Towards Transboundary Water Monitoring in the Prespa lakes

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Abstract

The transboundary Prespa lakes, shared between Albania, Greece and the Former Yugoslav Republic (FYR) of Macedonia, are characterized by high biodiversity and endemism, and are protected by national, EU and international law on water and environment. The Prespa Park, a transboundary protected area comprising the lakes and their catchment, was established by Declaration in 2000 and by International Agreement in 2010.

In 2007-2009 a transboundary monitoring system (TMS) for Prespa was designed by the Society for the Protection of Prespa (SPP) and Tour du Valat, France, in coordination with a concurrent GEF-UNDP Project. The TMS covers a wide array of environmental parameters, including water (quantity/ quality) parameters (19 indicators comprising ca. 54 water parameters) for the Prespa lakes and their tributaries.

In 2011 the original TMS proposal for transboundary water monitoring of the Prespa lakes was rapidly reviewed and revised by a group of national water experts from the three littoral countries. The group of experts produced an operational transboundary water monitoring system for Prespa, defining the parameters that are adequate for the characterization of the status of the lakes' waters.

The revised water monitoring proposal is based on the Water Framework Directive EU 2000/60 (and is in accordance with both its letter and goal) and its daughter directives, and on the national water legislations and plans of each littoral state as they pertain to the Prespa basin.

The revised water monitoring proposal codifies the water parameters for water quantity (10 parameters or parameter groups) and water quality monitoring (31 parameters/ parameter groups for lakes and 29 parameters/ parameter groups for tributary rivers). It defines in full detail sampling sites, sampling frequencies, methodologies and lab analytical methods (where applicable). It is tailor-suited to the Prespa lakes as a transboundary system, but also based on existing planning for water monitoring in Greece and the FYR of Macedonia. Water monitoring methodologies in the three countries were harmonized, to the extent possible, in order to enable the exchange and comparison of data.

The revised water monitoring proposal aims to put forward a scientifically and technically solid scheme for an operational transboundary water monitoring system for the Prespa lakes, that could be adopted by the national water authorities of the three countries and implemented reliably and with low cost. It is proposed that it be ideally part of, or incorporated in, the national monitoring programs of the three countries in order to ensure cost-effectiveness and sustainability in the long term. To this effect, the revised water monitoring proposal will be submitted to the national water authorities of the three littoral states in the framework of a forthcoming Prespa Park meeting and/ or its working group on water management.

Keywords: *Prespa; Water monitoring; Transboundary cooperation; EU Water Framework Directive*

Introduction

The transboundary Prespa lakes basin is shared by Albania, Greece and the Former Yugoslav Republic of Macedonia. The two interconnected tectonic lakes, Lake Macro Prespa (Great Prespa) and Lake Micro Prespa (Lesser Prespa) have surface areas of 259.4km^2 and 47.4km^2, respectively

(1). The water level of Lake Micro Prespa is higher than that of Lake Macro Prespa, and the overflow of the former into the latter is controlled by a sluice gate. The basin has no natural surface outflow and possesses a complex and not fully known ground water hydrology. There is a well documented hydrological connection to Lake Ohrid, which lies 150m lower than Lake Macro Prespa, via karstic springs that are regularly monitored. Accordingly the level of the lakes -and their surface area- exhibits considerable fluctuation both on an annual basis and over the years (1).

The Prespa system, apart from its complex hydrology and hydrogeology, is also characterized by internationally important biodiversity and high endemism connected to the lakes. Indicatively 23 fish species including 8 Prespa endemics, endemic benthic macrofauna, and 27 bat (Chiroptera) species, many of them utilizing lakeside caves, have been identified (2-5); moreover Prespa hosts rare or endangered waterbird species including the largest worldwide colony of Dalmatian Pelicans *Pelecanus crispus* (3, 5, 6). As a result, various protection regimes under national, EU and international law on water and biodiversity have been designated. Additionally, due to the shared waters in the basin and its international biodiversity importance, the Transboundary Prespa Park was declared in 2000, considered to be the first transboundary protected area in Southeast Europe (7, 8). In 2010 a quadrilateral International Agreement for the Prespa Park was signed by the three littoral states and the EU Commission for the Environment (9, 10).

