranges of humidity from 70% to 84% throughout the year. Wind Speed from March to June is oven 20km per hour, and the predominant wind direction is from south and south-west. Rainfall is around 1642 cm, 34 cm per annum and minimum rainfall is received between June and October respectively. The mean track of the cyclone passes oven this region. The weather in BhitarKanika is typically wet and humid due to its proximity to the east coast of the Bay of Bengal. The temperature in the area ranges from 14 degree Celsius in the winter to 40 degrees Celsius in the summer.

5.3 Soil and Geology

In BhitarKanika Wildlife Sanctuary, the sandy loam soil coast which is washed by Bay of Bengal and is subjected to tides twice a day. Its proximity to Bay of Bengal makes the soil of the area enriched with salts, the vegetation and the species of the sanctuary is comprised of those which are mainly found in the tropical and subtropical inter tidal regions. The soil sediments are divided into two categories, indicating recent or sub-recent forms named as 'newer alluvium" and Pleistocene forms named as 'olden alluvium". The recent sediments are represented by sand, sild and clay with assented boulders and pebbles. The Pleistocene deposits comprise of the clay. sand, salt and "kankar' with locally cemented pebbles and gravels. Roots of the mangroves forest control the soil erosion.

5.4 Drainage Pattern:

BhitarKanika Wildlife Sanctuary is bounded by Dhamara River in the north, the Hamsun in the west and the Bay of Bengal in the east and south. The river Dhamara (the confluence of Brahmani and Baitarani) in combination with Maura, the tributary of Brahmani, constitutes the delta developed by creeks and channels in Odisha coast. The water body category includes all the rivers, creeks, channels, ponds etc. now the land use study shows decline of area under water body. This can be a change drawn between the high tides and low tides. Some portions of this water get in to the feeding channel which supply water to the aquaculture ponds. The trend chart of water body shows that 82.1 km having 12.2 percent of area in 1990 was under this category, whereas in 2020 the land use under water body category decreased and went down to 75.0 km with 11.20 percent decrease in area under water body.

5.5 Natural Vegetation

Bhitarkonika Wildlife Sanctuary provides a great variation in diversity at species and ecosystem levels, which is divided into following natural vegetation types (S.A. Hussain, et. al., 2010). The prominent forest of this region is mangroves forest. It is typically a closed evergreen honest of moderate height composed of species specially adapted to survive on tidal mud, which is partially submerged with salt water of brackish water. Major area of the National Sanctuary is covered by these mangroves. Here, mangroves are found on the mud banks of the delta streams along the edges of the water ways and the tails of island. Heritiera forms is occupies major portion of BhitarKanika Reserve Forest followed by Excoecarianin agallocha and Avicennian alba occur as a pure community found on the offshore islands on in fringes to the seaward side. Another one is mangrove scrub. This is an open forest of very low average height, often 3 to 5 m in height and represents the species of mangrove forest. It is characterized by mined mangroves. There is no specific zonation pattern as like Mangrove Forest. Endocrania agallocha and Avicennian alba are found to be the pioneering species in disturbed mangroves areas. Diospyros peregrina swamp forest is remarkable pure localized fresh water swamp forest and found above the tidal level mainly in BhitarKanika Reserve Forest. The ground is inundated by fresh water. Forest cover is fairly dense and biologically rich with 71 number of plant species. Diospyros Peregrina is the most dominant tree species in this type, associated with several evergreen tree species and few deciduous elements.

A salt marsh is a marsh land on mud in which the salty inundated the surface of the ground. The vegetation seen in this area is a of herbaceous type and generally referred as mudflat vegetation. Grass lands is one of the vegetation covers of this area. This is a unique type of vegetation hound in BhitarKanika Reserve Forest, nearby Diospyros swamp forest. The soil is mainly alluvial. Major portion of the area is covered by Tali grasses. Arundo donax. Chrysopogon aciculatus, Dicanthium perdusum and impetrate cylindrica are some of the dominant species found in this area.

