Freshwater Snails of East Hammar Marsh and Shatt Al-Arab During 2008-2009

Inaam A. Qazar* N.M. Azeez* B.A. Marina**

** Ecology department, **Biology department\ College of science\ University of Basrah*

E-mail Enaam_a2000@yahoo.com

Abstract

Richness and abundance of some freshwater snails were determind in Basrah province southern Iraq since October 2008 until July 2009, Six stations of East Hammar marsh and it's lower reaches were chosen for getting samples for aquatic gastropods. Ten species were found, *Bellamya bengalensis* (Lamarck, 1822), *Bellamya unicolar* (Olivier, 1804), *Bithynia hareerensis* (Glöer, and Nasser, 2009), *Gyraulus ehrenbergi* (Beck, 1837), *Melanoides tuberculata* (Müller, 1774), *M. costata* (Olivier, 1804), *M. nodosa* (Fèrussac, 1823), *Physlla acuta* (Draparnaud, 1805), *Lymneae auricularia* (Linnaeus,1758), and *Theodoxus jordani* (Sowerby, 1832). Individual density varied from zero to more than 100 ind./metre^2 for many species according to spatial and temporal changes.

Introduction

Gastropoda including freshwater snail species, is an important ecological component in the aquatic habitats (Costil et al., 2001). They are represent a food source for many fishes, turtles, and aquatic birds, as well as being essential in recycling of dead plant materials, also they are excellent water quality indicator because of their sensitivity to certain chemicals (Johnson,2003; Van der Valk, 2006).

They can be found at the bottoms and on aquatic plants of rivers, lakes, small streams and ponds (Johnson,2003).

Populations of freshwater snails as a part of the Iraqi marshlands were subjected to knowledge severe ecological stressors imposed by wide temporal fluctuations in their environment which have a big influence on the niche availability and snail abundance (Niggebrugge et al., 2007).

Al-Qarooni (2005) found four species of snails in Hammar marsh; *Lymnaea auricularia*, *Gyraulus ehrenbergi*, *M. tuberculate*, and *M. nodosa*. And the most common species in Hammar according to his study was *L. auricularia*. Qazar (2009) showed that numbers of aquatic snails were not only differ from one station to another, but they also differs at the same station by being much higher at the aquatic plants compared with that on sediments.

Khalaf (2011) found seven species of snails; *Bellamya bengalensis*, *Bithynia badiella*, *Melanopsis costata*, *Melanopsis nodosa*, *Melanoides tuberculate*, *Neritina violacea*, and *Theodoxus jordani* in Shatt Al-Arab. The most common one was *M. tuberculate*. The aim of the study was to investigate the effect of some ecological factors on the structure and intensity of snails in six chosen station adjust the Hammar marsh.

Materials and methods

Sampling sites

Aquatic macroinvertebrates were sampled seasonally at six stations (Table, 1). Two of them Burga and Sadda undergo a drainage and restoration process, whereas the others represent a normal natural ecosystem, in Jazzera, Najebia, Qarmma, and Hareir (Figure, 1).

Sampling methods

Seasonally macrophyte samples were collected with its attached snails at each station by using an aluminum trap box which designated for this purpose (Qazar, 2009). At the laboratory we separated the gastropoda species for counting and classification process according to Ahmed (1975) and Frandsen (1983).

Environmental measurements

Many environmental measurements were taken in this study at each collection, like air and water temperatures, pH using Elmetron pH meter mod. CP-411, dissolved oxygen according to (APHA, 2003), salinity using WTW electrical conductivity meter mod. LF91, total hardness according to (APHA, 2003), and light penetration using a Secchi disk.

Table1: Stations of the study area.

