ON THE BIOLOGICAL AND ECOLOGICAL CHARACTERISTICS OF ASIAN JEERY (SILURUS TRIOSTEGUS) IN THE MIDDLE REACHES OF THE EUPHRATES RIVER, THI QAR PROVINCE, IRAQ. I- ABIOTIC ENVIRONMENTAL CHARACTERS

Sadek A. Hussein1 and Kamel K. Fahad2*

1 Department of Fisheries & Marine Resources, College of Agriculture, Basrah University, Iraq.
2 Department of Animal Production, College of Agriculture and Marshlands, Thi Qar University, Iraq.

Abstract

A seasonal investigation on abiotic ecological characteristics (i.e. physico-chemical conditions) was executed on location selected in the middle reaches of the southern sector of the Euphrates River at the city of Thi Qar. This study is one aspect of a comprehensive work on the biological and ecological topics on Asian jeery (Silurustriostegus) for the period extending for one year from February 2013 to January 2014. Results showed fluctuation in values of the studied properties throughout the year. It reveals that air temperature ranged between 16-43 ºC and water temperature from 13-36ºC. Light transparency exhibited significant increase throughout the year, but peak was in winter. Values were between 80 to 128 cm in the spring and winter respectively. Turbidity showed marked variations, with the lowest value (NTU 8) recorded in the summer and the highest (NTU 24) in fall. Salinity revealed, a relatively slight rise up from the normal and the highest encountered in winter and autumn (2.6 ppt.). Dissolved oxygen concentrations were relatively high synchronized with decline in temperature in the spring and winter, when the highest values (9.6 ppm) were recorded. Biological oxygen demand (BOD) was higher in summer (1.94 ppm) compared to other periods of the year. pH was generally in the alkaline direction and values were within the appropriate range of natural inland waters. Almost similar values of active nitrate were detected in various seasons and the highest (2.3 µg/L) was encountered in the winter, whereas the lowest (1.3 µg / L) in spring.

Key words: Dissolved oxygen, biological oxygen demand, natural inland waters, Asian jeery.

Introduction

The importance of fresh water environments lies in its bio-diversity, that the diversity of fishes are among those occupying the first positions. However, nearly 58 species of freshwater fishes are spreads in Iraq’s inland waters (Coad, 1991). Many researchers over the past few decades (Khalaf, 1961; Al-Daham, 1982; Hussein and Al-Kananni, 1993; Hussein, 2000; Al-Rudaini et al., 2001 and Al-Lami et al., 2002; Al-Saad et al., 2010 and Assad, 1986) had accomplished several studies on the ecological and biological aspects of the Iraqi inland waters.

Euphrates river is one of the main two sources for freshwater. Several branches emerge from this river during its running course in Iraq until achieving the southern sector at Basrah province. Waters of the river are considered warm and fresh with steadily increasing salinity as we headed southerly towards the Gulf. The water is generally alkaline (Hussein et al., 2000; Hussein et al., 2006 and Hussein et al., 2008), all over the year reflecting the status of the entire inland waters. However plenty of studies were accomplished on the Euphrates River (Fahd, 2001; Salman, 2006; Tamimi, 2004; Kredy, 2006; Al-Shawi et al., 2007 and Saleh, 2007; Al-Shamm`a, 2009; Al-Noor et al., 2009; Zidane et al., 2009; Salman et al., 2010; Algum and Abdel Moneim, 2011; Al-Shidood, 2012; Al-Ghalibi et al., 2013 and Abdullah, 2015), but no such previous work was executed on the middle reaches of the Euphrates river. This work, however, consider investigation the abiotic conditions in this sector of the river.

*Author for correspondence: E-mail: sdk_hussein@yahoo.com
Materials and Methods

Description study area

The Euphrates river occupies the twenty-fourth position among the world rivers. It is one of the longest rivers in Asia continent (Whitton, 1975). It emerges from the mountains of southeastern Turkey, northern land of Room area with an altitude exceeding 3000 m above sea level (Al-Masoudi, 2000). Euphrates is one of the two main rivers emerging the Iraqi territory and run internally as long as 1060 kilometers or about 35% of its total length measuring 2800 km (UNESCO, 2002) is situated in Iraq (Frenken, 2009). The rest portion passes in Turkey and Syria. The river is classifies within the category of the longest rivers in the world and is one of the longest rivers in the Middle East (Jehad, 1984).

