USE OF QUALITATIVE AND SEMI-QUANTITATIVE HISTOPATHOLOGY ANALYSIS IN ASSESSMENT OF WATER POLLUTION AND INFECTIONS IN *OREOCHROMIS NILOTICUS* OF LAKE VICTORIA, KENYA

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Introduction

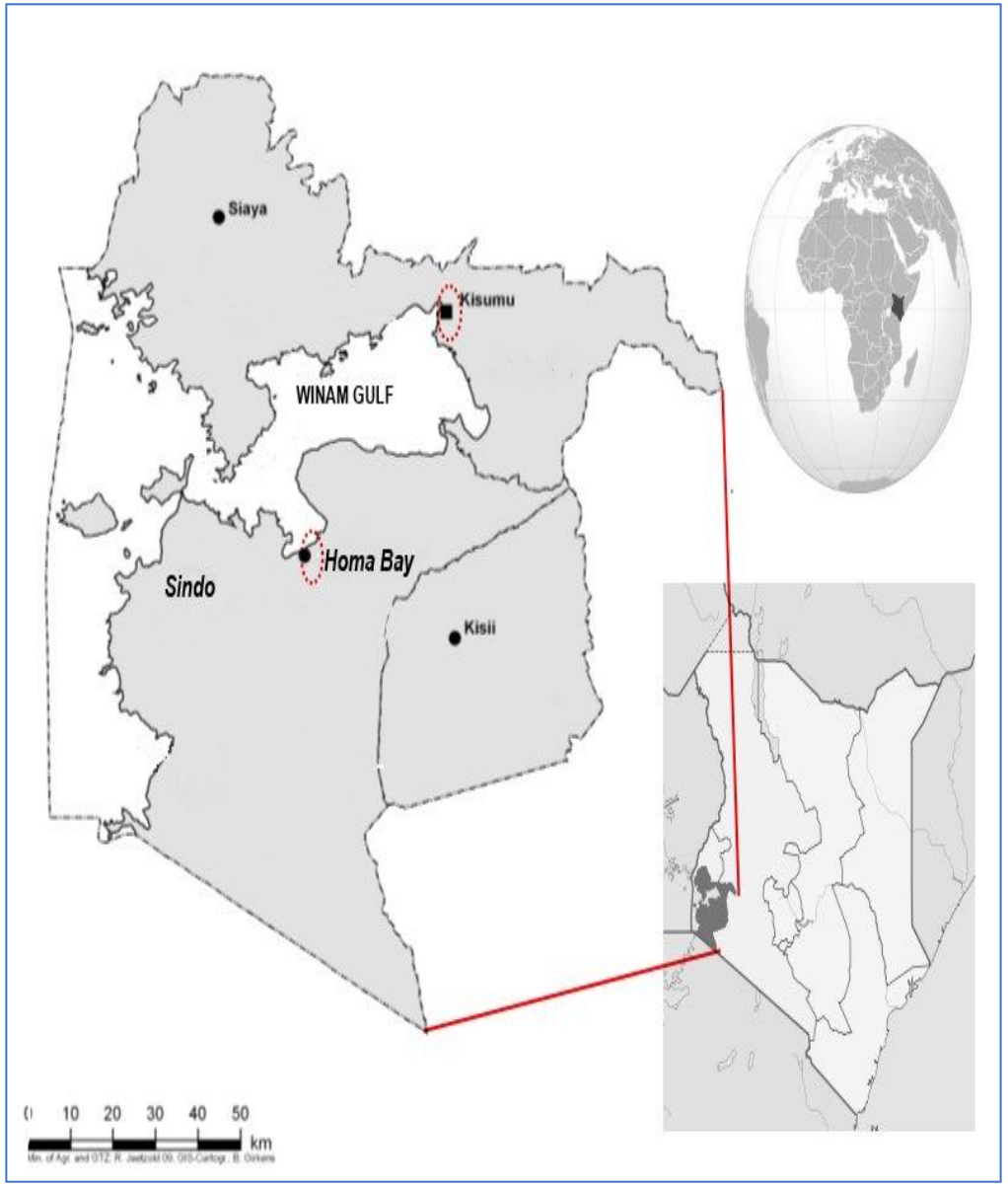
- Aquatic animal (Fish) exposure to pollutants and pathogenic microbes
- What are the adverse effect(s) on the health/welfare of fish.
- ***What is Qualitative and semi-quantitative histopathology analysis?***

