Assessment of Anthropogenic Impacts on Tasaul Lake, Romania, and Ecosystem Rehabilitation - The "Tasaul" Project in the Framework of the Swiss-Romanian Research Program ESTROM - Environmental Science and Technology in Romania - An Overview *(Jürg Bloesch, Laura Alexandrov)*	"Cercetari Marine" Issue no. 37 **Pages 7-16**	**2007**

Assessment of Anthropogenic Impacts on Tasaul Lake, Romania, and Ecosystem Rehabilitation - The "Tasaul" Project in the Framework of the Swiss-Romanian Research Program ESTROM - Environmental Science and Technology in Romania - An Overview

Jürg Bloesch[1], Laura Alexandrov[2]

[1]EAWAG, Swiss Federal Institute for Environmental Science and Technology, Switzwerland, E-mail: Juerg.Bloesch@emeriti.eawag.ch
[2]NIRDEP - National Institute for Marine Research and Development "Grigore Antipa", 300 Mamaia Blvd., 900581 Constanta, Romania
E-mail:lalexandrov@alpha.rmri.ro

ABSTRACT

Tasaul Lake, a former lagoon, is a heavily modified water body and an important ecosystem on the Romanian Black Sea coast. It is used mainly for aquaculture and fish production and is a recognized bird sanctuary. This paper describes a Swiss-Romanian cooperative project performed in Tasaul Lake during 2005-2007. The concepts and results of an investigation on contaminant distribution and general limnology, including the tributaries, are summarized and discussed. Tasaul Lake is not seriously contaminated, but shows all features of a shallow eutrophic lake, in particular high turbulence and frequent algal blooms throughout the year. Special attention is given to the framework, i.e., public participation, gained value of Romanian stakeholders, and follow-up actions. This special issue of NIMRD's scientific journal "Recherches Marines" provides all project results in more detail.

KEY-WORDS: Romanian coast, Tasaul Lake, chemistry, euthrophication, contamination, biodiversity, fisheries, anthropogenic pressures, ecological recovery, dissemination, public event

AIMS AND BACKGROUND

In 2003, the Swiss National Science Foundation - SNSF) and the Swiss Agency for Development and Cooperation (SDC) launched the pilot program ESTROM in Romania. The project TASAUL was one out of nine proposals that were selected from 30 letters of intent submitted (Giger, 2008a).

The ESTROM project implementation plan aimed at combining basic and applied topics in the field of environmental research. The main focus was on environmental pollution by dangerous substances as defined by the EU Water Framework Directive (WFD), persistent organic pollutants, heavy metals, emerging contaminants (pharmaceuticals and biocides) and nutrients in Romanian waters including sediments, drinking water and waste water. The investigations should elucidate the sources, inputs exposures to biota and humans as well as risk assessment, measures of mitigation and public participation. From a broader perspective, ESTROM aimed to foster integrated water quality management and create a decision basis for industry and regulators on how to avoid the negative impact of today's environmental contaminants. In particular, the project TASAUL fulfilled the premise of establishing new partnerships between research institutions in Switzerland and Romania. An important outcome of the ESTROM activities was the improvement of the involvement of Romanian scientists in international networks, e.g. the TASAUL poster presentation at the First European Chemistry Congress in Budapest, August 27-31, 2006. Internal scientific exchange took place during three project meetings in Cluj-Napoca (2005, kick-off), Tulcea (2006, mid-term) and Iasi (2007, final). The projects of the interdisciplinary ESTROM program were presented at the International ESTROM Conference in Bucharest (September 3-5, 2008) and are published, amongst other, in IAD (2008), Giger (2008b) and Panin (2008).

The aim of this paper is to describe the framework of the project TASAUL, to synthesize major investigations and results and to provide an outlook for further scientific projects and management strategies of Tasaul Lake and other Black Sea coastal lakes. It is an introduction to this special issue of NIMRD's scientific Journal "Recherches Marines" that reviews the project TASAUL by publishing the results of the following "workpackages": history and ecological rehabilitation of Tasaul Lake (Laura Alexandrov), hydrology of the lake and tributaries and coring methodology (Razvan Mateescu), heavy metals (Andra Oros), pesticides (Valentina Coatu), hydrocarbons (Victoria Piescu), hydrochemistry (nutrient concentrations) of the lake and tributaries (Dan Vasiliu), primary production (Daniela Rosioru), phytoplankton (Alice Sburlea, Monica Iordan), fishery (Irina Cernisencu, Laura Alexandrov), GIS application for lake management (Marius Nedelcu).

