STUDIES ON THE MOST PREVAILING PROBLEMS ASSOCIATED WITH FISH ANOMALIES IN LAKE TEMSAH

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ABSTRACT

Fishes used in the present study were collected from two different sites of lake EL-Temsah. Nile tilapia Oreochromis niloticus (150 fish /season) were collected from site (A) and Bolti akhdar Tilapia zillii (250 fish /season) were collected from site (B). The fishes were subjected to external, x-ray, post-mortem and parasitological examinations. Moreover, water and fish musculature were analysed for detection of heavy metals.

The results of external and x-ray examinations performed on all O. niloticus revealed that the prevalence of anomalies in examined fish were 7.166%. The seasonal prevalence of deformity were 21 , 5.3, 2 and 0% in spring, autumn, summer and winter respectively. The anomalies recorded were represented as deformed jaws, bird like head, deformed mandible, vertebral deformities, hard structure at anal opening, unequal jaws and fusion of anal and dorsal fins. The results also recorded that O. niloticus with deformed mandible appeared in heavy musculature with fatty tissue surrounding the internal organ. The results of external and x-ray examinations of T. zillii revealed that, the prevalence of anomalies (bending of the operculum) was 1.6%, all of which in autumn. The results also recorded that all cases of deformity appeared in males of both fishes O. niloticus and T. zillii except in bird like head appeared in both males and females.

The results of water analysis revealed presence of lead, nickel, manganese and cadmium more than the permissible limits. Besides, the results of musculature analysis of O. niloticus and T. zillii revealed presence of cadmium and lead exceeding the permissible limits. Site (A) displayed a low salinity (2.77-2.80 ‰) while site (B) revealed high salinity reached up to (30.3-30.6‰).
INTRODUCTION

Fish anomalies are defined as gross structural defects which observed frequently in fish body and in particular of the extremities. They may not necessarily be pathological, where certain number of anomalies occurred in even normal broods (Reichenbach–Klinke, 1965). On the other side, fish anomalies may be originated from mutations and from teratogenic effects of adverse environmental factors (Lien 1997). Some deformities may be retard the fish growth or lethal by direct or indirect effect in young fish.

Moreover, malformed fish which do not differ in weight from normal fish are so often rejected by the consumer (Sloof, 1982 and Boglione et al., 2001).

Lake Temsah is one of the water bodies that constitutes the Bitter lakes, north of Suez Canal, a land engulfed embayment with a total area of 15 Km². It is a repository site for a variety of pollutants, including pesticides, heavy metals originated from farming and industrial activities. Also, a variety of aliphatic and aromatic hydrocarbons originated from shipping activities, ballasting water, maintenance and maritime works in the several docks around (Tundo et al., 2005).

For these reasons, this study was planned to record the different abnormalities in Oreochromis niloticus and Tilapia zillii caught from lake EL-Temsah.

MATERIALS & METHODS

Fish:

Fishes used in the present study were collected from two sites (A & B) of lake El-Temsah (Fig.1). Site (A) is called Bogas EL-Temsah or Western Lagoon where EL-Mahsama drain and Abu Gamous drain pours in. Site (B) located in the north of the lake and near the Suez Canal Pilot Building. This later site receives sewage water from covered drain and small amount of freshwater from the Ismailia Canal. O. niloticus were collected seasonally (150/season) from site (A) and T. zillii were collected as (250/season) from site (B).

Examination of the external features of the fish:

The external examination of fish was performed for detecting any anomalies in fish. The external observation was done by using photos and Fish Health External Examination Form according to Smith et al. (2002).

X-rays examination:

X-ray photographs of the whole skeleton were taken. Lateral and dorsoventral photographs were taken using Agfa medical X-ray film. A technique chart utilizing 50-60 KVp and 10mAs was used.
Postmortem examination:

Post-mortem examination was carried out for determination of the internal abnormalities according to the methods described by Amlacher (1970).

Parasitological examination:

The fishes were submitted to parasitological investigations by macroscopic and microscopic examinations according to Noga (1996).

Water and Tissue analysis:

Musculature was dried at 70°C for 48 hours and ground. A 5g specimens were digested by sulfuric acid and hydrogen peroxide according to Jackson (1967). Heavy metals were measured in water and tissue samples by using atomic absorption spectrophotometer, SOLAAR AA according to Page et al. (1982).

Salinity:

Electrical conductivity of the water was measured using conductivity meter model 710 according to Richards (1954).

