eISSN: 2313-5514
pISSN: 2312-9123

Hosain et al. Annals of Veterinary and Animal Science 2014
http://naturepub.org/index.php/journal/navas

AVAS
Annals of Veterinary and Animal Science

RESEARCH ARTICLE OPEN ACCESS

Health status of eels from open waters: a clinical and histopathological approach

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ABSTRACT

An experiment was conducted to know the health and disease problems of two freshwater eels, viz. *Monopterus cuchia* and *Mastacembelus armatus* which were collected from open waters of Mymensingh region (i.e. Kailla beel and Brahmaputra river) through clinical and histopathological examination. Water quality parameters, clinical and histopathological examinations were carried out on a monthly basis. The average value of temperature and dissolved oxygen (DO) decrease in winter season. During month of December and January, eels were found to be severely affected and characterized by clinical signs of red spots, rough skin and deep ulcers in the ventral and lateral regions of the body. Additionally, there weresevere necrosis in the skin and muscle of eels, presence of melanomacrophage, loss of epidermis, vacuoles, split of dermis and muscle were observed. Histopathological examination of gills were revealed missing of primary and secondary gill lamellae, necrosis, hyperplasia, highly hypertrophied and hemorrhagic gill lamellae. In liver, pyknotic and hyperplasid hepatocytes, necrosis, hemorrhages and vacuoles were evident. Hemorrhages, vacuolation, necrosis, missing and ruptured kidney tubules, pyknosis and presence of fungal granuloma were the major pathological alterations of kidney. The observed signs of diseases in eels could be realted to epizootic ulcerative syndrome (EUS), dactylogyrosis, parasitic and bacterial diseases associated with other opportunistic pathogens.. Our results indicated that the examined eels of Kailla beel river were found to be more severely affected than eels of the Brahmaputra oneduring the colder months of the year (December and January), in comparison to other months of the year.

Key words: Eel fish, Health and disease, Open water, Histopathology, EUS.

INTRODUCTION

Small indigenous species (SIS) are important group of fish, which grow up to a length of about 25 cm or 9 inches (Felts et al., 1996; Hossain and Afroze, 1991). Among the commercially important (SIS), eels are considered as delicious and precious food in many countries of the World including Bangladesh. These eels are the potential source of protein and have very high market demand. They command higher and more lucrative price than Indian major carps and other table fishes. According to the local fishermen, due to several reasons the population of these freshwater eels has been drastically declined from the natural water bodies along with other fish species (Rahman et al., 2010). Outbreak of various types of diseases is one of the most important causes of reduced biodiversity of wild fishes (Rahman and Chowdhury, 1996). Environmental parameters and seasonal variation might play a significant role in the diseases outbreak in aquatic animals including shrimp (Iqbal et al., 2011) and fishes (Kashem et al., 2014). Colder environment with reduced temperature play major role in the incidence of diseases outbreaks in the fishes of Bangladesh (Ahmed and Hoque, 1999). Clinical and histopathological observations are very helpful in diagnosing fish disease. Histopathological analysis has been successfully used throughout the world and also a commonly used diagnostic method for penaeid diseases (Lightner, 1996; Bell and Lightner, 1998). Due to limitation in facilities and technical knowhow, this analysis in Bangladesh have used for disease diagnosis in a limited extent (Ahmed et al., 2000). Several histopathological studies have been done on many SIS and major carps though only few works have been done on freshwater eels. Therefore, the present study was undertaken to investigate the health and disease problems of two freshwater eels, viz. *Monopterus cuchia* and *Mastacembelus armatus*

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from open water bodies of Mymensingh through clinical and histopathological measures.

MATERIALS AND METHODS

Site profile:

The present investigation was conducted for a period of six months from August 2012 to January, 2013 in two open water bodies of Mymensingh namely, Kailla beel and Brahmaputra river (Fig. 1).

Table 1. Monthly variations of water quality parameters (ranges) in *Kailla beel* and Brahmaputra river.

Source	Months*	Temperature (°C)	Dissolved oxygen (mgl^{-1})	pH
Brahmaputra river	Aug-Sept	22 - 28	5.5 – 6.1	6.5 - 7.2
	Oct- Nov	21- 29	5.0 – 6.2	7.4 - 8.0
	Dec- Jan	17- 20	4.4 – 5.3	7.0- 8.1
Kailla beel	Aug-Sep	22 - 28	5.0 – 5.9	7.1 - 7.3
	Oct-Nov	21- 29	5.2 – 6.1	7.1- 8.0
	Dec- Jan	15- 19	3.9 – 4.8	6.6 – 7.8

*Aug- August, Sep- September, Oct- October, Nov – November, Dec- December, Jan- January.

