

CONSERVATION OF GANGETIC DOLPHIN IN BRAHMAPUTRA RIVER SYSTEM, INDIA

Final Technical Report



A. Wakid
Project Leader,
Gangetic Dolphin Conservation Project
Assam, India
Email: wakid@rediffmail.com



the bp conservation programme



ACKNOWLEDGEMENT

There was no comprehensive data on the conservation status of Gangetic dolphin in Brahmaputra river system for last 12 years. Therefore, it was very important to undertake a detail study on the species from the conservation point of view in the entire river system within Assam, based on which site and factor specific conservation actions would be worthwhile. However, getting the sponsorship to conduct this task in a huge geographical area of about 56,000 sq. km. itself was a great problem. The support from the BP Conservation Programme (BPCP) and the Rufford Small Grant for Nature Conservation (RSG) made it possible for me. I am hereby expressing my sincere thanks to both of these Funding Agencies for their great support to save this endangered species. Besides their enormous workload, Marianne Dunn, Dalgen Robyn, Kate Stoke and Jaimye Bartake of BPCP spent a lot of time for my Project and for me through advise, network and capacity building, which helped me in successful completion of this project. I am very much grateful to all of them. Josh Cole, the Programme Manager of RSG encouraged me through his visit to my field area in April, 2005. I am thankful to him for this encouragement.

Simon Mickleburgh and Dr. Martin Fisher (Flora & Fauna International), Rosey Travellan (Tropical Biology Association), Gill Braulik (IUCN), Brian Smith (IUCN), Rundall Reeves (IUCN), Dr. A. R. Rahmani (BNHS), Prof. R. K. Sinha (Patna University), Dr. Anwaruddin Choudhury (Rhino Foundation), Dr. S. P. Biswas (Dibrugarh University), Prof. J. N. Sharma (Dibrugarh University), Prof. P. C. Bhattacharya (Guwahati University) helped me tremendously in fund raising for this work and successful completion of each step of this enormous task. I, therefore, hereby expressing my sincere thanks to all of them.

Unless the tremendous help from Sanjay Das, Dhruva Chetry, Satrapati Das and Ashok Dey during the field work, the Project will not get its current status. Therefore, I am grateful to all these team members for their field assistance.

Due to the management support from the Chief Conservator of Forest (Wildlife) of Department of Environment & Forest, Mr. M. C. Malakar, the field works were successfully completed. Mr. N. K. Basu, the Director of Kaziranga National Park, Mr. Utpul Bora, the D. F. O. of Eastern Assam Wildlife Division and the Range Officers of Kaziranga National Park, viz., Dharani Boro (Kohora range), Mukul Tamuli (Bagori Range) and Salim Ali (Burhapahar Range), Mr. Alam (Agoratoli Range) provided tremendous field supports to the survey team within Kaziranga National Park survey. Mr. Aniruddha Dey, the DFO of Tinsukia Wildlife Division and Mr. Nripen Kalita, the Range Officer of Saikhowa Range provided management support during Dibru-Saikhowa National Park survey. I express my sincere thanks to all these officers of Department of Environment & Forest, Govt. of Assam.

Colonel Dalal, Captain Sachin, Captain Jamwal and Captain Rajesh of Indian Army provided security support to the survey team during Assam-Arunachal border survey. Assistant Commandant Bharat Singh and S. B. Singh of Border Security Force helped the project team to conduct dolphin survey in India-Bangladesh border. Inspector-General of Police (Special Branch) Mr. K. N. Sharma and Mr. Rawat provided security supports to the team in the rest part of Assam. The Superintendent of Police of Goalpara district and Lakhimpur district provided the security support during the field survey in the respective districts. I, therefore, thankful to all of these officers of Indian Army, Border Security Force and Assam Police Department.

I also express my sincere thanks to the Director of Inland Water Transport for providing the survey vessel, SDB Aparupa, to survey the Brahmaputra River, from Dibrugarh to India-Bangladesh border. The staffs from this Department, Mr. Ranjan Mahanta, Nageshwar Choudhury, Arjun Baishya, Kartik Das, Bharat Das, Goutom Saha, Shyam Lal

Choudhury, Kuddus Ali, Salimuddin Ahmed, Digen Kalita, Deben Das and Guluk Das are highly acknowledged for their sincere assistance during the field survey. Besides I am also thankful to Mr. Satya Narayan Singh, Sunil Rabha and Mahendra Bhuyan for providing their boats to survey Lohit River, Kulsi River and Subansiri River respectively.

I am particularly thankful to the help and guidance from Dr. Hilloljyuti Singha, Dr. Shahjamal Sheikh, Dr. Debajit Baruah, Lakhi Hazarika, Amal Dutta, Debajit Phukan, Naren Dutta, Ravindra Nath, Dr. Bibhab Talukdar, Dr. Rathin Barman, Bikul Goswami, Bibhuti Lahkar, Firoz Ahmed, Narayan Mahanta and Sonali Ghosh.

I also thankful to the following personnel who helped me a lot in different times of field surveys, viz., Subrata Sarkar, Ashoke Das, Muhibul Hussain, Ubed Ali, Manjeet Gogoi, S. Dhar, Hemen Saikia, Bakhanta Dutta, Simanta Goswami, Gagan Das, Daisa Basumtari, Hemanta Haud, Hiren Dutta, Bijit Dutta, Ananta Dutta, Ripunjay Das, Jitu Chetia, Imdadur Rahman, Ani Baruah, Binita Baruah, Prof. Pradip Gogoi, Krishna Chaulou, Mohan Saikia, Dipankar Dutta, Dadu Datta, Trinayan Dutta, Sanjib Dutta, Dadul, Manabhanjan Hazang, Lalan Sanjib, Malla, Silum Dulal, Kalu Bhai, Sultan Giasuddin, Nurjamal Sheikh, Ibrahim Ali, Dipul Hussain, Aatur Rahman, Prabin Boro, Tankeshwar Nath, Jubbar Ali, Abdul Kalam, Suleiman Haque, Anil Kurmi, Min Bahadur, Jagdish Pegu and Kamal Das.



Place: Guwahati

(A. WAKID)

Date: 28-10-2005

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PROJECT AT A GLANCE

1. **Title of the Project:** Conservation of Gangetic dolphin in Brahmaputra river system, India.
2. **Project Leader and Organization:** A. Wakid
Research Fellow,
Department of Life Sciences
Dibrugarh University
Dibrugarh – 786004, Assam, India
Phone: 91 94350 33226
Email: wakid@rediffmail.com
3. **Current address of PL:** Programme Manager,
Gangetic Dolphin Research
& Conservation Programme
Aaranyak,
Survey, Betlotola,
Guwahati – 28
Assam, India
Phone & Fax: 91 361 2228418
Web: www.aaranyak.org
3. **Project duration:** 1 year (October, 2004 to September, 2005)
4. **Funding Agencies:** BP Conservation Programme, UK
Rufford Small Grant for Nature Conservation, UK
5. **Amount of award:** \$ 7,500 (from BP Conservation Programme)
£ 5,000 (from RSG)
6. **Project Advisors:** Gill Braulik
IUCN Cetacean Specialist
Downstream Research Group, Macon, USA

Dr. Anawaruddin Choudhury
Chief Excecutive,
Rhino Foundation, Guwahtai, Assam

Prof. P. C. Bhattacharya
Dept. of Zoology, Guwahati University, Guwahati, Assam

Dr. S. P. Biswas
Reader,
Dept. of Life Sciences, Dibrugarh University, Assam
7. **Project Assistants:** Sanjay Das, Dhruba Chetry, Chatrapati Das

EXECUTIVE SUMMERY

To initiate a long term site and factor based conservation efforts for the endangered Gangetic dolphin (*Platanista gangetica*) in Brahmaputra river system within Assam, after finding out the population status, distribution pattern, ecological status of habitats and threats, this one-year field project was undertaken in the whole river system, from October, 2004 to September, 2005. The investigation or survey was conducted in two phases: a) tributary survey, and b) Brahmaputra river survey. In tributary survey, altogether 51 major tributaries of Brahmaputra Valley were surveyed extensively in search of dolphin population residing throughout the year. In Brahmaputra River, the survey was conducted from Assam-Arunachal border to India-Bangladesh border. Here the investigation was conducted Sector-wise, dividing the whole river into six Sectors.

The tributary survey has resulted in the recording of dolphin population in two tributaries, viz., River Subansiri of Lakhimpur district and River Kulsi of Kamrup district. 26 dolphins (six calves, five sub-adults and 15 adults) spreading in 11 locations with an encounter rate of one dolphin per 4.15 km, were recorded in Subansiri River and 15 dolphins (two calves, five sub-adults and eight adults) spreading in four locations with an encounter rate of one dolphin per 2.0 km were recorded in Kulsi River.

The Brahmaputra River survey recorded altogether 197 dolphins (27 calves, 32 sub-adults and 161 adults) spreading in 82 locations of the river with an encounter rate of one dolphin per 3.8 km. Altogether 28 dolphin (three calves, six sub adults and 19 adults) were recorded in the river stretch from Assam-Arunachal Pradesh border to Bogibeel (Dibrugarh); 23 dolphins (seven calves, two sub adults and 14 adults) in the river stretch from Dibrugarh to Nimatighat; 54 dolphins (10 calves, 10 sub adults and 34 adults) in the river stretch from Nimatighat to Silghat (Koliabhumura); 26 dolphins (two calves, three sub adults and 21 adults) in the river stretch from Silghat to Guwahati; 25 dolphins (four calves, five sub adults and 16 adults) in the river stretch from Guwahati to Pancharanta (Jugighopa) and 41 dolphins (one calves, six sub adults and 34 adults) were recorded in the river stretch from Pancharatna to India-Bangladesh border. Dolphin encounter rate was highest in the river stretch in between Nimatighat to Silghat, particularly within Kaziranga National Park.

Altogether 238 dolphins were recorded in the entire Brahmaputra river system (Brahmaputra River and two tributaries). The distribution of this entire population is not uniform throughout the entire river system; rather they are distributed as groups with a size from 1 to 8, in 97 locations in the valley. Since these 97 locations are very important from the dolphin habitat occurrence point of view, therefore, they can be termed as **Important Dolphin Habitats** (IDHs). Accordingly, this project identifies altogether 97 IDHs in Brahmaputra Valley. Out of these, 15 IDHs are distributed in three tributaries and rest 82 in Brahmaputra River itself.

In Subansiri River, most of the sightings were made in the river meanderings, followed by river mouths and just near the junctions of two currents flowing through the mid-channel islands. In Kulsi River, all the dolphins were sighted in river meanderings. In Brahmaputra River, most of the dolphins were sighted in the downstream of tributary junctions, river meanderings, in the downstream of the junctions of two currents flowing through the mid-channel islands and in the deeper stretch of wide-single channel. In Subansiri River, the dolphins were observed in a depth range from 3.3 to 17.1 m, whereas in Kulsi River it was in a depth range from 2.2 to 7.8 m. On the otherhand, in Brahmaputra River, the dolphins were found in a depth range from 2.2 m to 11.3 m from Arunachal border to Bogibeel, 3.5 to 10.3 m from Bogibeel to Nimatighat, 2.2 to 15.6 m from Nimatighat to Silghat, 4.4 to 21 m from Silghat to Guwahati, 6 to 32 m from Guwahati to Pancharatna, and 4.4 to 15.6 m from Dhubri to Bangladesh border.

The survey team recorded the death of altogether 28 dolphins in the entire river system. Out of these 28, 25 were the victim of accidental killing through gill net entanglement (particularly known as by-catch) and rest three were the victim of poaching. Thus, the project identifies the **by-catch** as the biggest threat to the dolphins of the Brahmaputra Valley. Besides, the high rate of sand mining is the main disturbing factor to the dolphins of Kulsi River and ongoing power dam construction is a possible future threat to the dolphins of Subansiri River.

As an extension of the project work, altogether 40 awareness campaigns were conducted in different parts of the Brahmaputra Valley and the target groups ranged from fishermen, community leaders, school students, teachers, management officers and defense officials.

Besides several minor communications, altogether 19 major media coverage were made during the reported period about the project and its findings. Two communications were made at international level. Five Monitoring Units were formed for monitoring dolphins in 15 identified threatened IDHs in collaboration with the local communities and management authority.

Based on these identified threats, the project recommended further research based investigations on impact of by-catch, sand mining and dam construction on the dolphin population of Brahmaputra, Kulsi and Subansiri River respectively, followed by site and factor-based conservation actions. Besides, the involvement of major stakeholders of Assam, formation of Dolphin Monitoring Units in identified IDHs in collaboration with local communities and management authorities, and working together in a single platform through networking all of the developed Monitoring Units, is identified as the best approach and thus recommended as the most prioritized works for the long-term conservation of Gangetic dolphin in the Brahmaputra valley.

INTRODUCTION

The Cetacea is one of the most distinctive and highly specialized orders of mammal. This Order contains two suborders, Mysticeti and Odontoceti. Odontocetes bear teeth, typically numerous and peglike, although sometimes modified, as in the single tusk of the narwhal or the odd, fanglike lower teeth of the beaked whales. Among the Odontocetes, the most interesting species are the dolphins belonging to the families of Iniidae, which inhabit the rivers of South America, and Lipotidae and Platanistoidae, which inhabit the rivers of Asia. The Iniidae is represented by the Amazon River Dolphin or Boto (*Inia geoffrensis*), the Lipotidae is by Yangtze River Dolphin or Baiji (*Lipotes vexillifer*) and the Platanistidae is by Indus River Dolphin or Bhulan (*Platanista minor*) and Gangetic dolphin or Sihu (*Platanista gangetica*). The 'Franciscana' (*Pontoporia blainvillei*) although phylogenetically a river dolphin, however, its distribution is marine rather than riverine – along the east coast of South America. Another Delphinid, Tucuxi (*Sotalia fluviatilis*) is sympatric with the Boto, but its distribution includes estuaries and coastal waters and its phylogeny places it with the marine dolphins. Another Delphinid, the Pesut (*Oreaella brevirostris*) is found in the freshwater zone of Irrawady river of Myanmar, Mekong river of Laos, Cambodia and Thailand, but due to its distribution in estuaries, coastal and marine waters, its phylogeny places it also with the marine dolphins (Reeves *et al.* 1993, Sinha 1997). Therefore, most of the cetacean researchers consider the occurrence of only four species of freshwater or river dolphins (Boto, Baiji, Bhulan and Gangetic dolphin) in the world.

Among these four species, the Gangetic dolphin is found in Ganges-Brahmaputra-Meghna and Karnaphuli river system of India, Nepal and Bangladesh (Anderson 1878, Kasuya & Haque 1972, Jones 1982, Mohan 1989, Reeves & Brownell 1989, Shrestha 1989 and Reeves *et al.* 1993). In the nineteenth century, the dolphins were plentiful in the entire distributional range, though no actual data on population is available (Sinha & Sharma 2003). However, due to various pressures the distributional ranges and abundance of this species has been sharply declined in its entire distributional ranges (Reeves & Leatherwood 1995) and for which the IUCN revised its threatened status from Vulnerable (Klinowska 1991) to Endangered (IUCN 1996). At present there are not more than 2500 individuals of this species in the world (Sinha & Sharma 2003).

In India, there is enough historical and mythological evidences to confirm that the Gangetic dolphin had been a close relationship with human beings. During the time of King

Ashoka, the Maurya Emperor in 230 B.C., the Gangetic dolphin was known as 'Ganga-Puputaka' and enjoyed the status of a 'protected animal' through a decree known as 'Fifth Pillar Edict'. In *Baburnama*, which was published in 1598, the Gangetic dolphin was known as *Khokk Aabi* or Water Hog. Bhattasali, the author of *Iconography of Buddhist and Brahminical sculptures* identified this species as the *Bahana* (carrier) of mythical goddess Ganga.

Although there is no conclusive fossil record, still it is estimated that the Gangetic dolphin evolved around 20 million years ago. The scientific world first came to know about the existence of Gangetic dolphin through Roxburgh (1801) and Lebeck (1801). Lebeck published his work on Gangetic dolphin in 1801 in Germany. Although the documentation made by William Roxburgh was published in 1801 in *Asiatick Researchers*, but its English version was published in 1803. Therefore, some researchers give priority to the Lebeck as the first worker to describe the Gangetic dolphin. However G. Pilleri discovered that Roxburgh's 1803 paper was in fact a reprint from the Indian edition of the same journal originally published in Calcutta in 1801.

Roxburgh named the Gangetic dolphin as *Delphinus gangetica*. In 1828 Rene Lesson adopted a genus based on the Bengali name 'Susuk' and described the species as *Susu platanista*. However, Johann Wagler adapted *Platanista* as a genus in 1930 and from then onwards the Gangetic dolphin became known as *Platanista gangetica* to the scientific community. This species is commonly known as *Susu* in India, *Shunshuk* in Bangladesh and *Saunch* or *Souch* in Nepal. Again, in each of these countries the species has different local names, i.e., in India this species has different names in different parts, viz., *Susuk* (West Bengal), *Susu* (Bihar), *Hihu* (Assamese), *Putukari* (in Mishing) tc. However, the systematic position of Gangetic dolphin is as follows.

Phylum:	Chordata
Sub-phylum:	Vertebrata
Class:	Mammalia
Order:	Cetacea
Suborder:	Odontoceti
Family:	Platanistidae
Genus:	<i>Platanista</i>
Species:	<i>gangetica</i>

After Roxburgh (1801) and Lebeck (1801), Anderson (1878) gave a detail distribution pattern of the species in India, where he mentioned the distribution of the species from Haridwar to Sundarban delta region. After that Eschricht (1852), Jerdon (1874), Sterndale (1884) and Blanford (1891) reported especially on the distribution, behaviour and anatomy of the species. In the twentieth century Kukenthal (1909) gave an account of structural peculiarities of dolphin. Arvy & Pilleri (1970) and Kamiya & Yamasaki (1974) also described the internal anatomic features of dolphin. The sound system, growth pattern, digestive tract and reproductive organ of the species were investigated by Pilleri (1970 & 1971), Pilleri & Gihl (1971), Kasuya (1972), Takahashi & Yamaski (1972) and Harrisson (1972). Kasuya & Haque (1972), Pilleri & K. Zbinden (1974) provided some information on the distribution and seasonal movement of the species. Jones (1974) suggested the introduction of Gangetic dolphin in some new habitats of Indian subcontinent for their better protection. Nath (1974) published a report on the habit and habitat of dolphin in Ganga near Patna. Haque (1976) reported the abundance and distribution and the effect of Farrakka barrage on the dolphin population. Again, Haque *et al.* (1977) described the biology and behaviour of Gangetic dolphin. Meanwhile, Kamiya *et al.* (1978) described the parathyroid gland and Migaki *et al.* (1979) described the hepatic trematodiasis in Gangetic dolphin. Singh & Sharma (1985) estimated the population status of dolphin in Chambal River, a south-western tributary of Ganga. Gupta (1986) reported the distribution pattern of dolphin in certain segments of Ganga. Rao *et al.* (1989) and Hussain & Choudhury (1992) documented the population status and ecological status of Gangetic dolphin in the National Chambal Sanctuary. Rao (1995) investigated the population status of dolphins in the Ganges main stream in between Bijnor and Narora Barrages (approx. 166 km). Gupta (1986) described his 27 surveys in scattered locations of the Ganges between Allahabad and Calcutta in 1978; Ali (1992) conducted surveys from Buxar to Sirighat, a stretch of Ganges of 463 km on 6-14th August 1989. Sinha (1997) conducted another survey in the Bhagirathi River from the Janjipur Barrage to Tribenighat (approx. 320 km). Sinha (1997) also conducted another survey in the Hoogly River from Tribenighat to Calcutta Boanical Garden (approx. 100 km). In Chambal River, Singh & Sharma (1985), Rao *et al.* (1989), Sharma (1993) and Sharma *et al.* (1995) investigated the population status at different times. Choudhury & Hussain (1992) reviewed the population status of dolphin in the protected areas of India and also suggested protection measures for this species. Sinha *et al.* (1993) documented the gut contents of five Gangetic dolphins. Benke (1993) also gave some illustrated and comparative osteological description

of this species of dolphin. Smith *et al.* (1998) described the effects of water development projects on dolphin population in Bangladesh. Endo *et al.* (1999) examined the trachea and bronchi of the species through MRI. Further, Behara & Rao (1999) observed some interesting behaviours of Gangetic dolphin and Kumari *et al.* (2002) reported the concentration of organochlorines in the body tissue of the species. Verma *et al.* (2004) investigated the phylogenetic relationship of the species with other cetaceans and found that the species is closer to Mysticeti than any other toothed whales.