No.	Station	Longitude	Latitude
1	Jazzera	30.35.659	047.46.171
2	Najebia	30.35.579	047.46.026
3	Qarmma	30.35.410	047.44.794
4	Hareir	30.35.592	047.42.580
5	Sadda	30.36.655	047.40.218
6	Burqa	30.40.047	047.38.574

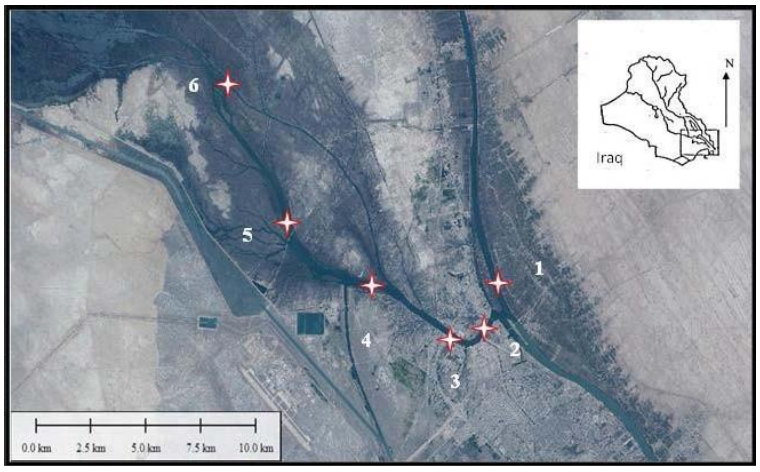

Figure 1: map of study area.

Biological indices and statistical analysis

Some indices were carried out like diversity index (Shannon and Weaver, 1949), richness (Margalefe, 1968), evenness (Pielou, 1977), Jaccard coefficient (Jacared, 1908), and domination. As well as statistical analysis of spss ver.16.

Results

Environmental factors

Air and water temperature as well as salinity values raised at Summer months. Dissolved oxygen rated from 7 to 12.5mg/l, while pH ranged from7.3 to 8.21. Salinity ranged from 1.8 to 6.81psu. Hardness values were generally high, reached 2000mg/l at Burqa station in Spring.

Statistical results for environmental factors under L.S.D. ($p<0.05$) showed that Oxygen, pH, and salinity were affected by temporal and spatial variations. As well as for the total hardness except for St.4 and 5 which showed no differences between them (Table, 2).

Table2: Environmental factors for the stations during 2008-2009.

Season	Station	Total hardness (mg/l)	Salinity (PSU)	pH	Dissolved oxygen(mg/l)	Air temperature (˚C)	Water temperature (˚C)
Autumn	**1**	837	2.12	7.3	8.8	30	**20.9**
	2	822	2.43	7.75	8.8	30	**21.6**
	3	817	2.95	8	8.8	30	**21.8**
	4	896	1.9	7.63	11	28.3	**21.4**
	5	1019	2.21	7.52	12.6	34	**21.2**
	6	1170	3.04	7.69	12.5	20	**14**
Winter	**1**	1400	1.8	7.93	11.6	10	**8.5**
	2	1400	1.92	8.01	11.4	10	**9.4**
	3	1500	2.24	8.13	12	10	**9.3**
	4	1460	2.75	8	12	11	**8.4**
	5	1540	2.11	8	12.2	10	**8.2**
	6	1700	3.84	8.01	11.6	10	**8**
Spring	**1**	1100	2.07	8.16	12.5	24	**20**
	2	1160	3.03	8.05	7.4	28	**20**
	3	1600	2.12	8.21	10	28	**20**
	4	1600	2.96	8.13	10.2	30	**23**
	5	1640	4.01	8.15	11.5	30	**23**
	6	2000	5.33	8.17	11	29	**21**
Summer	**1**	1098	3.6	7.79	9.88	40	**33.2**
	2	1080	3.62	7.85	7.1	40	**33.2**
	3	1082	3.62	7.81	8.8	40.2	**34**
	4	1077	5.38	7.59	8.8	39.8	**34.1**
	5	1510	5.8	7.69	10.5	39	**30.2**
	6	1441	6.81	7.64	10.5	38.7	**30.2**

Snail species

Ten gastropod species were found in the study area; *Bellamya bengalensis, B. unicolar,Lymneae auricularia,Physa acuta,Theodoxus jordani, Melanoides tuberculata, M. costata, M. nodosa, Gyraulus ehrenbergi, Bithynia hareerensis*.

(Figure, 2-11). These snails were found nearly in most stations during the study period, most numbers of snail species were recorded in Summer in most of the study area, while *B. hareerensis* were recorded at St.2, St.4, and St.6 only (Table, 3).

