

BULGARIA: SREBARNA

NATURE RESERVE

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**MISSION REPORT
ON THE
CONSERVATION STATUS OF SREBARNA
NATURE RESERVE AND WORLD HERITAGE SITE
IN DANGER, BULGARIA¹
1 - 6 October 1998**

¹ Based on Srebarna Mission Team (1-6 October 1998) findings and prepared by R.C. Milne (Chief of Mission, WHC/WCPA-IUCN), Tim A. Jones (Ramsar Secretariat, Switzerland) and Gerard Collin (IUCN/MAB, France) in compliance with WHC Contract No. 700.647.8 (15/9/98).

TABLE OF CONTENTS

Chapter I:	Mission Overview, Synthesis and Recommendations
Chapter II:	Ornithological Review and Analysis of Pending Legislation
Chapter III:	Buffer-zone Mangement and Community Involvement
Appendix 1:	Mission Terms of Reference
Appendix 2:	Mission Report by Dr. Gerard Collin
Appendix 3:	Mission Report by Tim Jones
Appendix 4:	Mission Contacts in Bulgaria
Appendix 5:	Conservation Status Report by Ministry of Environment and Waters, September 1998
Appendix 6:	Scientific Papers Presented to Mission Team

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CHAPTER I: Mission Overview, Synthesis and Recommendations²

Introduction. The Mission Team was requested to address the following general consideration:

“Meeting with the responsible officials to discuss the current socio-economic political and institutional context. Address organisational, statutory and policy factors. Preliminary Assessment of the status of conservation of the area with particular focus on the water management, waterfowl populations and site management capability with officials in Sofia.”.

The Mission Team was further provided with terms of reference and objectives (see Appendix 1). In accordance with the general considerations and the terms of reference, a Summary Report with recommendations and this Mission Report were prepared by the team and provided to the World Heritage Centre, UNESCO. In the latter instance, this Mission Report is a composite of three individual papers prepared by the team members respectively with key reference documents provided by the State Party authorities and members of the Bulgarian Academy of Sciences attached.

Summary. On the basis of discussions, the review of available data and findings during the site field visit, it is the unanimous opinion of the Mission Team that on the basis of significant restorative efforts by the State Party and the resulting rather remarkable ecological recovery of World Heritage values as established and defined at the time of inscription (1983), the Srebarna Nature Reserve and World Heritage Site In Danger should not be removed from the World Heritage List.

However, it is equally concluded that the ecological recovery period has been relatively short and several key statutory and administrative actions including the preparation of the Srebarna Nature Reserve Management Plan clearly affecting the long term integrity of the site were pending at the time of the Mission. For these reasons, the Mission Team is of the opinion that Srebarna Nature Reserve and World Heritage Site should remain on the List of World Heritage Sites In Danger until at least the year 2000 when the

² Prepared by R.C. Milne (Chief of Mission).

ecological recovery trend and administrative accomplishments may be evaluated and a determination made as to whether apparently successful ascertained and potential threat mitigation has been sustained, management and action plans have been developed and effectively implemented, site integrity strengthened by management intervention and World Heritage values satisfactorily restored to 1983 conditions or better on a sustained basis, or not. Given the relatively small size of the Srebarna Nature Reserve, demonstrated effective collaboration in effective buffer zone management will be of particular importance.

Background: Srebarna Lake Nature Reserve was inscribed on the World Heritage List in 1983. This 602 ha fresh-water site on the flood plain of the Danube River was acknowledged to be of regional and global significance under *criteria iv* of the 1983 Operational Guidelines (e.g. "Geological and physiographic formations and precisely outlined area which are habitats of threatened by extinction, plant or animal species with extraordinary and world value from the point of view of science, nature protection or natural beauty"). Specific World Heritage bench-mark values considered by the Advisory body (IUCN) and the Sixteenth session of the Committee at the time of inscription were: (a) the importance of the area as breeding grounds for 99 bird species most of which are rare or endangered in the world, regional or national scale including in particular the Dalmatian pelican (*Pelecanus crispus* - average 67 pairs) and pygmy cormorant (*Phalacrocorax pygmeus* - average about 20 pairs); (b) use by for migration or wintering (80 species) including use by at least two species (red-breasted goose for wintering and corncrake for nesting) of international importance; (c) an important wetland on the Western Palaearctic migratory bird flyway; and, (d) outstanding (biological) diversity. The nomination per se and IUCN background evaluation documents also noted that: (a) the hill topography (surrounding Lake Srebarna) provided a unique scenic opportunity to observe birds without disturbing them; (b) the reed community (*Phragmites communis*) occupied two thirds of the lake in which the water lily (*Nymphaea alba*) was found and a number of rare marsh plants in the wetland surrounding the lake; and, (c) that the situation (Srebarna Nature Reserve) was not completely natural and was maintained by water management measures.

An ample and historical accumulation of ornithological and plant records provided a partial baseline inventory which supported the IUCN recommendation for inscription of the Srebarna Nature Reserve on the World Heritage List. Of particular significance was the area's importance as a nesting site for the Dalmatian pelican, ferruginous duck (*Aythya nyroca*), the pygmy cormorant and corncrake. As noted by IUCN in its evaluation and brought to the Committee's attention, the Srebarna Nature Reserve was not completely natural at the time of its inscription. The lake and marshland were disconnected from the Danube in 1949 by the construction of a dike between the river and the lake precluding regular annual inundation; subsequent water management measures primarily consisting of drainage canals had also been constructed prior to the time of inscription. Engineering efforts in 1979 to mitigate the impact of the dike construction had not proved successful. Gross estimates of reduced Danube in-flow water quantity and disrupted periodicity were available and accepted during the review process

prior to inscription, but neither fully understood, nor adequately interpreted at the time. Quantitative and qualitative data on ground water seepage and surface runoff within the Srebarna Lake drainage, or an analysis of the complex and inter-related ecological and biochemical processes which would have provided a more comprehensive baseline on which ongoing natural and anthropogenic changes could be assessed were addressed in the nomination evaluation or in the inscription process.

During the period between 1985 and 1990, the adverse effects of a protracted regional draught on the Balkan peninsula and the cumulative effects of historical and recent regional and international anthropogenic influences reached more readily observable proportions in Lake Srebarna. The combination of the latter causal agents with regulation of annual Danube flood crests by the Romanian Iron Gates control structure, the previous elimination (1979) of local traditional land-use practices (reed harvest and burning), the lack of adequate buffer-zone management with introduction of more modern agricultural practices (chemical fertilizers and insecticides) and increased domestic animal populations into the surrounding arable drainage accelerated the decline of World Heritage values. Both ground water seepage and surface runoff into Lake Srebarna had been reduced by wells and tributary control structures. Among the cumulative net adverse results documented in ongoing lake monitoring studies by the Bulgarian Academy of Science were increased levels of dissolved nitrogen and phosphate, decreased dissolved oxygen levels, increased sedimentation and turbidity, a decreased water column and lake volume, initially increased primary productivity and a subsequent simplification in the structure of phytoplankton populations, an accelerated transition from lake to marsh (hyper-eutrophication), the decline of biodiversity (particularly fish species), diminished utilization of the area by rare and threatened resident and migratory bird species, and reduced nesting success ratios of key breeding bird species determined to be of World Heritage significance. Without the periodic fluctuation in water level and a flushing action by Danube flooding, previously floating reed beds ("kotchky") coalesced and stabilized leaving nesting colonies more vulnerable to disturbance and predation.

Informed by IUCN in 1991 of the Srebarna situation, and recognizing the rapid accumulation of deteriorating ecological indices and diminishing World Heritage values, and in consultation with the Bulgarian authorities, and after consideration of removing Srebarna from the World Heritage List and while awaiting the results of further studies, the Sixteenth session of the World Heritage Committee (1992) inscribed Srebarna on the List of World Heritage In Danger. The Committee accepted the State Party's indication that it was undertaking efforts to mitigate the adverse impacts on Srebarna through additional assessment, data analysis, monitoring, the provision additional water by canal construction between the Danube and Srebarna Lake and ecosystem restoration. Subsequently, Srebarna Nature Reserve was additionally placed on the Montreux Record (register of sites in need of priority conservation action) of the Ramsar Convention in 1993.

Conservation status reports from the Bulgarian authorities were provided to the Committee in 1994 and 1995. During its Nineteenth session (1995), the Committee examined a substantive state of conservation report from the Bulgarian authorities. The report indicated that the successful completion of re-connecting the Danube River and Srebarna Lake for the first time since 1949 had been achieved with bilateral assistance (USAID) and was operational with control structures (1995); a permanent Reserve Administration had been established (1994) and intensive monitoring studies were ongoing. Upon advice from IUCN and based on encouraging Ramsar Secretariat mission findings, the Committee then requested a further substantive conservation status report from the State Party for consideration in 1998, and retained Srebarna on the In Danger List. In 1996, the Committee examined a monitoring report prepared by the Ramsar Secretariat indicating that the new canal and water control structure were operational allowing water into Srebarna Lake and that the Dalmatian pelican nesting colony was increasingly successful. Through a 35,000SF allocation from the Ramsar Small Grants Fund (1997), the development of a management plan for Srebarna Nature Reserve was initiated by the Bulgarian authorities (Srebarna Management Plan Outline Attached). Further conservation status reports were examined by the Committee in 1997, and by the Bureau in June 1998. As had been requested by the Committee, the State Party submitted a substantive and timely "Threat Mitigation Status Report 1992-1998" signed by the Minister of the Environment and Waters (Report Attached).

Assessment Mission: In response to the June 1998 Bureau's suggestion, the State Party invited a mission to Bulgaria for verification of the results of the measures undertaken to mitigate threats to the World Heritage values and integrity of Srebarna Nature Reserve. That mission was undertaken 1-6 October 1998 by representatives of IUCN, the Ramsar Secretariat and the Centre. The Mission was facilitated by the UNESCO National Commission and the Ministry of Environment and Waters (MoEW), Sofia, Bulgaria. During the mission, team members met and examined relevant issues with key MoEW officials, leading scientists in many appropriate disciplines from the Bulgarian Academy of Sciences and Central Laboratory of General Ecology, Srebarna Nature Reserve management staff, representatives of the conservation NGO community and vested interest groups including elected officials and community representatives from the three towns near to Srebarna (See attached Mission Programme and List of Mission Contacts). Data on paleo-ecological conditions and the ethno-historical land-use of the area which might provide useful insight into possible future management interventions was not available, although it is understood research into these important topics has been recently initiated. Socio-economic conditions, local demographic changes and prescriptive buffer-zone management initiatives were not fully addressed in the technical papers presented.

In the scientific papers on the Srebarna Nature Reserve presented during the Mission, the following key points were noted:

- The 1998 breeding success ratio of the nesting colony of the Dalmatian pelican and of the pygmy cormorant significantly exceeded the 1980's average levels. The 80

breeding pairs of Dalmatian pelicans produced 99 successfully fledged chicks in a dramatic improvement over World Heritage inscription and post inscription levels; Sixty breeding pairs of pygmy cormorants were recorded in 1998.

- Since recent invertebrate bottom community studies were initiated (1994), 138 species have been recorded; there is an apparent enrichment in both diversity and numbers of species within this community since the connection with the Danube was re-established (1994-95); a slow restoration of the macrozoobenthon is occurring.
- Of the 157 species of higher plants of historical record (since 1911) in the Srebarna Nature Reserve, 139 species are now present (no accurate plant census exists for the date of World Heritage inscription and species may have been lost prior to that time) and only minor changes in the species in the buffer-zone have been noted; 5 new species have been reported since 1995 including one species (*Aldrovanda vesiculosa*) considered extirpated since 1928.
- Based on historical records, 23 species fish of typical of the Danube river system were found in Lake Srebarna through 1949; declines in both diversity and numbers were noted in investigations between 1952-53; algae blooms in 1991-93 resulted in high fish mortality; post reconnection with the Danube 14 fish species have re-established themselves and two new species (*Pungitius platigaster* and *Carassius auratus gibelio*) have been recorded for the first time. Although the aquatic environment is not yet stabilized, it is concluded that the ichthyofauna is gradually restoring itself.

The extremely important substantive research and monitoring of the phytoplankton populations of the Srebarna Nature Reserve was not initiated before World Heritage inscription; qualitative and quantitative investigations between 1987-88 found up to 97 taxa per sample (35 species from 28 genera were dominant); a substantial increase in biomass (phytoplankton cell density) and decrease in species diversity (two species per sample) was detected in (1989-91) and after a short temporary recovery, only 7 species per sample were found in 1993 accompanied by the elimination of the blue-green algae populations. With the reconnection between the lake and the Danube, an overall increase in species was recorded with certain populations reaching levels comparable to pre-1989 conditions. Positive changes in the phytoplankton population numbers and structure reflect a reversal from hyper-eutrophic situation (1989-1993) to a more typical eutrophic conditions such as likely to have existed prior to World Heritage inscription.

- Cumulative drying of Lake Srebarna and associated wetland was reflected in changes of the mineral content of the water. In pre-inscription conditions (1964), lake water was reported to have been a bicarbonate-chloride type; 1985 investigations revealed a change to a bicarbonate type. The drying process and reduction of water column increased mineralization (doubled concentrations), shifted the lake type from

bicarbonate to sulfate and caused alterations in the water's ionic composition. Lake water nutrients (nitrates, nitrites, ammonia and phosphates) increased significantly during the 1990-93 period; nitrate concentrations increased 5-10 times, ammonia concentrations increased up to 6 times for minimal values and phosphate concentrations increased 4-5 times. The resulting hyper-eutrophication process was immediately reflected in the phytoplankton populations noted above. In 1995 (no measurements were taken in 1994) with the water column increased, the nutrient levels were significantly reduced particularly in the months of March - May; however maximum seasonal nutrient levels in 1998 appear to be once again somewhat elevated and will require further close monitoring and possible further management intervention.

- It is noted that several mammals (jackal and wild boar) are of management concern particularly during low water periods in the past when nesting waterfowl have been especially vulnerable to predation and disturbance; nesting colony fencing appears to have been at least partially successful, but further considerations may be necessary.
- The hydrological characteristics and water balance of Lake Srebarna and its surrounding wetlands are at least partially understood and systematically monitored, but data on the quantitative and qualitative significance of underground seepage and flow in maintaining this balance and its affect on the complex ecological processes appears to require further investigation.
- As noted elsewhere in the Mission Report, it appears from the information presented to the Mission Team that the collaboration necessary for the effective management and functioning of the Srebarna Nature Reserve's "buffer-zone" is inadequate. Opportunities to enhance this situation exist during the Management Planning process, the reinstatement of traditional practices such as reed harvest and fishing should this be required as a management tool, and a more active community involvement in the management decision making process. No data was presented on the direct or indirect impact (past and present) of agricultural practices, domestic livestock and demographic changes within the Lake Srebarna drainage and the theoretical buffer-zone area, nor was the buffer-zone adequately defined for management purposes.

The publication of "Biodiversity of the Srebarna Biosphere Reserve: Checklist and Bibliography" by the MoEW (September 1998), provided an additional and valuable baseline inventory previously unavailable from a single source. It notes that over 70 scientific articles have been published as the result of intensive investigations since the inscription of the Srebarna Nature Reserve on the List of World Heritage In Danger (1992).

In the Mission's initial review of the available data and in discussions with the representatives from the Central Laboratory of General Ecology (CLGE), Bulgarian Academy of Sciences, it was apparent that a considerable and extraordinary effort had

been concentrated in intensifying monitoring the Srebarna Nature Reserve since the area had been inscribed on the List of World Heritage In Danger (1992).

As had been requested early in the Mission, the team was provided with a scope of work for the "Srebarna Biosphere Reserve Management Plan" and "Time Table for the Development and Implementation of a Management Plan for Lake Srebarna Ramsar Site: Monitoring and Management Plan" on the concluding day of the Mission (see Appendix 4).

An initial review of this scope of work and schedule suggests that additional training in the preparation of management plans, such as has been previously provided to a number of NGO organizations in Bulgaria, would significantly enhance the development of an effective Srebarna Management Plan. Utilization of the scope of work as presented in its current form, is more likely to result in a restatement of scientific findings without establishing necessary management directions, guidelines, priorities to maintain World Heritage values. The suggested process also unfortunately does not indicate a role for Bulgarian conservation NGOs or the adjacent communities, nor does it address key management concerns for buffer-zone management and community collaboration, acquisition and analysis of paleo-ecological and ethno-historical land-use data and appears to treat options for re-establishing traditional community practices (reed harvest and fishing) and potential tourism impacts somewhat superficially. There is no indication of the importance of addressing budgetary and administrative implications and requirements in the planning process. The possibility of a companion "Action Plan" to address the development of an environmental education/interpretation programme, resource management intervention actions including regional and international cooperation, future research priorities and equipment and staffing needs is omitted from the current Outline.

Based on discussions, a review of the existing data, and the field assessment, the Mission concluded that significant affirmative actions and investments have been made by the Bulgarian authorities to investigate, analyze and mitigate threats to Srebarna's World Heritage values as defined at inscription in 1983. Positive results included:

A. Re-establishment of a seasonal connection between the Danube and the Srebarna Lake and surrounding wetlands for the first time since 1949 which since its operation (1995) has resulted in increasing the water volume and water column, dilution and/or reduction of dissolved nitrogen and phosphate levels, lowered turbidity, re-established phytoplankton population structure and increased fish species diversity to pre-1983 levels.

B. The 1998 breeding success ratio of the nesting colony of Dalmatian pelicans significantly exceeded 1980s average population levels. The Dalmatian Pelican Society verified the statistical average number of breeding pairs were only 52.2 pairs with a much lower breeding success level of .79 in 1979-90. The sixty breeding pairs of pygmy cormorant (1998) also reflects a similar significant key species response to more

favourable ecological conditions now present. Other globally significant breeding rare water bird species including the corncrake and ferruginous duck, as well as regionally significant breeding species have responded in a dramatic and positive way with almost all of the most important species now returning to nest at pre-inscription levels (see Chapter II of the Mission Report for more detailed ornithological information). Improved ecological conditions have also fostered the return of the water lily (*Nymphaea alba*).

C. Administratively, significant legislation (Draft Protected Areas Act - No. 802-01-16) has been promulgated by the MoEW, approved by the Council of Ministers, and is under a second review in the National Assembly. The intent of this legislation is to strengthen conservation in Bulgaria in general and harmonize Bulgarian protected area classification with international standards including relevant European Union Directives. Elements of the draft legislation have specific application to the effective management of Srebarna. Inherent will be the required decision with respect to continuing Srebarna as a "strict" nature reserve excluding all non-scientific activities, or reclassified as a "maintained" reserve allowing for a more flexible and necessary restorative management regime (see Chapter II of the Mission Report for a more detailed review of pending legislation).

A small but competent staff has been established for the Srebarna Nature Reserve management and is currently cooperating well with the Academy of Science on ongoing monitoring activities; an automated weather recording facility is in place and will facilitate the latter effort. Both management staff and Academy researchers appear on excellent terms with local community leadership which would be necessary to establishing effective buffer zone cooperation. With Ramsar funding, the necessary integrated management planning process has been initiated, although a product may be still 18 months away and does not appear to adequately involve public participation, nor address ethno-historical and socio-economic considerations; the plan outline does not necessarily translate into an action plan in its current form. The Minister, MoEW, indicated both a desire and determination that Srebarna be removed from the List of World Heritage In Danger and has guided administrative efforts toward this end.

