Clinicopathological Changes in Fish Exposed To Pollutants

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Abstract: Water pollution is one of the major problems in the world especially in the developing countries. It could by physical, chemical or biological. Heavy metals pollution are the most dangerous form of water pollution. It results from industrial, agriculture or domestic effluents in water. It also resulted from geologic weathering, mining effluent, agricultural and industrial effects, storm run off and atmospheric sources (environment).
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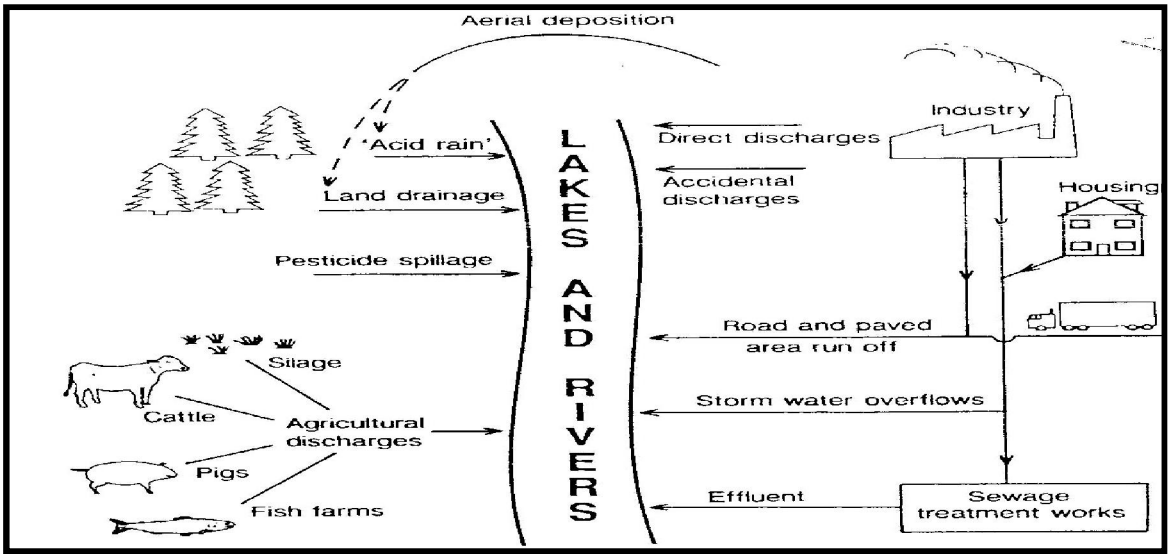
Introduction

Heavy metals are persistent contaminants in the environment that come to the forefront of dangerous substances such as cadmium, lead, mercury, copper and zinc causing serious health hazard in humans and animals [1-10]. The agricultural and industrial wastes partially treated or without treatment are being discharged into surface water [11-16]. Such metals are absorbed from polluted water through gills, skin and digestive tract of fish by bio-concentration and bio-magnification. Chronic cadmium toxicity or "itai-itai" disease was recorded [17-20].

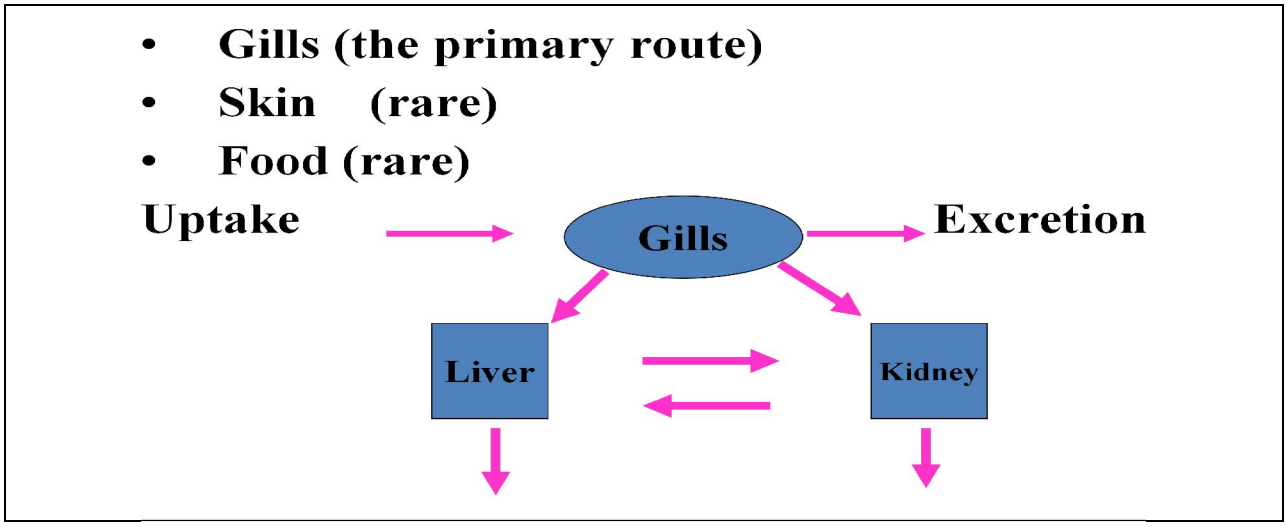
Cadmium toxicity was interfered with calcium/phosphorus ratio [21, 22] Suppression of cell mediated and humoral response of mammals exposed to sublethal dose of cadmium has been reported [23-26].