6. SOCIAL AND CULTURAL ASPECT

6.1 Education Status

The literary level is found to be very low. The literacy rate in BhitarKanika (85.15 percent) is marginally lower than that of Kandarpa District. The literacy rate of Odisha is 72.87 percent of per the 2011 Census, and the national literacy rate is 74.07 percent. This indicates disport perianal access to education opportunities in the region. Higher education is accessible to only 1.5 percent of the total surveyed population. There are 0.5 percent of the male members of the population and 0.2 percent of the female members are post-graduates. Technical courses offering degrees are accessible to 0.54 percent of the population (0.28 percent males and 0.26 percent. females). These data reflect the limited opportunities for higher education in the region. The communities are pushed towards greater dependence on the available natural resource for their livelihood.

6.2 Health Services

There is a health infrastructure in some parts of the BhitarKanika Wildlife Sanctuary. There are in a few panchayats such as Taletha, Rajnagar Block has medical facilities, but the population can access specialized service only in Cuttack and Bhubaneswar.

6.3 Cultural Heritage

In BhitarKanika the communities have deep connections with the water bodies as well as the forest. Many beat, functions, activities, songs, folklore and interactions are closely associated with the water bodies and forests.

6.4 Recreation and Tourism

Ecosystem has been promoted in the area by the state government. Local, national and international tourists are attracted by the beauty of the ecosystem and the experience it offers. The ecosystem, delta situation and natural vegetation adds tremendously to the aesthetic value of the region.

7. METHODOLOGY

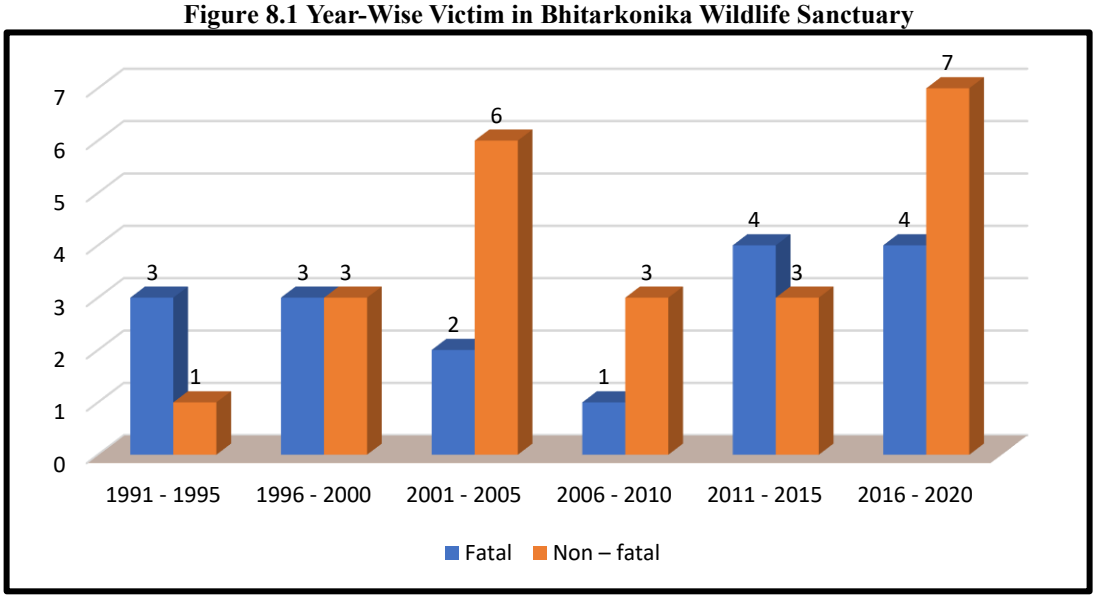
The methodology of the present study is based quantitative methods of analysis and interpretation. This study conducted with a combination of secondary and primary data source. Field survey was conducted in 2023 for collecting primary data and secondary data regarding the relationship between People and saltwater crocodiles was collected from the office of Mangrove Forest Division, Kendrapara district, Odisha. Others secondary sources were various books, research articles, census of India, District Statistical Hand Book, Dist. Human Development Report ete. Community surveys were conducted with the help of local people, using questionnaires and interview method. Data were collected from door to door in the villages regarding causes of attack time, of attack season and type of attack etc. Simultaneously, the villagers were asked about their knowledge on saltwater crocodile, attitude and perception towards reservation of saltwater crocodile and how does affect the livelihood of the villagers from man wildlife conflict. Measure and record relevant environmental factors (temperature, humidity, soil composition, etc.) to correlate with observed adaptations. There are fifty households are taken for primary survey. Data were examined and tabulated using simple percentage and MS Excel.