CONCEPT AND METHODS

When the joint project proposal was submitted, the main focus was given by the investigation of water and sediment contamination in Tasaul Lake by using commonly applied standard methods (NIMRD). Then, during the first contacts and discussions between the Romanian project leader and the Swiss project coordinator, it became evident that the project program was somewhat overloaded and too broad/general. The immunology of Tasaul Lake is not well known and historical data are scarce (Alexandrov, 2006). Major conceptual discrepancies about the monitoring encompassing water and sediments had to be debated and compromised. Hence, during May 2005 - April 2006, surface sampling at eight

stations was performed to elucidate horizontal variability; then, during May 2006 - July 2007, vertical profiles at the deepest site of the lake provided insight into lake-turnover and sediment archives. The project goal was changed from the original "nutrient mass balance" into the "establishment of a fully operational limnological field program, lake and tributary monitoring". The fisheries part was taken by the DDNIRD Tulcea (Cernisencu et al., this volume, pp. 126-142).

The first project year was mainly focused on new method introduction combined with extensive trainings in Switzerland and in Romania: measuring primary production with the ^{14}C acid bubbling method (Gächter et al., 1984), taking and analyzing sediment profiles with a gravity corer (019001 corer 90 mm, UWITEC, Mondsee, Austria), and assessing nutrient load in tributaries by applying limnigraphs/gauging (Ott R16, Bern, Switzerland) and QS-3000-samplers (Quantum Science Ltd, Cheltenham, England). NIMRD provided the basic analytical and sampling equipment as used in marine projects. Cooperation turned out to be difficult because of the different mentality in Romania and Switzerland, the bureaucratic and inefficient structures in Romania and some conceptual bias, hoping in the future improvement, eliminating these stages.

Introducing the ^{14}C method was a difficult, complicated and laborious task with many unforeseen technical, financial and personnel problems. In total, fourteen certificates were needed according to Romanian law to make NIMRD the only institute capable to apply this method in Romania. Further, institutional facilities such as new furnishing of the lab for handling radioactive materials, liquid scintillation counting, light/radiation measurement and lab sample processing had to be installed. Altogether, six training courses (four in Kastanienbaum, two in Constanta) were necessary to establish the ^{14}C technique (field and lab), teach data processing/interpretation and substantiate theoretical knowledge. For the first time, such results will be available for a lake in Romania.

Similar great difficulties arose with introducing river/gauging and discharge measurement, and integrated nutrient sampling and analysis (nutrient input load by major tributaries). Installation of limnigraphs took over one year and became operational in May 2006. Concerns about damage by high flooding and vandalism (with protection and an alarm system applied) were fortunately in vain, and limnigraphs worked properly. They are still in operation and being used beyond the ESTROM project. A serious problem was hydrological cooperation with Romanian Waters (Apele Romane): while some joint work was possible on the technical level (limnigraph installation and operation, gauging) it failed on the operative institutional level. Therefore, three trainings in Switzerland were necessary to provide support in method introduction, data processing and theoretical understanding.

RESULTS AND DISCUSSION

Persistent chemical contamination of Tasaul Lake

Persistent contaminants such as PAHs, PCBs and heavy metals showed significant temporal and spatial variation in water and in sediments, but no severe pollution (Alexandrov et al. 2006a, 2006b; Alexandrov & Bloesch 2008). Contamination of Tasaul Lake was low and mostly below critical threshold values (Table 1). Hence, pollution with toxic substances was less than expected, but chronic, and may potentially cause sub-lethal effects on biota, fish in particular. Some peak concentrations of pesticides may be due to wash-out from the catchment during heavy rainfall. Endrin was predominant in the deeper

sediment layers (44-80%), whereas pesticides were concentrated in the top layers (0-15 cm). Despite of the fact that heavy metals are scavenged by particles and adsorbed to sediments, their concentrations were mostly low. However, we could see a tendency to increased concentrations in the upper parts of the sediment cores, indicating recent contamination. Sediment analysis included also organic substance (6% on average), proteins (1.5%), lipids (0.2%) and glucides (0.07%).

