Design for Scientific RENAISSANCE

JASER

Effect of some environmental factors on the density of Barnacle's Balanus amphitrite amphitrite nauplius larvae in Shatt Al-Basrah Canal, south of Iraq

Article Info

Received: 10/10/2013
Accepted: 8/11/ 2013
Published online: 1/12/2013

Aliaa H. Mizhir

Department of Biology, University of Kufa, Najaf, Kufa, Iraq
aliaa_78@yahoo.com

ISSN 2231-8844

Abstract

Effect of some environmental factors on the density of the nauplius larvae of the barnacles Balanus amphitrite amphitrite was studied at water of Shatt Al-Basrah South Iraq for the period from July 2011 until January 2012, as samples were collected twice monthly by six replicates as well as measured the environmental factors. Results showed that the density of nauplius larvae of barnacles ranged between (55-128) larva / 100 L, water temperature ranged between 11.3 ºc - 30.5 ºc, salinity between (42.6 – 54) ppm, pH between 7.7 to 8.4 and dissolved oxygen between (4.7 - 7.7) ppm. As shown a positive relationship between nuplius density and salinity, water temperature, while an negative relationship emerged between nuplius density and water dissolved oxygen, pH.

Keywords: **Key word: nauplius larvae density, Balanus amphitrite amphitr, environmental factors, Shatt Al-Basrah**

1. Introduction

Shatt Al-Basrah is an artificial canal, opened in 1983 to spill the high water quantity in the Euphrates River during the flood period and as a transporting waterway. It influenced by the semi-diurnal tidal phenomenon (Al-Badran et al., 1996). The canal was controlled by barrage to prevent the entrance of marine water from Khor Al-Zubair during the flood tide (Al-Ramadhan, 1986). Balanus amphitrite amphitrite is crustacean animal belongs to the Arthropoda Phylla of Balanidae family that owned to Cirripedia secondary class, which consists of three Orders Acrothoracica, Rhizocephala, and Thoracica which belong to it members of this species (Anderson, 1998; Hegner and Engemann, 1968). It were marine crustaceans surrounded her body with calcareous shell and had six pairs of biramous thoracic appendages, filterfeeder and stick to the rocks and floating debris and vessels, found in coastal and estuarine environments on natural hard surfaces like rocks and snail shells (Hegner and Engemann, 1968; Sabtie, 2009). the life cycle of this crustacean Include two

larval stages nauplius and cyprid before transfer to sessile adult phase (Strathman, 1987). The fact that the barnacles marine animals, many of its vital activities get when water immersion like nutrition, fertilization, respiration, larvae deposit, larvae settling and molt and growth (Abdul-Sahib, 1997). The change in the environmental factors of water affects the vital events of aquatic animals. The temperature major factor affecting environmental Physiology of invertebrates is a limiting factor for the organisms' geographical distributions, growth, metabolism and nutrition (Jayaprada, 2002). They also have a special importance in the effectiveness of Cirripedia larvae deposit and secretion of the stimulation factor to spread after the completion of the incubation which stimulates embryo movement and tearing membrane eggs (Barnes, 1955; Crisp and Spencer, 1958). The barnacles Euryhaline animal and the proof is that spreads from the Arabian Gulf to the inland waters of Iraq, Barnes and Barnes (1962) observed that the species Euryhaline B. improvises and global distribution B. amphitrite does not show any change in the characteristics of the shell when the salinity changes. Well as surface water pH is of great significance to aquatic life through its influence on the normal physiological functions of aquatic and included with ion exchange water and breathing. As the bioactivity of aquatic organisms naturally extent between pH 9-6 (El-Deeb Ghazy et al., 2011). Crustaceans and fish suffer decline in the growth and distort the exoskeleton in acidic water (Haines, 1981). Depending on the facts that the summer works to increase drought in the Iraqi rivers and Barnacles presence in internal Iraqi rivers cause a problem for aquatic Facilities. The present study aimed to stand on the optimal conditions to increase intensity of Barnacles larvae during the summer as the study area is under the influence of the Arabian Gulf, which is the basic environment for Barnacles presence.