RESULTS

Results of external examination

The skeletal anomalies observed in *O. niloticus* represented as deformed jaw (0.166 %) (Fig.2), unequal jaws (0.33 %) (Fig.3), fusion of anal & dorsal fins (0.166%) (Fig.4), Bird like head (1%) (Fig.5), vertebral deformities (0.5%)(Fig.6), hard structure at anal opening (0.166%) (Fig.7) and deformed mandible (4.83%) was characterized by projection the bone of the mandible laterally on one or both sides consequently the ventral surface of the mandible become larger than normal (Fig.8).

The only skeletal anomalies observed in *T. zillii* was characterized by bending of the operculum (Fig.9).

Total and seasonal prevalence:

The total prevalence of anomalies reached up to 7.166% and 1.6% in *O.niloticus* and *T. zillii* respectively.

The results of seasonal prevalence of deformity among *O. niloticus* throughout the four seasons(spring, summer, autumn, and winter) were 21, 2, 5.3 and 0.0 % respectively. While in *T. zillii* the all deformed fishes were recorded during autumn 6.4% (Table,1).

Relation between body weight and fish deformity:

All types of deformity in *O. niloticus* appeared in high body weight except in deformed jaws appeared in low body weights. Unequal jaws appeared in both high and low body weights. In case of *T. zillii* appeared in both low and high body weights.
Relation between sex and fish deformity:

The results showed that all cases of deformity appeared in males of both fishes *O. niloticus* and *T. zillii* except in bird like head appeared in both males and females.

Result of X-ray examination:

In case of *O. niloticus*, the deformities were mainly seen in cranial region as malformation in mouth parts (Fig.10), unequal jaws (the upper jaw was shorter than the lower one) (Fig.11), fusion of anal and dorsal fins (Fig.12), bird like head (Fig.13).

Vertebral deformity (including dorsal arching,kyphosis, and dorso-ventral spinal flexures ,lordosis,) (Fig.14), new bony structure at anal opening (Fig.15) and deformed mandible (Fig.16).

In addition, the deformities in *T. zillii* were seen as bending of the operculum (Fig.17).

Results of Postmortem examination:

The postmortem examination of all examined *O. niloticus* and *T. zillii* revealed the absence of any abnormalities in the internal organs. On the other side, postmortem examination of deformed mandible revealed that the fish appeared with heavy musculature and the fatty tissue was surrounding the internal organs (Fig.18).

Results of Parasitological examination:

The results of parasitological examination of external and internal organs in *O. niloticus* and *T. zillii* not indicate for parasitic infection.

Water and Tissue analysis:

The results of water analysis revealed that, the presence of lead, nickel, manganese and cadmium exceeded the permissible limits while the level of copper and zinc in the examined water samples were within the permissible limits (Table,3). The concentration level of cadmium and lead in musculature of *O. niloticus* and *T. zillii* exceeded the permissible limits (Table,2).

Salinity:

Site (A) displayed a low salinity (2.77-2.80 ‰) while site (B) revealed high salinity reached up to (30.3-30.6‰).

DISCUSSION

The present study found that skeletal anomalies have been observed in high prevalence 7.166% in *O. niloticus*. While reached up to 1.6% in *T. zillii*. These results nearly agree with *Safaa (1975)* who found that the morphological and cytological results clearly show that water pollution has deleterious effects on *Tilapia zillii*, *Tilapia galileae* and *Tilapia nilotica*. 
*T. zillii* is more tolerant to water pollution while *T. nilotica* is more sensitive. This may be attributed to the high salinity.

The results also explain that, the frequently reported anomalies in *O. niloticus* and *T. zillii* were those appeared on cranial region and in operculum. Such results are in a line with those reported by *Easa et al., (1989)* who observed that the principal anomalies encountered in Tilapia spp. were mainly related to the cranial region.

The results also explained that, all cases of deformed mandible appeared in fishes with heavy musculature and the fatty tissue surrounding the internal organ. These characters may be related to the amount of food consumed by fish where the deformed mandible make the fish mouth more wider than normal fish.

The present study also explained that, most cases of deformities were appeared in fish with high body weight. These results agree with those recorded by *Sindermann (1990)* who mentioned that the frequency and severity of anomalies increased with increasing of fish size and weight due to disturbed calcium metabolism.

All deformed cases in *O. niloticus* and *T. zillii*, were males except in the Bird like head cases were found in both males and females. Such findings support the observations given by *Shakweer and Abbas (2005)* that the sex of fish can be considered as a main factor affecting the concentration of trace elements.

