IMPACTS OF DIFFERENT WATER RESOURCES ON THE ECOLOGICAL PARAMETERS AND THE QUALITY OF TILAPIA PRODUCTION AT EL-ABBASSA FISH FARMS IN EGYPT

FATMA A. EL-NEMAKI[1], NEMA A. ALI[1], MOHAMED M. ZEINHOM[1] AND OLFAT A. RADWAN[2]

1. *Central Laboratory for Aquaculture Research. Agriculture Research Center, Egypt.*
2. *Centeral agriculture pesticide laboratory. Agriculture Research Center, Egypt*

Abstract

The main aim of the Egyptian government is not only to increase the fish production from the different resources, particularly from aquaculture, but also to improve the quality of the fish produced. One of the main factors which affect the quality of fish is the water quality. Therefore, the present study aims to investigate the impacts of different water resources on the quality and production of *Oreochromis niloticus* fish reared in two different farms at EL–Abbassa, Sharkia governorate, Egypt. While the first farm uses irrigation water from Ismalia Canal, which is the branch of the river Nile, the other uses agriculture drainage water. Water samples were taken randomly from different ponds of each farm every week for two season (winter and spring) to evaluate the physical, chemical and biological characteristic of the two types of water, sample of fish were taken one time at harvest for measuring heavy metals load on (fish muscle and liver) and measuring condition factor, gonadosomatic index and pesticides in fish muscle, gills and liver .The heavy metal load and pesticide residuals in the fish tissue and water were also measured. The results obtained show significant differences between the two water types, particularly in their physical and chemical characteristics (pH, NH_3, NH_4, O_2, salinity, electric conductivity, transparency, total alkalinity, total hardness, available phosphorus and nitrate). Phytoplankton communities showed higher significant density in the ponds that received agriculture drainage water compared to those received irrigation water. There were significant variations in the concentrate of (Fe, Zn, Cu, Cd and Pb) and different pesticide contents of the different fish organs as well as their gonadosomatic index (GI), and condition factor.

Key words: Tilapia, Ecosystem, Pollution, Fish quality, Fish farms, El-Abbassa, Egypt.

INTRODUCTION

Aquaculture is the main source of fish production in Egypt, it contributes about 61% of the total production (GAFRD, 2006). One of the main targets of the Egyptian government is to compensate the deficiency in meat production by increasing high quality fish production. This production should not only be for the local consumption but also for export. However, and because of the shortage of water resources, different sources of water as agriculture drainage water are usually used in the fish farms in Egypt. These water sources have a different physical, chemical and biological characteristic (Saeed, 2000 & Pulatsu *et al.* 2004) which correspondingly affects the quality of the cultured fish (Ali, 2007). Besides due to the variety of human activities, the aquatic environment is becoming increasingly threatened by xenobiotics. Many of them may have deleterious effects which could be enhanced by bioaccumulation of heavy metals or pesticides. In addition, these compounds may become concentrated in the organs of aquatic organisms, especially these at the top of the food chain. The largest problem is the accumulation of heavy metals and pesticides in fish tissues. Several publications that revealed the existence of pesticide residues in various aquatic ecosystems were presented by several investigators (Badawy, 1998, EL_Kabbany *et al*, 2000, Gupta *et al*, 2002, Radwan and Atalla, 2005, Tarek, 2007 and Radwan, 2008). Elnemaki and badawy in 2005 & 2006 found out that the concentrations of different heavy metals exceeded the maximum permissible concentrations in both *Mugil cephalus* and *Ctenopharyngodon idella* tissues. These fish were raised in water environment which received water from different resources. Knowing that fish can store about 58-93% of pesticides in their tissues a study by Elnemaki and Abuzinadah (2003) showed necrosis, myolysis lesions and hemorrhage in most of the *Oreochromis spilurus* tissues as a result of the pesticide toxicity. Furthermore, different water pollutants affect the reproduction of the fish as well. In a study carried out by Barakat (2004) found that most of the dissolved, metals and organic contaminants or their metabolites were monitored in the fish and their eggs. These pollutants were found to affect spawning behavior and duration. The average number of eggs per spawning was higher in the control group than the contaminated ones. Tilapia is the most important fish species in Egypt, and because the quality of water environment is considered the main factors controlling fish quality and subsequentially its growth and production. The main aim of the present study is to investigate the effect of using two different water sources in water and fish quality in order to determine which one could be most suitable for use in the Egyptian conditions to yield the best quality of fish for human consumption. These are achieved by determination of:

1- Physico-chemical properties of water at the two tested sources of water, a- Irrigation water, b- Agriculture drainage water
2- Primary productivity (phytoplankton) essential as natural food for fish.
3- Some heavy metals as (Fe, Zn, Cu, Cd and pb), and different pesticide contents of water and different fish organs.
4- Condition factor (K) and chemical composition of the fish fillet.
5- Gonadosomatic index (GI).
6- Pesticide residuals in both fish tissues and its environment.

MATERIALS AND METHODS

Description of the study area

This study was conducted at the Central Laboratory for Aquaculture Research (CLAR) at, El-Abbassa, Abu-Hammad, Sharkia governorate, Egypt, on two fish farms of monoculture intensive system, the first farm includes 3 earthen ponds (5 feddan each) that received their water supply from Ismailia canal (irrigation water). The second farm includes 3 earthen ponds (5 feddan each) that had their water supply from El-Wadi drain (agriculture drainage water). Each pond was stocked with Nile tilapia *Oreochromis niloticus* (3.0 ± 0.04g). The artificial feed (25% CP) was supplemented at rate of 3% of fish biomass.

Sampling procedures

Water samples were taken randomly from water supplies and ponds weekly for two seasons (winter and spring of 2008) with a column water sampler from at least five spots in each experimental pond between 9.00 and 10.0 AM at a depth of 30cm below the water surface. The samples were mixed together in a plastic container and analyzed for chemical, physical and biological parameters and heavy metals residues, iron (Fe) Copper (Cu), zinc (Zn), cadmium (Cd) and lead (Pb) and pesticides. Samples of fish were taken at harvest time for measuring heavy metals and pesticides loads on fish muscles and liver and measuring fish weight and length to determine its K factor and gonadosomatic index.

Analytical methods.

Measured physico-chemical water quality parameters were measured as follows:

pH.

pH was measured using glass electrode pH meter (Digital Mini-pH meter, Model 55).

Temperature and dissolved oxygen (DO).

Temperature and dissolved oxygen were measured at the site of sampling using an oxygen meter (model 58 YSI).

Visibility (Transparency).

Visibility was measured by a secchi disc according to Boyd (1990).

Total ammonia and un-ionized ammonia.

