HISTOPATHOLOGICAL STUDIES ON COMMONLY CONSUMED FISH *HARPODON NEHEREUS* COLLECTED FROM SASSOON DOCK, WEST COAST OF MAHARASHTRA, INDIA.

[1]Archana Oza, [2]Leena Muralidharan
[1]Research Scholar, [2]Research Guide
[1]Department of Zoology,
[1]Ramniranjan Jhunjhunwala College, Mumbai, India

Abstract: Fishes being the important members of food chain in aquatic ecosystem they are more prone to get affected by any contaminants present in their surrounding environment. In recent years marine pollution has become a major concern throughout the world. This negatively affects fish health leading to cause abnormalities associated with different organs particularly gills, liver and kidney that are involved in various biochemical pathways of an organism. Fishes act as a pollution indicator by showing classical stress response. Histopathological studies can give us an indication of organ damage caused to the fish in order to assess the health status of the fish and the extent of pollution in marine environment. The present research work aims at studying histopathological changes in liver, gill and kidney of commonly consumed fish *Harpodon nehereus* collected from Sassoon dock, west Coast of Maharashtra, India. Structural alterations were noted in all the selected tissues of *Harpodon nehereus* indicating that the selected fish is under high risk of pollution stress.

Key words: **Histopathology, *Harpodon nehereus*, gill, kidney, Liver.**

I. INTRODUCTION

Histopathological changes have been widely used as biomarkers in evaluating the health of the fish exposed to contaminants (Marina M.P. Camargo and Claudia B.R. Martinez, 2007; S. Thopan et al, 2003;). Histopathology of fishes are increasingly being used as indicators of environmental stress that helps in determining the historical exposure (G.D. Steniford, 2003) and also provides a data concerning changes in cellular or sub-cellular structure of an organ much earlier than any external notice (Leena Muralidharan, 2014). Heavy metals due to their potential toxicity induce biochemical changes in the organs of animals (Jalaludeen M.D. et al, 2012). One of the great advantages of using histopathological biomarkers in environmental monitoring is that it allows examining specific target organs including gills, kidney and liver that are responsible for vital functions (Marina M.P. Camargo and Claudia B.R. Martinez., 2007). Histopathology provides a rapid method to detect the effects of irritants, especially chronic ones, in various tissues and organs (Drishya M K et al, 2016). Liver is an organ responsible for detoxification and plays an important role in elimination of toxic substances in the body thus any alteration noticed in liver may indicate pollution stress in their surrounding environment. Gill being the first target organ in fishes exposed to foreign material also indicates pollution in their surroundings. Kidney is associated with excretion of unwanted material from the body. When fishes are exposed to any kind of pollution stress including heavy metal pollution or any other type of contaminants in their surrounding environment, it induces number of alterations in different organs (Hanan S.Gaber et al, 2014).

Many authors have reported histopathological alteration in organs of marine fishes as well as fresh water fish when they are exposed to toxic contaminants. Leena Muralidharan 2014 reported histopathological alterations with respect to heavy damages in kidney, gills and liver of *Cyprinus carpio* when exposed to varying concentrations of fenthion. Bioaccumulation of heavy metals leads to cause structural alteration in fish tissues (Imam A.A. mekkawy et al 2013; Mehjbeen Javed and Nazura Usmani, 2013). Gill, kidney and liver damages were also showed by Marina. M.P. Camargo and Claudia. B. R. Martinez, 2007 in their study on Neotropical fish caged in an urban stream. Gill and liver damages were also recorded by Hanan S Gaber et al, 2014 in their study on comparison of tissue lesions in marine fish species inhabiting Bardawil Lagoon. Pathological alteration in gill, kidney and liver tissues were also observed by G.D.Steniford et al, 2003 in estuarine fish species for the assessment of biological effects of contaminants. Alterations in kidney, liver and gill of white seabass were noticed by S. Thopon et al, 2003 when the fish were exposed to acute and subchronic doses of cadmium. With the view to through more light on quality of fish health in marine ecosystem, the present research work was carried out to study histopathological alterations in gill, kidney and liver tissue of commonly consumed fish, *Harpodon nehereus* collected from Sassoon dock, Mumbai coast of Maharashtra.

II. MATERIALS AND METHODS

The fresh fishes measuring 26-30 cm in length and 160-180 grams in weight were collected from Sassoon dock, Mumbai coast of Maharashtra during the year 2016-18. The fresh fishes were immediately collected after the landing, and the fishes were dissected to remove the liver, gill and kidney. The excised organs were washed with distilled water and immediately fixed in 10% neutral buffered formalin and then brought to the laboratory for further processing. Fixed tissues were processed for paraffin embedding technique. Rotary microtome was used to take 5 µ thick sections of the embedded tissues. The selected tissues were stained using haematoxylin and eosin stain (HE). The tissues were fixed by DPX to prepare permanent slides. The extent of damage and structural alterations in the selected tissues were studied by focusing it into different magnification power of compound light microscope and digital photographs were taken to show the specific site of damages observed.

III. RESULTS AND DISCUSSIONS:

In the present study gill tissues of fish, *Harpodon nehereus* showed histopathological alterations like lamellar deformity and shortened secondary lamellae as shown in fig. 1(a); more clear view of severe lamellar disorganization can be observed from fig. 1(b); tips of lamellae were found to be deformed and expanded (fig. 1(c)); curling of secondary lamellae, lifting of epithelial cells and lamellar fusion were also noticed and shown in fig. 1(d); severe epithelial necrosis were also observed in gill tissues of selected fish (fig. 1(e)).

Kidney tissues of *Harpodon nehereus* showed tubular degeneration and shrinkage of tube lumen (fig. 2 (a)). More histopathological alterations could be viewed from fig. 2(b) showing cloudy swelling degeneration and tubule cells with hypertrophied nucleus; hyaline droplet degeneration and shrinkage of tube lumen were noticed in renal tissues as shown in fig. 2(c). Disintegration of renal cells was also seen in kidney of *Harpodon nehereus* (fig. 2(d)).

