i. The present investigation has been centred on the dolphin, their habitat, threats and strategies for their protection in the River Barak of southern Assam, India. It covered a continuous 135 km length (12 km in hilly terrain and 123 km in plain areas) of the river up to its point of bifurcation in Indo-Bangladesh border. Altogether, five sites of which one was a dolphin congregation spot were selected for sampling purpose. The study period was of three years (2005 to 2008). However, population data of 1999-2005 has been incorporated to facilitate assessment of population trend.

ii. The aquatic animal, called Foo Maach or Foo fish, found in the River Barak is a dolphin, Gangetic River Dolphin, \( \text{Platanista gangetica gangetica} \) Roxburgh 1801). Till 1970s, this dolphin was common in the River Barak and its tributaries. They are now rarely seen. At present during the dry season, dolphins of the River Barak congregate at Lalmati Dahr and Niyairgram Dahr lying 14 km apart from each other. During this period they forage mainly at and between these two spots.

iii. During the rainy season, dolphins from their congregation sites migrate to other places. During this season, one or two dolphins are often sighted at river confluences and meanders. Individual dolphins or mother-calf dolphin pairs from downstream (the
Meghna, Kalni, Kushiyara etc.) also visit various parts of the Barak lending chances of faunal exchange between different stocks. Dolphins return to their own residential spots when south-west monsoon recedes or water level in the river goes down. The driving force in the seasonal change of distribution and density of the dolphins is mainly the fluctuations in water levels and change in availability of their prey fish.

iv. In the last 10 years (1999-2008), a decrease in dolphin population has been noted in the River Barak. It was 14 in 1999, 12 in 2001, 10 in 2003, 9 in 2005 and 2006 and 8 in 2007-08. Roughly 60%, 31% and 9% of the total dolphin population are composed of adults, juveniles and infants respectively. Each and every year after the first few pre-monsoon showers, new born dolphin calves are seen in the area but population of adult and juveniles have not increased rather decreased in these years.

v. Collected information on the mortalities of 29 dolphins in the Barak River system indicates that 90% of the mortalities occurred solely due to fishing activities at various sections of the river. Double boat operated nets caused 27.59%, single boat operated nets 17.24%, gill nets 17.24%, hook and lines 17.24%, harpoon 3.45%, seine net 3.45%, fishing trap 3.45% and others 10.34% of the mortalities of dolphins.

vi. In the Barak, infant dolphins suffered maximum casualties (38%) followed by sub-adults (34%) and adults (28%). Again, among the cases of infant casualties 36.36% were due to entanglement in gill nets, 18.18% in double boat operated drag nets, 36.36% in single boat operated fishing nets and 18.18% in seine net. All of these nets are now made using synthetic fibres.
In general, many catching and killings of small and infant dolphins do not come to the notice of the people.

vii. During 1998-2001, linear density of dolphins (dolphins per linear river kilometre) decreased as one moved upstream from the Kalni to Kushiyara in the Meghna-Kalni-Kushiyara-Barak river system. The density increased slightly on moving up towards the Barak. But, during 1999-2008, about 28% decrease in linear density of dolphin has taken place in the River Barak.

viii. The survival and well being of dolphins in the River Barak is intricately related to the prevailing conditions in the river, its upstream and downstream, tributaries and catchments and anthropogenic activities in the region.

ix. The topography of the region consists of a considerable number of north-south oriented short and long spurs or ridges, a number of tributaries to the River Barak, wide plains, hillocks and water logged areas known as beels, haors and anuwas. Vegetation cover in inhabited areas is mostly composed of bamboo groves, areca nut, banana and coconut plants and small to medium sized trees. Rice is mainly cultivated in the rain-fed plain fields. Hillocks and foot-hills are mainly covered with tea cultivations. Forests in many of the hills are degraded.

x. The River Barak, in Indian soil, traverses about 400 km in hill and about 123 km in plain areas before its bifurcation into the Surma and the Kushiyara. The average sinuosity of the river is 2.1, a high value. The river runs in single channel meandering with a wavelength of about 5 km and amplitude of about 3 km. During December-January, the river at the five sampling sites had width ranged from 127m to 189m, depths from 4.6 m to 7.8 m, average speed of flow 0.14 ms\(^{-1}\) to 0.31 ms\(^{-1}\) and flow
discharge $176.8 \text{ m}^3 \text{s}^{-1}$ to $245.7 \text{ m}^3 \text{s}^{-1}$. Average bankful and low-water widths are around 300m and 150m, respectively. Generally, the river becomes bankful and flooded once or twice in a year and it takes place during June to September. Flood means abundance of food and fish for the dolphins. In 2006, the River Barak never reached bankful condition.