In Nepal, Shrestha (1989 & 1995), Smith (1993), Smith *et al.* (1994) and Sinha *et al.* (2000) investigated the population status and distribution pattern of dolphins in the major rivers viz., Karnali, Narayani, Mahakali and Kosi Rivers.

After the classical works of Anderson (1878) on the dolphins of Bangladesh, Jones (1982) recorded the maximum upstream distribution of dolphins in Meghna river system of the country. Besides, Reeves & Brownell (1989), Reeves *et al.* (1993), Ahmed (2000) and Smith *et al.* (2001) reported the status of dolphins in the Karnaphuli River, Halda River, Matamuhuri River, Bangkhali River and Kaptai Lake of the country.

Due to very low population status and rapidly declining distribution ranges, the action plan of IUCN/SSC Cetacean Specialist Group calls attention to the need for range-wide population assessments in support of conservation effort for the Gangetic dolphin as well as its other three close relatives of the world (Reeves & Leatherwood 1995, Reeves *et al.* 2000). However, for that the most important requirement is a standard survey methodology to avoid bias in the estimate, since surveys of rivers have generally been conducted without rigorous application of a well-defined survey-design (Smith & Reeves 2000). Also, without a standard survey-design it is impossible to detect trends in absolute population abundance (Reeves *et al.* 1993). After several debate and recommendation on survey design including Perrin & Brownell (1989), which was a modified line transect, cue counting and simultaneous multi-platform survey method, Smith & Reeves (2000) put forward a standard survey methodology to estimate the river dolphin population in Asian rivers. This method has successfully been applied to estimate the population in India and Nepal (Sinha *et al.* 2000) as well as in the rivers of Bangladesh (Smith *et al.* 2001).

Besides Ganges river system of Northern India, the Brahmaputra drainage system of Assam is a major habitat of Gangetic dolphin in India. In comparison to Ganges river system, little works have been undertaken so far in the Brahmaputra river system of Assam. So far, the reported works on Gangetic dolphin from Assam are mainly on the distribution

and population status. Choudhury (1997) mentioned the distribution of the species in both Brahmaputra and Barak river system of Assam. Mohan *et. al.* (1997) investigated the population of dolphin in the Brahmaputra and again Mohan *et. al.* (1998) documented one residential dolphin population in the Kulsi River, near Guwahati. Biswas *et. al.* (1997) reported the population status of dolphin in upper Brahmaputra basin and Biswas & Baruah (2000) investigated the habitat ecology of Gangetic dolphin in the same river stretch. Bairagi (1999) reported the impact of oil bait fishery of cat fishes on the dolphins of Brahmaputra River. Recently, Wakid (2005) assessed the population status and distribution pattern of dolphin population in and around of Dibru-Saikhowa National Park of Eastern Assam.

According to the older generations of Assam, the Gangetic dolphin was one of the commonly sighted aquatic mega-fauna in the Brahmaputra river system before two decades. However, due to increasing anthropogenic pressures, the overall population of the species has been declining in such a way that currently most of the major tributaries of Brahmaputra are devoid of any dolphin population and even in Brahmaputra River also, the species is found in certain pockets only (*pers. comm.*). Therefore, at this critical situation it is highly essential to undertake an extensive effort for the long-term conservation of the species in collaboration with all the concerned stakeholders of the region. As the first attempt to that, the most prioritized work is to determine the current conservation status of the species, based on which follow-up conservation measures can be undertaken in a more scientific and systematic manners. The present work was conducted as an attempt to that based on following objectives:

1. Identification of all the habitats of Gangetic dolphin in Brahmaputra river system.
2. Determination of current population status, distribution pattern and ecological status of Gangetic dolphin in each identified habitat.
3. Identification of threats to the dolphins and their habitats.
4. Conservation initiatives through awareness campaign and local community involvement.

MATERIALS & METHODS

a. Study area

The Brahmaputra is one of the longest rivers in the world, which is flowing through Tibet, India (Arunachal Pradesh & Assam) and Bangladesh. The river is known as Tsangpo in Tibet, Siang or Dihang in Arunachal Pradesh, Luit or Brahmaputra in Assam, Jamuna and later in the downstream as the Padma in Bangladesh. The 2,880 km long Brahmaputra, larger than the Ganges in length and volume, traverses its first 1,625 km in Tibet, the next 918 km in India and the remaining 337 km in Bangladesh up to its confluence with the Ganga. After entering India the river flows as the Siang or Dihang River travels about 52 km from Pasighat at the foothills of the Himalayas before two major rivers, namely the Dibang and the Lohit join it opposite Kobo located on its west and the town of Sadiya nestling between the two rivers to its east (Fig-1). From this trijunction, the river is known as Brahmaputra. From here the river enters a narrow flat valley, which is known as Assam Valley or Brahmaputra Valley.

In its length of about 750 km in Assam valley, the river is aligned almost ENE-WSW. The valley is bounded by the Eastern Himalayas on north and by the Patkai-Naga hill ranges on south. The average width of the valley is about 86 km. It is broadest where the river divides the districts of Sibsagar and Lakhimpur. It then contracts to 44 km with Aka Hills on its north and the isolated block of Mikir Hills on its south. Lower down, it widens out in Nagaon district. Further down, near the confluence of the Kalang River, the Khasi Hills restrict the valley width to 60 km. The hills remain close to the river up to Guwahati. They recede again and do not approach the river till Goalpara, which is situated on a spur of the Garo Hills. Beyond this point, the valley again widens and opens out into the plains of Bangladesh a few kilometers downstream of Dhubri. Of the width of the valley, the river itself occupies 15 to 18 km.

Throughout its course within India, the Brahmaputra is braided with some well-defined nodal points, where the river width is narrow and is restricted within stable banks. West of Guwahati, at places, the river flows between inselbergs. All along its course in the valley, abandoned wetlands and back swamps are common.

The river receives about 103 notable tributaries from both sides 65 in the north bank and 38 on the south bank all along its course through Assam. In the north principal tributaries are the Subansiri, the Jia Bhareli, the Dhansiri (North) Puthimari, the Pagladiya, the Manas,

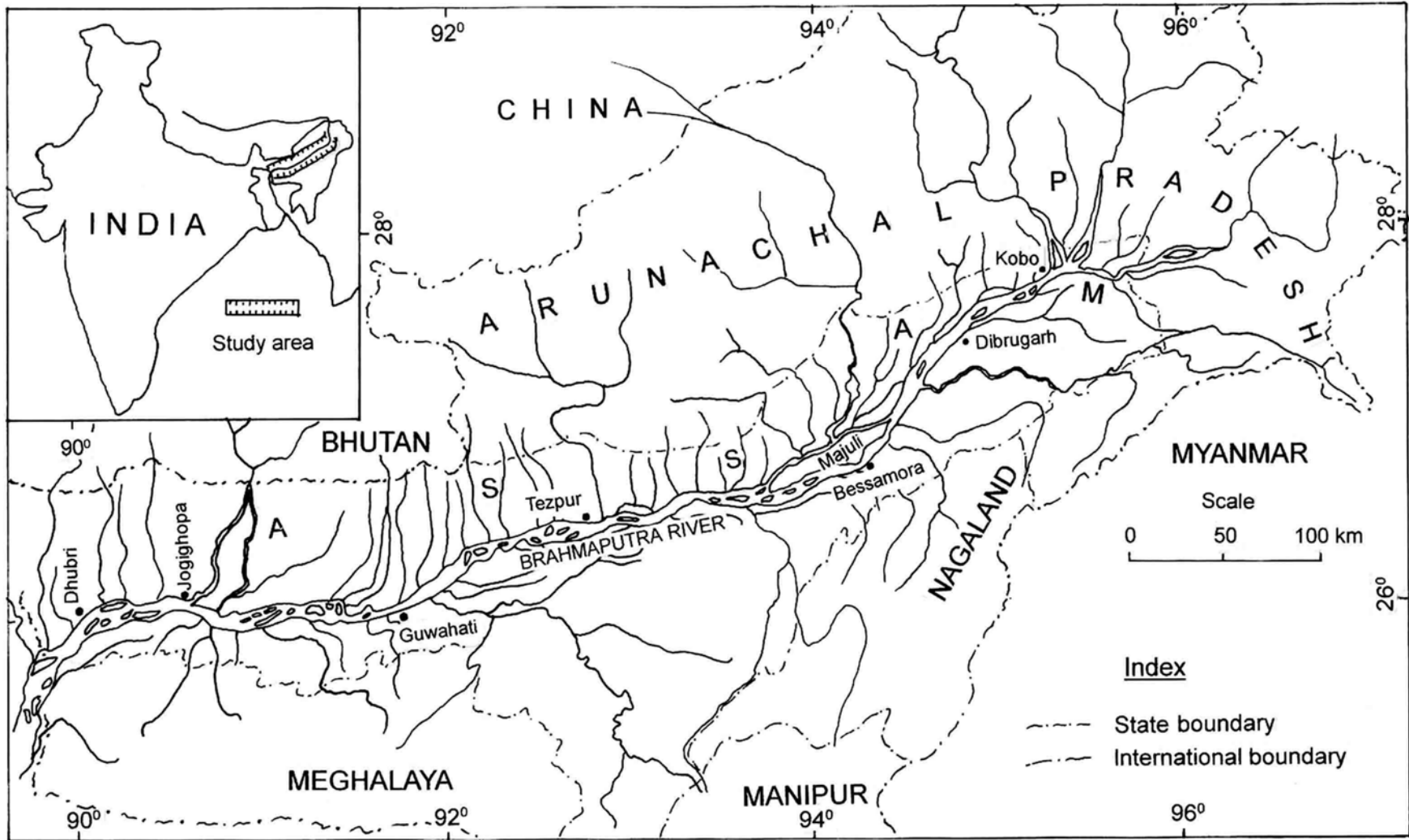


Fig-1: Location map of Brahmaputra river system

the Champamati and the Sankosh. On the south bank, the main tributaries are the Burhi Dihing, the Disang, the Dikhow, the Dhansiri (South) and the Kopili. The positions of the confluence of the tributaries go on changing due to bank erosion by the Brahmaputra. The north bank tributaries come from higher rainfall region and pass through the fragile Himalayan reaches with steeper slopes. Hence they carry heavy sediment load of coarser material such as gravel and cobbles. Also because of steep slope and heavy sediment load, these rivers develop braiding over major portion of their lengths. The south bank tributaries pass through relatively stable reaches with gentler slopes. Hence their sediment load is relatively low and finer in size; they are meandering rivers with deeper cross-sections (Sharma, 2004).

b. Methodology

All the channels of Brahmaputra River as well as its major tributaries having the potentiality of dolphin habitat occurrence were first identified with the help of recent satellite imageries (IRS-1C, LISS-III, 1: 50,000), in collaboration with the GIS and Remote Sensing Laboratory of the Department of Geology, Dibrugarh University. Secondary information was collected from the fringe villagers, especially from the fishermen about the existence of dolphins in the identified waterbodies (Plate-1). The collected information then confirmed through direct field verification. This phase of survey was conducted from October, 2004. Through this methodology all the tributaries of Brahmaputra River as well as the channels of the main Brahmaputra River were scanned in search of potential as well as existed dolphin habitats.

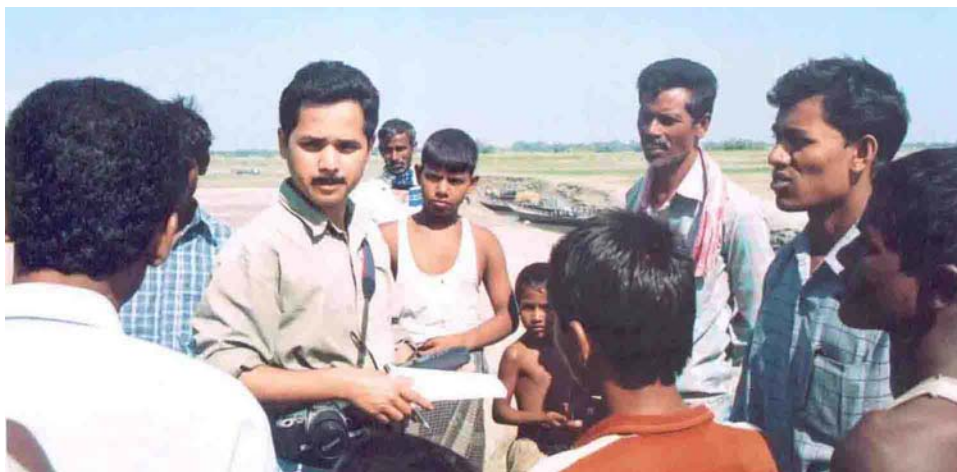


Plate-1: Secondary information collection

This methodology confirmed the existence of dolphin population in the two tributaries (Subansiri River in Lakhimpur district and Kulsi River in Kamrup district) as well as in the main channel of Brahmaputra River. After confirming the information, direct survey was conducted in both the tributaries twice in 2005. The Brahmaputra River was surveyed once in 2005.

The Kulsi River was surveyed from Kulsi to Gumi, a stretch of around 30 km during January, 2005 and again in April, 2005. Since this a small river of an average 15-30 m wide and low water depth in most of its parts (minimum 0.4 m during survey time), therefore, locally-made wooden country boats were used during the survey (Plate-2). Four observers were used to make dolphin observation. Sighting of dolphin, various anthropogenic activities, viz., fishing, sand mining, bathing, poaching etc. and primary habitat characteristics, viz., water depth, width, riparian conditions, geomorphological conditions etc. were recorded at one km interval. A standard 15 minutes observation was made to determine the exact number of dolphins remaining in a group. The dolphin group size was estimated using the best, high and low estimates as suggested by Smith *et al.* (1994). High and low estimates were used to reflect the confidence of observers in the accuracy of best estimate. The low estimate was considered as a minimum count and the high estimate as the maximum count.



Plate-2: Dolphin survey in Kulsi River

Identical best, high and low estimates indicated a high level of confidence in the best estimate. Sightings that could not be substantiated by subsequent surfacing or confirmation by a second member of the survey team were given a best and low estimate of zero and a high estimate of one. Group size was determined by following Mohan *et al.* (1997) with some modification based on the recommendation from Smith & Reeves (2000). After confirming the sighting, the sighting locations were recorded by a GPS, and later transferred into concerned satellite imagery and finally analyzed to determine the population distribution. The age-class of the sighted dolphins was determined through observing their body size (Mohan *et al.* 1997). Dolphin having the body size of less than 1m was considered as calf, between 1 and 1.5 m as sub-adult and more than 1.5m as adult. The width of the channel was determined through using satellite imageries as well as visual observation and the depth was determined using Echosounder cum Fish Finder (Navman 450) at 1 km interval. The depth reading was particularly taken in dolphin sighted area.

The Sunabsiri River was surveyed two times, one in January and another in the first half of May, 2005. Altogether 108 km long stretch of Subansiri River, from Sawoldhuwaghat to Jamugurighat, was surveyed in details. The methodology that was followed in Kulsi River survey, was also followed here. However, due to comparatively more width (70-150 m), water depth and water current than Kulsi River, instead of hand-driven country boats, mechanized boat (7 m in length) fitted with 5 HP engine was used during the survey (Plate-3).



Plate-3: Dolphin survey in Subansiri River

The Brahmaputra River survey was conducted from February to April, 2005. This season was selected due to low level of water and to minimize the effect of environmental constraints on dolphin sighting. Besides, to avoid the directional movement of dolphins during rising and falling water stage (as reported by Kasua & Haque, 1972; Singh & Sharma, 1985), this was the best season within the survey period. For the maximum accuracy in population determination in the entire river, the survey was conducted in sector wise (Mohan *et al.* 1997) and there were altogether six sectors as follows:

Sector-I: Assam-Arunachal Pradesh border to Bogibeel Ghat (Dibrugarh)

Sector-II: Bogibeel Ghat to Nimatighat

Sector-III: Nimati Ghat to Silghat (Koliabhumura)

Sector-IV: Silghat to Guwahati

Sector-V: Guwahati to Goalpara (Pancharatna)

Sector-VI: Goalpara to India-Bangladesh border

Besides the extensive use of recent satellite images, local fringe villagers, especially from fishermen community who were quite experienced with the channels route and dolphin habitats of the concerned area, were used as field guides, so that no channels were left from being surveyed. One mechanized steel boat having the facility of night halting was hired from Inland Water Transport of Govt. of Assam for conducting the entire survey of Brahmaputra River (Plate-4). The boat was kept at an optimum speed of 6-8 km for maximizing the dolphin sighting. The number of observers varied depending on the width of the channel, from minimum 5 to maximum 11. The number of observers was increased in wide channels and the sighting area allocation and rotation among them was made according to the recommendation of Smith & Reeves (2000) to attain the maximum sighting records. During group size determination, already mentioned best, high and low estimation process was followed. A 30 minutes stoppage was made in the favourable dolphin habitats, viz., confluences, river meanderings, mid-channel islands, since Kasua & Haque (1972), Smith (1993), Smith *et al.* (1998) reported these microhabitats as the high-density areas during their survey in the rivers of Bangladesh and Nepal and therefore, followed as suggested by Smith & Reeves (2000). Rest all procedures; viz., recording of sighting location through GPS,

water depth and width recording etc. were same as followed during Kulsi and Subansiri survey.



Plate-4: Dolphin survey team in Brahmaputra River

Various types of fishing practices operated in the surveyed river stretch, poaching and accidental killing of dolphins were recorded during the survey time as the anthropogenic pressures to the concerned dolphin populations. The collected information was used to identify the threatened habitats, the factors behind these threatening and the concerned communities involved in those disturbances. Informal awareness campaigns were conducted among the communities of the identified threatened habitats. Communications were established among the fringe villagers of identified threatened habitats, local NGOs and concerned Divisional Forest Offices of Assam Forest Department. During the awareness campaign, the survey findings of that area were communicated among these target groups. A 'Dolphin Conservation Unit' was formed in each of such identified area at the end of awareness campaign, by keeping the most active and interested persons of each of the target groups in that Unit, for protecting their dolphins and habitats.