8. Discussion

8.1 Year-wise victim in Bhitarkonika Wildlife Sanctuary

Figure 8.1 reveals about the attack on human beings by saltwater crocodiles around Bhitarkonika Wildlife Sanctuary in 5 years interval (e.g. 1991-1995, 1996-2000, 2001-2005, 2006-2010, 2011-2015, 2016-2020). From 1991 to 2006 the number of victims gradually increased like 4, 6, 8 respectively out of them fatal and non-fatal are almost same. The victim rate is low in the duration of 2006 to 2010 (only 4). After that the victim is increased from 2011 to 2020 like 7 and 11 respectively where fatal is something less than non-fatal. Moreover, the total victim by saltwater crocodiles in duration of 30 years (1991-2020) in Bhitarkonika Wildlife Sanctuary are 40. The increasing attacks on human beings are probably due to over-crowding of the saltwater crocodiles in the limited area of natural habitat.

Figure 8.1 Year-Wise Victim in Bhitarkonika Wildlife Sanctuary

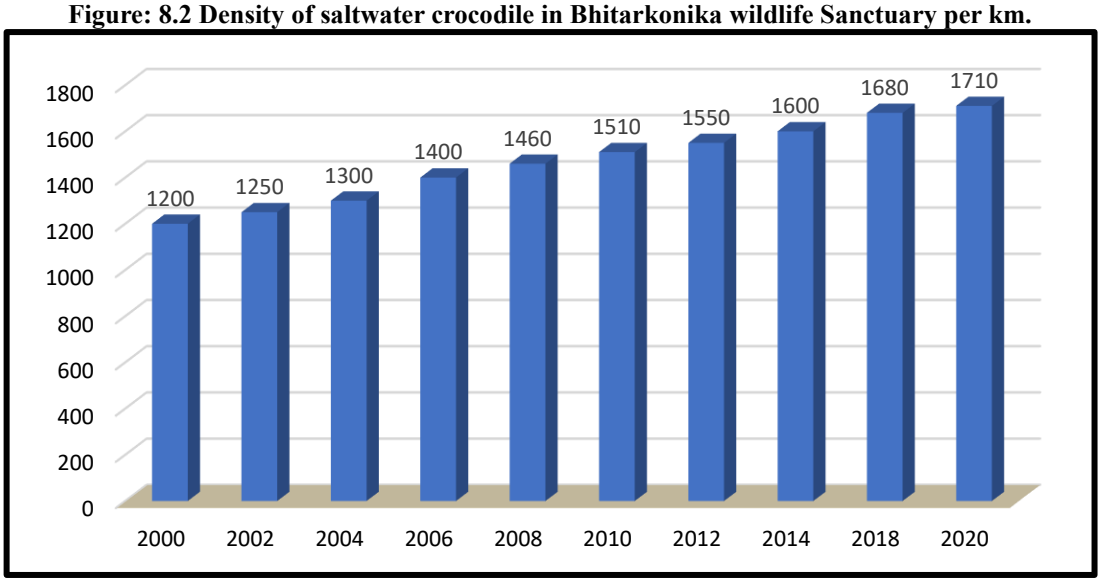


Source: Odisha wildlife Organization, 2020.