Total ammonia concentration was measured by Hach comparison apparatus following the method reported by APHA, (1985), then the deionized ammonia (NH_3) was calculated from total ammonia according to Boyd (1990).

Nitrate-nitrogen (NO_3-N)

Nitrate-nitrogen was measured by phenoldisulphonic acid method according to Boyd (1984). The spectrophotometer model used was Milton roy 21D and the resulting color was measured at 410 nm wave length.

Total alkalinity and total hardness.

Total alkalinity and total hardness were measured by titration according to APHA (1985).

Available phosphorus.

Available phosphorus was measured according to APHA (1985) by means of spectrophotometer (model Miltob Roy 21D) at 880 nm wave length.

Heavy metals

Ten fish from each pond were collected for heavy metals analysis. The collected fish were washed with distilled water; about 5g from wet organs (muscle and liver) was dried, ignited and digested with conc HNo_3 and Hcl. The heavy metals, Fe, Cu, Zn, Cd and Pb in water and in fish liver and muscle were measured using atomic absorption spectrophotometer (Thermo 6600, thermo electron corporation, Cambridge, UK).

Pesticides analysis residues

Extraction and cleanup.

Ten ml of acetone were added to 1g of each liver sample, while 100 ml of the same solvent were added to (10g) of the fish muscles and gills. The mixture was blended and centrifuged at high speed centrifuge for 2 min and partition with dichloromethane. The resulting extracts of fish tissues were cleaned by activated florisil using elution solvent system of 50% dichloromethane, 48.5% n-hexane, and 1-5% acetonitril gradually (Mills *et al.* 1972) and (Mann, 1981). The pesticide extracts were evaporated at 30 $^{\circ}$C to dryness. After clean up the pesticides extract was dissolved in 1ml HPLC methanol. The HPLC apparatus of Model Agilent series 1100 with UV detector and C_{18} stainless column (4-6 X^{250} mm) (Merk company)

Phytoplankton.

In both groups of ponds (irrigation and agriculture drainage water) the phytoplankton organisms were estimated by the quantity procedure according to the methods reported by APHA (1985). The phytoplankton organisms were quantitively counted after fixing and preserving the water sample (one liter) by lugol's solution at a ratio of 0.3 ml to 100 ml sample .

Each sample was allowed to settle over night, then the supernatant was siphoned off and the volume was adjusted to 100ml. From the fixed sample, 1ml was drawn and placed into Sedgwilx. It was then microscopically examined for counting.

Condition factor

Samples of 15 fish from each water type were taken for measuring weight, length to determine K factor. The condition factor of fish was calculated for individual fish from the formula as fallows

$K = (W / L^{3)} \times 100$

Where:

W = the weight in gram   L = the total length in centimeter

Hepatosomatic index.

Fish liver was taken from 15 fishes per each treatment. Hepatosomatic index was calculated as liver percentage to the whole fish weight as the following equation:-

HSI = (Liver weight (g) / Fish weight (g)) × 100

Gonadosomatic index.

Fish gonad was taken from 15 fishes per each water type. Gonadosomatic index was calculated as gonad percentage to the whole fish weight as the following equation:-

GSI = (Gonad weight (g) / Fish weight (g)) × 100

Chemical analysis of fish flesh and artificial diet.

At the end of the experimental period, 35 fish from each water type were sacrificed for the experiment analysis. Analysis of fish and artificial diet for moisture, crude protein, fat and ash were determined by standard methods according to AOAC (1990). The nitrogen free extract was calculated by difference $^{N.F.E}$ = 100 - (moisture + protein + lipid + fiber +ash), the gross energy (kcal/kg diet) were calculated using factor 5.64, 9.44 and 4.11 for crude protein, fat and carbohydrate, respectively according to NRC (1993).

Statistical analysis

Statistical analysis was performed using the Analysis of variance one way (ANOVA) and Duncan's multiple Range Test, to determine differences between treatments means at significance rate of $P < 0.05$. The standard errors of treatment means were also estimated. All statistics were carried out using Statistical Analysis program (SAS, 2000).

RESULTS

Physico-chemical analysis of water

Analysis of variance for overall average physico-chemical parameters of water during January to April (2008) are shown in Table 2.

Temperature.

Analysis of variance for average water temperature in Table 2, revealed that differences among the two tested groups of ponds water were insignificant. However, ponds of the irrigation water sources showed slightly lower temperature average (18.0 ± 0.18) compared to ponds that received agriculture drainage water (18.2 ± 0.16).

Dissolved oxygen (DO).

Results in Table 2, revealed that the average DO concentration as affected by the water supply (mg/l) was significantly different. The ponds with agriculture drainage water had significantly ($p<0.05$) higher dissolved oxygen (7.19 ± 0.16) compared to those with irrigation water (6.03±0.09), although the water supply showed the reverse.

pH.

There was a highly significant differences in the water pH between the two tested water groups ($p<0.05$). PH values in Table 2, showed a higher value for agriculture drainage water (9.25±0.03) against (8.22±0.06) for irrigation ponds water.

Total ammonia ($NH_3 + NH_4$) and un-ionized ammonia (NH_3).

Analysis of variance for overall average of total ammonia and unionized ammonia in Table 2, showed that the differences among the two tested groups of ponds were significant ($p<0.05$). However ponds received agriculture drainage water showed lower values of total ammonia (1.9 ± 0.06), than those of the irrigation water (3.07 ± 0.09). The unionized ammonia showed the inverse, the ponds with agriculture water had higher value (0.70 ± 0.01) compared to those of the irrigation water (0.14± 0.02 mg/l).

Secchi disc.

There was a highly significance difference ($p<0.05$) in Secchi disc values between the two tested groups of water. Secchi disc reading in Table 2, showed a higher transparency for irrigation ponds water (25.0±0.58 cm) compared with (9.0 ±1.0 cm) for the agriculture drainage water.

Salinity (g/l) and electric conductivity (ml/mohs).

There were highly significant differences in the water salinity and electric conductivity levels between the two tested groups of ponds water ($p<0.05$). The values of salinity and electric conductivity of ponds water that received agriculture drainage supply were higher (0.3±0.0), (541.97±5.29) than those received irrigation water (0.2±0.0 g/l) and (318.70±38.29).

Total alkalinity and total hardness.

Results in Table 2, showed that the total alkalinity and total hardness varied significantly ($p<0.05$), where the ponds with irrigation water had higher values

(84.67±0.33) and (170±2.89 mg/l), than those with agriculture drainage water (65±2.89) and (150±2.89 mg/l).

Available phosphorus.