D. The State Party has been responsive to the Committee in providing detailed and timely information required for consideration and analysis of the state of conservation for Srebarna. It has met both the terms and conditions of the Committee's suggestions without reservation. Under the terms of the Convention, Bulgarian authorities have successfully sought outside technical and funding assistance where it would facilitate their efforts to restore Srebarna to 1983 conditions, or better.

Therefore, the Committee may wish to consider the following Mission recommendations:

1. Commending the State Party for extra-ordinary efforts to restore Srebarna environmental conditions and World Heritage values to 1983 standards, or better;

2. Encouraging the State Party to accelerate their interdisciplinary management planning and threat mitigation efforts and continue to pursue their intensive monitoring to assure continued ecological restoration so that the area may be removed from the List of World Heritage In Danger at such time as it can be demonstrated that such recovery appears sustainable;
3. Encouraging the State Party to seek necessary cooperation with Romania to assure that the feeding areas and flyways for the Srebarna breeding Dalmatian pelican population offer safe haven, and based on the terms of the Convention (Article 6.3) seek to establish a more favourable hydraulic regime of the Danube River;
4. Encouraging the State Party to actively participate in regional and international scientific, and management exchanges to further benefit the management of all the Danube River wetland resources;
5. Encouraging the State Party to explore the ways and means to collaborate with other States Parties sharing resident and migratory bird species and populations to collectively consider the merits of a "serial-like" or composite transboundary "Danube Wetland World Heritage Site" to link and embrace all suitable and qualified areas which collectively represent a globally significant and outstanding natural and cultural resource;
6. Advising the State Party that the Committee will consider removing Srebarna from the List of World Heritage In Danger upon the passage of pending Draft Protected Areas Act (No. 802-01-16) or substantively similar conservation legislation, the satisfactory and timely completion of the Srebarna Management Plan with the establishment of an effective resource management regime and buffer-zone management compatible with restoring and maintaining World Heritage values, and the provision of data to support indices of sustained World Heritage value recovery through the year 2000.

The Committee may also wish to suggest to the State Party the advantages of involving local community and NGO representation in the management planning process and in the formulation of specific cooperative actions which may be required in the management of the buffer zone and adjacent Lake Srebarna drainage area. Further, the State Party may wish to consider the value of acquiring additional scientific data and information including ethno-historical and paleo-botanical analysis of lake sediments prior to dredging activity, complete aerial photographic records for management planning and restoration purposes and the development of a Srebarna Action Plan establishing management and environmental education/interpretation priorities and requirements to supplement the Srebarna Management Plan as outlined. (see further information on buffer-zone enhancement and community participation in Chapter III of the Mission Report).

Considering the inter-relatedness and select mutually supportive objectives of the World Heritage Convention, Ramsar, the Bonn and Biodiversity Conservation Conventions and

the Biosphere Reserve programme of MAB, the Committee may wish to encourage the State Party to continue and strengthen participation in these Conventions and programmes.

Chapter II: Review of Pending Legislation and Ornithological Importance³

Legislation. By Decision 101, on 12 March 1998, the Council of Ministers of the Republic of Bulgaria approved a Draft Protected Areas Act (no. 802-01-16) and forwarded it to the National Assembly for review. During our mission, we had access to both the original Bulgarian text of the Act, and an English translation. We were also able to consult, with the help of a translator, the reports of the two Parliamentary Commissions which reviewed the Draft Act prior to its First Reading by the National Assembly. The Second (and final) Reading was due to take place on 6 October.

The Ministry of Environment of Waters indicated to us that one of the main aims of the Draft Act is to harmonize Bulgarian protected area legislation with international standards, including the IUCN categories of protected area, and relevant EU Directives. A review of the English translation of the Draft Act indicates that these aims would be partially met. For example, Article 5 of the Draft Act provides for six categories of protected area, but these do not conform precisely with the IUCN terminology:

1. reserve
2. national park
3. natural monument
4. maintained reserve
5. natural park
6. protected locality

The Draft Act does not allocate each of the existing protected areas to one of the new categories (this is a point strongly criticised by some NGOs). Instead, the Ministry of Environment and Waters must undertake consultations and designate categories 1,2 and 4 within six months of the Act entering into force, and categories 2,3 and 5 within three years. Until recategorization takes place, the existing protected area regimes remain in force. Recategorization may involve the modification of site boundaries; an issue of concern for some NGOs we talked to, since some site boundaries may be restricted. The Act does not provide for, or otherwise refer to buffer zones, which is also an issue for concern.

In relation to Srebarna, there is some dispute over which category should be applied. Certain traditionalists consider that Srebarna should continue as a strict reserve (= category 1, 'reserve' of the Draft Act) with all non-scientific human activities excluded. However, the majority view seems to be that Srebarna should become a 'maintained reserve' (category 4 of Draft Act). Article 26(2) of the Draft Act states:

"The maintained reserves shall be managed for the purpose of:
1. preservation of the natural characteristics;

³ Based on the Mission Report prepared by Tim Jones, Regional Co-ordinator, Ramsar Bureau, Appendix 3.

2. *scientific and educational purposes and/or ecomonitoring;*
3. *restoration of populations of plant and animal species and/or the conditions of the habitats thereof;*
4. *conservation of genetic resources."*

Article 27(1) states:

"Prohibited in maintained reserves shall be all activities except:

1. *guarding thereof;*
2. *visits for scientific purposes;*
3. *movement of people along defined trails, including for purposes of education;*
4. *gathering of seed material, wild plants and animals for scientific purpose or for restoration thereof elsewhere;*
5. *conducting of maintenance, guidance, regulatory or restorative measures"*

Article 27(2) states:

"The activities under paragraph 1, item 5 shall be defined in the maintained reserve management plan."

Taken together, Articles 26 and 27 appear to offer a reasonable legislative basis for an appropriate management regime at Lake Srebarna, including the possible re-establishment of traditional human activities which are important in restoring and maintaining the site's natural values. However, there also appear to be some internal contradictions in the text. For example, Article 8.1 indicates that national parks and 'natural reserves' are to be owned exclusively by the state. Article 8.3 indicates that 'natural reserves' are reserves (category 1) or maintained reserves (category 4) which are model ecosystems and where human activities being excluded or kept to a minimum. This seems to imply that Srebarna could be designated as a maintained reserve, but under a 'natural reserve' regime, meaning that it would be state owned, with minimal human activities. In this respect, care would be needed to avoid repeating the mistakes of the past.

Chapter Four of the Draft Act assigns responsibility as the management authority for protected areas to the Ministry of Environment and Waters. The Ministry is specifically charged with commissioning and approving management plans for protected areas, including the organization of the activities of owners and users of protected areas, and coordination with other ministries, agencies etc.

Article 56 of the Draft Act requires management plans for all reserves and maintained reserves to be developed within two years of their declaration (under the new Act). It also states that management plans shall be updated every ten years.

Article 58 states:

“The management plans shall contain:

- 1. general description of the protected area and its components;*
- 2. the objectives of management in the protected area;*
- 3. the standards, regimens, conditions or recommendations for the performance of: activities within the forests, lands and aquatic areas; development of infrastructure and construction; organization of management and others that ensure achievement of the objectives;*
- 4. short-term and long-term action programmes related to scientific research and monitoring of the environment components, maintenance of endangered species, communities and habitats, ecological training and education etc.”*

Chapter Five of the Draft Act deals with financing for protected areas and indicates that preparation of management plans shall be supported by the National Environmental Protection Fund of the Ministry of Environment and Waters.

The Draft Law was reviewed by the Parliamentary Commissions dealing with Environmental and Legal matters, on 12 March 1998 and 30 March 1998, respectively. The Legal Commission suggested reviewing the Act to bring it into conformity with the Forest Law. However, we understand that the Draft Act passed its First Reading by the National Assembly, on 1 October 1998, without substantial amendment. It was due to receive its Second Reading, after which it would be adopted in law, on 6 October 1998.

In summary, the new Act appears to provide the basis for a more appropriate protected area regime for Lake Srebarna in the future. However, there remain several issues of potential concern, requiring close attention from the Bulgarian conservation authorities and the international community:

the time frame for implementation of the Act and recategorization of Srebarna under the Act; the site boundaries to be applied to the recategorization;

the future status of the current reserve ‘buffer zone’ is unclear;

the implications of ‘natural reserve’ status for undertaking necessary management actions at Srebarna, including re-establishment of certain traditional land-use practices;

the process of development of the management plan and securing of sufficient funding for its implementation.

Ornithological Importance. Water birds have responded in a dramatic and positive way to the re-flooding of the lake, with almost all of the most important species returning to nest. For example, the following numbers of nesting pairs were recorded during the 1998 breeding season (data from Srebarina Reserve Administration):

pygmy cormorant**	<i>Phalacrocorax pygmeus</i>	60	
Dalmatian pelican*	<i>Pelecanus crispus</i>	80	
little bittern**	<i>Ixobrychus minutus</i>	30	
night heron**	<i>Nycticorax nycticorax</i>	80	
squacco heron**	<i>Ardeola ralloides</i>	25	
little egret	<i>Egretta garzetta</i>	60	
purple heron**	<i>Ardea purpurea</i>		10
glossy ibis**	<i>Plegadis falcinellus</i>	10	
garganey**	<i>Anas querquedula</i>	30	
gadwall**	<i>Anas strepera</i>	50	
corncrake*	<i>Crex crex</i>	2	
ferruginous duck*	<i>Aythya nyroca</i>	60	
whiskered tern**	<i>Chlidonias hybridus</i>	20	

The total number of breeding species is now comparable to that of the early 1980s. White-tailed eagle** (*Haliaeetus albicilla*) and great white egret (*Egretta alba*) do not nest inside the reserve, but are regularly recorded. Furthermore, red-breasted goose* (*Branta ruficollis*) occurs in winter, with numbers up to 1,000, depending on weather conditions.

* = species of global conservation concern;

** = species with unfavourable conservation status in Europe.

It is notable that Lake Srebarina is currently supporting internationally important breeding numbers of two bird species of global conservation concern (Dalmatian pelican and ferruginous duck), and is used by at least two other species of global conservation concern (wintering red-breasted goose, and nesting corncrake). At least nine other wetland bird species of European conservation concern nested in significant numbers in 1998.

Recent data from Srebarina indicate that it has regained much of its importance as a site of global and European importance for wetland birds. This appears to be directly attributable to the restoration and rehabilitation efforts to date. However, the long-term value of the site is clearly contingent on implementation of further work to achieve a stable, well-functioning wetland ecosystem.

Chapter III. Buffer-zone Management and Community Involvement⁴

Buffer-zone Management. Srebarna Nature Reserve is also a designated biosphere reserve and the selective application of related management principles could not only be compatible with World Heritage values, but may enhance sustaining the integrity of the Nature Reserve. An area declared as biosphere reserve would be normally divided in three zones :

- a core area where conservation is the unique objective;
- a buffer zone where conservation is the main objective but where traditionnal activities can be allowed;
- a cooperative zone where the objective is to cooperate with local population for introducing conservation objective in their activities.

The clear delineation and effective use of the Srebarna Nature Reserve buffer-zone referred to in the Srebarna World Heritage Nomination and IUCN evaluation appears to be questionable. The administrative staff of the area pointed an unmarked two hundred meter zone surrounding the reserve which remained paritally fenced and unclutivated, but allowed the passage of agricultural equipment and other vehicles.

The establishment of an effective buffer-zone would be of high importance for the protection and conservation Srebarna World Heritage Site. The creation of an effective buffer-zone zoning would facilitate the management of the Nature Reserve and address the critical relationships with local and adjacent land holders. The application of the biosphere reserve concepts in the Srebarna Nature Reserve buffer-zone could be highly useful in the management planning process. This approach could be equally useful if the island in the Danube which is the object of a territorial disagreement between Bulgaria and Romania was included in an expanded buffer-zone; inclusion of interstitial navigable portions of the Danube would be problematic, but one approach might be to create a cluster biosphere reserve.

Community Relations and Involvement. As part of the Mission assessment, it was requested that the team have the opportunity to meet with elected officials and representatives from the local communities. The Mayor of the nearby town of Srebarna believes that local population is quite attached to and supports in general the conservation of the Srebarna Nature Reserve despite their resentments towards the curtailment of traditional reed harvest and fishing practices (for 17-18 years) without any economical offsets. According to the Mayor, the people living around the reserve feels that the conservation status of the area was better before it was declared a strict reserve.

⁴ Based on the Mission Report prepared by Dr. Gerard Collin, Conservateur Regional, Region Languedoc-Roussillon, France Appendix 2.

The Mayor of Silistra asked for more contacts and more discussion with scientists and officers of the Ministry of Environment and Waters so that better information could be provided to the public and so that the management objectives of Srebarna World Heritage Site could be integrated with the management of the Silistra region. He was also of the opinion that the management of Srebarna Nature Reserve would be important to be discussed with Romanian authorities as a part of a large territory related to Danube; he believes the future of Srebarna will certainly be at least in part contingent to the environmental policy of Romania in this section of Danube River.

The Museum Adjacent to the Srebarna Nature Reserve. The Natural History Museum located adjacent to the Administrative Building for the Nature Reserve (operated by the town of Srebarna) would provide an excellent opportunity for strengthened collaboration between Reserve officials and the community. At present, both the museum concept and approach is outdated and offers minimal appeal to tourists and young visitors. An estimated 15,000 visitors enter the Museum per year (less than 10% of the tourists to Srebarna region per year). Currently no mention is made of the World Heritage or Ramsar status of the Nature Reserve, or of the conservation and management issues within the Museum. The primary Museum focus is on static exhibits and nomenclature of preserved specimens in glass cases. Ecological issues remain unaddressed. Tourist understanding and economic benefits to the local community remain relatively insignificant under these conditions.

An opportunity exists however to use more modern interesting and visitor friendly exhibition techniques to present an appealing and broader conservation learning situation to tourists and students alike. The inclusion of Museum rehabilitation in both management and action planning would be a constructive approach to enhancing community benefits from the area.

APPENDIX 1

MISSION TERMS OF REFERENCE

1. Assessment of the status of the area with particular focus on the annual sedimentation, on the water influence and on the development of the number of water and passerine bird population as well as on the site management capability;

2. Identification of impact and damages caused by agricultural and residential use of surrounding areas and the Iron Gate Dam requiring remedial actions ;

3. Evaluation of the impact of implemented activities to re-establish the ecosystem and estimation of future activities and strategies regarding the recovery of the ecosystems balance;

4. Review of relevant legislative, organisational, administrative and management framework regulating the site and environs;

5. To develop a summary action plan to address priority needs with a view to assist the State Party to rehabilitate the site;

6. Review of international status of the site as World Heritage Site (1983), World Heritage Site in Danger (1992), UNESCO Biosphere Reserve (1977), Ramsar Site (1975) and Ramsar-Montreux List (1993);

7. Consideration of a conceptual framework and requirements to elaborate and/or revise the general management plan for the area and to re-establish an effective management capability, as necessary;

8. Prepare a full report to the World Heritage Committee considering Operational Guidelines paragraphs 82 89, 77 88 and 46 56.

APPENDIX 2

Srebarna Mission Report 1-6 October 1998

Prepared by: **Dr. Gerard Collin, Conservateur Regional,
Charge de Mission Investissements,
Region Languedoc-Roussillon,
France**

I will not give a complete analysis of the report here, but just stress on some points that seem to be of interest for the development of the foreseen management plan.

1. **Tourism** : it is said (p4) that there is an "increasing number of tourists in the region (about 100.000 a year). The data given by the local authorities (mayor of Srebarna, mayor of Vetren, responsible of Srebarna museum) is around 15.000 visitors for the museum. That means that only 10% of the tourists coming in the Silistra region are in touch with the Srebarna reserve. Two conclusions proceed from this :

- the impact of tourism on the reserve is certainly insignificant

- the economical interest of local population for the reserve cannot be related at this moment to touristical activities

2. **Anthropogenic Impact** : Very curiously we have a good and scientific approach of the biological questions in the "Conservation Status Report" but this very critical question of the impact (negative as well positive) of human activities is treated in a very poor way (p 12) "Activities" is a very vague word that forbid to know where exactly the problems are and how to reduce them. "Possible impact of the waste waters" is an innacceptable expressing in a process of precise analysis of all the factors playing a part in the reserve. Nothing is said directly about the impacts of nearby pig farms (cf. world heritage committee, 15th session, Carthage, dec. 1991).

This is certainly one of the weakness of the report but, above, all of the work done for the reserve rehabilitation: absence or little importance given to human and sociological researches in a place so related to Man since a long time

3. **Management Plan of the Reserve** : the question of how to prepare this plan is a crucial one (p 14) and the workshop held with the help of UNESCO WHC, the ceremony for the 50 th anniversary... are favourable but insufficient actions. If, as it seems

according with discussions with Bulgarian authorities, this plan is prepared by scientists and officers of the Ministry of Environment and then just presented for discussion to local people the risk of misunderstanding is great.

The question of who is in charge of the preparation of the plan is an other crucial point if we consider the document prepared by the Central Laboratory of General Ecology (Bulgarian Academy of Sciences) with the development and work out as follows :

- Ecology, habitats
- Flora, vegetation structure
- Hydrobiology
- Phytoplankton
- Zooplankton
- Zoobenthos
- Fish
- Invertebrates, reptiles, amphibians
- Mammals
- Birds
- Socio-economy aspects

The place given to the study of the relations between Man and nature is too short and not given in an historical approach. The need for a paleo-ethno-historical ecology of the place is great for a better knowledge of the functioning of the area along times.

Real participation of the population in the preparation of the management plan as well the realization on ethno-historical studies is needed. These studies could be a way to associate closely people from the area to the reserve (an ethno-historical research needs necessarily investigations about the local knowledges, giving this the first step to a participative process).

4. Workshop for establishing social cooperation between institution and local population

This workshop held in 1994 with financial help from Unesco has certainly been useful (p 27). But we have not had any mention of educationnal or training experience led since 5 years to follow the necessary link with local people

The success of Srebarna rehabilitation will be possible if there is understanding, acceptance and then adhesion to the project

THE MEETING WITH THE SCIENTISTS

▪ All along the day we have had a good and complete review of the biological status of the reserve. Globally the status is improving since 1994-95 (opening of a new canal between Danube and lake Srebarna). Since that date it seems that Danube has overflowed and entered the new canal just once. It has allowed, by closing the sluice n° 2, to maintain sufficient water level in the lake. All the indicators show a positive recovery even the levels are under those existing before 1992.

▪ All scientists but two consider that established fact is not at all conjectural but the beginning of a come back to the previous status. I think that the statistical period is too short for giving such statement.