2. Materials and methods:

1. Sampling method

Barnacles' larvae were collected from Shatt Al-Basrah at N: 30º 24' 30.2177" E: 47º 46' 33.6142" for the period from July 2011 to January 2012 twice monthly by six replicates. Used plankton net had diameter openings 10 µm to collect larvae from a depth of half a meter below the surface of the water. The volume of water sample was 100 liters. Samples were fixed by 70% ethyl alcohol and then collected the number of larvae by Petri dish labeled with parallel lines, the distance between them 1 cm using a manual counter and a dissecting microscope Type Wild.

2. Estimating the concentration of some environmental factors of water

Used field Water Quality Multi Meters to measure water temperature, dissolved Oxygen, pH and electrical conductivity (EC) which multiply with 0.64 to obtain water salinity as (Mackereth et al., 1978).

Statically analysis:

Used Simple Linear Correlation Coefficient (r) to find a relationship between environmental factors and larval density.

3. Result and Discussion:

1. Larvae density

The results of collecting water samples containing larvae in Figure 1 described varies in density and presence quarterly as shown in Figure 2 and recorded the lowest density of 55 larva / 100 L in January 2012, while the highest density of larvae 128 larva / 100 L in August 2011. In present study barnacles nauplius larvae had more density in summer because some types of cirripedia in warm areas and sub-tropical poses many births in small quantities through successive periods in the summer (Crisp, 1950; Hines, 1978)

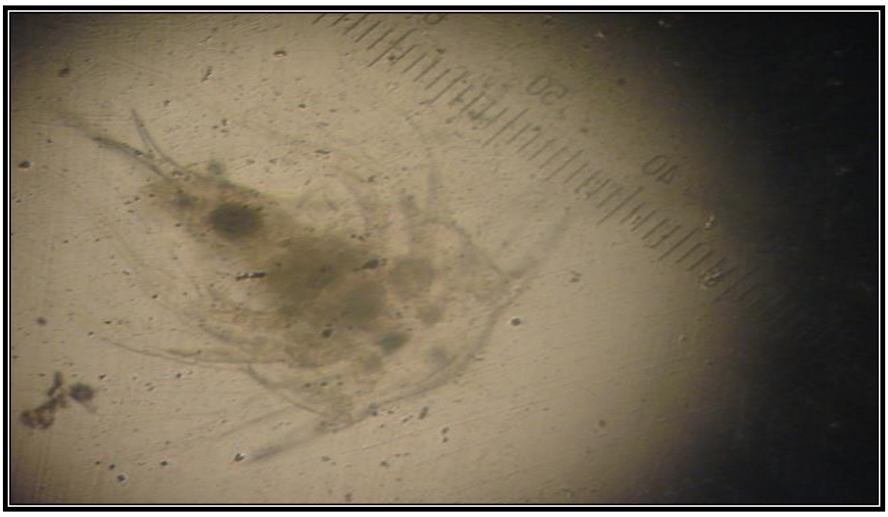

Fig.1: nauplius larva.