There was a significant difference in the available phosphorus contents between the two groups of ponds ($p<0.05$). A higher value was detected in the ponds with agriculture drainage water source (0.083±0.004 mg/l) compared to those with irrigation water (0.025±0.003 mg/l).

Nitrate.

The different water sources showed significant effect on pond water nitrate content. Ponds of agriculture drainage water showed higher nitrate content (0.22± 0.02 mg/l) compared to ponds that received irrigation water (0.12±0.15 mg/l).

Phytoplankton density.

Results presented in Table 3, showed that the agriculture drainage water had higher density of phytoplankton (92416 org/l) compared to the irrigation ponds water (5000 org/l). The water supply showed the reverse. The phytoplankton population was dominated by green algae in the agriculture drainage water supply, and by diatoms in the irrigation water supply, while in ponds water diatoms dominated in the agriculture drainage ponds water and green algae dominated in ponds with irrigation water.

Condition factor, Hepatosomatic index and Gonadosomatic index.

Results illustrated in Table 4, Showed that the higher significant values of Condition factor (2.01± 0.11), Hepatosomatic index (0.63± 0.04) and Gonadosomatic index (0.162 ±0.02) were observed in ponds that received agriculture drainage water and the lower values of Condition factor (1.69± 0.043), Hepatosomatic index (0.44 ± 0.042) and Gonadosomatic index (0.045 ± 0.003) were observed in ponds that received irrigation water.

Chemical composition

Chemical compositions of the flesh (*Oreochromis niloticus*) as affected by different water sources are presented in Table 5. Ponds water that received agriculture drainage water supply showed higher significant ($P<0.05$) flesh protein (20.01 ± 0.25), lower moisture (76.44 ± 0.02) and fat content (1.48 ± 0.04), while there was no significant differences in ash content among the two tested groups of ponds water.

Heavy metals in water

Table 6, showed that higher significance differences in the concentration of (Fe, Cu and Zn) were observed in the agriculture drainage water supply and ponds. The values were: Fe (4.34±0.45 and 1.11±0.10), Cu (0.0059±0.001 and 0.011±0.001) and Zn (0.2±0.03 and 0.164±0.01) for agriculture drainage water supply and ponds respectively, the results of the irrigation water supply and ponds were Fe (0.152±0.007 and 0.174±0.006), Cu (0.0056±0.00 and 0.0045±0.00) and Zn (0.062±0.006 and 0.096±0.008). While the concentration of Pb was not detected in the irrigation water supply and agriculture drainage ponds water, the concentration of Pb in the agriculture drainage water supply was (0.018±0.01), and in the irrigation ponds water was (0.112 ±0.00) mg/l .

Heavy metals in Fish muscle and liver

Results presented in Table 7, showed higher concentrations of Fe (154.87±23.28), Cu (31.53 ± 4.41), Zn (94.38 ± 2.96) and Cd (0.13 ± 0.03) in fish muscle from irrigation ponds water, than those of agriculture drainage water ponds Fe (82.67±3.23), Cu (17.18±1.86), Zn (48.81± 3.39) and Cd (0.04 ± 0.01) mg/l. There was no significance difference in the concentrations of Pb between the 2 groups of ponds, but the concentration of Pb in fish muscle of agriculture drainage ponds water was slightly lower (0.90 ± 0.10) than those of the irrigation ponds water (1.54 ± 0.23) mg/l. It is shown in Table 8, that fish liver of irrigation ponds water had higher values of Fe (7069 ±221), Cu (46.94±1.32), Zn (173.19 ± 4.33), Pb (6.07 ± 0.16) and Cd (1.685 ± 0.14), while the lower values of Fe (2126 ± 41), Cu (33.21 ± 3.20), Zn (81.38 ± 8.12), pb (3.92 ± 0.24) and Cd (1.235 ± 0.045) were reported in fish liver of the agriculture drainage ponds water.

Pesticide residues in the different water resources.

Table 9, showed that the concentration of the pesticide residues were higher in the agriculture drainage water than the irrigation water except for the Triazophos, the Triazophos concentration was higher in the irrigation water (0.003972) than in the drainage water (0.0022287) ppm. Many pesticides absent in the present study were absent in the irrigation water. Conversely, the results showed wide variations in the pesticides concentrations between the group of ponds that received drainage water and those received irrigation water. Some of the pesticides concentrations were higher in the first ponds group and other were higher in the second ponds group. Some of the pesticides residues which were absent in the source of the irrigation water pond were present in the pond with the same type of water in sensible amounts, such as Abamectin (0.00203), Chlorfenapyr (0.007811) and Chloroflazwzen (0.004522). These pesticides were even in higher concentrations in ponds with irrigation water than those with the drainage water.

Pesticide residues in fish organs.

Table 10, showed the concentration of the 16 different pesticides residues in the fish muscles, gills and liver, from both ponds group that received water from either irrigation or agriculture drainage supplies. The types of pesticides (Chloroflazwzen, Delta methrin and Es-fenvalerate) were almost not detected in all tested fish organs from both types of water, in addition, to the two other pesticides (Flofenoxuron and Penconazole) which were absent in the fish organs from the irrigation ponds. Most of the pesticides residues were higher in the fish organs from the irrigation water ponds than those from the agriculture water ponds, except for the Chlorfenapyr, Flofenoxuron, Penconazole and Mthomyl. These residues values for the fish muscles, gills and liver, from the agriculture drainage water were as follows, (0.0150, 0.0356 and 0.0387 ppm) for Chlorfenapyr, (0.0508, 0.01892 and 0.06471 ppm) for Flofenoxuron, (0.0156 and 0.01248 ppm) for Penconazole and (0.0232, 0.0281 and 0.0336 ppm) for Mthomyl. Moreover, the present results indicated that fish muscle was the least organ contaminated with the pesticides residues except for the Triazophos (0.0898 ppm, 0.03518 ppm) for both types of water, Profenfos (0.03518 ppm), Buprofezen (0.04108 ppm) and for fish muscles from the drainage water. The concentration of the pesticides residues in the fish gills and liver slightly varied from those in different water types.

DISCUSSION

Temperature

Water temperature is one of the most influencing environmental factors affecting pond dynamics and both the metabolism and growth of fish (Weatherley and Gill, 1983, Herzing and Winkler, 1986 and Boyd, 1990). Boyd (1990) mentioned that water temperature in fish ponds is related to solar radiation and air temperature. In the present study, water temperature was favorable for fish culture as mentioned by Boyd (1990) in both types of water, agriculture drainage pond and irrigation water.