RESULTS

Objective-1: Identification of dolphin habitats

The survey resulted into the identification of three main dolphin habitats in the entire Brahmaputra river system. They are:

- a. Subansiri River, from Bhimpara Ghat to Jamuguri Ghat of Lakhimpur district (Plate-5).
- b. Kulsi River, from Kukurmara to Gumi (Plate-6).
- c. Brahmaputra River, from Asam-Arunachal Pradesh border to India-Bangladesh border (Plate-7).



Plate-5: River Subansiri near Bhimparaghat



Plate-6: River Kulsi near Kukurmara



Plate-7: River Brahmaputra within Kaziranga National Park

Objective-2: Population status, distribution pattern of dolphins in identified habitats and habitat ecology of identified habitats

A. Subansiri River: In Subansiri River 26 ($SD \pm 1.68$, Group size 1-6) dolphins (six calves, five sub-adults and 15 adults) were recorded, spreading in 11 locations of the river with an encounter rate of one dolphin per 4.15 km (Table-1). Out of these 26 individuals, adults were highest (58%), followed by calf and sub-adult (Plate-8).

Table-1: Population status and distribution pattern of dolphins in Subansiri River

Sl. No. of sighted area	Name of dolphin sighted area	Sighting location	Number of dolphins			
			Calf	Sub-adult	Adult	Total
1.	Bhimpara	N 27 ⁰ 23'736"; E 94 ⁰ 14'725"	--	--	1	1
2.	Badhakora	N 27 ⁰ 16'862"; E 94 ⁰ 12'268"	--	--	2	2
3.	Ghunahuti	N 27 ⁰ 14'238"; E 94 ⁰ 12'192"	--	--	1	1
4.	Dholghat	N 27 ⁰ 12'520"; E 94 ⁰ 12'009"	1	--	1	2
5.	Ghagormukh	N 27 ⁰ 06'731"; E 94 ⁰ 10'246"	2	1	2	5
6.	Khabolughat	N 27 ⁰ 02'852"; E 94 ⁰ 07'601"	1	--	1	2
7.	Baralimara	N 27 ⁰ 01'705"; E 94 ⁰ 06'636"	--	1	--	1
8.	Bahgora	N 26 ⁰ 59'631"; E 94 ⁰ 00'741"	--	--	1	1
9.	Senimora	N 26 ⁰ 58'943"; E 94 ⁰ 00'055"	--	1	1	2
10.	Hilikhaguri	N 26 ⁰ 53'685"; E 93 ⁰ 52'971"	1	--	2	3
11.	Batahkona	N 26 ⁰ 54'115"; E 93 ⁰ 51'263"	1	2	3	6
Total			6	5	15	26

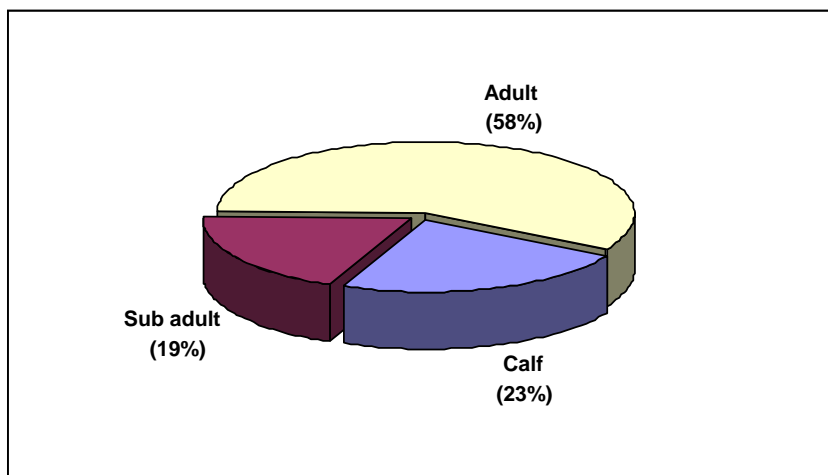


Plate-8: Population structure of dolphins in Subansiri River

B. Kulsī River: Altogether 15 ($SD \pm 3.2$, Group size 1-7) dolphins (two calves, five sub-adults and eight adults) were recorded spreading in 4 locations in Kulsī River with an encounter rate of one dolphin per 2.0 km (Table-2). However, here the major aggregations of dolphins were recorded in 1st three km stretch of the River, from Kukurmara to Kumarpara, with an encounter rate of one dolphin per 0.2 km. Out of these 15 individuals, adults were highest (54%), followed by calf (33%) and sub-adult (13%) (Plate-9).

Table-2: Population status and distribution pattern of dolphins in Kulsī River

Sl. No. of sighted area	Name of dolphin sighted area	Sighting location	Dolphin no.			
			Calf	Sub-adult	Adult	Total
1.	Kukurmara	N 26°03'457"; E 91°26'623"	--	3	4	7
2.	Noaviata	N 26°04'602"; E 91°26'029"	2	1	3	6
3.	Kumarpara	N 26°05'562"; E 91°25'294"	--	1	--	1
4.	Panibheti	N 26°05'932"; E 91°24'225"	--	--	1	1
Total			2	5	8	15

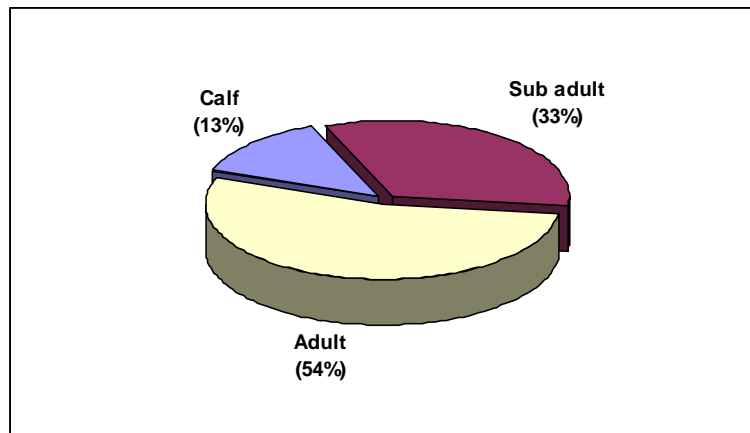


Plate-9: Population structure of dolphins in Kulsī River

C. Brahmaputra River:

In Brahmaputra River, altogether 197 dolphins (27 calves, 32 sub-adults and 138 adults) were recorded from 82 locations of the river (Table-3) with an encounter rate of one dolphin per 4.2 km. 28 ($SD \pm 0.88$, Group size 1-4) dolphins (three calves, six sub-adults and 19 adults) were sighted in Sector-I (Plate-10); 23 ($SD \pm 1.30$, Group size 1-5) dolphins (seven calves, two sub-adults and 14 adults) were sighted in Sector-II (Plate-11); 54 ($SD \pm 1.76$, Group size 1-8) dolphins (10 calves, 10 sub-adults and 34 adults) were sighted in Sector-III (Plate-12); 26 ($SD \pm 0.83$, Group size 1-3) dolphins (two calves, three sub-adults and 21 adults) were sighted in Sector-IV (Plate-13); 25 ($SD \pm 2.22$, Group size 1-6) dolphins (four calves, five sub-adults and 16 adults) were sighted in Sector-V (Plate-14), and 41 ($SD \pm 1.80$, Group size 1-7) dolphins (one calves, six sub-adults and 34 adults) were recorded in Sector-VI (Plate-15). From sector-wise analysis, it was found that the adults formed 68%, followed by 21% sub-adults and 11% calves in Sector-I; 61% adults, 30% calves, 9% sub-adult in Sector-II; 62% adults, 13% calves and 13% sub-adult in Sector-III; 80% adults, 12% sub-adults and 8% calves in Sector-IV; 64% adults, 20% sub-adult and 16% calves in Sector-V and 83% adults, 15% sub-adult and 2% calves in Sector-VI. As a whole, adults (76%) dominated the age groups of dolphins in Brahmaputra River, followed by sub-adults (13%) and calves (11%) (Plate-16). Besides, majority (83%) of the dolphin population of Brahmaputra Valley was found in the Brahmaputra River, followed by Subansiri (11%) and Kulsī River (6%) (Plate-17). From the different age class point of view, we observed maximum calves in Sector-III (Plate-18), sub-adults in Sector-III (Plate-19) and adults in Sector-VI & III (Plate-20).

Table-3: Population status and distribution pattern of dolphins in Brahmaputra River

Sl. No. of dolphin sighted area	Sector	Name of dolphin sighted area	Location of sighted area	Dolphin no.			
				Calf	Sub-adult	Adult	Total
1.	Sector-I	Hilaguri Chapori	N 27°45'138"; E 95°44'828"	--	--	2	2
2.		Miri Chapori	N 27°46'980"; E 95°41'132"	1	--	2	3
3.		Kaitia	N 27°39'718"; E 95°26'632"	1	--	1	2
4.		Nahoroni Chapori	N 27°35'275"; E 95°21'375"	--	--	1	1
5.		Raidang	N 27°35'062"; E 95°20'452"	--	--	2	2
6.		Memdubi	N 27°34'613"; E 95°19'183"	--	1	1	2
7.		Rongagora	N 27°34'318"; E 95°17'330"	--	1	1	2
8.		Balijan	N 27°34'669"; E 95°10'420"	--	1	2	3
9.		Bela Chapori	N 27°41'853"; E 95°20'049"	--	1	2	3
10.		Laika Ghat	N 27°40'707"; E 95°16'548"	--	--	1	1
11.		Nagaghuli	N 27°31'291"; E 94°59'539"	1	1	2	4
12.		Bogibeel	N 27°26'803"; E 94°47'414"	--	1	2	3
Sub total				3	6	19	28
13.	Sector-II	Arunachapori	N 27°15'051"; E 94°36'625"	--	--	1	1
14.		Panidehing	N 27°06'483"; E 94°32'906"	--	--	1	1
15.		Takeliphuta	N 27°05'533"; E 94°31'332"	--	--	1	1
16.		Disang Ghat	N 27°02'905"; E 94°31'572"	2	--	1	3
17.		Gharbhanga	N 27°01'086"; E 94°27'939"	--	--	2	2
18.		Horaguri Chapori	N 27°00'510"; E 94°27'085"	--	1	--	1
19.		Dikhowmukh	N 27°59'012"; E 94°26'492"	3	--	--	3

20.		Janjimukh	N 26 ⁰ 55'819 ^{''} ; E 94 ⁰ 21'816 ^{''}	2	--	3	5
21.		Salmara	N 26 ⁰ 54'036 ^{''} ; E 94 ⁰ 16'985 ^{''}	--	--	2	2
22.		Nimati Hatihal	N 26 ⁰ 51'495 ^{''} ; E 94 ⁰ 16'675 ^{''}	--	--	1	1
23.		Nimati Ghat	N 26 ⁰ 51'841 ^{''} ; E 94 ⁰ 14'656 ^{''}	--	1	2	3
Sub total				7	2	14	23
24.	Sector-III	Kokilamukh	N 26 ⁰ 53'197 ^{''} ; E 94 ⁰ 10'542 ^{''}	1	--	1	2
25.		Digholi Chapori	N 26 ⁰ 51'509 ^{''} ; E 94 ⁰ 03'232 ^{''}	--	--	3	3
26.		Pagro Gaon	N 26 ⁰ 51'300 ^{''} ; E 93 ⁰ 58'139 ^{''}	1	--	1	2
27.		Misamari	N 26 ⁰ 50'024 ^{''} ; E 93 ⁰ 55'980 ^{''}	--	1	--	1
28.		Pahumara	N 26 ⁰ 46'474 ^{''} ; E 93 ⁰ 43'945 ^{''}	--	--	2	2
29.		Dhansirmukh	N 26 ⁰ 43'243 ^{''} ; E 93 ⁰ 39'773 ^{''}	--	1	3	4
30.		Kaziranga NP	N 26 ⁰ 42'017 ^{''} ; E 93 ⁰ 33'625 ^{''}	1	1	3	5
31.			N 26 ⁰ 44'668 ^{''} ; E 93 ⁰ 30'025 ^{''}	3	1	4	8
32.			N 26 ⁰ 44'744 ^{''} ; E 93 ⁰ 29'294 ^{''}	--	--	1	1
33.			N 26 ⁰ 44'810 ^{''} ; E 93 ⁰ 25'025 ^{''}	1	1	--	2
34.			N 26 ⁰ 44'821 ^{''} ; E 93 ⁰ 25'217 ^{''}	2	1	2	5
35.			N 26 ⁰ 38'088 ^{''} ; E 93 ⁰ 12'319 ^{''}	--	1	1	2
36.			N 26 ⁰ 38'691 ^{''} ; E 93 ⁰ 11'110 ^{''}	--	--	1	1
37.			N 26 ⁰ 37'275 ^{''} ; E 93 ⁰ 07'978 ^{''}	--	--	2	2
38.			N 26 ⁰ 36'335 ^{''} ; E 93 ⁰ 05'713 ^{''}	--	1	--	1
39.			N 26 ⁰ 35'713 ^{''} ; E 93 ⁰ 04'844 ^{''}	--	--	1	1
40.	N 26 ⁰ 36'746 ^{''} ; E 92 ⁰ 59'758 ^{''}	--	--	2	2		
41.	N 26 ⁰ 37'233 ^{''} ; E 92 ⁰ 56'846 ^{''}	--	--	1	1		
42.	N 26 ⁰ 37'009 ^{''} ; E 92 ⁰ 55'504 ^{''}	--	--	1	1		
43.	N 26 ⁰ 37'132 ^{''} ; E 92 ⁰ 54'399 ^{''}	--	--	2	2		

44.			N 26°37'132"; E 92°54'082"	1	1	2	4
45.			N 26°37'321"; E 92°53'748"	--	1	1	2
Sub total				10	10	34	54
46.	Sector-IV	Gabhorumukh	N 26°36'947"; E 92°38'315"	--	--	2	2
47.		Dakhaltapu	N 26°34'069"; E 92°35'074"	--	--	1	1
48.		Rangai	N 26°33'025"; E 92°26'093"	--	1	2	3
49.		Hiligundha	N 26°16'979"; E 92°00'877"	--	--	1	1
50.		Kalangmukh	N 26°15'088"; E 91°55'877"	--	--	2	2
51.		Chandrapur	N 26°14'681"; E 91°54'742"	--	--	3	3
52.		Chawolkhowa	N 26°14'957"; E 91°51'799"	1	--	1	2
53.		Tatumara	N 26°15'150"; E 91°51'068"	1	--	1	2
54.		Guwahati	N 26°11'239"; E 91°44'365"	--	--	1	1
55.			N 26°10'981"; E 91°44'175"	--	1	2	3
56.			N 26°10'610"; E 91°42'587"	--	1	2	3
57.	N 26°10'699"; E 91°41'066"		--	--	3	3	
Sub total				2	3	21	26
58.	Sector-V	Suwalkusi	N 26°09'633"; E 91°34'902"	2	1	3	6
59.		Bohori	N 26°14'362"; E 91°08'101"	--	1	3	4
60.		Baghbor	N 26°14'985"; E 90°48'960"	--	--	2	2
61.		Goalpara	N 26°11'520"; E 90°35'745"	--	--	1	1
62.			N 26°11'978"; E 90°34'491"	1	2	3	6
63.		Joghghopa	N 26°13'177"; E 90°33'425"	1	1	4	6
Sub total				4	5	16	25
64.	Sector-VI	Balapara	N 26°13'332"; E 90°32'930"	1	--	4	5
65.		Chandardinga	N 26°11'221"; E 90°21'810"	--	1	1	2

66.	Kamarpara	N 26 ⁰ 04'218 ^{''} ; E 90 ⁰ 17'456 ^{''}	--	--	1	1
67.	Patakata	N 26 ⁰ 04'270 ^{''} ; E 90 ⁰ 15'753 ^{''}	--	--	1	1
68.	Kalchibhanga	N 26 ⁰ 05'124 ^{''} ; E 90 ⁰ 11'608 ^{''}	--	--	1	1
69.	Burha-burhi	N 26 ⁰ 02'652 ^{''} ; E 90 ⁰ 08'409 ^{''}	--	--	4	4
70.	Purabhita	N 26 ⁰ 02'268 ^{''} ; E 90 ⁰ 06'674 ^{''}	--	--	1	1
71.	Fakirganj	N 26 ⁰ 02'508 ^{''} ; E 90 ⁰ 02'877 ^{''}	--	--	2	2
72.	Dhubri	N 26 ⁰ 01'149 ^{''} ; E 89 ⁰ 59'756 ^{''}	--	--	1	1
73.		N 26 ⁰ 00'742 ^{''} ; E 89 ⁰ 59'342 ^{''}	--	1	4	5
74.	Birsing Char	N 26 ⁰ 00'503 ^{''} ; E 89 ⁰ 58'797 ^{''}	--	--	1	1
75.	Amina Char	N 25 ⁰ 59'960 ^{''} ; E 89 ⁰ 54'314 ^{''}	--	1	--	1
76.	Bankshi Char	N 25 ⁰ 57'555 ^{''} ; E 89 ⁰ 58'347 ^{''}	--	--	1	1
77.		N 25 ⁰ 56'614 ^{''} ; E 89 ⁰ 58'129 ^{''}	--	--	2	2
78.	Bandaralga	N 25 ⁰ 55'808 ^{''} ; E 89 ⁰ 57'320 ^{''}	--	--	1	1
79.	Akbar Char	N 25 ⁰ 53'855 ^{''} ; E 89 ⁰ 56'397 ^{''}	--	2	5	7
80.	Baraikandi Char	N 25 ⁰ 52'427 ^{''} ; E 89 ⁰ 56'193 ^{''}	--	--	3	3
81.	Haddi Char	N 25 ⁰ 50'973 ^{''} ; E 89 ⁰ 55'610 ^{''}	--	1	--	1
82.	Sukh Char	N 25 ⁰ 46'168 ^{''} ; E 89 ⁰ 53'106 ^{''}	--	--	1	1
Sub total			1	6	34	41
Total			27	32	138	197

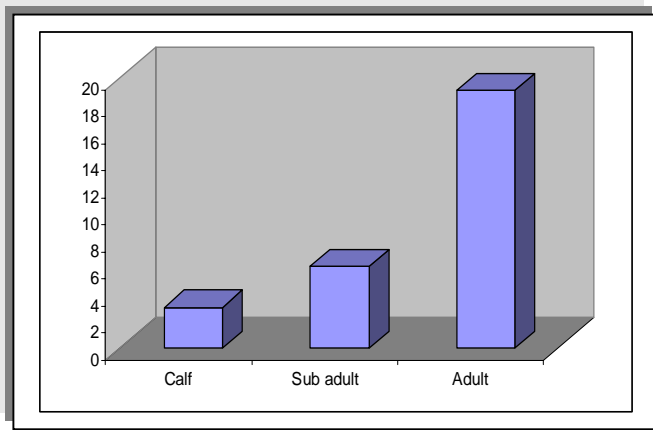


Plate-10: Population structure of dolphins in Brahmaputra River in Sector-I

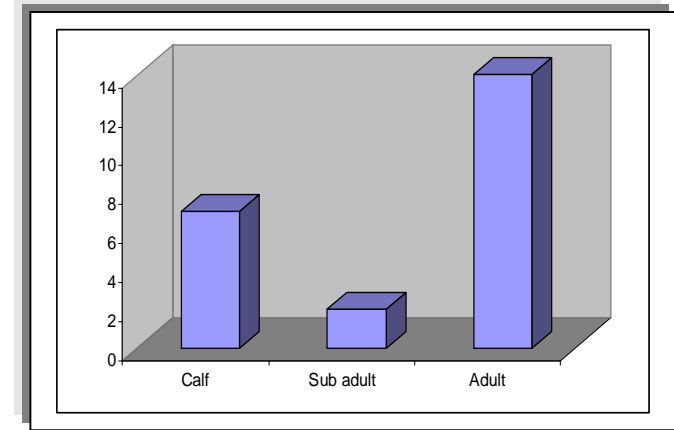
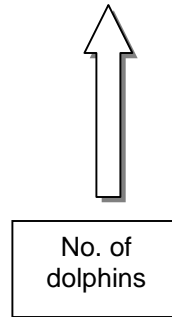