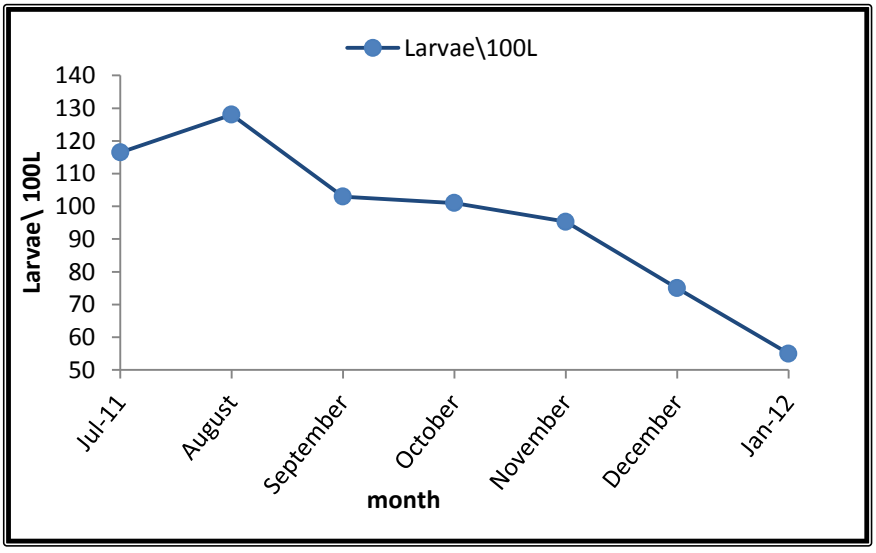

Fig. 2: Density of nauplius larvae of *Balanus a. amphitrite* in Shatt Al-Basrah.

2. The relationship between Water Temperature and larvae of barnacles

Water temperature ranged between 11.3 °C – 30.5 °C. The results showed positive correlation (r= 0.9203) between water temperature and the density of nauplius larvae of barnacles *B. a. amphitrite* (Figure 3). Temperature intervention as main controlling factor of the distribution of organisms through its impact on main biological processes as a major factor in breathing,

nutrition, growth, productivity and osmoregulation. Temperature regulate productivity in several ways, as it controls maturely gonads and the formation of sperm and eggs, and in many cases the heat tolerance of the embryonic and larval stages lower than in adult stages. Thus heat has main effects on reproduction rate and his term as well as mortality rates during the early stages of the larval development and life (Al- Saadi *et al*., 1986).

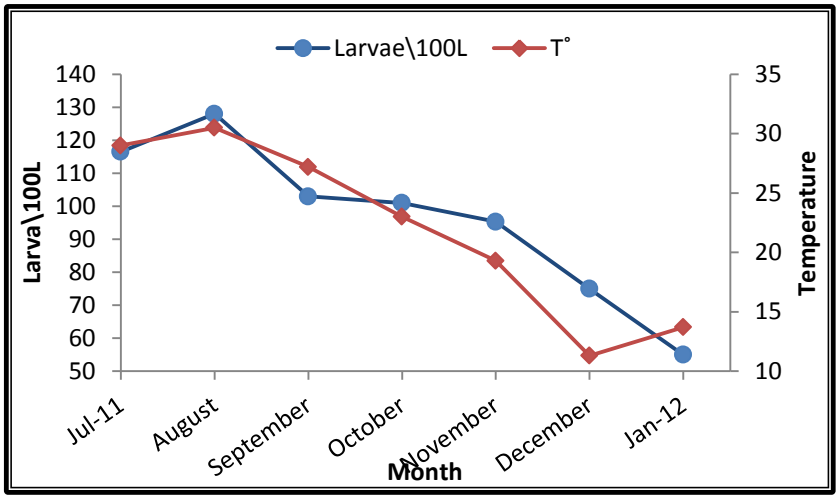

Fig. 3: Relationship between nauplius larvae of *Balanus a. amphitrite* and water temperature in Shatt Al-Basrah.

3. The relationship between Dissolved Oxygen (DO) and larvae of barnacles

The results showed that lowest value for the dissolved oxygen concentration in water 4.7 ppm in August 2011 while the highest value for the dissolved oxygen concentration 7.7 ppm in December 2012. Upon rise water temperature carrying the solubility of oxygen in it(Al- Saadi *et al*., 1986). Results also showed negative correlation (r= -0.348) between the concentration of dissolved oxygen in the water and the density of nauplius larvae (Figure 4). Harms (1987) cleared that respiration rates increase with the development of *Elminius modestus* larvae, thus, the need for dissolved oxygen increases reflected negatively on the larval density decrease concentration of oxygen dissolved in water.