Dissolved oxygen (DO)

In the present results, the higher value of DO in the agriculture drainage ponds water may be due to the abundance of phytoplankton that increase photosynthetic activity leading to production of large amount of DO. The recorded dissolved oxygen in the two groups of ponds was favorable for fish culture (Boyd, 1990) and comparable with results of Abdel-Tawwab *et al.* (2007) and Ali (2007).

pH and Alkalinity

In the present study, the overall mean pH values were significantly higher at agriculture drainage ponds water compared to irrigation ponds water. This may be due to the higher Nitrogen and phosphorus concentrations of the agriculture drainage water which contains more phytoplankton than the irrigation water. The present results also showed that the agriculture drainage ponds water had the lowest total alkalinity and the highest pH compared to irrigation ponds water. This may be due to the increase in pH value in water with high photosynthetic rate and the depletion of carbon dioxide. The hydrolysis of bicarbonate ions at higher pH values may lead to reduce the total alkalinity. Autotrophic activity increases pH through Co_2 absorption, while heterotrophic activity decreases pH through respiration, since the autotrophic and heterotrophic processes affect the measured variables in opposite ways (Boyd and Lichtoppler, 1979). The present results are in agreement with Boyd (1990), Saeed (2000) and Ali (2007).

Total ammonia (NH_4+ NH_3) and un-ionized ammonia (NH_3).

The present results indicated that the total ammonia in water of irrigation source was highly significant than that of the agriculture drainage water. This may be due to transformation of a large part of the water nitrogen into protein by abundance of the phytoplankton drainage water. The previous transformation causes depletion to the ammonia concentration in water and this agrees with the finding of Vymazal (1995). The results also showed that the un-ionized ammonia (NH_3) was higher in the agriculture drainage ponds water than the irrigation ponds water. This was due to higher pH in the first type of water compared to the second one. The ammonia formation depends on water pH, where at higher pH, free toxic ammonia is released to critical levels (Boyd, 1990).

Total hardness

The present results show that the total hardness of the agriculture drainage ponds water was significantly lower when compared to that of the irrigation ponds water. This is due to the higher photosynthetic activity in the agriculture drainage fish ponds water compared to the irrigation one. The high photosynthetic activity causes the release of carboxyl (OH^-) group which helps binding Ca with the carbonate group (Co_3) to form $CaCo_3$ as reported by Saeed (2000) and Ali (2003).

Nitrate concentration (No_3-N).

Nitrate concentration in agriculture drainage fish ponds water was significantly higher than that of irrigation ponds water. This may be due to that agriculture drainage water is rich in nitrate content. Moreover, the high level of ammonia in agriculture drainage ponds water may be nitrified to nitrate due the high concentration of the available Do (Boyd, 1990 and Gross *et al.*, 2000).

Available phosphorus

Available phosphorus concentration (mg/l) was significantly higher in the agriculture drainage ponds water compared to irrigation ponds water. This coincided with results of EL-Wakeel and Wahby (1970) and Ahmed (1983) who pointed out that agriculture drainage water contained high concentrations of different elements including phosphorus.

Salinity and electric conductivity

The higher values of salinity and electric conductivity were observed in the present study for the agriculture drainage water supply and ponds than those of the irrigation water and this was due to the high levels of dissolved salts in the agriculture drainage water.

Secchi disc depth (SD)

SD visibility testes indicate the turbidity of the water which is usually caused by suspended soil particles and/or plankton abundance (Boyd, 1990). The present results showed lower visibility in the agriculture drainage ponds water compared to the irrigation water, and this was due to the higher abundance of phytoplankton in the agriculture drainage water.

Phytoplankton

The present results showed that the Green algae and Diatoms were abundant in the water supply of the two types of ponds. However, the irrigation water supply had higher phytoplankton density compared to its ponds water and this might be due to the high discharged wastes into the water supply. The highest density of the drainage ponds water phytoplankton than that of its water supply was due to the increase of ammonia concentration as a result of the fish farming activities. This ammonia levels could be absorbed by the available phytoplankton which subsequently converts the nitrogenous compounds into amino acids which depict a much idealized algal cells as pointed out by Vymazal (1995). As mentioned above that sechi disc reading was lower in the drainage pond water and this support the latter finding and agrees with Almazan and Boyd (1978) who stated that the increased levels of the phytoplankton standing crop could be related to the lower value of Secchi disc.

Condition factor, Hepatosomatic index and Gonadosomatic index

In the present study the higher significant values of Condition factor (2.01± 0.11), Hepatosomatic index (0.63± 0.04) and Gonadosomatic index (0.162 ±0.02) were observed by ponds water that received agriculture drainage water supply. These results may be due to improvement of the water physico-chemical parameters. Similar results were obtained by Ali (2007) who found the higher Condition factor (2.49) of Nile tilapia grown in agriculture drainage water than those grown in irrigation water. Barakat (2004) found that the duration between periods of spawning was increased from 30-36 to 55-75 days in control and organic contaminated groups, respectively, and the average value of eggs per spawn was decreased from 162-195 in the control groups to 120-170 in the organic contamination ones.

Chemical composition

Producing fish should not only be limited to fish quantity but also concerns with the quality of fish produced (Weatherley and Gill, 1987). The present results showed that the chemical composition of *Oreochromis niloticus* flesh was significantly affected by the water resources. In ponds that received agriculture drainage water, a significant ($P<0.05$) improvement of the fish chemical composition, protein, fat and moisture was observed, compared to those grown in ponds that received irrigation water. These results may be due to the higher density of available phytoplankton in the agriculture drainage water. This finding is in agreement with what obtained by Ali (2007) who reported that the deposed nutrients inside fish body depend upon the availability of the food and its quality. However, the same author found that no significant differences in body composition of Nile tilapia grown in agriculture drainage water and irrigation water.

Heavy metals in water

The concentrations of heavy metals (Fe, Cu, Zn, Cd and pb) were higher in the ponds received agriculture drainage water compared with those received irrigation water. However, the present study revealed that the agriculture drainage water had higher phytoplankton density and higher pH value (9.25) and this decrease the heavy metals toxicity. Malcolm (1995) stated that the toxicity of heavy metals is usually reduced as pH increase because at higher pH the metals bind to form hydroxide and carbonate complexes which are considered less toxic to fish than the metal ions. Also, Saleh (1988) found that the concentrations of heavy metals in plankton were 1000 to 4000 times higher than those in water. In the present study, although most of the heavy metals concentrations were within the permissible levels, the concentration of Fe (1.11 ± 0.16 mg/l) in ponds that received agriculture water was higher than the permissible levels (0.3 mg/l) according to USEPA (1986). These results agree with Saeed (2000) who stated that the agriculture drainage water usually contains higher Fe level than the irrigation water.

