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BULGARIAN BLACK SEA DATABASE MANAGEMENT: HYDROLOGICAL AND HYDROCHEMICAL SEGMENT

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Abstract: *Since the early 1950s Institute of Fishing Resources - Varna, Bulgaria has been carried out hydrological and hydrochemical observations both in the coastal and open-sea zones in front of the Bulgarian Black Sea coast, assessing the environmental conditions.Since 1992 research in the 30-mile Black Sea zone in front of the Bulgarian coast, down to 150-metre isobath was done, with aim hydrological and hydrochemical base to be built and managed. Research was done in front of Capes Galata, Emine, and Kaliakra along transects with 5 stations each, perpendicular to the Bulgarian coast. Since 1992 study of Varna Bay was carried out at 10 stations, with a control station since 1995. During 1994-1998 research in Burgas Bay was performed at a net of 12 stations. The hydrological and hydrochemical Bulgarian Black Sea database allows research in a variety of marine science's fields. General view for the carried out research was done.*

Keywords: *Database Management, Hydrology, Hydrochemistry, The Black Sea.*

Introduction

Since the early 1950s Institute of Fishing Resources - Varna, Bulgaria has been carried out hydrological and hydrochemical observations both in the coastal and open-sea zones in front of the Bulgarian Black Sea coast, assessing the environmental conditions (Rojdestvensky, 1978; Rojdestvensky, 1986).

Since 1992 research both in the 30-mile Black Sea zone in front of the Bulgarian coast, down to 150-metre isobath and in the Bay waters was done, with aim hydrological and hydrochemical database to be built and managed.

Such a database allows research in a variety of marine science's fields.

Material and Methods

Observations were performed aboard the IFR R/V Prof. A. Valkanov.

Since 1992 research was done in front of Capes Galata, Emine, and Kaliakra (Figure 1), along transects with 5 stations each, perpendicular to the Bulgarian coast. Stations were selected to reflect gradients in properties, with a control station at 3-miles in front of Cape Galata since 1995. Sampling was performed at standard depths (0, 10, 25, 50, 75, 100, 150 m).

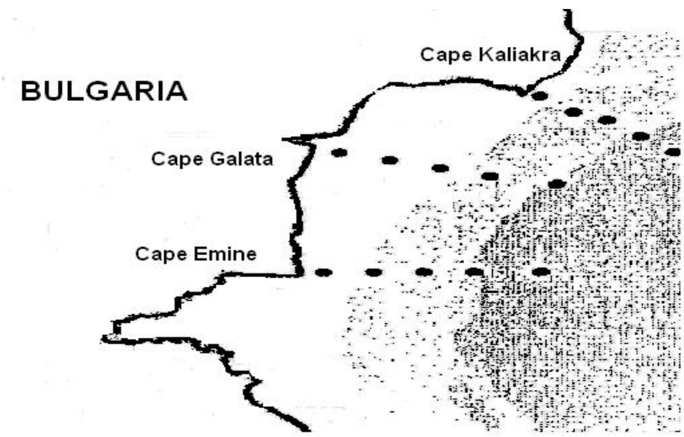

Figure 1. Map of sampling stations in front of the Bulgarian Black Sea coast ahead of Capes Kaliakra, Galata and Emine.

Since 1992 study of Varna Bay was carried out at 10 stations, with a control station (St.5 in Figure 2) since 1995.

During 1994-1998 research in Burgas Bay was performed at a net of 12 stations (Figure 3).