Liver tissues of *Harpodon nehereus* showed severe histopathological alterations in the present study. Hepatic tissues showed lymphocyte infiltration and ruptured central vein as can be easily viewed from fig. 3(a). Fig. 3(b) reveals structural alterations like vacuolated, cloudy, swollen, disintegrated and ruptured hepatic cells. Liver of selected fish also showed Pycnosis and many necrotic regions during the study period (fig. 3(c)). Structural damages like fatty degeneration, disturbed cordal

arrangement of hepatic cells, increase in sinusoidal space and necrotic hepatocytes were noticed and presented in fig. 3(d). Liver tissue of *Harpodon nehereus* also showed structural alterations like macrovesicular steatosis (fig. 3(e)).

Similar observations were recorded by other authors in their study on histopathological variation in different fish species in different part of the world. Mehwish Faheem and Khalid Parvez Lone in the year 2017 reported histopathological alteration in liver and kidney of fish *Ctenopharyngodon idella* and observed lymphocytic infilteration and ruptured central vein of liver along with degeneration of renal tubules and shrinkage of tube lumen. Hanan S Gaber et al in the year 2014 studied histopathological changes in marine fish species *Solea solea* and *Mugil cephalus* from Bardawil lagoon and observed epithelial lifting and necrosis of gills, liver tissue showed necrosis, edema and dilation of central vein. Leena Muralidharan, 2014 observed shortened, swollen, ruptured and deformed secondary lamellae of gill, damaged hepatic cells with peripheral pyknosis, ruptured, vacuolated and disintegrated renal cells when the fish *Cyprinus carpio* were exposed to high concentration of fenthion. Marina M.P. Camargo and Claudia B.R. Martinez in the year 2007 reported epithelial lifting of gills along with lamellar disorganization, hypertrophy of lamellar epithelium and lamellar fusion in gills, kidney showed occlusion of tubular lumen and cloudy swelling degeneration, liver tissues were found to be with cytoplasmic vacuolation and focal necrosis in their study on Neotropical fish, *Prochilodus lineatus*. Ashish K Mishra and Banalata Mohanty, 2008 reported hyperplasia of lamellar epithelium of gills, lamellar fusion, epithelial lifting and curling of secondary lamellae, degeneration of renal cells and vacuolization of hepatocyte with pyknotic nuclei in their study on *Channa punctatus*. JC Van Dyk et al, 2009 studied histolopathology in tissues of four fish species, *Clarias gariepinus, Clarius ngamensis, Oreochromis andersonii* and *Serranochromis angusticeps* from Okavango delta, Botswana and showed hyperplasia of gill epithelium and macrovesicular steatosis in liver. Histopathological studies on organs of estuarine fish species were studied by G.D.Steniford et al, 2003 and reported lamellar fusion of gills, hydrophic vacuolation in biliary epithelium of liver and inflammation of kidney tubules. S. Thopan et al in the year 2003 observed structural alterations where gills showed edema of epithelial cells and fusion of secondary lamellae, liver cells showed hydropic swelling, kidney showed hydropic swelling along with pyknosis, vacuolar degeneration and tubular necrosis in white seabass, Lates calcarifer from commercial fish farm in chonburi, Thailand. Essential contribution in the field of environmental pollution and the effects of contaminant exposure on histopathological alteration in organs of fish were also made by many other researchers in their study (Karina Fernandes et al, 2016; Rita Triebskorn et al, 2007; Edith Fanta et al, 2003; Renata Fracacio et al, 2003).

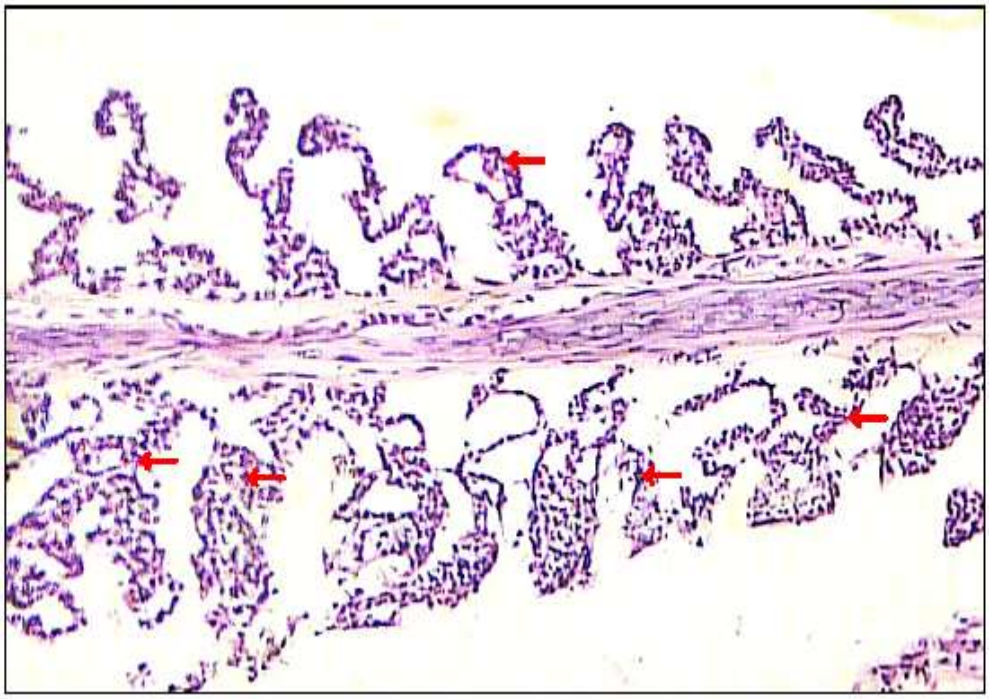

Fig. 1. (a) Gill- HE stained (400 X); showing deformed and shortened secondary lamellae (arrows)

