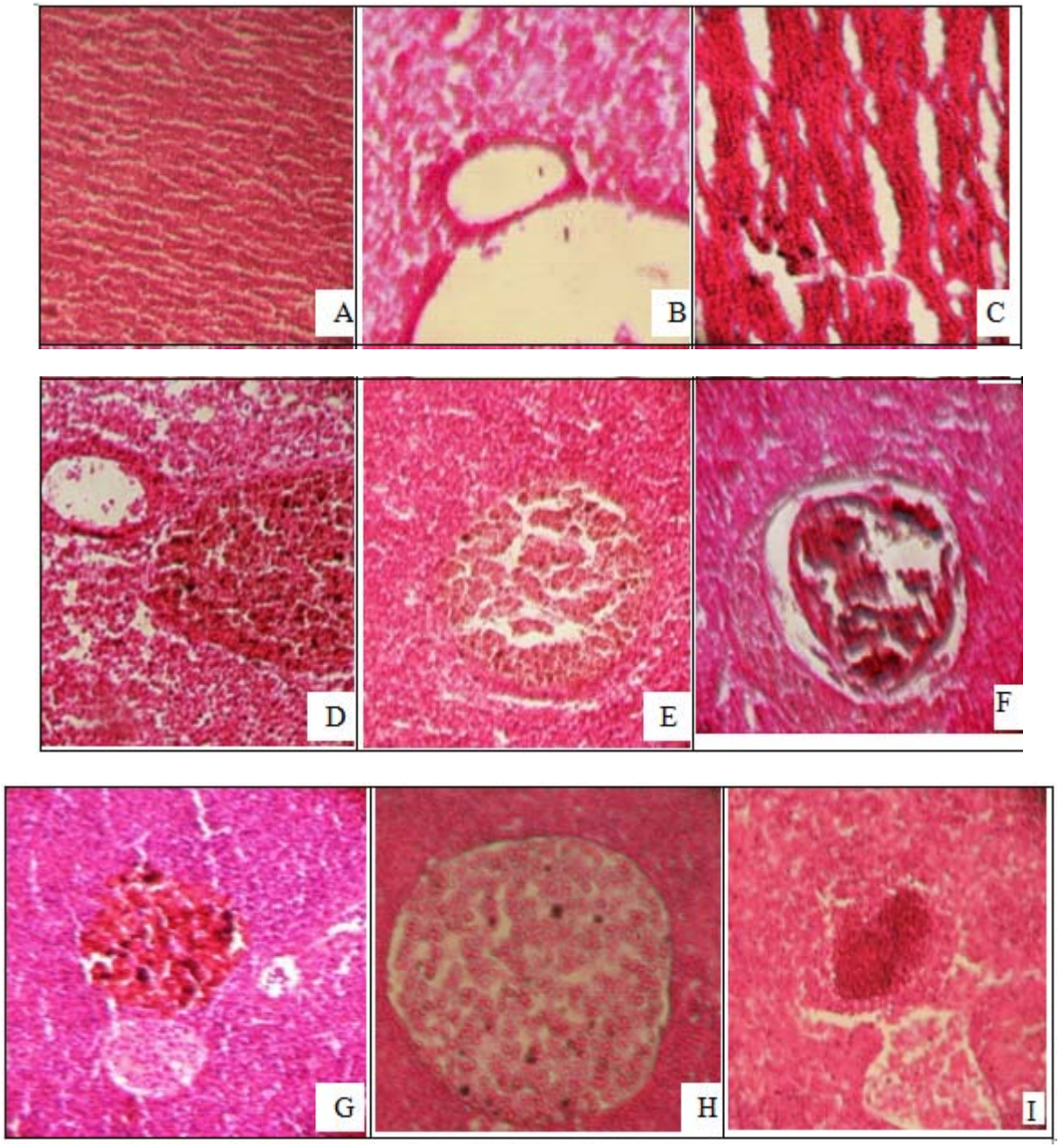

Figure 4.0: Kidney histopathology of *Sarotherodon melanotheron* from Bietri Bay in Ebrie Lagoon. A normal Kidney (HE, 150×); B vacuolization(HE, 200×); C severe dilation with renal cells degeneration (HE, 200×); D hemorrhage (HE, 200×); E parasitic cyst (HE, 200×);F vacuolar degeneration in the epithelium of renal tubules (HE, 200×);G hemorrhage (HE, 200×); H parasites (HE, 200×); I dilation in renal blood vessels and cyst (HE, 200×).