▪ Every scientists has agreed that we are (certainly more than in the past) in a place where Nature can maintain if Man help it permanently by, for instance :

- opening and closing the sluices
- dredging the new canal
- cutting reeds
- constructing floating nests for birds
-

▪ The main conclusions we can give after that serious and controversial meeting are :

- the efforts of bulgarian scientists and officers seem to improve the status but need to be confirmed

- the results have been obtained by managing and monitoring the area, this would say that Srebarna is now a managed and not a strict reserve

THE LESSONS FROM THE FIELD

1. The museum or Visitor Centre of Srebarna : the responsables of the place ask for a renewal of the naturalized animals displayed in the showcases. If we can agree that their status is not good, we think the main question is : a museum for what for ? The museum must be the only place where tourists as well as schoolboys and schoolgirls can understand the reserve and its problems. The actual exhibition is just a non living list of the animals of the Srebarna Reserve. Nothing is said on the ecological history of the area, on the human settlements and there activities, on the recent evolution of the lake, on the ways of life and relations between animals...

What is now needed is an interpretation centre

2. The zoning of the reserve :

The Srebarna Reserve is also a biosphere Reserve : according to the definition given by the Man and Biosphere Programme (MAB), the area declared as biosphere reserve would be normally divided in three zones :

- a core area where conservation is the unique objective
- a buffer zone where conservation is the main objective but where traditionnal activities can be allowed
- a cooperative zone where the objective is to cooperate with local population for introducing conservation objective in their activities

When we have asked for the limits of the buffer zone we have had no real answer : the administration of the reserve has just shown us a two hundred meters zone all around the reserve looking just like a "noman's land" between the reserve and the non preserved territory.

This seems to be of high importance for the future of Srebarna World Heritage Site. A zoning making easier the management of the area and the relation with local people is certainly necessary. The use of the biosphere reserves concept could highly be useful. This would be also helpful ! if the idea of including the island in the Danube (object of a territorial dispute between Bulgaria and Romania) was put in action : it would be impossible to include it directly in the area of the reserve with the navigable area of the river but the solution could be to create a cluster biosphere reserve.

3. The opinions of the mayors

The mayor of Srebarna thinks that local population is really attached to the conservation of the area because it is a part of themselves but they are unhappy to have just to obey interdictions without any economical offsets. The people leaving around the reserve feels that the status of the place was better before the declaration as a strict reserve. All these points lead to the question of information and to the question of association of local population to the reserve.

The mayor of Silistra asks for more contacts and more discussion with scientists and officers of the Ministry of Environment and Waters for a better information of the public and for the integration of the objectives of Srebarna in the management of all Silistra region. He thinks that the management of the area must also be discussed with Romanian authorities as a part of a large territory related to Danube. The future of Srebarna will certainly be put in relation with environmental policy of Romania in this zone of Danube river

THE PROJECT FOR A LAW ON PROTECTED AREAS

▪ A project has been prepared for March 12, 1998 and is supposed to be voted before the end of this year. The Commission for Preservation of Environment and Water Resources has given his complete agreement to the project but the Commission on Legal Matters has asked for a reviewing of the project before a second lecture in Parliament. The main criticisms were :

- insufficient definition of parks and natural reserves boundaries
- question of property and use of forests
- interdiction of political parties as owners of territories in the protected areas
- place of town inhabitants in the protected areas

▪ We must consider that the protected area categories proposed by the law are not far from those of IUCN

The six categories are present in the two classifications but the words "strict" and "managed" are not used in the bulgarian law. The bulgarian Ministry of Environment has not be able to say us if Srebarna will be classified as a strict or a managed reserve

▪ Management plans : for reserves, they must be developed within two years after their declaration. This means that for Srebarna there is no obligation before year 2000

▪ The promulgation of this law is a great progress for the organization of the protected areas of Bulgaria but a lot of questions are remaining for the specific case of Srebarna :

- in which category will be classified the reserve ?
- is there a possibility of zoning given by law ?
- in which date a management plan will be approved ?

CONCLUSIONS

The documents received from Bulgarian government, the statements from scientists, the discussions with the administration of Srebarna Reserve, the observations in the field, the opinions of the mayors of the area lead to the following questions and suggestions :

1 - the gap in ethno-historical researches is not only a gap of knowledge but also, and overall, a gap for the decisions to be taken for the management of the reserve ; this study should be undertaken with high priority

2 - an inventory of cultural and natural heritage of the whole area must be done in order to prepare an interpretation plan that could be the basis for a sustainable tourism interesting for local population in respect of the conservation aims ; this would be the second priority work for the next months

3 - measurement of human direct and indirect activities on the protected area is a crucial necessity (use of fertilizers, use of water reserves, destination and impact of waste waters, poaching, water quality of Danube...)

4 - complete monitoring of the reserve should be continued in order to observe the biological evolution at least at short dated using a few number of indicators and using comparative series of aerial photographs or/and satellite views

5 - if we consider that the area has been used by Man since a long time and that the reserve is actually functioning with artificial tools (new canal, sluices, artificial nests...) the future status of Srebarna reserve would be certainly that of a managed reserve

6 - the classification of Srebarna reserve, according to the new law on protected areas, must be in the fourth category (maintained reserve i.e. managed reserve) ; managed reserve meaning for us with a management plan including more than management with scientific tools (as the new canal is) but with limited human activities in relation with a zoning of the reserve (for example cutting the reeds is not only an activity but can have huge impact on the sedimentation, on the open water for birds watering...)

7 - a large part of the preceeding points can be in fact related to the concept of biosphere reserves ; as Srebarna World Heritage Site is also a Biosphere Reserve it would be very useful, in respect with that nomination, to make it working really by defining a core area (or a number of it), a buffer zone (which could be partly in the actual limits of the reserve allowing for instance cutting reeds in certain places or allowing fishing in artificial ponds completing those yet existing in the marshy area at northern part of Srebarna reserve) and a cooperative zone (where local population could be associated to the reserve)

Considering that the improvement of the reserve status is very encouraging but also that it could be, in the short time of observation, just a fluctuation in the observed previous situation

Considering that at the moment no official qualification (strict or managed reserve) has been foreseen by the project of law on protected areas (this leaving a doubt on what is the future for Srebarna reserve in bulgarian network of protected areas)

considering that the scientific approach is actively done but shows important gaps in the field of research on human uses and activities in past times as today

Considering that the question of association of local authorities as well as local population is at the moment insufficient

□ Considering that a significant effort could be done in the field of touristical activities for the benefit of the area, developing an interpretative plan and interpretation centres

↳ **It is proposed that Srebarna World Heritage Site be maintained within the list of en danger sites for a period of three more years, this time being used to verify the improvement of the status as well to comply with the above recommandations.**

APPENDIX 3

Srebarna Mission Report 1-6 October 1998

**Prepared by: Tim A. Jones
Regional Co-ordinator - Europe
Ramsar 'Convention on Wetlands' Bureau
Gland, Switzerland**

1. Overview

Lake Srebarna was established as a protected area under Bulgarian law in 1948 and later as a Strict Nature Reserve, from which all human activities (with the exception of scientific research) were banned. The Nature Reserve was extended from 600 ha to 902 ha in 1993, to include adjacent marshes and a small island in the Danube. The lake was designated for the Ramsar 'List of Wetlands of International Importance' in 1975, as a Biosphere Reserve (under UNESCO's MAB programme) in 1977, and inscribed on the World Heritage 'List of Natural Properties' in 1983. The Ramsar site was extended to 902 ha in 1996, to reflect the 1993 extension of the Nature Reserve, though the World Heritage Site retains its original area of 600 ha.

Under natural conditions, Srebarna was connected to the main Danube channel and was subject to regular spring flooding. Water used to enter from the north-west, flow through the lake, and exit towards the north-east, taking with it sediment and loose organic matter. In 1949, however, a major dike was built along the Danube, isolating the lake (as well as extensive areas of freshwater marshes downstream towards Silistra) from the river.

As noted above, non-scientific human activities, such as traditional reed cutting, hay-making and grazing, were prohibited inside the Nature Reserve from the mid-1970s. This led to accelerated vegetation succession, which, in combination with the breaking of the link with the Danube, and construction of small-scale dams on the two intermittent streams which enter the lake from the south, led to the rapid siltation of the lake, a decline in water quantity and quality, and scrub invasion. As a consequence, the site began losing its natural values, including its importance as a resource base for local people, who were forced to stop harvesting of vegetation and to fish illegally.

In an effort to improve things, 500m of the dike along the Danube were removed in 1979, but this was insufficient to restore the natural functioning of river/lake interactions. A few years earlier, completion of the 'Iron Gates' dams on the Danube upstream of Bulgaria, had caused a radical change in the downstream hydrological regime, with a significant reduction in spring flood peaks. Subsequently, the Danube level rarely reached a level high enough to over-top the 500m gap in the dyke. Furthermore, the late

1980s and early 1990s saw a period of protracted drought in the Balkan peninsula, adding further to the problems of water quantity and quality at Srebarna.

As a consequence of deterioration of the site's ecological character and natural values, Lake Srebarna was placed on the List of 'World Heritage Sites in Danger' in 1992, and on the 'Montreux Record' (register of sites in need of priority conservation action) of the Ramsar Convention in 1993.

A Ramsar Management Guidance Procedure Mission visited the site in 1992, and submitted a series of recommendations to the Bulgarian Government. In 1993, the Government established a Reserve Administration, with a small permanent staff. In 1994, US AID money was used together with funds provided by the Bulgarian Ministry of Environment to dredge a channel, controlled by sluice gates, establishing a direct connection between the lake and the Danube for the first time since 1949. Furthermore, an allocation of 35,000 CHF was made from the Ramsar Small Grants Fund in 1997 to finance development of a management plan for the site. Nevertheless, reports received by successive meetings of the World Heritage Committee and its Bureau led to the retention of Srebarna on the List of Sites in Danger, and to the establishment - in conjunction with the Bulgarian authorities - of the present mission.

I have been asked to report on four specific areas:

- legislation (notably implications of the new law on protected areas)
- ornithological importance of Lake Srebarna
- the Ramsar site status of Lake Srebarna and its inclusion in the Montreux Record
- my assessment of the site's current status in relation to its retention on both the World Heritage List and the list of World Heritage Sites in Danger.

2. Legislation

By Decision 101, on 12 March 1998, the Council of Ministers of the Republic of Bulgaria approved a Draft Protected Areas Act (no. 802-01-16) and forwarded it to the National Assembly for review. During our mission, we had access to both the original Bulgarian text of the Act, and an English translation. We were also able to consult, with the help of a translator, the reports of the two Parliamentary Commissions which reviewed the Draft Act prior to its First Reading by the National Assembly. The Second (and final) Reading was due to take place on 6 October.

The Ministry of Environment of Waters indicated to us that one of the main aims of the Draft Act is to harmonize Bulgarian protected area legislation with international standards, including the IUCN categories of protected area, and relevant EU Directives.

A review of the English translation of the Draft Act indicates that these aims would be partially met. For example, Article 5 of the Draft Act provides for six categories of protected area, but these do not conform precisely with the IUCN terminology:

1. reserve
2. national park
3. natural monument
4. maintained reserve
5. natural park
6. protected locality

The Draft Act does not allocate each of the existing protected areas to one of the new categories (this is a point strongly criticised by some NGOs). Instead, the Ministry of Environment and Waters must undertake consultations and designate categories 1,2 and 4 within six months of the Act entering into force, and categories 2,3 and 5 within three years. Until recategorization takes place, the existing protected area regimes remain in force. Recategorization may involve the modification of site boundaries; an issue of concern for some NGOs we talked to, since some site boundaries may be restricted. The Act does not provide for, or otherwise refer to buffer zones, which is also an issue for concern.

In relation to Srebarna, there is some dispute over which category should be applied. Certain traditionalists consider that Srebarna should continue as a strict reserve (= category 1, 'reserve' of the Draft Act) with all non-scientific human activities excluded. However, the majority view seems to be that Srebarna should become a 'maintained reserve' (category 4 of Draft Act). Article 26(2) of the Draft Act states:

"The maintained reserves shall be managed for the purpose of:

- 1. preservation of the natural characteristics;*
- 2. scientific and educational purposes and/or ecomonitoring;*
- 3. restoration of populations of plant and animal species and/or the conditions of the habitats thereof;*
- 4. conservation of genetic resources."*

Article 27(1) states:

"Prohibited in maintained reserves shall be all activities except:

- 1. guarding thereof;*
- 2. visits for scientific purposes;*
- 3. movement of people along defined trails, including for purposes of education;*
- 4. gathering of seed material, wild plants and animals for scientific purpose or for restoration thereof elsewhere;*
- 5. conducting of maintenance, guidance, regulatory or restorative measures"*

Article 27(2) states:

“The activities under paragraph 1, item 5 shall be defined in the maintained reserve management plan.”

Taken together, Articles 26 and 27 appear to offer a reasonable legislative basis for an appropriate management regime at Lake Srebarna, including the possible re-establishment of traditional human activities which are important in restoring and maintaining the site’s natural values. However, there also appear to be some internal contradictions in the text. For example, Article 8.1 indicates that national parks and ‘natural reserves’ are to be owned exclusively by the state. Article 8.3 indicates that ‘natural reserves’ are reserves (category 1) or maintained reserves (category 4) which are model ecosystems and where human activities being excluded or kept to a minimum. This seems to imply that Srebarna could be designated as a maintained reserve, but under a ‘natural reserve’ regime, meaning that it would be state owned, with minimal human activities. In this respect, care would be needed to avoid repeating the mistakes of the past.

Chapter Four of the Draft Act assigns responsibility as the management authority for protected areas to the Ministry of Environment and Waters. The Ministry is specifically charged with commissioning and approving management plans for protected areas, including the organization of the activities of owners and users of protected areas, and co-ordination with other ministries, agencies etc.

Article 56 of the Draft Act requires management plans for all reserves and maintained reserves to be developed within two years of their declaration (under the new Act). It also states that management plans shall be updated every ten years.

Article 58 states:

“The management plans shall contain:

- 1. general description of the protected area and its components;*
- 2. the objectives of management in the protected area;*
- 3. the standards, regimens, conditions or recommendations for the performance of: activities within the forests, lands and aquatic areas; development of infrastructure and construction; organization of management and others that ensure achievement of the objectives;*
- 4. short-term and long-term action programmes related to scientific research and monitoring of the environment components, maintenance of endangered species, communities and habitats, ecological training and education etc.”*

Chapter Five of the Draft Act deals with financing for protected areas and indicates that preparation of management plans shall be supported by the National Environmental Protection Fund of the Ministry of Environment and Waters.

The Draft Law was reviewed by the Parliamentary Commissions dealing with Environmental and Legal matters, on 12 March 1998 and 30 March 1998, respectively. The Legal Commission suggested reviewing the Act to bring it into conformity with the Forest Law. However, we understand that the Draft Act passed its First Reading by the National Assembly, on 1 October 1998, without substantial amendment. It was due to receive its Second Reading, after which it would be adopted in law, on 6 October 1998.

In summary, the new Act appears to provide the basis for a more appropriate protected area regime for Lake Srebarna in the future. However, there remain several issues of potential concern, requiring close attention from the Bulgarian conservation authorities and the international community:

- the time frame for implementation of the Act and recategorization of Srebarna under the Act;
- the site boundaries to be applied to the recategorization;
- the future status of the current reserve 'buffer zone' is unclear;
- the implications of 'natural reserve' status for undertaking necessary management actions at Srebarna, including re-establishment of certain traditional land-use practices;
- the process of development of the management plan and securing of sufficient funding for its implementation.

3. Ornithological importance of Lake Srebarna

When Srebarna was included in the World Heritage List in 1983, the 'Justification for inclusion' provided by the Government of Bulgaria stated:

".....Srebarna is an old and traditional habitat for a number of rare and threatened by extinction bird species of world (Pelecanus crispus and Haliaeetus albicilla), regional (Casmerodius albus, Platalea leucorodia, Plegadis falcinellus, Phalacrocorax pygmaeus, Branta ruficollis, Anser erythrops), and national (Podiceps grisegena, Anas strepera, Aythya nyroca, Netta rufina, Chlidonias nigra, Chlidonias hybrida, Anser anser, Panurus biarmicus) importance...."

Indeed, it was Srebarna's ornithological importance (especially its nesting colony of Dalmatian pelican *Pelecanus crispus*), more than any other, that led to its inclusion in the World Heritage List, Ramsar List and MAB Biosphere Reserve List. However, as indicated in section 1 above, the ornithological importance of Lake Srebarna declined significantly between 1950 and the early 1990s, in line with the deteriorating ecological character of the wetland. From 1990 to 1994, the condition of the site was so poor, that

of the key species, only Dalmatian pelican continued to nest, due largely to concerted human protection efforts, and the fact that the pelicans feed at fish ponds on the Romanian side of the Danube. All other key species deserted the site, so moving to islands in the Danube.

The construction of the canal in 1994, linking the lake to the Danube, allowed for the inflow of spring flood water, and the partial re-establishment of the ecological character of the wetland. The canal does not allow for re-establishment or mimicking of the natural circulation of flood water and scouring of sediment and accumulated organic material from the lake. This means that the lake remains shallow and vulnerable to algal blooms because of accelerated sedimentation during recent decades.

Nevertheless, water birds have responded in a dramatic and positive way to the re-flooding of the lake, with almost all of the most important species returning to nest.

For example, the following numbers of nesting pairs were recorded during the 1998 breeding season (data from Srebarna Reserve Administration):

pygmy cormorant**	<i>Phalacrocorax pygmeus</i>	60	
Dalmatian pelican*	<i>Pelecanus crispus</i>	80	
little bittern**	<i>Ixobrychus minutus</i>	30	
night heron**	<i>Nycticorax nycticorax</i>	80	
squacco heron**	<i>Ardeola ralloides</i>	25	
little egret	<i>Egretta garzetta</i>	60	
purple heron**	<i>Ardea purpurea</i>		10
glossy ibis**	<i>Plegadis falcinellus</i>	10	
garganey**	<i>Anas querquedula</i>	30	
gadwall**	<i>Anas strepera</i>	50	
corncrake*	<i>Crex crex</i>	2	
ferruginous duck*	<i>Aythya nyroca</i>	60	
whiskered tern**	<i>Chlidonias hybridus</i>	20	

The total number of breeding species is now comparable to that of the early 1980s. White-tailed eagle** (*Haliaeetus albicilla*) and great white egret (*Egretta alba*) do not nest inside the reserve, but are regularly recorded. Furthermore, red-breasted goose* (*Branta ruficollis*) occurs in winter, with numbers up to 1,000, depending on weather conditions.

* = species of global conservation concern;

** = species with unfavourable conservation status in Europe.

It is notable that Lake Srebarna is currently supporting internationally important breeding numbers of two bird species of global conservation concern (Dalmatian pelican and ferruginous duck), and is used by at least two other species of global conservation concern (wintering red-breasted goose, and nesting corncrake). At least nine other

wetland bird species of European conservation concern nested in significant numbers in 1998.

In summary, recent data from Srebarna indicate that it has regained much of its importance as a site of global and European importance for wetland birds. This appears to be directly attributable to the restoration and rehabilitation efforts to date. However, the long-term value of the site is clearly contingent on implementation of further work to achieve a stable, well-functioning wetland ecosystem.