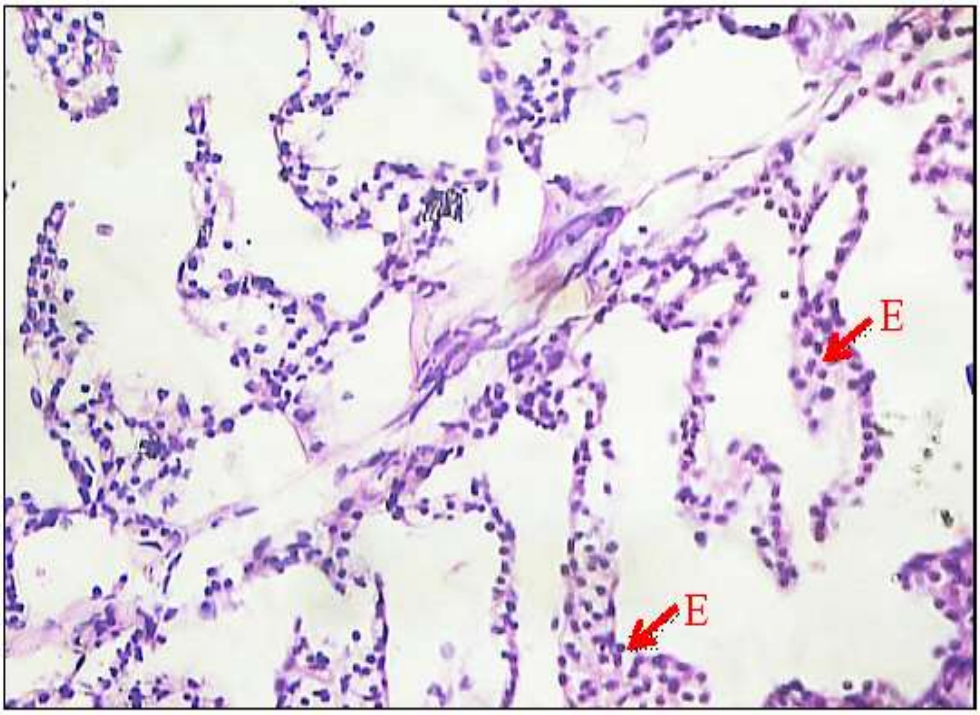

Fig. 1. (b) Gill- HE stained (400X); showing (E) edema of secondary lamellae and lamellar disorganization.

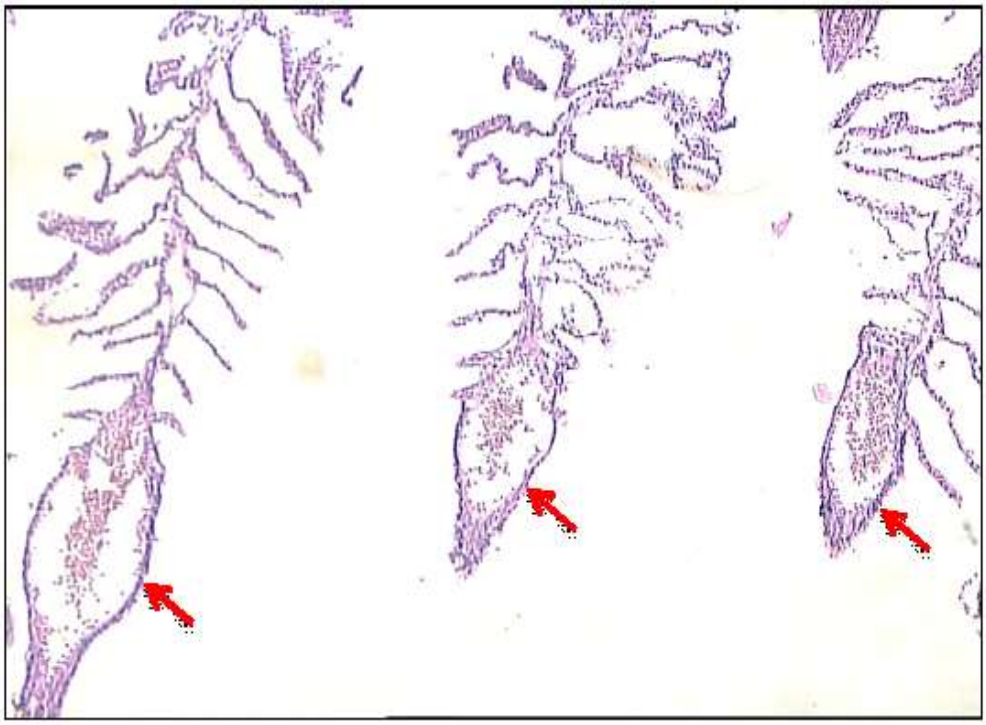

Fig. 1. (c) Gill- HE stained (200X); showing disorganized tips (distal clubbing) of secondary lamellae (arrows)