Kailla beel, situated at Ishwarganj subdistrict, located in between 24°33' and 24°44' north latitudes and between 90°28' and 90°46' east longitudes and about 30 km south east of Mymensingh district (Banglapedia, 2013), comprised an area of approximately 4000 acres, having average depth 2.5 and 8.0 meter (m) in winter and rainy seasons respectively. The Brahmaputra river, possess average depth of five and 15 m in dry and rainy season respectively, flowing through the East side of the Bangladesh Agricultural University campus, Sadar, Mymensingh, located between 24°38´ and 24°54´ north latitudes and between 90°11´ and 90°30´ east longitudes (Banglapedia, 2013).

Sampling procedure:

Live eels and water samples were collected monthly from the study sites and immediately carried to the Fish Disease Laboratory of the Faculty of Fisheries, BAU, Mymensingh. Water quality parameters like temperature, dissolved oxygen (DO) and pH were measured by using HACH's kit (Model FF-IA).

Clinical and histopathological examination:

The sampled fishes were clinically examined by naked eye and magnifying glass to record any external signs, injury and other abnormalities. Organs like skin and muscle, gills, liver and kidney were collected with the help of a sharp scalpel and forceps and fixed in 10% buffered formalin for histopathological examination. After at least eight hours of fixation, the samples were trimmed in order to obtain a standard size of 1 cm^3 (maximum) and placed in an automatic tissue processor (SHANDON CITADEL 1000) for dehydration, clearing and infiltration. The samples were then embedded, sectioned (5µm thickness) and stained with Haematoxylin and Eosin. Sections were mounted with Canada balsam and covered by cover slips and examined under a compound microscope (Olympus). Photomicrographs of the stained sections were obtained by using a photomicroscope (OLYMPUS, Model CHS, Japan).

RESULTS AND DISCUSSION

In the present investigation, the highest water temperature and dissolved oxygen (DO) content were recorded as (29°C and 6.2 mgl^{-1}) respectively during months of August and September and the lowest were 15° C and 3.9 mgl^{-1} respectively during December and January from Kailla beel and Brahmaputra river (Table 1). Average values of pH ranged from 6.5 to 8.1 (Table 1). Mamun et al. (2012) recorded dissolved oxygen 5.9-8.1 mgl^{-1}; and pH 6.6-8.1 in the pond condition which were well within the

acceptable range fish production. More or less similar DO and pH values were also