Despite the protection regimes and the high visibility of the Transboundary Prespa Park, the ecological status of the lakes is under threat due to declining water levels and increasing eutrophication, according to various studies over the last two decades (11-16).

The present paper proposes an operational transboundary water monitoring system for the Prespa system, defining the parameters that are adequate for the characterization of the status of the lakes' waters and enabling the three littoral states to jointly work for the protection of the lakes and their ecosystems (17).

Context

Developing a Transboundary Monitoring System (TMS) for the Prespa Park (2009)

A transboundary monitoring system (TMS) for monitoring of various environmental parameters in the Prespa Park -a prerequisite for sound management and decision making in transboundary basins- was proposed in 2009 by SPP (Society for the Protection of Prespa), Greece and Tour du Valat, France (2). The design of the TMS was implemented with participation of monitoring experts, institutions and authorities from the three countries and in coordination with a concurrent GEF-UNDP Project (18). The proposed TMS covers a wide array of environmental parameters, ranging from waters, biodiversity, habitats to land-cover; of those parameters, water (quantity/ quality) monitoring amounts to 19 indicators, corresponding to 54 water parameters, for the two Prespa lakes and their tributaries.

Revising the transboundary water monitoring system for Prespa (2011)

Selected monitoring indicators concerning biodiversity were tested and evaluated during a pilot application phase of the TMS in 2010-2011 by trilateral study teams with national and international experts (19-23). Conversely, indicators pertaining to water monitoring were not piloted by the TMS study teams, as the final decision on water monitoring must be based on the mutual agreement of the national monitoring institutions and on the national plans of the three littoral countries for water monitoring and management. Additionally, technical issues and the availability of funding and equipment have to be taken into account for a sustainable and technically sound water monitoring system.

Consequently, the 2009 water monitoring proposal laid down in the TMS study had to be reviewed and revised, in order to be mainstreamed with national planning of the three littoral states. In 2011 a revised water monitoring proposal for Prespa was developed by a group of national water experts from the three littoral countries. The group of water experts proposed an operational transboundary water monitoring system for Prespa, presented in this paper, which defines the parameters that are adequate for the characterization of the status of the lakes' waters (17).

The revised water monitoring proposal codifies the water parameters for water quantity (10 parameters or parameter groups) and water quality monitoring (31 parameters/ parameter groups for lakes and 29 parameters/ parameter groups for tributary rivers), with the definition of sampling stations, sampling frequencies, methodologies and lab analytical methods.

Methods

The revised water monitoring proposal took into consideration and reviewed the 2009 water monitoring proposal developed in the framework of the TMS, which had been based on the input of national experts from the three countries assembled in transboundary thematic workshops, and was tailor-suited to Prespa (2).

Additionally, the revised water monitoring proposal is squarely based on the Water Framework Directive EU 2000/60 and its daughter directives, in accordance with both its letter and goal thus providing information on the ecological status of waters and not merely measuring physico-chemical parameters (24, 25).

It takes into consideration the national water legislations and plans for national water monitoring and management of each littoral state pertaining to the Prespa basin, as the three water experts, Prof. M. Kolaneci (Institute of Energy, Water and Environment, Polytechnic University of Tirana), Prof. S. Krstić (Faculty of Natural Sciences and Mathematics, University of S.S. Cyril and Methodius, Skopje) and Dr. V. Tsiaousi (Greek Biotope Wetland Centre/ EKBY, Thessaloniki) are affiliated with the national institutions of the three countries that are directly involved in the formation of the national plans for water monitoring and management.

The revised water monitoring proposal identified the parameters (water quality, quantity) that are adequate for the characterization of the status of the lakes' waters, and are appropriate and feasible to be measured by the national competent authorities or other national organizations with the authorization to do so. For the parameters selected, the sampling methodologies have been harmonized, to the extent possible, in order to enable the exchange and comparison of data between the three littoral countries. The selection of the parameters was made under the assumption that monitoring and analysis can be made in each country independently, in order to respect national sovereignty.

The ultimate aim is to come up with a scientifically and technically solid proposal for an operational transboundary water monitoring system for the Prespa lakes. This proposal could be adopted by the national water authorities of the three countries and implemented reliably and with low cost. It should be ideally part of, or incorporated in, the national monitoring programs of the three countries in order to ensure cost-effectiveness and sustainability in the long term.