Table 1. Compilation of chemical data (contaminants) from Tasaul Lake, water and sediments (2005-2007)

Contaminant	Concentration in water Mean (Range)	Concentration in water Mean (Range)
Copper (Cu)	12.6 (3.1 - 48.3) µg/l	34.5 (18.6 - 57.4) µg/g
Cadmium (Cd)	0.27 (0.02 – 1.3) µg/l	1.95 (0.6 - 3.4) µg/g
Lead (Ld)	0.73 (0.05 – 4.5) µg/l	73.9 (26.9 - 126) µg/g
Nickel (Ni)	5.4 (0.4 - 24.1) µg/l	65.0 (10.7 - 92.1) µg/g
Chrome (Cr)	2.6 (1.3 - 4.3) µg/l	-
Total (15) PAHs	380 µg/l	700 µg/g
Total (9) pesticides	1,790 µg/l	250 µg/g

Detailed results are given in Oros (this volume, pp. 66-74), Piescu & Tiganus (this volume, pp. 75-87) and Coatu (this volume, pp. 88-100)

General limnology of Tasaul Lake

Tasaul Lake, monitored from May 2005 to June 2007, showed the typical features of a shallow, turbulent and eutrophic lake (Alexandrov, 2008). Frequent wind prevented stratification and oxygen depletion near lake bottom, and induced sediment resuspension and turbidity. Mean phosphate and nitrate concentrations (17 resp. 370 µg/L) varied spatially and seasonally (Table 2). The N/P ratios (mean 125) exceeded significantly Redfield's ratio (16:1) and point towards P-limitation, although light may play a crucial role at time of high turbidity (self-shading effect of algal blooms). Horizontal changes did not show a consistent pattern (Figure 1, Alkalinity) and were smaller than seasonal variation.

Primary production (80-2712 mg $C_{ass}/m^2 \cdot h$), algal biomass (maximum 38 mg/l) and chlorophyll *a* (mean 164 µg/l, maximum 417 µg/l) were high (Rosioru et al., this volume, pp. 101-113). Biodiversity was rather high. Phytoplankton (69 species) was dominated by Cyanophytes (67-94%) forming frequent blooms (Iordan et. al., this volume, pp. 114-125). Secchi depth often was < 1m. Zooplankton (35 species, maximum biomass 9.5 mg/l) was dominated by rotifers with low diversity and productivity. There was a lack of cladocerans. The total number of bacteria was $5 \cdot 10^3$ - $1.6 \cdot 10^6$ per ml, and two stations with anthropogenic influence showed increased bacteria concentrations including pathogenic forms. The low benthos abundance (39 mg/m^2, no Mysids and Amphipods) can be explained by anoxic sediments providing unsuitable habitat for bottom fauna.

Fish stock assessment in Tasaul Lake was performed in 2005 for two of the species (*Carassius gibelio* [giebel carp] and *Rutilus rutilus* [roach], Alexandrov et al., 2008). Biomass was 23.6 for giebel carp and 34.2 to for roach. Since the fishing mortality

coefficient was greater than the natural mortality coefficient, fishery is claimed not to be sustainable. There is uncontrolled poaching and insufficient restocking.