This river does not feed any tributary in Iraq (Assad et al., 1986), but several branches emerge out penetrating the agricultural lands and the adjacent areas of the river basin through its course in Iraq until reaches the city of Basrah. Several important dams were established on the river inside Iraq namely, Al-Qadisiyah dam constructed in 1987 and Al-Hindiya dam. The quality of water of the Euphrates start to deteriorating when leaving Shinafiyah in Diwaniya province, after it passes Samawa saline location as a result of groundwater springs areas of Um Guelleh and Abu Ehlayel, which can increase the salinity up to 6.4 g/L (Hussein et al., 2006). The River runs through the province of Thi Qar of the North West Frontier at Batha city and ends in Fudhaliyah at the south-eastern border. Fig. 1 shows the location of sampling in the Euphrates river.

This river is considered one of the most important sources of fresh water for human consumption, watering plants, industrial purposes and navigation. However, salinity increases as directed downstream as a result of releases drainage water from adjacent agricultural lands as well as sewage and residential areas.

The marshlands that penetrates by the river after passing the city of Nasiriyah, is drained according to an irresponsible measure of the previous regime which is considered as the era environmental criminal offense. Plenty of irrigation canals and drainage were established but the river kept the main track to follow. Several dams were also established along the Euphrates River in Iraq in order to protect cities from flood risk and to meet the purpose of providing water resources for agriculture, power generation, domestic uses and to be exploited for tourism purposes. Al-Kubaisi (1996) pointed out the relative improvement of Tigrisand the Euphrates Rivers water quality as a result of the establishment of the main drainage canal (the third river), which led to the provision of new water locations could be exploited in aquaculture (Al-Saadi et al., 1999) depending on a thorough study of the location concerning the environmental and health matters. The aim of the third river is to discharge salty water from the surrounding cultivated lands with discharge capacity of 80 million tonnes per annum (Hussein et al., 2000). However, the Euphrates river is regarded as warm water location allowing environmentally aquaculture suitability (Al-Saadi et al., 1999) and could harbor many species of local fish communities.

Many aquatic and semi-aquatic plants are grown in
the study area as reed (*Phragmites australis*), shilint (*Ceratophyllum demersum*), bardy (*Typhado mingensis*), barbin Jiddawi (*Phyla nodiflora* L), cholan (*Cyperus mallaccensis*). Palm groves, vegetables lands and residential citizens houses are spread on the banks of the river, which is inhabited with those practicing the agriculture, fishing and livestock. Some waterfowl spread in the region. River also contains many local and exotic fish species i.e. himri (*Barbus luteus*); Shillig (*Aspius varax*); jerry (*Silurus triostegus*); common carp (*Cyprinus carpio*); broadband siminan (*Acanthobramam armid*); tilapia (*Tilapia zilli*); shaboot (*Barbus grypus*); Khishni (*Liza abu*) and other freshwater fishes known to be present in Iraq. The river also contains invertebrates as mollusca; crustaceans and various categories of aquatic insects.

Air and water temperatures were measured by a simple mercury thermometer (0-100°C). light penetration was calculated by using Secchi disc 30 cm diameter. Turbidity was determined by turbidity meter. Salinity concentrations was measured by conductivity meter type TOA Model CM-SET. The reading multiplied with 0.64 to obtain the salinity as part per thousand (ppt.).

Winkler method described in Welch (1964) was adopted in measuring the amount of dissolved oxygen (ppm) in such unpolluted natural water (ppm). The method described by the American Health Association (APHA, 2005), which is based on measurement of two samples of water in the field and preserved under 20°C, was used to determine the biological oxygen demands (BOD) (ppm). pH meter type GTCmodel Lesibolo used in the measurement of pH value. The device was calibrated using buffer solutions with pH values of 4, 7 and 9. Wood *et al.* (1967) method modified by Strickland and Parson (1972) and described in Parsons *et al.* (1984) was adopted to determine reactive nitrates (NO$_3$) using a spectrophotometer type 4050 LKB wavelength 543 nm and after deducting the amount of nitrite the level of nitrates was obtained (µg N atom/liter).