It seems worth adding a note to emphasize that whilst the Dalmatian pelican has always been a 'flagship' for Srebarna, its value as an indicator of the ecological status of the lake is very limited. As noted above, the pelicans only nest at Srebarna, and flying across the Danube to feed at fish ponds in Romania. Significant efforts have been made to protect the nest sites at Srebarna from predation and the effects of water level fluctuations, but the colony is vulnerable to events entirely outside the control of either the World Heritage Site managers, or the Bulgarian authorities. For this reason, bi-lateral conservation arrangements between the Bulgarian and Romanian authorities should be given the highest priority.

For the record, the following statistics were provided to us regarding the Dalmatian pelican colony:

<u>Years</u>	<u>Av. no. pairs</u>	<u>Av. no. chicks</u>	<u>Av. no. chicks fledged per pair</u>
1979-90	69	52.2	0.79
1991-94	64	54	0.72
1995-96	51	52.2	0.97

In 1998, there were 80 pairs, which produced 99 chicks, rearing just over one chick per pair to fledging.

4. Montreux Record listing of Lake Srebarna

The Montreux Record operates rather differently to the World Heritage List of Sites in Danger, in that ultimate authority for making decisions about addition/removal of Montreux Record Sites is made by the Contracting Party concerned.

The aim of the Montreux Record is to highlight those Ramsar sites which are in need of priority conservation action.

In my discussions with officials from the Ministry of Environment and Waters, I indicated my view from a technical perspective that, whilst significant improvements have been noted at the site since 1994, the situation is far from fully restored and stabilized and it would be wise to retain Srebarna in the Montreux Record.

The next Conference of Parties to the Ramsar Convention will take place in Costa Rica in May 1999, and the national reports of Contracting Parties on implementation of the Convention during the period 1996-1998 are now due. The Bulgarian National Report is expected to include the Bulgarian Government's view of the Montreux Record status of Lake Srebarana.

5. Conclusions

I had visited Lake Srebarana on one previous occasion, in May 1995, the first year after the reconnection of the lake to the Danube. I have followed events at the site since then with close interest. My personal assessment is that the measures implemented to date have led to a number of markedly positive changes to the ecological condition of the lake. However, the results of research carried out by the Central Laboratory of General Ecology indicate that the lake remains in a highly eutrophic (but no longer hyper-eutrophic) state, with a thick deposition of silt and organic sediment having severely reduced the water column depth.

I recognize that, if being considered for designation today, it is questionable whether Srebarana would meet the criteria as elaborated in the Operational Guidelines. However, given the current context, it seems entirely inappropriate to recommend removal of the site from the World Heritage List. Significant achievements towards restoration of the site have been made, a management plan is currently being developed, new protected areas legislation is pending, and there is clearly a great deal of political will and technical effort, often under very difficult circumstances, going towards further improvement of the situation. On the other hand, the international community should stress its desire for the site management plan to be appropriately developed (e.g. in full consultation with community representatives, and giving highest priority to practical conservation and restoration measures, not only research and monitoring) and fully resourced. In this respect, it is my conclusion that Lake Srebarana should remain on the List of World Heritage Sites in Danger.

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APPENDIX 5

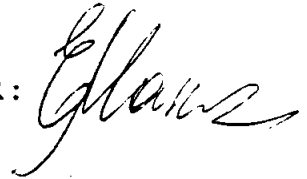
CONSERVATION STATUS REPORT, SEPTEMBER 1998

Prepared by the Ministry of Environment and Waters

Sofia, Bulgaria

REPUBLIC OF BULGARIA
MINISTRY OF ENVIRONMENT AND WATERS

MINISTER :



***SREBARNA NATURE AND BIOSPHERE RESERVE -
WORD HERITAGE SITE***

**TREAT-MITIGATION STATUS REPORT
1992-1998**



C O N T E N T S

- 1. Annotation**
- 2. Characteristics of the Site and its general Ecological State**
- 3. Measures undertaken to restore the ecological characteristics and biodiversity of the Srebarna reserve in 1992-1998**
- 4. Automatic monitoring station at Srebarna Reserve**
- 5. Current ecological state according to the monitoring conclusions**
- 6. General conclusions**

Photos: E. Matveeva- MoEW

I. Kutsarov- Director of Srebarna NBR

REPUBLIC OF BULGARIA

MINISTRY OF ENVIRONMENT AND WATERS

TREAT-MITIGATION STATUS REPORT
SREBARNA NATURE AND BIOSPHERE RESERVE -
WORD HERITAGE SITE

1992-1998

ANNOTATION

Subject to this report is the Current Ecological Status and Restoration Measures Undertaken at Srebarna Nature and Biosphere Reserve (SNBR) during the 1992-1998 period.

Srebarna Lake, located on the Danube bank between 391 and 393 km, was designated as a Protected Site in 1942 and some years later, in 1948, was upgraded as a Nature Reserve in order to protect the rich biodiversity of the site. Since 1992 Srebarna Nature and Biosphere Reserve (SNBR) covers an area of 902.1 ha.

In 1975 the lake was designated as a Wetland of International Importance (a Ramsar Convention Site) and in 1977 it was acknowledged by UNESCO as a Reserve of the Biosphere within the "Man and the Biosphere" Programme.

*In 1983, because of the extreme richness in rare species of birds, nesting in the reserve and mostly because of the presence of a permanent colony of Dalmatian Pelicans (*Pelecanus crispus*) - a species globally threatened with extinction, the reserve was enlisted in the World Cultural and Natural Heritage Convention of UNESCO, meeting in full the requirements of the 4th criterion of the Convention.*

In 1949 the lake Srebarna was cut off from the Danube by a dyke and its water exchange with the river was terminated. Since then till 1994 recharging of the lake with fresh water took place only from underground springs and the surface runoff from the neighbouring hills.

After the construction of the protection dyke the lake changed its characteristics. The deposited biogenic sludge (sapropel) started to decay and release marsh gases, the character of the bottom and the populations of bottom dwelling animals and plants changed thus in turn changing the feeding conditions for fish and birds.

Until 1975 small scale fishing was practiced in the lake while reed and bullrush were mowed and used for industrial purposes. Since then all economic activities in the reserve have been closed down.

In 1978 the connection with the Danube was partially restored. However, the dyke was opened at a very high point and due to a general drop in the Danube water level, river waters had entered the lake only for times since making the breach. The overall shallowing of the lake due to the raising of its bottom and the lowering of the river water level has caused a number of negative consequences.

For almost half a century ecological conditions in the lake have slowly worsened because of the accumulation of dead organic matter and the increasing eutrophication of its waters.

The deterioration of the reserve ecosystem and the reduction of the number of bird species typical for the lake caused a serious concern among Government institutions, scientific community and local people.

In 1992, as a result of the deteriorating ecological conditions in the lake ecosystem it was proposed, at the 14th Session of the World Heritage Committee, to move the SNBR to the List of the World Heritage Sites in Danger.

Between 1992 and 1998 the Bulgarian Government, particularly the Ministry of Environment (since 1997 Ministry of Environment and Waters), has made serious efforts to improve significantly the conditions at SNBR and there is convincing evidence for its achieving positive results in this respect.

At its 21st Session, held in Naples in December 1997, the World Heritage Committee decided to retain Srebarna in the World Heritage Sites in Danger.

Since 1992, following a proposal of the Institute of Ecology of the Bulgarian Academy of Sciences, the Ministry of the Environment, confident of the indisputable national and international importance of the reserve, decided to take steps to mitigate threats and adverse effects of deterioration of the lake ecosystem and to join efforts with a number of international bodies aimed at the improvement of ecological conditions in the reserve. Action was focused first on decreasing the eutrophication of lake waters and then on gradually restoring the ecosystem functioning as it was before the intervention. After long and detailed discussions, analyses and assessments, it was decided to construct a water-supply canal to link the lake with the Danube. A monitoring procedure was also established at the same time to help speed the returning of life to the reserve.

During the first phase of the work on restoring the hydrological conditions in the reserve the objective was to guarantee twice a year, in spring and in autumn, the flow of the Danube waters into the lake as well as to help gradually restore the course of natural chemical and biological processes typical for the normal functioning of the reserve ecosystem.

participation in these events of the national and local media should be especially noted as they are most instrumental in shedding light on the achievements and difficulties the project faces. A Japanese volunteer, who came through the Japan International Cooperation Agency (JICA) and Japan Overseas Cooperation Volunteers (JOVC) has been helping the reserve Director for two years - 1996-1997.

Monitoring the fluctuations of water level in the lake as well as exercising control on it, the improvement of the water quality, the increase of fish stocks as well as the species of birds occurring in the lake during various parts of the year (see supplements to this report) indicate clearly that the measures taken have been appropriate and the life slowly returns back to the lake ecosystem. The best evidence supporting this conclusion is the unusually high breeding success of the Dalmatian Pelicans colony in 1998: 99 chicks have been born and successfully fledged from 80 breeding pairs.

On 28 September 1998 a Scientific Session dedicated to the 50th anniversary since the designation of lake Srebarna as a nature reserve will be held in the village of Srebarna. To celebrate this anniversary local public as well as local and national conservation NGOs have initiated a number of events and actions, among them the production and distribution of booklets, posters and other printed materials.

Bringing about the project' second phase (finishing the protection dyke, monitoring, improving the system of paths crossing the canal, etc.) led to ensuring control over flooding certain parts of the reserve and surrounding agricultural lands and to regulating the natural run-off of lake waters to the Danube as a necessary precondition for reducing the lake eutrophication.

In order to improve the management of the reserve the Ministry of Environment has formed, since 1993, a Reserve of Srebarna Administration (with a permanent guard service under its authority), directly responsible to the Ministry. In 1995-1996 a building for the Administration was erected and equipped to help, among other, the research activities and monitoring the state of the lake ecosystem. With financial help from UNESCO a vehicle for the Administration was also purchased.

In monitoring activities on the lake research teams from the National Centre on Environment and Resource Management, Sofia Technical University, the Central Laboratory of General Ecology were involved together with the Administration permanent team of researchers and experts seated in the building of the reserve museum. The Administration research team is staffed with local people from the town of Silistra.

The Museum of the Reserve which administratively is responsible to the Silistra municipality was also actively involved in the project.

After the link between the Danube and the lake was restored there came the first results indicating a definite improvement in the state of the reserve ecosystem, most notably an increase in the number of species inhabiting the reserve and their numbers.

These results were presented to by the Ramsar Convention Bureau in 1997 and it was decided then to provide funding for the development of a Management Plan for the reserve. The work on the elaboration of this Plan has started in the spring of 1998 by a team of researchers and scientists from various institutes of the Academy of Sciences (Central Laboratory of General Ecology, Institute of Zoology, Institute of Botany, etc.), hydrologists, climatologists, ornithologists, experts from the town of Silistra, local NGOs. The Ministry of Agriculture, Natural Resource and Fishery of the Netherlands has also offered the expertise of its specialized staff.

In activities aiming at preservation of the reserve water qualities local people from the whole watershed of the reserve were also involved. In the autumn of 1994 a number of workshops were held in the town of Silistra. Topics like rational fertilization of agricultural lands, protection of surface and ground waters from pollution, ecotourism and related social and economic changes following its development were among the most lively discussed ones. Local mayors, farmers, businesses, mediarnen, NGOs participated in these workshops stimulating the broad public for more active involvement in the numerous campaigns for improving the state of lands surrounding the reserve and providing better services to the increased number of tourists in the region (about 100 000 tourists a year). The active

In the period 1949 - 1994 ground water was the main inflow component in Srebarna lake water balance. In comparison with the period prior to 1949 this inflow is significantly reduced due to the fact that several pumping stations have been built around the lake for ground water abstraction and embankment made on the natural Dragaika canal, what accelerated the process of organic matter composition and colmatation of underground griffons. The surface run-off to the reserve is limited by seasonal variations of the neighboring gullies. The surface run-off is also reduced due to natural decline in the amount of rainfalls. As a result the sources of water for the lake reduced about three times. The mean water depth in the lake has reduced approximately by 5m to 1,5 - 2,0m. It is very rare (once per 40 years and above) when Danube waters overflow through the damaged 300 stretch of the dike and the water level in the wetland increases by 3 - 4m after what reduces sometimes to 0.5 - 1,0m. Due to the decrease in water level the surface of the lake reduced approximately by 2 km².

The balance of the lake waters is formed principally by:

- direct penetration of Danube waters during high river water;
- ground waters, appearing as springs, partially along the bank and partially as underwater ones. The flow rate of these waters is highly reduced during the last years;
- surface feeding by several small rivers periodically discharging into the lake; rainfalls, which have insignificant influence because of the small area;
- surface run-off that have negative influence over the lake water quality;

Up to 1948, Srebarna lake had almost annual link with Danube river at high water. The water level of the lake have been increased to an elevation greater than 14 m. During the water draw-back (to an elevation of 12 m) there have been drawn out a huge amount of biogenic sludge - sedimentation of the year-long vegetation.

Anyway Srebarna lake has been formed as a stable in the time since its basin, to a considerable extent preserved from silting.

The characteristic sharp water fluctuation of the lake has increased the flooded territory about two times, and the volume - about 4-5 times.

The developing zoocenoses, as well as the fish reserves were accessible food for the birds.

The sharp rise of the lake water level led to periodical formation of typical reed isles ("kotchky"), which were not flooded and were hardly

Characteristics of the Site and its general Ecological State

The Danube river forms a boundary between Bulgaria and Romania more than 400 km long, where the wetlands and small islands form a spectacular chain, richly endowed with rare and endangered species.

Srebarna lake is located at about 17 km westwards of the town of Silistra and is situated in the west part of the Danube-Aidemir lowland, which in this part has an enlargement to the south up to Srebarna village and forms a small valley. It is formed in a depression, which is a part of the flooded terrace of the Danube river. The north bank line of the lake is located at about 1 km southwards from the Danube river-bed, between kilometers 393 and 391. The south bank line of the lake is tangent to the Rousse-Silistra main road. To the west, south and partially to the east the lake is surrounded by slopes of hills with height of 130 m above the lake water-level. The catchment area of the lake is 1020 sq.km of surface water.

The buffer zone surrounding Srebarna NR consists of arable lands, pastures and forest areas.

The genesis of Srebarna Lake is presumably seismic one - it originates from an event which occurred at the boundary between Holocene and Pleistocene epochs, and which caused landscape deformation - sinking of an earth mass in the embankment area of the Sreburnenska and Kulnezha Rivers. This fact is of a great importance for explanation of lake's flow pattern in past periods. Presumably due to seismic activity in the formed lithological window underground waters from Barmian and Apatian water boundaries was discharged into the formed lowland. Other inflow component to the lake - main water source in the past periods - is the surface water run-off from running down to Srebarna lake gullies - Sreburnensko, Kulnezha and Babukovsko, which flow is significantly greater than the amount of water flowing into to the lake from the Danube. Up to 1949 the lake inflow was more than 15 million m³ estimated for an average year. Water inflow in Dragaika canal (which provides a connection between the lake and the Danube) is about 0,5 m³/s. Before 1949 the depth of this canal has been sometimes more than 7m. The contact period between the Danube and the lake waters through Dragaika canal was about 100 - 120 days.

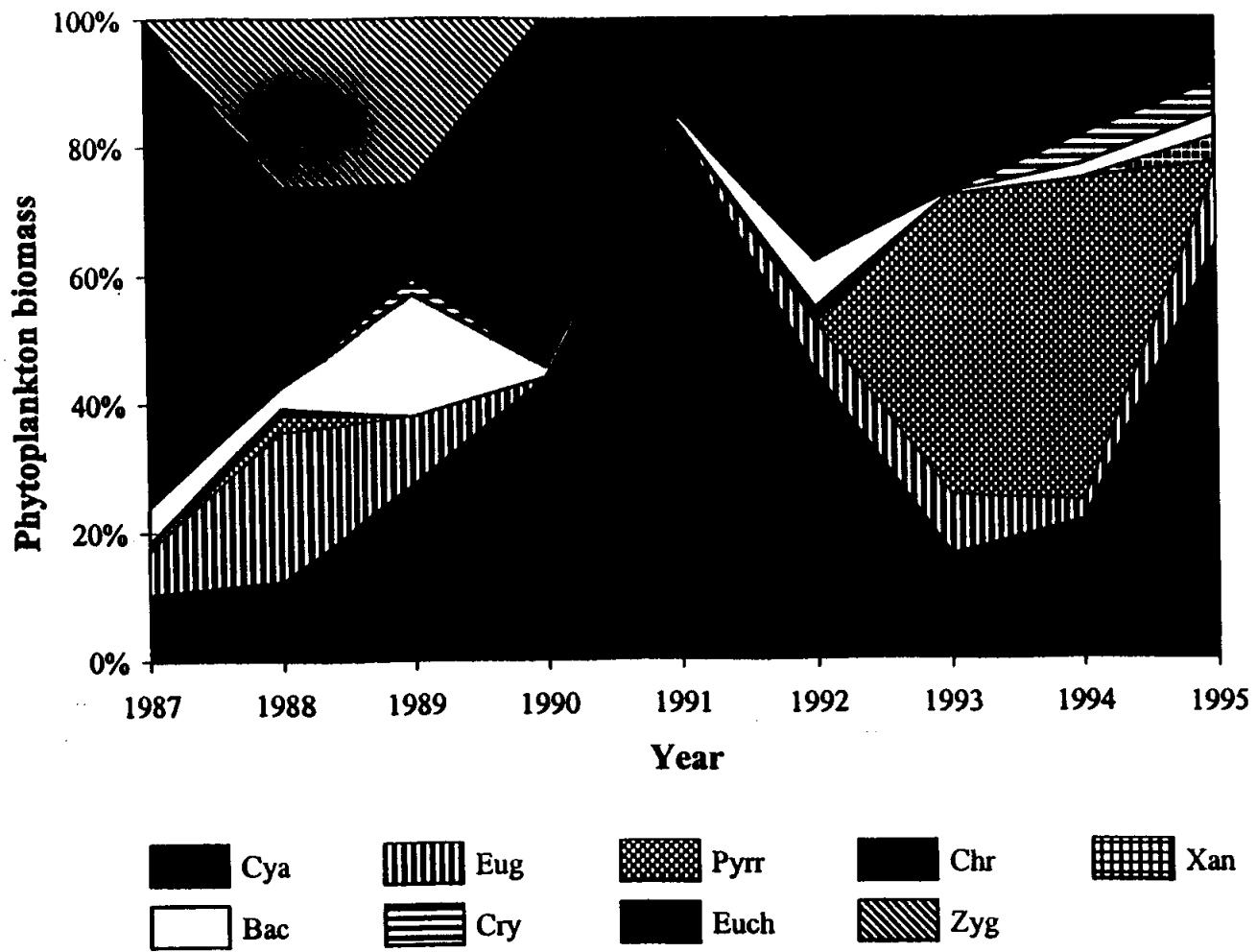


Fig. 1

accessible for the land beasts and served as places for the nesting of the birds.

Srebarna is known with a variety of different flora and fauna species:

1. PHITOPLANKTON DEVELOPMENT DURING THE PERIOD 1987-1995

The Lake Srebarna and its adjacent water bodies in the reserve territory are characteristic by their extremely rich algal flora in which more than 450 taxa were found. During the period 1982-1995 phytoplankton was dominated by 35 different species from 28 genera.