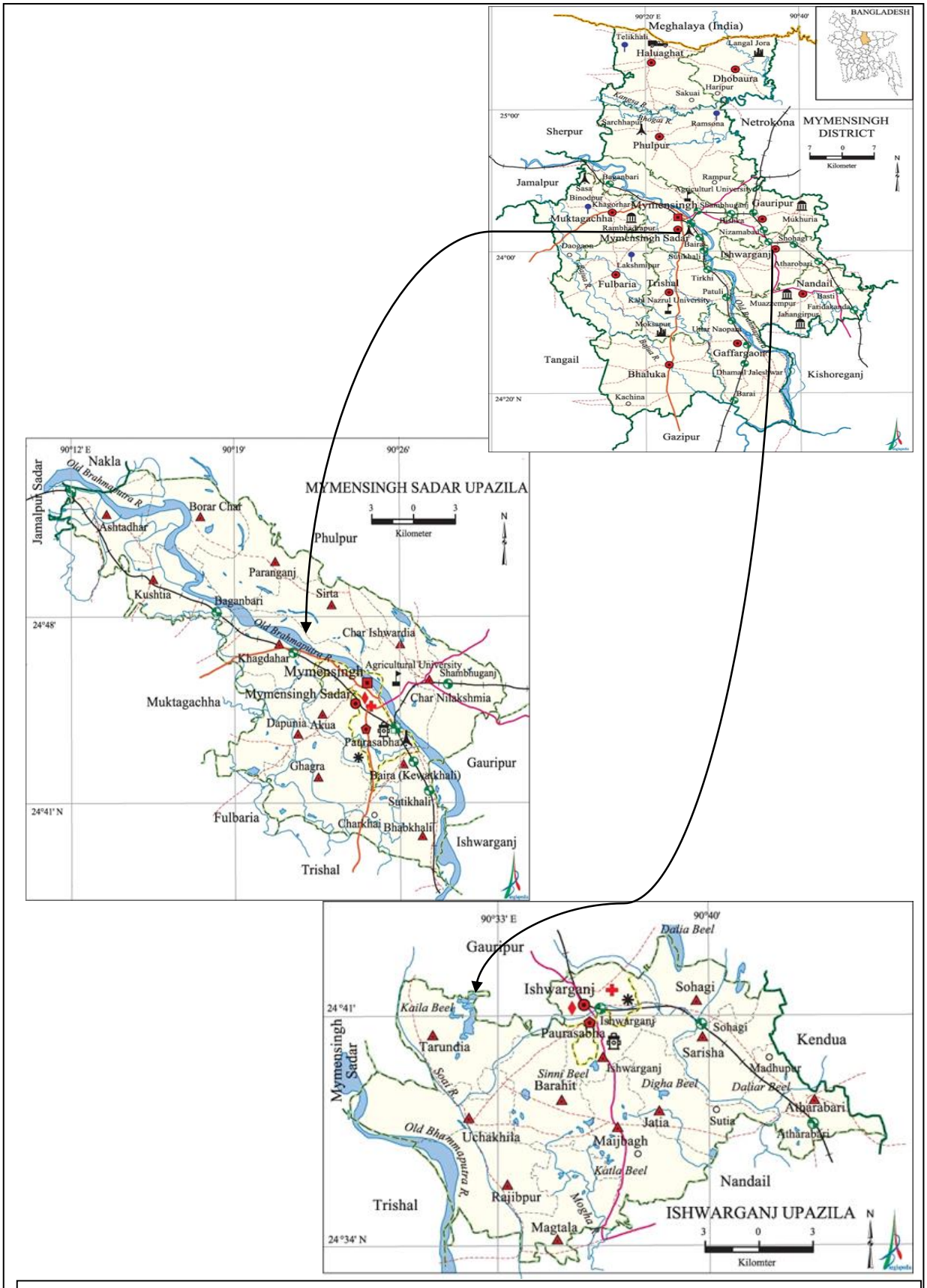


Fig. 1. Showing geographical location of the study area i.e. Brahmaputra river in sadar and Kailla beel in Ishwarganj upazila of Mymensingh, Bangladesh. (Banglapedia, 2013)

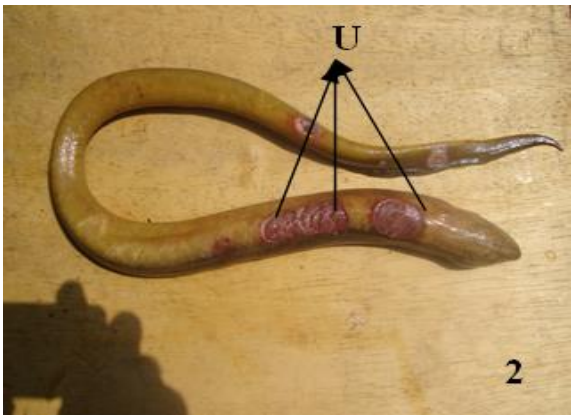
recorded by Hossain (2009); Kader et al. (2009); Rahman et al. (2009); and Shariful et al. (2009) in the ponds of Mymensingh sadar. Low temperatures were recorded by (Ahmed et al., 2013) in the months of December and January in Mymensingh region. It was observed that the average value of temperature and dissolved oxygen decreased in winter season particularly in the coldest months of the year**.** Ahmed and Banu (2001) observed reduced temperature and DO in freshwater bodies of Bangladesh during December, January and February. Environmental parameters and seasonal variation might play a significant role in the diseases outbreak in fishes. Colder environment with reduced temperature play the major role in the incidence of diseases outbreaks in the fishes of Bangladesh (Ahmed and Hoque, 1999).

