Summary

Reuse of agricultural drainage water has been practiced for many years to cover the shortage in surface fresh water needed for the expansions in agricultural area in order to cover the increase in demands for food for the increase in population. This study was carried out to investigate the effect of different water drainage canals (agricultural drainage canals and a mixture of agricultural and sewage water) and fresh canals on water quality parameters, through the investigating the following items:

- Physico-chemical parameters of water during different seasons.
- Heavy metals residues in water during different seasons.
- Heavy metals residues in muscle, gills, and liver samples of (*Oreochromis niloticus*) fingerlings during different seasons.
- Chlorophyll "a" concentrations in water during different seasons.
- Dynamics of different phytoplankton divisions as well as total phytoplankton count.
- Dynamics of different zooplankton divisions as well as total zooplankton count.

Samples were collected from three different water sources (fresh water, agricultural drainage water, and mixed drainage water). Located inside the Sharkia Governorate**.**

The results obtained from this study may be summarized as follows:

1- physico-chemical water quality parameters of water

Temperature:

The lowest water temperature value (13.25 ± 0.57 **˚C)** was recorded in mixed drainage water during winter, while the highest value (25.02 ± 0.002 **˚C)** was recorded in fresh water during summer.

Water visibility:

The lowest Secchi disc value was (6.67 ± 0.44 cm) which recorded in mixed drainage water during spring, while the highest one (60.00 ± 2.61 cm) was recorded in fresh water during winter.

Dissolved oxygen:

The lowest and highest concentrations of dissolved oxygen were 0.76 ± 0.03 and 9.86 ± 1.02 mg/l in mixed water and agricultural drainage water during summer and winter respectively.

The annual over all means of dissolved oxygen were 5.31 ± 0.46 7.46 ± 0.93, and1.59 ± 0.34 mg/l in fresh water, agricultural drainage water, and mixed drainage water respectively.

pH:

The lowest pH value (7.25 ± 0.028) was recorded in mixed drainage water during spring, while the highest one (8.05 ± 0.041) was recorded in fresh water during winter.

Electrical conductivity:

The annual over all means of electrical conductivity were 0.37 ± 0.02, 2.48 ± 0.08, and 2.18 ± 0.06 µmhos in fresh water, agricultural drainage water, and mixed drainage water respectively.

Total dissolved solids:

The lowest total dissolved solids concentration (0.204 ± 0.003 g/l) was recorded in fresh water during summer, while the highest one (1.95 ± 0.04 g/l) was recorded in agricultural drainage water during winter.

Salinity:

There were significant differences concerning salinity values among different sampling sites especially during autumn and winter. The lowest value was observed in fresh water during summer (0.13 ± 0.01g/l), while the highest value was observed in agricultural drainage water during winter (1.59 ± 0.02g/l).

Total ammonia:

There were significant differences in total ammonia values among different water sources. The annual over all means of total ammonia were 0.27 ± 0.06, 0.71 ± 0.11, and 56.42 ± 1.9 mg/l in fresh water, agricultural drainage water, and mixed drainage water respectively.

Un-ionized ammonia:

The highest un-ionized ammonia concentration (0.98 ± 0.06 mg/l) was recorded in mixed drainage water during summer, while the lowest concentration (0.004 ± 0.0004 mg/l) was recorded in fresh water during winter.

Nitrite:

There were significant differences concerning water-nitrite values among different water sources. The annual means of water-nitrite were 0.04 ± 0.008, 0.11 ± 0.03, and 0.008 ± 0.002 mg/l in fresh water, agricultural drainage water, and mixed drainage water respectively.

Nitrate:

The maximum and minimum values of nitrate recorded during the present work were 1.01± 0.19 and 0.03 ± 0.012 mg/l in agricultural drainage water during winter and mixed drainage water during summer, respectively.

Total alkalinity:

There are significant differences in total alkalinity values among different water sources during all seasons. The annual over all means of total alkalinity were 174.04 ± 20.5, 349.63 ± 30.8, and 690.85 ± 62.1 mg/l as $CaCO_3$ in fresh water, agricultural drainage water, and mixed drainage water respectively.

Total hardness:

There were significant differences in total hardness values among different water resources. The lowest and highest concentrations of total hardness were 156.67 ± 5.54 and 660.83 ± 39.2 mg/l as $CaCO_3$ as recorded in fresh water during spring and agricultural drainage water during winter, respectively.

Orthophosphates:

The annual over all means of orthophosphate were 0.01 ± 0.007, 0.02 ± 0.004, and 1.17± 0.07 mg/l in fresh water, agricultural drainage water, and mixed drainage water respectively.

Total phosphorus:

There were highly significant differences in total phosphorus concentrations among different water sources. The lowest total phosphorus concentration (0.11 ± 0.042 mg/l) was recorded in fresh water during summer, while the highest concentration (2.44 ± 0.13 mg/l) was recorded in mixed drainage water during autumn.

Heavy metals residues in water:

Water heavy metals residues results showed that mixed drainage water had the highest values for investigated heavy metals except for cadmium which was

higher in agricultural drainage water due to intensive use of agricultural fertilizers which contain cadmium in their constituents.

Generally, the average concentrations of different investigated heavy metals in water were below the maximum acceptable limits mentioned by (USEPA, 1999). Except for Iron and lead where their concentrations were higher than maximum acceptable limits in mixed drainage water during spring.

Heavy metals residues in different fish (*Oreochromis niloticus*) organs:

Data obtained alongside the present work showed that Liver and gills had higher tendency to accumulate heavy metals more than muscles tissue and ranked in the following order: muscle < gills < liver.

Concentration of heavy metals in organ of fish that collected from agricultural drainage water was higher than those collected from fresh water. There were no fish could be found in mixed drainage water alongside the study period, this may be due to that the environment not suitable for growth of fish. Generally, the concentration of heavy metals in fish organs was in the safe limits according to (FAO, 1983) except for iron and zinc in liver tissue.

Biological characteristics:

Chlorophyll "a":

There were significant differences concerning chlorophyll "a" concentrations among different water sources and different seasons**.**

The annual over all means of chlorophyll "a" concentration were 23.71 ± 1.8, 84.43 ± 25.2, and 62.72 ± 15.7 µg/l in fresh water, agricultural drainage water, and mixed drainage water respectively.

Phytoplankton:

Concerning different phytoplankton divisions, it is clear that Chlorophyceae were the most dominant group in the mixed drainage water, and fresh water. Their recorded annual average numbers were (3085, and 1808 cell/ml) respectively. While in agricultural drainage water Bacillariophyceae represent the dominant group with annual average (3348 cell/ml). But concerning species composition, it is clear that *Microcystis* sp was the most dominant species in mixed drainage water during autumn and spring seasons. While *Cosmarium* sp, and *Melosira* sp were the most dominant species during autumn in the agricultural drainage water, and fresh water respectively.

Zooplankton:

Rotifera individuals represent the most dominant division followed by Copepoda individuals then Ostrocoda individuals were the less abundance in the agricultural drainage water and fresh water. In mixed drainage water, there were zooplankton individuals during winter season only.

It could be concluded that:

-The different water sources had effect on physico-chemical and biological parameters of water

-Increased the concentrations of investigated heavy metals in mixed drainage water.

- The concentrations of investigated heavy metals in liver and gills of fish were higher than muscle tissue.

- Concentration of heavy metals in muscles (ediable part) of fish which collected from two sources was lower than the maximum acceptable limits.