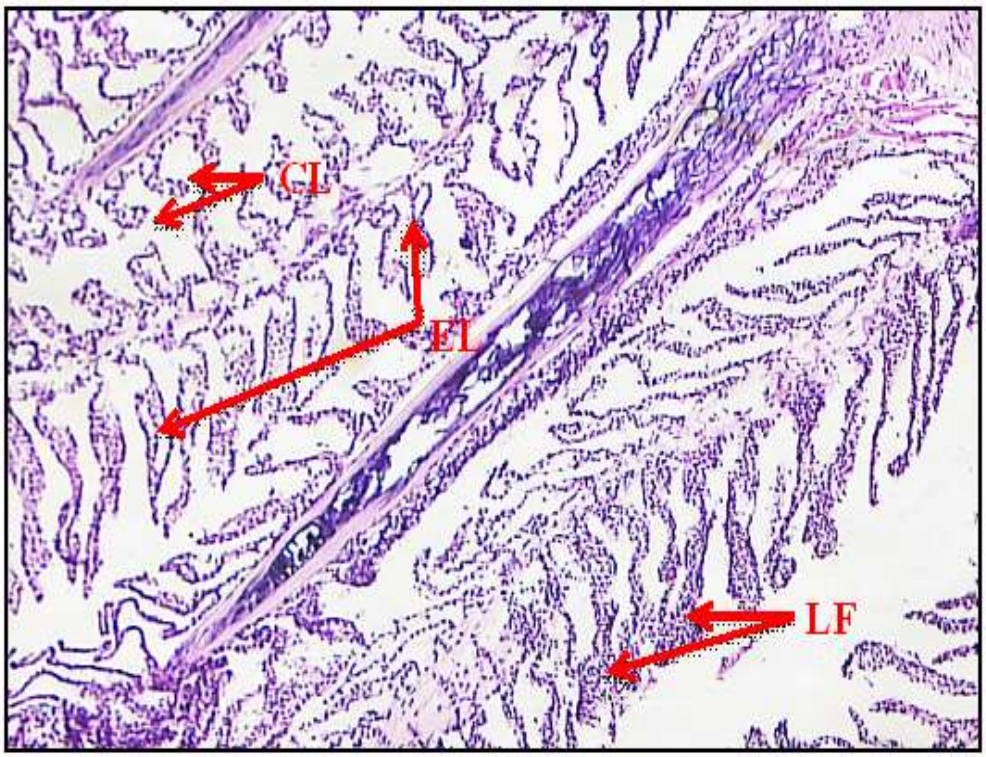

Fig. 1. (d) Gill- HE stained (200 X); (CL) curling of secondary lamellae; (EL) epithelial lifting of gill lamellae; (LF) Lamellar fusion

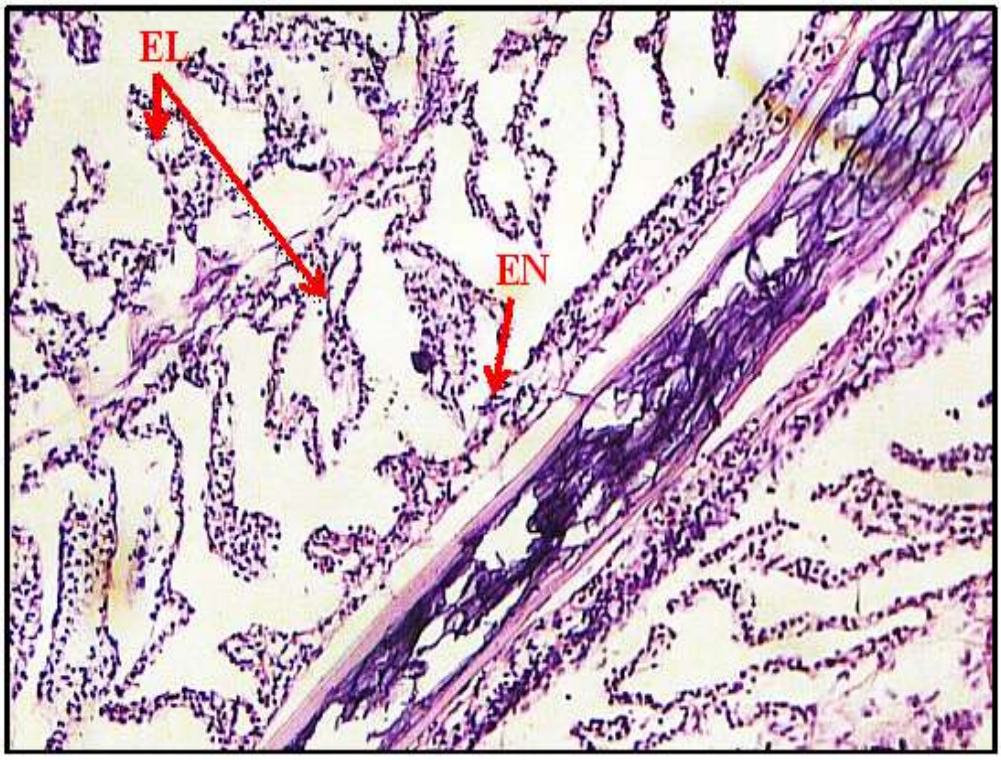

Fig. 1. (e) Gill- HE stained (200 X); showing (EN) epithelial necrosis; disorganization of lamellae and (EL) epithelial lifting.