Table 2. Lake Tasaul chemistry (selected parameters): May 2005 - November 2007

Parameter	Mean value (± S.D.)	Range
Salinity (‰)	0.95 ± 0.389	0.24 - 2.67
Alkalinity (meq/l)	5.6 ± 0.37	4.4 - 6.70
pH	8.7 ± 0.46	7.6 - 9.60
O_2 (mg/l)	12.4 ± 2.41	3.9 - 17.10
O_2 saturation (%)	132 ± 26.1	62 - 210
SRP (mg/l)	0.017 ± 0.0121	0.003 - 0.700
TP (mg/l)	0.106 ± 0.1435	0.023 - 0.899
NO_3-N (mg/l)	0.37 ± 0.419	0.02 - 1.71
TN (mg/l)	1.884 ± 0.641	0.852 - 3.784
TOC (mg/l)	16.318 ±3.763	8.430 - 23.050
Chl *a* (mg/l)	164.3 ± 122.6	8.6 - 417.0
Atomic N/P	125 ± 108	4.7 - 451.0

During May 2005 - March 2006, surface samples from 8 stations;
During April 2006 - November 2007, vertical profiles at mid-lake station.
Data from Vasiliu et al., this volume, pp. 39-50, 51-65.

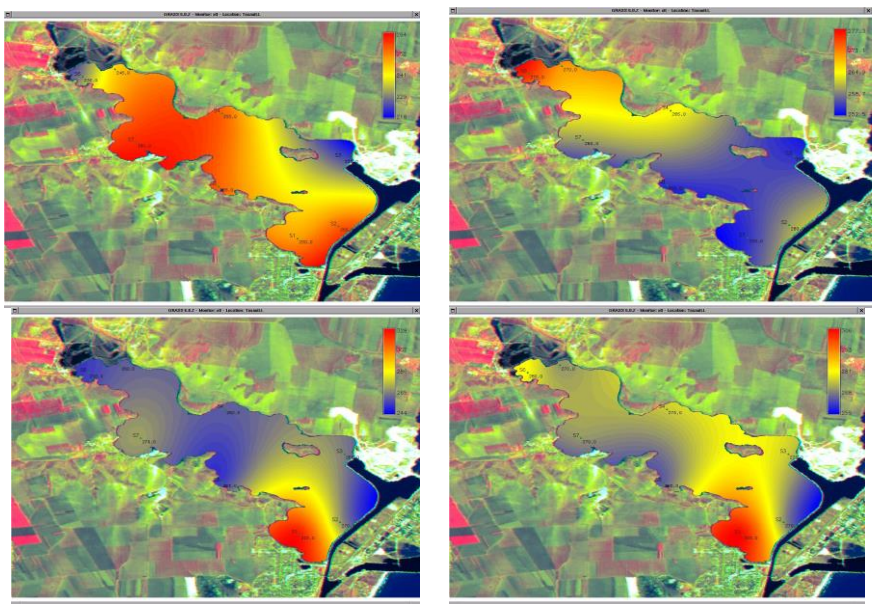

Fig. 1. Horizontal distribution of alkalinity (mval/l) in August, October, November and December 2005 (from left to right). Blue color indicates low concentrations, red color indicates high concentrations. (Author Nedelcu, this volume, pp. 143-147)

Casimcea River and other tributaries

Limnology was combined with hydrology to estimate the nutrient input to Tasaul Lake. Gauging curves allowed for monthly and annual discharge of Casimcea, Sibioara and Dalufac Rivers as the main tributaries (Fig. 2). Monthly sampling of nutrients showed some significant gaps, including one extreme and some medium high flow events not measured. Since both discharge and nutrient concentration calculations were significantly delayed and are partly biased the annual nutrient load could only be estimated, and the nutrient mass balance as originally planned was not possible, since lake output and ground water interactions could not be assessed. The investigation of the complex hydrology at the south shore of Tasaul Lake (outlet now closed by abandoned channels, unpredictable groundwater exfiltration) and an accurate nutrient output was beyond the scope of this ESTROM Project.

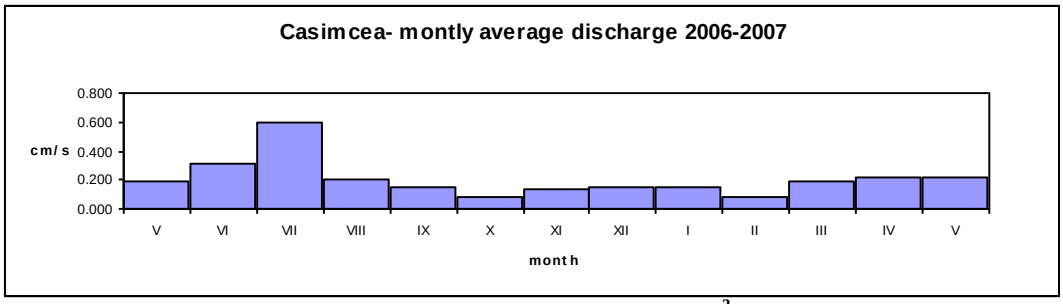

Fig. 2. Casimcea River, mean monthly discharge (m^3/s) in 2006-2007. Data from Mateescu et al. this volume, pp. 17-31