3.4. Discussion

Histopathological changes have been widely used as biomarkers in the evaluation of the health of fish exposed to contaminants, both in the laboratory and field studies. These histopathological biomarkers are closely related to other biomarkers of stress since many pollutants have to undergo metabolic activation in order to be able to provoke cellular change in the affected organism. Previous studies reported that the exposure of fish to pollutants resulted in several pathological alterations in different tissues (gills, liver, Kidneys, muscle and gonads) of fish [5] [6] [7] [8]. In our study, the tissues sections whose metal rates are inferior with 0, 01µgkg $^{-1}$ exhibit a normal structure with no abnormalities in the tissues sections. Results of the present study revealed that *Sarotherodon melanotheron* obtained from Bietri Bay in Ebrie Lagoon during February 2008 and January 2009 manifest histopathological changes in gills, liver and kidney. It is possible that the pathological alterations in the tissues of studied fish could be a direct result of the heavy metals, which are entered to constantly into the lagoon in a general way and in particular into bay of Biétri with the drainage water.

Our study reveals that the gills are the most faded bodies (98% of the sample observed are faded). The gills, which participate in many important functions in fish, such as respiration, osmoregulation and excretion, remain in close contact with the external environment, and particularly sensitive to changes in the quality of the water, are

considered the primary target of the contaminants [6] [9]. Proliferation in the epithelium of gill filaments and secondary lamellae, proliferation of mucous cells, cyst at the top of secondary lamellae, dilation and congestion in gill filaments blood vessel, atrophy of secondary lamellae, lamellar disorganization with focal fusion and hyperplasia of the epithelial cells and between secondary lamellae were observed in *Sarotherodon melanotheron* gills. These pathological changes may be attributed to a reaction to toxicants intake or an adaptive response to prevent the entry of the pollutants thorough the gill surface [10]. That can cause the increased distance between water and blood due to epithelial lifting, the oxygen uptake is impaired and as a consequence caused hypoxia or anoxia of the tissue [6]. In addition, gills are immediately exposed to the environment external to the body and are the first organs exposed to pollutants, such as heavy metals [11]. Similar alterations in the gills have been reported by [12] in *Tilapia zillii* and *Solen vulgaris* from Lake Qarun, Egypt exposed to metals. Similar alterations were detected by [13] in *Liza saliens* from Esmoriz-Paramos lagoon, Portugal contaminated by copper and zinc and by [11] in *Litopenaeus vannamei* gills after acute exposure to cadmium and zinc from coastal areas, China.

In our study, several histological alterations were observed in *Sarotherodon melanotheron* liver (80% of the sample observed). These pathological alterations included dilation in cells hepatic, focal areas of necrosis, cells hepatic degeneration, vacuolar degeneration with infiltration of lipid, blood vessels degeneration, hemorrhage and severe dilation in liver cells. That is explained by the fact why the liver plays an important role in vital function, basic metabolism and accumulation, transformation and excretion of contaminants [14] [15]. Moreover, the liver, as the major organ of metabolism, comes into close contact with xenobiotics absorbed from the environment and liver lesions are often associated with aquatic pollution. Deteriorations of the liver can be due to the storage of heavy metals in this body [16]. [17] were noted similar histopathological alterations in the liver of *Gymnocephalus cernua* collected from Elbe Estuary contaminated by domestic, industrial and agricultural pollutants. The liver anomalies in this work are similar to those observed in laboratory exposures, such as *Clarias gariepinus* after exposure to lead [18]. These authors observed cells hepatic degeneration after 3 days and necrosis after 2 weeks exposure to lead. The present results are in agreement with those observed in other fish species under the influence of different pollutants [19] [20] [21].