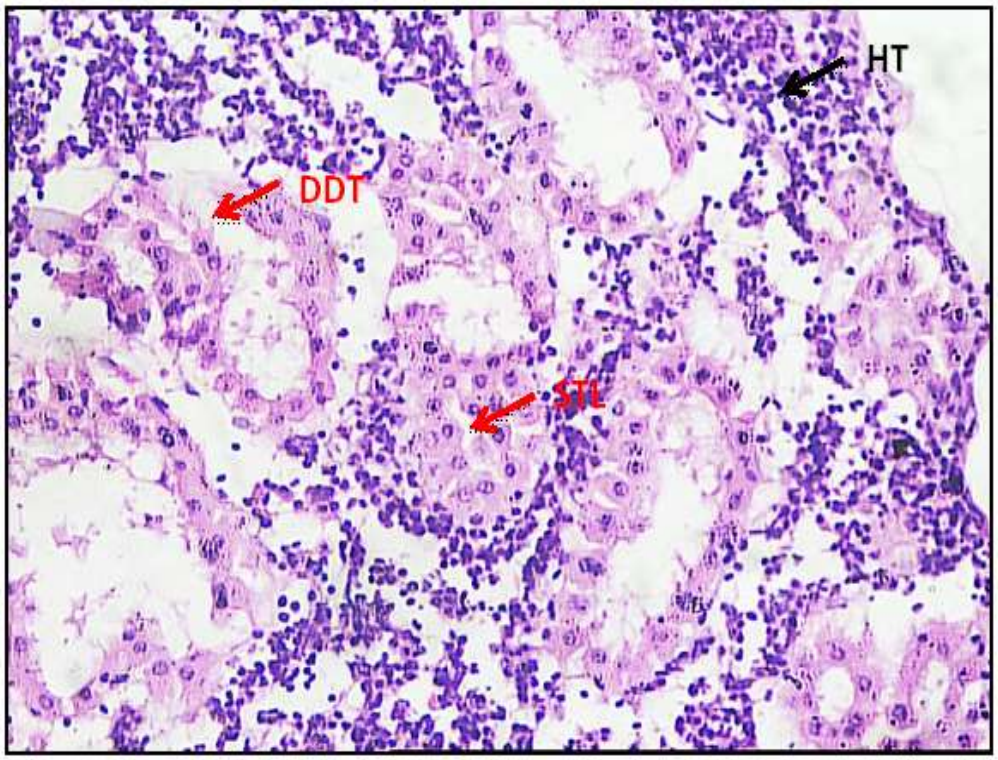

Fig. 2. (a) Kidney- HE stained, 400 X; (HT) haematopoietic tissue; (DDT) degeneration of distal tubules; (STL) shrinkage of tube lumen

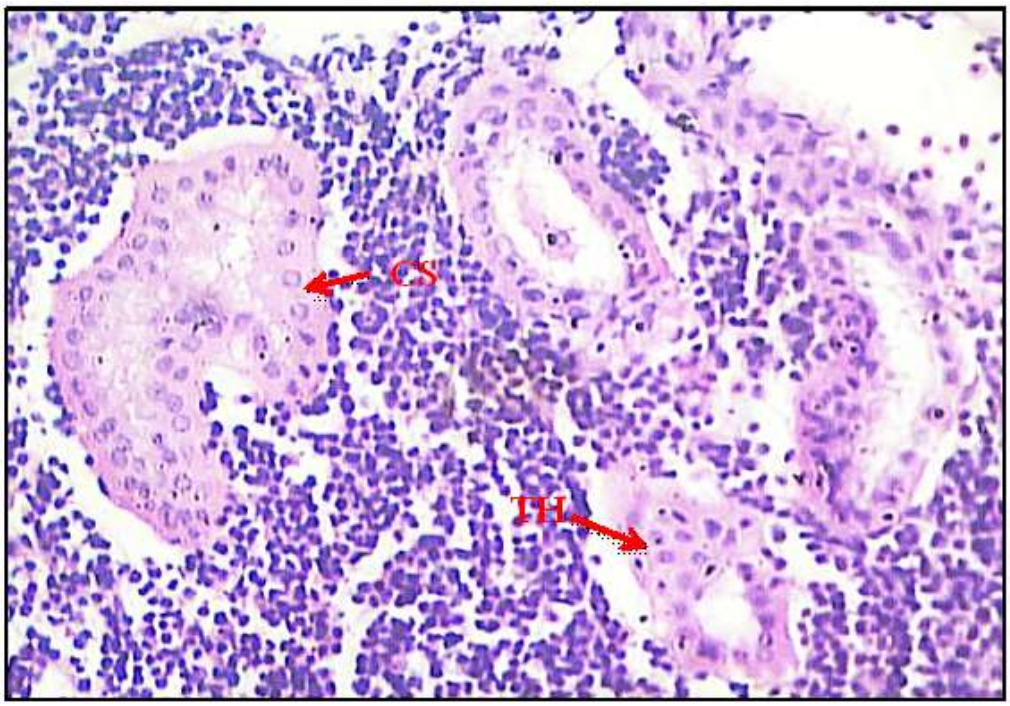

Fig. 2. (b) Kidney- HE stained, 400 X; (CS) cloudy swelling degeneration; (TH) tubule cells with hypertrophied nucleus.

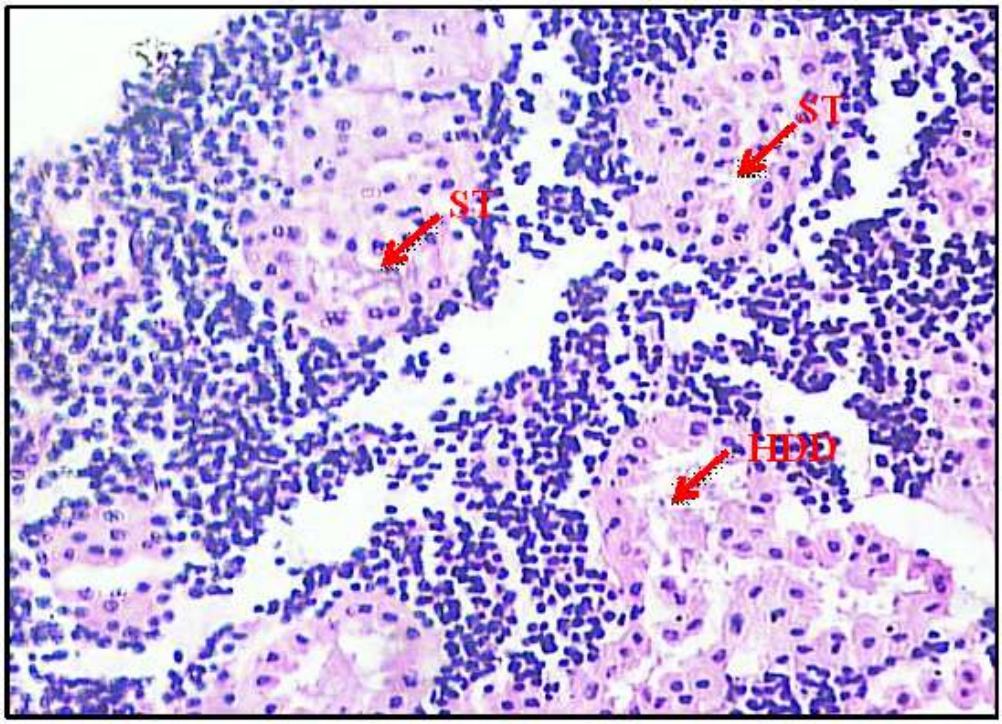

Fig. 2. (c) Kidney- HE stained, 400 X; showing (HDD) hyaline droplet degeneration; (ST) shrinkage of tube lumen