Objectives of the Study

- Assess the health of Nile tilapia (*Oreochromis niloticus*) using histopathological changes (qualitative tool) and histopathological semi-quantitative tool on select organs.
- Compare the qualitative vs semi-quantitative tools

Methododoloy

- Fish capture by fishermen: Dunga beach in Kisumu and Homa Bay
- Sample size: 144 fish (*Oreochromis niloticus*)
- Select organs: liver, kidney, gills collected and preserved in 10% buffered formalin.
- Tissues processed - histopathology slides (Luna, 1963).



The five reaction patterns and the respective histological lesions

Methodology

Semi-qualitative assessment: uses weighted indices that have an ordinal-ranked value

- **Reaction pattern**
- **Score value**
- **Importance factor**

Reaction Pattern	Alteration/ Lesion
Circulatory	Haemorrhages, Hyperemia, Aneurysm, Intercellular oedema
Regressive charges	Architectural and structural changes, plasma alteration, nuclear alterations, atrophy and necrosis
Progressive changes	Hypertrophy, hyperplasia
Inflammation	Exudate, activation of the reticulo-endothelial system (RES)
Tumour	Benign and malignant tumor

Methodology

Score value (a)	Description
0	No occurrence of the lesion
2	The mild occurrence of the lesion
4	The moderate occurrence of the lesion
6	The severe occurrence of the lesion

Importance factor (w)	Description
1	Minimal pathologic importance
2	Moderate pathologic importance
3	Severe pathologic importance

- Organ Index:

$$Iorg = \sum rp \sum alt \left[a_{1\,org\,all\,rp\,all\,alt} \times W_{1\,org\,all\,rp\,all\,alt} \right]$$

Where: I_{org} = Organ Index, $a_{1\,org\,all\,rp\,all\,alt}$ = Reaction Index and $W_{1\,org\,all\,rp\,all\,alt}$ = Importance Factor