Reactive phosphate (PO$_4$) was determined by Murphy and Riley (1962) method described in Parson *et al.* (1984) using a spectrophotometer at wavelength of 885 nm (µg P atom / liter).

**Results**

Table 1 and fig. 2 shows seasonal changes in air and water temperatures in the study area at the Euphrates River for the period from February 2013 to January 2014. Results, in general, indicate a marked contrast in values over the year as a gradual rise take place after winter, the season recorded the lowest values, passing through the spring to give the highest in the summer. The lowest air temperature value (16°C) was obtained in winter and the highest (43°C) in summer. Other seasons showed relative stability in air temperatures. On the other hand, the lowest value of water temperature was encountered in winter as well (13°C) whereas the highest (36°C) in the summer. Similarly, relative stability was noted in the rest period of
Fig. 3 shows seasonal changes in light penetration in the study area from the Euphrates river. Values showed a notable rise all the year round and the lowest (80 cm) was recorded in the spring, but the highest (128 cm) in the winter. Values, however, were almost resembling each other in the other periods of the year.

Fig. 4 shows seasonal changes in turbidity values in the study location of the Euphrates River. Results indicate a marked contrast between the different seasons of the year, but the lowest (8 NTU) encountered in the summer. It was almost resembling that recorded in spring and the highest (24 NTU) was encountered in the fall, followed by winter (17.3 NTU).

Table 1 and fig. 5 show seasonal changes in salinity concentrations in the study area. The concentrations revealed a relatively little increase than the normal values in the location with noted decline during warmer period of the year, and were almost resembling each other’s in the other seasons. The lowest value (2.21 ppt.) was recorded in the summer and the highest in winter and autumn (2.57 ppt.). However, in spring it was closer to the highest detected level.

Fig. 6 reveals seasonal variations in the dissolved oxygen levels in the studied habitat. D.O concentrations showed a significant rise in the spring (9.9 ppm) and winter (9.6 ppm) synchronized with the booming of aquatic vegetation and the decline in water temperatures, respectively. The lowest recorded values (6.6 ppm) were encountered in summer and fall (7 ppm), exhibiting the inverse correlation with water temperature. However, they were still acceptable for supporting the requirements of the aquatic life.

Fig. 7 shows seasonal fluctuations in values of the biological oxygen demands (BOD) in the investigated location. Values were generally low, that characterize such environments with continuous water movement. However, Values exhibited a significant increase in summer (1.94 ppm), while in winter and spring they were much lower and resembling each other (0.5 ppm). The lowest value of BOD (0.32 ppm) was encountered in autumn.

Fig. 8 reveals seasonal variations in the pH values of the study area. The hydrogen ion concentrations were generally in the alkaline direction, which distinguish Iraqi waters in general. The highest were detected in fall (8.3) and summer (8.1), whereas the lowest in the spring (7.9), but never decline towards the neutral or acidic direction.

Table 1 shows seasonal variations in environmental characteristics values in the southern sector of the Euphrates River for the period from February, 2013 to January, 2014.

<table>
<thead>
<tr>
<th>Month</th>
<th>pH</th>
<th>PO₄ (µg/L)</th>
<th>NO₃ (µg/L)</th>
<th>%S</th>
<th>D.O Mgl/L</th>
<th>Turb. NTU</th>
<th>BOD Mgl/L</th>
<th>Water Temp.ºC</th>
<th>Air TempºC</th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter</td>
<td>7.96</td>
<td>0.15</td>
<td>23</td>
<td>2.57</td>
<td>9.09</td>
<td>17.3</td>
<td>0.5</td>
<td>13</td>
<td>16</td>
<td>Winter</td>
</tr>
<tr>
<td>Spring</td>
<td>7.9</td>
<td>0.08</td>
<td>13</td>
<td>2.49</td>
<td>9.9</td>
<td>7.9</td>
<td>0.5</td>
<td>24</td>
<td>28</td>
<td>Spring</td>
</tr>
<tr>
<td>Summer</td>
<td>8.1</td>
<td>0.05</td>
<td>1.6</td>
<td>2.21</td>
<td>6.6</td>
<td>8</td>
<td>1.94</td>
<td>35</td>
<td>43</td>
<td>Summer</td>
</tr>
<tr>
<td>Autumn</td>
<td>8.3</td>
<td>0.1</td>
<td>1.8</td>
<td>2.56</td>
<td>7</td>
<td>24.1</td>
<td>0.32</td>
<td>27</td>
<td>32</td>
<td>Autumn</td>
</tr>
</tbody>
</table>

Fig. 5: Seasonal changes in salinity in the study area of the Euphrates for the period from February 2013 to January 2014.

