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Original Article

The occurrence and density of some molluscs species in different areas of Basrah province, southern of Iraq and first record of The invasive golden mussel *Limnoperna fortunei* (Dunker, 1857)

A ocorrência e densidade de algumas espécies de moluscos em diferentes áreas do governo de Basrah, sul do Iraque, e o primeiro registro do mexilhão dourado *Limnoperna fortunei* (Dunker, 1857)

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Abstract

The study was conducted to compare the distribution and composition of the Molluscs community in 4 ecosystems (4 sites) in southern of Iraq, namely: (Site 1)- in Euphrates River at Al-Madinah city, (Site 2)- in Shatt Al-Arab at Al-Sharsh area, (Site 3)- in the Garmat Ali River at Al-Mashib area and Site 4- in the Al-seba area. Samples were collected from study sites during a period of January to August 2019. (11) species from the class Gastropoda and (4) species from the class Bivalves, species were predominated in most of the study months which are species: *Melenodies nodosa, Bellamya bengalensis* and *Melanopsis turbculata* from Gastropoda and two of the species are bivalve: *Corbicula fluminalis* and *Limnoperna fortunei* (Dunker, 1857), and the last species, *L. fortunei*, was recorded in the current study for the first time in freshwater of Iraq. The total biodiversity values of Molluscs at the Euphrates River at Al-Madinah area (Site. 1), Al-Sharsh area (Site 2), Al-Mashib area (Site 3) and Al-seba area (Site 4) were 3.1, 2.9, 2.4, 1.8, respectively, and It was noted that the highest seasonal densities of the species in the current study were recorded in the winter season, reaching 1013, 905, 762 and 639 individuals / m^2 in four sites, respectively.

Keywords: biodiversity, invertebrates, density, *Limnoperna fortunei*.

Resumo

O estudo foi realizado para comparar a distribuição e composição da comunidade de moluscos em quatro ecossistemas (quatro locais) no sul do Iraque, a saber: Local 1- no rio Eufrates, na cidade de Al-Madinah, Local 2- em Shatt Al-Arab na área de Al-Sharsh, Local 3- no rio Garmat Ali na área de Al-Mashib, e Local 4- na área de Al-Seba. As amostras foram coletadas nos locais de estudo durante um período de janeiro a agosto de 2019. Onze espécies da classe Gastropoda e quatro espécies da classe Bivalves predominaram espécies na maioria dos meses de estudo, que são as espécies *Melenodies nodosa*, *Bellamya bengalensis* e *Melanopsis turbculata*, de Gastropoda, e duas das espécies, *Corbicula fluminalis* e *Limnoperna fortunei* (Dunker, 1857), de Bivalvia, e *L. fortunei*, foram registradas pela primeira vez em água doce do Iraque. Os valores totais de biodiversidade de moluscos no rio Eufrates na área de Al-Madinah (Local 1), área de Al-Sharsh (Local 2), área de Al-Mashib (Local 3) e área de Al-Seba (Local 4) foram 3,1, 2,9, 2,4, 1,8, respectivamente, e notou-se que as maiores densidades sazonais da espécie no presente estudo foram registradas na estação de inverno, chegando a 1013, 905, 762 e 639 indivíduos/m^2 em quatro locais, respectivamente.

Palavras-chave: biodiversidade, invertebrados, densidade, *Limnoperna fortunei*.

1. Introduction

Mollusca is one of the most widely distributed and variable phylum's in the animal kingdom. Most of them are marine creatures, although some species do live in freshwater as well as in terrestrial environment (Mader, 1998).

Among the studies conducted on the mollusca in the Shatt al-Arab and the Iraqi wetlands: The study of Al-Dabbagh and Daoud (1985), as they recorded a number of species in ponds at the Shatt Al-Arab, the East Hammar marsh, and the Zajri marsh, which is one of the central marshes. Al-Azzawi (1986) used environmental evidence in calculating the diversity, richness, and equivalence of bivalve and gastropods in two species of marshes before

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drying. Abdul-Sahib (1989) studied the life history and production of two species of freshwater bivalves in the Shatt al-Arab River, *Corbicula fluminea* and *Corbicula fluminalis*.

Plaziat and Younis (2005) put together a guide to the species of mollusca collected from the marshes, which included six basic gastropods and four bivalve genera. Abdul-Sahib and Khalaf (2006) presented a study on the precise characteristics of some gastropods in the Shatt al-Arab, and Naser (2006) recorded three species of *Melanopsis* in the southern marshes.