Heavy metals in Fish muscle and liver

The values of heavy metals (Fe, Cu, Zn, Cd and pb) in fish muscle from ponds that received irrigation water were higher compared to those that received agriculture drainage water. Although the ponds with irrigation water contain lower concentration of heavy metals than those received agriculture drainage water. These results might be related to the higher density of phytoplankton in the agriculture drainage water. Voight (2003) and kucuksezgin *et al.* (2006) stated that phytoplankton occurred in the ecosystem could absorb and accumulate heavy metals. It is noticed that the heavy metals accumulation in liver was higher than that deposed in muscles. Heavy metals bioaccumulation in liver may be because liver being the responsible organ in controlling the toxicity of heavy metals. Similar results were obtained by Benson *et al.* (2006) and Ali (2007). They also agree with Elnemaki and badawy (2005 & 2006) who found out that Fe, Cu, Zn and pb concentrations in the carp and mullet liver were higher than those in the fish muscles. The previous investigations reported negative correlation between the heavy metals concentration and the phytoplankton density in water, and this agreed with the present results. The present study showed that the concentrations of the heavy metals (Fe, Cu and Zn) in fish muscles from the ponds that received irrigation water were higher than the permissible limits of WHO (1989).

Pesticide residues

The results of pesticide residues in the present study are in agreement with those obtained by Atalla (2005) who monitored the pesticide residues in agriculture drainage water samples collected from different governorates (Sharkia, Menofya, Giza and Kalyobia) during 2003 in Egypt. The same trends were found by several investigators as Iwatw *et al.* (1995), (Tarek (2007) and Radwwn (2008) who estimated the maximum residues level of pesticides in water. It could be mentioned that such levels are available only for drinking water (WHO, 1984). The residues concentrations of B-cyflothrin, Cypermethrin, Es-fenvalerate, Lambada cyhalothrin and Penconazole in all samples were lower than acceptable daily intake (ADI) values. In contrast, the residues concentrations of Triazophos, Abamectin, Profenfos and Buprofezen in all samples were higher than ADI. The ADI values for Chlorfenapyr and Flofenoxuron were not available, and the residue concentration of Melathion was higher than ADI value in fish samples grown in agriculture drainage water source, irrigation water source, agriculture drainage water ponds and irrigation ponds water.

The ADI values of Abamectin, Triazophos, Chlorpyrifos, Buprofezen, B-cyflothrin, Profenfos, Es-fenvalerate, Lambada cyhalothrin, Delta methrin, Cypermethrin, Melathion, Mthomyl and Penconazole were reported in Pesticide manual (2005) as 0.0001, 0.001, 0.01, 0.01, 0.02, 0.01, 0.02, 0.01, 0.01, 0.05, 0.02, 0.03 and 0.03 mg/kg body weight respectively.

Results presented in this study showed that the concentrations of most pesticides were at their highest level in the fish gills from the irrigation water, followed by the fish liver. This finding agrees with Elnemaki and Abuzinadah (2003) who showed that the *Oreochromis spilurus* gills were the most affected organ when fish was exposed to different concentrations of the contra insect pesticides for different periods of time. In the present study the least concentrations of pesticides were in the fish muscels from agriculture drainage water. The fish levels coincided with the concentrations of the same pesticides in both types of the experimental water. Some of the pesticides were found at higher concentrations in the irrigation ponds water, when compared with the water source. At the same time these pesticides were at lower concentrations in ponds that received agriculture drainage water than in the source. This could be explained by the higher density of phytoplankton it's irrigation water source and drainage ponds water which could absorb a high quantity of most pesticides (Elnemaki and badawy, 2005 and 2006).

CONCLUSION

Results obtained showed wide variations between water quality of both type of waters. These variations affected fish nutrients contents and growth, heavy metals and pesticides concentration in different fish organs. The results revealed that the quality of fish produced in the agriculture drainage water meets the standard fish quality levels. This water is not highly contaminated with pollutants such as the heavy metals or pesticides. Furthermore, the agriculture drainage water was highly productive and this might have minimized the pollutants contents of the water and have a positive effect on fish growth and quality. Therefore, the study recommends using agriculture drainage water at Al-Abbassa fish farm under the condition of carrying out complete analysis of the water and fish before and on a periodical basis during the fish growing seasons to assure good quality of water and fish production.

The present study conclusions are not necessary applied to other fish farms which use agriculture drainage water in different areas of Egypt.

Table 1. Proximate analysis of artificial diet (on dry matter basis)

Items	(%)
Dry matter	90.00
Crude protein	25.31
Ether extract	5.25
Crude fiber	6.11
Ash	20.61
Nitrogen free extract	42.72
Gross energy kcal/100g	367.89
Pb µ/g	0.81
Cd µ/g	0.45
Cu µ/g	33.73
Zn µ/g	135.27
Fe µ/g	243

Table 2. Mean values ± SE of physico-chemical parameters of the different water resources.

Parameters	Water supply		Ponds water		Significance
	Irrigation	Agriculture drainage	Irrigation	Agriculture drainage	
Temperature	18.0 ± 0.14	18.2 ± 0.10	18.0 ± 0.20	18.2 ± 0.17	NS
pH	7.48±0.03[c]	8.39±0.08[b]	8.22±0.06[b]	9.25±0.03[a]	***
$N(NH_4)$ (mg/l)	4.07 ±0.07[a]	2.63±0.09[c]	3.07± 0.09[b]	1.9± 0.06[d]	***
NH_3(mg/l)	0.06±0.00[d]	0.23±0.01[b]	0.14± 0.02[c]	0.70±0.01[a]	***
S.D	37.67±0.88[a]	12.33±0.60[c]	25.0±0.58[b]	9.0 ±1.0[d]	***
O_2	5.68±0.16[b]	2.53±0.24[c]	6.03±0.09[b]	7.19±0.16[a]	***
Salinity (g/l)	0.2± 0.00[b]	0.3±0.0[a]	0.2±0.0[b]	0.3±0.0[a]	***
Electric conductivity (EC) (ml.mohs)	561.9±4.37[a]	401.83±0.93[b]	318.7±38.29[c]	541.97±5.29[a]	***
Total alkalinity (mg/l)	86.67±1.67[a]	96.67±6.67[a]	84.67±0.33[a]	65±2.89[b]	**
Total hardness (mg/l)	160±0.00[b]	170±2.89[a]	170±2.89[a]	150±2.89[c]	**
Available phosphorus (mg/l)	0.038±0.002[b]	0.046±0.003[b]	0.025±0.003[c]	0.083±0.004[a]	***
Nitrate (mg/l)	0.12± 0.02[b]	0.16±0.00[b]	0.12±0.15[b]	0.22± 0.02[a]	**

Means in the same row with the same letter have no significant difference (P>0.05)

Table 3. Average values ± SE of phytoplankton density (org / l) in the different water resources.