Fig. 6: Seasonal changes dissolved oxygen values in the study area of the Euphrates from February 2013 to January 2014.
Biological and Ecological Characteristics of Asian jeery

value (1.3 µg/L) were encountered in spring.

Fig. 10 reveals seasonal variations in active phosphate concentrations in the study area of Euphrates river from February 2013 to January 2014.

Discussion

Results of the present work showed seasonal variations in values of air and water temperatures. These changes may be due to differences in the brightness of the sun, the length of daylight, the degree of purity of the sky and season (Hussein et al., 1992; Hussein and Attee, 2000).

Water temperature is exclusively a very vital parameter in aquatic environment. Quite few workers, were pointed out that this category is one of the most sensitive ecological abiotic factors in water ecosystem (Hussein, 1983; Hussain et al., 1992; Hussein et al., 1992; Hussein and Al-Kanaani, 1989; 1991; 1993; Lampert and Sommer, 1997 and Hussein and Mahdi, 1999). However, water temperature, in addition to the sun energy and the climate, is affected by several internal parameters including water movement, surface irritation and current flow and velocity that lead to thorough mixing of water masses and homogeneity of temperature in the water column (Hussein et al., 2000; Hassan et al., 2001).

Temperature is also one of the most environmental factors controlling the abundance, distribution, growth and nutrition of aquatic organisms together with their biological and phylogenetic activities (Araujo et al., 2000; Power et al., 2000; Hussein et al., 2000; Hussein et al., 2002). Changes in water temperature was coincided with that of air, with minor differences during the winter. However, high values were encountered in summer stimulating ecological and biological activities of aquatic inhabitants. This is consistent with a number of researchers (Hussein et al., 1992; Al-Shamma et al., 1997; Hussein et Attee, 2000; Hussein et al., 2002), who have also made it clear that thriving, production and growth in warm waters are much faster than in colder ones.
Light permeability is a physical environmental characteristic possessing a direct effect on growth of aquatic plants, algae and phytoplankton, and their spread on the water surface. It also has an indirect effect on the distribution, propagation, and feeding of fish species and other aquatic organisms (Hussein and Fahad, 2008). They are inversely associated with the turbidity. However, both parameters are affected by dissolved and suspended materials in the water medium along with water movements, light intensity, and the prevailing weather conditions (Hussein and Attee, 2000). Results of the study revealed a relative decrease in values of light penetration in the spring and autumn. This might be due to several factors including weather conditions such as the degree of sky purity, presence of dust, the angle of light incidence, light intensity, and the amount of suspended matter in the water column together with the water movement and turbidity (Hussein and Fahad, 2008; Abdullah et al., 2001), in addition to decomposition of organic matters and sources of domestic waste. The degradation of organic matters leads to flourishing of algae that have a significant role to decrease penetration values (Hussein et al., 2000; Al-Lami et al., 2001). The rise in values of light penetration may be due to the lack of water movement, low turbulence and stability of the suspended materials. Hussein et al. (2006) achieve the same conclusion on the Euphrates River at the city of Nasiriyah. Water turbidity is a measure of suspended and dissolved materials (Al-Lami, 1998; Hussein and Attee, 2000) and has a reverse impact on photosynthesis processes as a result of dispersion and absorption of light (Farrakha, 2005). Turbidity is also attributed to the solid materials created in the water column as a result of silt and clay, or may be related to the existence of microorganisms and plankton (Abawi and Hassan, 1990). The variation in their values is related to the current speed, irritation the bottomsediments and erosions might be occur on the banks, as well as the materials in suspension, turbulence and the impact of domestic sewage and organic matters (Al-Saadi et al., 1999; Hussein 2001), in addition to topography and human activities (Fleeming, 1977). Aquatic plants, however, reduce turbidity through their activity as a natural filter for suspended substances (Scheffer, 1999).