As annual averages, the total numbers of phytoplankton cells in Srebarna varied from 1.9×10^8 cells l^{-1} to 18.5×10^9 cells l^{-1} . The algal quantities generally rose from 1982 to 1993, but the situation before and after the last dilution of lake water by natural flow from the Danube (1988) was different.

After the Danube waters entered the lake in May 1994 and March - April 1995 the algal numbers tended slowly to decrease to 3.9×10^9 cells l^{-1} in average (fig1).

2. The dominant plant species of Srebarna NBR is *Phragmites australis*, which occupies 2/3 of the lake's area. *Typha angustifolia*, *T. latifolia*, *Sparganium ramosum* are also widely spread, among them there are small clusters of *Salix caprea*, *S. cinerea* and *S. purpurea*. The *Nymphaea alba* is covering part of the water areas of the lake.

Up to present there have been identified 136 taxons of plants out of their total number - 156.

The uniqueness of this natural reserve is related to the existence of a water body characterized by significant area and all components of an wetland in active succession. The latter is due to the intensive eutrophication of the lake and the disturbances in its hydrological pattern which have been taken place for more than 46 years. These processes were accompanied by eutrophication of the lake, anomalies in the trophic web, changes in the water mirror surface, changes in the type and number of plant elements and of fauna species, decrease in quality of habitats and others.

The species included in the Bulgarian "Red Book" (1984) from Srebarna reserve are in the following categories:

Extinct: Aldovanda vesiculosa (L.)

1. Rare: Stratiotes aloides (L.), Wolffia arhiza (L.), Cicuta virosa (L.),

Nymphoides peltata (S. G. Gmel) O.Kuntza, *Utriculatia vulgatis* (L.), *U. australis* (L.), *Sonchus palustris* (L.)

Threatened with extinction: *Tizelypteris palustris* Schott., *Leucojum aestivum* (L.), *Nymphaea alba* (L.) *Carex disticha* Huds., *Nuphar lucta* (L.) S. et S.

Included in the European list of the endemic plants: *Susittaria angittifolia* (L.) forma *vallisnoriifolia* Casson et Germain- form indicated only for the old Kozlodouy wetland, which now the whole is almost dry; *Persicatia minor* (Huds) Opiz. - species that are indicated for Middle and East Stara Planina, Sofia region, Vitosha region, Rila mountain and Tracian plain; *Caltha palustris* (L.) subsp. *cornuta* (Schott. Nym. et Kotschy) Hayek - indicated up to now only for Stara Planina, up to an altitude of 1600 m; *Utricularia australis* (L.) - species, indicated for the flooded areas of Maritza river near Plovdiv town and Beloslav lake near Varna town; *Epilobium tetragonium* (L.) subsp. *tetragonium* - a sub species, indicated for the south Black Sea coast.

For the species indicated above, Srebarna is a new habitat.

The vegetative species of Srebarna biosphere reserve, indicated above, can be observed mainly in the shore areas and are threatened with extinction as a result of the decreasing of the water quantity in the lake.

Many of the species are not observed since 1989, as: *Aldrovanda vesiculosa* (L.), *Utriculatia vulgatis* (L.), *U. australis* (L.); groups of *Stratiotes aloides*; associations of *Lemna minor*, *Hydrochario morsur-ranae*. *Nymphoides peltata*, *Myriophyllum spicatum*; the association of *Nymphaea alba* have significantly decreased in area.

Identifying and dominating species in number per 1 m² and biomass for the lake appear to be: *Phragmites anatalis* (Cav.) *Tripex Stend.*, *Typha angustifolia* (L.), *T. latifolia* (L.), *Schoenoplectus lacustris* (L.) Palla, *Bolboschoenus maritimus* (L.) Palla, *Ceratophyllum demersum* (L.), *Thelypteris palustris* Schott., *Lemna minor* (L.)

A characteristic feature of the reed and the bulrush is that there can be a general tendency of getting smaller in height and diameter as a result of the processes of burning and mowing of the reed after 1989. A long dry period in the last few years. The species *Schoenoplectus lacustris* (L.) Palla, *Bolboschoenus maritimus* (L.) Palla, *Ceratophyllum demersum* (L.), *Lemna minor* (L.), *Spirodela polyrrhiza* (L.) can be observed in groups and as single specimens, but not as dominating ones.

From all said for the flora world up to now can be made the conclusion that as a result of the drying of the lake and drying up of the shore parts, the rare and endangered vegetative species in the reserve that

are enlisted in the Bulgarian "Red Book" (1984) are threatened with extinction, as well as the associations of water plants in the shore parts.

3. Characteristics and review of the fauna.

The variety of wetland habitats within Srebarna NBR and its surroundings harbour an important population of breeding and migrating birds - in total 162 birds species, more than 100 breeding species (the Bulgarian ornitofauna consists of 383 bird species), and 24 of them are rare or threatened with extinction.

The most significant is the colony of *Dalmation pelican* (*Pelecanus crispus*) World Red data Book species. An average 70 - 80 pairs are nesting there (the variation of the pairs from 1950 - 1980 is from 29 - 127 pairs).

Some of the most characteristic in Srebarna BR habitats are thousands of herons - *Ardea cinerea*, *A. purpurea*, *Ergetta garzetta*, *Ardeola ralloides*, *Nycticorax nycticorax*, it is the only nesting area of *Ardea alba* in Bulgaria.

There are also common colony *Phalacrocorax pygmaeus* (only 10 pairs) and *Phalacrocorax carbo* (50 pairs) as well as 10 - 15 pairs *Platalea leucorodia*. The reed areas are favourable breeding area for *Cygnus olor* (20 pairs) and *Anser anser* (10 - 15 pairs) as well as for numbers of different ducks as *Anas chapeata*, *A. querquedula*, *A. nigrocygna* etc. Species breeding in the surrounding hills are *Merops apiaster*, *Upupa epops*, *Alcedo atthis* etc. It is an important breeding area for 19 Bulgarian Red Data book species such as *Netta rufina*, *Casarca ferruginea* etc.

Srebarna is an important station for many migrating birds. More than 15 000 *Anas platyrhynchos* and 10 pairs of *Cygnus olor* as well as 2000 to 11 000 *Anser albifrons* are wintering in the lake. It is important wintering area for globally threatened species - *Branta ruficollis* and is of international importance for wintering of *Anas anser*, *Anser albifrons* and *Anser platyrhynchos*.

More than 10 large mammal species Wild Boar (*Sus scrofa*), Jackal (*Canis aureus*), fox (*Vulpes vulpes*) and rare or globally threatened species - European otter (*Lutra lutra*), *Mustela eversmanni* and *Vormela peregusna*.

Twenty one are the herpetofauna species. Widely spread are *Emys* and *Natrix natrix*, It is the only habitat of *Rana esculenta* in Bulgaria. *Triturus cristatus* and rarely *T. hermanni* inhabit the neighbouring dry hills as well as *Lacerta taurica*, *Coluber jugularis*, *Elaphe longissima* etc.

The ichthiofauna numbered almost 20 fish species in the lake in 1946. Nowadays the fish population decreased to less than 10 species, due to the different water regulations and building dyke in the past.

When analysing the statistical data of the draughts and on the basis of some conversations with old fishermen was determined that in the past

Srebarna lake have been a rich fishing site. The annual draught have been 30-50 tons of fish - carp, pike, sheat-fish, *Abratnis brama* (L.), *bream*, *Carassius carassius* (L.), and from the more rare fishes - conger-eel, Danubian mackarel.

During the last years the fauna of Srebarna reserve suffered serious changes regarding the variety of species and quantity.

Anthropogenic Impact

There were identified some anthropogenic factors that have led to ecological degradation of the reserve:

- activities that have led to a change in the hydrologic and hydrochemical regime of the Danube river and disturbance of the natural conditions for annual inflow of river water during several decades;
- stopping of the traditional annual mowing of the reed during the last 17-18 years;
- drawdown of the ground waters in the area because of their intensive drawing;
- presence of considerable poplar trees in the catchment area, near the reserve;
- possible impact of the waste waters from Srebarna village.
- soil erosion and accumulation of soil into the lake water.

MEASURES UNDERTAKEN TO RESTORE THE ECOLOGICAL CHARACTERISTICS AND BIODIVERSITY OF THE "SREBARNA" RESERVE in 1992 - 1998

1. In 1992/93 a National Plan for protection of wetlands of national and international importance, updating of environmental legislation, institutional strengthening, monitoring and information system, rising public awareness has been developed and issued. In this plan Srebarna received first priority. These measures are part of the comprehensive Nature Protection Programme of the Ministry of Environment.

2. During 1993, under suggestion of the Ministry of the Environment, supported by the local public, was restored the buffer zone (between Danube river and the internal protection dike), and in the water area also were included section of Danube river from river kilometer 391 up to kilometer 393 with Devnya isle, which increased the total area of Srebarna reserve to 902.1 ha. (Decree No.581/28.06.1993, SN, No.8/1993). The Danube island Komluka was included, where the nest colonies of herons and cormorans have moved in recent years.

3. Since 1993 the Ministry of Environment has taken over the management of the Srebarna Nature and Biosphere Reserve, and has appointed a Manager and 3 guards.

It has to be pointed that since 1973 was established a Natural Science Museum "Srebarna" and since 1983 the Museum was situated in a new, modern building, with bare and not replenished afterwards exhibition.

In the period 1961-67, the Zoology Institute managed a small biological station. Since 1983 up to now, the Central Laboratory of General Ecology of Bulgarian Academy of Sciences (BAS) manages Ecological station with one employ at Srebarna.

The Srebarna Reserve is a Ramsar Site of International importance and is visited by near 100 000 tourists each year. The Museum and the Ecological station have laboratories and a hall giving possibilities for scientific and research work connected with the reserve and its occupants, as well as carrying out training courses.

MoE started a project "Construction of Hydrolic Link between Danube and Srebarna Lake at River High Waters" for the restoration of water balance and the ecological status of the Srebarna Biosphere Reserve. The project started with additional preliminary studies and analyses included in the scope of final design of the canal.

This project was the most significant moment of the governmental efforts for improving of the hydrological conditions which should guarantee successive restoration of the normal functioning of the ecosystems of the Srebarna reserve.

4.1. The project include construction of a 2084 m channel (width at bottom - 7 m) and slope of 1:2, the height above sea level of the bottom being 10.5 m. has been approved. The filling and the discharging of the lake should be controlled through outlets (Gates) No. 1 and 2 at the cross points with the Danube's river protective dyke until 17.15 height above sea level and a 695 m long protective dyke 13.80 according to the project.

4.2. The second stage of the project was completion of the construction of the protective dyke until the top of the dyke 17.15 corresponding to the top of the dyke of the Danube dike and ensuring maximal security against floods of adjacent agricultural lands.

5. A Monitoring Programme has been elaborated to oversee the recovery of the ecological status of the reserve and the first studies of priority indicators began in May 1994. The monitoring program includes development of projects for short-term monitoring system. In 1995 an essential part of the monitoring was supported financially by UNESCO. The Monitoring project included setting up a monitoring system to control key parameters of the lake's ecosystem : purchase equipment for hydrological and hydrogeological monitoring, automatic climatic station; purchase a vehical to control activities in the buffer zone; completion of computer and printer equipment.

6. Another project has been prepared and funding has been approved from UNESCO for a Workshop with the local public "Sustainable development of land use and water management in the water catchment area of the Biosphere reserve", financed by the WCH Convention at UNESCO.

The aim of the Workshop was to create the necessary pre-requisites for establishing of social co-operation between the interested institutions, local citizens groups and individuals in the preparation of the future Management Plan of the Reserve and its effective implementation.

In late spring of 1998 team of scientist from Central Laboratory of Geology, together with Management body of Srebarna NBR have started preparation of Management plan of the site, funded by the Bureau of Ramsar Convention.

**MEASURES INITIATED BY THE MINISTRY OF ENVIRONMENT AND WATERS AIMED AT RESTORING THE
ECOLOGICAL STATE OF SREBARNA NATURE AND BIOSPHERE RESERVE**

Completed projects and activities (year)	Internal funding	Funding from sponsors	Achieved and expected results
Increasing the reserve overall area by 30%, 1992	MoEW		
SNBR - the first priority in the National Wetland Conservation Plan, 1993		10 000 USD from the French Government	Survey of the state of wetlands in the country and setting priorities for measures to support and restore normal functioning of wetland ecosystems
Assignment of the execution of the project for restoring the hydraulic link between lake Srebarna and the Danube, 1993	23 170 USD MoEW		Approving the completion of Project Phase One Approving the EIA
Completion of the hydraulic link between lake Srebarna and the Danube, 1994	110 000 USD MoEW		Refreshing reserve waters and improving their quality May 1995 - 130 cm level of lake water June 1995 - 200 cm level of lake water
Appointment of a Manager of SNB Reserve, 1993	Budgeted in MoEW overall budget		Improvement of the reserve management and control. Ensuring proper and timely execution of projects.
Organising and carrying out of a workshop on "The sustainable land- and water resources use within the SNB Reserve watershed", 1994		14 000 USD from UNESCO	Publicity and awareness building for the conservation and rational use of natural resources among local population
Controlling the activities on the restoration of the lake ecosystems and execution of the monitoring procedures, May 1995		Ramsar Convention Bureau	Discussion and approval of the results so far achieved. Submission of a report to the UNESCO World

			Heritage Centre
Contracting Sofia University Faculty of Biology for ecosystems monitoring in SNB Reserve, 1994- 1995	2000 USD MoEW		Monitoring changes in specific ecosystem components and water quality
Contract for supplying equipment and a vehicle for the SNB Reserve monitoring 1995 - 1998		15 000USD from UNESCO	Monitoring of the SNB Reserve waters
Erection of an administration building for the SNB Reserve Administration, 1995 - 1998	40 000 USD MoEW		Providing suitable conditions for the execution of the reserve projects
Appointment of a Japanese expert to study bottom sediments at the reserve	MoEW budget for accomodation	JOCV - Japan	Development and implementation of projects
Purchase of a sediment-collecting probe and a telescope for the SNB Reserve Administration, 1996	900 USD MoEW	5647 USD from JOVC 2500 USD from JOVC	Upgrading the Administration equipment
Providing fire arms for the reserve guards	MoEW		Support for the reserve guard service
Furnishing the Administration building. Computer equipment, 1997	MoEW		Improvement of the staff work and building-up of the monitoring surveys database
Management Plan for SNB Reserve		35 000 USD from the Ramsar Convention Bureau	Providing better conditions for normal functioning of the reserve ecosystems
Producing publicity materials and holding an anniversary session to celebrate 50th anniversary of the Nature and Biosphere Reserve Srebarna	1000 USD MoEW		Public involmnet in the rational land use of areas surrounding the reserve; stimulating the development of ecotourism
Publishing a book on the SNB Reserve' ecosystem richness	1000 USD MoEW		
Building a fence around the automatic weather station in the reserve; providing an automatic alarm system	2000 USD MoEW		

CURRENT ECOLOGICAL STATE ACCORDING TO THE MONITORING CONCLUSIONS

Hydrological and Hydrochemical situation of Srebarna Nature and Biosphere Reserve

In 1994 a canal has been built and the hydraulic connection between the Danube and the lake restored (Fig.2). The canal is designed for reversed flow - at presence of high river waters the flow is towards the lake and in the opposite - when water level in the river goes down - water drains from the lake to the river. The canal is ground made and his bottom level mark is 9,4m. At this elevation when water level mark in the lake is 11,7m the Danube would overflow through the canal when there is river discharge of about 8350 m³/s. Statistically in 9 out of every 10 years there will be water inflow to the lake. Mean contact period between the river and the lake is 91 days. At water level mark in the lake 11,7m and increase in the Danube water level up to 13,30m in the lake will flow 6.45 million cubic meters. This volume could increase to 12.3 million cubic meters if the Danube water level rises up to 14.0m.

The fluctuations of the water level of Srebarna are an integral parameter for the variation of the lake's volume. This variation is due to several parameters, most significant of which are morphometric peculiarities of the lake, inflow and outflow and internal circulation of water masses. Lake's volume is 6,37 million cubic meters measured at mean water mark of 11.55m. Studies carried out in 1991 and 1992 found out that bottom sediments are 1.5 - 1.7m in thickness and water depth is in the boundaries 30 - 150cm. Water balance is composed in its input component by the surface and ground water inflow and in its output component by evaporation and underground losses. Quantitative measurement of the ground water inflow is determined on the basis of the monitoring done on ground water pattern in this area. The intensity of evaporation is being measured by the existing meteorological station. Surface water inflow is due to the Sreburska and Kulnezha rivers which discharge too much in water discharge and are getting dry during spring and autumn.

By putting into operation of the hydraulic system: the Danube river - connecting canal - Srebarna lake, a condition is provided for water level management in the lake which is a function of the water quantities flowing from the Danube. The dynamics of water in the lake shown in terms of water level mark, flooded areas and water volume is presented in Table 2.

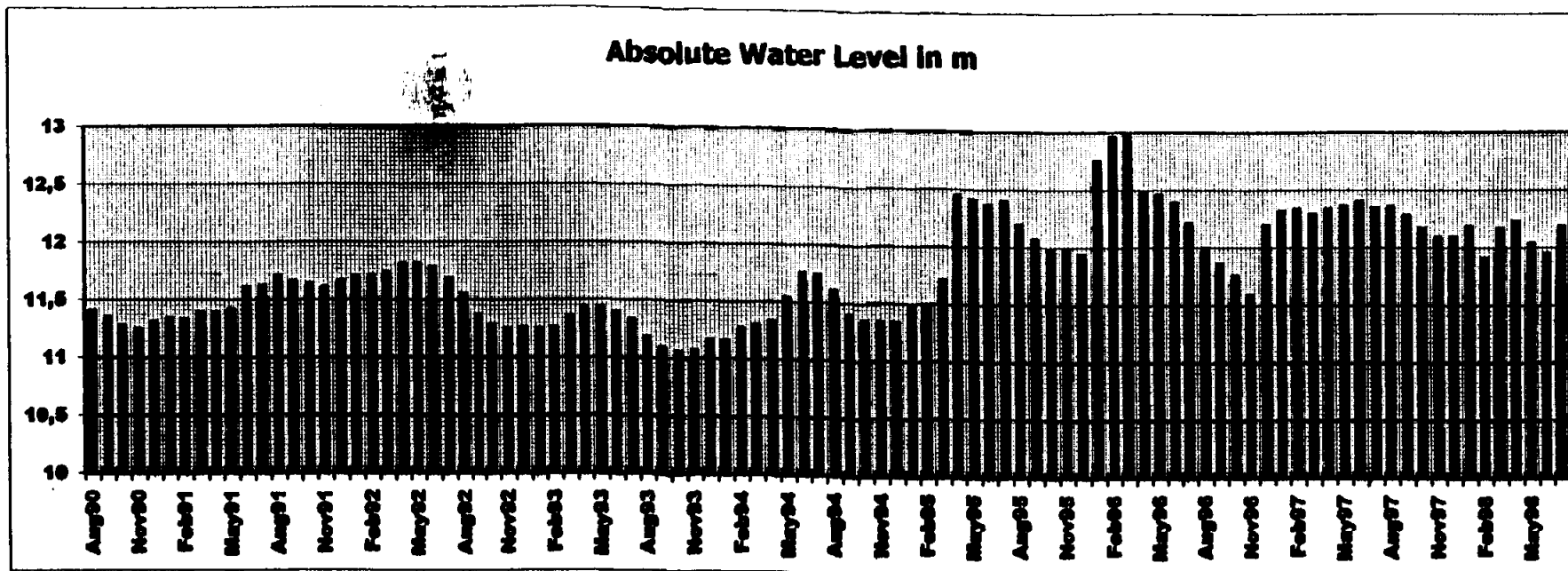


Fig. 3

Water Level in Srebarna Nature Reserve

Water level mark [m]	Flooded area [m ² x10 ⁶]	Water volume [m ³ x10 ⁶]
11.25	0.985	0.16
11.70	2.000	0.70
12.00	2.524	1.35
12.70	5.000	3.95
13.00	6.034	5.55
13.30	6.125	7.55

Table 2. Dynamics of the water level, flooded areas and water volume in Srebarna lake

By directing the water level at 13.30 mark water exchange could be reached more than 97%. Getting back to normal water exchange pattern for the Srebarna lake provides favorable ecological conditions for the functioning of lake ecosystem.