In addition, our results showed that the kidney presents also serious lesions (74% of the sample observed are faded). The kidney pathological alterations included vacuolization, dilation in renal cells, severe dilation with renal cells degeneration, hemorrhage, parasitic cyst, vacuolar degeneration in the epithelium of renal tubules, parasites, dilation in renal blood vessels and cyst. These changes may be attributed to direct toxic effects of pollutants on renal, since the kidney is the site of detoxification of all types of toxins such as heavy metals.

Also, the kidney is a vital organ of body and proper kidney function is to maintain the homeostasis [22]. According to [23], the kidney is one of the first organs to be affected by contaminants in the water. The same type of damage has been reported in kidneys of pole *Lates calcarier* due to exposure to cadmium [23]. In the same way, [24] reported severe lesions in kidneys of tilapia (*Oreochromis mossambicus*) after exposure to mercuric chloride.

4. Conclusion

It could be concluded that the environmental contamination of Bietri bay induced several Histopathological alterations in the tissues of *Sarotherodon melanotheron*. This study showed thus that heavy metal contamination not only directly affects fish health.

References

[1] Krishna1 PV, Rao KM, Swaruparani V & DS Rao. 2014. Heavy Metals Concentration in Fish *Mugil cephalus* from Machilipatnam Coast and Possible Health Risks to Fish Consumers. *British Biotechnology Journal 4(2): 126-135*

[2] Jordao CP, Pereira MG, Bellato CR, Pereira JL & Matos AT. 2002. Assessment of water system for contaminants from domestic and industrial sewages, *Environment Monitoring and Assessment* 79:75-100.

[3] Coulibaly S., Atse B. C., Koffi K. M., Sylla S., Konan K. J. & Kouassi N. J., 2012. Seasonal Accumulations of Some Heavy Metal in Water, Sediment and Tissues of Black Chinned Tilapia *Sarotherodon melanotheron* from Bietri Bay in Ebrie Lagoon, Ivory Coast. *Bulletin of Environmental Contamination and Toxicology*, 128: 12-522.

[4] Ochieng E.Z., LalahJ.O. & Wandiga S.O., 2007. Analysis of Heavy Metals in Water and Surface Sediment in Five Rift Valley Lake in Kenya for Assessment of Recent Increase in Anthropogenic Activities. *Bulletin of Environmental Contamination and Toxicology*, 79:570-576.

[5] Nero V., Farwell A., Lister A., Van Der Kraak G., Lee L.E.J., Van Meer T., MacKinnon M.D. & Dixon D.G., 2006. Gill and liver histopathological changes in yellow perch (Perca flavescens) and goldfish (Carassius auratus) exposed to oil sands process-affected water. *Ecotoxicology and Environmental Safety*, 63: 365–377.

[6] Camargo M. P. M. & Martinez B. R. C., 2007. Histopathology of gills, kidney and liver of a Neotropical fish caged in an urban stream. *Neotropical Ichthyology*, 5: 327-336.

[7] Peyghan R., Oskoiizadeh K., Esmailzadeh S. & Rasekh A., 2007. Pathological Study of Effect of Short and Long-term Copper Sulfate Bath on Gill in Grass Carp, *Ctenopharyngodon idella. Asian Fisheries Science* 20:109-116.

[8] Chezhian A., Kabilan N., Suresh Kumar T., Senthamilselvan D. & Sivakumari K., 2010. Impact of Common Mixed Effluent of Sipcot Industrial Estate on Histopathological and Biochemical Changes in Estuarine Fish *Lates calcarifer*. *Current Research Journal of Biological Sciences*, 2: 201-209.

[9] Olurin, K., Olojo E., Mbaka G. & Akindele A., 2006. Histopathological responses of the gill and liver tissues of *Clarias gariepinus* fingerlings to the herbicide, glyphosate. *African Journal of Biotechnology*, 5: 2480-2487.