Dissolved oxygen is considered as the lifeblood of the aquatic environment and the determinants of life (Peithakis et al., 1999). D.O. concentrations are influenced by the prevailing ecological and living environmental characteristics. Results showed higher dissolved oxygen values during winter and spring than in other seasons of the year. This may be due several factors mainly to the increase in dissolving rates which are inversely proportional to the temperature (Hussein et al., 2002), to low consumption by inhabitants due to reduce movement and decline in activity (Hussein and Fahad, 2008) and decrease in growth and thriving of aquatic vegetation. The increase in spring, may be related to the growth and flourishing of phytoplankton and algae (Al-Hamdaoui, 2009).

Best and Ross (1977) pointed out that BOD is a measure of the amount of oxidized and decomposed organic matters by microorganisms. Results showed that levels of BOD increased during the summer and fall. This may be attributed to the degradation of organic waste discharged directly to the river along with sewage and domestic water. This is consistent with Hussein et al. (2002) who studied Al-Khouri canal in Basrah. The present study pointed out that the BOD values never exceeded 10 mg/L, the sign indicates deterioration of water quality. This may be related to river runoff and the continuous movements of water masses (Hynes, 1970).
Organic matter flowing into the river contributes to a worsening of blooming. Hussein (2001) also referred to this phenomenon through investigating the causes of organic pollution in Iraqi inland waters. Al-Galeby (2013), however, attributed this to the effect of high temperatures on increasing microorganism activities and the degradation of organic matter, leading to higher values of the BOD. This is consistent with the conclusion of Al-Moel (2010) and Sabah (2007).

Results of pH were in the alkaline direction and were in agreement with findings of other inland studies (Hussein et al., 1992; Hussein et al., 2000; Hussein et al., 2008; Al-Shamma et al., 1997; Taher, 1986; Salman et al., 2008 and Al-Hamdawi, 2011), with a relative increase in values during the winter due to the dominance of bicarbonates (Fahd, 1999; AL-Lami et al., 2005, 1999). This is consistent with many environmental studies (Lafta et al. (2010), who investigate Kufa river; Hussein et al. (2013) on the Shatt al-Arab River and Hussein et al. (2006) on the Euphrates River on the city of Nasiriayah. However, low values recorded during the spring may be due to bio-decomposition of organic matter, as noted by Al-Galiby et al. (2013).

pH values obtained in the current study were among the Iraqi determinants of potable water for the year 2001 and the legislations for rivers maintenance from pollution No. 25 of 1967 and the amendments thereto (pH = 6.6-8.5) and within the appropriate limits of feeding and growth (Svobodova et al., 1993). Brown (1980) noted that many factors may affect pH levels in natural water bodies, including free carbon dioxide and precipitation (Hynes, 1970).

Nitrates represent the predominant form of inorganic nitrogenous compounds in the water medium and rarely have a concentration of 10 mg/L (Lind, 1979). The high concentration may be attributed to domestic sewage and organic waste discharged from agricultural lands adjacent to the water body (Hussein, 2001; Glayem, 2001). The highest values encountered in the winter due to the lack of use by the plant components and the high concentration of oxygen that contributes to nitrite oxidation process. As well as due to the drift from nearby agricultural areas as fertilizer (Glayem, 2001; Hussein, 2001, Hussein and Fahad, 2008). However, the decline in concentration in other seasons, especially in the spring, may relate to the rise in consumption by phytoplankton, algae and higher aquatic plants. This is coincided with the results of Hussein and Fahad (2008) and Al-Asadi (2014).

One of the most important sources of phosphorus in the aquatic environment is detergents, organic wastes and phosphorous fertilizers (Hussein, 2001; Glayem, 2001 and Hussein et al., 2008). Mixing processes contribute to the release of phosphates from sediments (Farkha, 2005). Phosphates is one of the most important nutrients for the growth of plant components, and its increase leads to the eutrophication phenomenon (Hussein, 2001; Sharpley et al., 2004).

References
cadmium from the Euphrates River at the city of Nasiriyah. 

MSc. Thesis, Thi Qar University, Coll. Education for Pure Sciences, 97 p.(in Arabic)