8.2 Density of Saltwater crocodile in Bhitarkonika wildlife Sanctuary per km.

Figure 8.2 highlights regarding the projection of the density of saltwater crocodiles in Bhitarkonika Wild life Sanctuary with a duration of 20 years (2000 to 2020). The population of salt water crocodiles, when incidence of sighting could be five to six crocodiles per km. length of water (Anon, 2018). Kar (2009) and Kumar et al. (2012) expressed in 2019 there were a total of 1484 crocodiles residing in the park and their relative density was 13.5 individuals per km. length of water. As per the Odisha wildlife Organization, 2020 suggests that the present density of the salt water crocodiles has exceeded the proposed density of five to six crocodiles per km. length of water.

Figure: 8.2 Density of saltwater crocodile in Bhitarkonika wildlife Sanctuary per km.

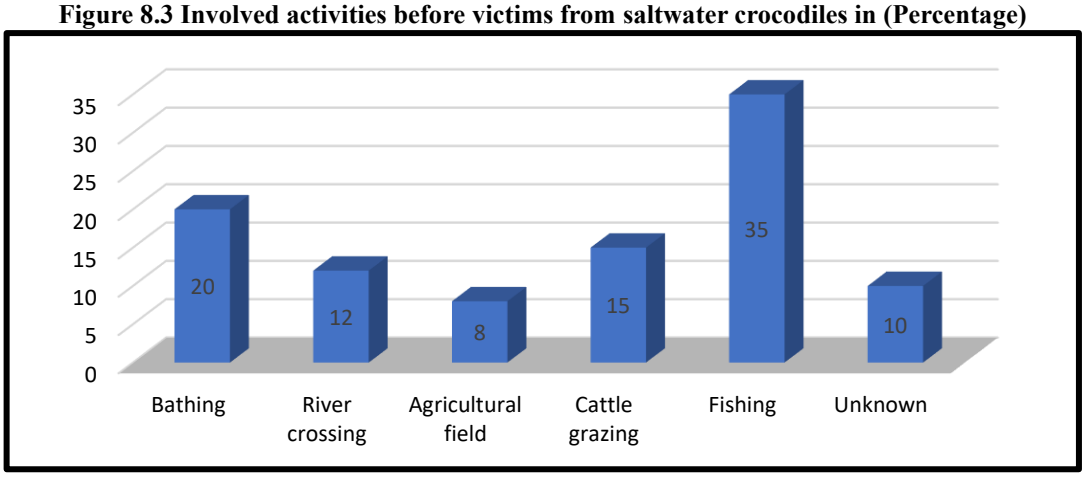


Source: Odisha Wildlife Organization, 2020.

8.3 Involved activities before victims from saltwater crocodiles

Figure 8.3 exposed the victim by saltwater crocodiles in Bhitarkonika Wildlife Sanctuary identified as the activities of bathing, river crossing, agricultural practice, cattle grazing, fishing and also unknown maximum attacks are observed at the time of fishing (35 percent) and during bathing (20 percent). Another major factor is responsible during cattle grazing (15 percent) and river crossing (12 percent). The salt water crocodile attack while doing agricultural practices in their field and nobody find the victim activities name as unknown situation (10 percent). This diagram suggest that the salt water crocodiles are mobile from one place to another for their overpopulation or shortage of available food, as a result such kind of incident happened regularly.

Figure 8.3 Involved activities before victims from saltwater crocodiles in (Percentage)