Figure 2: *Bellamya bengalensis*

Figure 3: *Bellamya unicolar*

Figure 4: *Bithynia hareerensis*

Figure 5: *Melanoides tuberculata*

Figure 6: *M. nodosa*

Figure 7: *M. costata*

Figure 8: *Physa acuta*

Figure 9: *Gyraulus ehrenbergi*

Figure 10: *Theodoxus jordani*

Figure 11: *Lymneae auricularia*

Ecological indices

The highest value for diversity indices 1.79 recorded in Autumn, 2008 at St.4, while the lowest was 0.075 for Autumn, 2008 at St.6. (Fig. 12) The highest value of richness was 2.23 at st.5 in Spring 2009, meanwhile it was the lowest level 0.21 for St.6 in the same season (Figure, 13).

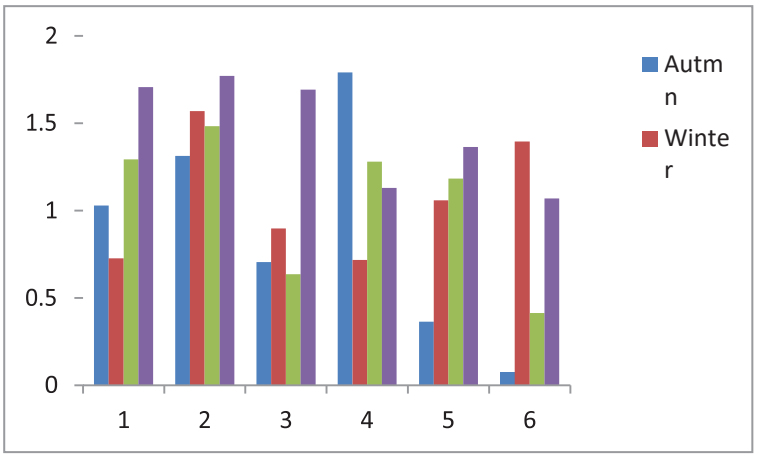

Figure 12: Diversity values of snails for the stations during study period.

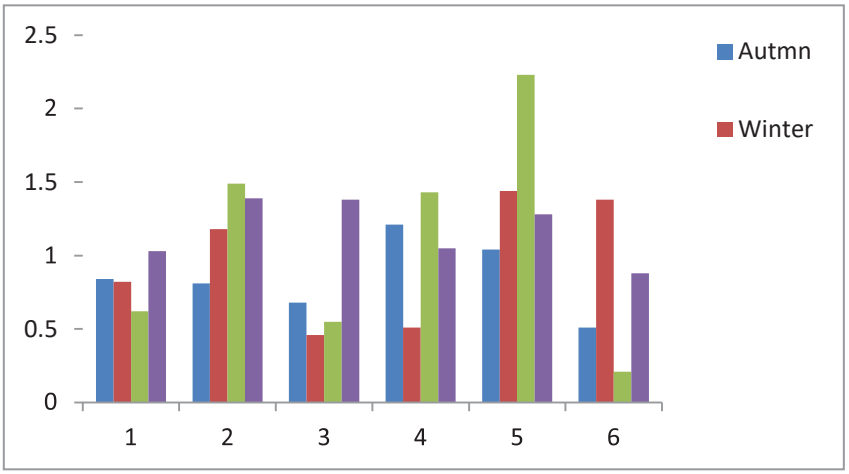

Figure 13: Richness values of snails for the stations during study period.

Table 3: Numbers of snails/m^2 at study area 2008-2009.