Results

The water monitoring parameters are divided into three categories:

A. Parameters for water quantity (A.1 hydrology/ hydrometrics; A.2 meteorology) in the Prespa lakes, the main tributaries, and their catchment, as well as in the three karstic springs of Lake Ohrid where water coming from Prespa is discharged. The 10 parameters or parameter groups are presented in Table 1.

B. Parameters for water quality (B.1 biological quality elements; B.2 physico-chemical supporting elements; B.3 chemical quality elements; B.4 hydro-morphological quality elements) in the Lakes Macro Prespa and Micro Prespa. The 31 parameters/ parameter groups are presented in Table 2. The 7 sampling stations L1-L7 are depicted in Figure 1.

C. Parameters for water quality (C.1 biological quality elements; C.2 physico-chemical supporting elements; C.3 chemical quality elements; C.4 current velocity) in the tributary rivers. The 29 parameters/ parameter groups are presented in Table 3. The 3 sampling stations R1, R2 and R3 are shown in Figure 1.

Besides the parameters, sampling stations, sampling frequencies, methodologies and lab analytical methods were defined and described.

Figure 1. Sampling stations for water quality parameters in Lakes Micro and Macro Prespa and their tributary rivers (Map background: Google Earth)

Conclusions

The revised water monitoring proposal aims to put forward a scientifically and technically solid scheme for an operational transboundary water monitoring system for the Prespa lakes, that could be adopted by the national water authorities of the three countries and implemented reliably and at low cost.

Based on the previous work done in the framework of a Prespa TMS (Transboundary Monitoring System) in 2009, on the Water Framework Directive EU 2000/60, and on the national planning of the three littoral states for water monitoring and management of the Prespa Lakes, the revised monitoring proposal presented in this paper proposes 10 parameters or parameter groups for water quantity monitoring, 31 parameters or parameter groups for water quality monitoring in the two lakes, and 29 parameters or parameter groups for water quality monitoring in the tributaries.

It is proposed to be a part of, or incorporated in, the national monitoring programs of the three littoral countries in order to ensure cost-effectiveness and sustainability in the medium- or long-term. To this effect, it will be submitted to the national water authorities of the three littoral states in the framework of a meeting of the Prespa Park Management Committee and/ or its working group on water management designated by the Agreement on the Protection and Sustainable Development of the Prespa Park Area (9).

Table 1. List of water quantity parameters in the Prespa lakes and their catchment

A. WATER QUANTITY					
Parameters	***Sampling Sites***	***Sampling Frequency***	***Sampling Method***	***Lab Analytical Method***	***Important Notes***
A.1 Hydrology/ hydrometrics					
Lake water level	**Macro Prespa** Albania: WL1: Liqenas Greece: WL2: Koula FYR-Macedonia: WL3: Stenje **Micro Prespa** Albania: WL4: Near Tren Cave Greece: WL5: Koula	a. Daily (staff gauge); b. Continuous (automated water level sensor)	a. Staff gauge, calibrated; b. Automated water level sensor with data logger	-	1. There is a need for an agreement on a common altitude reference for water level 2. The option of using automated sensors with data loggers depends on funding, and on availability of secure site.
Inflow catchment Macro Prespa	**Macro Prespa** Mouth waters of: R1. Golema River; R2. Brajcinska River R3. Agios Germanos River	12 times/ year	Water level gauge	Computed. Need to establish rating curve (stage-discharge relationship)	According to TMS (2), Istocka river mouth may be considered.
Koula Micro to Macro Prespa flow	Koula sluice	12 times/ year	Computed	Computed from water level and sluice position at Koula using adequate hydraulic formula	
Pumping from Micro Prespa	Pumping station in Greece	12 times/ year (or during irrigation season)	Computed	Computed from daily/ monthly pumping duration and pumping stations characteristics	
Karstic spring flow to Ohrid	Tushemisht, Drilon, Sv.Naum	Continuous or at least daily	Water level gauge	Discharge data from continuous (or at least daily) water level measurements	
Groundwater level	See TMS (2)	See TMS (2)	Piezometric level in a selection of wells	-	
A.2 Meteorology					
Precipitation Catchment	Existing meteo stations; additional stations as per recommendations of TMS (2)	Daily (averages, highs, lows); or continuous. See TMS (2).	See TMS (2)	-	According to TMS (2), precipitation/ snow should also be taken at a selection of sites between 1300 and 2000 m asl
Precipitation lake	Same as above	Same as above	Same as above	Spatial average of precipitations measurements; see TMS.	
Air temperature Lake	Same as above	Same as above	Same as above	See TMS.	
Lake evaporation	Same as above	Same as above	Same as above	Calculated by the Penman method, compared to pan evaporation (data of Koula); see TMS.	