Casimcea River, the main tributary of Tasaul Lake with a large catchment, discharges much suspended solids and anthropogenic nutrient input: runoff, erosion and leaching from fertilized agricultural areas and wastewater from cities/villages and industry. The hydrological and chemical monitoring program of four tributaries (2006-2007) was set up to determine the nutrient load into the lake. Peak concentrations in Casimcea River were 0.54 mg/l total P (TP) and 15.7 mg/l total N (TN) which represents quality class III-IV. A load estimate for Casimcea River (2006-2007) yielded about 3 tons TP/year and 660 tons TN/year (Mateescu et al., this volume, pp. 17-31).

Public participation and dissemination of results

One of the most successful and strongest outputs of this ESTROM-Project was public dissemination of results to potential end-users such as Petroleum Company, Environment Protection Agency, Romanian Waters National Adminstration, Regional Division "Dobrogea Litoral" and Municipalities of Constanta and Navodari. Strengthening public awareness by public events included encounters in kindergardens (painting contests and exhibition) and primary schools in Navodari (interactive learning with awards), as well as courses for local professional fishermen (sustainable fishery) and forum discussions about environmental problems on Tasaul Lake and its catchment. Environmental education and public actions also included cleaning up nature sites along the shores of Tasaul Lake (NGO's collaboration). By the end of October 2007, a final public action took place in the framework of the NIMRD International Symposium "*Protection and Sustainable Management of the Black Sea Ecosystem, Imperative of the 3rd Millenium*", by providing

recommendations for a lake management plan, based on the overall data interpretation; the intended Tasaul Lake's Guide was elaborated in 2008. The Public Event in April 17-21, 2007, was a great success, and it was planned to organize this event as *TASAUL LAKE DAY* every spring. Based on ESTROM team's experience and financial support, this was done in May 2008.

In addition, institutional partnership between NIMRD, "Ovidius" University Constanta, DDNIRD Tulcea, EAWAG and FOEN (lands hydrology) and cooperation with NGOs and local stakeholders such as "Mare Nostrum", "Monachus", Balkan Environmental Association (B.EN.A.), PESCOM/PESTOM Fisheries Firm and Farm, and others could be strengthened. Many fruitful discussions took place with Ministries (of Agriculture and Rural Development; of Environment and Sustainable Development), local people, stakeholders and authorities, private and public agents in the area, the National Agency for Fishing and Fisheries.

OUTLOOK AND CONCLUSIONS

The integrated monitoring of Black Sea coastal lakes was applied for the first time in Romania. It is the general NIMRD strategy to revitalize, after 15-20 years of inactivity, coastal lake's investigation in terms of hydrological-ecological assessment and rehabilitation. Already prior to the submission of the ESTROM Project, NIMRD, represented by the Project Leader, started activities in Black Sea coastal lake rehabilitation. Several projects and contacts were implemented since 2003 and some last beyond 2007. Thus, the ESTROM Project was embedded in a framework of institutional and governmental activities in line with the EU-WFD. On the basis of our investigations we provided realistic solutions for reducing the nutrient and contaminants load to Tasaul Lake, and making decision makers and politicians aware that basin wide water management is the only sustainable way to protect the common resource.

The ESTROM-Project provided a good start and example into coastal lake research and protection, and follow-up actions are proposed to keep this process into sustainable Tasaul Lake management going. In this respect, it is important to note that institutional partnership, activated in 2005, is crucial for maintaining and further developing limnological research at NIMRD. Our project showed that chemical pollution is not critical, but needs continuous attention. We could rise public awareness concerning littering along the lake shore and the catchment. Further assessment is needed, extending research into the lake basin (see follow-up projects below).