The water level is measured once a week, and in case of abrupt changes - 5 times per month. The data are processed as the average value is calculated and they are given in absolute altitude, as they are given in the enclosed Fig 3.

The data clearly reveal that there have been two distinct periods. Before May 1994, the water level was below 12 m, with a clear peak in June-August. After the new channel was opened, the water level has been almost always above 12 m, and in February it reached its highest values of 13 m. This clearly shows the positive effect of the implemented measures for the improvement of the environmental status of the reserve.

It should be appreciated that the data after 1994 are affected by the several openings of the gate facilities, and the release of water volumes into the Danube River.

Ivan Djadovski,

Nikola Mihov, CLGE- BAS

Kalina S. MoWE

Water Quality

Concentrations of nutrients - NO_3 , NO_2 and PO_4 and total mineral content, are of major water quality impact on the reserve. The comparison between the three conditional periods of the reserve: relatively normal condition (1980 - 89), critical condition (1990 - 1993) and present condition after the canal Srebarna - Danube was dug out (1995 and 1998) leads us to the following.

Because of the failures in water discharge in 1990 - 93 period water level decreased and eutrophication took place, what causes the major part of the negative variations. Eutrophication is due to the increase in nitrates concentration (5-10 times), ammonia concentration (up to six times estimated for the minimal values) and phosphorous (five to four times - Fig.4).

These variations lead to high organic matters productivity and anoxic and anaerobic conditions in the water. As a result food chains are disturbed and food source for watering birds is limited. As it could be seen in Fig 4 nutrients concentrations reduced significantly and are in normal variations.

Total mineral content for the period 1985 - 1993 increased almost threefold from 496 to 1285 mg/l. Substantial increase is present in concentration of chlorides - 4 times, of magnesium - two times, and especially of sulphates - 10 times. Water samples taken in the summer of 1998 reveal getting back to normal concentrations of magnesium, chlorides and sulphates to their 1985 levels. Quality assessment indicates severe reduction in the total mineral content in comparison with the critical 1993.

As a conclusion it could be accepted that chemical composition of the Srebarna lake's waters in the summer of 1998 is very similar to the one measured in 1985 and is in full conformity with the required for normal condition of the aquatic ecosystem.

Ivan Diadowski, Georgi Hiebaum, Central Laboratory of General Ecology, BAS

Mitigation of eutrophication

Long term studies of the Srebarna phitoplankton, permitting the main trends to be outlined, have clearly shown that changes both in its qualitative and quantitative structure are linked to the changing trophic state of the lake: eutrophic during the period 1982-1989, hypertrophic during the period 1990-1993 and the eutrophic again in 1994-1995. Undoubtedly, the entrance of Danube waters in the Srebarna Lake lead to its re-development.

AUTOMATIC MONITORING STATION AT SREBARNA NATURE RESERVE

In order to achieve sustainable management and operation of the canal locks and in order to obtain regular information on the function and evolution of the aquatic eco - system in 1998 automatic monitoring station has been put into operation financially assisted by UNESCO. The automatic monitoring station measures some main meteorological parameters:

- ambient temperature;
- relative humidity;
- wind direction and velocity;
- rainfalls.

Mean values in intervals of ten minutes for the above parameters are recorded in the data collection and operation station, which is situated in the Reserve's administrative building.

In order to specify the flow pattern of the lake and to operate skillfully water gates, several continuous measuring devices will be put into operation for observation of water level in the lake, water level in the south sluice and underground water level in the well, which was drilled for observation purposes. Data transfer to the control station is done by radio equipment.

In order to achieve best results in the management of the aquatic eco- systems it is needed to extend the monitoring by the following observations:

- evaporation from water surface;
- evaporation from reed areas;
- water quality parameters measured in the Danube, the lake and underground water;
- solar radiation;
- soil humidity and temperature;
- water level at south sluice.

Data acquisition and information gathering from regular monitoring activities which have already started in Srebarna Nature Reserve will contribute to its sustainable management.

K. Shopov - MBEW

Nutrients

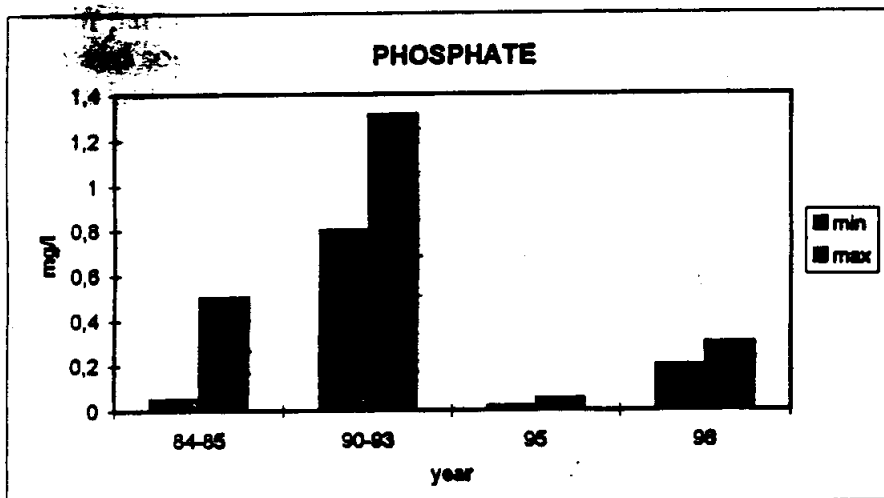
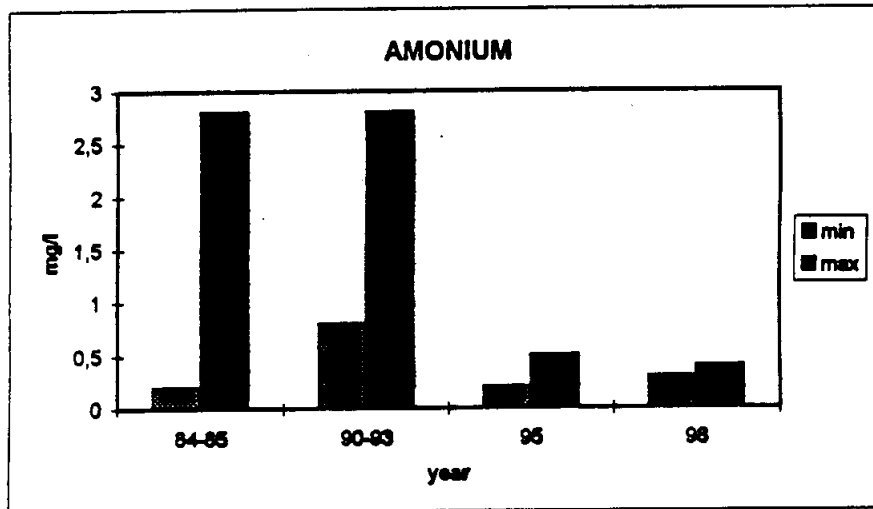
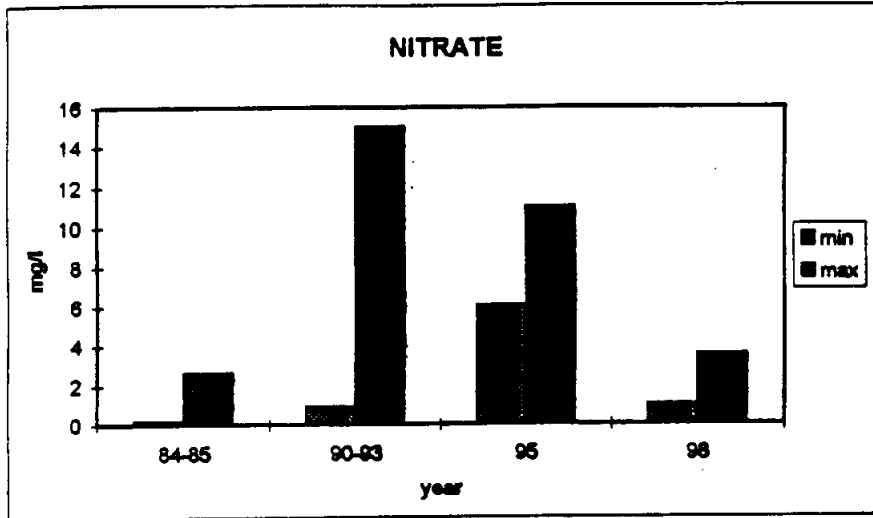


Fig. 4

Changes in the Ornithofauna of Srebarna Nature reserve during the last 20 years

Srebarna lake ornithofauna is one of the main reasons for its designation a reserve. From the perspective of its diversity of species, the presence of species of high conservation value and the impressiveness of its ornithocenosis, Srebarna reserve is of outstanding value. This fact is verified by the evaluation of the reserve using BirdLife's international criteria for ornithological value which classify Srebarna as Ornithological site of world importance.

The number of bird species registered in the reserve has grown up to 205 to the year 1998 (out of about 400 species for Bulgaria).

Over the last 20 years long term changes in the reserve's ornithofauna occurred in three periods:

- 1979-1990 - relatively normal period in the state of the reserve and several penetration of Danubian water in spring;
- 1991-1993 - period of small water volume and; intensive eutrophication and lack of connection with the Danube river;
- 1994-1998 - period of restoring the normal state of the reserve; penetration of Danubian water

During the three periods the composition of bird species was defined in May-June in one and the same way - visual observations from the western and southern banks.

A relatively stable level of diversity of species in the range of average 44 species (40-48 in different years) was observed in the period 1980-1990. There was an abrupt decrease to average of 19 species (18-20 in different years) in the period 1991-1994, while after 1995 their number rose again to average 38 species (36-41 in different years) which although being lower than the level of the relatively initial period reveals a trend of restoring former diversity of species.

An important change in the ornithofauna of the reserve which has taken place over the last 20 years is connected with the species composition of cormorants, herons, glossy ibises and spoonbills. These species but the glossy ibises more can be used as bioindicators for the overall state of wetlands and Srebarna is particular. During the first period they nested in the two big reed beds (northern and southern) in the reserve as well. During the second period cormorants and herons (unlike glossy ibises and spoonbills) moved to the nearby Danubian island Komluka, which was included in the reserve).

Data is presented in the following Table 3:

Species / Period	1979-1990	1991-1993	1994-1998
<i>Phalacrocorax carbo</i>	+	-	-
<i>Phalacrocorax pygmeus</i>	+	-	+
<i>Nycticorax nycticorax</i>	+	-	+

<i>Ardeola ralloides</i>	+	-	+
<i>Egretta garzetta</i>	+	-	+
<i>Egretta alba</i>	+	-	-
<i>Ardea cinerea</i>	+	-	+
<i>Ardea purpurea</i>	+	-	+
<i>Platalea leucorodia</i>	+	-	+
<i>Plegadis falcinellus</i>	+	-	+

Table 3. Herons, spoonbills and glossy ibises nesting in colonies in Srebarna reserve over the last 20 years.

It is evident from the table that only two species have not returned to their traditional nesting sites (the northern and southern reed beds). the first One - the big cormorant still nests in the colony on Komluka island, while the second one visits the reserve at times of migration only.

The greatest treasure of Srebarna reserve is the nesting colony of *Pelicanus crispus* information about which was published back in the middle of the last century. The changes in it which occurred during the three periods are presented in Table 4 below:

Period	Average Number of Breeding Pairs	Average Number of Chicks	Average Breeding Success
1979-90	69,2	52,2	0,79
1991-93	72,3	72	0,96
1994-98	48,8	41,8	0,78

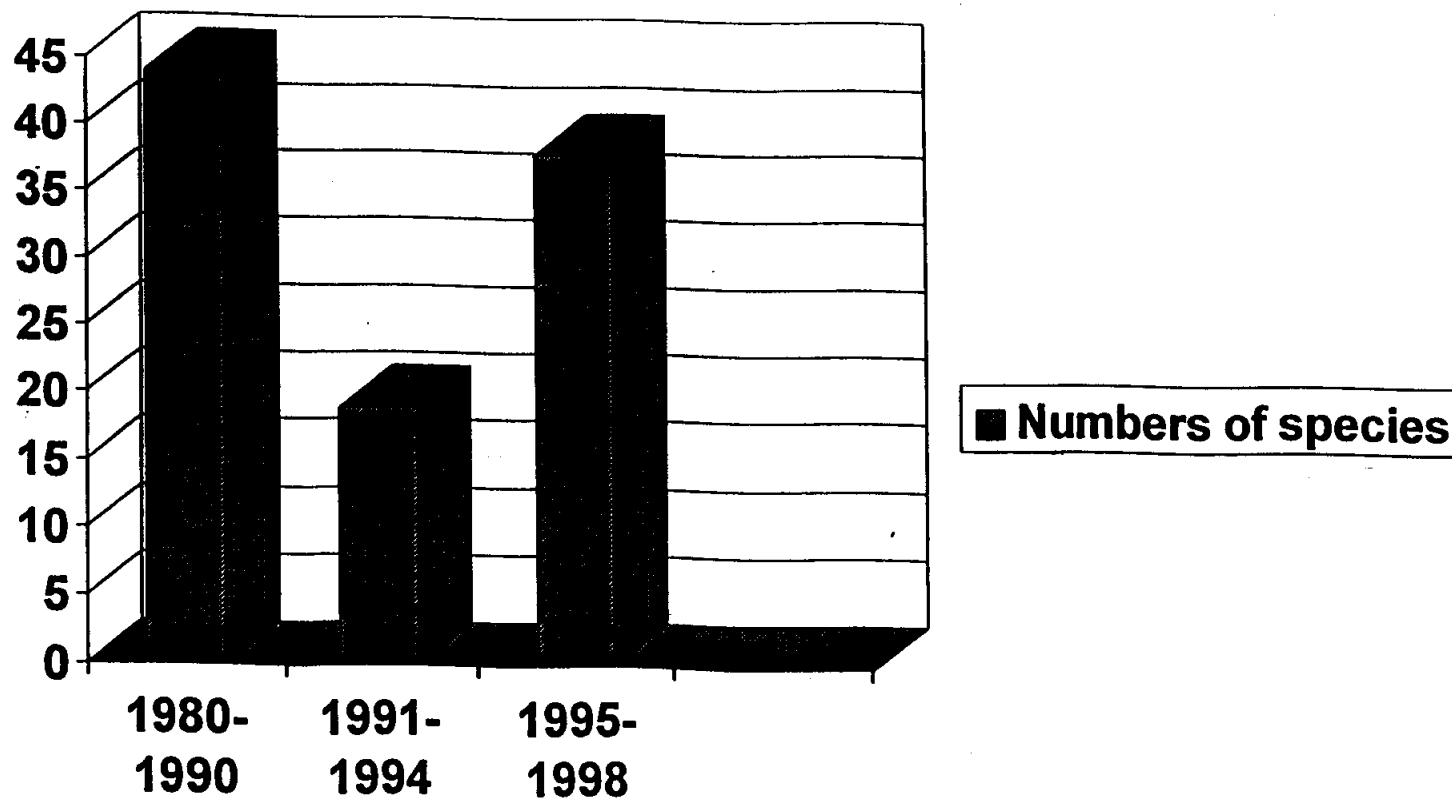
Tab. 4 Average number of breeding pairs and of juveniles, average breeding success in the colony during the three periods.

The average values of indicators for the nesting colony of *Pelicanus crispus* in Srebarna reserve for the periods 1955-1998, 1995-1998 and 1998 are presented in table 5:

Indicators	1955-1998	1995-1998	1998 r.
Number of breeding pairs	66,5	51,0	80
Number of fledged youngs	53,9	52,2	99
Breeding success	0,86	0,97	1,24

Table 5 . Average values of indicators for the nesting colony of *Pelicanus crispus* for 1955-1998, 1995-1998 and 1998

Fig. 5. Changes in the bird species diversity of Srebarna Reserve during the period 1980 - 1998 (Bulgarian Society for the Protection of Birds/BirdLife Bulgaria data)



In making a comparison it is clear that in the period 1995-98 the average values of indicators are lower, the exception being the breeding success. All indicators in 1998 are considerably above the average and amongst the highest for the period 1995-1998. The number of breeding pairs and juveniles and the breeding success increased in the last several years, as the following Figure 6 reveals.

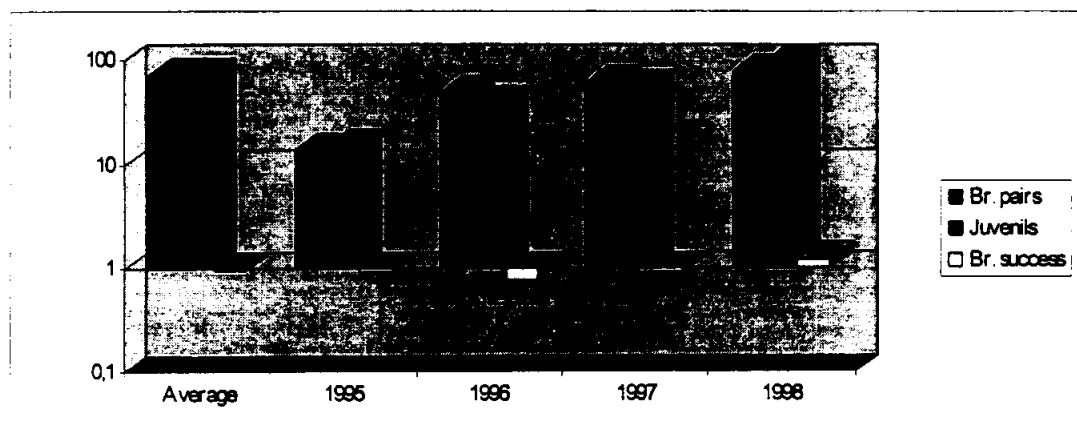


Fig. 6. Number of breeding pairs and of juveniles, breeding success in the colony the of *Pelicanus crispus* for the period 1995-1998.