xi. Bed and bank materials consist mainly of stiff clayey silt. Some sand is found on the channel bed and confluence area of its tributaries. There are mid-channel islands and rock expositions of riparian sides and river bed at some places. Erosion on one side and accretion on the other side of the river result in slow and quite often rapid migration of its channel at many of its meanders and dahr areas.

xii. Physico-chemical conditions of water at sampling Site II at any time were found intermediate or at an optimum (towards the lowest or highest) of those found at the other sampling sites. However, at any given time, similar physico-chemical characteristic prevailed at one or more than one of the sites.

xiii. As a whole, surface temperature of water ranged from 18.9 – 30.1 °C with an average of $24.6 \pm 2.75$ (standard deviation). Secchi Disc transparency ranged from 2.35 cm to 64 cm. Conductivities of water varied from 48 $\mu$S cm$^{-1}$ to 194 $\mu$S cm$^{-1}$ with an overall average of $117.86 \pm 38.75$. pH of water had the readings of 6.8 to 8.1 with an average of $7.58 \pm 0.25$. The dissolved oxygen (DO) content ranged from 6.4 mg L$^{-1}$ to 8.6 mg L$^{-1}$ with an overall average of $7.37 \text{ mg L}^{-1}$ under standard deviation 0.49. Dissolved and free carbon dioxide content ranged from 3 to 8 mg L$^{-1}$ with an average of $6.42 \pm 1.3$. Total alkalinity, in terms of mg L$^{-1}$ of CaCO$_3$, read from 30 to 94 and an overall average of $61.03 \pm 13.83$. Total dissolved solid (TDS)
content (in mg L⁻¹) ranged from 74-218 giving an overall average of 135.86 ± 35.6. Total suspended solid (TSS) in mg L⁻¹ ranged from 46-812 with average 267.45 ± 175.67. Total solids (TS) in mg L⁻¹ in the water samples collected from the sites ranged from 178-944 with the overall average of 403.31 ± 169.76.

xiv. The annual and dry season physico-chemical characteristics of dolphin habitat in the River Barak are summed up and presented in Table 20.

xv. Altogether 87 species of fish belonging to 29 families and 62 genera were identified from the River Barak and its connected water bodies. Species abundance was highest in Cyprinidae with 28 species (32.2%) followed by Bagridae with 8 species (9.2%) and Schilbeidae with 6 species (6.9%). Among the genera, *Labeo* and *Puntius* were the two richest ones with 5 species in each; they were followed by *Channa* and *Mystus* with 4 species in each. 36 species were categorised as common, 34 as occasionally available and 17 species as rare.

xvi. Within the dolphin congregation area, altogether 67 fish species of 48 genera and 23 families were recorded. Cyprinidae, with 20 species in 12 genera, ranked top followed by Bagridae with 8 species in 4 genera and Schilbeidae with 6 species in 5 genera. A total of 29, 27 and 11 of the 67 species were estimated to be common, occasional and rare, respectively.

xvii. Available fish in both within the study area and the dolphin congregation area of the River Barak included five globally endangered species, namely *Notopterus chitala*, *Anguilla bengalensis bengalensis*, *Ompok bimaculatus*, *Ompok pabo* and *Eutropiichthys vacha*. 
xviii. Fish abundance peaks twice in a year in the Barak – first a low peak in April-May and second a high peak in October-December. Catch per unit effort (c.p.u.e.) in kg per head per fishing hour ranged from 0.040 to 0.275 with an overall average 0.108 ± 0.05 (S.D.) at the various sampling sites. The average c.p.u.e. along with their standard deviations (±) at the sites I, II, III, IV and V had been 0.092 ± 0.03, 0.134 ± 0.06, 0.093 ± 0.04, 0.108 ± 0.04 and 0.114 ± 0.04 respectively, indicating that the density of fish is highest at Site II (dolphin congregation spot), followed by Sites - V, IV, III and I, in order.

xix. Lalmati Dahr and Niyairgram Dahr are the last two Residential (homely) Spots of the dolphins in the River Barak due to the following reasons -

a) The presence of large water cover with pools and shallow areas, point bars and counters currents on a non-homogenous sandy bed help dolphins in catching their prey, in taking refuge in the area and for the nourishment of their new born calves.

b) Geomorphologic and hydrological conditions along with the prevailing physico-chemical characteristics of water make the areas favourable for the production and concentration of fishes and other preys for the dolphins.

c) The presence of long, wide, unbound and uninhabited river plain on both sides of the river between these two spots and the presence of serene and unpolluted condition all the year round in this section make the area ideal in serving as the foraging ground and shelter for the dolphins.
Except Lalmati Dahr and Niyairgram Dahr, no other spot now in the River Barak, fulfil all the above mentioned conditions together.