Table 2. List of water quality parameters in Lakes Micro and Macro Prespa

B. WATER QUALITY – LAKES					
Parameters	**Sampling Sites**	**Sampling Frequency**	**Sampling Method**	**Lab Analytical Method**	**Important Notes**
B.1 Biological Quality Elements					
Phytoplankton 1. Species composition; 2. Chl *a* (biomass); 3. Blue-green dominance; 4. Toxic 'blooms'	**Macro Prespa** FYR-Macedonia: L1. Stenje L2. Asamati L3. Dolno Dupeni Albania: L4. WQPC-L1 Greece: L5. Macro Prespa A L6. Macro Prespa B **Micro Prespa** Greece: L7. Micro Prespa A L8. Micro Prespa B Albania: L9. Micro Prespa Tren Cave	4 times/ year in the period Apr-Oct 1. Apr-May 2. Jun-Jul 3. Aug-Sep 4. Oct	Collection of depth integrated samples at the euphotic layer (2.5*Secchi Disk depth), with a water sampler. Plankton net/ mesh size 5 μm.	Utermöhl, microscopy, BBE field Chl-α probe, ELISA test, HPLC, MS Spectro. Alive and preserved samples will be used for the determination of phytoplankton biomass and composition, using Utermöhl method with Inverted Microscope (Utermöhl 1958 (26)). Assessment of total biovolume, % of Cyanobacteria, Catalan Index (2003) and Assemblage Index (Padisák *et al* 2006 (27)). For Chlorophyll α, extraction with acetone 90%, Fiber glass filter. Spectrophotometric evaluation by Lorenzen 1967 (28) and Jeffrey & Humphrey 1975 (29) methods. No ISO/CEN Standards.	1. Sufficient length of net sample dragging. 2. In FYR-Macedonia BBE sampler will be used. In Greece either BBE or a comparable Chl-α method will be used.
Macrophytes Not included in the proposal.	-	-	-	-	An exchange of data every 5-6 years is suggested in order to enhance the water quality picture.
Fish 1. Composition 2. Abundance 3. Sensitive species 4. Age structure 5. Fish endemic to Prespa lakes trend	Same as above	1-2 times/ year	EN 14011:2003	Fishing with Nordic nets for fish trend and quantitative results for the assessment; electro fishing (deep-water or coastal) to complement species list.	Alternatively, plain nets could be used for fish trend, if budget for Nordic nets is not made available.
B.2 Physico-chemical Supporting Elements					
General physico-chemical parameters 1. Transparency (Secchi depth, turbidity, colour, TSS) 2. Thermal conditions	Same as above	5 times / year (4 times in active months + 1 in winter) - profiling	EN 25814:1992; EN ISO 10304-1:1995; EN 12260:2003	Field probes, meters, spectrophotometry, various analytical tests. - Transparency: Secchi Disk. - Thermal conditions, Salinity,	Profile samples for pH.