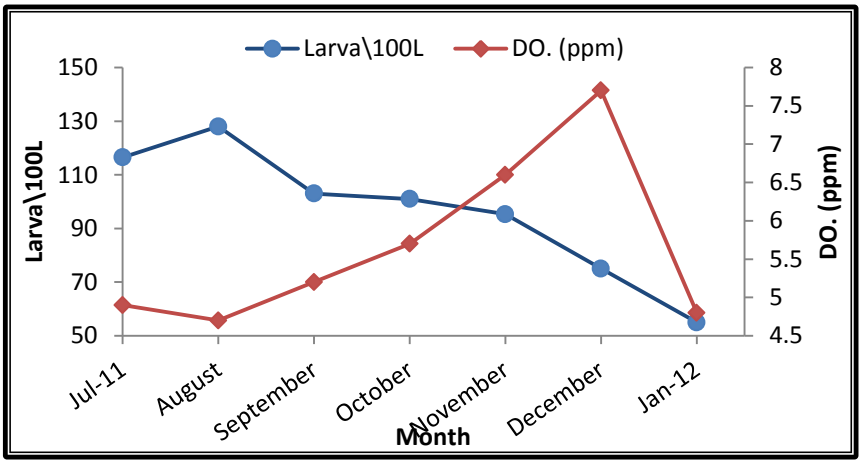

Fig. 4: Relationship between nauplius larvae of *Balanus a. amphitrite* and dissolved oxygen in Shatt Al-Basrah.

4. The relationship between Potential hydrogen Ion (pH) and larvae of barnacles

The results showed that lowest value for pH in water 7.7 in July and August 2011 while the highest value for pH 8.4 in December 2012. So as to influenced by tidal from the Arabian Gulf which have pH value range from 7.9 to 8.3 (Al-Saadi *et al*., 1976). The results also showed negative correlation (r= -0.811) between pH in the water and the density of Nauplius larvae (Figure 5). The pH has indirect effect in nuplius density through its effect on the concentration of nutrients. Hutchinson (1975) referred to that high value of pH effect on release rate of nutrients from the bottom, especially for the bottom phosphorus which associated with iron and aluminum as the decrease in pH increases the solubility of carbonate and other compounds and release phosphorus associated with them. Phosphorus is the limiting factor for the growth of algae as it enters in the composition of the cell wall in addition to proteins, especially enzymes (Suthers and Rissik, 2009). which is considered food for the nauplius larvae.

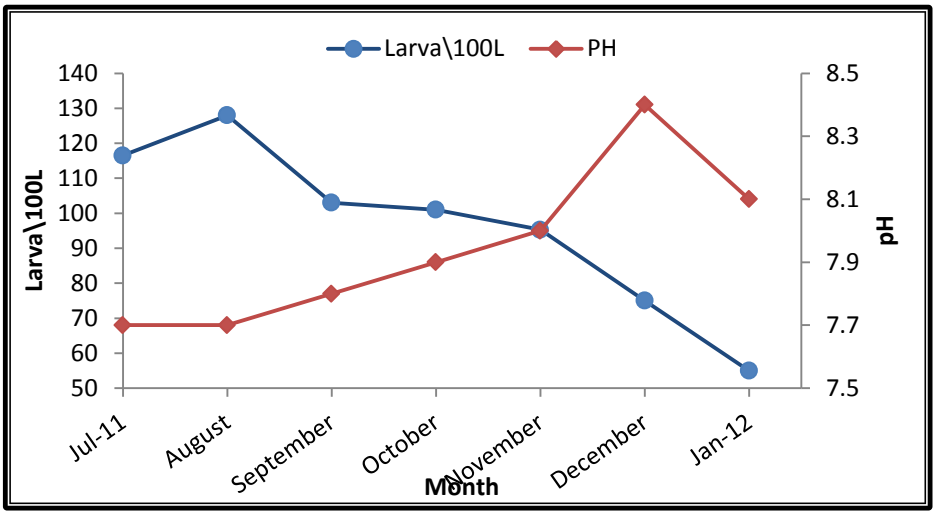

Fig. 5: Relationship between nauplius larvae of *Balanus a*. *amphitrite* and pH in Shatt Al-Basrah

.