The results of water analysis revealed that lead, nickel, manganese and cadmium were exceeded the permissible limits while tissue analysis revealed that cadmium and lead in musculature of *O. niloticus* and *T. zillii* were exceeded the permissible limits. *Mourad (1996)* studied the heavy metals in fishes collected from El-Temsah lake and found in *O. niloticus* the maximum average levels of Cd and Pb were recorded in gills, in liver for Cu and the skin for Zn and in *T. zillii* the maximum average levels of Cd and Pb were recorded in gills, in liver for Cu and the skin for Zn. Moreover, the results nearly agreed with those reported by *Manal (1999)* who found that the level of lead and cadmium in water and fish samples obtained from El-Temsah and El-Manzala lakes were found to be more than the limits of WHO.

The results of water salinity in lake El-Temsah revealed that, the salinity of site (A) was low (2.77-2.80‰) EL-Mahsama drain and Abu Gamous drain pours in while was (30.3-30.6‰) in site (B) where this site receives sewage water from Covered drain and small amount of freshwater from the Ismailia Canal.
These results nearly agreed with those reported by Younes (1995) and Mourad (1996).

The present study concluded that, there was a relationship between the water pollution with heavy metals and fish anomalies. Also, *O. niloticus* is sensitive to water pollution more than *T. zillii*. Finally, the frequently of anomalies mostly appeared in such fish with heavy body weight and in male more than female.

**Table (1): Seasonal prevalence of skeletal deformity in *O. niloticus* and *T. zillii*.

<table>
<thead>
<tr>
<th>Season</th>
<th>No of fish</th>
<th>No of deformed fish</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><em>O. niloticus</em></td>
<td><em>T. zillii</em></td>
<td><em>O. niloticus</em></td>
</tr>
<tr>
<td>spring</td>
<td>150</td>
<td>250</td>
<td>32</td>
</tr>
<tr>
<td>summer</td>
<td>150</td>
<td>250</td>
<td>3</td>
</tr>
<tr>
<td>autumn</td>
<td>150</td>
<td>250</td>
<td>8</td>
</tr>
<tr>
<td>winter</td>
<td>150</td>
<td>250</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>600</td>
<td>1000</td>
<td>43</td>
</tr>
</tbody>
</table>

**Table (2): The concentration levels of heavy metals(mg/l) in musculature of deformed fishes collected from lake El-El-Temsah.

<table>
<thead>
<tr>
<th>Metals Examined</th>
<th>E.O.S.Q.C. (1993) ppm</th>
<th><em>O. niloticus</em></th>
<th><em>T. zillii</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cadmium</td>
<td>0.1</td>
<td>0.11</td>
<td>0.33</td>
</tr>
<tr>
<td>Lead</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Copper</td>
<td>0.36</td>
<td>0.23</td>
<td></td>
</tr>
<tr>
<td>Nickel</td>
<td>8.93</td>
<td>7.4</td>
<td></td>
</tr>
<tr>
<td>Zinc</td>
<td>106.62</td>
<td>240.75</td>
<td></td>
</tr>
<tr>
<td>Manganese</td>
<td>39.45</td>
<td>43.84</td>
<td></td>
</tr>
</tbody>
</table>
Table (3): Results of water analysis of location (A & B) during spring and autumn seasons, 2007.