[10] Fernandes M.N. & Mazon A.F., 2003. Environmental pollution and fish gill morphology. In: Val, A.L. and B.G. Kapoor (Eds.). Fish adaptation Enfield. *Science Publishers*, 203-231.

[11] Wu J.P., Chen H.C. & Huang D.J., 2009. Histopathological Alterations in Gills of White Shrimp, Litopenaeus vannamei (Boone) After Acute Exposure to Cadmium and Zinc. *Bulletin of Environmental Contamination and Toxicology*, 82: 90-95.

[12] Fatma A.S.M., 2009. Histopathological Studies on *Tilapia zillii* and *Solea vulgaris* from Lake Qarun, *Egypt World Journal of Fish and Marine Sciences*, 1: 29-39.

[13] Fernandes C., Fontaınhas-Fernandes A., Monteiro S.M. & Salgado M.A., 2007. Changes in plasma electrolytes and Gill Histopathology in Wild Liza saliens from the Esmoriz-Paramos Coastal Lagoon, Portugal. *Bulletin of Environmental Contamination and Toxicology*, 79: 301–305.

[14] Athikesavan S., Vincent S., Ambrose T. & Velmurugan B., 2006. Nickel induced histopathological changes in the different tissues of freshwater fish, Hypophthalmichthys molitrix (Valenciennes). *Journal of Environmental Biology*, 27: 391-395.

[15] Tayel, S.I., Yacoub A.M. & Mahmoud S.A., 2008. Histopathological and haematological responses to freshwater pollution in the Nile catfish *Clarias gariepinus*. *Journal of Egyptian Academic society for Environmental Development*, 9: 43-60.

[16] Rodrigues E.L. & Fanta E., 1998. Liver histopathology of the fish *Brachydanio rerio* after acute exposure to sublethal levels of the organophosphate Dimetoato 500. *Revista Brasileira de Zoologi*, 15: 441-450.

[17] Sorensen, E.M., 1991. Metal poisoning in fish: Environmental and life sciences Associates. Austin Texas. *CRC Press Inc., Boston*.

[18] Aly, S.M., Mona S.Z. & Halam M.E., 2003. Pathological, biochemical, haematological and hormonal changes in catfish (*Clarias gariepinus*) exposed to lead pollution. *Journal of the Egyptian Veterinary Medical Association*, 63: 331-342.

[19] Zahra K., Amin M. & Reza K., 2010. Bioaccumulation of some Heavy Metals and Histopathological Alterations in Liver of *Euryglossa orientalis* and *Psettodes erumei* along North Coast of the Persian Gulf. *African Journal of Biotechnology*, 9: 6966-6972.

[20] Olfat M.W & Zeinab A.E-G., 2007. Comparative Impact of Different Waste Sources on the Reproductive Parameters and Histology of Gonads, Liver and Pituitary Gland of S*iganus rivulatus*. *Journal of Applied Sciences Research*, 3: 236-244.

[21] Atif M.E-N., Soaad A.M. & Safaa I.T., 2009. Bioaccumulation of Some Heavy Metals and Histopathological Alterations in Liver of *Oreochromis niloticus* in Relation to Water Quality at Different Localities along the River Nile, *Egypt World Journal of Fish and Marine Sciences*, 1: 105-114.

[22] Iqbal F., Qureshi I. Z. & Ali M., 2004. Histopathological changes in the kidney of common carp, *Cyprinus carpio* following nitrate exposure. *Journal of Research Sciences*, 15 (4): 411-418.

[23] Thophon S., Kruatrachue M., Upathan E.S., Pokethitiyook P., Sahaphong S. & Jarikhuan S., 2003. Histopathological alterations of white seabass, *Lates calcarifer* in acute and subchronic cadmium exposure. *Environmental Pollution*, 121: 307-320.

[24] Handy R.D. & Penrice W.S., 1993. The influence of high oral doses of mercuric chloride on organ toxicant concentrations and histopathology in rainbow trout, *Oncorhynchus mykiss*. *Comparative Biochemistry and Physiology (C)*, 106: 717-724.