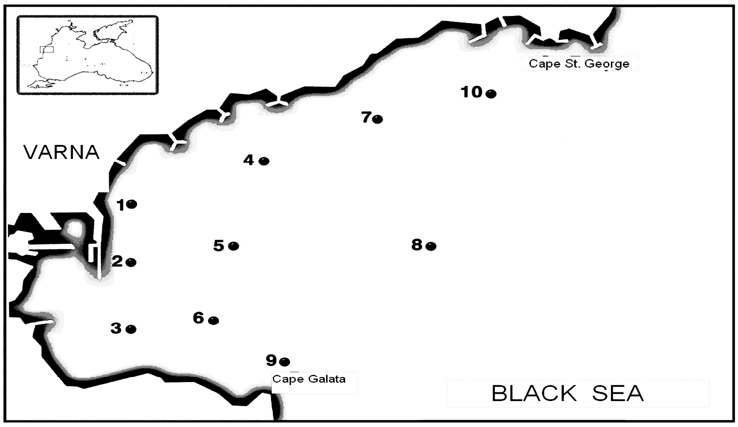

Figure 2. Map of sampling stations in Varna Bay

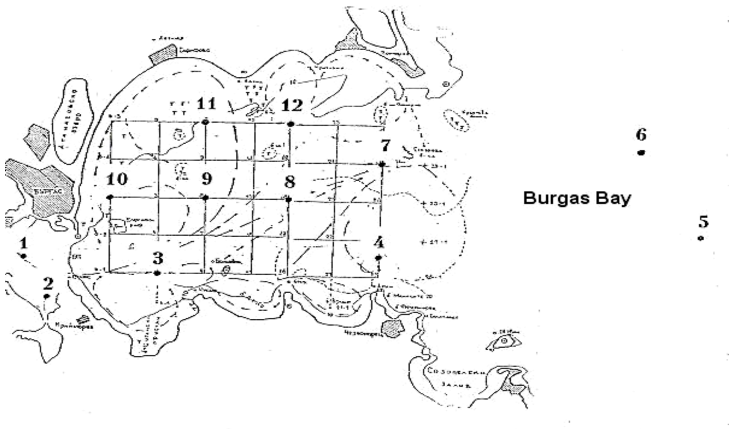

Figure 3. Map of sampling stations in Burgas Bay

Over 1990s processing of samples was performed via unified methods for marine waters (Gashina, 1993; UNESKO, 1994).

Concentrations of nutrients were established by Japanese Spectrophotometer HITACHI-U 2001 UV/Vis (1995).

Since 2001 measurements of temperature, salinity, oxygen and oxygen saturation were done by CTD 60 (2001). In-situ observations were carried out.

Results and Discussion

The hydrological and hydrochemical study since 1992 now is a continuation of observations carried out by the IFR - Varna since the early 1950s both in the coastal and open-sea zones in front of the Bulgarian Black Sea coast.

A database was built in annual, seasonal, and monthly aspect.

This Bulgarian Black Sea database allows management and research in the field of hydrochemistry (Dineva, 2006); hydrology (Dineva, 2005); impact assessment of climate change (Dineva, 2009; Dineva, 2010 a); monitoring (Dineva, 2005); long-term, inter-annual, seasonal, and monthly dynamics of hydrophysical and hydrochemical parameters (Dineva, 2007); trends (Dineva, 1999; Dineva, 2007; Dineva, 2010 b); coastal and open-sea waters (Dineva, 2007); blocks in the structure of the Black Sea water body (Dineva, 2007); Danube transformed waters in the Black Sea (Dineva, 2002; Dineva, 2004); Bay waters (Dineva, 2007; Dineva, 2009), Ecosystems (Mihneva et al., 2007; Uzunova et al., 2009), etc.

The hydrological and hydrochemical database of the Bulgarian Black Sea allows participation both in national and international projects.

Building and management of this database create possibility for modelling of important hydrological and hydrochemical processes.

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Efficient management of the Black Sea watershed needs knowledge, provided by such databases.

General view on carried out research related to hydrological and hydrochemical Bulgarian Black Sea database

Over the 1990s, there were no significant deviations of sea temperatures from the long-term averages. However (Figure 4), gradually the winters were becoming warmer, the springs and the autumns colder, and the summers short and hot (Dineva, 2005; Dineva, 2007).

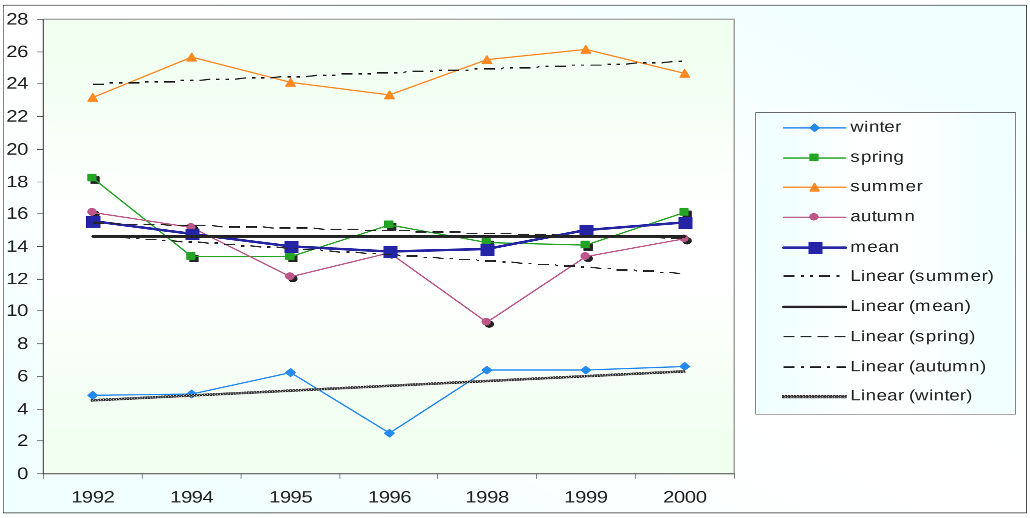


Figure 4. Long-term seasonal changes and trends of sea surface temperatures (SSTs, ˚C) in the 30-mile zone in front of the Bulgarian Black Sea coast during the period 1992-2000