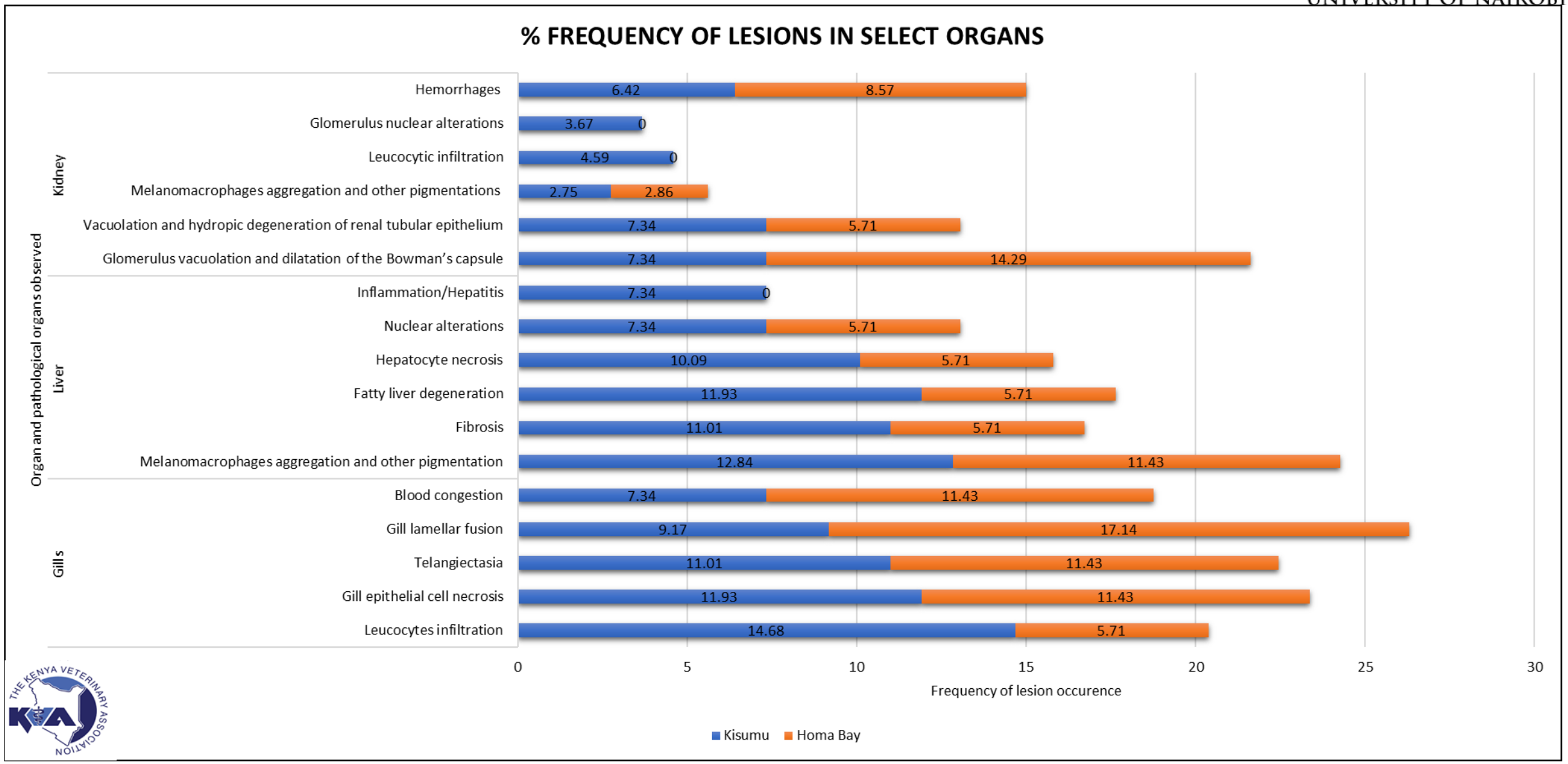
- Total Organ Index:

$$Tot\,I_{org} = \sum org \sum rp \sum alt \left\{ a_{1\,org\,all\,rp\,all\,alt} \times W_{1\,org\,all\,rp\,all\,alt} \right\}$$