Parameters	Water supply		Ponds water	
	Irrigation	Agriculture drainage	Irrigation	Agriculture drainage
Phytoplankton (org/l) green algae	12600 ± 57	7396±378	3500 ± 57	29536 ± 75
Blue green algae (org/l)	2433 ± 88	5206±268	300 ± 28	29680 ± 145
Diatoms (org/l)	13950 ± 5.77	5950 ± 5.77	1200 ± 0.0	33200 ±14302
Total	28983	18552	5000	92416

Table 4. Average values ± SE of Condition factor, Hepatosomatic index and Gonadosomatic index of Nile tilapia fish reared in the different water resources.

Parameters	Fish pond of irrigation water	Fish pond of agriculture drainage water	Significance
Condition factor (K)	1.69 ± 0.043[b]	2.01 ± 0.11[a]	*
Hepatosomatic index (HSI)	0.44 ± 0.042[b]	0.63 ± 0.04[a]	**
Gonadosomatic index (GSI)	0.045 ± 0.003[b]	0.162 ± 0.02[a]	***

Means in the same row with the same letter have no significant difference (P>0.05)

Table 5. Chemical composition (Mean± SE) of Nile tilapia flesh, reared in the different water resources.

Items	Fish pond of irrigation water	Fish pond of agriculture drainage water	Significance
Moisture (%)	77.56 ± 0.27[a]	76.44 ± 0.02[b]	*
Crude protein (%)	18.03 ± 0.17[b]	20.01 ± 0.25[a]	**
Crude Fat (%)	2.73 ± 0.07[a]	1.48 ± 0.04[b]	***
Ash (%)	0.55 ± 0.20[a]	0.90 ± 0.24[a]	NS

Means in the same row with the same letter have no significant difference (P>0.05)

Table 6. Average values ± SE of heavy metals (mg/l) in ponds and water supply that received different types of water.

Parameters	Water supply		Ponds water		Significance
	Irrigation	Agriculture drainage	Irrigation	Agriculture drainage	
Fe	0.152±0.007[c]	4.34±0.45[a]	0.174±0.006[c]	1.11±0.10[b]	***
Cu	0.0056±0.00[b]	0.0059±0.001[b]	0.0045±0.00[b]	0.011±0.001[a]	**
Zn	0.062±0.006[b]	0.2±0.03[a]	0.096±0.008[b]	0.164±0.01[a]	**
Pb	0.0±0.0[b]	0.018±0.01[a]	0.012 ±0.00[a]	0.0±0.0[b]	**
Cd	0.0014±0.00[a]	0.0 ±0.0[a]	0.0014±0.00[a]	0.0016±0.00[a]	NS

Means in the same row with the same letter have no significant difference (P>0.05)

Table 7. Average values ± SE of heavy metals (µg/g) in the muscles of Nile tilapia fish reared in the different types of water.

Parameters	Fish muscles		Significance
	pond of Irrigation water	pond of Agriculture drainage water	
Fe	154.87±23.28[a]	82.67±3.23[b]	*
Cu	31.53 ± 4.41[a]	17.18±1.86[b]	*
Zn	94.38 ± 2.96[a]	48.81± 3.39[b]	***
Pb	1.54 ± 0.23[a]	0.90 ± 0.10[a]	NS
Cd	0.13 ± 0.03[a]	0.04 ± 0.01[b]	*

Means in the same row with the same letter have no significant difference (P>0.05)

Table 8. Average values ± SE of heavy metals (µg/g) in the liver of Nile tilapia fish reared in the different types of water.

Parameters	Fish liver		Significance
	pond of Irrigation water	pond of Agriculture drainage water	
Fe	7069 ±221[a]	2126 ± 41[b]	***
Cu	46.94±1.32[a]	33.21 ± 3.20[b]	*
Zn	173.19 ± 4.33[a]	81.38 ± 8.12[b]	***
Pb	6.07 ± 0.16[a]	3.92 ± 0.24[b]	**
Cd	1.685 ± 0.14[a]	1.235 ± 0.045[b]	*

Means in the same row with the same letter have no significant difference (P>0.05)

Table 9. Pesticide residues (ppm) in the water supplies and ponds received two different types of water.

Name of pesticides	Water supply		Ponds water	
	Irrigation	Agriculture drainage	Irrigation	Agriculture drainage
Abamectin	ND	0.007565±0.120	0.00203±0.030	0.00157±0.003
Buprofezen	0.00013±0.003	0.0003667±0.025	0.0012286±0.038	0.02896±0.098
B-cyflothrin	ND	0.0000014±0.002	0.0000018±0.006	0.0000011±0.002
Chlorfenapyr	ND	0.007501±0.065	0.007811±0.004	0.001499±0.002
Chloroflazwzen	ND	0.00634±0.006	0.004522±0.004	0.001680±0.005
Chlorpyrifos	0.001535±0.033	0.002458±0.006	0.005365±0.008	0.00581±0.005
Cypermethrin	0.0000006±0.003	0.000001±0.008	0.0000018±0.032	0.00002±0.004
Deltamethrin	ND	ND	ND	ND
Es-fenvalerate	ND	ND	ND	ND
Flofenoxuron	ND	0.009953±0.004	ND	0.00298±0.004
Lambada cyhalothrin	ND	ND	ND	ND
Melathion	ND	0.00381±0.002	0.00550±0.002	0.00167±0.034
Penconazole	0.00426±0.080	0.00682±0.007	0.01488±0.004	0.016098±0.049
Profenfos	0.00088±0.014	0.041624±0.001	ND	ND
Triazophos	0.003972±0.001	0.0022287±0.004	0.000908±0.012	0.0052322±0.002
Methomyl	0.000995±0.003	0.001997±0.008	0.00669±0.041	0.00716±0.003

ND = Not detected

Table 10. Pesticide residues (ppm) detected in Nile tilapia fish muscles, gills and liver reared in two different types of water.

