

Aquatic Oligochaetes of Iraq's Southern Marshes

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Abstract:

Aquatic Oligochaetes community in the Iraqi southern marshes, Al- Hawiezah, Al- Chibayish and Al-Hammar, have been studied for the period from July 2006 to June 2007. Two sites within each marsh, in addition to a reference site located at Shatt Al-Garma, have been chosen for sample collection using Ekman dredge. The results revealed that the highest average annual density was 16800 individual / m² recorded in Al-Hawiezah marsh, while in Al-Chibayish and al-Hammar marsh the density did not exceed 5111 individual/m². In contrast, the density of Oligochaetes recorded in Shatt Al-Garma was about 10500 individual / m². The highest monthly density was recorded in April 2007. The highest local percentage occurrence was 96% recorded in Al-Hawiezah marsh, while the highest average monthly percentage occurrence was recorded in January 2007. The study revealed the presence of 19 Oligochaetes species belonging to 14 genera and 4 families. Naididae was represented by 8 spp.; Tubificidae 8 spp.; Lumbriculidae 2 spp. and Lumbricidae 1 spp. Tubificid worms formed about 73% of the total count while Naididae formed 15%, Lumbriculidae 8% and Lumbricidae 4%. Among Tubificidae, *Limnodrilus* was the most abundant genus composed about 35% of *L. hoffmeisteri*; 11.5% *L. claparedianus*; 8% *L. profundicola* and 4.7% *L. maumeensis*, followed by *Tubifex tubifex* 23%. Other species were *Branchiura sowerbyi* formed 15%; 2.8 and 2 % for *Pelosclex velutinus* and *Aulodrilus pigueti* respectively. Naididae worms comprised 8 species including 32% of *Dero digitata*, 24% of *Nais variabilis*, 14% of *Amphichaeta* sp. and 11% of each of *D. obtuse* and *Pristina longisetata*. However, *D. dorsalis* represented only 7.5% of the total Naididae. Few individuals of *B. sowerbyi* and *Lumbriculus variegates*, with two regenerated parts at the posterior end were also detected in some samples. This case was considered a rare observation within the population of these worms in this particular area.

Key words: Aquatic oligochaeta; Tubificidae; Naididae; Lumbriculidae; Lumbricidae; Iraqi's southern marshes; Al- Hawiezah marsh; Al-Chibayish marsh; Al-Hammar marsh

Introduction:

The Mesopotamian marshes cover a total area of 7500 square meter and represent the largest wetland area in the middle east and west Asia [1,2] They have a role in determining the course of Rivers Tigris and Euphrates and their branches. Freshwater Ecosystem of these important

wetlands, especially at Al-Chibayish, Al-Hammar, and Al-Hawiezah marshes were most affected since the area was subjected to deliberate desiccation during the eighties of the last century. The consequent drought was considered as the most drastic environmental change ever happened

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in this area. The complete desiccation and subsequent incineration of large parts of their exposed dried debris of the remaining aquatic plants also contributed to the mentioned environmental drastic changes [1,3] By 2003 restoration of the marshes began and by mid 2006 restored water has already recovered about 41% of the original marshland area. The water surface area increased 100 and 200 km² in Al-Hawiezah and Al-Hammar and it was not increased in Al-Qurnah marshes [4]. Oligochaetes is a subclass of Class Clitellata, Phylum Annelida. They are predominantly aquatic and terrestrial worms, though a few species are marine. Aquatic oligochaetes are placed in two suborders, Megadrili and microdrili. Megadrili are relatively robust worms related to earthworms. Microdrili are mostly smaller, ranging from 1mm to few centimeters in length, thin-bodied worms without any close terrestrial relatives. 4 of the 14 described megadriles families include species that occur in aquatic habitats. The microdriles are comprised of 13 families which are fully aquatic, with the exception of the primarily terrestrial family Enchytraeidae. About 1700 valid species of aquatic Oligochaetes are known to date, of these about 1,100 are freshwater. The most specious group is the Tubificidae with more than 1000 described species including 582 being considered as freshwater inhabitants. More than 60 species of megadriles are also considered aquatic [5]. Four families of the orders Tubificida and Lumbriculida are common in freshwater, the Tubificidae, Naididae, Lumbriculidae, and Enchytraeidae, in addition to the minor families, Pavidrilidae; Dorydrillidae; Phreodrilidae and propappidae [6] Since the important aquatic group of Oligochaetes has never been the focal point of interest in this area before, the