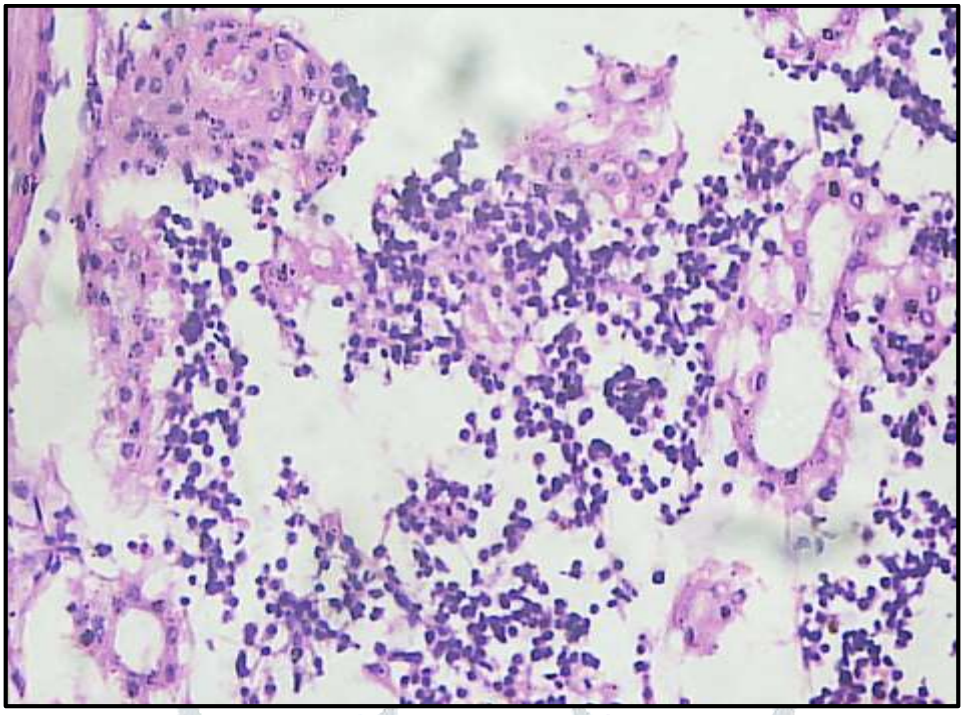

Fig. 2. (d) Kidney- HE stained, 400 X; showing disintegration of renal cells

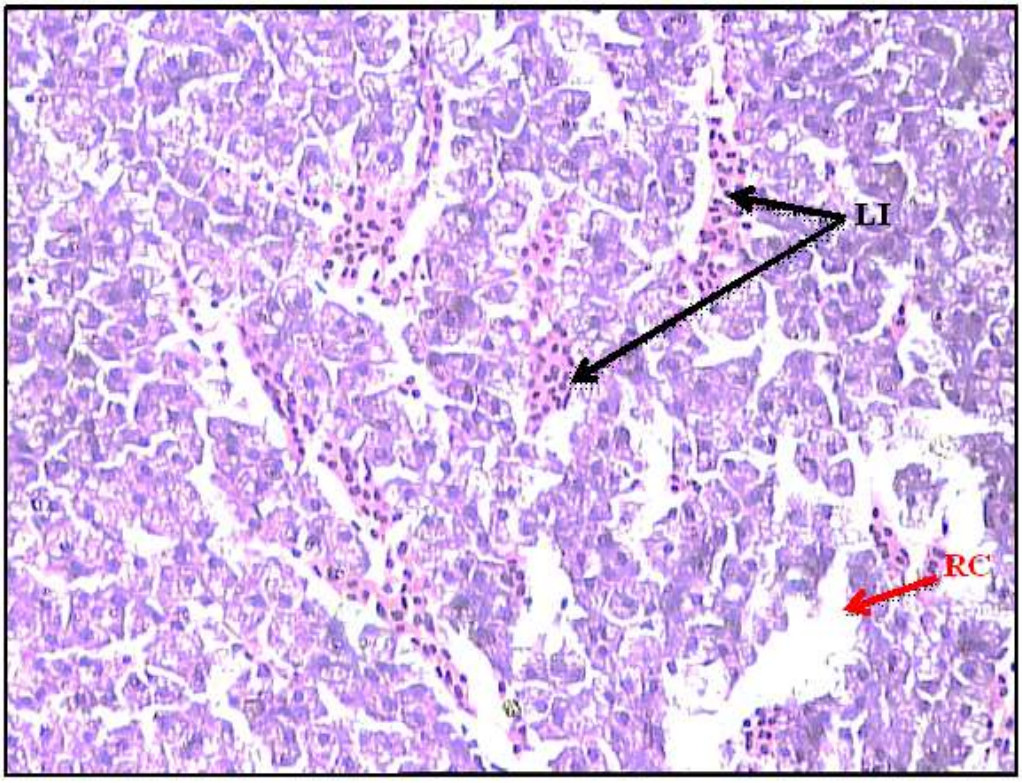

Fig. 3. (a) Liver HE stained , 400 X; (LI) lymphocyte infiltration, (RC) ruptured central vein