In conclusion it should be pointed out that the ornithofauna of Srebarna reserve has undergone considerable changes. Following a period of unfavorable environmental conditions which have had a negative impact on the composition of species and mostly on the nesting cormorants, herons, spoonbills and glossy ibises a gradual restoration of the traditional ornithofauna is taking place (Fig. 5).

Tanyo Michev, CLGE, BAS

Petar Jankov, L. Profirov,

Bulgarian Society for the Protection of Birds/ BirdLife Bulgaria

Current Phyto-ecological Dynamics of Srebarna Natural Reserve

It is very indicative to see the dynamics of the main phyto-cenoses of the reserve at his newly established hydrological parameters, especially after the long-term isolation of the lake by the dikes

One problem which is closely related to the drought is that the reed and rush are constantly prevailing over the water mirror surface and diminishing it in size. The quantity of organic matter is increased and thus the intensity of biochemical processes is increased what is followed by a dissolved oxygen deficiency.

WORKSHOP:
SREBARNA Nature Reserve and World Heritage Site-
“Sustainable Land Use and Water Management of the Catchment Area”

The aim of the workshop was to create the necessary pre-requisites for establishing of social co-operation between the interested institutions, local citizens groups and individuals in the preparation of the future Management Plan of the Reserve and its effective implementation.

The management of a Srebarna reserve represented a focal point of the interests, the positions, the rights and the obligations of different institutions, social groups and individuals. In order to achieve effective sustainable development, it was necessary to combine and co-ordinate these different positions and interests and in this way to overcome the existing and avoid new conflicts.

The main topics of the workshop were focused on :

- Investigation of the level of interest of all relevant institutions, social groups and individuals
- Preliminary training of the participants in the seminar in the technology of team work and methodology of decision making.
- Work with journalists.
- Seminar on the selected topics.

Results: Creating of conditions for development of a Management Plan for Srebarna Biosphere Reserve.

Elizaveta Matveeva, MoEW

At this stage which is characterized by water scarcity, destruction of hygrophilous and mesophyll cenoses is reported. Associations of *Salvinia natans*, *Azola filicoloides*, *Azola caroliniana*, *Spirodela polyrriza* + *Lemna minor*, *Lemna minor*, *Hydrocharis morsus-ranae*, *Nymhoidea peltata* and others are decreased and even according to some authors disappeared .

This is valid also for the plantations of *Heleocharis palustris*, *Sparganium erectum*, *Stratiotes aloides*, *Piceus longus*. Associations of *Nymphaea alba* decrease significantly in terms of the area occupied. Some of the species are not observed: *Aldrovanda vesiculosa*, *Ultricularia vulgaris*, *Ultricularia australis*, *Sagittaria sagitifolia* f. *valisneriifolia*, *Caltha palustris* ssp. *cornuta*, *Ranunculus lingua*, *Najas marina*, *Najas minor*.

In the drained littoral parts of the lake invasion of ruderal plants is taking place - *Urtica dioica*, *Cirsium canum*.

On the floating islands of reed populations of *Tussilago farfara* are observed .

Three of the thirteen plant species included into the Bulgarian Red Book inhabit Srebarna Nature Reserve are not identified since 1988 . These are *Nuphar lutea*, *Cyrtia virosa* and *Carex distachia* .

Recently six plant species are reported which have not been observed in Srebarna lake. One of these has been considered as not existing in the flora of this country - *Aldrovanda vesiculosa*.

It is figured that high flora of Srebarna lake is consisting of 157 species. Up to now 136 taxa have been reported, fitting into 98 genera and 45 families. Still not confirmed are 21 high-hierarchy plant species.

The forthcoming floral investigations, carried out in the framework of the elaboration of a Management Plan will enrich the information available about the floral genetic fund of this unique Nature and Biosphere Reserve.

Vladimir Velev, CLGE, BAS

GENERAL CONCLUSION

As a result of the measures and the efforts of the Ministry of Environment and Waters, and the International Institutions that provided financial assistance for the implementation of the projects, the ecosystems in the Srebarna reserve are in a very close to their natural state. This can be seen from the available scientific evidence:

- The diversity of bird species in the reserve has recovered;
- The status of the colony of *Pelecanus crispus* has improved over the last few years, and particularly in 1998;
- The colonies of herons, glossy ibises and spoonbills have returned to their traditional nesting places in the reserve;
- The average water level and the volume of water in the Srebarna lake have increased considerably;
- The water quality in the lake has also improved;
- There are preconditions for the extension of educational programs and for greater public participation in the solving of the problems of the reserve.

Currently a Management Plan for the Srebarna Biosphere Reserve is being developed, and the overall status of the ecosystems is being monitored. Considering the possibilities for irregular and insufficient income of water from the Danube River into the lake, the monitoring in the reserve will continue after the completion of the Management Plan in order to secure the complete recovery of the natural status of the ecosystems.

Different conservation measures have been undertaken as the re-establishment of the hydraulic connection between the lake and the Danube river.

In 1994 the water level of the lake rise up to 50 cm and in 1995 the Danubian water twice put out to the lake. The water level reached 1 m next year. As an appraisal of the quik change of the ecological characteristics of the reserve was the fact that 80 couples of Dalmation pelicans (*Pelecanus crispus*) have nested on the area that year and have grown 60 young birds.

That meets entirely the requirements of the 4-th criterion of the Convention.

The colony of Dalmatian pelican (*Pelecanus crispus*) is continuing to nest in Srebarna Nature Reserve - 1995 -1998.

These measures are giving reasonable oppottunities and hopes for restoration of the ecological state of the reserve within the norms and indicators required which determines its international value as a World Cultural and Natural

Heritage Site. Nevertheless further efforts are required to support and manage SNR Srebarna and to take out it's name from the WCNC Endangered Sites list.

APPENDIX 6

SCIENTIFIC PAPERS PRESENTED TO MISSION TEAM

PROGRAMME

of the Workshop about the Srebarna Biosphere Reserve

October 2, 1998

Central Laboratory of General Ecology (CLGE), Bulgarian Academy of Sciences
2 Gagarin Street, 1113 Sofia

- 10:30 - Opening by Dr G. Hiebaum, Director of CLGE; initial statements of representatives of the Ministry of Environment and Waters and the Mission of the World Heritage Center, UNESCO
- 10:35 - General characteristics and main problems of the Srebarna Biosphere Reserve - Dr T. Michev (CLGE)
- 10:45 - Biodiversity of the Srebarna Biosphere Reserve - Dr B. B. Georgiev (CLGE)
- 10:55 - Hydrological issues - Dr I. Dyadovsky (CLGE)
- 11:10 - Hydrogeological peculiarities - Ms K. Shopova (Ministry of Environment and Waters)
- 11:20 - Water quality - Dr G. Hiebaum (CLGE)
- 11:35 - Phytoplankton: present state and dynamics - Dr M. P. Stoyneva (Department of Botany, University of Sofia 'St Kliment Ohridsky')
- 11:50 - Coffee break
- 12:10 - Zoobenthos: present state and dynamics - Dr Y. Uzunov (CLGE)
- 12:25 - Fish fauna: state and changes - Dr L. Pekhlivanov (Institute of Zoology, BAS)
- 12:40 - Avian fauna: state and changes, with special reference to the Dalmatian Pelican colony - Dr T. Michev (CLGE) and Mr. L. Profirov - Ministry of Environment and Waters.
- 13:00 - Lunch break
- 14:00 - Fauna of mammals: state and changes - Professor S. Gerasimov (Forestry University, Sofia)
- 14:15 - Vascular plants flora and vegetation: state and changes - Dr G. Baeva (Pedagogical Institute, Silistra) and Dr V. Velez (CLGE)
- 14:30 - Statements of the NGO representatives and of the UNESCO Mission members
- 15:30 - Discussion
- 16:30 - Closure

BIOSPHERE RESERVE "SREBARNA" - WATER QUALITY

Assoc.Prof. Georgi Hiebaum, PhD
Central Laboratory of General Ecology

The lake of Srebarna is obviously formed by the activity of the Danube river 8000 year ago. Undisturbed by the men the state of the lake changes periodically with the annual penetration of floodwater from the river modifying both its volume and surface. A second source of water are karst springs in its south end.

After the breaking the connection between the lake and the Danube under circumstances revealed by my colleges, the natural processes in the ecosystem lead to a succession of a classical type - fig. 1, 2. At present the Srebarna lake is in the first stage of the transformation. The first major factor affecting the water quality is the periodically penetration of river water and the volume declination in the dry period. The production of organic matter is the second major factor controlling the water quality. The principal primary producer in the lake are the littoral microphytes, but the phytoplankton can not be underestimated. The primary production is simultaneously depending on the water composition and it controls the water quality as well. Together with the erosion of the surrounding territories the organic matter production is the main factor for sediment creation and the reduction of the lake water depth.

Mineral content

Bicarbonate, chloride, sulfate, sodium, calcium and magnesium ions constitute the main part of the mineral content. In 1964 the water was reported to be bicarbonate-chloride type (The lakes in Bulgaria, 1964). The investigation in 1985 reveals some changes and the water is characterized as bicarbonate type. The critical events in the 1990-93 periode - drying process and water depth reduction alter seriously the mineral composition: the mineralisation rose almost twice and a shift in the water type to sulfate water was registered. Even though from a few analyzes in July 1998 once again a decrease in the mineralisation and a recover of the bicarbonate character of the water can be seen - fig. 3. The water ionic composition undergo serious seasonal alteration connected with the flooding and partly drying processes in the lake as well.

From the literature it is known that during the succession from drainage lake to bog system the bicarbonate water is changing to sulfate dominated one. We can suppose that during the 1990-93 period the water quality undergo partly this transformation but after the opening of the channel to Donube in 1995 the normal bicarbonate character was recovered.

Nutrients concentration

Nutrients concentration (NH_4 , NO_2 , NO_3 and PO_4) are of major importance for the water quality. Because of the disturbances in the water regime during the 1990-93 period and eutrophication has taken place, that caused the major part of the negative changes. Eutrophication is due to the increase in the nitrate concentration (5-10 times), ammonia concentration (up to 6 times for the minimal values) and phosphate concentrations (five to four times) - fig. 4. This alteration leads to high organic matter

productivity and anaerobic condition in the water column. As a result food web are disturbed and food source for waterfowl is limited.

As it could be seen from fig. 4 since 1995 nutrients concentration reduced significantly and it is in normal ranges for a eutrophicated environment.

Water quality assessment according the Lake Classification Scheme of OECD (Organization for Economical Cooperation and Development) Cooperative Proramme

From the view of the lake trophic state the water quality changes can be assessed with the help of various systems: **Trophic State Index, US Trophic Status, Lake Condition Index, Dillon and Rigler System** and so on. The most of them take into account the concentration of the **total phosphorous, total nitrogen, chlorophyll a and Secchi disc transparency**. To demonstrate the water quality dynamics during the 1990-1998 period we choose the **Lake Classification Scheme of OECD** as the most flexible one. Unfortunately the lack of data but for **Chl a and Secchi disk transparency** gives us not a big chance. Anyway fig. 5 represents some information about the place of the Srebarna reserve in the trophic classification scheme and the last trends in its water quality dynamics.

As a final conclusion we can accept that the Lake of Srebarna is in Hyper-eutroficated state, but with trends to improving. The mineral composition of the water in the summer of 1998 is very similar to the one measured till 1985 and it is in ful conformity with the requirement for normal condition of the aquatic ecosystem.

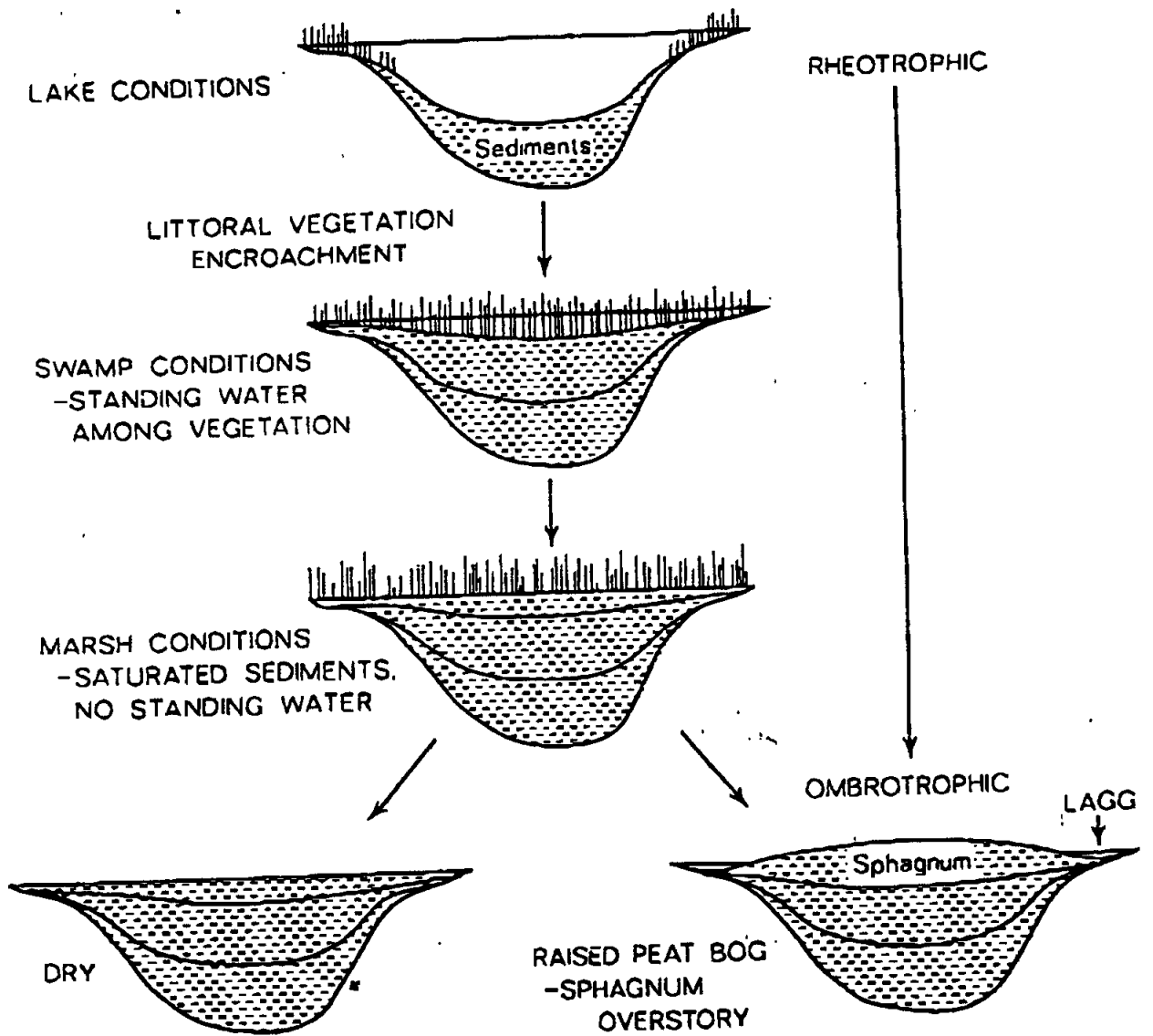
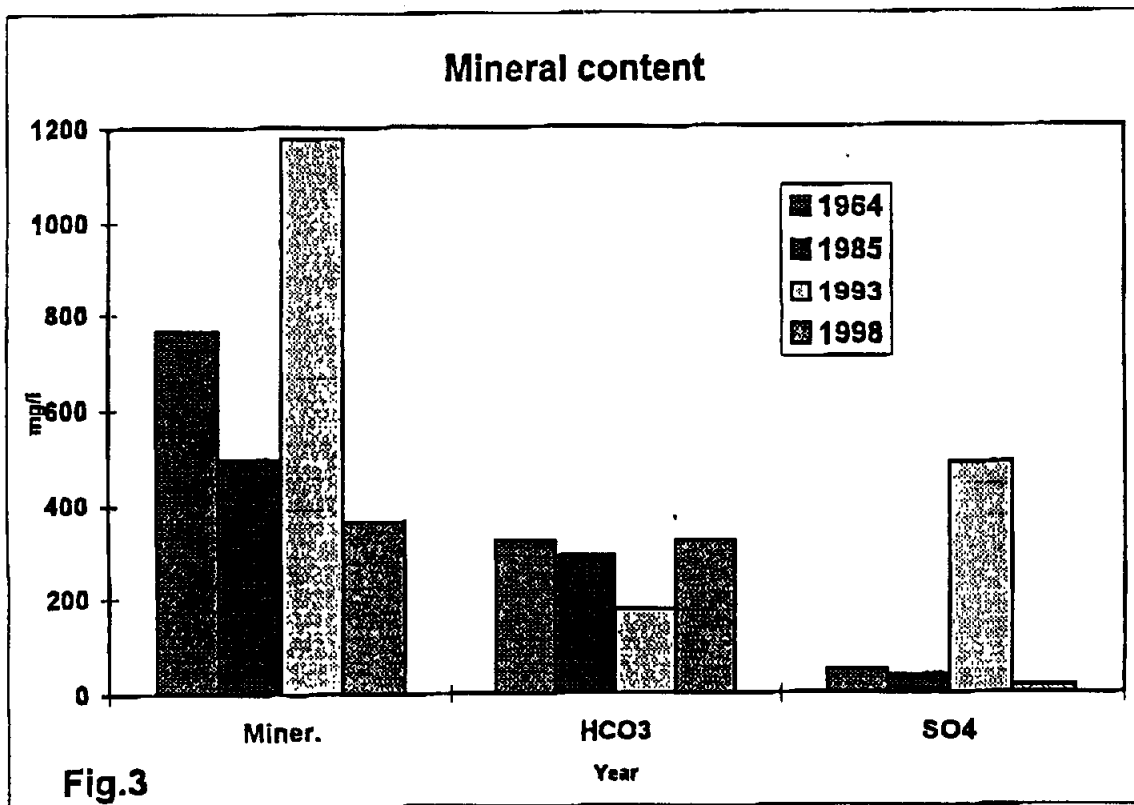
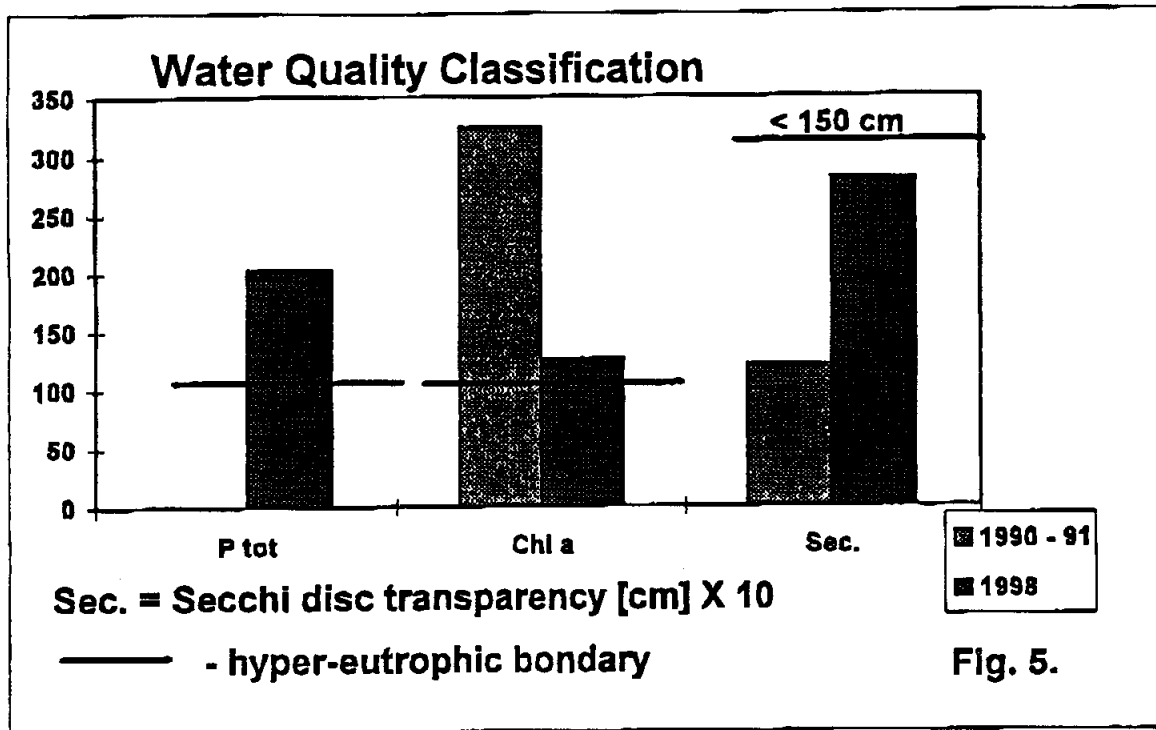


Figure 1-2 : Frequently observed ontogeny of shallow lake systems through swamp and marsh stages to terrestrial conditions or to raised peat bogs. See text for discussion.