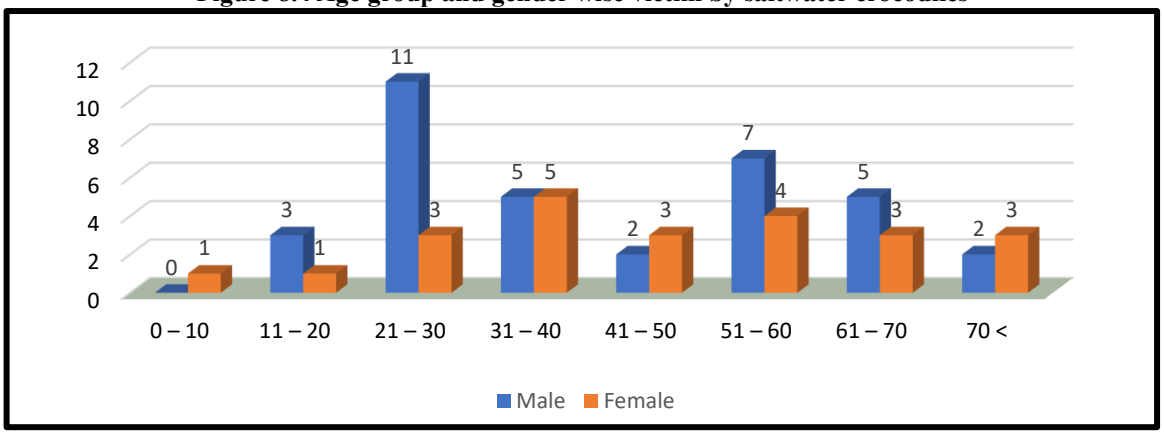


Source: Odisha Wildlife Organization, 2020

8.4 Age group and gender wise victim by saltwater crocodiles

Figure 8.4 highlights on the age of victims and their genders in Bhitarkonika Wildlife Sanctuary by saltwater crocodiles. People mainly within this age group 21-60, are going to victims by crocodile. For reason, we may say that in this age group maximum people going outsider their job. Females also go but number of them little but less because maximum of them are engaged with household work. Age group in between 60+, considered as dependent people, that's why they stay at home. Due to that they are being attacked by crocodile less in number.

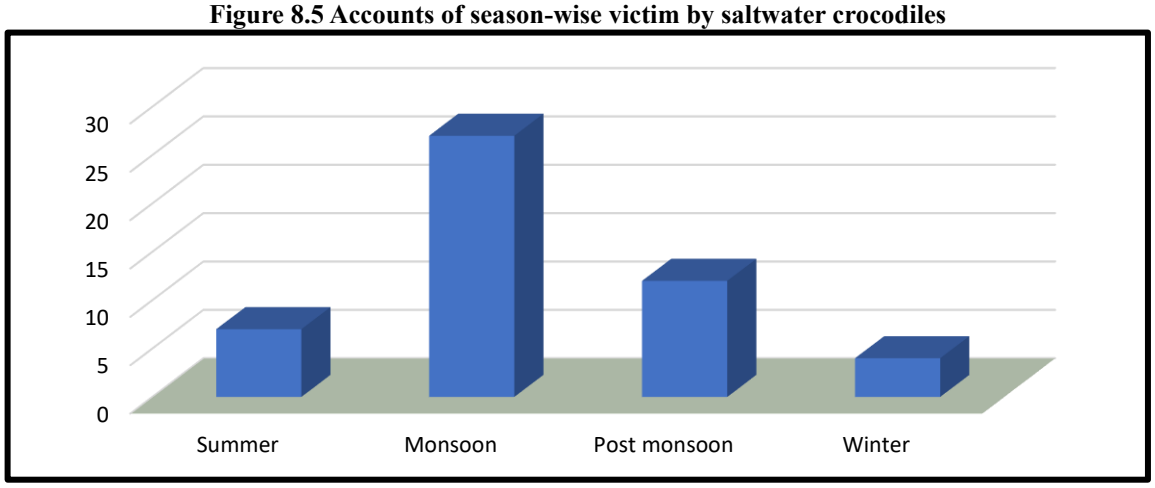
Figure 8.4 Age group and gender wise victim by saltwater crocodiles