Naser et al. (2008) dealt with the phenotypic and anatomical aspects of the *Radix* gastropods in the Garmat Ali river and the Hammar marsh. Qazar (2016) calculated the environmental evidence of gastropod snails in the eastern Hammar marsh during the years 2007 and 2008. Abdul-Sahib and Abdul-Sahib (2010) also studied the age and growth of four species of gastropods in Shatt al-Arab.

Many of species within the phylum moullsca have been studied in some water bodies in Iraq, such as the Shatt al-Arab and the Arabian Gulf regions. (Ali et al., 2007; Khalaf, 2016; Khaled et al., 2018) and some water bodies in central Iraq (Akbar, 2013; Al-Ameen, 2018; Rhadi, 2018). Mollusca is characterized by its large size and limited mobility as well as being dominant.

The Mollusca phylum ranks second after the Arthropods in the number of species, as there are about 100,000 living species and 35,000 extinct species and the Mollusca phylum members include a large group of invertebrates with different shapes and environments, including terrestrial and aquatic (Subba Rao, 1993) They are animals with undivided bodies that contain a calcareous shell (Leftwich, 2004). The gastropods of the gastropod class are the main components of the large benthic invertebrates in the intertidal areas (Bennison and Suter, 1990).

Abdul-Sahib and Abdul-Sahib (2009) was recorded the bivalve *Anodonta vescoiana* Bourguignat, 1857 for first time, where this bivalve was collected from Al-Ezz River in Al-Umara marshes, iraq. it is considered as benthic, freshwater clam.

Number of studies has been done on molluscs groups in Iraq, including (Ahmed, 1975) in Shatt Al-Arab and Arabian Gulf, (Al-Dabbagh & Daoud, 1985) whom identified the Mollusca in Shatt Al-Arab, (Al-Khafaji et al., 2016) were recorded for the first occurrence and abundance of the invasive snail (*Pomacea canaliculata*) with six native gastropod snails in Shatt Al-Arab, (Atee, 2008) studied these organisms in southern of Iraq, (Abdul-Sahib et al., 1995) studied two Bivalves species *Corbicula fluminea* and *Corbicula fluminalis* in Shatt Al-Arab. Therewith several local studies are dealing with Mollusca as a group within benthic invertebrates, such as (Plaziat and Younis, 2005; Qazar, 2009; Al-Waaly et al., 2014; Mirza & Nashaat, 2019).

Therefore, the current study aimed to compare the occurrence, abundance and diversity of Mollusc's species in different water systems in southern region of Iraq, during a period from January to December 2019. In addition, this paper is determining the new occurrence of golden mussel in the south of the Iraq and Ecological implications related to biodiversity.

2. Materials and Methods

Four different sites of flowing water systems in southern Iraq were chosen to study the biodiversity of the Molluscs community (Figure 1).

(Site 1)- in Euphrates River at Al-Madinah city, (Site 2)- in Shatt Al-Arab at Al-Sharsh area, (Site 3)- in the Garmat Ali River at Al-Mashib area and (Site 4)- in the Al-Seba area.

Geographical coordinates of Site 1 were: 31° 13' 26" North, 47° 20' 26" East, Site 2: (30° 31′ 32.39″N, 47° 50′ 33.43″ E), Site 3: (30°34'46.96"N, 47°46' 27.37" E), Site 4: (30° 27′ 49.88″ N, 48° 00′ 30.89″E).

Samples were collected from the four study sites for a period of January to August 2019. The bottom sediment samples were taken at a distance of 1-3 m from the banks of the river and at a depth of less than 1 m using a dredger of 45 cm x 15 cm dimensions with Ekman Dredge and an area of 2500 cm^2 with three replications. And a distance of 1 m between one repeater and another. The Molluscs member were identified via the keys of classification (Ahmed, 1975). Shanon-Weiner index were calculated as described in (Shannon and Wiener, 1949) respectively, while calculation of relative abundance index was depending on (Omori and Ikeda, 1984).

3. Results and Discussion

The composition of the benthic invertebrate community is affected by a number of factors in any water body, such as the nature of the bottom, abundance of benthic algae, current speed, Salinity and temperature (Al-Dabbagh and Daoud, 1985).

In the current study, (15) species of molluscs were classified, of which (11) belong to the class Gastropoda and (4) belong to the class Pelecypooda (Bivalvia) (Table 1).