Plate-11: Population structure of dolphins in Brahmaputra River in Sector-II

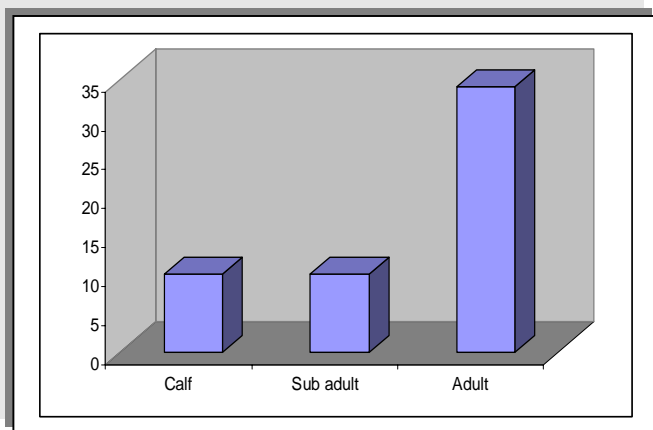


Plate-12: Population structure of dolphins in Brahmaputra River in Sector-III

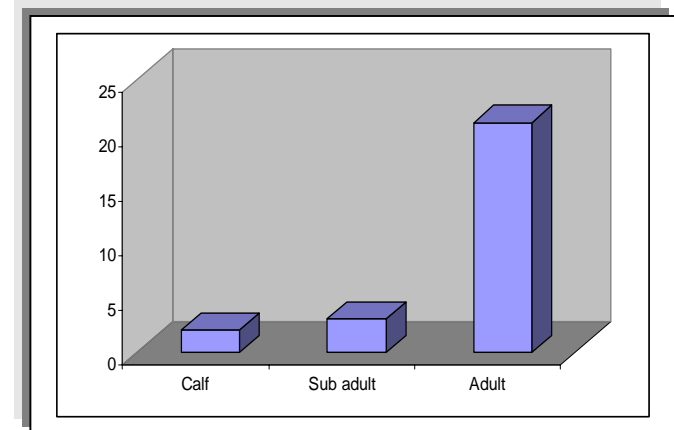
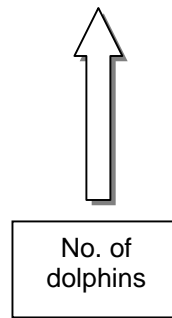


Plate-13: Population structure of dolphins in Brahmaputra River in Sector-IV

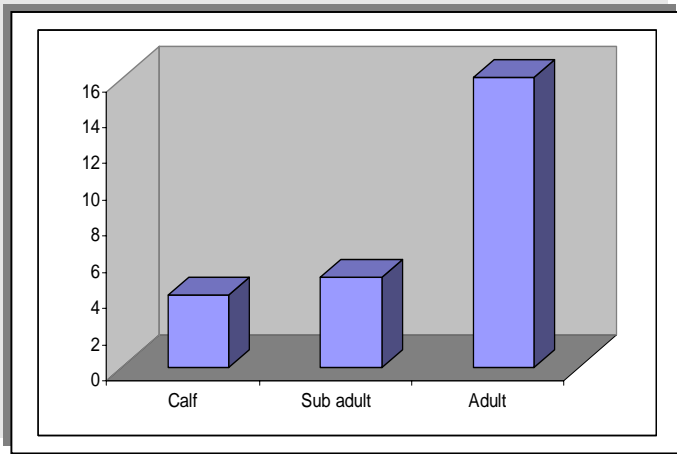


Plate-14: Population structure of dolphins in Brahmaputra River in Sector-V

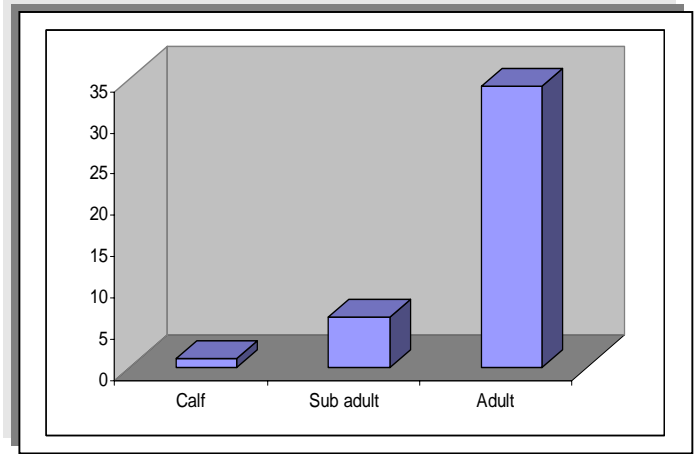
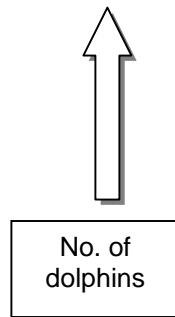


Plate-15: Population structure of dolphins in Brahmaputra River in Sector-VI

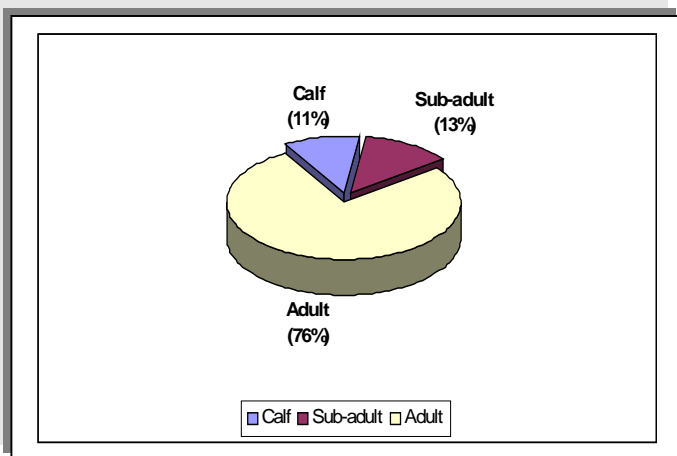


Plate-16: Population structure of dolphins in Brahmaputra River in general

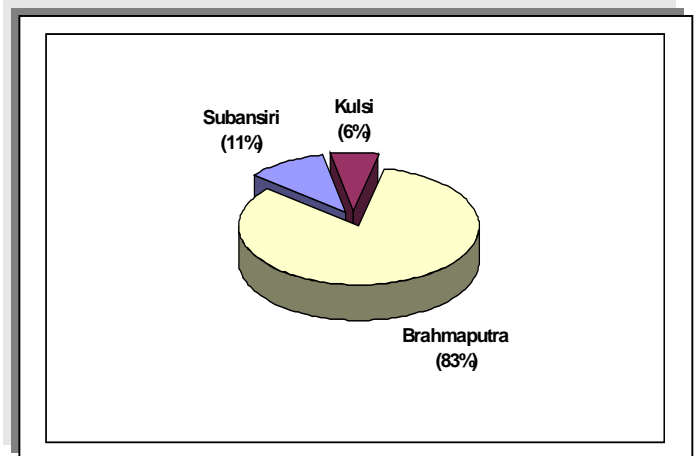


Plate-17: Comparative population distribution of dolphins in Brahmaputra Valley

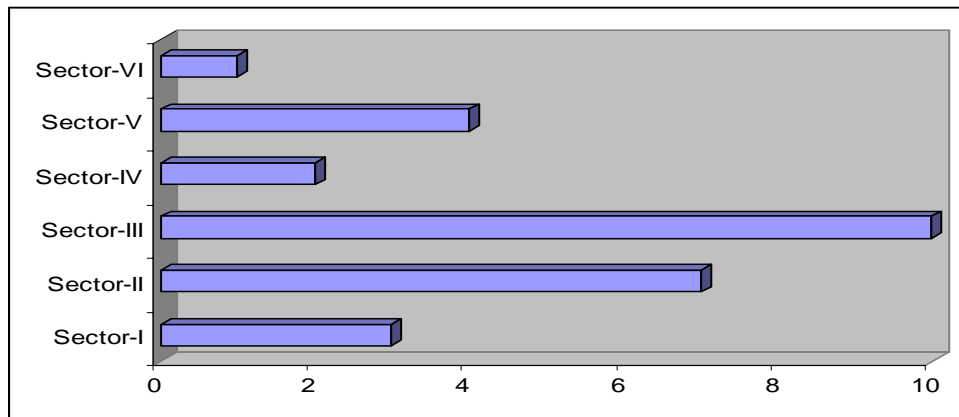


Plate-18: Comparative occurrence of dolphin calves in different sectors of Brahmaputra River

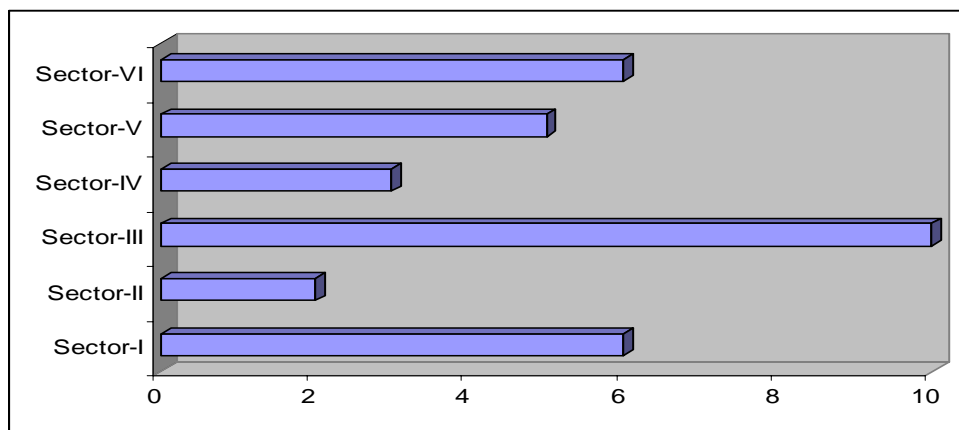


Plate-19: Comparative occurrence of dolphin sub-adults in different sectors of Brahmaputra River

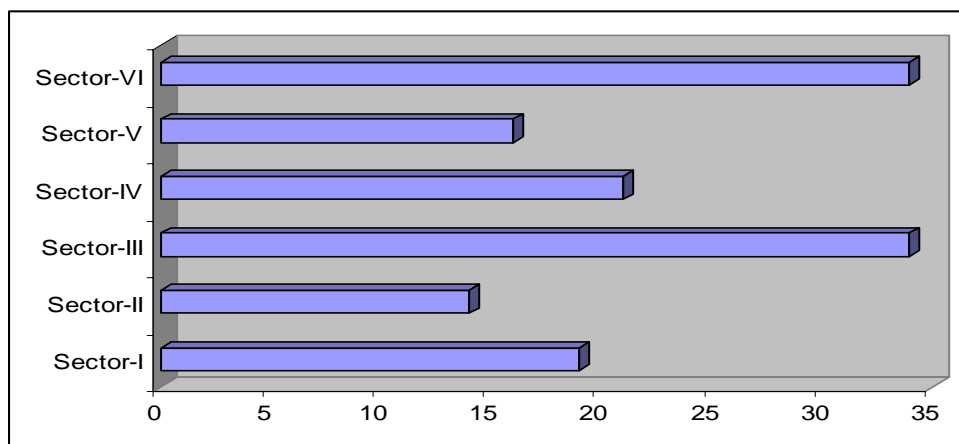


Plate-20: Comparative occurrence of dolphin adults in different sectors of Brahmaputra River

Habitat ecology:

In Subansiri River, most of the sightings were made in the river meanderings (42%), followed by river mouths or confluences (35%), near the downstream of the junctions of two currents flowing through the mid-channel islands, termed as mid-channel island (15%) and rest (8%) in the wide single channel (Plate-21). In Kulsī River, all the dolphins were sighted in river meanderings. In Brahmaputra River, most of the dolphins were sighted in river confluences or tributary junctions (32%), followed by near the mid-channel islands (26%), river meandering (25%) and wide single channels (17%) (Plate-22).

In Subansiri River, the dolphins were observed in a depth range 3.3 - 17.1 m (average 7.47 m \pm 3.99) (Plate-23), whereas in Kulsī River it was in a depth range from 2.2 to 7.8 m. (average 4.45 m \pm 2.42) (Plate-24). On the otherhand, in Brahmaputra River, the dolphin groups were found in a depth range from 2.2 m to 11.3 m in Sector-I (average 5.07 m \pm 2.58) (Plate-25), 3.5 to 10.3 m (average 6.14 m \pm 2.25) in Sector-II (Plate-26), 2.2 to 15.6 m (average 5.84 m \pm 3.08) in Sector-III (Plate-27), 4.4 to 21 m (average 10.8 m \pm 8.21) in Sector-IV (Plate-28), 5.9 to 32 m (average 8.26 m \pm 3.08) in Sector-V (Plate-29) and 4.4 to 15.6 m (average 7.82 m \pm 3.10) in Sector-VI (Plate-30). As a whole, maximum (39%) dolphin distribution was recorded in a depth range of 3.1-6 m, followed by 6.1-9 m (36%), 9.1-12 m (11%), above 12 m (8%) and 1-3 m (6%) in Brahmaputra River (Plate-31).