present study investigated the community structure of aquatic Oligochaetes species found in these wetlands. However, these worms capture a worldwide interest evidently documented in the vast amount of literature currently available [7, 8, 9, 10, 11]. Nevertheless, some research works have recorded different species of Tubificidae in different aquatic habitats of Iraq, including *Limnodrilus hoffmeisteri*; *L. caparedianus*; *L. profundicola*; *L. maumeensis*; *Branchiura sowerbyi*, *Tubifex tubifex*. [12, 13, 14, 15, 16, 17, 18].

The Study sites

In this study three main marshes of Iraq's southern wetland were investigated. Two sampling locations within each marsh were chosen in addition to a reference site, Shatt Al-Garma, which is located further south in an area not subjected to desiccation thus providing a contrast location.

1- Al- Hawiezah marshes, site HZ

The locations within this site were Um Al- Wared (S1) and Um Al-Naaj (S2). Most of Al-Hawiezah marsh was subjected to desiccation from the year 1991 onwards, while re-flooding started in mid 2003 [4, 18]. The site is noted for the presence of various flora including *Ceratophyllum sp.*, *Typha sp.* and *Phragmites australis*, growing on the banks in addition to different algae species.

2- Al- Chibayish marsh, site CM

The locations within this site were the beginning of A- Baghdadia (S3), and the Middle of Al- Baghdadia (S4). The entire site was previously subjected to desiccation, but it was re-flooded by the mid of 2003. Many aquatic plants and algae notably grow in the site, including *Typha sp.*, *Phragmites sp.* and *Ceratophyllum demersum*.

3- Al- Hammar marsh, site HM

Two sampling locations were selected on Al-Hammar, Al-Nagara (S5) and

Al-Burka (S6). This site was also subjected to the previously mentioned desiccation where 90% of the marsh was dried up, but re-flooded in 2003 [18].

4- Shatt Al-Garma river, site GR

It is a reference site location for this study (S7) that is situated near the campus of the University of Basrah, on the bank of Al- Garma River, which represents the natural environment of aquatic habitat especially for the benthic macroinvertebrates, as they were not subjected to any previous period of desiccation or other harsh environmental changes.

Material and methods:

Sample collection

Ekman dredge (15X15cm) has been used to collect sediment samples from all sites through the study period from July 2006 to July 2007. Five random replicates have been collected and rinsed through a 0.2 mm slanted ASTM metal sieve in the field, then labeled and preserved for laboratory examination [19]. Large worms were easily sorted with the aid of a magnifier. The smaller meiobenthos form, like Naididae, is well visible and isolated under a low power dissecting microscope. The sorted worms then killed and preserved in 70% alcohol

Mounting and Identification of Worms

Temporary mount preparation have been prepared using Amman's lactophenol which was recommended by Brinkhurst [20], in which phenol (carbolic acid) and lactic acid added to glycerol. This mounting fluid was prepared as: Carbolic acid , 400 g ; Lactic acid, 400ml; Glycerol, 800 ml; and water 400ml. The preserved worms were transferred to 30% alcohol then to water before mounting

on the slide and covered with a cover slip and left in this fluid for several hours before examination. The megadrilus worms, such as Lumbriculidae and Lumbricidae can be identified without any mounting, using only a low- power stereoscopic microscope. The worms were identified to species level according to [21]. After Identification the number individuals of each species in the sample, the percentage of each genus, the percentage of each species within each genus were recorded. The percentage of occurrence of Oligochaetes in each sample has also been calculated.

