Sediment Assessment of Al-Hindyia and Al-Abbasyia River / Iraq by aquatic oligochaeta community as bioindicators

Nadia Imad AL-Ameen 1

Dlovan Kammal Al-Jaff

Department of Biology, College of Science for Women, University of Baghdad, Baghdad, Iraq

*Corresponding author: nadyait_bio@csw.uobaghdad.edu.iq
E-mail addresses: dodobio2006@gmail.com

Received 5/11/2021, Revised 30/1/2022, Accepted 31/1/2022, Published Online First 20/7/2022, Published 1/2/2023

This work is licensed under a Creative Commons Attribution 4.0 International License.

Abstract:
Bioindicators have an important role in assessing the quality of water bodies. Aquatic oligochaetes, was used as a bioindicator to assess the sediment quality of Al-Hindyia and AL-Abbasyia river (branches of Euphrates River in Iraq). Two sites in each river have been chosen for this purpose, site S1 was located at Al-Hindyia River and S2 at Al-Abbasyia River. Some kinds of biological indices were used in this study, comprising the percentage of oligochaetes in benthic invertebrates, ranged from 20.3-60.16%. While the percentage of Tubificidae within benthic invertebrates was close 43.3-43.9%. Index of pollution D ranged from 0.13-0.21. The maximum percentage of aquatic oligochaetes to insects larvae of family Chironomidae ranged from 0.13-0.21. The maximum percentage of aquatic oligochaetes to insects larvae of family Chironomidae larvae was recorded at S2 90% while at S1 60%. Ix was scored high value at S1 36.06 whilst only 30.56 at S2. Eo was at S1 and As at S2 while IOBS was 15.26 at S2 and 7.07 at S1. The percentage of subfamily Tubificidae (TUSP) showed the highest value 21.21% at S1 while 11.79% at S2.

Keywords: Aquatic oligochaetes, Benthic invertebrats, Bioindicators, Sediment quality.

Introduction:
Bioindicators are qualitative situation of the environment; they are responsible for different types of pollutants gradually. They play a key role in monitoring changes in the environments and can discover the effects of incidental as well as cumulative pollution and habitat shifts.

Many organisms such as plants, planktons, fishes are used as bioindicators. The benthic macro invertebrates like Oligochaeta are most commonly used to evaluate the water health, they are subclass of class Clitellate, phylum Annelida, predominantly aquatic and terrestrial, used as an indicator for water and sediment quality. About 1700 rightful species of Oligochaetes are recognized to date; of these nearly 1,100 are freshwater. The most group is the Tubificidae, with more than 1000 described species including 582 being considered as freshwater inhabitants, Tubificid worms which belong to Naididae family were the most group of aquatic oligochaetes used as bioindicator to assess water quality.

In Iraq, many studies refer to Oligochaeta in Euphrates River such as, and in Tigris River. The present study adds a new scope on the relevance between the aquatic oligochaetes and quality of sediment in both of Al-Hindyia, at Al-Kifil region and AL-Abbasyia rivers, both of these two rivers are branches of Euphrates River in Iraq run through agricultural places.

Material and Methods:
Sediment samples were collected monthly during the period from March to August 2020 by sediment sampler as three replicates for each site as in (Fig.1) by using an Ekman grab 15X15cm with a total area of 225 cm2 just 1 m from river edge. The samples were collected in suitable size plastic containers filled with river water. Site one (S1) located at Al-Hindyia River, (32°13'26.15"N, 44°21'46.40"E) which is a main branch of Euphrates River after Al-Hindyia dam. It passes through Karbala and Babil Provinces to wide spaces of farm lands and palm trees orchards in Al-Kifil region at the south of Iraq / Babil province and (S2) at Al-Abbasyia River (32°07'11.09"N, 44°23'43.07"E), other branches of Euphrates River, about five kilometer after AL-Kifil city. It passes through Babil and Al-Najaf provinces to wide
spaces of farmlands, and there is a barrage on it known as AL-Abbasyia barrage which was constructed in 1984. By using 0.5 mm sieve, the sediment samples have been checked in lab that by circulate on the white plate, and big worms can easily be sorted from the remains, using enlargement hand lens, divided into groups\textsuperscript{13}. Different indices as in\textsuperscript{14-18}comprise community indices, pollution indices and the following ecological indices have been calculated.

a. In benthic community, percentage of aquatic Oligochaetes worm as: (Olig. %) $<$ 60% Good water quality; 60-80 % Dubitable; $\geq$ 80 % hardly polluted, whether organic or industrial.
b. Oligochaetes worms to Chironomid larvae ratio.
c. L. hoffmeisteri accounts for the percentage of the entire tubificid worms.
d. Pollution index D: relevance number of tubificid worms to entire oligochetes community values $\geq$ 0.30 considered good; 0.30-0.55 a little polluted; 0.56-0.80 polluted and ; 0.81-1 hardly polluted.
e. Biological quality Index $I_0$ setup on proposed equation: $I_0=10ST^{-1}$, S= The total number of benthic invertebrates species found in the sediment. T = tubificids relative abundance that have no hair setae.
f. Comprehensive index of Biological quality $E_0$,
The relative abundance code of tubificid worms that have no hair setae indicate by the letters arranged below as: A $\geq$ 91%, B = 71-90%, C = 46-70%, D = 36-45%, E=35-16, and F $\leq$ 15 Subindex is a symbol of species richness of the oligochaete.
g. Oligochaeta index of sediment bioindication (IOBS) indicate by the equation: IOBS=10ST$^1$.
S = Oligochaete total species number. T = Dominant tubificid Percentage that cohort (with or without hair chaetae) to the total oligochaete worms.
h. TUSP index = tubificid worms percentage have no hair setae in total Oligochaeta.