Name of pesticides	Irrigation water pond			Agriculture drainage water pond		
	Muscles	Gills	Liver	Muscles	Gills	Liver
Abamectin	0.0163±0.006	0.0277±0.034	0.0269±0.015	0.0059±0.002	0.0139±0.013	0.0217±0.044
Buprofezen	0.01117±0.003	0.0184±0.043	0.0295±0.021	0.04108±0.016	0.01135±0.003	0.1791±0.044
B-cyflothrin	0.0112±0.034	0.0041±0.001	0.0002±0.004	0.00026±0.003	0.00039±0.001	0.00017±0.14
Chlorfenapyr	ND	0.0116±0.098	0.0093±0.021	0.0150±0.004	0.0356±0.080	0.0387±0.007
Chloroflazwzen	ND	ND	ND	ND	ND	ND
Chlorpyrifos	0.0039±0.003	0.0177±0.010	0.0211±0.002	ND	0.0311±0.024	0.0238±0.006
Cypermethrin	0.00004±0.024	0.00055±0.006	0.00002±0.005	0.0008±0.040	0.00021±0.003	0.00018±0.054
Delta methrin	ND	ND	ND	ND	ND	ND
Es-fenvalerate	ND	ND	ND	ND	ND	0.0001±0.008
Flofenoxuron	ND	ND	ND	0.0508±0.002	0.01892±0.002	0.06471±0.001
Lambada cyhalothrin	0.00003±0.045	0.00042±0.011	0.00001±0.022	0.0006±0.033	0.0028±0.056	0.0014±0.036
Melathion	0.0111±0.003	0.0166±0.044	0.0145±0.006	0.0213±0.010	0.0591±0.045	0.0306±0.004
Penconazole	ND	ND	ND	0.0156±0.159	0.01248±0.027	ND
Profenfos	ND	0.0411±0.027	0.0615±0.017	0.0537±0.098	0.0199±0.023	0.0273±0.034
Triazophos	0.0898±0.090	0.0453±0.036	0.02863±0.073	0.03518±0.120	0.01305±0.340	0.04730±0.039
Methomyl	0.0020±0.097	0.0033±0.015	0.0064±0.004	0.0232±0.249	0.0281±0.018	0.0336±0.014

ND = Not detected

REFERENCES

1. Abdel-Tawwab, M., A. E. Abdelghany and M. H. Ahmad. 2007. Effect of diet supplementation on water quality, phytoplankton community structure, and the growth of Nile tilapia, *Oreochromis niloticus* (L.), common carp *Cyprinus carpio* L., and silver carp, *Hypophthalmichthys molitrix* V. polycultured in fertilized earthen ponds. J. Appl. Aquac.., 19. 1: 1-24.
2. Ahmed, Z. A .1983. Studies on phytoplankton of the Nile system in upper Egypt. Msc Thesis. Assiut Unive. Egypt.
3. Ali, A. N. 2007. Ecological study on some water characteristics used in fish farms and their relation to fish productivity. Ph. D. Thesis. Al-Azhar Unive. Fac Sci. Chemistry dept. Egypt.
4. Almazan, G. and C. E. Boyd. 1978. Phytoplankton and Tilapia yields in ponds. Aquac, 15:75-77.

5. A. O. A. C. 1990. Association of Official Analytical Chemists. Official Methods of Analysis. 13th Ed. Washington DC, USA.

6. A. P. H. A 1985. Standard methods for examination of water and waste water. Amrican puplic health association. Washington. D. D., USA.

7. Barakat, K. K. 2004. Effect of some water pollutants on the biology of the Nile Bolti, Oreochromis niloticus. Pakistan. J. Biologcal Scinces. 7. 3: 305-308.

8. Benson, N. U., M. U. Etesin, J. P. Essien, I. U. Umoren and M. A. Umoh. 2006. Tissue elemental levels in fin-fishes from Imo river system, Nigeria: assessment of liver/muscle concentrations ratio. J. Fisheries and Aquatic Sci. 1 (3. 277-283).

9. Boyd, C. E. 1990. Water Quality in ponds for aquaculture. Agriculture Experiment Station, Auburn Univ., Alabama, U.S.A: 482.

10. Boyd, C. E. 1984. Water Quality in Warm water Fishponds. Alabama Agriculture Experiment Station, Auburn Unive., Auburn, Alabama, USA.

11. Boyd, C. E. and F. Lichkoppler. 1979. Water quality management in pond fish culture. Auburn univ, Alabama, International for aquaculture. Agric. EXP. Station Research and Development series, 22: 30

12. El-Kabbany, S, M. M. Rashed and M. A. Zayed. 2000. Mointoring of the pesticide levels in some water supplies and agriculture land, in El-Haram, Giza (A. R. E). Hazardous Materials. 72. 1: 11-26.

13. El nemeki, F. A and T. E. Badawy. 2006. Impact of different water resources and seasonal variations on the heavy metals concentration in Grass carp. Ctenopharyngod on idella. African. J. Biol Sci. 2. 2:67-74.

14. El nemeki, F. A and T. E. Badawy. 2005. Effect of water quality and seasonal variations on heavy metals concentrations in Mugil cephalus tissues, at El-Abbassa fish farm Egypt. Ain shams Science. Bulletin.43:33-44.

15. El nemeki, F. A and O. A. Abuzinadah. 2003. Effect of Contra/Insect 500/50 E. C. on the histopathology of Oreochromis spilurus fish. Bull. Nat. Inst. of Oceanogr & fish, A. R. E. 29:222-253.

16. El-Wakeel, S. K and S. K. Wahby. 1970. Hydrography and chemistry of lake Manzalla, Egypt. Arch. Hydrobiol. 67:173-200.

17. G. A. F. R. D. General Authority for Fish Resources Development. 2006. Fishery Annual Report, Cairo, Egypt.

18. Gross, A., C. E. Boyd and C. W. Wood. 2000. Nitrogen transformations and balance in channel catfish ponds. Aquac. Eng. 24: 1-14.

19. Gupta, G, Z. H. Zidan, M. I. Bdel-Mageed, K. A. Mohamed and A. E. Bayoumi. 2002. Monitoring of the pesticide residues and metals in water soil systems in

industrial and agricultural areas at Kalubia governorate, Egypt. The first Conf. of the Central Agric, Pesticide Lab. 3-5 Sept: 119-138.

