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ASPECTS OF THE HYDROLOGICAL BALANCE OF THE RAZIM SINOE COMPLEX

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Abstract

This paper follows the description of the physico-geographic natural setting from the Razim-Sinoe lagoon complex area and the detailed presentation of its characteristics. The tasks of the study are determined by the achievement of goals by conducting a series of data and information analyzes, consulting a number of specialized sources in the field of geography. The statistical data and graphs present in the paper were processed after the Meteorological Center Dobrogea Litoral and the Dobrogea Seaside Basin Administration. Materials and studies were also carried out by Geoecomar, but also by the Danube Delta Biosphere Administration, given the complexity of the complex. The interpretation of the obtained information and data is presented by the analysis method, being represented by interpretations, maps, graphs, tables, statistical data representing the product of the research, indicating the role of the elements in the structure of the whole work. Given the large expanse and geographical position of the lagoon complex, the hydric and physico-chemical regimes have certain peculiarities. Due to its peculiarities, the very diverse fauna and flora present in the Razim-Sinoe complex, it can be said that it is one of the main tourist attractions in the area.

Key words**:** *hydrological balance, water, food, tourism*

INTRODUCTION

The formation of the Razim-Sinoe lagoon complex, for more than 1,000 years, has contributed both the gradual eastward movement of the shoreline along Delta and the Danube with alluvial deposits. [2]
The two trials took off the shore of Halmyris' old golf course under the direct intervention of the sea and created favorable conditions for the formation of new shores that isolated the complex.

Fig. 1. The golf phase of the Razim-Sinoe complex
Source: Tulcea Danube Delta Museum.

The Razim-Sinoe lagoon complex is a part of the former marine bay that stretched between Midia's head in the south and the Danube peninsula in the north and which in ancient Greek-Roman communication still spread with the Black Sea. The justification for the inclusion of this lagoon complex in the Danube Delta consists in the formation of perisipes (narrow strips of seabed land formed by the accumulation of alluviums that close a liman or a lagoon).

Fig. 2. The lagoon phase of the Razim-Sinoe complex
Source: Tulcea Danube Delta Museum.

At a certain point, by advancing the mouths of the Danube (St. George's arm) to the east

and by clogging the arms of Dunavăţ and Cerneţ, the Razim complex was about to lose touch with the Danube. [1]

MATERIALS AND METHODS

In order to accomplish this work a number of bibliographic sources, from various specialized books, to websites using methods of research, analysis and synthesis of information were used and consulted. The statistical data and graphs present in the paper were processed after the Meteorological Center Dobrogea Litoral and the Dobrogea Seaside Basin Administration. Theoretical information from the books of Ovidius University Library and the Ioan N. Roman County Library was also accessed. Materials and studies were also carried out by Geoecomar, but also by the Danube Delta Biosphere Administration, given the complexity of the complex.

The interpretation of the obtained information and data is presented by the analysis method, being represented by interpretations, maps, graphs, tables, statistical data representing the product of the research, indicating the role of the elements in the structure of the whole work.

Synthesis is another method used in the realization of the work, and can not exist in the absence of detailed analysis, representing the part of a scientific work presented as a short presentation on the structure of the work and as an explanation on the subject under consideration.

In relation to analogue data processing, the digital one has a much wider scope for analyzing, storing, shaping and representing some natural images and processes. For this purpose, different statistical data, maps, tables were used to better visualize the content of the paper.

RESULTS AND DISCUSSIONS

Hydrological regime and hydrological balance

Given the large expanse and geographic location of the Razim-Sinoe lagoon complex, the water and physico-chemical regimes have certain peculiarities. [3]

Relative to the surface of the 867 km² complex, the 2,462 km² receiving basin is quite small given the climatic conditions it finds (precipitation of about 400 mm/year and water evaporation of about 850 mm/year). Among the most important rivers we mention Teliţa and Taiţa, which come in the Babadag lake and therefore in Razim, Slava and Beidaud, in Ceamurlia Lake and further in Golovita, Salines in Sinoe, Weddings and Săcele in Nuntaşi-Tuzla Lake. Although all the mentioned rivers have permanent character, the volume of water they bring into the complex is quite insignificant in the weight ratio of water (400 l / s, Teliţa 80 l / s multi-year average). [4]

If this complex had no connection with the Black Sea through which the sea waters penetrate into the lakes when the level falls or would not have received natural freshwater channels from the Sfântu Gheorghe arm, emery lake plain.