5. The relationship between Salinity and larvae of barnacles

The results showed that lowest value for the Salinity concentration in water 42.6 ppm in January 2012 while the highest value for the Salinity concentration 54 ppm in July and August 2011. Salinity linked closely with temperature, Wetzel (1983) has attributed the increase of salinity values during the summer to increase evaporation in addition to the change in the deposition of salts and low water levels. The low salinity in the winter is attributable to the impact of freshwater inflows to the region and increase the amount of rainfall and low soluble salts (Al-Mansouri, 1996). The results also showed positive correlation (r= 0.974) between the Salinity concentration oxygen in the water and the density of nauplius larvae (Figure 6). Due to that barnacle is a euryhaline species, capable of withstanding a wide range of salinities. Large populations are commonly found in the field in waters from 5-30 ppt (Bacon, 1971).

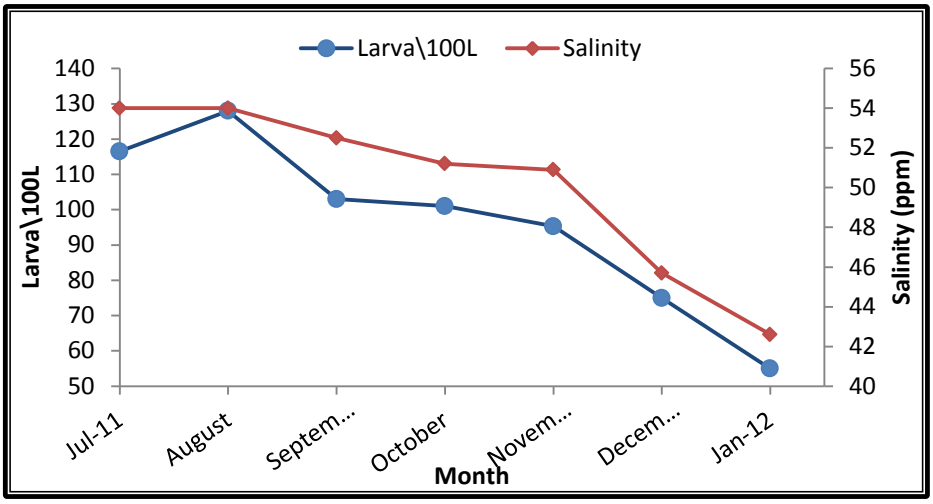

Fig. 6: Relationship between nauplius larvae of *Balanus a. amphitrite* and Salinity in Shatt Al-Basrah.

4. Conclusions:

From this study it could be concluded that possibility of invasion Barnacles Interior Iraqi water as a result high salinity and increased Barnacles density approaching salinity than it is in marine waters, also require remain pH within a specific range of alkalinity for the Liberation of nutrients necessary for the growth of phytoplankton, as larval food, from the bottom of the various water bodies.

Reference:

Abdul-Sahib, I.M. (1997). Energy Flow in the Barnacle Balanus amphitrite amphitrite Darwin (Cirripedia: Crustacea) in the Intertidal Zone of Al-Qarma River. PhD thesis. College of Science. University of Basrah. 102 pp. (in Arabic)

Al-badran, B.; Al-Saadoon, B. and Jassim, T. (1996). Flow characteristic measurements of Shatt Al-Basrah Canal, South of Iraq. Mari. Meso.11(2): 299-310.