Result and Discussion:
Depending to the information illustrated in (Table 1), the dominance was to the tubificid worms that have no hair setae at the both study sites, which are known as pollution tolerant organisms \textsuperscript{19}, where tubificid worms with hair chaetae occurred in rare number.

The data used to calculate some of biological indices are represented in (Table 2). To overall benthic invertebratesm, the oligochaeta percentage was extending from (60.16-20.3) % if (Olig.%) $<$ 60% Good water quality; 60-80 % Dubitable; $\geq$ 80 % hardly polluted, whether organic or industrial that mean . The percentage of tubificid worms to total benthic invertebrates were almost close in study sites (43.3-43.9) %.the percentage of oligochaetes to Chironomidae larvae stretched between 60% in (S1) and 90% in (S2). Both groups are considered as pollution tolerant \textsuperscript{20, 21}. Pollution index (D) was extend between (0.21-0.13) and that
indicate the Euphrates river is good according to 16, if values ≥ 0.30 considered good; 0.30-0.55 a little polluted; 0.56-0.80 polluted and; 0.81-1 hardly polluted. Iₐ index value was (36.06) recorded in (S1), and reduce gradually as proceed downstream to reach its lowest value of (30.56) recorded in (S2). This point depends upon the turnout of hairless tubificid worms associated with total benthic species, because they are more resistant to oxygen nude created by various types of pollutants such as organic pollution 17, 22. The highest value was showed shown at (S2) 7.07 according to JOQS which represented the tubificid worms relative abundance jointly with or without chaetae to total oligocheates worms. TUSP index reached the highest percentage at (S1) 21.21% and the lowest at (S2) 11.79%. Eo index, represents by A₈ and A₀ for (S1) and (S2) respectively.

### Authors' declaration:
- Conflicts of Interest: None.
- We hereby confirm that all the Figures and Tables in the manuscript are mine ours. Besides, the Figures and images, which are not mine ours, have been given the permission for re-publication attached with the manuscript.
- Ethical Clearance: The project was approved by the local ethical committee in University of Baghdad.

### Authors' contributions statement:
N.I.A. conceived of the presented idea and the data of the oligochaeta worms by collection of the samples from the rivers while D.K.A. was analyzed the data by using the indexes, the authors discussed the results and contributed to the final manuscript.

### References:
1. Asif N, Malik M, Chaudhry FN. A review of on environmental pollution bioindicators. Pollut. 2018 Jan 1; 4(1): 111-8.
2. Samsi AN, Asaf R, Santi A, Wannebo MI. Gastropods as a bioindicator and biomonitoring metal pollution. Aquac Indones. 2017; 18: 1-8.
3. Patang F, Soegianto A, Hariyanto S. Benthic macroinvertebrates diversity as bioindicator of water quality of some rivers in East Kalimantan, Indonesia. Int J Ecol. 2018 Jun 12; 2018. https://doi.org/10.1155/2018/5129421
4. Martin P, Martinez-Ansemil E, Pinder A, Timm T, Wetzel MJ. Global diversity of oligochaetous clitellates (“Oligochaeta”; Clitellata) in freshwater. Hydrobiologia; 2008 595:117–127
5. Al-Lami AA, Jaweir HJ, Nasbaat MR. Benthic invertebrates community of the River Euphrates upstream and downstream sectors of Al-Qadisia dam, Iraq. River Res Appl. 1998 Jul; 14(4): 383-90.
6. Jaweir HJ, Salman JM, Abaid ZH. Spatial and temporal distribution of benthic Oligochaeta in Euphrates River, middle of Iraq. Mesopo Environ J. 2014; 1(1): 1-6.
7. Jaweir HJ, Al- Janabi EOS. New record of Naidid worms (Oligochaeta:Naididae) in Euphrates River. Baghdad Sci J. 2014;11(2).
تقييم نوعية الراسب في نهرى الهندية والعباسية/العراق باستخدام مجتمع قليلة الاهلاب المائية كمؤشرات حيوية

نادية عماه الامين
قسم علوم الحياة، كلية العلوم للبنات، جامعة بغداد، بغداد، العراق

الخلاصة:
تحظى المؤشرات الإحاثية باهمية كبيرة في تقييم التلوث في المستطبات المائية، وقد استخدمت في هذه الدراسة ديدان قليلة الاهلاب المائية ضمن اللافقريات القاع لأغراض الفحص الاحاثية وتحديد نوعية الراسب في نهرى الهندية والعباسية في محافظة بابل. استخدمت الدراسة لمراقبة التلوث بناءً على مستويات تلوث عن طريق قياس مساحة النمو ووزن الاعضاء، كما قام الدراسة بقياس نوعية الراسب عن طريق تحليل نسب الأنواع المختلفة المتواجدة ضمن نمط التواجد الاحاثي.

الكلمات المفتاحية: ديدان قليلة الاهلاب المائية، اللافقريات القاع، نوعية الراسب، إدلة حيوية.