Results and Discussion:

Aquatic Oligochaetes were present at all sites and locations, but in varied densities and number of species. Records show the presence of 17 species belonging to 14 genera and four main aquatic Oligochaetes families, Naididae, Tubificidae, Lumbriculidae and Enchytraeidae, (Table 1). It is clear from this table that *Limnodrilus hoffmeisteri* and *L. claparedianus* were the most widely distributed species found at all seven locations, followed by *Dero digitata* and *D. obtuse*, which were found at 6 locations. Highest species richness was recorded in Al- Hawiezah marsh, in which, 17 and 15 species were recorded at S1 and S2 respectively, while at Al-Chibayish and Al-Hammar sites the number of species did not exceed 6, rising to 8 at Shatt Al-Garma (S7). Table 2, shows the total densities of aquatic Oligochaetes of all study sites during the study period. It is clear that the highest densities of 15170 individual/m² and 16,804 individual/m² were recorded at S1 and S2 respectively, while the highest density recorded in other sites was 5111 individual/m² in S3. In Shatt Al-Garma , the total density was

10559 individual/m². This result revealed the effects of desiccation and land incineration in Al- Chibayish and Al- Hammar marsh [1]. In general the Oligochaetes occurred in densities higher than that recorded by [22] at the upper Tigris river; and [17] in Al-Zab River. In Shat Al-Garma (S7) the aquatic Oligochaetes fauna were directly affected by the environmental conditions of Shatt- Al- Arab especially for salinity, besides the presence of predators and competitors such as Polychaeta worms, which are also affected by the abundance of Oligochaetes in Al-Hammar marsh (1). In relation to monthly abundance, table 2 showed highest density of aquatic Oligochaetes to occur in April 2007. It is clear from figure 1, that the sampling of aquatic Oligochaetes is recommended in spring and early summer (March-July). The effect of temperature was documented in many research works, and most of them agreed with the fact that the aquatic Oligochaetes breed and reproduce during spring and summer, [23]. The percentage of occurrence of Oligochaetes was prevalent at all sites and locations, with few exceptions as in S3 and S4, and also in S5 in few months, but the general average of percentage of occurrence was between 20-100% (table 3). A higher local average of percentage occurrence recorded was 95.25% in S1, while a lower value (15%) was recorded in S4. The monthly average percentage of occurrence record was at highest level during January (91.4%), and at lowest level during July (39.3%), (table 3). Fig 2 shows that Tubificidae composed 72.92% of the total identified worms, followed by Naididae, (15%), while Lumbriculidae and Lumbricidae represented 7.98% and 4.2% of the total catch respectively. The ratio of the number of individuals of Naididae

to the number of individuals of Tubificidae was used by some authors as bio- indicator index to assess water quality in respect to environmental factors [13]. Among Tubificidae 35% of Tubificid worms was *L.hoffmeisteri* , 23.5% was *T.tubifex* and 11.5% *L. claparedianus* . Other species were *L. maumeensis*; *Branchiura sowerbyi* ; *Pelosclex velutinus* ; and *Aulodrilus pigueti* which recorded 4.7, 9, 2.3.and 2 % respectively. Martin et al [24] indicated that *Limnodrilus hoffmeisteri*, which is widely used as an indicator of organic pollution, composed more than 75% of his sample. Figure (4) Shows the percentages of different species of Naididae worms, which were dominated by the genus *Dero*, in which *D.digitata* was the dominant species and represents 19% of the total Naididae, followed by *Stylaria fossularis* (16%), while *Nais variabilis* represented 14.5%. *Amphichaeta* sp. recorded 14%, and other species included *D. dorsalis* (7.5%) ; *D. obtuse* (7.5%); *Paranais litoralis*, (6%) and finally *Pristina longiseta* (3%). All These species were newly recorded in the area by Sabtie [18]. The occurrence, abundance, diversity, and density of aquatic Oligochaetes were highly affected by environmental variables, Features such as pollution by heavy metals [25] prevalence of gravelly sediment [26], low availability of organic matter [27], competition and predation [24] may interfere negatively with the numerical abundance of Oligochaetes. The presence of *L.hoffmeisteri*, *T.tubifex* and *L. claparedianus* in higher density may indicate a probable organic enrichment in the area. Tubificid worm's counts are traditionally important in the evaluation of pollution status and water quality studies [28] The water salinity also has its effect on the abundance of aquatic Oligochaetes,