(temperature) 3. Oxygenation conditions (DO, TOC, BOD, COD, DOC) 4. Salinity (conductivity) 5. Acidification status (pH) 6. Nutrient conditions (total P, SRP, total N, N-NO3, N-NO2, N-NH, Sulphates)				pH: autographic instruments. - Nutrient concentrations: A.P.H.A. - Oxygenation conditions: Samples from the field and laboratory analysis.	
B.3 Chemical Quality Elements (Priority Substances, Non-priority specific pollutants, Other pollutants)					
Metals Pb Fe Zn As Cu Hg Mn	Same as above	4 times / year as above (3 times in active months + 1 winter)	Various standards Refer to Table B below	AAS	
PAHs (poly-aromatic hydrocarbons) Organochlorine Pesticides Halogenated/ Chlorinated hydrocarbons Other pesticides Phenols Others (refer to (17))	Same as above	4 times / year	EN ISO 15680:2003 EN ISO 6468:1996 EN 1485:1996 EN ISO 11369:1997 EN ISO 17495:2003 ISO 18856:2000	Gas chromatography	In GR-Prespa and AL-Prespa, during 1st year surveillance monitoring will be implemented. It will include all substances (refer to (17)), 12 times/ year. During years 2-5, operational monitoring will be conducted 4 times/ year. It will include only selected substances found in excess during surveillance.
B.4 Hydromorphological Quality Elements					
Hydrological regime lakes 1. Quantity and dynamics of water flow [inflow and outflow rates, water level, spillway and bottom outlets discharges (reservoirs), mixing and circulation pattern)] 2. Residence time (volume, depth, inflow and outflow) 3. Connection to groundwater bodies (lake surface, lake volume) and groundwater level	Refer to quantity (hydrology/ hydrometrics) parameters, and their sampling sites, Table 1.	Every month. (Daily for water level)	Quantity: Construction of Water level - volume relation using lake bed topography. Dynamics: a) Water level gauge; b) inflow discharges using flowmeter.		1. Refer to quantity (hydrology/ hydrometrics) parameters, Table 1. 2. These parameters strictly speaking are not monitoring parameters but research analysis and data processing; they are included here for the sake of completeness.
Morphological conditions 1. Lake depth variation - water level variation - bathymetry (lake surface, lake volume, lake depth)	Same as above	Every 6 years	Same as above	Same as above	These parameters strictly speaking are not monitoring parameters but research analysis and data processing; they are included here for the sake of completeness.

Table 3. List of water quality parameters in the tributary rivers in the Prespa catchment

C. WATER QUALITY – RIVERS

Parameters	Sampling Sites	Sampling Frequency	Sampling Method	Lab Analytical Method	Important Notes
C.1 Biological Quality Elements					
Phytobenthos 1. Species composition; 2. Chl *a* (biomass); 3. Blue-green dominance; 4. Diatoms	Mouth waters of: R1. Golema River R2. Brajcinska River R3. Agios Germanos River	4 times / year, seasonal	EN 13946:2003	Indices	This parameter group is not included in Greek national monitoring schedule.
Zoobenthos / Macroinvertebrates 1. Species composition; 2. Abundance; 3. Diversity; 4. Indexes	Same as above	4 times / year, seasonal	EN ISO 8689-1:2000	Biotic Indices (e.g. HES, Artemiadou and Lazaridou 2005 (30))	
Riparian vegetation (not included in first monitoring cycle of 6 years)	Same as above	Once every year	EN 14184:2003	Vegetation cover continuity	Riparian vegetation monitoring not included in the first monitoring cycle (first 6 years). Indicators to be applied to be defined.
Fish Endemic Trout population trend	Along the rivers at suitable habitats (e.g. three locations per river)	Once per year	EN 14011:2003	Electro fishing	Sampling will also include upper stretches of rivers; see (2, 19).
C.2 Physico-chemical Supporting Elements					
1. Transparency (Secchi depth, turbidity, colour, TSS) 2. Thermal conditions (temperature) 3. Oxygenation conditions (DO, TOC, BOD, COD, DOC) 4. Salinity (conductivity) 5. Acidification status (pH) 6. Nutrient conditions (total P, total N, $N\text{-}NO_3$, $N\text{-}NO_2$, $N\text{-}NH_4$, Sulphates)	R1, R2, R3 sampling sites.	5 times / year, together with biological quality elements.	EN 25814:1992 EN ISO 10304-1:1995 EN 12260:2003	Field probes, meters, spectrophotometry, various analytical tests	SRP measured in lakes but not in rivers.