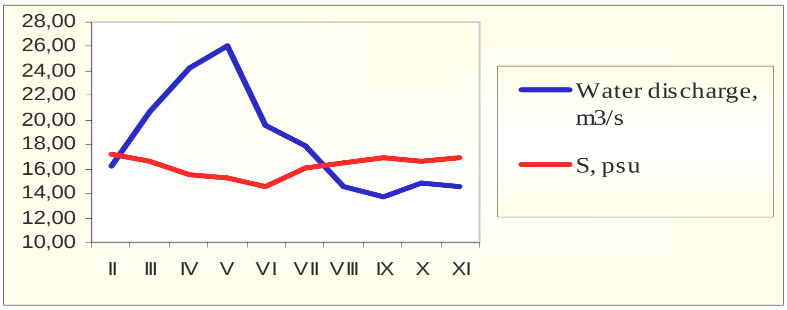


Figure 5. Monthly dynamics of Danube run-off ($m^3.s^{-1}$) and sea surface salinity (SSS, psu) of the Black Sea in front of the Bulgarian coast (Cape Galata, 3-miles offshore) over 1995 – 2000

Danube water discharge (Dineva, 2002) is a major climatic and anthropogenic factor for the Western Black Sea. The Danube transformed waters, passing along the Bulgarian coast, influence strongly the seasonal and inter-annual variability of salinity, mainly in the surface layers. As a result of May maximum (in average) of the Danube runoff, a June minimum of SSS was observed in the Bulgarian Black Sea waters (Dineva, 2002; Dineva, 2005; Figure 5).

Oxygen saturation changes are mainly depending on changes of temperature, salinity, water mixing, biological factors as well as some chemical processes. There were no hypoxic or anoxic situations in Varna Bay during 2004-2007 (Dineva, 2009; Figure 6).

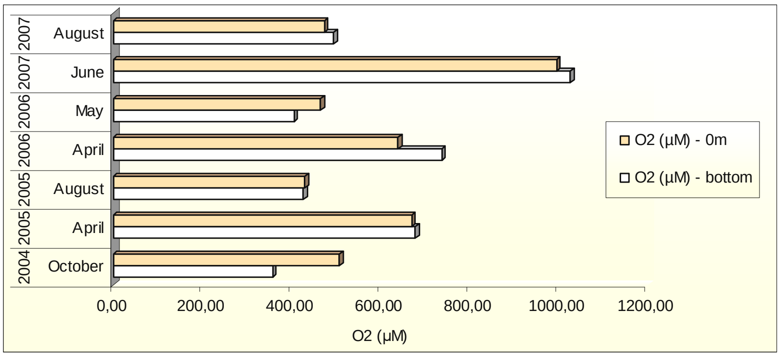
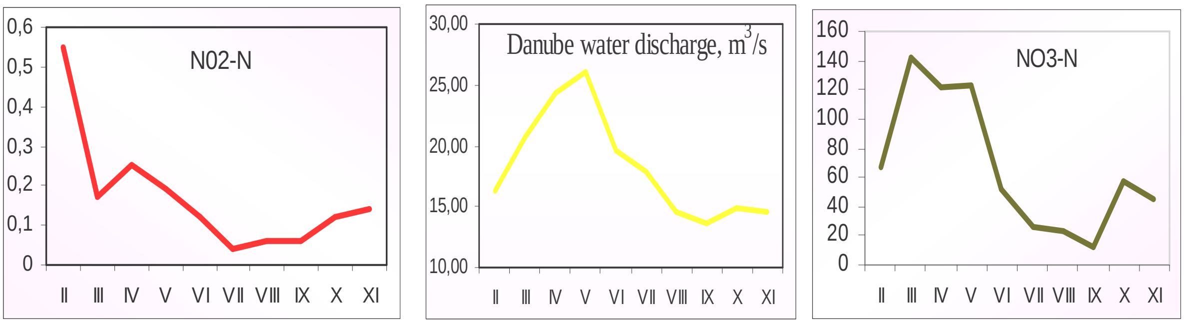


Figure 6. Monthly oxygen concentration (µM) variability, both in the surface and bottom waters of the Varna Bay Control St. B5 during 2004-2007.