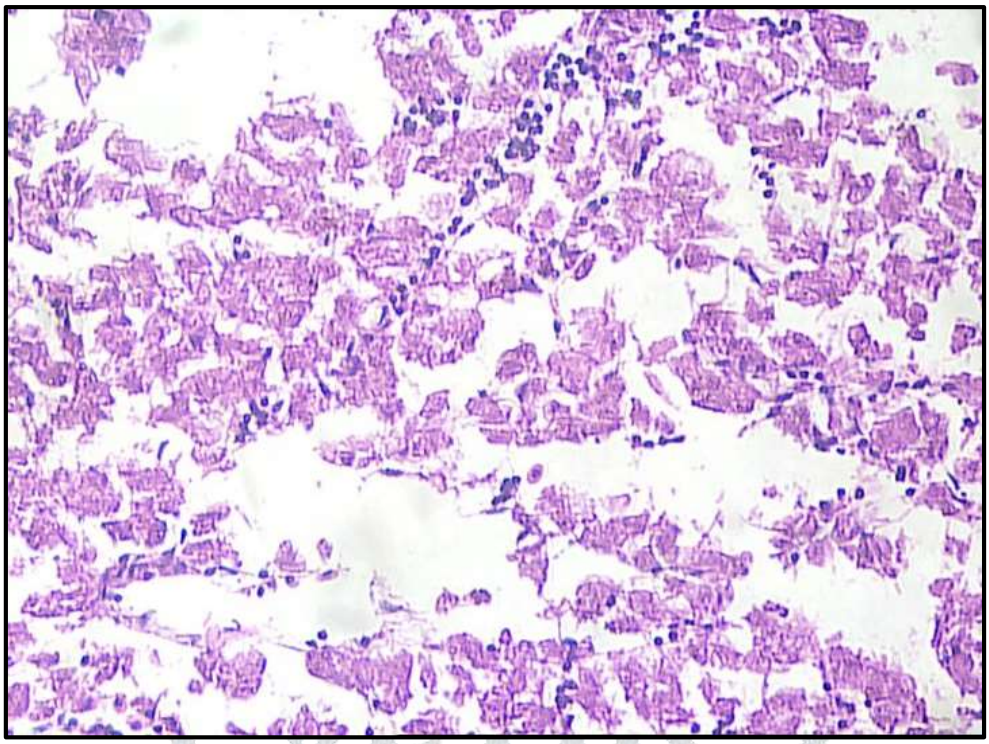

Fig. 3. (b) Liver- HE stained, 400 X; showing vacuolated, cloudy, swollen, disintegrated and ruptured hepatic cells

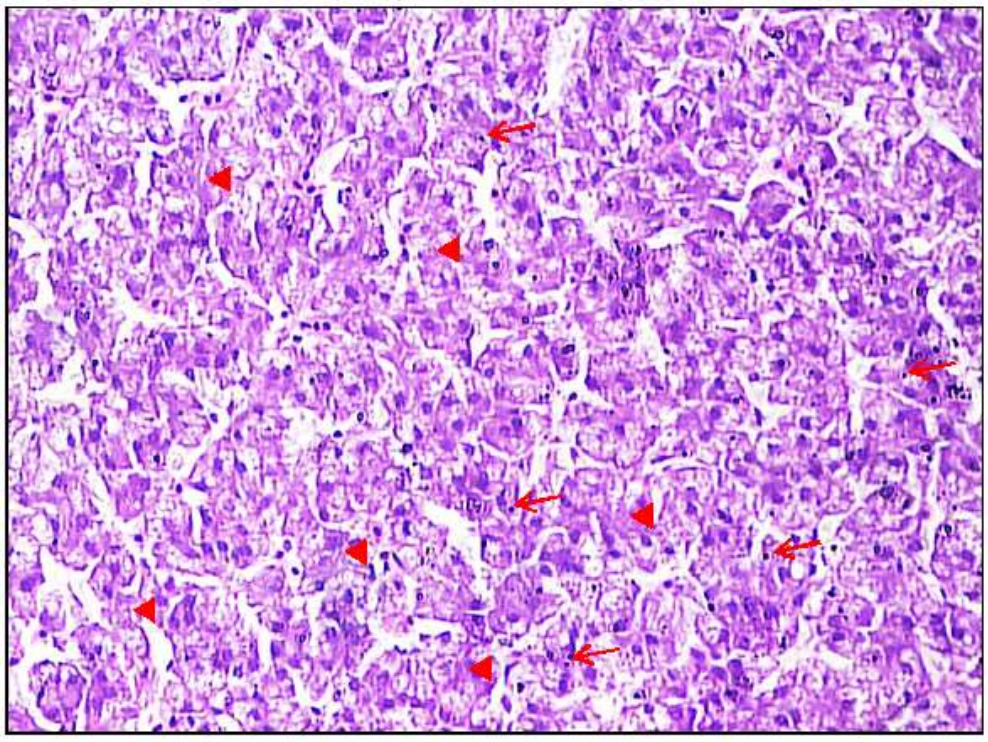

Fig. 3. (c) Liver- HE stained, 400 X; showing Pycnosis (arrows) and necrotic (arrow head) regions