Al-Mansouri, F.Y. (1996). Study of sediment transport in the southern part of the Shatt al-Arab. Msc Dgree. Agriculture College. University of Basrah. 119 pp. (in Arabic)

Al-Ramadhan, B.M. (1986). Distribution of the salinity in the Khor Al-Zubair. Oceanography of Khor Al-Zubair. Basrah 25-27 May. 1986. 34-53. (in Arabic)

Al-Saadi, H.A.; Aldaham, K. and Al-Hassan, L.A.J. (1986). Aquatic ecology. Ministry of Higher Education and Scientific Research. University of Basrah. 538. (in Arabic)

Al-Saadi, H.A.; Saad, M.A.H.; R. A. Hadi and N. A. Hussain. 1977. Further investigations on some environmental characteristics of north-west Arab Gulf. Indian National Science Academy Proceeding, Part A, Physical Sciences. 43 : 183-192.

Anderson,D.T.(1998). Invertebrate zoology. Melbourne Oxford University Press: 467pp

Bacon, PR. 1971. The maintenance of a resident population of *B. eburneus* (Gould) in relation to salinity fluctuation in a Trinidad mangrove swamp. *J. Exp. Mar. Biol. Ecol.* 6: 187-198.

Barnes, H. and Barnes, M. (1962). The growth rate of *Eliminus modestus* (Crust. Cirripedia) in Scotland. Int. Rev. Hydro., 47: 481-486.

Barnes,H.(1955). Surface roughness and the settlement of *Balanus balanoides* (L.). Arch. Soc. Z. B. Fenn. Vanamo: 2-10.

Crisp, D. J. (1950). Breeding and distribution of *Chthamalus stellatus*. Nature Lond. 166: 311.

Crisp, D.J. and Spencer, C. P. (1958). The control of the hatching process in barnacles. P. R. Soc. London. Ser. B., 148: 278-299

El-Deeb Ghazy, M.M.; Habashy, M.M. and Mohammady, E.Y. (2011). Effect of pH on survival, growth and reproduction rates of the Crustacean, *Daphina magna*. Australian. J. Bas. Appl. Sci., 5(11):1-10

Haines, T.A. (1981). Acidic precipitation and its consequences for aquatic ecosystems. A review Trans. Am. Fish. Soc., 110: 669-707.

Harms, J. (1987). Energy budget for the larval development of *Elminius modestus* (Crustacea: Cirripedia). Helgolander- Meeresunter. 41: 45-67.

Hegner,R.W. and Engemann,J.G.(1968). Invertebrate zoology. 2nd Ed. Macmillir publishing CO. INC. New York:620 pp

Hines, A. H. (1978). Reproduction in three species of intertidal barnacles from central California. Biol. Bull. Mar. Biol. Lab. Wood Hole 154: 262-281.

Hutchinson, G.E. (1975). A Threatise on Limnology, Vol. 3.Limnological Botany. Wiley, New York.

Jayaprada, C. (2002). Composition and distribution of epigrowth fauna in Visakhapatnam harbor, east coast India. Ind. J. Mar. Sci. 31(4): 310-314.

Mackereth, F. J.; Heron, J. and Talling, J. F. (1978). Water analysis, some revised methods for limnologists, Sci. Pub. Fresh water. Biol. Ass. (England)., 36: 1-120.

Sabtie,H.A.(2009). An ecological study of the benthic macroinvertebrates community in the southern marshes of Iraq. Ph.D. Thesis. College of Science for Women, University of Baghdad:145pp

Strathman,M.F.(1987). Reproduction and development of Marine invertebrates of the northern Pacific coast. Univ. Washington press, London. 670pp

Suthers, I.M. and Rissik, D. (2009). Plankton for Natural Resource Managers: a guide to the ecology and observation. CSIRO Publishing. 9 chapters, 270 pp

Wetzel, R. G. (1983). Limnology. 2nd Ed. CBS College Publ. Philadelphia.