with some variation between species in relation to salinity tolerance. The salinity in the study area ranged between 0.2-3.3‰ and considered as brackish water [18]. An outstanding record of unusual body feature, rarely known to occur in Oligochaetes was obtained during the course of the present investigation. Four worms of *Branchiura sowerbyi* have been

collected on different occasions from location S5, and another two of Lumbriculid worms collected from location S7, were noted to possess two regenerated parts at the posterior end of the worms (Plate 1, A and B). This observation may stimulate further research to establish the possible natural or other causes for such abnormal features.

Table 1. The occurrence of aquatic Oligochaetes species at the study sites of Iraq's southern marshes and Shat Al- Garma.

| Family | Species | sites | | | | | | |
|-----------------------|----------------------------------|-------|----|----|----|----|----|----|
| | | HZ | | CM | | HA | | GR |
| | | S1 | S2 | S3 | S4 | S5 | S6 | S7 |
| Naididae | <i>Amphichaeta sp.</i> | + | + | - | - | - | - | - |
| | <i>Dero digitata</i> | + | + | + | - | + | + | + |
| | <i>D. obtusa</i> | + | + | + | + | + | - | + |
| | <i>D. furcatus</i> | + | + | - | - | - | - | - |
| | <i>Stylaria feosularis</i> | + | - | - | - | - | - | - |
| | <i>Nais variabilis</i> | + | + | + | + | + | - | + |
| | <i>Pristina longiseta</i> | + | + | + | - | - | - | - |
| | <i>Paranais litoralis</i> | + | - | - | - | - | - | + |
| Tubificidae | <i>Limnodrilus hoffmeisteri</i> | + | + | + | + | + | + | + |
| | <i>L. claparedianus</i> | + | + | + | + | + | + | + |
| | <i>L. maumeensis</i> | - | + | - | - | - | - | - |
| | <i>L. profundicola</i> | + | + | - | - | - | + | - |
| | <i>Tubifex tubifex</i> | + | - | - | - | - | - | - |
| | <i>Pelosclex vulatinus</i> | + | + | - | - | - | - | - |
| | <i>Branchiura sowerbyi</i> | + | + | - | - | - | + | - |
| | <i>Aulodrilus piguiti</i> | + | + | - | - | - | - | - |
| Lumbriculidae | <i>Stylo-drilus herringianus</i> | + | + | - | - | - | - | + |
| | <i>Lumbriculus variagatus</i> | + | + | - | - | - | - | + |
| Lumbricidae | <i>Eiseniella tetrahydra</i> | + | + | - | - | - | - | - |
| Total No. of species. | | 17 | 15 | 6 | 4 | 5 | 5 | 8 |

Table 2: Numbers of total aquatic Oligochaetes (individual /m²) in different sites of southern marshes and Shat Al-Arab

| Month | Sites | | | | | | | |
|------------------------|-------|-------|-------|------|-------|-------|-------|---------|
| | S1 | S2 | S3 | S4 | S5 | S6 | S7 | average |
| July 2006 | 2352 | 1642 | 0 | 0 | 0 | 222 | 8706 | 1846 |
| August | 621 | 5328 | 133 | 0 | 1998 | 710 | 1776 | 1509 |
| September | 1420 | 4084 | 1510 | 44 | 133 | 843 | 1510 | 1363 |
| October | 2709 | 10656 | 88 | 89 | 3019 | 1021 | 1465 | 2590 |
| November | 1021 | 8081 | 799 | 89 | 3552 | 888 | 3729 | 2594 |
| December | 1465 | 8658 | 4706 | 89 | 4218 | 399 | 977 | 2930 |
| January 2007 | 15362 | 15522 | 3774 | 44 | 2175 | 89 | 710 | 5382 |
| February | 29749 | 2464 | 14874 | 222 | 6837 | 666 | 11410 | 12628 |
| March | 31523 | 56565 | 8524 | 1509 | 32101 | 1998 | 22732 | 22136 |
| April | 37073 | 38983 | 976 | 2087 | 7181 | 36363 | 63403 | 26569 |
| May | 41735 | 16029 | 21800 | 0 | 2844 | 800 | 14963 | 14024 |
| June | 19688 | 11544 | 4440 | 0 | 82939 | 12698 | 22333 | 22946 |
| Average Annual Density | 15170 | 16804 | 5111 | 348 | 3621 | 2763 | 10559 | |