Source: Odisha Wildlife Organization, 2020

8.5 Accounts of Season-wise Victim by Saltwater Crocodiles

Figure 8.5 Accounts of season-wise victim by saltwater crocodiles



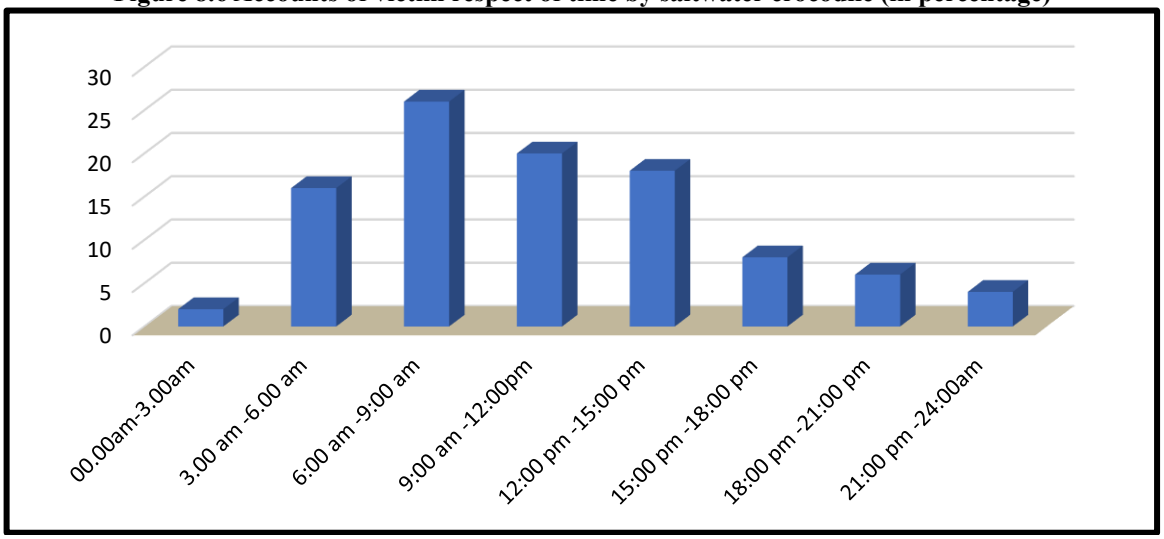
Source: Odisha Wildlife Organization, 2020

Figure 8.5 exposed that the majority of attacks happened in monsoon season i.e., 27 (54 percent) and in post-monsoon season i.e., 12 (24 percent). So, the duration of monsoon and post-monsoon are very crucial period. In monsoon period the saltwater crocodiles to take parental care and remain aggressive for the protection of their younger ones. In post monsoon period they are aggressive in behavior due to probably they are in hatching situation. The minimum attacks happened in summer season I.e. 7(14 percent) and in winter season i.e. 4 (8 percent).

8.6 Accounts of victim respect of time by Saltwater crocodile

Figure 8.6 stated about the accounts of victims in respect of time by saltwater crocodiles in Bhitarkonika Wildlife Sanctuary. As per our data indicated that most of the attacks took place from 6.00am to 3.00 pm. Out of this 6.00 am to 9.00 am is the period when it is very crucial as the maximum attacks happened (26 percent). The rest time of the day, the number of attacks is very few in numbers.

Figure 8.6 Accounts of victim respect of time by saltwater crocodile (in percentage)



Source: Odisha Wildlife Organization, 2020

9. MAJOR FINDINGS

The major findings are as follows:

(I) Basic amenities like adequate, safe and pure drinking water are not available inside.

(II) No provision of refreshments and food facilities either at the entrance or inside the sanctuary, causing highly inconvenience to the visitors/tourists.

(III) The waste bins/cans are not installed at the entrance and inside the park premises.

(IV) Accommodation units both outside and inside the park are found to be inadequate.

(V) The watchtowers are not in sufficient number and are also not sufficient in height.

(VI) Many trails were noticed on both sides of the itinerary inside the park.

(VII) The guides are mainly locals and less trained but found to be inadequately conversant with languages other than Oriya and Bengali.

10. ATTITUDE AND PERCEPTION OF LOCAL COMMUNITIES TOWARDS CROCODILE CONSERVATION

(I) The villagers (62 percent) have been seen saltwater crocodile project in Bhitarkonika Crocodile Sanctuary and remaining 38 percent in habitants have no idea about this project.

(II) Out of 50 respondent's 42 percent replied that the population of saltwater crocodiles have been increased in this sanctuary only because of proper protection (32 percent), 12 percent said that the proper availability of food and 12 percent inhabitants of the respondents did not know about it.

