Summary

Catfishes (Osteichthys: Siluriformes) include exceptionally diverse forms, some of which have high food values, while many have interesting shapes and behaviors which make them good candidates for ornamental fishes. They are characterized by having a naked body, usually four pairs of barbels: one each of nasal, maxillary and two pairs of mandibular; usually an adipose fin. Body is often covered with bony plates. The order is also characterized by the absence of parietal, symplectic, suboperculum, and intermuscular bones. The second, third and fourth vertebrae are fused to a single ossification called a “complex vertebrae”. Principal rays of the caudal fin are less than 10+9, with upper principal rays equal to, or fewer than, the lower rays.

Northeast India is very rich in catfish diversity. Many new species are expected from this region. Out of the 12 families of catfishes recognized in the All Catfish Species Inventory (ASCI) project, as many as 10 families are recorded in the northeast India. However, a detailed catfish inventory of the region has not been done. Although taxonomic and evolutionary studies of catfishes were carried out by several workers (Mo, 1991; de Pinna, 1996) and others, the works are far from complete since many species and genera found in northeast India have not been included so far.

The objective of the present study is on the detailed inventory of diverse forms of catfishes of northeast India, particularly on those of the superfamily Sisoroidea and the family Bagridae, clarification of their
taxonomic status and examination of the phylogenetic relationships among them on the basis of morphological and anatomic characters.

Fishes were collected from various water bodies of northeast India and preserved in 10% formalin and deposited in Manipur University Museum of Fishes (MUMF). Fishes were identified based on the latest literature on the particular taxon. For study of bones, the specimens were cleared and stained with Alizarin red S by the method of Hollister (1934). In case of rare specimens, Digital X-ray model Centricity CR SP100 was used for radiography of fish bones. Counting of gill rakers and vertebrae follows Roberts (1989). Nomenclature of bones is done as per Mo (1991) and de Pinna (1996). Images of certain bones were captured using Leica DFC 425 fitted to Leica S8APO stereo-zoom microscope and processed using LAS (Leica Application Suite) ver.3.6 software.

Phylogenetic study using morphological and anatomical characters is based on Hora (1922), Chen and Lundberg (1995), de Pinna (1996) and Zhou & Zhou (2005). Other newly adopted characters were polarized using the outgroup comparison method (Maddison et al., 1984). Cluster analysis was carried out using NTSYSpc Version 2.2 (Numerical Taxonomy and Multivariate Analysis System) software (Rolf, 2004).

Systematic Description of Catfishes of Northeast India

a. Systematic study of three families of superfamily Sisoroidea and family Bagridae were conducted. Survey to different drainages flowing through northeast India viz., Barak, Brahmaputra, Chindwin-Irrawaddy and Kaladan could obtain 59 species under 20 genera belonging to the superfamily Sisoroidea. Three families viz., Amblycipitidae, Akysidae and Sisoridae are included under the superfamily Sisoroidea. Family Erethistidae which was included under Sisoroidea is no longer valid. Present works reveal the inclusion of representing genus of Erethistidae under the Sisoridae. A number of 29 species, eight genera and four subfamilies were found to constitute the
family Bagridae. Correct distribution of the fishes is also documented. A database of catfishes of the superfamily sisoroidea and family bagridae of northeast India is created with correct identity (including the red list status of each species) and up-to-date systematic positions. Key to species of each genus is also established.

b. New Species Described: Seven new species viz., Batasio convexirostrum, Hara koladynensis, Pseudecheneis koladynae, Glyptothorax ater, Glyptothorax caudimaculatus and Glyptothorax chintuipuiensis from the Kaladan basin of Mizoram and Glyptothorax pantherinus from Brahmaputra drainage, Arunachal Pradesh are newly described. The diagnostic characters of the new species are as follows:

Batasio convexirostrum. The species is characteristic in having light brown body with a dark-brown vertical predorsal bar; dorsal fin dark grey at base and distal one-third hyaline in between; fewer gill rakers on the first branchial arch (4-5) and longer pectoral spine (14.6-17.6% SL).

Hara koladynensis. The species is diagnosed by having a rough anterior margin of dorsal spine; longer head (36-38.3% SL) and post adipose distance (18.6-21.9% SL); deeper body (21.9-25.2% SL) and shorter preanal length (58.5-60.9% SL).

Pseudecheneis koladynae. It is characteristic in having three isolated ovoid nuchal patches, one in mid-dorsal line in front of dorsal fin origin and two on either side of the middle spot, slightly behind; prominent bony spur on the antero-dorsal surface of the first dorsal fin pterygiophore; short caudal peduncle (length 16.0-18.8% SL); pelvic fin not reaching the base of first anal fin ray and distinct sexual dimorphism with robust conical papilla in males and flat leaf-like comparatively smaller bilobed papilla with a small mid-ventral lobe in females.