Table 3: Monthly Percentage of occurrence of total aquatic Oligochaetes At different study sites during the study period

| Site | HZ | | CM | | HA | | GR | MonthlyAverage |
|---------------|------|------|------|----|------|------|------|----------------|
| Location | S1 | S2 | S3 | S4 | S5 | S6 | S7 | |
| July '06 | 100 | 75 | 0 | 0 | 0 | 25 | 75 | 39.3 |
| August | 75 | 75 | 50 | 0 | 100 | 100 | 74 | 67.8 |
| September | 100 | 100 | 20 | 0 | 100 | 80 | 100 | 71.4 |
| October | 80 | 100 | 80 | 20 | 100 | 60 | 80 | 74.2 |
| November | 100 | 100 | 100 | 20 | 100 | 40 | 100 | 80 |
| December | 100 | 100 | 80 | 20 | 100 | 40 | 40 | 68.5 |
| January 07 | 100 | 100 | 100 | 60 | 100 | 40 | 100 | 91.4 |
| February | 100 | 100 | 80 | 20 | 100 | 80 | 100 | 82.8 |
| March | 100 | 100 | 100 | 0 | 100 | 80 | 100 | 80 |
| April | 100 | 100 | 80 | 40 | 100 | 80 | 100 | 82.8 |
| May | 100 | 100 | 80 | 0 | 100 | 80 | 100 | 77.1 |
| June | 100 | 100 | 40 | 0 | 100 | 100 | 100 | 77.1 |
| Local average | 96.2 | 95.8 | 62.5 | 15 | 91.6 | 70.4 | 89.1 | |

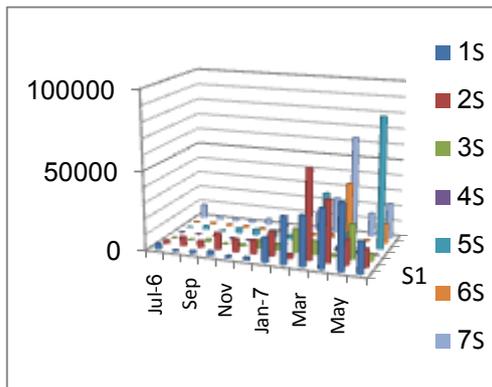


Fig. 1: Aquatic Oligochaetes Density (individual/m²) during the study months in different Study sites

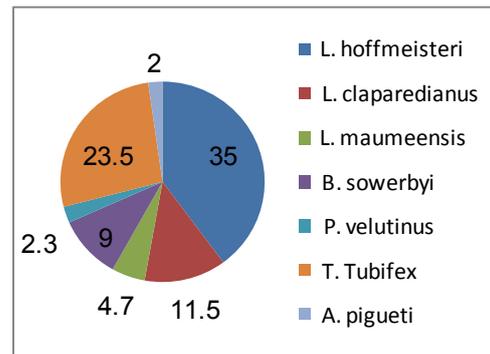


Fig. 3: Percentages composition of Tubificid species collected during the study period at all study sites.

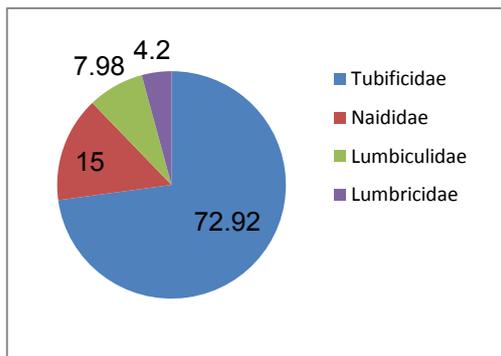


Fig. 2: Percentages composition of aquatic Oligochaetes families collected during the study period at all sites.