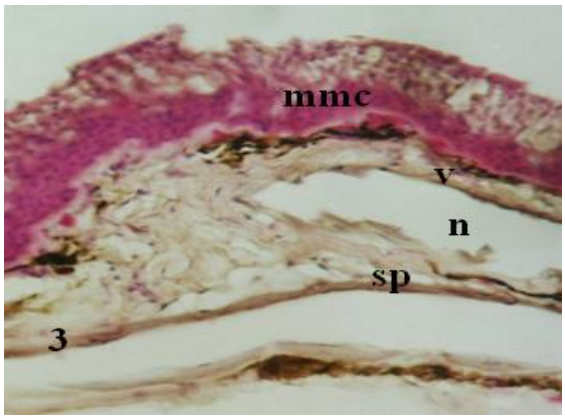
Clinically, it was observed that eels were almost normal during the months of August, September and October. However, in November mild lesions of the skin are characterized by rough skin, minor ulcer and few minute red spots. During months of December and January, eels were found to be severely affected and clinical signs like red spots, rough skin and deep ulcers were observed in the ventral and lateral regions of the body (Fig. 2). These findings coincided with the works done by Ahmed et al. (2009a); Hossain et al. (2009a); Ahmed et al. (2007); Marma et al. (2007); Parveen et al. (2005); Ahmed et al. (2000) and Chinabut (1994). Ahmed et al. (2004) found that all SIS fishes examined through clinical, parasitological and histopathological examination were severely affected during months of December and January. Roy et al. (2006) found that small indigenous freshwater fishes were more affected during the period of winter in comparison to other seasons of the year.

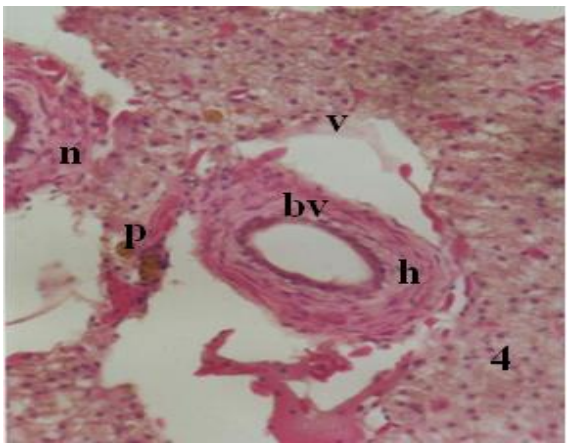
Histopathologicaliy, it was seen that skin,muscle, gills, liver and kidney of both *M. cuchia* and *M. armatus* were almost normal during months of August, September and October. However, in November reduced pathological changes like mild necrosis, pyknosis, few vacuums and hemorrhages were observed. On the contrast, during months of December and January marked pathological symptoms were obsereved when compared with other months. Patwary et al. (2008) observed that most of the air breathing fishes were more severely affected during months of December and January compared to other months. Our results were in agreement with the works of Ahmed et al. (2009c); Ahmed et al. (2004); Chinabut (1994) and Rodgers and Burke (1981).

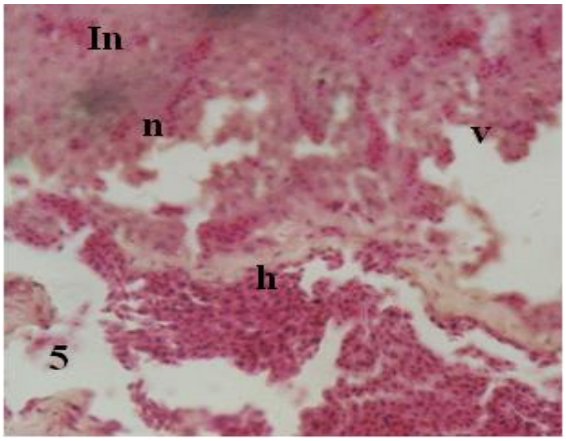
During the months of December and January marked pathological changes like severe necrosis, presence of melanomacrophage, loss of epidermis, vacuoles, spllited of dermis and muscle were noticed in skin and muscle of both *M. armatus* and *M. cuchia* (Fig. 3). Ahmed (1990) reported that excess mucus secretion or loss of the cuticle layer could be considered as stressed or diseased condition. Almost similar observation was found by Ahmed et al. (2009b); Ahmed et al. (2009c); Hossain et al. (2009b); Patwary et al. (2008); Ahmed et al. (2007); Parveen et al. (2005); Ahmed et al. (2004) and Hoque et al. (1999).