xx. The outward and inward migration of dolphins of the Barak from their present concentration centre, Lalmati Dahr is associated with the change in c.p.u.e. at the spot. Dolphins start migrating outward with the onset of monsoon rains and when c.p.u.e. starts dipping down. They begin reaching Lalmati Dahr after the rainy season is over and when c.p.u.e. starts soaring up. Thus, dolphins’ migration is mainly food-oriented.

xxi. Dolphins usually move solitarily. Presence of prey animals is a factor for the cohesion of dolphins. At the time when c.p.u.e. at Lalmati Dahr is much less, as indicated clearly by the absence of fisherman there (in monsoon days or after devastating fishing in the area), dolphins too remain absent from there.

xxii. Before resurfacing from water for taking breathe, an adult dolphin in dahr areas in the Barak remains under water for 2 to 3 minutes normally and quite often more than 5 minutes. The time taken in the River Barak is comparatively more. Surfacing and resurfacing requires to be economic in terms of energy (food) gained and energy spent. Density of fish in Barak is comparatively low (c.p.u.e., less than half of what is present in the River Brahmaputra). Therefore, unless more time is spent inside water, it will be difficult on the part of a dolphin to get its daily requirement of food/fish. Thus, dolphins in the Barak are constrained by food.

xxiii. Community fishing activities or fishing using seine nets or the presence of too much traps and hooks and lines strewn from
both sides of the river at the congregation sites push the animals out of the area.

xxiv. A limited number of people in the Barak Valley are aware of the fact that a species of dolphin was or is available in the River Barak. River-side people other than those at Lalmati Dahr and Niyairgram area are not sure about the present availability of *Foo Maachh* (river dolphin) in the rivers of Barak Valley. People of Lalmati Dahr and Niyairgram Dahr area are of the opinion that dolphin population is decreasing day by day in their area. Many of the people are indifferent whether dolphin survives or becomes extinct from the River Barak.

xxv. Dolphins, in the Barak are caught and killed as direct catch and by-catch during fishing activities. Uses of dolphin oil as fish attractant and as medicine for some ailments by a section of the people encourage deliberate trapping, hunting and poaching of dolphins. Habitat degradation, in the form of loss of *dahrs* (riverine pools) due to shortening of river course and siltation of river beds, depletion of prey fish, reduction of foraging grounds due to the erection of embankments and sluice gates, pollution of water etc. have occurred. Long periods of maturity and gestation and low rate of reproduction also threaten dolphins. Though included in Schedule I of Indian Wildlife (Protection) Act, 1972, there is lack of enforcement of relevant Rules and Regulations for protecting the animal and its habitat in the River Barak. Unless effective conservation measures are adopted at war footing, the eventuality of local extinction of the dolphins in the River Barak is bound to happen.
Table 20: Physico-chemical characteristics of dolphin habitat in the River Barak

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Annual</th>
<th>Dry season</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Range</td>
<td>Average ± S.D.</td>
</tr>
<tr>
<td>Surface water temperature (°C)</td>
<td>19 - 27.9</td>
<td>23.7 ± 2.5</td>
</tr>
<tr>
<td>Secchi-disc transparency (cm)</td>
<td>6 - 56</td>
<td>31.83 ± 16.4</td>
</tr>
<tr>
<td>Conductivity (µS cm⁻¹)</td>
<td>60 - 167</td>
<td>105.65 ± 29.63</td>
</tr>
<tr>
<td>pH</td>
<td>7.1 - 8.1</td>
<td>7.48 ± 0.2</td>
</tr>
<tr>
<td>Dissolved oxygen content (mg L⁻¹)</td>
<td>6.4 - 8.5</td>
<td>7.66 ± 0.44</td>
</tr>
<tr>
<td>Free carbon dioxide (mg L⁻¹)</td>
<td>3 - 8</td>
<td>5.76 ± 1.18</td>
</tr>
<tr>
<td>Alkalinity (as mg L⁻¹ of CaCO₃)</td>
<td>40 - 88</td>
<td>58.12 ± 12.45</td>
</tr>
<tr>
<td>Total Dissolved Solids (mg L⁻¹)</td>
<td>86 - 178</td>
<td>118.76 ± 25.39</td>
</tr>
<tr>
<td>Total suspended solid (mg L⁻¹)</td>
<td>60 - 798</td>
<td>247 ± 190.3</td>
</tr>
<tr>
<td>Total Solid content (mg L⁻¹)</td>
<td>192 - 884</td>
<td>365.76 ± 174.36</td>
</tr>
</tbody>
</table>