The results also showed a clear dominance of Relative abundant in three species *M. tuberculata, M. nodosa* and *B. bengalensis* of class Gastropoda, where two species *M. tuberculata* and *M. nodosa* were dominanced in Relative abundant at site1, 2 and site3, while individuals of species

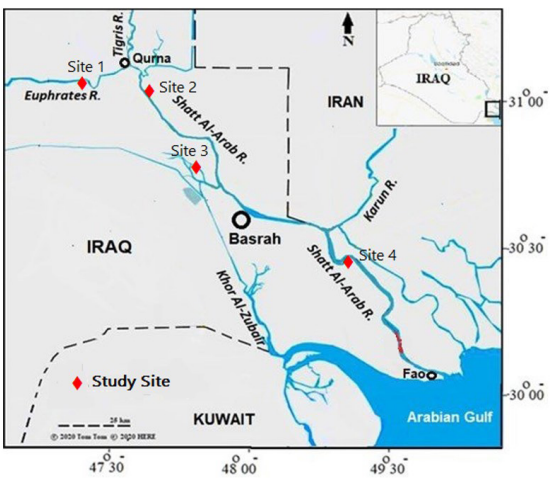

Figure 1. The map of the four study sites in the southern of Iraq.

Table 1. Relative abundant of Mullscas species were collected from four study Sites during 2019.

Mullscas species	Site 1	Site 2	Site 3	Site 4
Phylum: Mollusca				
Class: Bivalvia				
Family: Unitidae				
Unio tigridis (Bourguignat 1852)	70	10	10	10
Family: Corbiculidae				
***Corbicula fluminea* (O. F. Müller, 1774)**	70	70	60	50
Corbicula fluminalis (O.F.Müller, 1774)	70	70	40	40
Family: Mytilidae				
Limnoperna fortunei (Dunker, 1857)	70	70	10	40
Class: Gastropoda				
Family: Thiaridae				
Melanoides tuberculata (Műller, 1774)	70	50	65	70
Family: Melanopsidae				
Melanopsis nodosa (Férussac, 1874)	65	60	70	55
M, costata (Oliver, 1804)	60	55	70	50
M. subtingitana (Annandale, 1918)	40	55	60	50
Family: Viviparidae				
Bellamya bengalensis (Lamark, 1822)	70	60	40	20
Family: Bithyniidae				
Bithynia badiella (Kűster, 1852)	70	40	40	10
Family: Planorbidae				
Gyraulus convexiusculus (Müller, 1774)	65	45	55	0
Family: Lymnaeidae				
Lymnaea (Radix)auricularia (Linnaeus, 1758)	55	55	15	10
Family: Physidae				
Physa acuta (Draparnaud, 1805)	50	10	25	10
Family: Neritidae				
Theodoxus jordani (Sowerby, 1832)	60	25	20	20
Neritina violacea (Gemlin, 1771)	0	0	0	40

B. bengalensis, they appeared at site 1, 2, 4 during this study. While, individuals of the two species of class Pelecypooda Which is represented by species *C. fluminea* and *C. fluminalis,* which appeared in abundant in all sites during this current study. While, *L. fortunei* (Dunker, 1857) (this species is a new record in freshwater of Iraq, its appeared abundant in site 1,2, 4 during the most of study months.

The current results showed absence of the three species *L. (Radix) auricularia, P. acuta* and *Bithynia badiella* during the study period in very low abundant at (sites 2, 3, 4) in the Shatt Al-Arab River. It seems that the occurrence of the same species in high abundant near the Non-pollution area is due to the availability of suitable environment for their growth and occurrence (Jamil, 2001).

In addition, the highest values for the total biodiversity of Molluscs were (3.1, 2.9, 2.4), respectively, recorded in the site 1, site 2 and site 3. A comparison with the observed value in (site 4) at Al- Seba area which reached (1.8), (Table 1) and certainly due to the differential of the environmental conditions of the study sites, that directly affect the distribution and composition of the Molluscs community (Akrawi, 1992), which needs more studies on the biodiversity assessments of another species of aquatic organisms because they my represented the food base in water bodies and thus they give an indicator of the quality of that environment and its suitability for the development of fisheries.

