NUTRIENT AND CHLOROPHYLL *A* DISTRIBUTION IN RELATION TO WATER COLUMN STRUCTURE IN THE MALI STON BAY (SOUTHERN ADRIATIC)

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Sampling was performed once a month at Usko station (12 m max. depth) in the Bay of Mali Ston from February 88 to February 89. The Bay of Mali Ston is an unpolluted area favouring oyster and mussel farming. This area is influenced by the fresh water income from the Neretva river at the outher part and submarine springs in the inner part. Parameters were determined by standard oceanographic methods (STRICKLAND and PARSONS, 1972).

The aim of this work has been to describe the distribution of nutrients and chlorophyll *a*, as well as their respective correlation to hydrodynamic characteristics of the water column. According to these hydrodynamic characteristics of the water column recorded throughout the year, two different periods were observed to exist : mixing (October-April) and stratification (May-September). During the stratification period, water column was divided into three layers: above, at and below pycnocline depth. The data on ranges, means and standard deviations of parameters investigated for annual, mixing and stratification periods are presented in Table 1. During the stratification period, all the parameters, except ammonia and reactive silicate, had the lowest range, mean and standard deviation. As regards the parameters above, at and below pycnocline, maximum values, excepting ammonia, were found above pycnocline depth. Significant difference between the layers was found only in nitrate and reactive phosphorus (Table 2).

Table 1. Range, mean, standard deviation (SD) of nutrients and chlorophyll *a* in annual, mixing and stratification periods.

	Annual (n=83)			Mixing (n=49)			Stratification (n=34)		
	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
c (NO_3)	0.96	1.54	0.01-9.73	1.28	1.90	0.06-9.73	0.53	0.65	0.00-2.52
c (NO_2)	0.14	0.22	0.01-1.11	0.21	0.27	0.01-1.11	0.04	0.03	0.01-0.13
c (NH_4)	0.72	0.84	0.01-3.98	0.62	0.60	0.05-2.20	0.86	0.89	0.01-3.98
c (TIN)	1.82	1.82	0.14-10.70	2.10	2.12	0.17-10.70	1.43	1.24	0.14-5.02
c (PO_4)	0.09	0.06	0.01-0.33	0.09	0.06	0.01-0.33	0.08	0.05	0.03-0.29
c (SiO_4)	2.92	1.77	0.21-7.15	3.16	1.70	0.21-6.18	2.59	1.85	0.37-7.15
φ O_2/O_2'	1.09	0.10	0.86-1.32	1.03	0.08	0.86-1.32	1.18	0.05	1.06-1.29
Chl *a*	1.44	1.54	0.21-6.73	1.94	1.84	0.25-6.73	0.77	0.37	0.21-1.58

c- μmol dm^{-3}, chl a - μ_g dm^{-3}

Table 2. The means of nutrients and chlorophyll *a* in pycnocline layers.

Layers	NO_3	NO_2	NH_4	TIN	PO_4	SiO_4	O_2/O_2'	Chl *a*
Above	1.10^{a*}	0.05	0.78	1.94	$0.11^{a,a*}$	3.46	1.20	0.86
At	0.39^{b*}	0.03	0.71	1.13	$0.05^{b,b*}$	2.22	1.19	0.73
Below	0.20^{b*}	0.04	0.94	1.19	0.08^{c}	2.34	1.16	0.73

*The means in the same column followed by different superscript are significantly different P<0.05, with * P<0.01 (ANOVA, SNK-multiple range test).*

A simple correlation coefficient, both negative and positive, was found among chlorophyll *a* and nutrients (Table 3). The correlation was not established to exist on an annual basis, except for nitrite. Chlorophyll *a* was significantly correlated to ammonia, total inorganic nitrogen (P<0.001), nitrite, reactive silicate (P<0.01) and reactive phosphorus (P<0.05) during the stratification period. During the mixing period, chlorophyll *a* significantly correlated only with reactive silicate (P<0.001). During the stratification period (at different levels), chlorophyll *a* significantly depended upon reactive silicate, ammonia and total inorganic nitrogen above pycnocline depth, with nitrite, ammonia, total inorganic nitrogen and reactive phosphorus (P<0.01) below pycnocline depth (Table 4). At pycnocline depth, the depedence was not established.

An intensive development of phytoplankton preceding the stratification period caused a decrease in concentration of most nutrients. An increase in reactive silicate concentration was caused by a haline stratification, namely, a fresh water influx, while high ammonia concentration recorded throughout the water column and especially below the pycnocline is indicative of a high heterotrophic activity. Most significant correlations between chlorophyll *a* and nutrients were found during the stratification period, especially below pycnocline depth.

Table 3. Simple correlation coefficients between chlorophyll *a* and nutrients for annual data (A),mixing (M) and stratification (S) periods.

		NO_3	NO_2	NH_4	TIN	PO_4	SiO_4
	A	0.033	0.299*	0.066	0.172	0.207	-0.182
Chl *a*	M	-0.215	0.175	0.179	-0.030	0.195	-0.522***
	S	0.229	0.537**	0.631***	0.583***	0.401*	0.539**

** P<0.05, ** P<0.01, *** P<0.001.*

Table 4. Simple correlation coefficients between chlorophyll *a* and nutrients in three layers during stratification period.

		NO_3	NO_2	NH_4	TIN	PO_4	SiO_4
	Above	0.442	0.486	0.612*	0.642*	0.377	0.866***
Chl *a*	At	-0.308	0.058	0.552	0.404	-0.107	0.152
	Below	0.078	0.599**	0.684**	0.677**	0.607**	0.190

** P<0.05, ** P<0.01, *** P<0.001.*

REFERENCE

STRICKLAND J. D. H. and PARSONS T. R., 1972. A practical handbook of seawater analysis. *Bull. Fish. Res. Bd. Can.*, 167 : 310 p.