(III) There are 71 percent of respondent replied that the saltwater crocodiles take food as turtle, fishes, Crab. 15 percent reported that they prefer the livestock as cattle, goat or ram and remaining 14 percent respondent had not any idea about the food habits of saltwater Crocodiles.

(IV) Surveyed data expresses that the people who are highly educated, they are in favour of crocodile conservation. Above 50 percent respondents, 62 percent reply that they are not interested or against saltwater crocodiles' conservation because crocodiles provide threat to their survival as well as to livelihoods. But remaining respondent (38 percent) want to conserve the crocodile because they know that by the process of crocodile conservation the balance of ecosystem remains unchanged.

(V) Out of 50 respondent's 41 percent respondent replied that the conservation of crocodiles' species is one of religions belief. There are 26 percent respondents present their importance role about in eco-system where they play an essential role to maintain the productivity and diversity of wetland eco-system. Remaining 33 percent respondents

do not know or have no idea about saltwater crocodiles, only they said that it is only for tourism purpose and benefitted by the Odisha Government.

11. CONSERVATION STRATEGY OF SALTWATER CROCODILES

The present situation of BhitarKanika Wildlife Sanctuary from a design and implement a management plan to decrease the man-crocodile conflicts. So, the management plan and conservation strategy are as follows:

(I) The alternative and sustainable livelihood are provided to the local inhabitants which reduces their interaction and dependency on forest-based resources. The ways such as agro-forestry, poultry, animal husbandry, apiculture, fisheries, coconut farming which are linked to local market that will be set up α ways like to promote ecotourism in this concerned area. This holistic approach assures positive attitude of the inhabitants towards the species and provides a protected habitat area for crocodiles' conservation.

(II) In Bhitarkonika wildlife sanctuary, the saltwater crocodiles prefer fish as a major food. So, it is needed to minimize the fishing activities in this area for survival of saltwater crocodiles.

(III) Government of Odisha as well as Central Government should create awareness programme to the local inhabitants about the living of crocodiles and the make the people conscious regarding the risk of such species.

(IV) The local inhabitants should be more careful during every July to October because of the breeding time.

(V) The local communities should develop alternative livelihood based on natural habitants of saltwater crocodiles.

(VI) The authority of BhitarKanika Wildlife Sanctuary should arrange huge number of bath huts around the sanctuary for the safety of public risk.

(VI) Develop ecotourism as a sustainable alternative, generating income while minimizing environmental impact.

(VII) Enforce and enhance regulations to control water pollution, involving industries in sustainable practices.

(VIII) Educate tourists about responsible behavior to reduce disturbance and protect crocodile habitats.

(IX) Support collaborative research efforts to understand and address fertility challenges in crocodile populations.

(X) Increase awareness about climate change and its impact on wildlife, advocating for global conservation initiatives.

12. CONCLUSION

The interrelation between saltwater crocodile and human beings has co-existed and have shared a long history of living together. But we know that relation between people and crocodile has very negative impact to the human beings such as human death, injury, loss of livelihood and others. Yet an enhancement in offensive by humans and their intolerance towards crocodile has gone against the restoration endeavour of project crocodile. It is very sad that mot most of the people does not have any knowledge about the ecological role to the environment so they are not interested towards the conservation of saltwater crocodiles. According to the view of local communities, the Department of Forest do not take proper care about the survival by breeding crocodiles and they think that it is one kind of threat towards the crocodile species. So, capacity building of local communities is very much essential for conversation of crocodiles. The Forest Department of Odisha and Government of India takes various initiatives towards the conservation of saltwater crocodiles in BhitarKanika Wildlife Sanctuary. This unique conservation program has achieved a great success regarding the boosting of the saltwater crocodile population (**Gopi and Pandav, 2009**). Moreover, the present situation reflected that in a particular limited habitat area, saltwater crocodiles overcrowding as a result the number of attacks is gradually increased to the human beings. That's why there should be proper conservation.