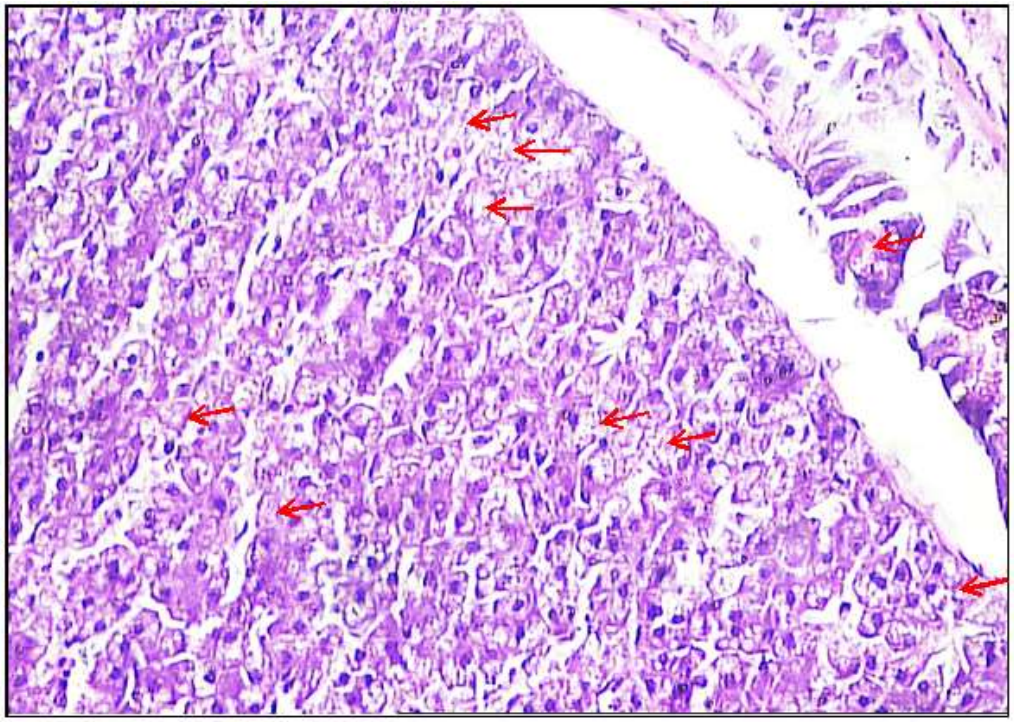

Fig. 3. (d) Liver- HE stained, 400 X; showing fatty degeneration; disturbed cordal arrangement of hepatic cells; increase in sinusoidal space and necrosis (arrows)

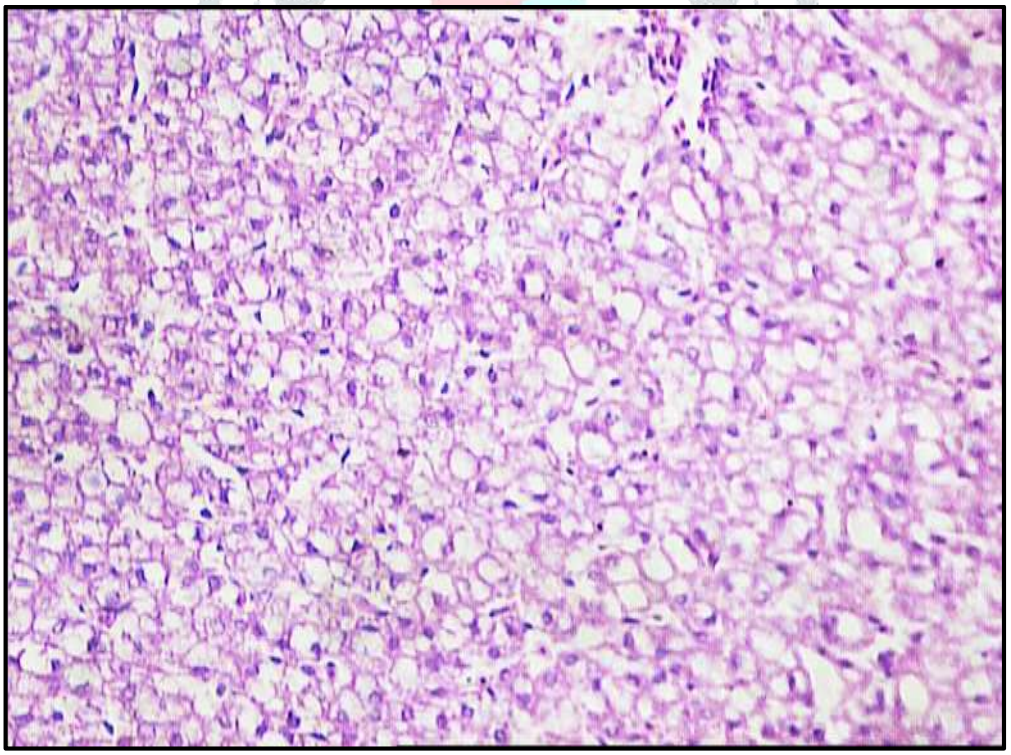

Fig. 3. (e) Liver- HE stained, 400 X; showing macrovesicular steatosis (severe fatty degeneration)

IV. CONCLUSION:

The above results and observations clearly indicates that the gill, kidney and liver tissue of fish *Harpodon nehereus* in the present study showed structural alterations that reveals health status of the selected fish. Thus it can be concluded that the fish

understudy is at the risk of damage due to pollution stress. Further the structural alterations in selected organ may also lead to imbalance in the physiological mechanisms of the fish. Further studies should be conducted to keep a continuous check on pollution stress in marine biota to conserve food chain and aquatic ecosystem.

V. ACKNOWLEDGEMENT:

Authors are thankful to Principal R. Jhunjhunwala College Dr. Usha Mukundan for providing necessary facilities to carry out the present research work. Special thanks to Dr. P.G. Kale former head of the Zoology department, R.J. College for necessary Guidance. We are grateful to Mr. Santosh Tiwari for helping with slide preparation. We are thankful to Dr. Nafisa Balasinor, Head department of Neuroendocrinology, NIRRH Parel for providing instrumental facilities to carry out the digital slide photography. Thanks to Mrs. Reshma Gaonkar, Research Scholar, NIRRH, for help rendered during slide photography.

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