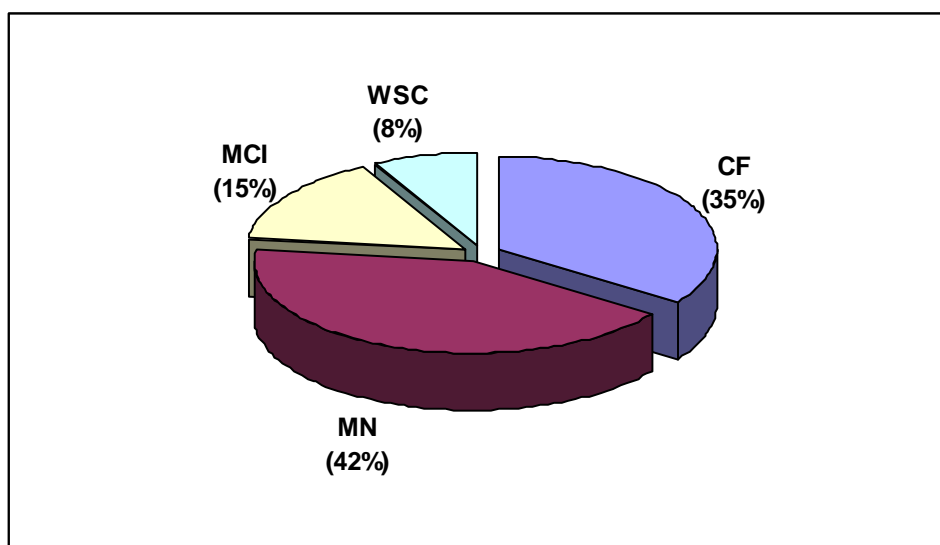


Plate-21: Habitat preference of dolphins in Subansiri River

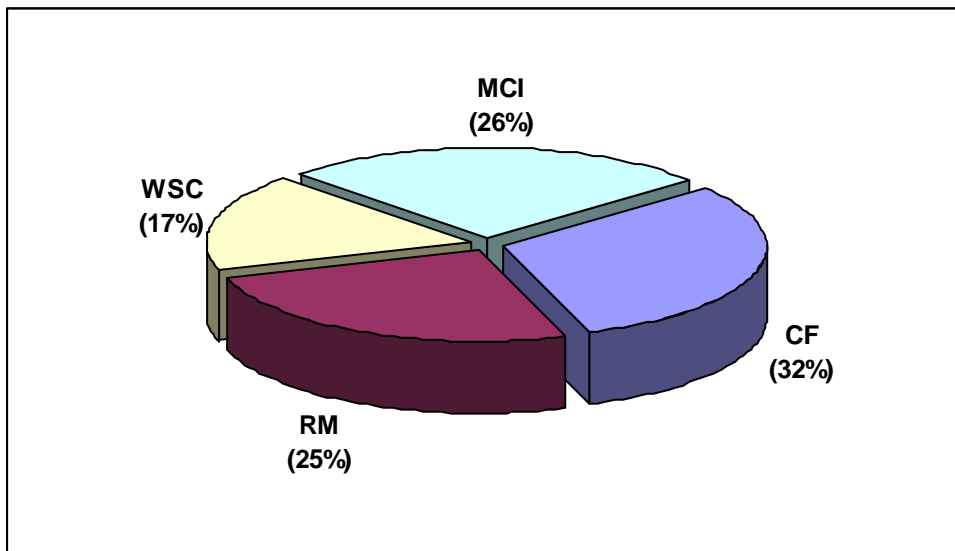


Plate-22: Habitat preference of dolphins in Brahmaputra River

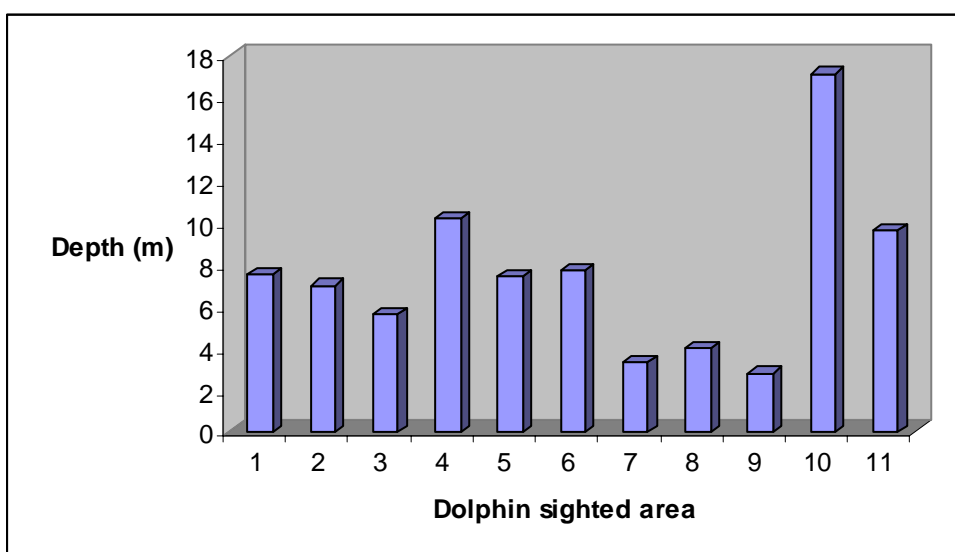


Plate-23: Depth preference of dolphin groups recorded in Subansiri River

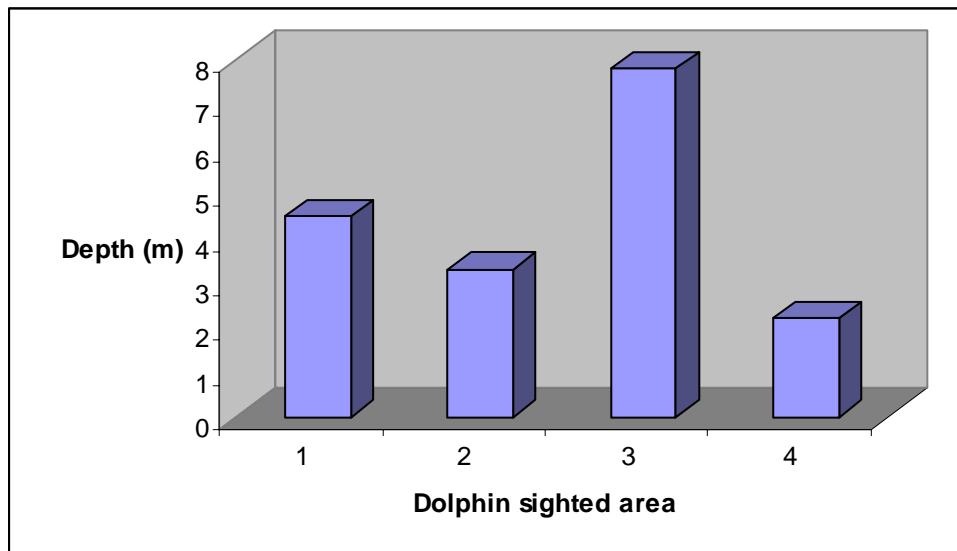


Plate-24: Depth preference of dolphin groups recorded in Kuls River

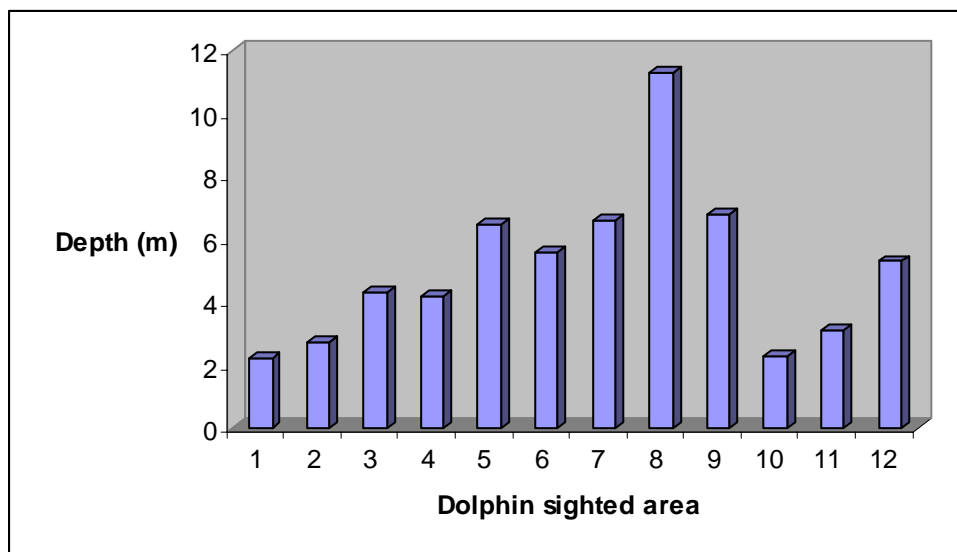


Plate-25: Depth preference of dolphin groups recorded in Sector-I of Brahmaputra River

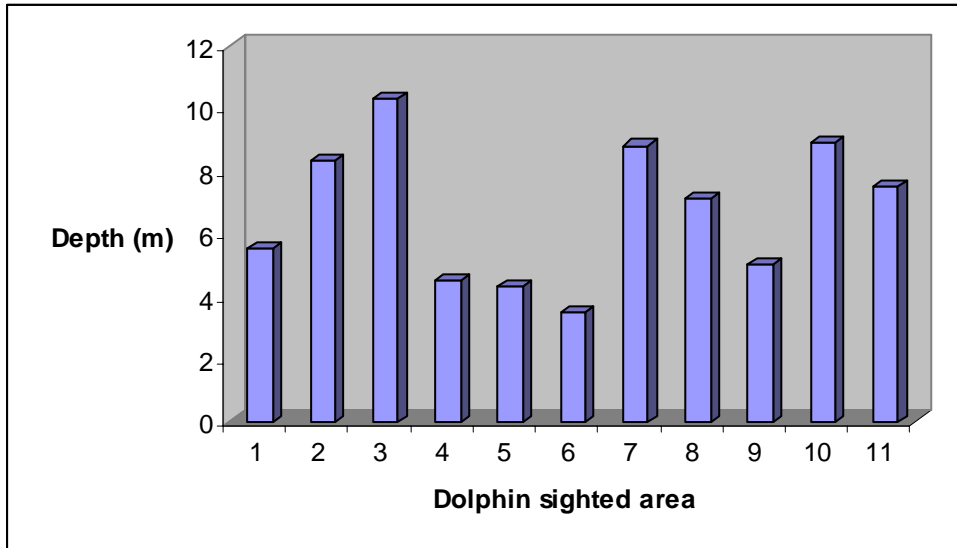


Plate-26: Depth preference of dolphin groups recorded in Sector-II of Brahmaputra River

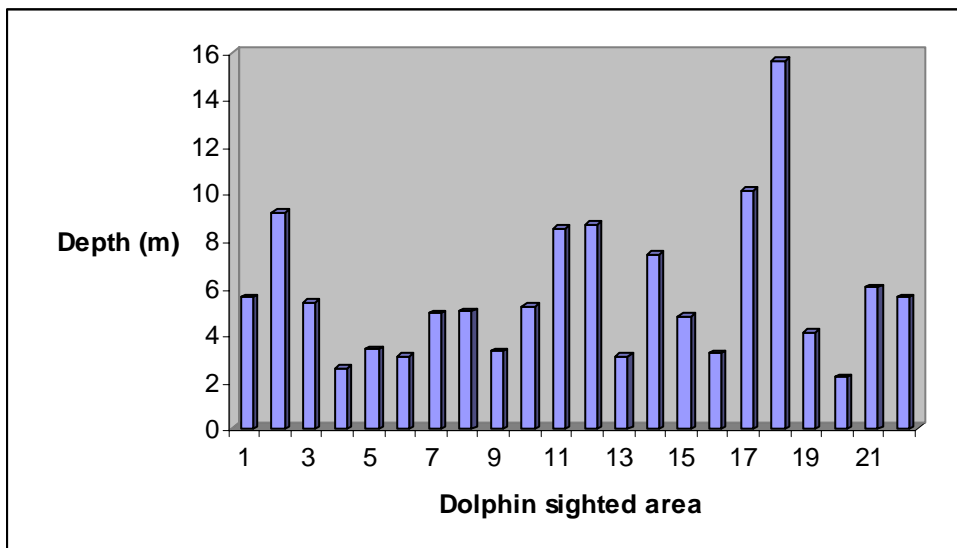


Plate-27: Depth preference of dolphin groups recorded in Sector-III of Brahmaputra River

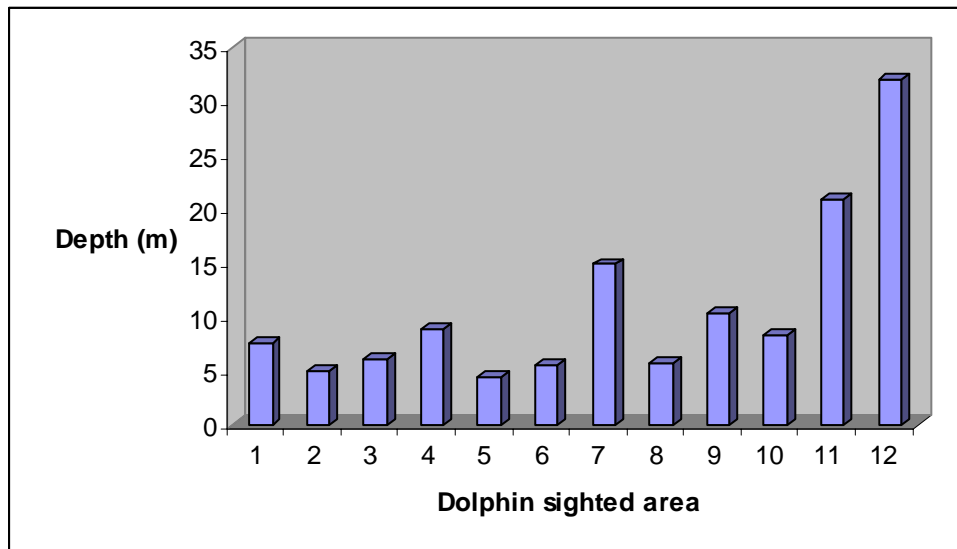


Plate-28: Depth preference of dolphin groups recorded in Sector-IV of Brahmaputra River

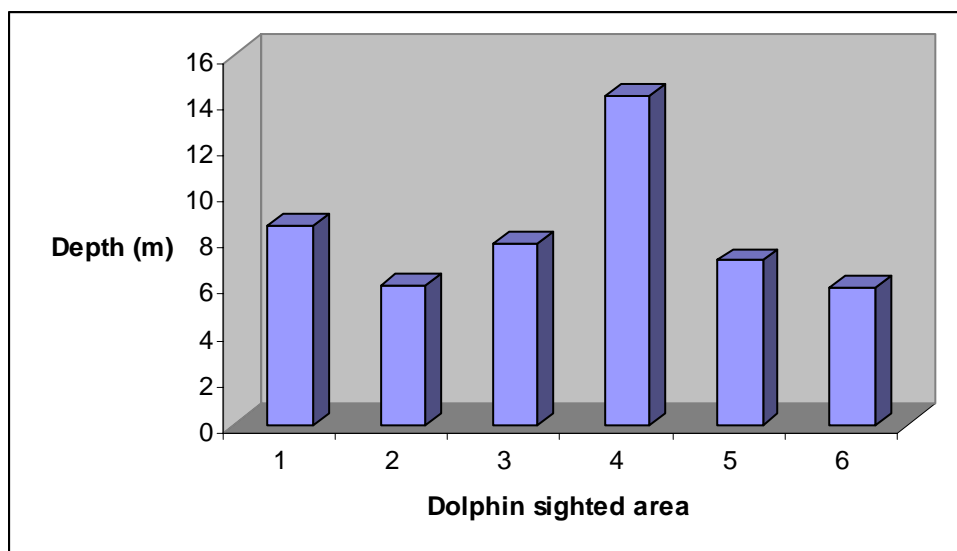


Plate-29: Depth preference of dolphin groups recorded in Sector-V of Brahmaputra River

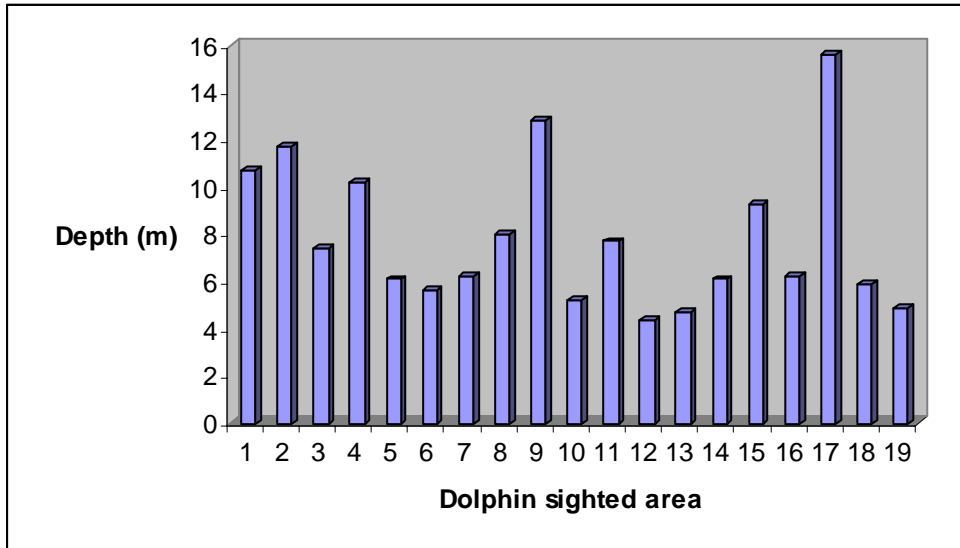


Plate-30: Depth preference of dolphin groups recorded in Sector-VI of Brahmaputra River

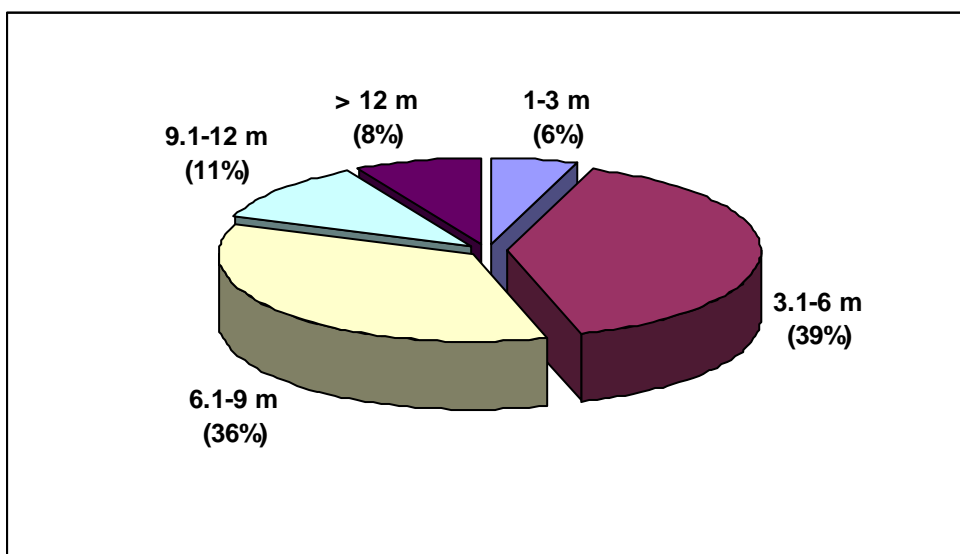


Plate-31: Depth preference of dolphin sub-groups in Brahmaputra River

Objective-3: Threats to the dolphins and their habitats

Altogether 28 numbers of dolphins recorded as being killed during 2004-2005, which were the victims of both accidental as well as intentional killing. Majority (89.3%) of them was the victim of fishing nets (Plate-32 to 37), particularly gill net entangling (Plate-38) and by poaching (10.7%). Details of the recorded death have been shown in Table-4. However, due to huge geographic area in comparison to our survey time, there is a chance of more unrecorded (dolphin) deaths during the survey period. Therefore, this death record (28 deaths) can be refer as the minimum number of dolphin death during the year 2004-05.

Dolphin oil has a high market value (Rs.600/- to Rs. 1,000/-) for its wide utilization being as medicinal as well as fish bait throughout the remote riverine areas of Brahmaputra Valley (Plate-39 to 41). Besides, instead of poaching, killing of dolphin through gill net utilization is not only an easier process, but also a less punishable process from legal point of view. Since most of the concerned people are aware about the legal actions against dolphin poaching and most of the operated areas are so remote that the legal actions against these crimes are quite impossible due to weak management infrastructure, therefore, dolphin killing is going on in these areas at a high rate.

There was no poaching or accidental killing record of dolphins in Kulsī River. However, high rate of sand mining was observed as the major disturbing factors to the dolphins of this river (Plate-42).

Besides the by catch and poaching, the ongoing water development projects in the upstream of Suabnsiri River is identified as the possible future threat to the dolphins of Subansiri River (Plate-43).

Table-4: Mortality record of dolphin in Brahmaputra River during 2004-2005

Area	Specific area	Location	Type of death	No. of death
Sector-I	Tengabari	N 27 ⁰ 34'; E 95 ⁰ 10'	Gill net entangling	2
	Rohmorria	N 27 ⁰ 31'; E 94 ⁰ 59'	-do-	1
Sector-II	Apholamukh	N 27 ⁰ 02'; E 94 ⁰ 31'	-do-	1
	Dikhowmukh	N 27 ⁰ 59'; E 94 ⁰ 26'	-do-	4
	Jhanjimukh	N 26 ⁰ 55'; E 94 ⁰ 21'	-do-	2
Sector-III	Moderguri	N 26 ⁰ 50'; E 94 ⁰ 00'	Poaching	1
	Sikarighat	N 26 ⁰ 43'; E 93 ⁰ 39'	Gill net entangling	1
Sector-IV	Gabhorumukh	N 26 ⁰ 36'; E 92 ⁰ 38'	-do-	1
	Lonke Char	N 26 ⁰ 34'; E 92 ⁰ 40'	-do-	1
	Kajia Char	N 26 ⁰ 18'; E 92 ⁰ 01'	-do-	1
	Chandrapur	N 26 ⁰ 14'; E 92 ⁰ 55'	-do-	1
	Kiriakata	N 26 ⁰ 15'; E 91 ⁰ 50'	-do-	1
Sector-V	Bohori	N 26 ⁰ 14'; E 91 ⁰ 08'	-do-	1
	Nirola Char	N 26 ⁰ 14'; E 91 ⁰ 04'	Poaching	1
	Sewra Char	N 26 ⁰ 14'; E 90 ⁰ 50'	Gill net entangling	1
	Uzir Char	N 26 ⁰ 11'; E 90 ⁰ 41'	-do-	1
Sector-VI	Balapara	N 26 ⁰ 13'; E 90 ⁰ 32'	-do-	1
	Tilapara	N 26 ⁰ 10'; E 90 ⁰ 20'	-do-	1
	Burha-burhi	N 26 ⁰ 02'; E 90 ⁰ 08'	-do-	1
	Solokhurachar	N 26 ⁰ 02'; E 90 ⁰ 02'	-do-	1
	Vasani char	N 26 ⁰ 00'; E 89 ⁰ 57'	-do-	1
	Bailachar	N 25 ⁰ 56'; E 89 ⁰ 58'	Poaching	1
	Haddi Char	N 25 ⁰ 50'; E 89 ⁰ 55'	Gill net entangling	1
Total				28



Plate-32: Bagarimara Jal (a type of gill net) is commonly involved in dolphin by catch



Plate-33: Mosquito net, a very fine mesh-sized gill net destroys the entire dolphin food source at once in the operated area



Plate-34: These types of gill nets usually used in Eastern Assam



Plate-35: Borjal usually blocks the dolphin passage in small streams



Plate-36: A gill net in an important dolphin habitat near Dibru-Saikhowa National Park



Plate-37: New generation gill net practitioners



Plate-38: A victim (dolphin) of by catch in Upper Brahmaputra Basin during July, 2005



Plate-39: Dolphin oil is being extracted from the body parts of dolphin



Plate-40: The dolphin oil is used as fish baits



Plate-41: Fishermen using dolphin oil as fish baits near Dhubri



Plate-42: High rate of sand mining is a major disturbing factor to the dolphins of Kushi River



Plate-43: The water development project at Garukamukh area will be a major threat to the dolphins of Subansiri River

DISCUSSION

Due to highly threatened status, the action plan of IUCN/SSC Cetacean Specialist Group calls attention to the need for range-wide population assessments in support of conservation efforts for the four freshwater species of dolphin, including the Gangetic dolphin (Reeves & Leatherwood, 1994). Since the Brahmaputra river system within Assam is one of the major habitats of Gangetic dolphin, therefore, this survey was quite important from the conservation point of view. This survey resulted into the existence of altogether 238 dolphins in the entire Brahmaputra river system, with 197 in Brahmaputra River and rest 41 in two tributaries. The spreading of this entire population is not uniform throughout the entire river system; rather they are distributed as sub-groups with a group size from 1 to 8, in 97 locations of the valley. Since these 97 locations are very important from the dolphin habitat occurrence point of view, therefore, they can be termed as Important Dolphin Habitats (IDHs). This project identifies altogether 97 Important Dolphin Habitats in Brahmaputra Valley. Out of these, 15 IDHs are distributed in two tributaries, viz., River Subansiri and River Kulsi. Rest 82 IDHs are in Brahmaputra River.