20. Hassan, I. M., M. F. Khallaf, Y. A. Abdel-Daim and M. T. Ibrahim. 1996. Organochlorine pesticide resiues in water and fish from the river Nile. Annals of Agric. Sci. Cairo Special Issue, 149-161. Nahrug. 42. 1: 39-41.
21. Herzing, A. and A. Winkler. 1986. The influence of temperature on the embryonic development of three cyprinoid fishes, Abramis brama, Chalcal burnus, Chalcoides mento and Vimba vimba. J. Fish Biol. 28: 171-181.
22. Iwata, H., S. Tamabe, K. Ueda and R. Tatsukawa. 1995. Persistent organochlorine residues in air, water sediments and soil from the lake Baikal regions. Rossia environmental science and technology. 29. 3: 792-801.
23. Kucuksezgin, F., A. Kontas, O. Alto, E. Uluturham and E. Darilmaz. 2006. Assessment of marine pollution in Izmir bay. Nutrient, heavy metal and total hydrocarbon concentrations. Environ. Int. 32: 41-51.
24. Malcolm, J. 1995. Text book of environmental biology of fishes. First edition. Printed in Great Britain by T. J. Press (Padstow) LTD. Padstow. Cornwall.
25. Mann, B. J. 1981. Manual for training of pesticides analysis. USA. Section 11-B: 2-5.
26. Mills, P. A., A. B. Baraka, R. K. L. Verene and A. B. Jerry. 1972. Elution solvent systems for florisil clean up in organochlorine pesticide residues analysis. JAOAC. 5: 39-43.
27. N. R. C. National Research Council. 1993. Nutrition requirements of fish. National Academy Press Washington C.U.S.A.
28. Pesticide manual. 2005. Version 3-1, thirteenth edition.
29. Pulatsu, S, F. Rad, G. Koksal, F. Aydm, A. C. K. Benli and A. Topcu. 2004. The Impact of Rainbow Trout Farm Effluents on Water Quality of Karasu Stream, Turkey. Turkish J. fisheries and aquatic Sci. 4: 09-15
30. Radwan, O. A. 2008. Monitoring of some pesticide residues in water and fish tissue samples collected from three locations at sharkia governorate, Egypt. J. Biol- Chem. Environ. Sci. 3. 1: 583-597.
31. Radwan, O. A. and I. E. Atalla. 2005. Monitoring of pesticide residues in agriculture drainage water and fish samples collected from different governorates, Egypt. Bull. Fac Agric. Cairo Univ. 56: 189-200.
32. S. A. S. 2000. Statistical Analysis Systems. Program Vel. 6. 12, SAS institute incorporation. Cary. NC 27513. USA.

33. Saeed, M. S. 2000. A study on factors affecting fish production from certain fish farms in the delta. M. Sc. Thesis. Ins. Environmental studies and Research. Ain Shams Univ. Egypt.
34. Saleh, M. A., A. S. Mostafa, M. F. Mostafa, A. S. Magdi, S. A. L. Mohamed and L. W. Bobby .1988. Inorganic pollution of man-made lakes of Wadi El-Raiyan and its impact on aquaculture and wildlife of the surrounding Egyptian desert. Arch. Environ. Contam. Toxicol. 17: 391- 403.
35. Tarek, O. Said. 2007. Detrermination of persistent organic pollutants in sediment and fish the western coast of Alexandria, Egypt. J. of Chemistry and Ecology. 23. 4: 289-302.
36. U. S. E. P. A. (United States Environmental Protection Agency). 1986. Quality Criteria for Water. EPA 440/5-86-001.
37. Voight, R. H. 2003. Concentrations of mercury and cadmium in some coastal fishes from the Fumash and Estman parts of the Gulf of Finland. Proceeding of Estonian Acad. Sci. Biol. Ecol. 52: 305-318.
38. Vymazan, J. 1995. Algae and element cycling in wet lands. Duke Univ. school of the envronment. Duke wet land center Durham, North Calorina. CRC Press. Inc.
39. W. H. O. World Health Organization. 1984. Guide lines for drinking water quality. Vol. 1, Recommendations. Geneva. 63.
40. W. H. O. World Health Organization. 1989. Guide lines for drinking water quality. Vol. 1, Recommendations. Geneva. 19.
41. Weatherley, A. H. and H. S. Gill. 1983. Protein, lipid, water and caloric contents of immature rainbow trout (Salmo gairdneri, Richardson) growing at different rates. J. Fish Biol. 23: 653-673.
42. Weatherley, A. H. and H. S. Gill. 1987. Tissue and growth. In: The biology of Fish Growth. 1st edition, St. Edmundshury press, Burry St. Edmunds, Suffelk, Great Britain: 147-173.

تأثير المصادر المختلفة من المياه على القياسات البيئية وجودة اسماك البلطى المنتجة فى مزارع الأسماك بالعباسة بجمهورية مصر العربية

فاطمة أمين النمكى[١]، نعمة عبد الفتاح على[١]، محمد مخمد زينهم[١]، ألفت عبد الحميد رضوان[٢]

١. المعمل المركزى لبحوث الأسماك با لعباسة – مركز البحوث الزراعية – مصر.

٢. قسم تحاليل المبيدات – مركز البحوث الزراعية – مصر.

الهدف الرئيسى لزيادة الثروة السمكية ليس فقط زيادة إنتاج الأسماك من المصادر المختلفة خاصة من الاستزراع السمكي ولكن أيضا تحسين جودة الأسماك المنتجة. احد العوامل الرئيسيةالتى تؤثر على جودة الأسماك هو جودة المياه، لذلك يهدف هذا البحث إلى دراسة تأثير مصادر مختلفة من المياه على إنتاج وجودة اسماك البلطى النيلى *Oreochromis niloticus* المربى فى مزرعتين مختلفتين فى مصدر المياه بمنطقة العباسة بمحافظة الشرقية بمصر. حيث تستخدم المزرعة الأولى المياه العذبة من ترعة الاسماعليه المتفرعة من نهر النيل، بينما تستخدم المزرعة الأخرى مياه الصرف الزراعى. وكانت عينات الأسماك والمياه تؤخذ عشوائيا من الأحواض المختلفة فى المزرعتين كل أسبوع لمدة فصلين (الشتاء والربيع) لتقدير الخصائص الفيزيائية والكيميائية والبيولوجية فى مصدرى المياه، خاصة الأس الهيدروجينى pH، الامونيا السامة NH_3، الامونيا الكلية، والأكسجين، الملوحة، التوصيل الكهربى، قرص الشفافية، القلوية الكلية، العسر الكلى، الفسفور المتاح والنترات. كما أخذت عينات الأسماك مرة واحدة فى موسم الصيد لتقدير العناصر الثقيلة فى عضلات وكبد الأسماك وكذلك تركيب الجسم ودليل الأعضاء التناسلية ومعامل الحالة والمبيدات فى عضلات وكبد وخياشيم الأسماك.

أظهرت النتائج أن كثافة مجاميع الهائمات النباتية (الفيتوبلانكتون) زادت بقيم دالة إحصائيا فى الأحواض التى تستخدم مياه الصرف الزراعى مقارنا بالأحواض التى تستخدم مياه الرى. كما وجدت اختلافات دالة إحصائيا فى تركيز العناصر الثقيلة (الحديد، الزنك، النحاس، والكادميوم ، الرصاص) وكذلك عدد من المبيدات فى مختلف أعضاء الأسماك وبالمثل مؤشر الأعضاء التناسلية ومعامل الحالة.