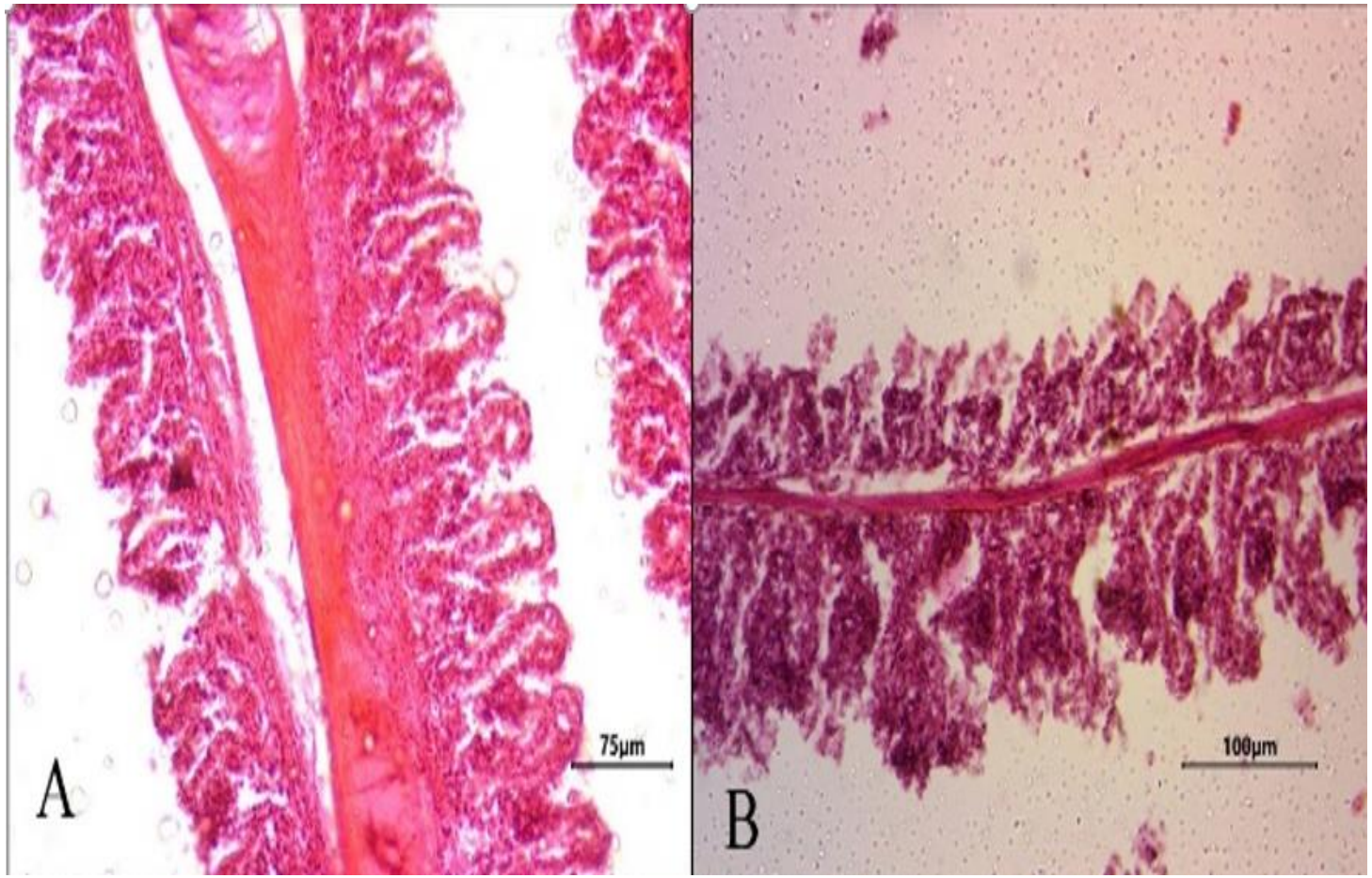
Results: Frequency of lesions and weighted total organ indices

Site and Season	N	Frequency of Liver lesions	Mean Total liver index	Frequency of gill lesions	Mean Total kidney index	Frequency of kidney lesions	Mean Total kidney index
KISUMU 1	19	53%	5.87 ± 1.84	79%	3.35 ± 1.32	53%	4.48 ± 1.92
KISUMU 2	21	52%	3.42 ± 1.02	52.40%	4.30 ± 1.05	50%	2.70 ± 1.30
KISUMU 3	69	85.50%	2.57 ± 0.87	69.50%	2.46 ± 0.94	85.50%	3.32 ± 1.26
HOMABAY 1	22	31.25%	3.20 ± 0.99	59.10%	3.47 ± 1.36	31.30%	6.07 ± 2.11
HOMABAY 2	13	69.20%	5.19 ± 1.19	69%	3.76 ± 1.44	69.30%	3.33 ± 1.93
P-Value			1.34, 0.25		0.43,0.78		0.67, 0.62