The first ever survey on the Gangetic dolphin in Brahmaputra river system was conducted by Mohan *et al.* (1997) in 1992-93. Although two other subsequent surveys were also conducted by Dolphin Conservation Society in 1997 and 2002 with the collaboration with WWF-India (pers. comm. with S. P. Bairagi), since they were not published, and Mohan *et al.* (1997) gave a detail account of their sighting record, therefore, here we are discussing our survey findings in context of Mohan *et al.* (1997) to see the population change within last 12 years. Mohan *et al.* (1997) surveyed the main stream of Brahmaputra River from 15th February to 18th March, 1993 and they observed 266 dolphins in the entire river, from Sadiya (Assam-Arunachal border) to South Salmara (India-Bangladesh border). In that survey, they recorded 28 dolphins in Sector-I, 45 dolphins in Sector-II, 34 dolphins in Sector-III, 58 dolphins in Sector-IV, 54 dolphins in Sector-V and 47 dolphins in Sector-VI. After 12 years gap, we recorded 28, 23, 54, 26, 25 and 41 dolphins in the respective sectors. Mohan *et al.* (1997) encountered maximum number of dolphins in the river stretch from Tezpur to Guwahati, whereas we encountered maximum dolphins in the stretch from Dhansirimukh to Silghat. Majority (74%) of the dolphins within this stretch are within Kaziranga National Park. This National Park is one of the best protected areas in India. During the survey we recorded no dolphin killing (poaching/accidental killing) within this stretch and minimum number of gill net operation within this stretch. Besides, we encountered maximum fish abundance (through Fish Finder) within this stretch, high abundance of favourable microhabitats

(confluences, river meanderings, mid-channel islands, wide single channel) and comparatively high water depth (average $5.92 \text{ m} \pm 3.32$), within this stretch. For these reasons, we encountered the maximum number of dolphins within this stretch. Therefore, after analyzing both of the surveys, we can confirm that the major dolphin populations within Brahmaputra Valley are now within Nimatighat to Silghat, instead of Tezpur to Guwahati as recorded in 1993. However, Mohan *et al.* (1997) did not explain the reason behind their highest dolphin encounter rate in the river stretch in between Tezpur and Guwahati.

After comparing our collected data with the data of 1993 of Mohan *et al.* (1997), it can be determined from the different age class point of view that after 12 years, the number of adults is increasing by 26.6% in Sector-I; decreasing through maximum of 50% in Sector-V, followed by 40% decreasing in Sector-IV, 39% in Sector-II, 33.3% in Sector-III and 3% in Sector-VI (Plate-44); number of sub-adults are decreasing in all the sectors with a maximum decline by 77% in Sector-IV, followed by 75% in Sector-V, 58.8% in Sector-II, 28.6% in Sector-III, 25% in Sector-VI and 14.3% in Sector-I (Plate-45); number of calves are increasing by 100% in Sector-III & V and decreasing by 80% in Sector-IV, 75% in Sector-VI, 60% in Sector-II and 50% in Sector-I (Plate-46). In sector-wise analysis, the dolphin population within last 12 years is decreasing by 55% in Sector-IV, 53.7% in Sector-V, 48.9% in Sector-II, 12.7% in Sector-VI, remain same in Sector-I and an interesting increase of 58.8% in Sector-III (Plate-47 to 52).

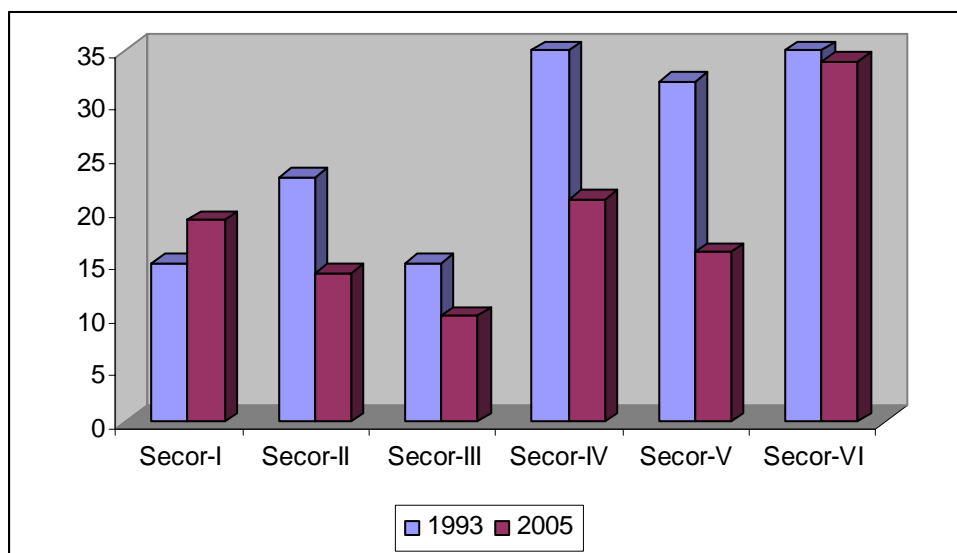


Plate-44: A comparative analysis of adult dolphin population of Brahmaputra River in 1993- 2005

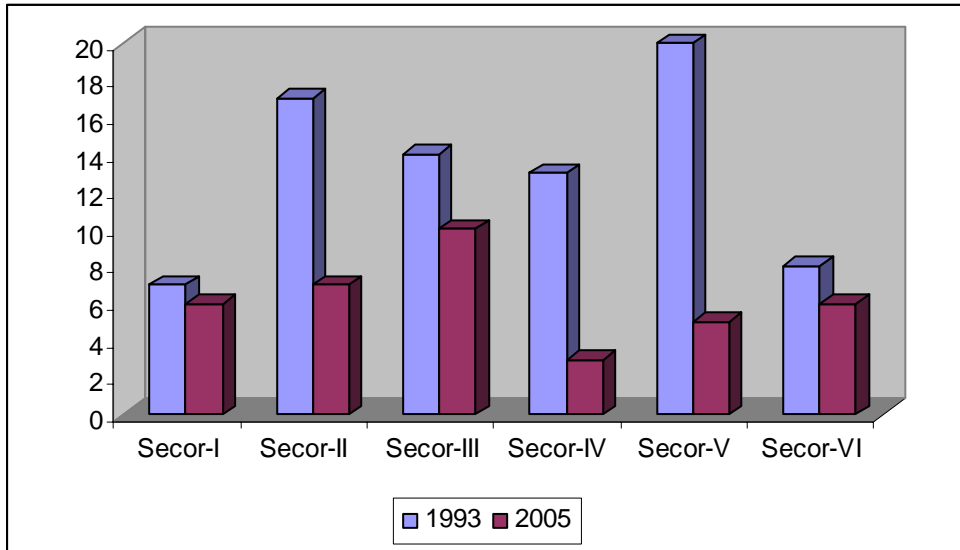


Plate-45: A comparative analysis of sub-adult dolphin population of Brahmaputra River in 1993 - 2005

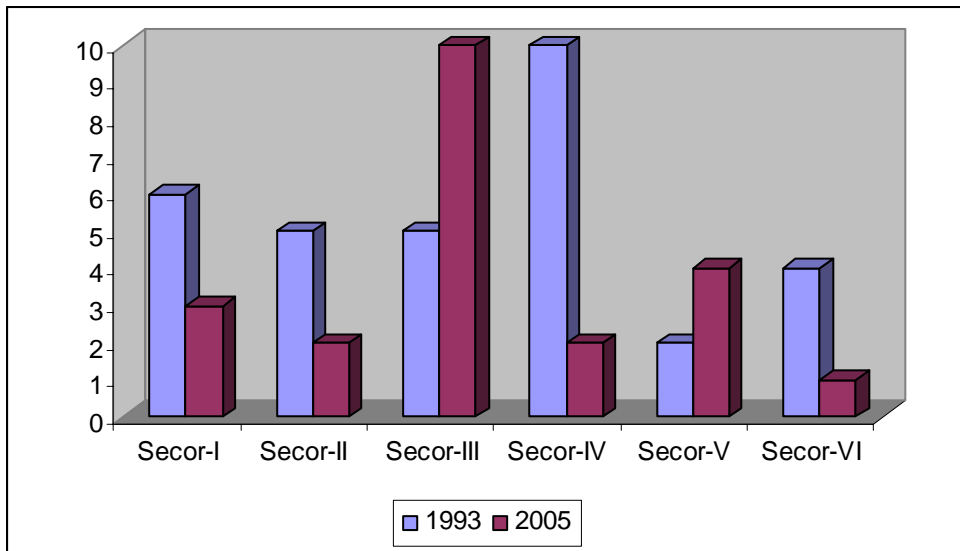


Plate-46: A comparative analysis of calf dolphin population of Brahmaputra River in 1993 - 2005

Mohan *et al.* (1998) recorded 24 dolphins (five calves, eight sub-adults, 11 adults) in Kulsī River in their survey during 1992. However, they recorded 17 (three calves, eight sub-adults, six adults), 14 (three calves, seven sub-adults, four adults) and 12 (two calves, six sub-adults, four adults) dolphins in 1993, 1994 and 1995 respectively with a decrease of population by 29% in 1992-93, 17.6% in 1993-94 and 14.3% in 1994-95. However, we recorded 15 dolphins in the same river stretch with an increase of population by 25% over 10 years (Plate-53). Increasing of dolphin population by 3 individual within a time span of 10 years is important from the view of a small river like Kulsī, which holds an overall population of only 15 individuals in a stretch of around 30 km.

Due to smoothening of bottom fauna and lowering of productivity of the river by blocking the sun-light and preventing photosynthesis, Mohan *et al.* (1998) reported the sand mining as the greatest threat to the dolphins of Kulsī River. Based on the fact of population declining from 1992 to 1995 at a rate of 14-29%, the same workers also commented that the population would not sustain in near future. However, during our survey we recorded an increase of population by 25% within last 10 years as mentioned above. One strong reason may be due to increase of awareness by the local people. The local communities of Kukurmara and other fringe villages of Kulsī River strongly believe that killing of dolphin will be harmful to their families. This was reported by Mohan *et al.* (1997 & 1998) and this traditional belief is still in the same depth during our survey also. On the otherhand, this place is hardly 40 kms away from Guwahati, the capital city of Assam. Due to extensive publicity by local media over last 12 years, the Kulsī River is now a tourist attraction for dolphin observation. A good number of tourist visit this area every year, which directly increasing the conservation awareness among local people. Moreover, the major livelihood of the fringe villagers of this area is sand mining, not on fisheries, as is going on other dolphin habitats of Assam. Each family earns an average of Rs. 200/-300/- per day from the sand mining. Therefore, they need not to be dependent on fish fauna of the river, which on the otherhand is helping in food abundance of the dolphins of the river. Besides, although the high rate of sand mining is one of the major disturbing factors to the dolphins of this river, still this sand mining has been maintaining the required depth pattern of the river stretch. All these factors have been helping in the population increase by 25% over the last 10 years (Fig-54). However, for a more concrete decision we are recommending more in-depth study on these issues and control rate of sand mining for a better habitat of the concerned dolphin population.

Mohan *et al.* (1997) recorded altogether 25 dolphins in Subansiri River. We recorded 26 dolphins in the same river in 108 km long stretch, from Sawoldhuwaghat to

Jamugurighat (the Subansirimukh). However, Mohan *et al.* (1997) surveyed the river stretch within Dikrangmukh and Subansirimukh. Since the Dikrangmukh is about 78 km downstream from Sawoldhuwaghat, therefore, Mohan *et al.* (1997) surveyed only 30 km stretch of Subansiri River during their survey in 1992-93. Occurrence of 25 dolphins in 30 km indicates an encounter rate of one dolphin per 1.2 km in 1992-93, whereas in 2005 it is 1 dolphin per 4.15 km. Although Mohan *et al.* (1997) gave a detail account of dolphin distribution and population status in Brahmaputra and Kulsi River, but they didn't mention very clearly the same aspects in Subansiri River. Still they mention that large numbers of dolphins were died during the 1950 great earthquake and local Missing tribe people killed the dolphins for meat, which often were brought to the Jengraimukh fish market.

Mohan *et al.* (1997) reported the occurrence of one large dolphin in the Mihi Beel of Kaziranga National Park. But we did not observe any dolphin there. Besides, collected secondary information also confirmed no existence of dolphins in this wetland within last 20 years.

Biswas & Baruah (2000) reported altogether 38, 28 and 24 dolphins in 1992-93, 1995-96 and 1997-98 in the Brahmaputra river stretch from Saikhowa Ghat and Nimatighat, with a declining of encounter rate from 0.25 km^{-1} to 0.09 km^{-1} within a span of five years. Mohan *et al.* (1997) recorded altogether 73 dolphins in this river stretch, whereas we recorded 51 dolphins in the same river stretch. Besides, Wakid (*in press*) recorded 16 dolphins within Saikhowaghat and Balijan in 2003-2004, whereas in this last survey the same worker recorded 12 dolphins in the same stretch with a decrease of population by 25%. If we compare the findings of Mohan *et al.* (1997) of 1993, Biswas & Baruah (2000) of 1997-98 and our survey, then it can be concluded that within time span of 5 years from 1993 to 1997-98, the dolphin population in this stretch of Brahmaputra river was decreased by 67% and within the span of another 7 years the population is increased by 112.5% in the same river stretch. Moreover, Biswas & Baruah (2000) recorded about 40 dolphins in between Saikhowaghat to Dhansirimukh, whereas we have recorded 65 dolphins in the same river stretch, an increase of dolphin population by 62.5% within a gap of about 14 years. Therefore, the population assessment made by Biswas & Baruah (2000) in upper stretches of Brahmaputra basin is not being supported either by Mohan *et al.* (1997), Wakid (2005) or this survey, which may be due to different in survey methodology.

Kasuya & Haque (1972) reported the occurrence of dolphins in Bangladesh immediately in the downstream of shallow areas or tributary junction. Smith (1993) recorded the dolphins of Karnali river most often in "primary habitats" where convergent

streams created eddy counter-currents in the mainstream flow and less often in “marginal habitats” where sharp upstream bends created a similar, but smaller counter-current. In the single narrow channel of the Kushiyara River, Bangladesh, Smith *et al.* (1998) observed all dolphins located within the boundaries of obvious counter-currents, with large counter-currents containing more dolphins than small ones. In Ganges river system, Sinha *et al.* (2000) reported high concentration of dolphins at the convergences of Yamuna, Tons, Ghagara, Gandak and Kosi River with Ganges; below sharp meanders and mid-channel islands scattered throughout the river course. Mohan *et al.* (1997) observed that majority (70%) of dolphins of Brahmaputra River was solitary individuals and only 2% of the entire population remained in a group of more than 10 individuals. These groups concentrated at the river confluences of the tributaries with fast current. Biswas & Baruah (2000) reported the river meandering and river confluences as the favourable microhabitats of dolphins in Eastern Assam. In our survey in Subansiri River, we have observed major dolphin aggregation in river meanderings and at the few confluences of small streams. On the otherhand, in Brahmaputra River, the dolphins are found with major aggregation just in the downstream of confluences or junctions of major tributaries, viz., Noa-Dehing, Dibang, Lohit, Burhi-Dehing, Subansiri, Disang, Dikhow, Jhanji, Dipholu, Dhansiri, Bharali, Kalang, Beki etc., river meanderings, just below the mid-channel island (locally called as Char or Chapori) and in the wide single channels. Since fish is the main food for dolphins (Sinha *et al.* 1993) and the confluences, river meanderings, sand bars are favourable microhabitats for fishes (Pilleri 1970, Sinha 1997, Biswas & Baruah 2000), therefore, piscivorous dolphins occur in large numbers in these microhabitats.

Mohan *et al.* (1997) recorded 40% of their sightings in 3-4.9 m water depth, 27% in 7-8.9 m, 18% in 5-6.9 m, 12% in 1-2.9 m and 3% in 9-15.9 m water depth. In comparison to that depth range, we recorded maximum (37%) dolphin occurrence in a depth range of 5-6.9 m, followed by 7-8.9 m (24%), 3-4.9 m (18%), 9-32.9 m (16%) and 1-2.9 m (5%). Biswas & Baruah (2000) recorded maximum 42.05% of their sightings in a depth range of 3-5 m, 31.82% in 5-7 m, 11.36% in below 3 m and rest 14.7% in 5-7 m water depth in the river stretch from Saikhowa to Nimati. In the same range and by following the same depth range we recorded maximum (34%) dolphin distribution in a depth range of above 7m, followed by 3-5 m (29%), 5-7 m (25%) and below 3 m (12%). These differences in depth measurements may be due to difference in measurement methodologies; instead of manual depth measuring processes as followed by Mohan *et al.* (1997) and Biswas & Baruah (2000), we used modern Echo-sounder for measuring the depth and therefore, we can claim more accuracy in depth measuring.

Accidental killing of dolphin through gill net entanglement, poaching, population fragmentation through water development projects, water pollution and over-exploitation of fish fauna, are the major threatening factors for the Gangetic dolphin (Sinha *et al.*, 2000). Although the water development projects and water pollution are not the major threatening factors for the dolphins of Brahmaputra Valley, but the accidental killing and poaching are the major threats to here. Mohan *et al.* (1997) reported the killing of altogether 57 dolphins in Brahmaputra River in 1993-94, with a maximum (26.3%) in the river stretch between Malkachar to Goalpara, followed by Jorhat to Dibrugarh (21%), Tezpur to Jorhat & Dibrugarh to Sadiya (17.5% each), Goalpara to Guwahati & Guwahati to Tezpur (8.77% each). Mortality at a rate of about 60 dolphins annually in Brahmaputra Valley, Mohan *et al.* (1997) calculated that the entire population would last for another 38.5 years, whereas Biswas & Baruah (2000) calculated it around 40 years for the dolphins of upper Brahmaputra basin.