Species	Sum of Density																							
	Autumn						Spring						Summer						Winter					
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	**6**
B. bengalensis	0	12	14	3	0	3	0	9	4	12	1	0	0	0	12	0	2	8	0	14	8	0	1	1
B. hareerensis	0	0	0	0	0	0	0	0	0	3	0	0	0	20	7	55	0	1	0	0	0	0	0	0
B. unicolar	0	12	1	3	2	0	0	7	0	0	4	0	0	8	0	4	5	0	0	15	0	0	2	0
G. ehrenbergi	2	0	0	4	3	0	2	0	0	8	1	0	108	3	4	4	0	0	32	0	0	0	0	0
L. auricularia	18	12	0	34	112	35	151	28	0	12	16	17	80	8	4	20	95	29	26	50	20	36	1	4
M. tuberculata	2	0	0	254	1	0	0	4	0	32	1	100	28	4	4	184	63	180	0	2	0	4	0	8
Melanopsis costata	24	0	0	3	0	0	46	2	0	4	1	0	8	0	0	10	2	0	4	0	0	0	0	0
Melanopsis nodosa	102	0	0	6	0	0	201	1	2	12	7	0	20	15	0	24	54	68	0	8	0	0	0	3
P. acuta	0	4	4	9	2	11	0	0	0	0	2	0	44	16	6	0	1	0	60	13	44	8	0	0
T. Jordani	226	0	0	0	1	0	178	5	0	50	3	0	52	0	0	0	8	6	8	56	0	0	0	2
Grand Total	**374**	**40**	**19**	**316**	**121**	**49**	**578**	**56**	**6**	**133**	**36**	**117**	**340**	**74**	**37**	**301**	**230**	**292**	**130**	**158**	**72**	**48**	**4**	**18**

The evenness values were moderate to high during study period for most stations especially in Spring, it ranged from 0.05 in St. 6 at Autumn to 0.96 at St.5 in Winter (Figure, 14).

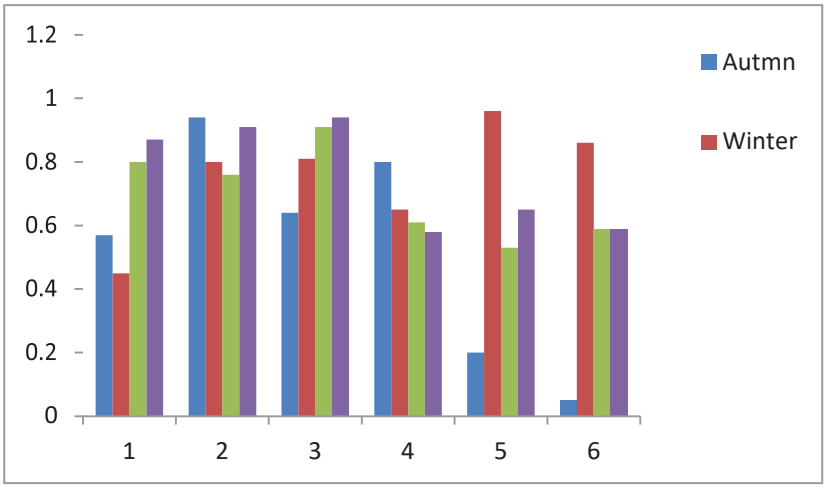

Figure 14: Evenness values of snails for the stations during the study period.

Domination measurements during the study period showed that the dominated species in st.1 and 2 were *T. jordani* with values of 46.9 and 40.8 and *L. auricularia* with values of 25.6 and 29.3 respectively. Meanwhile at St.3 the snail *T. jordani* with value of 21 was dominated. While at St. 4, 5, and 6 dominant species was *M. tuberculata* with values of 72.4, 22.5, and 60.9 respectively, and the second species *L. auricularia* with values 11.7, 52.7, and 22.2 respectively.

Similarity index for the species among stations shows high similarity 77.77 between St.2 and 5 in Spring, While it was zero in Autumn for St.1 and 3 as well as for St.3 and 6 in Spring (Table, 4).

Results of statistical analysis showed that snails species, occurrence, and density varied significantly ($P < 0.05$) between the six stations.

Table 4: Monthly changes in Jaccard similarity index values for the study area.

Month	Station	1	2	3	4	5	6
Autumn	1		20	0	55.6	50	12.5
	2			75	50	42.8	75
	3				37.5	28.5	50
	4					55.5	37.5
	5						28.5
	6						
Winter	1		33.3	33.3	33.3	20	25
	2			42.8	42.8	42.8	71.4
	3				50	50	46
	4					20	33.3
	5						33.3
	6						
Spring	1		50	16.66	62.5	55.55	20
	2			28.57	66.66	77.77	28.57
	3				25	22.22	0
	4					70	25
	5						22.22
	6						
Summer	1		55.55	44.44	55.55	66.66	44.44
	2			57.14	75	50	44.44
	3				44.44	40	50
	4					50	44.44
	5						55.55
	6						

Discussion

As habitat availability and macrophyte abundance changes along the stream of studying area, it is doubtful that samples from one or two stations can reflect community composition in the whole stream properly (Grubaugh et al., 1996), so six stations were chosen to determine the abundance and distribution of aquatic snails in East Hammar marsh and Shatt Al-Arab river.