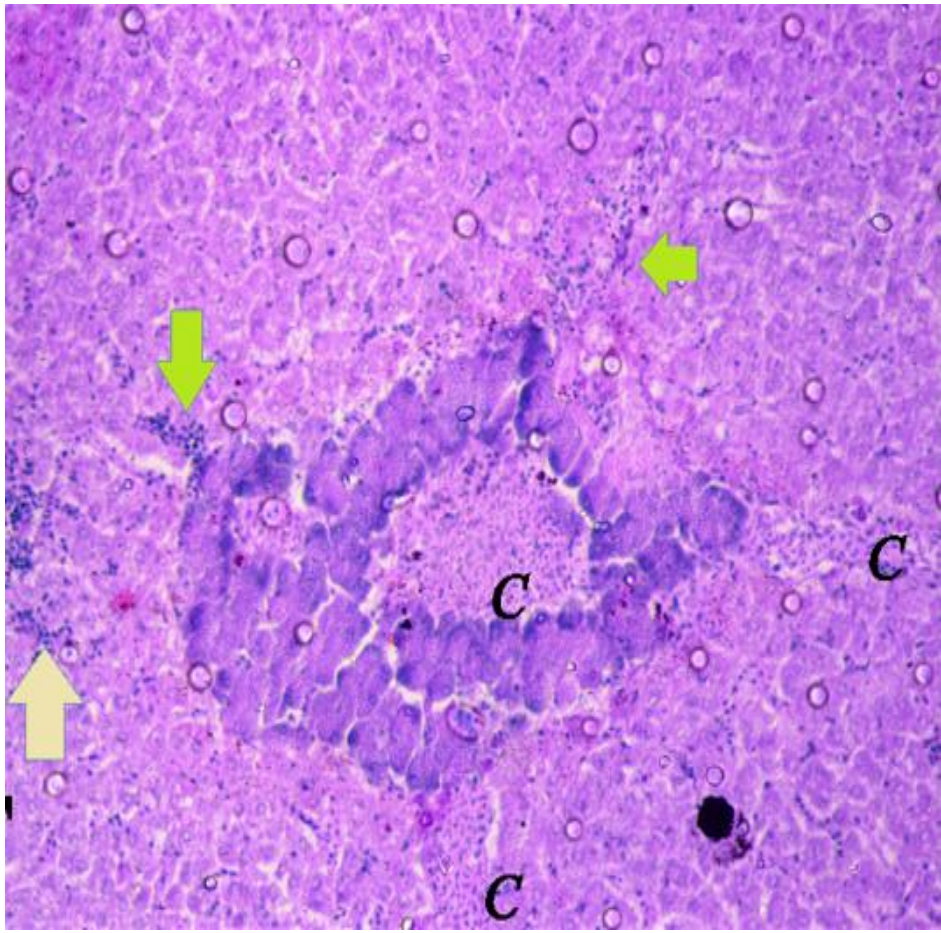
Results…….cont.



Results…….