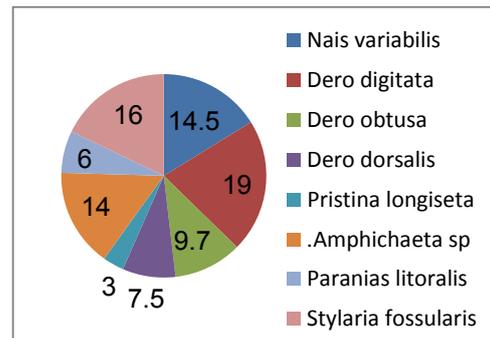


Fig.4: Percentage composition of Naididae species collected during the study period at all study sites.



(A)



(B)

Plate 1: Abnormal regeneration at the posterior end of worm's body, A- *Branchiura sowerbyi*; B- *Lumbriculus variegatus*

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الديدان قليلة الالهلاب المائية في اهورار جنوب العراق

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**وزارة العلوم والتكنولوجيا/ بغداد/ العراق

الخلاصة:

تم دراسة مجتمع الديدان الحلقية قليلة الالهلاب المائية في اهورار جنوب العراق، هور الحويزة والجبايش والحمار للفترة ما بين تموز 2006 وحتى نهاية حزيران 2007، واختيرت محطتين لجمع العينات في كل هور، 1 و2 في هور الحويزة، 3 و4 في هور الجبايش و5 و6 في هور الحمارة، اضافة الى محطة سابعة (7) في شط الكرمة اختيرت لغرض المقارنة. بينت النتائج ان اعلى معدل كثافة سنوية سجلت في محطات هور الحويزة وبلغت حوالي 16800 فرد / م²، بينما لم تتعدى 5111 فرد / م² في اهورار الجبايش والحمارة. بالمقابل بلغ معدل الكثافة السنوية في شط الكرمة حوالي 19500 فرد / م². وسجل اعلى معدل كثافة في شهر نيسان 2007. سجلت اعلى نسبة تواجد موقعي 96% في هور الحويزة، بينما كانت اعلى نسبة تواجد شهري في شهر كانون ثاني 2007. سجل 19 نوع تعود الى 14 جنس، ثمانية منها تعود للعائلة Naididae وثمانية للعائلة Tubificidae ونوعين للعائلة Tubificidae ونوع واحد للعائلة Lumbricidae. شكلت افراد العائلة Tubificidae حوالي 73% من عدد الافراد الكلي، وافراد العائلة Naididae 15% و8% لافراد العائلة Lumbriculidae وشكلت افراد العائلة Lumbricidae 4%، من ضمن العائلة Tubificidae كان الجنس *Limnodrilus* هو الكثر سيادة ويشمل 35% من النوع *L. hoffmeisteri* و 11.5% من النوع *L. claparedianus* و 8% من النوع *L. profundicola* و 4.7% *L. maumeensis*، يتبعه النوع *Tubifex tubifex* بنسبة 23%. ومن الانواع الاخرى النوع *Branchiura sowerbyi* الذي سجل 15%، وكانت النسبة 2.8 و 2% لكل من النوعين *Pelosclex velutinus* و *Aulodrilus pigueti* على التوالي. وفيما يخص بديدان العائلة Niadidae فتكونت من ثمانية انواع شملت 32% منها النوع *Dero digitata* و 24% النوع *Dero digitata* و 14% نوع تابع للجنس *Amphichaeta* و 11% لكل من النوعين *Dero obtuse* و *Pristina longiseta* واخيرا النوع *Dero dorsalis* الذي مثل 7.5% من مجموع عدد العائلة Niadidae. لوحظ ضمن بعض العينات وجود افراد قليلة من النوع *B. sowerbyi* و النوع *Lumbriculus variegates* تمتلك جزئين متكونة بالاخلاف في النهاية الخلفية للدودة وهي حالة نادرة في مثل هذه الديدان.