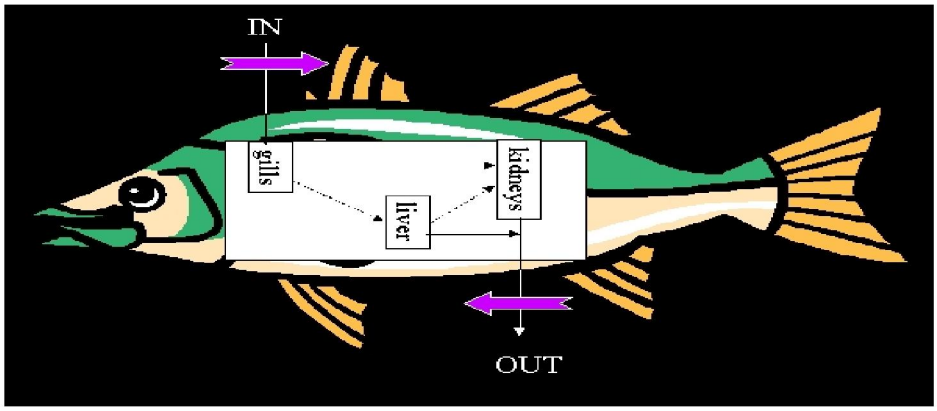
Histophathological examination of fish exposed to cadmium showed edema of secondary gill lamellae, degeneration of hepatocytes and epithe-liallining of renal tubules. Degeneration and necrosis in the gill lamellae of fish xposed to cadmium were noticed [13-19].

Heavy metals are recognized as cumulative toxic substances causing serious health hazards to man depending on their concentration.



Source of Heavy metal pollution





Metal Flow in Fish

Defense mechanism in the body

Detoxified in the liver and their metabolites may be excreted via the

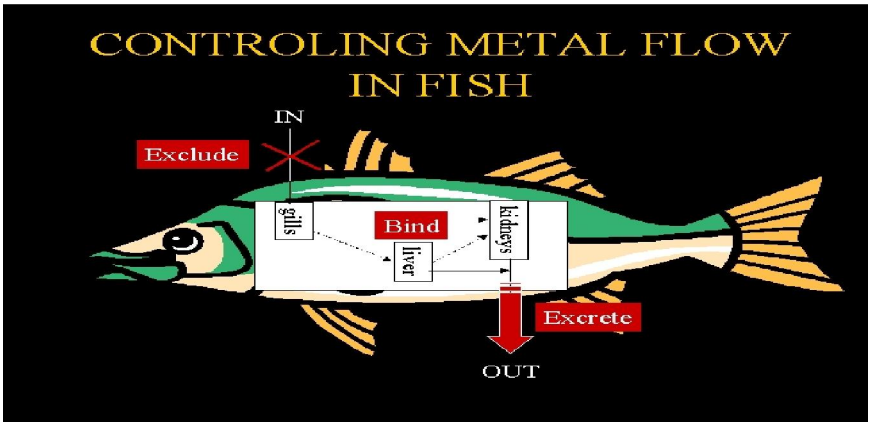
Excretion by

If the conce the fish may deve withstand a high harmful (This "acclimation").

A prolonged water may exhau the fish becomes succumb.