Eutrophication of Tasaul Lake induced by internal and external nutrient loading causes frequent algal blooms and is one reason for declining fish yield. Some chronic contamination of persistent chemicals and heavy metals may affect the biota in the long term. Human health is not of direct concern here and was not is focus of the project.

Based on international experience, we could propose realistic solutions to improve the state of Tasaul Lake and its tributaries (Alexandrov & Bloesch, 2008). These include nutrient input reduction of point and diffuse sources, more sustainable fishery practice, and general managerial measures. The conclusion and recommendations towards a more sustainable fishery management in Lake Tasaul are: (1) to reduce nutrient input of Casimcea River by fighting point sources; (2) to continue the general monitoring, hydrology nutrients, primary production and fish production in particular; (3) to perform a detailed monitoring of

yearly restocking to quantify fishing effort/input; (4) to perform detailed statistics about net catches and angling, and estimate poaching, to quantify fishing/output.

Some gaps are evident as a result of many, huge objectives proposed in the short project time given and some goals could be achieved like was planned, being changed. The overall goal, a nutrient mass balance could not be realized because of the many constraints experienced and was changed in mass impact. Further, conceptual work on data bank management for Tasaul Lake and tributaries, Tasaul Lake water and mass balance, and estimating diffuse nutrient sources by GIS application using statistical data need still to be done to support the on-going Integrated Monitoring System (IMSCL) for coastal lakes, including Tasaul Lake (IMST). In a pragmatic approach, our data can contribute in promoting nutrient and contaminant input identification, assessment and reduction as the basic measure to combat eutrophication and ecosystem degradation. However, it is a long way to develop and apply lake models and scenarios that could help to predict the future state of Tasaul Lake.

The follow-up projects are different from the proposed measures/strategies for lake restoration. They are specific limnological research activities at NIMRD, while measures are performed by policy and government (upon our recommendations at best), e.g. to implement Romanian law and the EU-WFD. Follow-up projects should be based on the general outcome of the ESTROM Project and respective conclusions. They should be prioritized according to the module principle to ultimately achieve long-term goals. They are generally aimed at understanding limnology/ecological function of Tasaul Lake as a typical shallow lake; later, or now if human resources/finances permit, Tasaul Lake may be compared with Lake Siutghiol (15 m deep), Sinoe Lagoon and other coastal lakes. Such projects must be performed to obtain the expertise and basis for possible restoration measures such as P-input reduction or biomanipulation, aquaculture, etc. The restoration measures must be in accordance with the lake use defined by politics and the public (use for fish production in Tasaul Lake, tourism in Siutghiol Lake. Since the ESTROM Program will not be continued, new projects need new partners and new financial resources. Some follow-up projects are already planned to extend TASAUL experience to Sinoe Lagoon (NIMRD) and sustainable bioindicators in the catchment ("Ovidius" University Constanta). Of particular interest is the impact of a new dam built in 2007 in the middle of the Casimcea River valley.

ACKNOWLEDGEMENT

This work was financed by the Swiss National Science Foundation, the Swiss Agency for Development and Cooperation and the Romanian Ministry for Education and Research within the framework of the Swiss-Romanian cooperation program on „Environmental Science and Technology in Romania - ESTROM". The reported study was performed in the TASAUL Project focusing on the assessment of anthropogenic impacts on Tasaul Lake, Romania, and ecosystem rehabilitation.

We greatly acknowledge the Swiss specialists who trained Romanian young researchers (Peter Bossard, Daniel Steiner, Mike Sturm, Heinrich Bührer [all Eawag], Andreas Kohler, Hanspeter Hodel, Alessandro Grasso, Bernhard Luder, Daniel Wyder [all FOEN, Ittigen]) and for the correction regarding our work and we are very thankful for the cooperation and support of EAWAG and FOEN (Landeshydrologie), as well their donations

of equipment. We appreciate the great efforts taken by NIMRD Constanta's staff and project team members (in particular, of Daniela Rosioru, Razvan Mateescu, Dan Vasiliu, Alice Sburlea, Victoria Smocov, Adriana Cociasu, Victoria Piescu, Valentina Coatu, Andra Oros, all technicians involved and NIMRD directors, Simion Nicolaev and Alexandru Bologa, where the research have been performed).