Because of its connection with the Black Sea, the Razim-Sinoe lagoon complex had salty waters with tendency to concentrate and salinize in the more isolated southern compartments (Sinoe, Istria, Weddings-Tuzla), close to seawater. Towards the end of the last century the Dunavăţ and Cerneţ channels were dredged and a submersible submersible threshold was built at Gura Portiţei to limit the penetration of salty waters from the sea and the leakage of the sweet ones into the lagoon complex.

The Razim-Sinoe complex is the second largest morpho-hydrographic unit, after the actual delta, which is part of the Danube Delta Biosphere Reserve. [6]

Under natural, unplanned conditions, where rainfalls at the lakes cover only 8.8% at intakes and 19% loss at loss, the persistence of the lakes was made possible by the Danube contribution, namely the Sfântu Gheorghe branch with 40% and the mutual network with The Black Sea through the most important links (Gura Portiţei and Periboina).

Prior to the first interventions of man in the modification of the water relations with the surrounding area, the water balance with its

consequences was determined by the low intake of fresh water from the Danube and the marine ones. The waters of the complex were wild in the northern compartment (the lakes Razim, Golovița and Zmeica) and salted in the southern part (Sinoe, Istria, Nuntași-Tuzla).

To exploit the fishing potential of this complex, especially of the northern compartment, which was subject to deficient state in terms of freshwater intake, at the beginning of the twentieth century, on the proposal of Gr. Anttipa, in 1905, the Charles Canal (the current Dunavăţ), in 1913 the channel Elisabeta (between the lakes Babadag and Razim - now called the Enisala canal) and in 1914, the Ferdinand canal (the current Dranov). [8].

By the construction of the fishing facilities in the Dranov unit and northern Razim Lake, after 1950, several canals were dug, but the main role in the fresh water supply remained also through the channels of Dunavăţ, Dranov and Lipoveni. [10]

Another stage in human intervention in the Razim-Sinoie Complex is in the 1970s of the twentieth century, when the northern compartment was transformed by appropriate works into a freshwater basin which, besides the fishery function, and water supply of irrigation systems in the adjacent area of about 120,000 ha. [5]

For this purpose Gura Portiţei was closed, on the Grindul Lupilor (Channels II and V), which connect with the southern compartment, the tunnels of the Dunavăţ and Dranov channels were built at a capacity of 100 m³/s at average flows. Through these hydrotechnical works, the normal retention level in the northern compartment is +0.50 m (compared to the Black Sea level at Sulina), and in the southern compartment (Sinoe), +0.30 m. Communication with the Black Sea in present is done by the Periboina fishing fence and the Edighiol hammer, on the Chituc grinder. [9]

The volume of fresh water (0.3-0.5 g / l fixed residue) in the northern compartment is 500 mil.m³. This volume of water has been used in irrigation systems during the period of operation to almost normal capacity by 1989 through six pumping stations, which have produced and produce many problems at the moment with juvenile fish juveniles.

The hydrological balance of the Razim-Sinoe lagoon complex was calculated for two periods according to the equations:

$X + YB + YD - Z - YM = \pm \Delta V$ for the period 1956-1970;

$X + YB + YD - Z - YM - Ir = \pm \Delta V$ for the period 1984-1987.

Table 1. The hydrological balance of the Razim-Sinoe Complex in the periods (1958-1970) and (1984-1987)

Period		**1958-1970**	**1984-1987**
X	Mil. m^3	334.5	286.1
	%	8.8	6.9
YB	Mil. m^3	45.6	44.2
	%	1.2	1.1
YD	Mil. m^3	1,542.7	1,755
	%	40	42.1
Z	Mil. m^3	724.1	646.4
	%	19	15.5
YM	Mil. m^3	1,170.4	663.0
	%	30.7	15.9
Ir	Mil. m^3	-	530
	%	-	12.7
ΔV	Mil. m^3	10.3	242
	%	0.3	5.8

Source: Romania's Georgraphy (Geografia României) Vol. 5, 2005.

In Table 1, the terms have the following specification:

X- lakes surface precipitation;

YB - liquid effluent from the associated river basin;

YD - liquid flow from the Danube through channels;

X - evaporation from lakes;

YM - shallow leakage in the Black Sea through the breaks of coastal seams (called ditches or periboines);

Ir = volume of water used for irrigation;

ΔV = the difference in volume of water accumulated (+) or lost (-) in the analyzed period compared to the previous one.

In the first period (1956-1970) there is a large proportion of YD and YM components in relation to others, rainfall and leakage in the native hydrographic basin. Evaporation played an important role in the hydrological balance.