Natural level of heavy metals (ug/Liter)

• Cadmium	0.07
• Lead	0.20
• Mercury	0.01
• Copper	1.80
• Zinc	1.00
Maximum levels in water (ug/liter)	
• Cadmium	10
• Lead	50
• Mercury	2
• Copper	1000
• Zinc	5000



Controlling Metal Flow in Fish

Suspension of metals

In solution as free or complex species.

By adsorption at solid-solution interface.

By incorporation into biological system.

By precipitation and co-precipitation as metallic coatings.

By incorporation into crystalline structure.

Forms of heavy metals:

- Free ions.
- Simple compounds.

Types of heavy metals :

- Essential (Fe, Mg, Mn, Co, Zn & Cu).
- Non Essential (Cd, Hg, Cr, Pb).

Effect of heavy metals on fish

- Suppress immune system.
- Increase susceptibility to disease.
- Toxicity.
- Carcinogenesis.

Pathological effect of heavy metals

- Circulatory changes: Copper cadmium Hg and Ld.
- Degenerative changes :Ld, Cd, Hg.
- Inflammatory reaction: Al, Cr, Vn.
- Necrosis: Hg, Cd, Ld, Vn.
- Carcinogenesis: Cr, Vn, Hg.

Long term exposure of Clarias lazera to 1/100 LC50/72h. Lead acetate Marcel (1997).

- All fish showed dull movement, darkening of the skin coloration and nervous manifestations.
- Gradual decrease in Hb, PCV values and RBCs count (microcytic anemia)
- Gradual increase in WBCs count.
- Gradual hypoproteinemia accompanied by hypoalbuminemia.
- Gradual hyperglycemia.
- No change in serum total cholesterol.
- Gradual increase of serum transaminases (AST, ALT).
- Gradual increase values of serum urea, uric acid and creatinine.

Pathology: The liver: vacuolar degeneration of hepatocytes.

- The kidney: T nephrosis, haemorrhage, peritubular fibrosis.
- The spleen: edema and proliferation of melanomacrophage, depletion of haemopoietic tissue.
- The gills: edema in the primary lamellae and desquamation of the secondary lamelle.

• The liver showed the highest residual contents of Pb followed by the kidney, the muscles revealed the lowest values.

Long term exposure of Clarias lazera to 1/100 LC50/72h. mercuric chloride.

• Fish showed unbalanced movement, presence of mucus secretion over the gills and darkening of the body colouration of the skin.

• Reduce in *HB, PCV and RBCs count (* microcytic anemia).

• Gradual increase *WBCs count.*

• Hypoproteinaemia accompanied by *hypoalbuminaemia.*

• Gradual *hyperglycaemia ended with hypoglcaemia*.

• Gradual *hypocholesterolaemia.*

• Gradual elevation of *serum transaminases (ALT and AST).*

• Gradual increase values of *serum urea, uric acid and serum creatinine.*

Pathology: The liver: necrosis of most hepatic cells.

• The kidney: Tubular nephrosis, marked proliferation of melanomacrophage cells and perivascular fibrosis.

• The spleen: lymphoid depletion and edema.

• The gills: exhibited necrosis along with hemorhage.

• Thee muscles: Zenker's necrosis, edema, focal aggregation of melanomacrophages.

• The liver revealed the highest residual contents of Hg followed by the kidney, the muscles showed the lowest residual content.

Long term exposure of Clarias lazera to 1/100 LC50/72h. cadmium sulphate

• Fish: uncoordinated swimming movements, loss of equilibrium, muscle spasms, ascites, convulsion and mucus secretion over the gill filaments.

• Gradual decrease in HB, PCV, RBCs count (microcytic anemia).

• Gradual decrease in WBCs count.

• Gradual hypoproteinemia accompanied by hypoalbuminemia.

• Hyperglycemia.

• Hypocholesterolemia.

• Gradual increase of serum transaminases (ALT and AST).

• Gradual increase of serum urea, uric acid and creatinine

Pathology : The liver: hemolysis of RBCs and necrosis of hepatocytes.

• The kidney: vacuolar degeneration of most renal tubules.

• The spleen revealed congestion, hemorrhage and perivascular aggregation of melanomacrophages, with focal hyperplasia of hemopietic tissue.

