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Estimation of The Physico-Chemical Parameters in Marine Environment (Yumurtalik Bight- Iskenderun Bay)

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ABSTRACT

The study was carried out to estimate the temperature, light intensity, salinity, Dissolved O_2 (DO), pH values and the biotic parameter chlorophyll- *a* in the water column related with the depth. Because, the physico-chemical parameters affect greatly both primary and secondary producers in marine life. For this purpose the physico-chemical properties were determined day and night for 40 meter depth during the eight days. The means were compared by using the analysis of variance method and Duncan's Multiple Comparison Test. Also physico-chemical parameters were estimated by using the analysis of regression and correlation. The effect of temperature and salinity were found significant according to the result of the analysis of variance during the day. Also the similar results were found for the night. While the effect of the depth on the chloropyll-*a* a was significant in the night, the effect of the depth on the DO was not significant in the day and night. The correlations among the depth and the parameters were defined. It was found the negative correlation between the depth and the temperature and light intensity. Determination coefficient of the model for salinity was also found different for day time. The correlation values among the depth and the temperature, salinity and pH were found different for the night.

Introduction

Biotic and abiotic interactions are associated with the living organisms in the water. The abiotic factors are important to understand the variation in diel? Vertical migration of the planktonic organisms, especially zooplankton. It is known that the primer productivity is affected from the environmental factors such as, temperature, light intensity, salinity, Dissolved O_2 (DO) and, pH. The hydrographical and hydrochemical properties are important to clarify the phytoplankton and zooplankton migrations and abundance at the different depths of the water column. The data related with the food chain in the marine environment can help to carry out the fisheries activities in coastal waters, effectively. The studies have been carried out in the region about the hydrographical and hydrochemical properties of the region and the effect of the physico-chemical factors on the phytoplankton abundance and seasonal distribution of protozooplankton (Akyuz, 1957; İyiduvar, 1986; Avşar and Çiçek, 1999).

The objective of this study was to estimate the temperature, light intensity, salinity, DO, pH values and the chlorophyll- *a*content at the different depths of the water column for day and night in Yumurtalik Bight, Iskenderun Bay, north-eastern Mediterranean, Turkey in July.

Materıal and Methods

The study was carried out between 1-8 July in 2004. The measurements were performed at the depths of 0-10,10-20,20-30,30-40 meters in Yumurtalik Bight (Iskenderun Bay, 36º42´ 348 N, 35º 46´ 330 E), north-eastern Mediterranean, Turkey. Temperature, light intensity, DO, salinity and pH were measured daily with the YSI 650 model CTD around mid-day (12:00 am) and mid-night (24:00 pm) at the station determined by GPS (Garmin GPS12 model)

Phytoplankton abundance was connected with chlorophyll *a* concentration (µg L^{-1}). Water samples were taken from the five depths by Nansen bottles. Two litres of water samples were filtered through glass-fibber filter papers (Whatman GF/C) for the chlorophyll *a* (chl *a*) measurements. Concentrations were determined by a UV-VIS SHIMADZU-1240 Spectrophotometer after extraction in 90 % acetone and held at 4 ºC for 24 h in the darkness. The chl *a* amount was calculated from the following equation,

$Ca = 11.6.\ D_{665}\text{-}1.31\ D_{645}\text{-}0.14\ D_{630}$,
Chl *a* (µg L^{-1}) = Chl *a*.v / V.l

Where,
V: Volume of water filtered for extraction

v: Volume of acetone used
l: pathlenght (in cm) of cuvette (Parsons, et al., 1963).

The analysis of variance method and Duncan's Multiple Comparison Test were used to compare the means (Gill, 1955). The regression and correlation methods were used to determine the relationship between the depth and the physico-chemical factors (Draper, 1966).

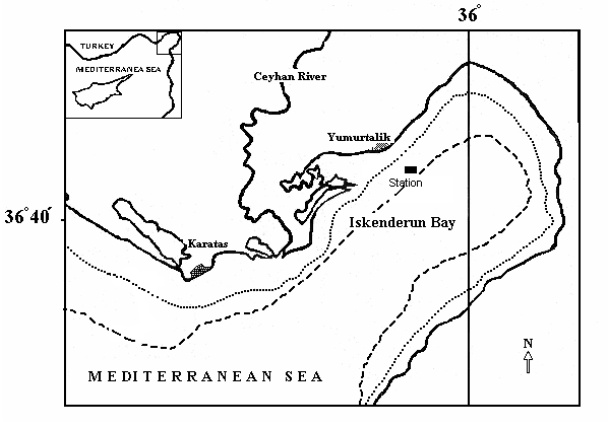

Figure 1 Sampling Station in Yumurtalik Bight

Results

The highest temperature at the surface water was recorded around the midday hours. The temperature was decreased by increasing of the depth. The lowest temperature was measured at the depth of 40 m. The salinity was also changed by the depth during the day according to the result of the analysis of the variance ($P<0.05$) (Table 1, 2, 3).