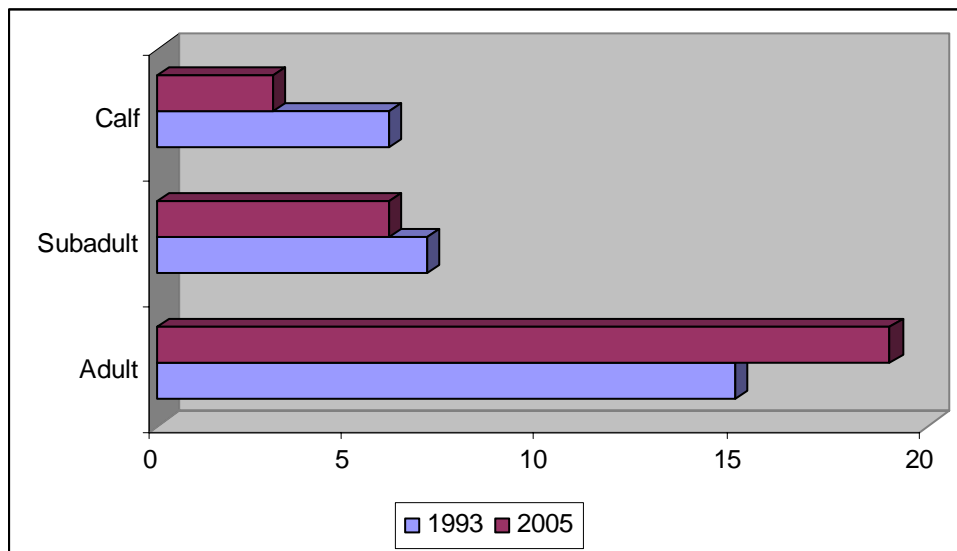


Plate-47: A comparative population structure in Sector-I during 1993-2005

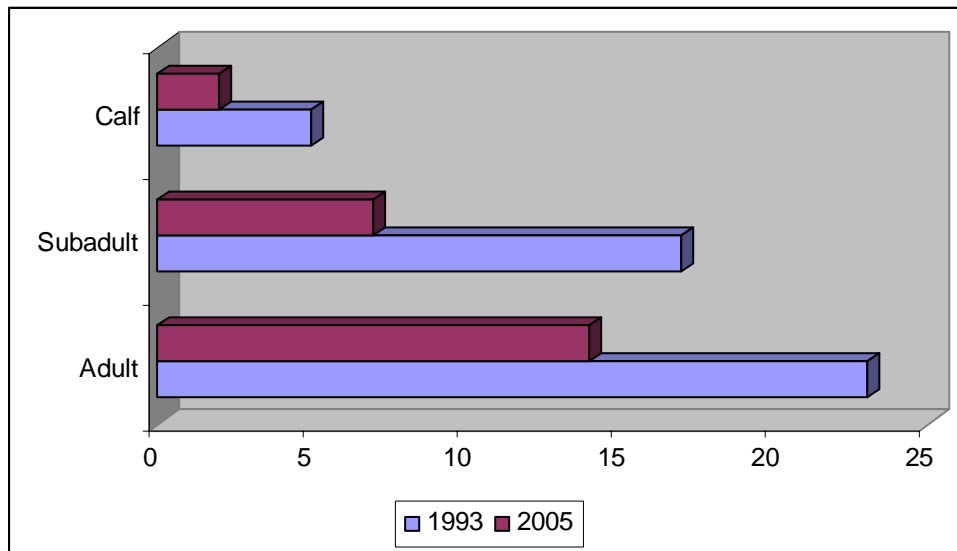


Plate-48: A comparative population structure in Sector-II during 1993-2005

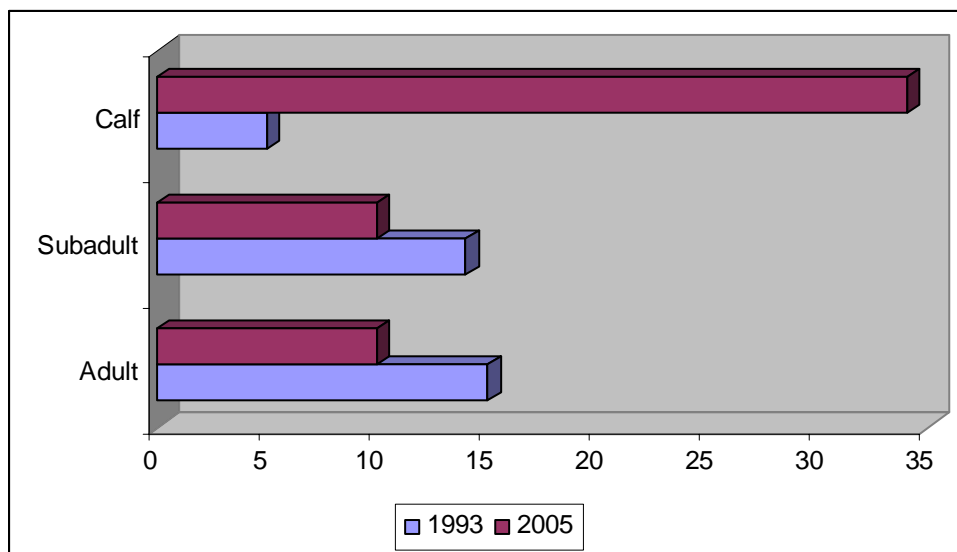


Plate-49: A comparative population structure in Sector-III during 1993-2005

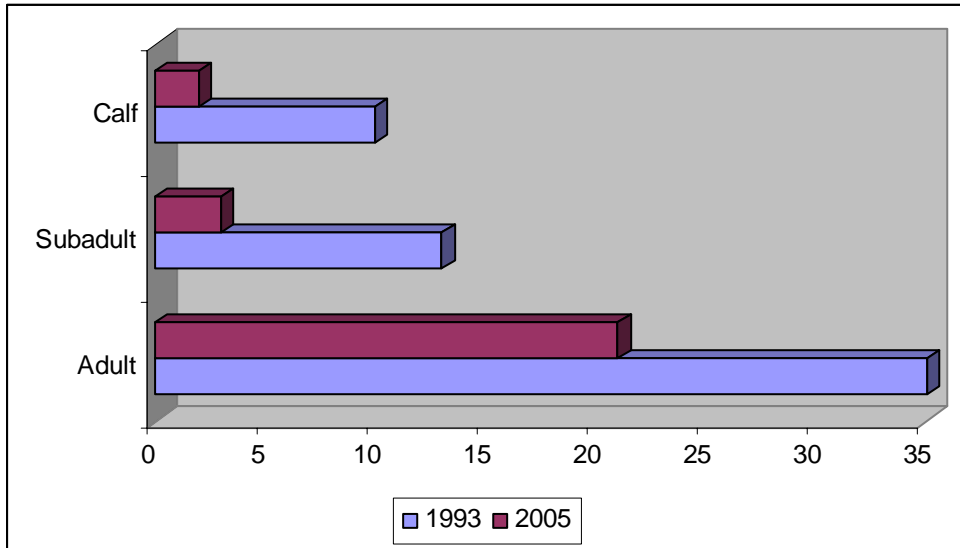


Plate-50: A comparative population structure in Sector-IV during 1993-2005

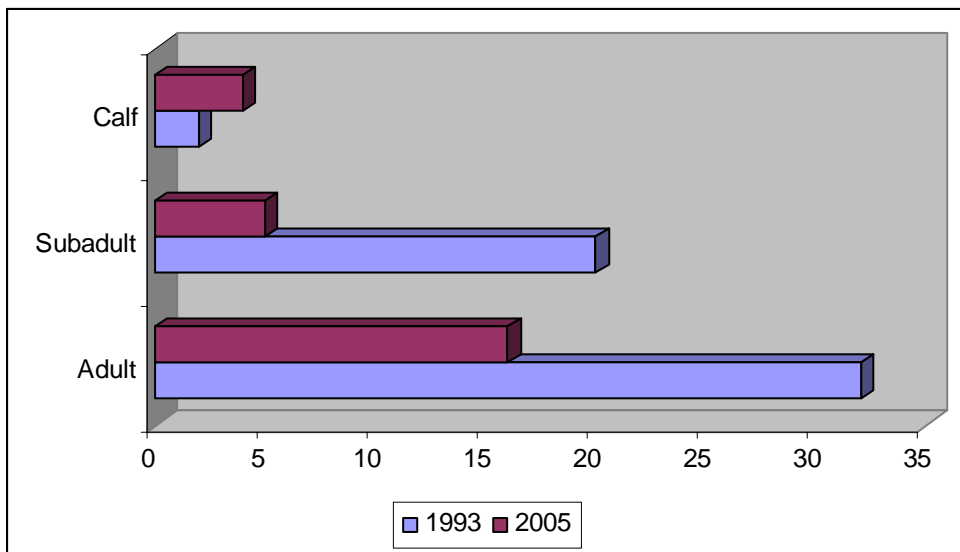


Plate-51: A comparative population structure in Sector-V during 1993-2005

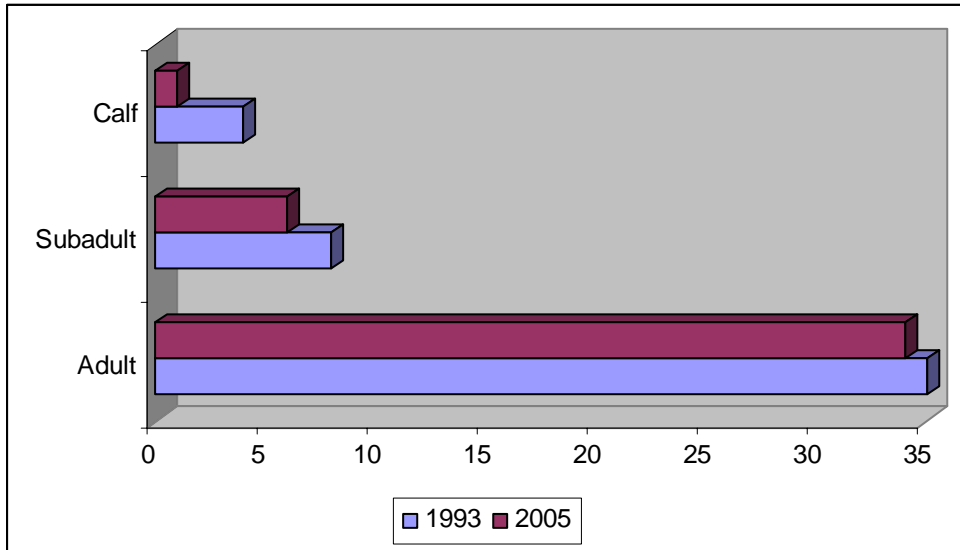


Plate-52: A comparative population structure in Sector-VI during 1993-2005

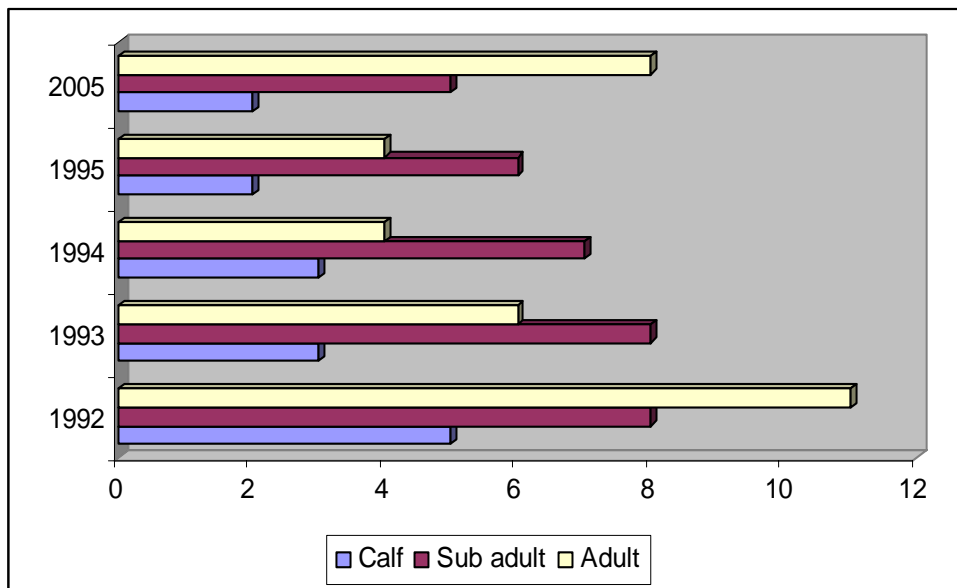


Plate-53: Comparative analysis of dolphin population of Kulsu River with the record of Mohan *et al.*, 1998 to with the latest survey conducted in 2005

The dolphins are killed for meat and oil. Missing tribes of Eastern Assam usually killed the dolphins mainly for meat, whereas in Western Assam, they are killed for oil, which is used for the preparation of bait for the catfish *Clupisoma garuam* (Mohan *et al.*, 1997; Bairagi, 1999). Besides, most of the fringe villagers of remote riverine area believe that dolphin oil has medicinal value and therefore, they use dolphin oil in different rheumatic disease (Wakid, 2005). Biswas & Baruah (2000) reported the killing of 4 dolphins within a span of 3 years through gill net entanglement in Brahmaputra River stretch within Eastern Assam. We have recorded the death of altogether 28 dolphins in 2004-2005, with a maximum (25%) in Sector-II & VI, followed by Sector-IV (17.9%), Sector-V (14.3%), Sector-I (10.7%) and Sector-III (7.1%). This least record in Sector-III is due to the high protection from Kaziranga National Park. Mortality at the rate of 28 dolphins per year indicates a survival span of 85.8 years for the dolphins of Brahmaputra River and 88.2 years for the entire dolphins of Brahmaputra Valley. Although Mohan *et al.* (1997) observed 266 dolphins during their survey, but they estimated the whole population around 400 with 48 calves, 116 sub-adults and 236 adults. In our survey we recorded 197 dolphins with 27 calves, 32 sub adults and 138 adults. According to this statistics, the population has been declining by 50.7% within a time span of 12 years with a declining of 43.7% calves, 72.4% sub-adults and 41.1% adults. If this rate of population declining will continue, we have to loose the entire population within next 12 years.

Although we are mentioning here the gill net entangling as accidental killing, however, during our investigation period we have observed that most of the killing through this process were of intentional, rather than accidental. Most of the dolphins were killed during premonsoon and monsoon season. During high flood season, most of the dolphins make local migration through the tributaries. When water recedes, the dolphins are coming back towards the main Brahmaputra River. During that time local fishermen use their gill nets mainly near the confluence area, in such a way that dolphins can't get escape from being entangled and usually the blocked dolphins get entangled. Since the dolphin oil has a market value and the killing area are so remote that no legal action against this crime is almost impossible due to weak management infrastructure, therefore, dolphin killing through this process is going on in these areas. In a small area like Dikhowmukh, four dolphins were the victim of this threat during May-June, 2005. In Jhanjimukh area, two dolphins were accidentally killed during September-October, 2004. After analyzing the weak management influence over these communities, we found that involvement of these communities in dolphin conservation is the only way to protect these dolphins from being killed. Based on this principle, we formed altogether five Dolphin Monitoring Units in collaboration with local communities. After providing enough

motivation through organizing several trainings to these Units, now dolphin killing is totally checked in these areas.

Water development projects have been directly affecting the ecology of the river systems throughout the southern Asia and all the three river dolphins in this region are directly affected through interrupted movements and habitat degradation (Reeves *et al.* 1991, Reeves & Leatherwood 1994, Smith *et al.* 1998, Ahmed 2000, Liu & Ding 2000, Sinha *et al.* 2000, Smith & Reeves 2000). At least 42 water development projects in India, 16 in Bangladesh and 8 projects in Nepal have affected the rivers that historically supported or currently support dolphin population (Smith *et al.* 2000). Although there is no such water development project till now in the main Brahmaputra River, still according to the Central Electricity Authority's "Preliminary ranking study of hydroelectric schemes" in the Brahmaputra basin published in October 2001, 22 schemes (each greater than 25 MW) have been identified in the Subansiri basin with a cumulative installed capacity of 15,191 MW (Vabolikar & Ahmed, 2003). Under this planning, currently the National Hydro Power Corporation (NHPC) is constructing the 116 m high dam on River Subansiri in Garukamukh area, which is in Assam-Arunachal Pradesh border and about 70 km away from Lakhimpur. The construction of this Dam on the River Subansiri will directly affect the dolphin population of the river through changing the whole ecological system of the river (Bairagi, 2003). However, an in-depth study is required to assess the impact and to take precaution before the dam show its negative impact on the concerned dolphin population.

The food of Gangetic dolphin mainly consists of fish and crustacean (Anderson, 1878). The same worker recorded prawns, *Wallago attu*, *Saccobranchus fossilis* and *Palaemon carcinus* in the dissected dolphin specimens by him. Norman & Fraser (1948) reported that Ganges dolphin mainly feeds on mud-frequenting fishes and freshwater shrimps. Shrestha (1989) also reported that besides the crustaceans and mollusks, fishes especially of catfishes are the main diet of the species. Biswas & Michael (1992) noticed that dolphin severed the head of the prey, especially the cat fish by their teeth. Sinha *et al.* (1993) observed a wide variety of food fishes like *Mastacembelus panculus*, *Puntius sophore*, *Colisa fasciatus*, *Chela laubuca*, *Chanda ranga*, *Glossogobius giuris*, *Nangra punctata* and *Puntius sp.* in the gut content analysis the species. Extensive using of various types of gill nets in the entire Brahmaputra Valley over last 15 years resulting into the sharp declining of fish fauna from this region, which has been directly affecting the dolphin population in this region through shortage of food (Mohan *et al.*, 1997; Biswas & Baruah, 2000, Wakid & Biswas, *in press*). Although fishing from 1st May to 15th July and using very low mesh-sized gill nets (current jal) are banned in Assam through State

Fishery Laws, still we observed both of these two banned activities occurrence throughout the year due to lack of proper management attention to this important issue, which has been resulting into severe increasing of anthropogenic pressure on fish fauna in Brahmaputra river system, which in turn affecting the dolphins through food shortage and habitat disturbance.

Objective-4: Conservation initiatives

A. Awareness campaign: Awareness campaigns have conducted among the fringe villagers of most of the identified threatened IDHs. Altogether 40 formal and informal awareness campaigns have been conducted so far in different parts of Brahmaputra Valley. The target groups ranged from fishermen, community leaders, school students, teachers and managers (Table-5 and Plate-55 to 58).

B. Media coverage: To popularize the dolphin research and conservation in Brahmaputra Valley, the project established and has been maintaining good linkages with the local media, spreading from Newspaper to television, from regional to national level and from regional languages to English language. Different activities of the Project Team were conveyed to the common people of Assam and India through these media and the Team felt the impact during the field survey. Besides the minor communications, altogether 19 major media coverage were made during the reported period (Table-6).

C. Capacity building and linkages developments in international level: During the reported period, the Project Leader has participated following international conferences and delivered talks on project findings.

a. Participated in the Student Conference on Conservation Science, organized by Department of Zoology, University of Cambridge, UK from 22nd to 24th March, 2005 and presented a talk on "Status and conservation of Gangetic dolphin (*Platanista gangetica*) in Upper Brahmaputra basin of North Eastern India".

b. Participated in the 19th Annual Conference of Society for Conservation Biology (USA) in the University of Brasilia, Brazil from 15th to 19th July, 2005 and presented a talk on "Status and conservation of endangered Gangetic dolphin (*Platanista gangetica*) population in Brahmaputra river system of India".

Research visit:

Visited the Lighthouse Field Station of University of Aberdeen, Scotland from 14th to 21st March, 2005 and worked with the Cetacean researchers of the Institute to understand the recent research development in dolphin and other cetacean species.

All of these 3 activities were sponsored by BP Conservation Programme.