Long term exposure of Clarias lazera to 1/100 LC50/72h toPb, Hg, Ca (triad combination)

• All fish exhibited dull movements, red patches on the skin ended with laceration, exophthalmia, darkening of skin colouration, presence of a thickened mucus film over the gills and abdominal ascites.

• Ggradual decrease in Hb, PCV, RBCs count (microcytic anemia)

• Gradual increase in WBCs count.

• Gradual decrease in serum total proteins specifically albumin.

• Gradual hypocholesterolemia

• Initial hyperglycemia, followed by hypoglycemia.

• Gradual increase in serum transaminases(ALT and AST).

• Gradual increased values of serum urea, uric acid and creatinine.

Pathology: The liver: vacuolar degeneration of most cells.

• The kidney: marked necrosis of most renal tubules.

• The gills: edema and hemorrhage in the gill arch, fibroblasts and mononuclear leucocytes were seem.

• The muscles: edema, hyaline degeneration and Zenker's necrosis along with numerous monuclear leucocytes.

• The liver and kidney showed the highest residual contents of lead, mercury and cadmium followed by the muscles (the lowest values).

Prevention of water pollution

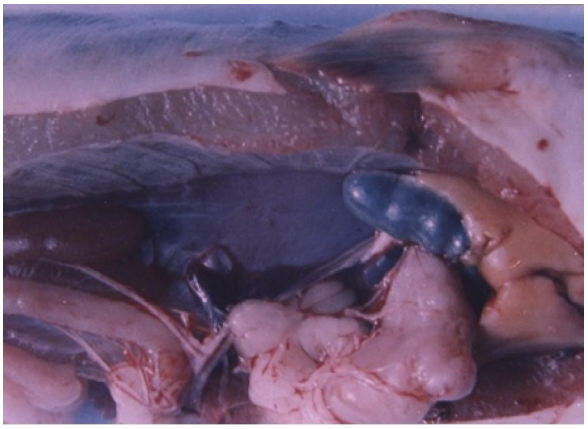
• A general public acceptance that a flourishing fish community is an important measure of an acceptable quality of water in our rivers, lakes and seas.

• Fisheries managers must define the status of the fish population which they would expect to find in their water, so that deviations attributable to chemical pollution specifically heavy metals can be identified.

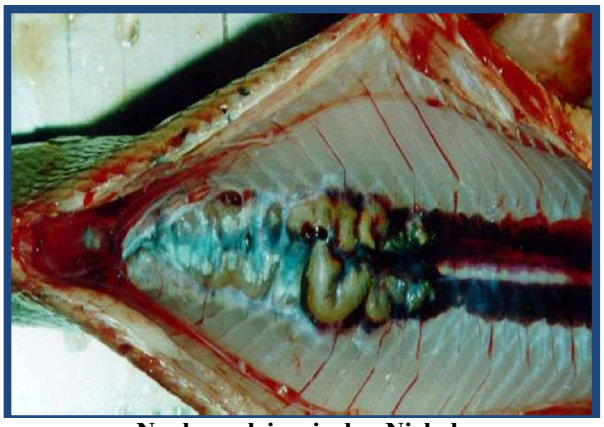
• chemical pollution from factories must be controlled as it affects the well being of fish and so human health.

• Well treated sewage is highly recommended before being discharged, as well as, properly chlorination of water.

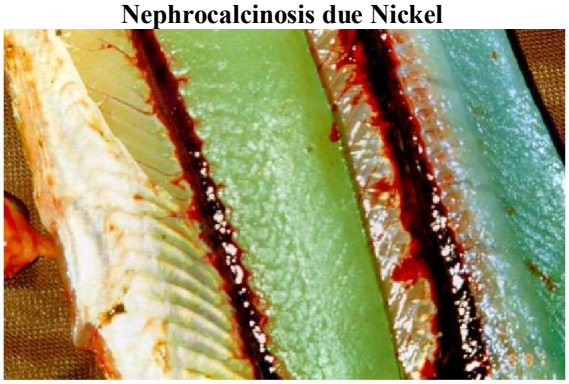
These are highly essential in order to protect the fish communities that form a most valuable and precious resources in our river, lakes and seas.