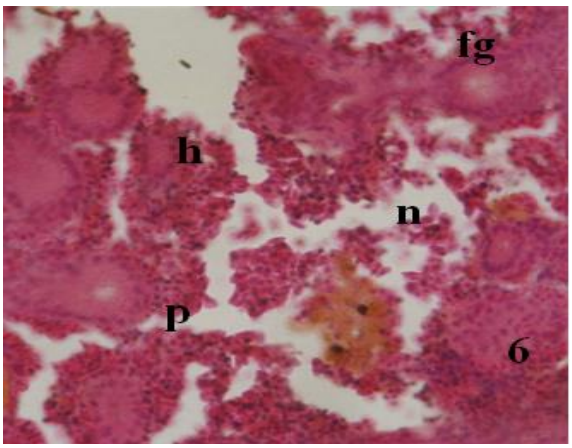
During months of December and January, necrosis and hyperplasia of hepatocytes, pyknosis, hemorrhages, vacuoles and blood vessels were evident in the liver of *M. cuchia*, (Fig. 4). Pathologies in liver of *M. armatus* include necrosis, pyknosis, vacuoles and hemorrhages and inflammatory cells (Fig. 5). Almost similar findings were recorded by Ahmed et al. (2009c); Hossain et al. (2009a); Hossain et al. (2009b); Joshi et al. (2007); Akter et al. (2006) and Ram and Singh (1988). Ahmed et al. (2004) found marked necrosis with blood cells, pyknotic cells and many fungal granulomas in the liver of *C. punctatus* during months of December and January. Kumar et al. (1991) observed marked pathological changes in the liver of EUS affected *Puntius, Mastacembelus* and *Channa* in India. Patwary et al. (2008) identified more or less similar pathological changes in liver of *H. fossilis. C. batrachus* and *A. testudineus.*











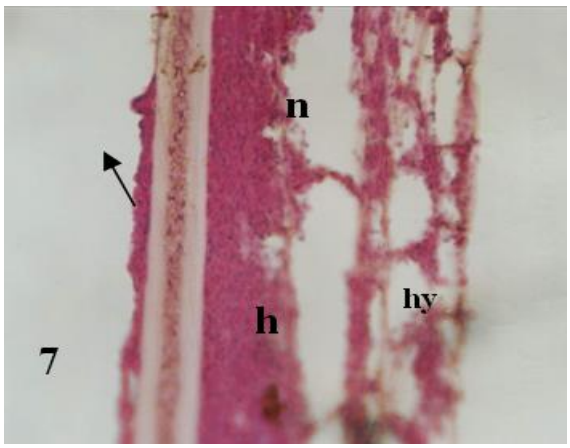


Fig. 2. Photograph of *Monopterus cuchia* from Kailla beel in January. Rough skin, red spots and severe ulcers (u) were seen in ventral region and throughout the body.

Fig. 3. Section of skin and muscle of *M. cuchia* in December & January, showing epidermal loss ( ), split off dermis and muscle (sp), necrosis (n), vacuolation (v) and melanomacrophage (mmc). H & E × 125.

Fig. 4. Section of liver of *M. cuchia* in December & January showing severe necrosis (n) of hepatocytes, hemorrhage (h) pyknosis (p) and vacuole (v). H & E × 425

Fig. 5. Section of liver of *M. armatus,*shal baim in December & January. In hepatocytes severe necrosis (n), hemorrhage (h), vacuoles (v), inflamatoty cells (In) were seen H&E ×425.

Fig. 6. Section of kidney of *M. armatus* in the month of December & January showing severe necrosis (n), hemorrhage (h), pyknosis (p) and presence of fungal granuloma(fg). H&E ×425.

Fig. 7. Section of gill of *M. armatus* in December and January showing loss of secondary gill lamellae (sgl) ( ), hyperplasia (hy), marked hemorrhage (h) and necrosis (n) with primary gill lamellae. H & E × 425.