The effect of the depth on the temperature and salinity was also significant statistically during the night ($P<0.05$) (Table 4, 5). The temperature was decreased by increasing of the depth.

The salinity valuesin 20, 30 and 40 m depths were found higher than surface and 10 m depth of the water. The dissolved oxygen values determined for different depths were similar during the day and night ($P>0.05$). The effect of the depth on the chlorophyll *a* was found significant statistically for the night ($P<0.05$) (Table 5). The highest chlorophyll-*a* value was observed at the depth of the 40 meter in the night. The chlorophyll-*a* amounts of the other depths were found similar.

The correlation among the parameters and the depth were determined for day time data. While the negative correlation was found between the depth and the temperature and depth and the light intensity ($P<0.01$), the positive correlation was found between the depth and the salinity during the day. The temperature and light intensity decreased with the increasing of the depth. ($P<0.05$) (Table 6).

The regression model of the depth and temperature was estimated for the day values as Temperature = 28.464 – (0.896) depth.

Table 1 The effect of the depth on the temperature of the seawater in the day.

Depth	Temperature
40 m	23.7[a]
30 m	24.9[b]
20 m	26.2[c]
10 m	26.8[d]
Surface	27.3[e]

The different letters in the same row denote significant differences ($P<0.05$).

Table 2 The effect of the depth on the salinity of the seawater in the day.

Depth	Temperature
Surface	38.2[a]
10 m	38.3[ab] 38.5
20 m	38.3[ab] 38.5
30 m	38.7[b]
40 m	38.7[b]

The different letters in the same row denote significant differences ($P<0.05$).

Table 3 The effect of the depth on the temperature of the water in the night.

Depth	Temperature
40 m	23.2[a]
30 m	24.6[b]
20 m	25.7[c]
10 m	26.9[d]
Surface	26.9[d]

The different letters in the same row denote significant differences ($P<0.05$).

Table 4 The effect of the depth on the salinity of the seawater in the night.

Depth	Temperature
Surface	38.2[a]
10 m	38.5[b]
20 m	38.7[c]
30 m	38.7[c]
40 m	38.7[c]

The different letters in the same row denote significant differences ($P<0.05$).

Table 5 The effect of the depth on the chlorophyll *a* in the night.

Depth	Temperature
20 m	0.26[a]
30 m	0.27[a]
10 m	0.31[a]
Surface	0.34[a]
40 m	0.51[b]

The different letters in the same row denote significant differences ($P<0.05$).

The parameters in the regression model were found significant statistically so the regression model was found significant ($P<0.01$) Determination coefficient (R^2) of the model was calculated as 0.854. While the temperature of

the surface water is 28.464ºC in the day, it is expected that the temperature decrease 0.896ºC for each 1 meter increased.

The regression model of the depth and light intensity was estimated for the day values as:

Light = 1106.431 – (241.346). Depth

The parameters in the regression model were found significant statistically so the regression model was found significant ($p<0.01$). Determination coefficient (R^2) of the model was calculated as 0.581. While the light intensity of the surface water is 1106.431 µmol m^2s^{-1} in the day, it is expected that the light intensity decrease 241.346 µmol m^2s^{-1} for each 1 meter increased.

The regression model of the depth and salinity was estimated for the day values as:

Salinity = 38.107 + (0.128). Depth

The parameters in the regression model were found significant statistically so the regression model was found significant ($p<0.01$). Determination coefficient of (R^2) the model was calculated as 0.208. While the salinity of the surface water is 38.107 ppt in the day, it is expected that the salinity increased 0.128 ppt for each 1 meter increased.

The correlation value among the pH, chlorophyll-*a*, DO and the depth weren't significant and the regression models weren't estimated for the parameters for day time. This situation was shown in Table 6.

The correlation among the parameters and the depth were determined for the night time data. While the correlation among the depth and the temperature, salinity and pH were found significant ($P<0.01$), among the DO and chlorophyll *a* were found insignificant ($pP>0.05$). The regression models weren't estimated for DO and chlorophyll *a* since the correlation values were low. The negative correlation between the depth and the temperature and the depth and pH was found during the night ($P<0.01$). The temperature and pH levels decreased with the increasing of the depth ($P<0.05$) (Table 7).