Glyptothorax ater. The species has a dark brown body with two horizontal light creamish stripes, one each along mid-dorsal line and lateral
lines; two pale creamish ovoid spots on either side of dorsal fin origin connected by thin creamish oblique stripes forming spectacle-like mark; greatly arched predorsal profile; shorter nasal barbels not reaching anterior margin of eye; rhomboidal thoracic adhesive apparatus with a conspicuous central depression, longitudinally elongated and with a constriction at mid-length; ventral surface of pectoral spine and two to four outer rays of pelvic fin pleated.

_Glyptothorax caudimaculatus_. The species is characteristic in having a rhomboidal-shaped thoracic adhesive apparatus with its unculiferous ridges extending anteriorly onto the gular region; central depression on thoracic adhesive apparatus opening posteriorly in an inverted V-shaped form; sparsely granulated skin; papillated lips; long nasal barbels, its length being 35.2-43.3% HL; acutely pointed snout; ventral surface of paired fin rays non-plaited and posteriorly serrated pectoral-fin spine.

_Glyptothorax chimtuipuiensis_. A short and stout _Glyptothorax_ with granulated skin; dorsal profile is greatly arched anterior to the adipose fin, the dorsal spine is short and smooth, its length 5.1-8.9% SL; shorter pectoral fin length (16.8-21.9% SL), ventral surface of its first simple ray pleated; adipose fin length (22.1-27.3% SL); thoracic adhesive apparatus is chevron-shaped, wider than long, the median ridges of the apparatus is perpendicular to its base, slightly diverging laterally, its base concave, open caudally, with a shallow depression at its posterior end followed by a small fold of skin.

_Glyptothorax pantherinus_. A species of _Glyptothorax_ characteristic in having two bean-shaped creamish spots one either side of the dorsal-fin origin; mottled skin, more prominent over dorsal and caudal region, extending to tip of caudal fin; a well developed leaf-shaped thoracic adhesive apparatus with no central depression, unculiferous ridges of the apparatus not extending anteriorly onto gular region, the ridges uninterrupted except for
posterior most region and ventral surfaces of the simple rays of the paired fins plaitsed marginally and distally.

**Osteological Study**

Detailed osteology of the species belonging to the genus *Amblyceps, Akysis, Batasio, hara, Glyptothorax, Gagata, Gogangra, Nangra, Mystus* and *Pseudecheneis* of northeast India comprising neurocranium, vertebral column, girdles, caudal skeleton, facial bones etc. have been carried and their phylogenetic implications are analysed in this work. Differences in the structures of tooth band, waberian lamina, infraorbital bone, fontanel, cleithrum of pectoral girdle, neural spine and hypural plates etc. are found to have phylogenetic implications. In addition to the results of Roberts & Ferraris (1998), distinguishing osteological characters are obtained among the closely related sisorid group comprising of *Gagata, Nangra* and *Gogangra*.

**Phylogenetic Study**

Examination of osteological characters of some species of *Glyptothorax* of northeast India and comparison with published information predict that the genus may not be monophyletic. However, examination of more species of the genus will be necessary. In *Pseudecheneis koladynae*, posterior fontanel is very much reduced and anterior limb of cleithrum becomes smooth at its anterior point of connection, a character which is plesiomorphic. Neural spine above the first anal fin insertion is broad in this species which is a derived character. *Akysis manipurensis* is found to be more advanced than *A. prashadi* in having short shelf-expansion of nasal bone on dorsal surface (vs. absent) and parhypural completely fuse with the fused first and second hypural plate (vs. incomplete fusion of parhypural to the fused first and second hypural plate). *Mystus* can be divided into two groups on the basis of certain osteological synapomorphic characters. Phylogenetic tree for the family Bagridae,
subfamily Sisorinae, Glyptosterninae and for the genus *Glyptothorax* and *Pseudecheneis* are drawn using the NTSYSpc 2.2 ver. software based on morphological and anatomical characters.

The study shows that northeast India has rich catfish diversity. Further survey will be required as there are more remote water bodies which have never been visited and explored by an ichthyologist. While the freshwater fish fauna is still in the discovery survey state, there are several threats to the species, both natural and anthropogenic. While conservation and species survival are the main thrusts of environmentalists and conservationists, human population increase, urbanization and developmental activities are also going on. Thus, understanding of problems by all concerned, active discussion and participation and planning would arrive at the desired goals.