C.3 Chemical Quality Elements (Priority Substances, Non-priority specific pollutants, Other pollutants)					
Metals Pb Fe Zn As Cu Hg Mn Refer to (17)	Same as above	4 times / year as above (3 times in active months + 1 winter)	Various standards	AAS	Refer to (17)
PAHs (poly-aromatic hydrocarbons) Organochlorine Pesticides Halogenated/ Chlorinated hydrocarbons Other pesticides Phenols Others (Refer to (17))	Same as above	Same as above	EN ISO 15680:2003 EN ISO 6468:1996 EN 1485:1996 EN ISO 11369:1997 EN ISO 17495:2003 ISO 18856:2000	Gas chromatography	In GR rivers, during 1st year surveillance monitoring will be implemented. It will include all substances 12 times/ year.During years 2-5, operational monitoring will be conducted 4times/year. It will include only selected substances found in excess during surveillance.
C.4 Current Velocity					
Current velocity	Measured at the site of samples where benthos is measured.	4 times / year, seasonal			

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References

(1) G.E. Hollis and A. C. Stevenson, 'The physical basis of the Lake Mikri Prespa systems: geology, climate, hydrology and water quality', Hydrobiologia, 351, 1-19 (1997).

(2) C. Perennou, M. Gletsos, P. Chauvelon, A. Crivelli, M. DeCoursey, M. Dokulil, P. Grillas, R. Grovel and A. Sandoz, Development of a Transboundary Monitoring System for the Prespa Park Area, Aghios Germanos, Greece, 381pp. (2009). (online on http://www.spp.gr/spp/fullstudy_vol1.pdf, accessed 15 February 2012)

(3) A.J. Crivelli and G. Catsadorakis (Eds) Lake Prespa, Northwestern Greece, A Unique Balkan Wetland, Dordrecht, Kluwer Academic Publishers (1997).

(4) E. Papadatou, X. Grémillet, F. Bego, S. Petkovski, E. Stojkoska, O. Avramoski and Y. Kazoglou, Status survey and conservation action plan for the bats of Prespa, Society for the Protection of Prespa, Agios Germanos (2011).

(5) A. Legakis and P. Maragou, The Red Data Book of Threatened Animals of Greece, Hellenic Zoological Society, Athens, Greece (2009). (in Greek)

(6) BirdLife International, *Pelecanus crispus*. In: IUCN 2011. IUCN Red List of Threatened Species. Version 2011.2. (2011) (online on www.iucnredlist.org, accessed on 15 February 2012)

(7) Society for the Protection of Prespa (SPP), WWF Greece, Protection and Preservation of the Natural Environment in Albania (PPNEA), Macedonian Alliance for Prespa (MAP) Strategic Action Plan for the Sustainable Development of the Prespa Park, Executive Summary, Society for the Protection of Prespa, Aghios Germanos, Greece, 75 pp. (2005). (online on www.spp.gr/spp/sap_executive_summary_edition_en.pdf, accessed 15 February 2012)

(8) I. Christopoulou and V. Roumeliotou, 'Uniting People through Nature in Southeast Europe: The Role (and Limits) of Nongovernmental Organizations in the Transboundary Prespa Park', Southeast European and Black Sea Studies, 6(3), 335-354 (2006).

(9) Agreement on the Protection and Sustainable Development of the Prespa Park Area (2010). (online on http://www.ramsar.org/pdf/wwd/10/wwd2010_rpts_prespa_agreement.pdf, accessed 15 November 2011)

(10) D. Mantziou and M. Gletsos, 'The Development of Transboundary Cooperation in the Prespa Lakes Basin'. In: Transboundary Water Resources Management: A Multidisciplinary Approach (Eds J. Ganoulis, A. Aureli and J. Fried), John Wiley and Sons Ltd, Weinheim (2011).

(11) H. Löffler, E. Schiller, E. Kusel and H. Kraill, 'Lake Prespa, a European natural monument, endangered by irrigation and eutrophication?', Hydrobiologia, 384, 69-74 (1997).

(12) A. Matzinger, M. Jordanoski, E. Veljanoska-Sarafiloska, M. Sturm, B. Müller and A. Wüest 'Is Lake Prespa jeopardizing the ecosystem of ancient Lake Ohrid?', Hydrobiologia, 553, 89-109 (2006).