<table>
<thead>
<tr>
<th>Heavy metals mg/L</th>
<th>permissible limits mg/l</th>
<th></th>
<th></th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>Eg.S. WHO (1982)</td>
<td>Spring Sample</td>
<td>Spring Sample</td>
<td>Autumn Sample</td>
<td>Autumn Sample</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>A</td>
<td>B</td>
<td>A</td>
<td>B</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>Fe</td>
<td></td>
<td>1.433</td>
<td>1.499</td>
<td>1.430</td>
<td>1.609</td>
<td>1.420</td>
<td>1.398</td>
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<tr>
<td>Na</td>
<td></td>
<td>1860.0</td>
<td>27930.0</td>
<td>1453.0</td>
<td>31550.0</td>
<td>1860.0</td>
<td>26840.0</td>
</tr>
<tr>
<td>K</td>
<td></td>
<td>78.06</td>
<td>2296.0</td>
<td>70.37</td>
<td>2447.0</td>
<td>74.02</td>
<td>2376.0</td>
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<tr>
<td>Cu</td>
<td>2 1</td>
<td>0.011</td>
<td>0.084</td>
<td>0.022</td>
<td>0.095</td>
<td>0.063</td>
<td>0.0215</td>
</tr>
<tr>
<td>Pb</td>
<td>0.015 0.05</td>
<td>0.182</td>
<td>0.426</td>
<td>0.225</td>
<td>0.524</td>
<td>0.3</td>
<td>0.0</td>
</tr>
<tr>
<td>Zn</td>
<td>5 0.1</td>
<td>0.074</td>
<td>0.142</td>
<td>0.103</td>
<td>0.086</td>
<td>0.985</td>
<td>0.3125</td>
</tr>
<tr>
<td>Ni</td>
<td>0.020 0.1</td>
<td>0.889</td>
<td>1.485</td>
<td>0.946</td>
<td>1.638</td>
<td>0.045</td>
<td>0.046</td>
</tr>
<tr>
<td>Cd</td>
<td>0.005 0.005</td>
<td>0.042</td>
<td>0.074</td>
<td>0.052</td>
<td>0.082</td>
<td>0.0535</td>
<td>0.0085</td>
</tr>
<tr>
<td>Mn</td>
<td>0.1</td>
<td>0.189</td>
<td>0.190</td>
<td>0.188</td>
<td>0.204</td>
<td>2.6785</td>
<td>1.656</td>
</tr>
<tr>
<td>Mg</td>
<td></td>
<td>135.7</td>
<td>6569.0</td>
<td>146.9</td>
<td>6585.0</td>
<td>123.4</td>
<td>6558.0</td>
</tr>
<tr>
<td>Ca</td>
<td></td>
<td>245.8</td>
<td>1031.0</td>
<td>255.1</td>
<td>1119.0</td>
<td>243.2</td>
<td>1010.0</td>
</tr>
</tbody>
</table>

Eg.S.= Egyptian standard in Al-Waqae'a Al-Masreya Magazine (2001)
Fig. (1): A map showing the sampling location in Lake El-Temsah.
Fig. (2): Deformed jaws

Fig. (3): Unequal jaw.

Fig. (4): Fusion of anal & dorsal fins.

Fig. (5): Bird like head.

Fig. (6): Hard structure at anal opening.

Fig. (7): Vertebral deformities.
Fig. (8): Deformed mandible.  

Fig. (9): Bending of the operculum.  

Fig. (10): Deformed jaws.  

Fig. (11): Unequal jaws (the upper jaw is shorter than the lower one).
Fig. (12): Fusion of anal & dorsal fins.

Fig. (13): Bird like head.

Fig. (14): Vertebral deformities (including dorsal arching "kyphosis" and dorsoventral spinal flexures "Lordosis").

Fig. (15): New bony structure at anal opening.
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**الملخص العربي**

دراسات عن أهم المشكلات السائدة المرتبطة بالتشوهات في الأسماك في بحيرة التمساح

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مركز بحوث التكنولوجيا الحيوية.

تناولت الدراسة الراهنة الكشف عن التشوهات العظمية بالتشوهات في الأسماك في بحيرة التمساح من موقعين فى بحيرة التمساح. هذا بالاضافة إلى التّوثيق الفيوجن من المعادن الثقيلة، وتثبت من الدراسة عدم تواجد هذا التشوه ببعض الأسماك المشروحة لفِي بحيرة التمساح. كما قامت الدراسة بتصوير الأسماك المشروحة بأشعة أكس لتوضيح التشوهات الداخلية.
وقد أظهرت النتائج تشوّهات البلطى البنيى والتي تجلت في تشوّه الفكين وتشوه الفك السفلي والتي أظهرت الأسمال كرأس الطير، نشوء العقود القفري، وإتحاد الزعنفة الظهيرة مع الزعنفة البطنية بينما أظهرت تشوهات الأسمال في البلطى الأخضر على احتواء في الغطاء الخيشومى. و أظهرت نتائج تحليل المياه عن زيادة بعض المعادن الثقيلة عن النسب المسموح بها مثل الرصاص، والنيكل، والكadmيوم، والمكزنيزين كأن النحاس و الزنك في حدود النسب المسموح بها. وقد أظهرت تحليل عينات الأنسجة في البلطى البنيى والبطلى الأخضر على زيادة نسبة الكadmيوم والرصاص عن النسب المسموح بها و من هذه النتائج يجب أن نشير أن زيادة نسب المعادن الثقيلة عن الحد المسموح به في مياه بحيرة التساحة تلعب دوراً هاماً في وجوه تلك التشوّهات.