Aquatic snails community at St.5 and 6 were exterminated at the nineties of the past century due to the marshes drainage, various invertebrates were affected negatively by this drainage which considered as a threat to the life at wetlands (Lewin and smolinski, 2006); that leads to changes in the snail's community, some native species disappear and new ones appear.

In aquatic ecosystems environmental requirements of the organisms determines their natural distribution (Flores and Zafaralla, 2012; Al-Akel and Suliman, 2012). Some of these important factors according to Van Duinen et al., (2003) are salinity, current velocity, duration of drought

periods, acidity and trophic state. The results of the environmental measurements of this study showed a direct relationship between snail numbers with the temperature and hardness of the water.

The high hardness levels of Iraqi rivers which ranged from 817 to 2000 mg/l in this study would be suitable for the diversity and richness of the snails. Supian and Ikhwanuddin (2002) and Vollan (2003) mentioned that the diversity of snail species usually increases along with the amount of calcium in the environment.

Researches confirmed that gastropod population size including freshwater snails depends on macrophyte abundance (I.F., 2003; Van Duinen et al., 2003), Aquatic vegetation plays an important role in aquatic systems, providing shelter, breeding habitat, and epiphytic forage for numerous fishes and aquatic macroinvertebrates (Lodge, 1985; Grubaugh et al., 1996; Colon-Gaud, 2003).

Aquatic macrophytes presence and density also may differs from one station to another according to the difference of water velocity, macrophytes can be affected negatively or even damaged by the high water velocity (Van der valk, 2006), that explain the low density of macrophytes in the third station during the whole study period, so current velocity considered as a limiting factor for the snails distribution (Giovanelli et al., 2005).

Numbers of species per site in restarted sites represented in station 5 and 6, tended to increase with the time elapsed after rewetting, it also could be inhibited by new population of snails (Van Duinen et al., 2003).

The snail *M. tuberculata* dominated the gastropod in stations 4, 5, and 6, this high population densities may be attributed to its high salinity tolerance which reaches in Summer 6.81 psu (Murray et al., 2010), also it's the commonest and most wide-ranging member of the family Thiaridae, found in almost any kind of freshwater (Supian and Ikhwanuddin, 2002).

According to the richness indices St. 2, 4 and 5 was the most rich ones because of the stable conditions of that stations and their high density of different macrophytes. A stable environment contains more species, more niches, and involves a higher degree of organization and food web complexity (Van Duinen et al., 2003).

Station 6 showed the lowest values of species richness, it might be due to the changes in water depth at that station which almost dry out at summer season, according to Flores and Zafaralla (2012) gastropod communities can be affected by the pond surface area, nitrates, chlorides concentrate, alkalinity and substrate.

Species evenness were higher in Autumn, Winter, and Spring for most stations and moderate for Summer, evenness is known to be sensitive to environment changes in stream ecosystems, and is used as a ecological indicator of habitat disturbance (Park et al.,1999).

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قواقع المياه العذبة في هور شرق الحمار وشط العرب خلال ٢٠٠٨-٢٠٠٩

انعام عبدالامير كزار نايف محسن عزيز بلسم أنيس مارينا*

قسم البيئة *قسم علوم الحياة
كلية العلوم-جامعة البصرة

المستخلص
تم قياس الغنى والوفرة لبعض النواعم بطنية القدم (القواقع) في محافظة البصرة جنوب العراق، اذ اختير ست محطات لغرض جمع العينات منها في منطقة هور شرق الحمار وشط الكرمة. شخصت عشرة انواع من القواقع في هذه المنطقة وتباينت اعداد افرادها من صفر الى اكثر من مئة فرد للمتر المربع الواحد وعزي ذلك الى الاختلافات المكانية والزمانية بينها، كما تم قياس بعض المتغيرات البيئية والتي بينت وجود علاقة مباشرة بين كل من اعداد القواقع المائية مع درجة الحرارة وكثافة الغطاء النباتي في تلك المنطقة.