(13) S. Krstić, Report on baseline data for water (surface and groundwater) including waste related data for the target region. EC-FP6 project "TRABOREMA", EC-Project Contract No. INCO-CT-2004-509177, Deliverable 2.2., 16 pp. (2005).

(14) S. Krstić, Report on natural and cultural rates of eutrophication and their impact on microflora biodiversity, past and present spatial and temporal trends and major pressures in the region. EC-FP6 project "TRABOREMA", EC-Project Contract No. INCO-CT-2004-509177, Deliverable 3.2., 21 pp (2006).

(15) S. Krstić, Saprobiological and trophic models for Lake Prespa (saprographs) for use in similar regions and its application for evaluation of Ecological Quality Ratios (indicators). EC-FP6 project "TRABOREMA", EC-Project Contract No. INCO-CT-2004-509177, Deliverable 3.3., 98 pp, (2007).

(16) S. Krstić, 'Geomorphological changes in lakes catchments as a trigger for rapid eutrophication – a Prespa Lake case study', Geomorphology, ISBN 979-953-307-113-7, Intech Inc., Rijeka, Croatia, 35 pp. (2012) (accepted)

(17) M. Kolaneci, S. Krstic, V. Tsiaoussi and G. Parisopoulos, Expert proposal for the transboundary water monitoring system of the Prespa Park, Society for the Protection of Prespa, Agios Germanos (2011).

(18) United Nations Development Programme (UNDP), Integrated Ecosystem Management in the Prespa Lakes Basin of Albania, FYR-Macedonia and Greece, UNDP Full Size Project Document, UNDP (2005)

(19) A. Crivelli, Pilot Application of the Transboundary Monitoring System for the Prespa Park: Fish and Fisheries Monitoring, Final report, Society for the Protection of Prespa - Tour du Valat, Agios Germanos (2010).

(20) R. Grovel, Pilot Application of the Transboundary Monitoring System for the Prespa Park: Forests and Terrestrial Habitats Monitoring, Final report, Society for the Protection of Prespa, Agios Germanos (2010).

(21) E. Papadatou, X. Grémillet and Y. Kazoglou, Pilot Application of the Transboundary Monitoring System for the Prespa Park: Workshop on the Monitoring of Bats, Final report, Society for the Protection of Prespa, Agios Germanos (2010).

(22) P. Grillas, Pilot Application of the Transboundary Monitoring System for the Prespa Park: Aquatic Vegetation (Reedbed) Monitoring, Final report, Society for the Protection of Prespa - Tour du Valat, Agios Germanos (2011).

(23) L. Krambokoukis and K. Hornigold, Pilot Application of the Transboundary Monitoring System for the Prespa Park: Brown Bear Monitoring, Final report, Society for the Protection of Prespa - Arcturos NGO, Agios Germanos (2011).

(24) European Parliament, Council, Directive 2000/60/EC of the European Parliament and of the council of 23 October 2000 establishing a framework for community action in the field of water policy. Official Journal of the European Communities, L327, 72pp. (2000).

(25) JRC European Commission, Water Framework Directive Intercalibration Technical Report. Part 2: Lakes, Joint Research Centre, European Commission (2009).

(26) H. Utermöhl, 'Zur Vervollkommnung der quantitativen Phytoplankton - Methodik', Mitteil. Int. Ver. Limnologie, 9, 1-38 (1958).

(27) J. Padisák, G. Borics, I. Grigorszky and É. Soróczki-Pintér, 'Use of phytoplankton assemblages for monitoring ecological status of lakes within the Water Framework Directive: the assemblage index', Hydrobiologia, 553, 1-14 (2006).

(28) C.J. Lorenzen, 'Determination of chlorophyll and pheo-pigments: spectro-photometric equations', Limnology and Oceanography, 12(2), 343-346 (1967).

(29) S.W. Jeffrey and G.F. Humphrey, 'New spectrophotometric equations for determining chlorophylls a, b, c1 and c2 in higher plants, algae and natural phytoplankton', Biochem. Physiol. Pflanz, 167, 191-194 (1975).

(30) V. Artemiadou, and M. Lazaridou, 'Evaluation Score and Interpretation Index for the Ecological Quality of Running Waters in Central and Northern Hellas', Environmental Monitoring and Assessment, 110, 1-40 (2005).