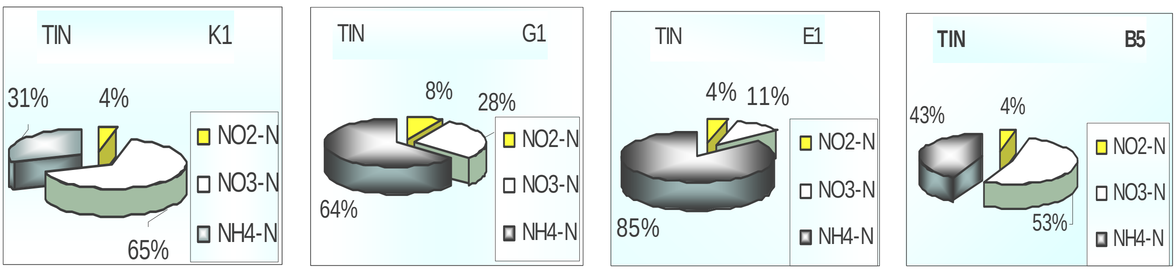
Generally, Figure 7 depicts positive correlations between Danube river discharge (Figure 7 B.), and concentrations of nitrite nitrogen (Figure 7 A.) and nitrate nitrogen (Figure 7 C.) in the surface Black Sea waters along the Bulgarian coast.



A. **B.** **C.**

Figure 7. Monthly dynamics of NO_2-N, µg/l (A.), and NO_3-N, µg/l (C.) in the surface Black Sea waters along the Bulgarian coast (Cape Galata – 3 miles offshore) over 1995 – 2000

Total inorganic nitrogen (TIN) was mostly distributed evenly in the surface–bottom layer. TIN distribution (Dineva, 2003; Dineva, 2010 a) in November at 1 mile in front of the Bulgarian Black Sea coast and in the Varna Bay was as follows in Figure 8.



A. **B.** **C.** **D.**

Figure 8. Ratio between nitrite nitrogen, nitrate nitrogen and ammonium in the layers of Varna Bay (B5) and of 1 mile in front of the Bulgarian Black Sea coast (Coastal zone) in November 2002: (A) in front of Cape Kaliakra (K1); (B) in front of Cape Galata (G1); (C) in front of Cape Emine (E1); (D) in the Varna Bay (B5).

Over 2002 the organic nitrogen (ON) concentration decreased greatly in August. Total nitrogen (TN) was dominantly formed by organic nitrogen – 72 % in the Varna Bay (Figure 9 D.), but mostly inorganic nitrogen (TIN) was dominating in the coastal zone and open sea. At 3 miles in front of the Bulgarian Black Sea coast TN distribution (Dineva, 2003; Dineva, 2010 a) was as follows: 81

% TIN in front of Cape Kaliakra (Figure 9 A.), 57 % TIN in front of Cape Galata (Figure 9 B.), and 100 % TIN in front of Cape Emine (Figure 9 C.).

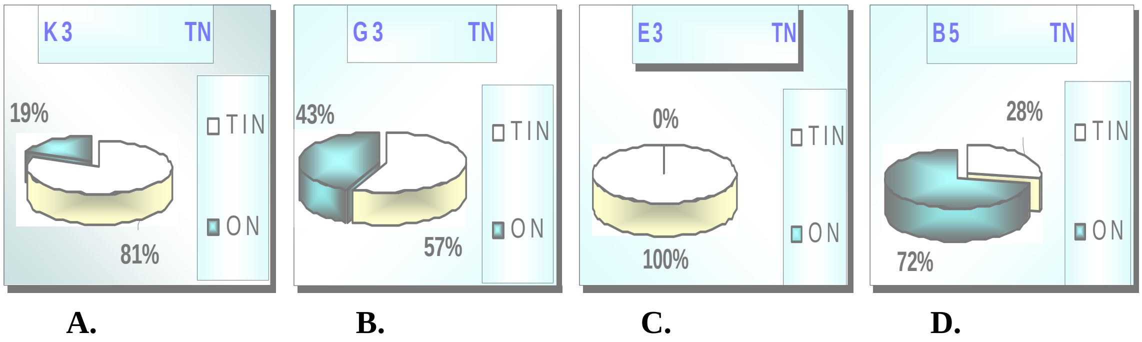


Figure 9. Ratio between total inorganic nitrogen and organic nitrogen in the layers of Varna Bay (B5) and of 3 miles in front of the Bulgarian Black Sea coast (Coastal zone) in August 2002: (A) in front of Cape Kaliakra (K3); (B) in front of Cape Galata (G3); (C) in front of Cape Emine (E3); (D) in the Varna Bay (B5).

Conclusions

The hydrological and hydrochemical segment of the Bulgarian Black Sea Database allows management and research in various fields related to assessing the environmental conditions and taking measures and actions for protection of the Black Sea.

This database appears as a background for development of fundamental and applied research about the Bulgarian Black Sea and contributing to the common view on the most important characteristics of the basin.

Such a database allows outreach to strengthen of efficient management and developing of effective strategies for protection of the Black Sea.

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