Figure 2 showed the abundance and total density of molluscs species collected in the four sites of the current study, which is the highest density in sites 1 and 2 and the lowest density in stations 3 and 4 and this is due to the fact the site 1 and site 2 is suitable environment for the

diversity and occurrence of these organisms and the high density of some species molluscs in the site 3 may be due to its being an "important" cesspool for the drainage of agricultural lands rich in fertilizers and pesticides, which leads to the nutritional enrichment of phytoplankton and filamentous algae (Akrawi, 1992; Abdul-Sahib, 1989) In addition to that, the increase in the members of the mollusca phylum often appears in areas with low-speed current (Al-Ameen, 2018; Qazar, 2009). It may be due to the increase in industrial waste from factories and Spilled fuel from fishing boats and other waste oil from boats which is considered an unsuitable environment for the waters, and therefore pollutes it (Al-Khafaji et al., 2016).

As for Figure 3 shows the higher values from the total seasonal density recorded in the winter season for Molluscs in the current study sites, (sites 1, 2, 3 and 4) were 672, 608, 576 and 384ind. / m^2, respectively,

As shown in Table 2, The invasive Asiatic bivalve *Limnoperna fortunei* Dunker, 1857 was found to be the most abundant of Bivalve species in Euphrates River (Site 1), its density varied from 168 ind. /m^2 in April 2019 to 76 ind. /m^2 in July 2019, and from 160 ind. /m^2 in January to 60 Ind./m2 in Al- Sharsh area (site 2). As for Al-Mashib area (Site 3) 99 ind. /m^2 in February to 16 at August 2019. While, for Al-Seba area (Site 4), its density varied from 66 ind. /m^2 in April to 16 ind. /m^2 at June and August 2019. This species of Bivalve has a wide range of temperature to lives in water during summer even when the water temperature reached to above 34 °C. Meanwhile, the banks of intertidal zone of Shatt al-Arab river and other water bodies, which have relatively range of temperatures of 12-34 °C. At the end of autumn and in winter, when the water temperature falls down sharply, the abundance and occurrence of this species of Bivalve retreats below in the intertidal zone to find their preferable temperatures. Table 2 show that *L. fortunei* was found in higher density at Euphrates River (site 1) and Al-Sharsh area (Site2), northern site, while in the extreme south site of the Al-Seba area, the specimens of this species were dominant in lower density. This result may directly correlate with high water salinity or may rather be related to the effect of other factors especially the sewage pollutants that are dumped into Shatt Al-Arab River in the Al-Seba area in the southern areas compared to the northern parts, which is the more preferable habitat.

The invasive Asiatic bivalve *L. fortunei* Dunker, (1857) (Figure 4) has a great invasive ability due to its great sexual ability, rapid sexual maturity, rapid and frequent

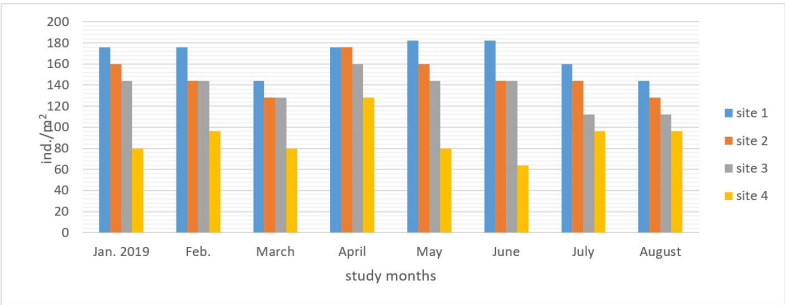

Figure 2. The total density values in the study months for Molluscs species in four sites during the study period in 2019.

Figure 3. The total density values in the two seasons for Mollusca species in four sites during the study period in 2019.

Table 2. The density of invasive Asiatic bivalve *Limnoperna fortunei* Dunker, 1857 in the four study sites the study period in 2019.

Sites	January 2019	February	March	April	May	June	July-	August
Al-Madinah site	112	120	98	168	140	112	104	76
Al-Sharsh site	160	96	98	80	112	80	64	60
Al-Mashib site	64	99	68	88	64	32	32	16
Al-Seba site	40	64	32	66	65	16	32	16

Figure 4. Picture 1, 2, 3, 4 represented *Limnoperna fortunei* Dunker, 1857.

reproduction during the year, in addition to having the ability to form colonies in places and unstable environmental conditions and great physiological tolerance (Darrigran & Ezcurra de Drago, 2000; Darrigran, 2002). The absence of competition in the freshwater environment and the association of this species with human activities highly increase its dispersion capacity (Darrigran & Ezcurra de Drago, 2000).

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