The correlation among the parameters (depth, temperature, salinity, pH, DO and chlorophyll *a*) were shown in the Table 7.

The regression model of the depth and the temperature was estimated for the night values as:

Temperature = 28.405 – (0.958).Depth

The parameters in the regression model were found significant statistically so the regression model was found significant ($P<0.01$). The determination coefficient (R^2) of the model was calculated as 0.84. While the temperature of the surface water is 28.405ºC in the night it is expected that the temperature decrease 0.958ºC for each 1 meter increased.

The regression model of the depth and pH was estimated for the night as:

pH = 7.12 - (0.006).Depth

Table 6 The correlation among the depth, temperature, salinity, pH, DO and chlorophyll *a* in the day

	Depth
Depth	1
Temperature	-0.924**
Salinity	0.456**
pH	-0.189
DO	-0.216
Light	-0.762**
Chl a	0.235

**: P<0.01; *: P<0.05

Table 7 The correlation among the depth, temperature, salinity, pH, DO and chlorophyll *a* in the night

	Depth
Depth	1
Temperature	-0.916**
Salinity	0.652**
pH	-0.377*
DO	-0.118
Chl a	0.206

**: P<0.01; *: P<0.05

The parameters in the regression model were found significant statistically so the regression model was found significant ($P<0.01$). The determination coefficient (R^2) of the model was calculated as 0.142. While the pH of the surface water is 7.12 in the night, it is expected that pH decrease 0.006 for each 1 meter increased.

Positive correlation was found between the depth and the salinity levels. The regression model of the depth and the salinity was estimated for the night values as:

Salinity = 38.278 + (0.108).Depth

The parameters in the regression model were significant statistically so the regression model was significant ($P<0.01$). The determination coefficient (R^2) of the model was calculated as 0.426. While the salinity of the surface water is 38.278 ppt in the night, it is expected that the salinity increase 0.108 for each 1 meter increased.

Regression equation for day at 40 m is:

Chlorophyll *a*=-204-0,814T-16,2S+7,6 pH+0,331O_2+ 0,0137 C (R^2=0.64868.4)

Regression equation for night at 40 m is:

Chlorophyll *a*=179-0,392T-4,00S-31,0 pH-0,594O_2+ 0,00361 C (R^2= 0.609)

Discussion

Yılmaz et al, 1992 reported that the surface water salinity was measured approximately as 39 ppt and the temperature was measured as 29ºC at the study in Iskenderun bay. Polat et al., 2006 found that the surface water salinity has changed between 33.6 and 37.1 ppt, and the temperature has also changed from 15.8ºC to 32.8ºC

in Iskenderun Bay. In the same region, Lakkis and Toklu, 2007 stated that the temperature was 29^{o}C at the surface; the salinity was 28-38 ppt in July-August. Terbıyık and Polat, 2012 notified that salinity was between 38.06 and 41.7 ppt, while the temperature ranged from 18.52 to 29.12 ^{o}C and DO ranged from 4.46 + 0.24 mg L^{-1} to 7.96 + 0.06 mg L^{-1}, Chlorophyll *a* varied from 0.42 + 0.08 µg L^{-1} to 1.08 + 0.14 µg L^{-1} in Iskenderun bay. Terbıyık Kurt and Polat, 2014 found that salinity changed between 36.96 and 41.78 ppt, the temperature varied from 17.55 to 29.23^{o}C at their study in Iskenderun Bay. Similar results were obtained in this study too. The surface water salinity was 38 ppt, the temperature approximately has been changing between 26 and 28^{o}C. However, the temperature decreased until 22^{o}C at 40 m.

The study area, Yumurtalik Bay was affected from the anticyclonic stream system observed at the surface water out of the bay, and also observed that cyclonic stream (Akyüz, 1957; İyiduvar, 1986). The effect of the depth on the temperature and salinity was observed during the day. During the night the effect of the depth on the temperature, salinity and chl *a* wasobserved.

Conclusions

The fisheries activities were carried out in the region and it was known that the physical and chemical properties are important for the food chain in the aquatic environment. The estimation of the some physico-chemical parameters will be support the studies about the primary and secondary productivity of the area. In addition to the insignificance of the determination coefficient (R^2) of the models for the parameters of DO and chlorophyll *a* can be related with the streams in the area. The regression models of the depth and the temperature, salinity, light intensity and pH can be use for the fisheries activities in the region.

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