Last of all, it is addressing the challenges faced by crocodiles in intertidal zones requires a multi-faceted approach that combines conservation efforts, community engagement, and sustainable practices. By combating poaching, preserving habitats, and promoting responsible tourism, we can contribute to the well-being of crocodile populations. Additionally, initiatives to improve water quality, understand fertility issues, and raise awareness about climate change play pivotal roles in ensuring the long-term survival of these remarkable creatures. Through collaborative efforts and a commitment to environmental stewardship, we can safeguard the delicate balance of intertidal ecosystems and protect the vital role crocodiles play within them.

REFERENCE

1. A.J. Eyebe, G.P. Dkamela, D. Endomana, Overview of Human-Wildlife Conflict in Cameroon, Poverty and Conservation Learning Group Discussion Paper, 2012 (05).
2. Anon, 2018. Wildlife Conservation in Odisha. Available from. http://odishawildlife.org/ projectcrocodile.html accessed June 2018.
3. C. Inskip, A. Zimmermann, Human-felid conflict: a review of patterns and priorities worldwide, Oryx 43 (1) (2009) 18–34.
4. C. Pattanaik, C.S. Reddy, N.K. Dhal, R. Das, Utilization of Mangrove Forests in BhitarKanika Wildlife Sanctuary, 2008 (Orissa).
5. Das, C.S. & Bandyopadhyay, S. (2012) Sharing Space: Human Animal Conflicts in Indian Sundarbans. Progressive Publishers, Kolkata, India.
6. Gopi, G.V., Pandav, B., 2009. Humans sharing space with Crocodylus porosus in BhitarKanika Wildlife Sanctuary: conflicts and options. Curr. Sci. 96 (4), 459–460.
7. J.B. Thorbjarnarson, H. Messel, F.W. King, J.P. Ross, Crocodiles: An Action Plan for Their Conservation, IUCN, 1992.

8. Kumar, A., Kumar, S., Zaidi, Y.F., Kanaujia, A., 2012. A review on status and conservation of saltwater crocodile (Crocodylus porosus) in India. Uttar Pradesh State Biodiversity Board 141–148.
9. Mac Gregor, J. (2002) International trade in crocodilian skins: review and analysis of the trade and industry dynamics for market-based conservation. In 16th Working Meeting of the IUCN SSC Crocodile Specialist Group, pp. 12-18. IUCN Crocodile Specialist Group, Gland, Switzerland.
10. Mandal, A.K. & Nandi, N.C. (1989) Fauna of Sundarbans Mangrove Ecosystem, West Bengal, India. Zoological Survey of India, Kolkata, India.
11. Me Gregor, J. (2005) Crocodile crimes: people versus wildlife and the politics of postcolonial conservation on Lake Kariba, Zimbabwe. Geoforum, 36, 353–369.
12. Odisha Wildlife Organization, 2018. Available from. https://www.wildlife.odisha.gov accessed June 2018.
13. P.W. Aust, The Ecology, Conservation, and Management of Nile Crocodiles Crocodylus niloticus in a Human Dominated Landscape, Imperial College, London, 2009. Unpublished PhD thesis.
14. P. Vyas, Biodiversity Conservation in Indian Sundarbans in the Context of Anthropogenic Pressures and Strategies for Impact Mitigation, Doctoral dissertation, Saurashtra University, 2012.
15. S.A. Hussain, R. Badola, Valuing mangrove benefits: contribution of mangrove forests to local livelihoods in BhitarKanika Conservation Area, East Coast of India, Wetland Ecological Management 18 (3) (2010) 321–331.
16. S. Kar, Crocodile Conservation in Orissa: a success. Results of annual (2009) census of saltwater crocodiles, Crocodylus porosus, Crocodile Specialist Group Newsletter 28 (1) (2006) 5–6.
17. S. Kar, Census of saltwater crocodiles, Crocodile specialist group newsletter 26 (2) (2007) 9–10.
18. R.A. Fergusson, in: S.C. Manolis, C. Stevenson (Eds.), Nile Crocodile Crocodylus niloticus. Crocodiles. Status Survey and Conservation Action Plan, third ed., 2002, pp. 84–89.