Pale internal organs of fish due to heavy metal pollutions



Nephrocalcinosis due Nickel



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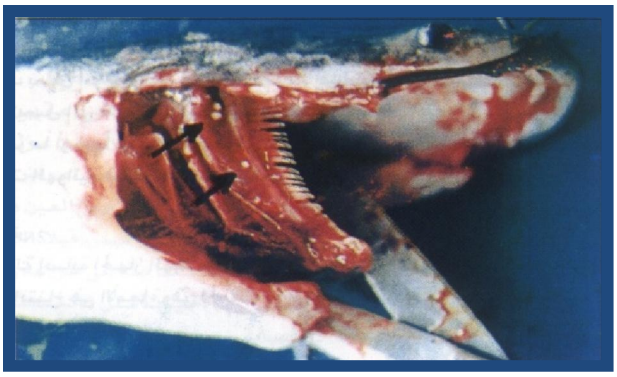
Cu pollution (Darkening of skin, bright gills)

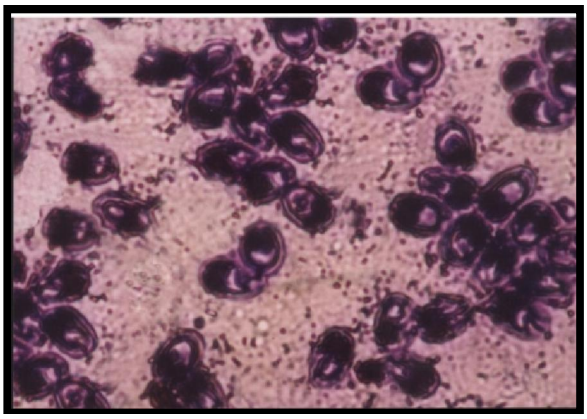
Nephrocalcinosis (calcification of kidneys) due to Cd pollution

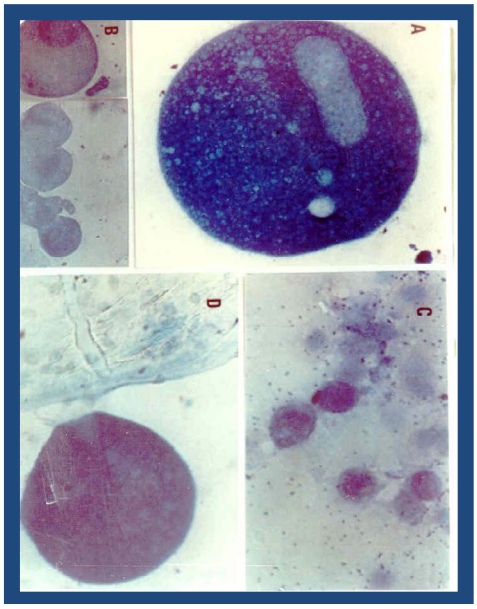
Death of Fish due to pollution by mercury

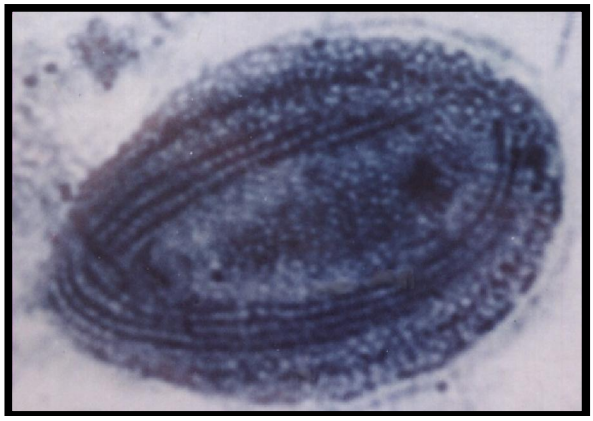
Heavy metal pollution (vanadium and aluminum)