Table-5: List of awareness (formal & informal) campaigns

Sl. no.	Date	Place	Target group	Participants	Collaboration
1.	28-10-2004	Tateliguri, Dihingmukh	Fishermen, Community leaders	12	--
2.	29-10-2004	Nimati & Kokilamukh	Forest Officials, NGO workers, conservationists, Fishermen, Community leaders	20	Aaranyak, SEWA, Prakriti
3.	03-11-2004	Bongaigaon	College students	12	Aaranyak
4.	05-11-2004	Dhubri	Defense Officials, Fishermen	10	--
5.	07-11-2004	Bongaigaon Refinery & Petrochemicals Ltd.	Executives from Refinery (Oil) Company	25	Aaranyak
6.	08-11-2004	Moinbori Char	Community leaders, villagers, fishermen	38	Kolgachiya College, Aaranyak
7.	09-11-2004	Goalpara, Jugighopa	College teachers, fishermen	32	Aaranyak
8.	16-11-2004	Dikhowmukh	Conservationists, Community leaders, fishermen	25	Aaranyak
9.	25-11-2004	Guijan	School students, conservationists	50	Aaranyak, Erab-Kirab
10.	30-12-2004	Kaziranga National Park	Management authority	8	--
11.	06-01-2005	Sawoldhuwa, Kodomial, Ghagor	Local youths, fishermen	25	--
12.	08-01-2005	Dhakuakhana	School Students, teachers, NGO activists	30	Megamix Nature Club
13.	09-01-2005	Lakhimpur (Dulungmukh)	School Students, teachers	30	Green Heritage, Lakhimpur Science Society
14.	10-01-2005	Simen Chapori	Fishermen, Villagers	12	--
15.	14-02-2005	Saikhowa Ghat	Local youths, Defense Official	8	--
16.	17-02-2005	Bhajni	Fishermen, villagers	25	--
17.	18-02-2005	Hatighuli, Dighaltarang	Fishermen, villagers	20	--
18.	19-02-2005	Mohmora	Fishermen, villagers	8	--
19.	20-02-2005	Laika	Fishermen, villagers	15	--
20.	23-02-2005	Bogibeel	Villagers, community leaders	10	--

21.	04-04-2005	Kulsi	Villagers	15	--
22.	05-04-2005	Kukurmara, Gumi	Villagers, sand mining workers, local youth	25	--
23.	11-04-2005	Baghbor	Fishermen, community leaders	20	--
24.	12-04-2005	Goalpara	Administrative Officers, Community leaders	10	--
25.	14-04-2005	Dhubri	Defense Officials, fishermen	12	--
26.	27-04-2005	Guwahati	Management authority, Researchers,	15	--
27.	28-04-2005	Digarughat	Villagers	10	--
28.	29-04-2005	Orang National Park	Forest Staff, Villagers	12	--
29.	03-05-2005	Kaziranga National Park	Forest Staff, Dairy farmers	30	--
30.	04-05-2005	Dhansirimukh	Fishermen, Forest Staff, Villagers	18	--
31.	05-05-2005	Moderguri	Fishermen, community leaders, villagers	25	--
32.	06-05-2005	Disangmukh	Fishermen, community leaders, villagers	12	--
33.	09-05-2005	Kareng Chapori	villagers	5	--
34.	16-05-2005	Khoga	Fishermen, community leaders, villagers	30	--
35.	17-05-2005	Ghagormukh, Khabolughat, Bodotighat,	Fishermen, community leaders, villagers	40	--
36.	31-05-2005	Nimatighat, Jhnajimukh, Dikhowmukh	Community leaders, teachers, conservationists,	35	SEWA, Kateki, Aaranyak
37.	16-06-2005	Saikhowaghat, Dighaltarang	Community leaders, teachers, conservationists, Managers	45	--
38.	18-06-2005	Dikhowmukh & Disangmukh	Community leaders, fishermen, conservationists	25	Aaranyak
39.	19-06-2005	Jhnajimukh & Nimati	Community leaders, fishermen, conservationists	38	Kateki, SEWA
40.	08-07-05	Guwahati	Managers, conservationists	14	Aaranyak

Table-6: List of media coverage

Sl. No.	Publication date	Media type	Published on	Language	News on
1.	13 th May, 2004	National Newspaper	The Telegraph	English	Award Winning
2.	24 th November, 2004	Regional Newspaper	Natun Dainik	Regional language	Dolphin survey in Brahmaputra
3.	26 th November, 2004	Regional Newspaper	Amar Asom	Regional language	Dolphin survey in Brahmaputra
4.	26 th November, 2004	Regional Newspaper	Akhamiya Khabar	Regional language	Dolphin survey in Brahmaputra
5.	27 th November, 2004	Regional Newspaper	Akhamiya Pratidin	Regional language	Dolphin survey in Brahmaputra
6.	4 th January, 2005	Regional Newspaper	Amar Asom	Regional language	Awarenees Campaign
7.	5 th January, 2005	Regional Newspaper	The Sentinal	English	Awarenees Campaign
8.	6 th January, 2005	Regional Newspaper	Dainik Janambhumi	Regional language	Awarenees Campaign
9.	8 th January, 2005	Regional Newspaper	Dainik Janahadharan	Regional language	Awarenees Campaign
10.	5 th January, 2005	Regional Newspaper	Ajir Asom	Regional language	Awarenees Campaign
11.	10 th January, 2005	Regional Newspaper	Dainik Agradut	Regional language	Awarenees Campaign
12.	10 th January, 2005	Regional Newspaper	Khabar	Regional language	Awarenees Campaign
13.	9 th April, 2005	Television	DD News	Regional language	Dolphin survey in Brahmaputra
14.	12 th April, 2005	Regional Newspaper	Dainik Batori	Regional language	Dolphin survey in Brahmaputra
15.	11 th March, 2005	Regional Newspaper	Dainik Janambhumi	Regional language	UK visit of PL
16.	15 th March, 2005	National Newspaper	The Telegraph	English	UK visit of PL
17.	21 st March, 2005	Regional Newspaper	Amar Assom	Regional language	UK visit of PL
18.	23 rd May, 2005	National Newspaper	Indian Express	English	Dolphin survey in Brahmaputra
19.	7 th September, 2005	National Newspaper	The Telegraph	English	Survey findings

Conservation Education

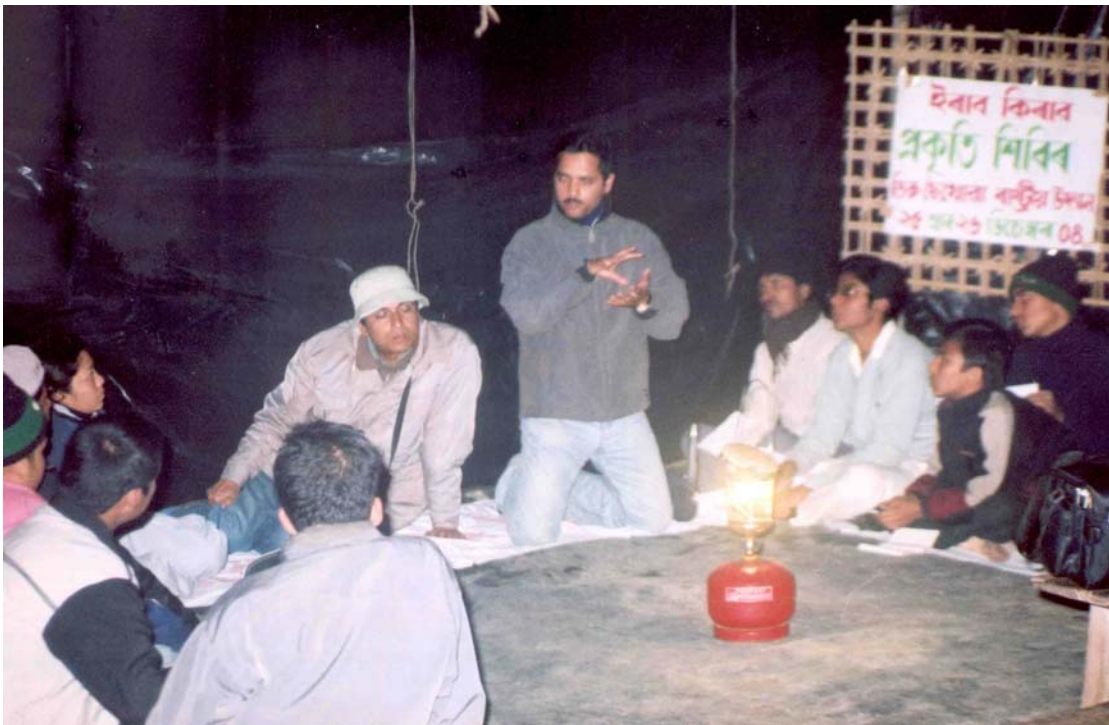


Plate-54: Awareness campaign among school student and teachers



Plate-55: Awareness campaign among local communities in Subansiri River



Plate-56: Awareness campaign among fringe villagers in Central Assam



Plate-57: Awareness campaign among fishermen communities in Eastern Assam



Plate-58: Awareness campaign among community leaders and conservationists in Eastern Assam

D. A Project into a Programme:

The **Gangetic Dolphin Conservation Project** is now taking a wider form through **Gangetic Dolphin Research and Conservation Programme**, which has been developing for the long term conservation of the species in Brahmaputra river system through Aaranyak, a society for biodiversity conservation of North East India. For details of the Programme, please visit: www.aaranyak.org/Programmes/GDRCP.htm.

E. Dolphin Monitoring Units:

The Project identified that Dolphin Monitoring Units in collaboration with the management authority and local communities is the best approach for the long term conservation of Gangetic dolphin in Brahmaputra Valley. If sufficient Units are developed to monitor the dolphins of identified 97 Important Dolphin Habitats and if all work together under a common Dolphin Conservation Network, then the survival rate of dolphins of Brahmaputra Valley, will be greater in near future. Based on this principle altogether 5 Dolphin Monitoring Units were developed in Eastern Assam. These 5 Units have been monitoring the dolphins of altogether 14 threatened Important Dolphin Habitats of the region.

- These Units are:
1. Saikhowa Unit (6 members, Plate-59)
 2. Dighaltarang Unit (8 members, Plate-60)
 3. Dikhowmukh Unit (13 members)
 4. Jhanjimukh Unit (21 members, Plate-61)
 5. Nimati Unit (7 members, Plate-62)



Plate-59: The members of Saikhowa Unit



Plate-60: The members of Dighaltarang Unit



Plate-61: The members of Jhanjimukh Unit



Plate-62: The members of Nimati Unit



Plate-63: Josh Cole, the Programme Manager of RSG observing dolphins during his visit to a dolphin habitat of Central Assam with the Project Leader A. Wakid

RECOMMENDATIONS

Based on the field experiences of last one year in the entire Brahmaputra river system, this project is putting following recommendations for the long term conservation of the Gangetic dolphin in the entire Brahmaputra Valley.

1. RECOMMENDATIONS FOR FURTHER RESEARCH

Issue	Approach taken so far	Approach need to be undertaken
Population status and distribution pattern of Gangetic dolphin	Direct counts by Mohan <i>et al.</i> , 1997 Reviewed through literature by Biswas <i>et al.</i> , 1997 Line transect and direct count by Wakid (this Report)	Multi vessel survey; Proper attention to the braided channels Identification of the seasonal migration route & maximum distribution range during monsoon season Application of GIS & Remote Sensing
Habitat ecology	Biswas & Baruah (2000); Wakid (2005) in upper Brahmaputra basin	Detail study on water quality, habitat geomorphology, food availability in the 97 Important Dolphin Habitats (IDHs).
Acoustic behaviour	No initiative so far.	Detail study with the help of sophisticated hydrophones in selected IDHs.
Home range determination	No initiative so far.	Radio and satellite telemetry in certain IDHs of Brahmaputra river. Photo identification techniques can also be undertaken.
By catch	No details baseline data	Determination of the frequency of by catch in Brahmaputra Valley and identification of responsible fishing gears.
Poaching	No baseline data	Determination of the frequency of poaching in Brahmaputra Valley and identification of poaching area and the poachers. Legal action against the identified poachers.

Prioritized research works on Gangetic dolphin in Brahmaputra river system from conservation point of view

Serial Number	Action	Output	Otherwise.....
Action-1	Determination of the impact of by-catch on dolphin population	a. Estimation of the frequency of dolphin by-catch b. Identification of concerned fishing gears c. Initiatives to modify the identified fishing gears d. Site and factor-based legal action by the State Forest Department and State Fishery Department.	Dolphin mortality rate will be high, resulting into population declining at current rate and even more in near future
Action-2	Determination of frequency of dolphin poaching	a. Identification of poaching areas. b. Identification of poachers. c. Legal actions on poachers. d. Monitoring of identified poaching area.	Population declining at current rate and even more in near future
Action-3	Determination of the maximum distribution range during monsoon season	a. Understanding of maximum distribution range b. Increase the survival rate during more vulnerable (monsoon) season of poaching and / by catch through site based monitoring and protection	Population declining rate will continue at current rate during the most active season of dolphin's life.
Action-4	Understanding of habitat ecology	a. Detail baseline data on the water quality and geomorphology of Brahmaputra Valley b. Detail data on fish & fishery resources of the Valley. c. In-situ conservation initiative.	Habitat requirements will not be known to the scientific community and management authority, which will hamper in future habitat restoration initiative.
Action-5	Behavioural ecology study	a. Impact of human disturbance on dolphin habitats. b. Habitat requirements c. Management initiative to minimize anthropogenic disturbances and maximize habitat suitability.	Habitat recovery in future (ex-situ & in-situ) will not get its targeted norms
Action-6	Regular population survey	a. Rate of population increasing or decreasing. b. Involvement of management authority & local community in dolphin conservation. c. Site specific conservation action in identified population declining sites.	Impact of research and conservation initiatives on dolphins and their habitats will be unknown

RECOMMENDATIONS FOR DOLPHIN CONSERVATION AT COMMUNITY AND MANAGEMENT LEVEL

Issue	Approach taken so far	Approach need to be undertaken
Monitoring	5 monitoring units in Tinsukia, Disrbugarh, Sivsagar and Jorhat district in collaboration with local community and management authority have been formed through this project.	More units should be formed in the entire Brahmaputra valley to monitor the dolphins of IDHs, which will work together under a single platform of Dolphin Conservation Network.
Local community involvement in dolphin conservation	Local communities have been involving in dolphin conservation through the formed 5 Monitoring Units in this project	Monitoring and protection of the 97 IDHs of Brahmaputra Valley should be made involving the local communities after detail training to the community's new generation leaders.
Involvement of Department of Environment & Forest, Govt. of Assam to control poaching and habitat disturbance	Legal protection to the species through Wildlife Protection Act, 1972 by the Department of Environment & Forest, Govt. of Assam	The grassroot offices, viz., Beat Office, Range Office etc. of the Department should be involved in dolphin monitoring. These offices should work together with the local communities of the area.
Involvement of State Fishery Department, Govt. of Assam to reduce dolphin by catch and their food over-exploitation	Have legal power to restrict the over exploitation of fishery resources in Brahmaputra Valley, but still lacking of strict application of the laws.	The Department should restrict the use of gill nets in the IDHs. The laws against fishing in monsoon season should be strictly implemented through the district offices. Involvement of the district offices with the local Dolphin Monitoring Units will be the best support from the Department in dolphin conservation.
Protected area	The river stretch of Brahmaputra river from Dhansirimukh to Silghat is legally protected being as a part of Kaziranga National Park	Except the identified 15 IDHs within Kaziranga National Park, rest 82 IDHs should be declared as Important Dolphin Habitats by the Department of Environment & Forest, Govt. of Assam and any anthropogenic activities should be strictly banned in these Protected Areas. The waterbodies surrounding Dibru-Saikhowa National Park should include under the Park Management for better protection.

Prioritized conservation works on Gangetic dolphin in Brahmaputra Valley involving management authority and local community

Serial Number	Action	How	Output	Otherwise.....
Action-1	Involvement of major stakeholders (State Forest Dept, State Fishery Dept, conservationists & community leaders) in conservation actions	Organizing workshops and meetings at management level and community level	a. Legal helps (management) to check by catch from Sate Fishery Department and to check poaching from the State Forest Department. b. Involvement of local communities in dolphin & their habitat monitoring	The conservation initiatives will be only wastage of time and money
Action-2	Establishment of a Dolphin Conservation Networks	Formation of Dolphin Monitoring Units in collaboration with management authority and local communities in the identified Important Dolphin Habitats and through networking of all these Units, after detail training to the activists.	a. Information on habitat disturbance and population declining will be updated quickly, based on which site & factor based legal action can be undertaken. b. Close monitoring of dolphins in the IDHs.	Habitat disturbance and population declining will continue.
Action-3	Awareness campaign and capacity building of local people	Organizing workshops at community level and publications on dolphins through various media	a. New generations of Assam will be more interested in dolphin conservation. b. The conservation will be a people oriented movements. c. More man-power in dolphin conservation. d. The anthropogenic disturbances will be decreased	The research and conservation initiatives will not touch the common people of Assam and thus will not be a 100% success conservation initiative.

SPECIFIC RECOMMENDATIONS FOR CONSERVATION OF RESIDENTIAL DOLPHIN POPULATIONS

Issue	Problem	Approach need to be undertaken
Conservation of dolphins of Subansiri River	One large power dam construction is going on in the Garukamukh area of the river. The rate of deforestation by the construction company in the riparian zone of the river has been carrying high silt load, which will cause low water depth in the down stream of the river, where dolphins are living.	The Department of Environment & Forest, Govt. of Assam should be strict about the monitoring of the MoU with the construction company.
Conservation of dolphins of Kulsi River	The majority of the dolphins of this river live only a 3 km long stretch, where 100-120 trucks of sand have been extracting per day	The Department of Environment & Forest, Govt. of Assam should regulate the rate of sand extraction.

Prioritized works for the conservation of dolphin populations in the 3 tributaries of Brahmaputra Valley

Rivers	Sl. No.	Actions	Output	Otherwise.....
Dolphins of Subansiri River	Action-1	Detail study on the impact of Garukamukh Power Dam on the dolphin population of the river.	The recommendations of this study will help in minimizing the dam effect on dolphins and their habitats.	The Power Dam may eliminate the dolphins from the river, unless taking serious legal actions at the beginning of the construction.
	Action-2	Monitoring Units formation in the IDHs of the river involving the Lakhimpur Forest Division and local communities	Reduction of anthropogenic pressures on dolphins and their habitats.	Dolphin by-catch and poaching will continue.
	Action-3	Dolphin Sanctuary announcement in the river stretch from Sawoldhuwaghat to Jamugurighat	Less anthropogenic disturbances on dolphin habitats and thus more survival rate	Increased anthropogenic disturbances may eliminate this residential population
	Action-4	Awareness campaign among fringe villages	Protection and monitoring of dolphins and their habitats will be more.	Conservation initiatives will not get their proper norms.
Dolphins of Kulsi River	Action-1	Detail study on the impact of sand mining on the dolphins & their habitats	Regulation on the rate of sand mining by the Department of Environment & Forest based on study recommendation	Disturbance rate through sand mining on the dolphins will increase and their will be no baseline data for legal actions to save the dolphins
	Action-2	Dolphin Sanctuary announcement in the stretch from Kukurmara to Kumarpara	Sand mining will be in control	Anthropogenic disturbances through sand mining will remain high.

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