The project could not have been performed without the material, interest and informational help of the main Tasaul Lake fisheries administrators: Doina Arhire (PESTOM Fish Farm manager), engineer Paris Paris (main PESCOM fisheries technologist) and Talip and Yuxel Servent (PESCOM managers).

Finally, we thank to all who voluntarily and continuously supported the Tasaul ESTROM project in terms of sharing research and disseminating results, namely: Lucica Tofan and Tim Ehlinger (University „*Ovidius*" Constanta), Laura Boicenco (NGO "*Mare Nostrum*"), Monica Axini (NGO „*Monachus*" Constanta) and many other local institutions.

REFERENCES

1. Alexandrov L. (2006): Research Report: Assessment of anthropogenic impacts on Tasaul Lake Romania, and ecosystem rehabilitation. (Acronym: TASAUL), NIMRD, March 2006, 82 pp.;
2. Alexandrov L., Bloesch J. (2008a): Assessment of anthropogenic impacts on Tasaul Lake Romania, and ecosystem rehabilitation (TASAUL). IAD DANUBE NEWS No. 17, 2008, p 15;
3. Alexandrov ML., Bloesch J. (2008b): Eutrophication of Lake Tasaul, Romania: Proposals for Rehabilitation. Environmental Science and Pollution Research 15, ISSN 0944-1344 1614- 7499 (Online), ESPR Special Volume ESTROM, Volume 16, Suppl.1, http://www.springerlink.com/content/t79g0943604887v1;
4. Alexandrov L., Bloesch J., Chirila E., Piescu V., Cernisencu I., Coatu V., Oros A., Smocov V., Mircea D., Sburlea A., Vasiliu D. (2006a): Pollution sources in the catchment of Tasaul Lake, Romania. Bulletin of the Transilvania University Brasov: 11/46;
5. Alexandrov ML., Cernisencu I., Bloesch J. (2008) : History and concepts of sustainable fishery in Tasaul Lake, Romania. Geo-Eco-Marina 14: 61-71;
6. Alexandrov L., Oros A., Chirila E., Bloesch J. (2006b): Cadmium, copper, nickel and lead occurrence in the biotope of Tasaul Lake. Ovidius University Annals of Chemistry: 17/2, 209-212;
7. Gächter R., Mares A., Tilzer MM. (1984): Determination of phytoplankton production by the radiocarbon method: a comparison between the acidification and bubbling method (ABM) and the filtration technique, Journal of Plankton Research, 6/2: 359-364;
8. Giger W. (2008a): ESTROM – History, perspectives and outlook. Danube News, Bulletin of the International Association for Danube Research (IAD), 17: 2-3;
9. Giger W. (ed) (2008b): The Swiss-Romanian Research Programme ESTROM (Environmental Science and Technology in Romania). Environmental Science and Pollution Research, GeoEcoMarina – No.14 / 2008, ISSN: 2248-2776;

10. IAD (2008): Persistent chemical pollution in Romania: A threat to ecosystem and human health. A swiss Romanian cooperative research programme on Environmental Science and Technology in Romania (ESTROM). Danube News, Bulletin of the International Association for Danube Research (IAD), Volume 17, 16 pp;
11. NIMRD, National Institute for Marine Research and Development: Guidelines chemical methods for water and sediment analysis, biological methods and species identification;
12. Panin N. (ed) (2008): Proceedings of Swiss-Romanian Research Programme on Environmental Science & Technology (ESTROM). Geo-Eco-Marina 14: 5-90;
13. Rosioru DM., Bossard P., Steiner D., Vasiliu D., Alexandrov L., Patrascu V. (2008): The acidification and bubbling radiocarbon method, used in the assessment of phytoplankton production in Romanian coastal lakes. 2008, Cercetari Marine, INCDM, Nr. 38, 73-79, ISSN:0250-3069.