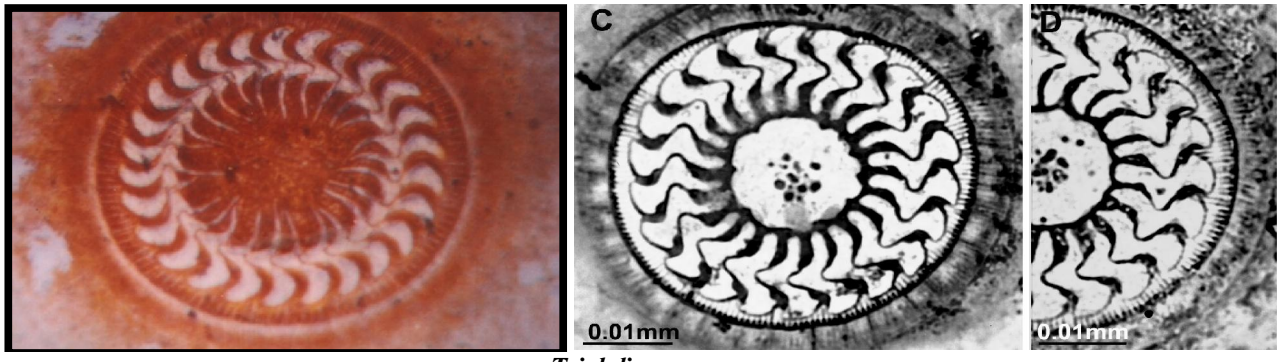
Protozoa in gills of cat fish due to heavy metals pollution



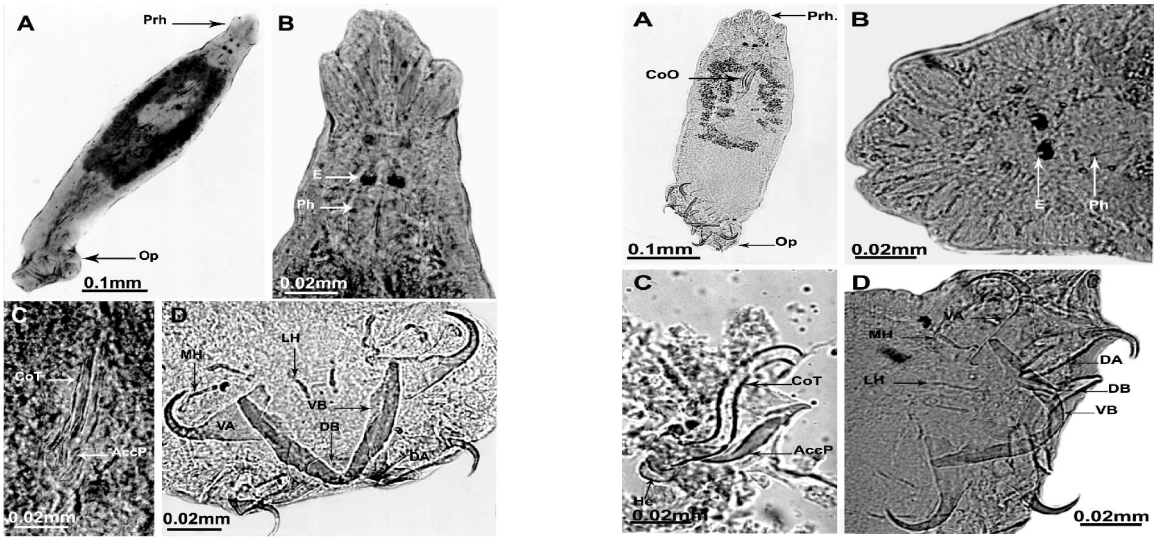




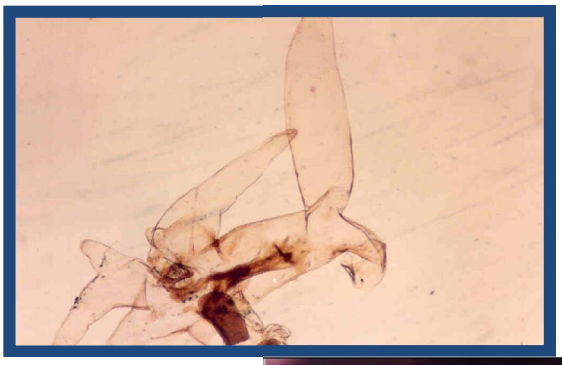
Ichthyophthirus multifiliis



***Trichdina* sp.**



***Cichlidogyrus* sp.**



***Dactylogyrus* sp.**

Conclusion

- Water pollution is considered a devastating problem in the world especially in the developing countries including Egypt.
- Industrial effluents are harmful for aquatic life and agriculture land with secondary effects on human health.
- Human wastages that contain different kinds of pathogen; and are considered the major contributor that affects health of people and organisms if drained in any water course.
- There is no method of legislation and enforcement that can guarantee the safety of fish from pollution.

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