The recorded pathological signs in the kidneys of both *M. cuchia* and *M. armatus* were hemorrhages, vacuolation, necrosis, fat droplets, missing and ruptured kidney tubules, pyknosis and presence of fungal granuloma (Fig. 6). Presence of fungal granuloma in the kidney of *M. cuchia* and *M. armatus*, indicates the eels might be were affected by epizootic Ulcerative syndrome (EUS). Hatai et al. (1994) also reported fungal hyphae and many granulomas in the internal organs and musculature of EUS affected *Colisa lalia* in Japan. Noga and Dykstra (1986) were of the opinion that marked granulomatous inflammatory response was shown by fish infected *with Aphanomyces* sp. Presence of fungal granulomas and fungal hyphae in the skin and muscle of *O. niloticus* and *C. cirrhosus* indicated that the fishes were affected by EUS (Ahmed et al. 2013; and Ahmed et al. 2012).This result also agreed with the observation on EUS of fresh water fishes of South and Southeast Asia (Roberts et al. 1993). Ahmed et al. (2004) observed marked necrosis; hemorrhages, pyknosis and fungal granuloma in the kidney of EUS affected *C. punctatus* collected from Kailla beel during months of December and January. Ahmed and Hoque et al. (1999) found that two internal organs of investigated freshwater fishes, kidney and liver were more affected during the colder months i.e.December and January of the year. Akter et al. (2006) found necrosis, fat droplets and hemorrhage, in the kidney of *M. aculeatus* and *M. cuchia,* during months of December and January. Ahmed et al. (2009a); Ahmed et al. (2009b); Ahmed et al. (2009c); Hossain et al. (2009a); Hossain et al. (2009b); and Hoque et al. (1999) found similar results in case of perch, *Nandus nandus;* air breathing teleost, *Anabas testudineus;* freshwater eel, *Monopterus cuchia;* snakehead, *Channa punctatus*; some small indigenous species *Mastacembelus pancalus* and *Glossogobius giuris* and major carps during winter season respectively.

Major gill pathologies of eels were in the form of missing of primary and secondary gill lamellae, necrosis, clubbing, marked hyperplasia, highly hypertrophied and hemorrhagic gill lamellae (Fig. 7). Ahmed et al. (2009c); and Ahmed et al. (1998) found similar pathological lesions in freshwater eel, *Monopterus cuchia; and* juvenile of Indian major carps respectively. Roy et al. (2006) reported cysts, hyperplasia, lamellar clubbing and hypertrophy in EUS affected *C. punctatus*, *M. tengara* and *H. fossilis*. Patwary et al. (2008) identified almost similar pathological changes in gills of *H. fossilis*. *C. batrachus* and *A. testudineus*. Parveen et al. (2005) also mentioned that in December and January marked hypertrophy and hyperplasia were observed in gill lamellae of *C. punctatus* and *N. nandus*. Most of the examined eels of both open water bodies were apparently healthy from external observations, but under histopathological observations it was found that a high percentage of fish were affected by pathogens especially fungus. Clinicallyand histopathologically, it was observed that eels were almost normal during months of August, September and October. However, during months of December and January, eels were severely affected with epizootic ulcerative syndrome (EUS), dactylogyrosis, parasitic and bacterial diseases. Similar observations were also made by Ahmed et al. (2004) who examined through clinical, parasitological and histopathological observation of three SIS and found that all fishes were severely affected in the months of December and January. These results were agreed with the works of Chinabut (1994); Barua (1994) and Rodgers and Bucke (1981). Both clinically and histopathologically examinedeels of Kailla beel river were found to be more severely affected than that of Brahmaputra river towards the colder months of the year i.e., December and January, in comparison with other months. In winter season, due to reduced temperature and lower water depth fishes become stressed which ultimately leads to infection and disease (Akter et al. 2006). The present results also agreed when compared with the findings of Ahmed et al. (2009a); Ahmed et al. (2009b); Ahmed et al. (2009c); Hossain et al. (2009a); and Hossain

et al. (2009b). Ahmed et al. (2004) also found that the prevalence of infection from Kailla beel was higher in December to January and lower in April to September. Parveen et al. (2005) found that most of the fishes of Oxbow lakes were severely affected during the months of December and January. These findings were more or less parallel to the present investigation.

Fishes of Brahmaputra river and Kailla beel could be stressed due to due to poor environmental condition such as, lower water depth, siltation, use of insecticide and pesticide, overuse of fertilizer, over exploitation, surface runoff human interference and introduction of pathogens. All of these stressors become widespread especially during the colder season. Low or rapidly changing water temperature, pH, low alkalinity and low DO were seasonal aggregations of fish diseases (FAO, 1986; Lilley et al. 1992). Proper preventive and control measures should be taken in order to overcome the disease problems, particularly during the winter season. But in Bangladesh countries, appropriate methods to prevent and control diseases of open water fishes were not well established. So, it could be concluded that the proper management strategies should be taken for open water fisheries in order to save these important eels from extinction.

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