In the second period (1984-1987), when the balance sheet was conducted for strictly economic purposes (irrigation), by increasing the water intake in the Sfântu Gheorghe arm and limiting the leakage in the Black Sea, there is a change in the weight of the components, YD, halving YM and obviously participating in the irrigation component (Ir).
These changes in the balance have led to major transformations in the Razim and Golovița lakes and, to a certain extent, to the southern ones (Sinoie, Histria, Nuntași). [7]

CONCLUSIONS

The Razim-Sinoe complex is a part of the Danube Delta Biosphere Reserve, located in the south of the Danube Delta, formed mainly of lakes, seashores and several higher relief formations.
The Razim-Sinoe complex is the only coastal lake in Romania, which is connected to both the Danube and the Danube. After some hydro-technical works in 1970 Razim-Sinoie lagoon complex was transformed into two units: the Razim unit and the Sinoe unit.
During the formation of the complex, over 1,000 years, both the presence of the Danube with alluvial deposits and the gradual eastward movement of the coastal currents contributed as Delta advanced.
Given the large expanse and geographical position of the lagoon complex, the hydric and physico-chemical regimes have certain peculiarities.
The fisheries in the north (Agighiol-Sarinasuf), the western part (Babadag with Tăuc and Topraichioi, Sălcioara) and the southwest (Jurilovca-Ceamurlia), related to the change of the basic use (fishing) (Razim) in agro-fishery use has led to important changes in the hydrological functionality and appearance of the water balance of the Razim-Sinoie Lake Complex.
Due to its peculiarities, the very diverse fauna and flora present in the Razim-Sinoe complex, it can be said that it is one of the main tourist attractions in the area.

REFERENCES

[1]Damian, N., 2013, Mediul geografic și factorii de risc social din Delta Dunării, Editura Universitară, (The geographic environment and the factors of social risk in the Danube Delta, Universitara Publishing House), București, pp.32-33.
[2]Driga, B.V., 2004, Delta Dunării- Sistemul Circulației Apei, Ed. Casa Cărții De Știință, (The Danube Delta- The system of water circulation, teh House of Science Book Publishing), Cluj-Napoca, pp.45-47.
[3]Gâștescu, P.,1969, Lacurile din Romania, Editura Academiei Republicii Socialiste Romania, (The lakes of Romania, The Publishing House of the Academy of the Socialist Republic of Romania), Bucuresti, pp.29.
[4]Grigore, P., Bogdan, O., Zăvoianu,I., 2005, Geografia Romaniei, Vol. V, Editura Academiei Române (Geography of Romania, Vol. V. The publishing House of the Romanian Academy), București, pp.88-99.
[5]Master Planul Rezervației Biosferei Delta Dunării (The Master Plan of the Danube Delta Biosphere Reservation), 2005, Institutul Național de Cercetare și Dezvoltare Delta Dunării (the Danube Delta National Research and Development Institute), http://www.ddbra.ro/media/master%20plan%20RBDD(2).pdf, Accessed on Jan.5, 2019.
[6]Mutihac,V., Ionesi, I.,1974, Geologia României, Editura Tehnologică (Geology of Romania, Tehcnological Publishing House), București, pp.45.
[7]Năstase, A., 2009, Cercetări asupra diversității ihtiofaunei din Delta Dunării pentru exploatarea durabilă a resurselor piscicole (Teză de Doctorat), (Researches on the ihtio-fauna diversity in the Danube Delta for the sustainble use of the fish resources (Ph.D.thesis), Galați.
[8]Neacșa, O., Popovici, C.,Popa, G.,Buzea, N.,1969, Resursele climato-terapeutice ale litoralului românesc, Editura Academiei Române (The climate-therapeutical resources of the Romanian Seashore, The Publishing House of the Romanian Academy), București, pp.36.
[9]Planul de Amenajare a Teritoriului Zonal „Delta Dunării" (The plan of territorial management 'The Danube Delta"), 2008, Institutul Național de Cercetare și Dezvoltare Delta Dunării (the Danube Delta National Research and Development Institute), http://www.mie.ro/_documente/dezvoltare_teritoriala/amenajarea_teritoriului/patz_delta_dunarii/CD_Predare2_1/Strategie_at_2_final.pdf, Accessed on Jan.5, 2019.
[10]Văidianu, N., 2013, Rezervatia Biosferei Delta Dunării, Editura Ars Docendi The Danube Delta Biosphere Reservation, Ars Docendi Publishing House), Bucuresti, pp.27-28.