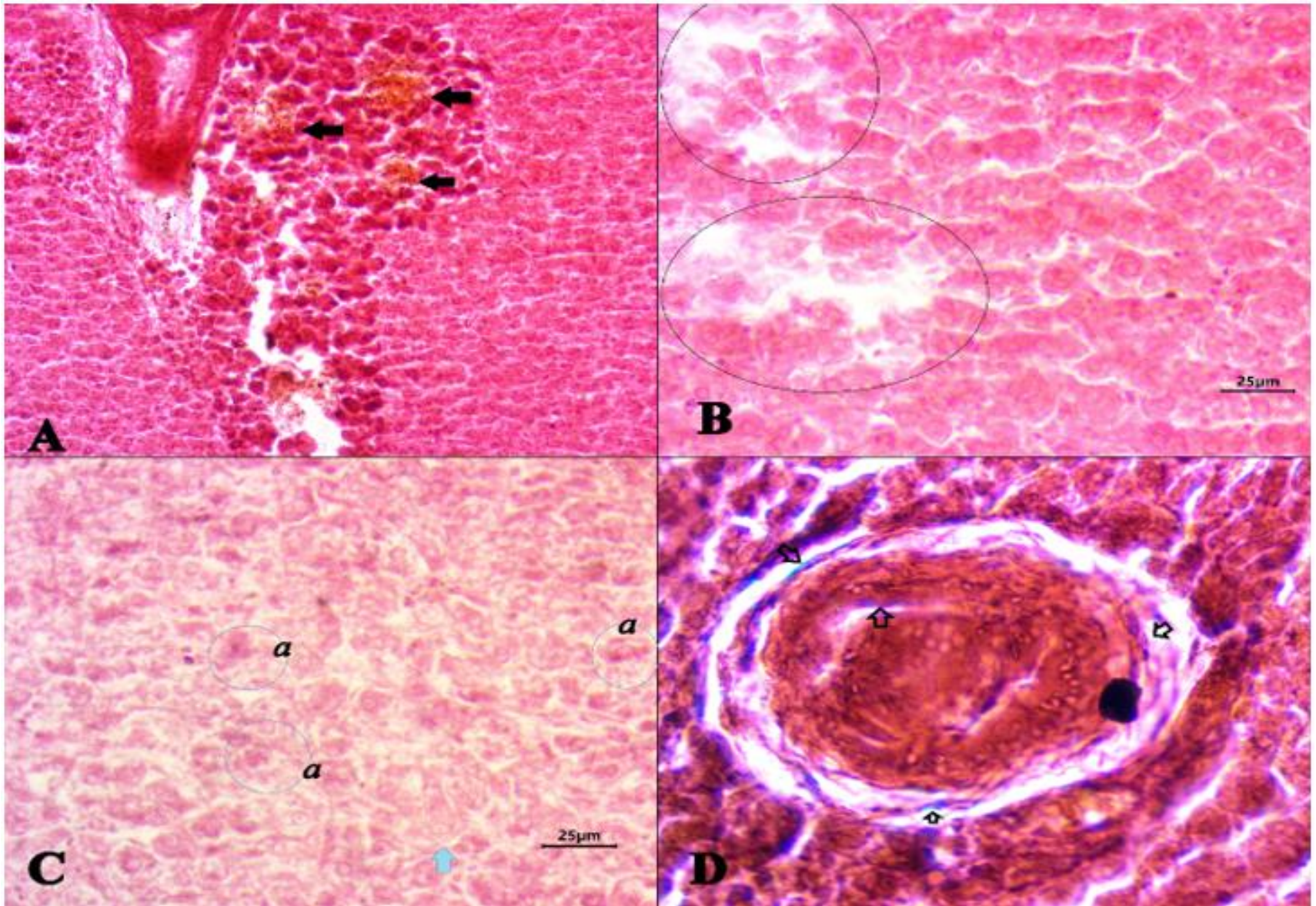


A- Epithelial lifting of gill lamella, B-Telangiectasia (H&E)



F- Inflammatory cells (green arrows) and blood vessel congestion in the hepatopancreas (C), (H&E, ×200)

Results.....



:A- Melanomacrophages centres interspersed in the pancreatic acinar cells (black arrows) (H&E, ×800),

coagulative necrosis showing hepatocyte and sinusoid cytolysis (H&E),

C- hepatocyte nucleus degeneration (blue arrow), enlarged and eosinophilic nucleus (a) and hepatocyte vacuolation and degeneration (H&E),

D-Thrombosis in a vein, showing the thin endothelial layer (black arrows)

Discussion

- The fish organs had lesions in the various organs at varying frequencies.
- The weighted indices (semi-quantitative) that have an ordinal-ranked value to specific lesion indicates the impact of lesions in fish that may not be highlighted by the qualitative

Discussion....continued.

- Lesions linked to pollutants (melano-macrophage aggregation, necrosis) and infections (e.g. necrosis, leucocytic infiltration) => compared (Roberts, 2012, Agius 2001)
- Weighted indices (semi-quantitative): more accurate impact of lesions
- Semi-quantitative tools should be developed further and adopted.

Acknowledgments

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Thank you all