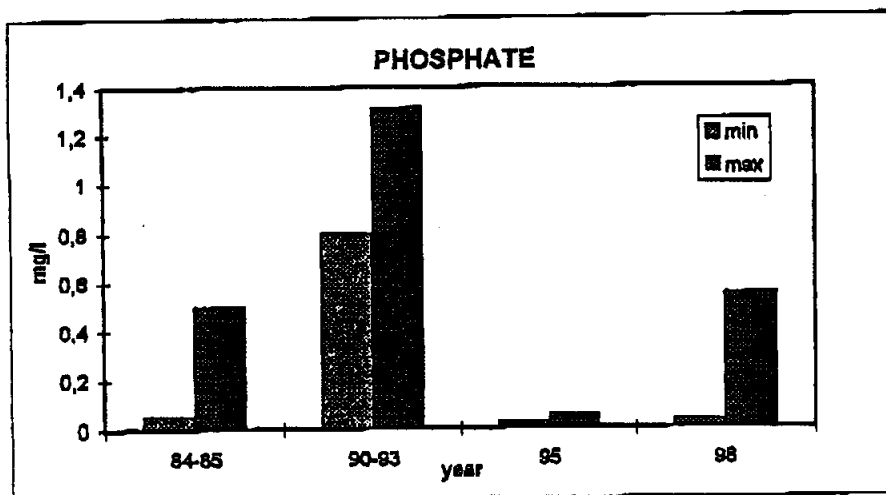
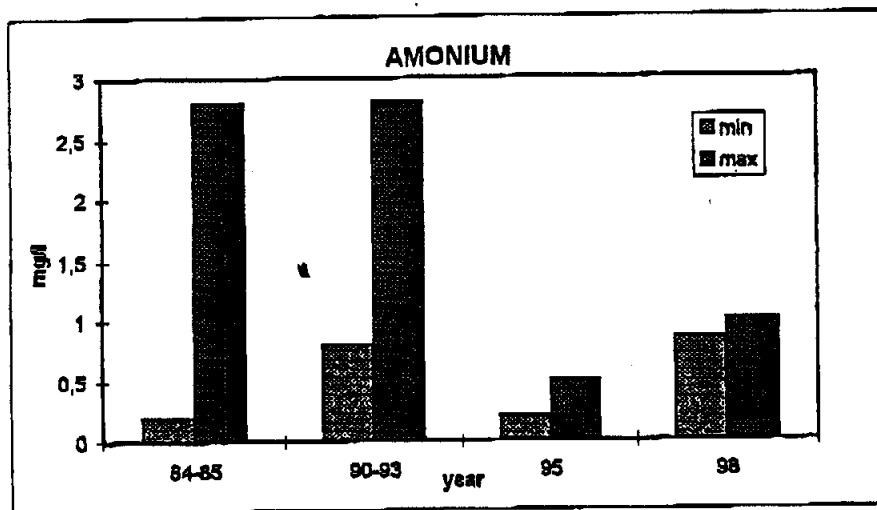
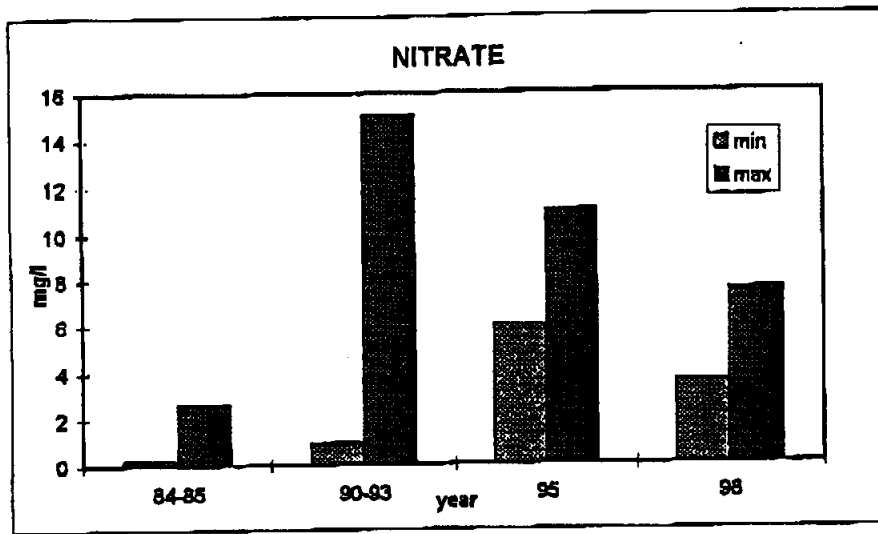


Fig. 4

REPORT ON THE SREBARNA PHYTOPLANKTON DEVELOPMENT DURING
THE PERIOD 1987 - 1995

Maya Petrova Stoyneva

Sofia University "St Kliment Ohridski", Faculty of Biology, Department of Botany,
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Species composition, number of species and dominants

The Lake of Srebarna and its adjacent water bodies in the reserve territory are characteristic by their extremely rich algal flora in which more than 450 taxa were found (Stoyneva & Draganov, 1994; Stoyneva, 1995).

The biggest number of taxa at species and infraspecies level in the lake phytoplankton was found in 1987 - 1988 (up to 97 taxa per sample - Stoyneva, in press). A substantial decrease of the number of species (down to 2 species per sample) was detected in 1989 - 1991 (Stoyneva, in press). The decrease in the numbers of chlorococcal algae was particularly remarkable because it is atypical for water bodies along the Bulgarian Danube shore and for the Danube River (Stoyneva, 1991). An increase in total number of species and, especially of the chlorococcal species, was detected in 1992 (up to 56 and 33 species per sample, respectively - Stoyneva, in press). It could have been coincident with the slight increase of the water column height after the strong rainfalls in that period. This attempt of the community for self-restoration seemed to be the last one before the extremely dry 1993 year with increased drainage of underground waters. Then the depth of the lake reached its most critical point of 20 cm in average (Michev et al., 1993) and the number of species sharply decreased again (down to 7 species per sample), heterocystous blue-green algae were excluded from the phytoplankton assemblages, but the number of chroococcal cyanophytes and pyrrophytes increased (Stoyneva - in Michev et al., 1993; Stoyneva, 1994; Stoyneva, in press). At that time teratological forms among some chlorococcal species appeared (Stoyneva, b, in press).

A renewed increase in overall species numbers (up to 43 species per sample) with enrichment of the algal groups was detected when the connection with the Danube River was restored and Danube waters brought in their phytoplankton (Stoyneva, in press). In that period, the number of chlorococals and diatoms increased, the presence of nostocalean blue-green algae and of cryptophytes were comparable to the

situation before 1989, and silica-scaled chrysophytes appeared in the phytoplankton assemblages (Stoyneva - in Kovachev et al, 1996; Kristiansen, Stoyneva, 1998).

During the period 1982-1995 phytoplankton was dominated by 35 different species from 28 genera (Stoyneva, in press). Even these dominant forms had exhibited marked inter-annual and within-year variation in the timing of their maxima and of their numerical densities. Moreover, there are differences in the dominants species estimated by biomass instead of cell numbers. The fact that some of the dominants so estimated belong to different phylogenetic groups is noteworthy. This is especially true for the most critical periods in the development of the lake after 1989, when there was no more normal influx of Danube waters and high amounts of fertilizers had been carried by strong rainfalls to the lake (e.g. in September 1993 *Plectonema* was dominant according to cell numbers, whereas *Peridinium* dominated according to biomass - Stoyneva, in press). Generally, during the eutrophication process dominant green chlorococcal algae were replaced by chroococcal and oscillatorelean blue-greens. Blue-green algae remained dominants in hypertrophic conditions and were replaced only once, by pyrrhophytes. With the recovery towards eutrophic conditions blue-green algae were partially replaced by chlorococcal (Stoyneva, in press).

During the development of the eutrophication process the role of genera like *Scenedesmus*, *Tetrastrum*, *Crucigenia*, *Monoraphidium* and *Schroederia* decreased. They appeared again in the sub-dominant complexes when the hypertrophic conditions tend to recede (Stoyneva, in press). In hypertrophic conditions, cyanophytes of the generic complexes *Microcystis* and *Gomphosphaeria* were replaced by smaller representatives like *Woronichinia*, *Lemmermaniella*, *Cyanodictyon*, *Chroococcus*, *Aphanocapsa* and *Merismopedia*, and filamentous *Leptolyngbya* and *Pseudanabaena* were replaced by smaller representatives of *Lynbya*, *Planktolyngbya* and unidentified filaments of *Plectonema*-type less than 1 μm wide (Stoyneva - in Michev et al., 1993; Stoyneva - in Kovachev et al., 1996; Stoyneva, in press). Nostocalean genera, previously represented by *Anabaena* and *Aphanizomenon* were replaced by *Cylindrospermopsis* and *Anabaenopsis*, though these disappeared in 1993. After April 1994 *Anabaena* and *Aphanizomenon* re-appeared (Stoyneva - in Kovachev et al., 1996; Stoyneva, in press).

Changes in phytoplankton quantities

As annual averages, the total numbers of phytoplankton cells in Srebarna varied from 1.9×10^8 cells l^{-1} to 18.5×10^9 cells l^{-1} (Stoyneva, in press). The algal quantities generally rose from 1982 to 1993, but the situation before and after the last dilution of lake water by natural flow from the Danube (1988) was different. For the 1987 - 1988 period the average numbers were 2.6×10^8 cells l^{-1} , and for the 1989 - 1993 period they were 4.8×10^8 cells l^{-1} (Stoyneva, in press). After the Danube waters entered the lake in May 1994 and in April - March 1995, the algal numbers tended slowly to decrease to 3.9×10^8 cells l^{-1} in average (Stoyneva - in Kovachev et al., 1996; Stoyneva, in press). The peak/mean ratio generally tended to decrease in the period 1987 - 1993 (values between 2.1 and 1.3) and clearly increased in 1994 and 1995 (up to value of 4.0 in 1995 - Stoyneva, in press). Thus, the lake is characterised as progressively eu-, eu-polytrophic and hypertrophic up to 1993 and began to reverse to eu-polytrophic conditions after 1994.

The changes concerned not only the total cell numbers but also the proportions among different algal groups and their appearance or disappearance. This analysis clearly shows a general shift from a chlorococcal-dominated community which includes a high number of groups towards chroococally-dominated and impoverished community during the increased eutrophication, followed by a subsequent tendency to revert to a chlorococcal plankton thereafter (Stoyneva, 1994; Stoyneva, in press).

The phytoplankton biomass, as annual averages, varied between 15.3 and 110.7 mg l^{-1} . It has to be mentioned that in several cases (before 1994 - 1995) biomass values varied between 170 and 200 mg l^{-1} (Stoyneva, in press).

As in the case of phytoplankton numbers, the average biomass value tended to rise from 1982 to 1993 and to decrease in 1994 - 1995. The average values for selected periods were as follows: 38.5 mg l^{-1} in 1987-1988, 67.9 mg l^{-1} in 1990 - 1993 and 40.8 mg l^{-1} in 1994 - 1995 (Stoyneva - in Kovachev et al., 1996; Stoyneva, in press). The peak/mean ratio generally tended to decrease during the first period and increased during the last one, reaching value of 3.2 (Stoyneva, in press).

In spite of this common general trend of forced eutrophication up to 1993 and slight oligotrophication in 1994 - 1995, some differences appear with the changes in total phytoplankton biomass. When the contribution of the various algal groups are compared with the situation estimated from cell numbers, a different impression is

given. There is a detailed difference in the fluctuations of total biomass and groups like pyrrhophytes, diatoms, desmids and nostocalean blue-green algae, whose role is more important in contribution to biomass than as cell numbers. All these differences are explainable by the variations in cell sizes and volumes. According to biomass changes, the succession through eutrophication leads from chlorococcal- through cyanophyte- to pyrrhophyte-dominated phytoplankton. With the shift to oligotrophication, the restoration of both the chlorococcal dominated community and of the nostocalean algae was detected. As the oligotrophication proceeds, the role of diatoms, both pennate and centric, clearly increases (Stoyneva, in press).

Structural parameters

The values of Shannon's diversity index (H) as annual averages varied from 3.13 to 0.86 (Stoyneva, in press). The values of H tended to decrease with the increased nutrient input, combined with the decreased water level and slowly tended to rise again after the dilution by Danube waters. Annual averages of the phytoplankton biomass and values of H generally were in inverse relations (Stoyneva, in press).

As it could be expected, the values (between 0.85 and 0.2) of index of evenness of Pielou (E) generally followed the dynamics of diversity, whereas the Margalef's index of dominance (C, with values between 0.64 and 0.05) followed just an opposite trend (Stoyneva, in press). The minimal values of H and E were detected during the period of lowest water level in 1993, whereas at the same time C reached its maximal value

Conclusion

Long-term studies of the Srebarna phytoplankton, permitting the main trends to be outlined, have clearly shown that changes both in its qualitative and quantitative structure are linked to the changing trophic state of the lake: eutrophic during the period 1982 - 1989, hypertrophic during the period 1990 - 1993 and eutrophic again in 1994 - 1995. Generally, the changes observed confirm the well known trends of qualitative impoverishment combined with quantitative enrichment of phytoplankton and decrease of community diversity and evenness with the ongoing hypertrophication, and *vice versa* - enrichment by species and groups combined with decreasing of phytoplankton abundance and increased community diversity and evenness during the

oligotrophication. However, the steps of phytoplankton development (and its qualitative and quantitative structure) to the extreme of the trophic gradient and back in the case of this anthropogenically forced, shallow, holo-polymictic, turbid lake were not exactly reverse (Stoyneva, in press). Undoubtedly, the entrance of Danube waters in the Srebarna Lake lead to its re-development.

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CURRENT STATE AND RECENT DEVELOPMENTS OF ZOOBENTHIC COMMUNITIES IN THE BIOSPHERE RESERVE "SREBARNA LAKE"

(SUMMARY)

The bottom invertebrate community (macrozoobenthon) of the Srebarna Lake has not been studied until 1994. Recently published inventories of the lake's species diversity consisted of data obtained as a result of non-system observations or occasional findings in macrozoobenthon. Totally 138 species which are elements or may belong to the benthic communities have been recorded, of them 35 dragon-flies (*Odonata*), 30 aquatic snails (*Gastropoda Limicola*), 26 oligochaet worms (*Oligochaeta Limicola*), etc.

Systematic studies on macrozoobenthon have been carried out in 1994-1995 period, just after the opening of the canal. Unfortunately, there are no published or available data because of lack of any alive organisms in the community during those investigations, according to our personal communication with team-leader Dr. S. Kovachev (Sofia University).

Several years later, some evidences about recent developments of enrichment of the benthic species diversity have been observed. First of all, the number of systematic groups and species having part in the species content of the community has been established as higher and more diverse: some new 6 species of aquatic *Heteroptera*, 4 species of oligochaet worms, 2 leeches (*Hirudinea*), 2 mayflies (*Ephemeroptera*), 14 species from various families of *Diptera*, etc. have been recorded since 1997. The appearance of the predator *Chaoborus cf. crystallinus* (*Diptera*) is of special interest. Some determinations should be confirmed by respective specialists.

Secondly, the fact of permanent presence of living organisms in zoobenthon sounds much more optimistic and it is of great importance in indicating a process of rebuilding the bottom community. It should be noted two specifics of this development. First, the primary aquatic groups/species (worms, snails, mussels, crustaceans) have been presented permanently, while the secondary aquatic ones (all kind of insects) have had non-constant presence in the species content. Second, two maximums in number and "soft" biomass of the zoobenthon have been observed during the early summer (probably relating to the canal operation and the income of fresh water from the Danube) and later in fall (probably, because of appearance of second/autumnal generations).

Preliminary results demonstrated a positive trend towards slow restoration of the macrozoobenthon - very conservative community of bottom invertebrates. It is of importance to continue the monitoring on the zoobenthon in order to reveal consequent stages of its full recovery, in terms of its qualitative (species diversity) and quantitative (productivity) parameters.

Biodiversity of the Srebarna Biosphere Reserve

(Report prepared for the workshop to be held at the Central Laboratory of General Ecology, Bulgarian Academy of Sciences, on October 2, 1998)

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Introduction

When the Srebarna Lake was initially declared as a protected area in 1948, it was mainly on the basis of the numerous bird species occurring there. The subsequent discussions on the conservational value of this reserve emphasized, in addition to the avian fauna, mainly the unique for Bulgaria associations of aquatic plants and the rich fauna of fishes and mammals. However, an entire evaluation of the biological diversity of the reserve (in terms of an inventory of its animal and plant species) was lacking until the beginning of 1998.

In 1998, a project was developed in order to prepare a checklist of the animal and plant species recorded in the reserve. The successful completion of this project became possible mainly due to the financial support for publishing the checklist provided by the Ministry of Environment and Waters of Bulgaria. However, it should also be mentioned that the efficient work on the checklist has been fulfilled because the emotional motivation of many colleagues: they agreed to prepare their chapters without any payment for the work, 'just for Srebarna'. The project was participated by 34 Bulgarian biologists, specialists on various systematic groups. As a result, the book 'Biodiversity of the Srebarna Biosphere Reserve. Checklist and Bibliography' was published.

Aims of the report

The aims of the present report are as follows:

- (1) To present a summary about the biological diversity of the Srebarna Biosphere Reserve (as a part of the general characteristics of the reserve).
- (2) To analyze the conservational significance of the reserve in view of the new data about the animal and plant species recorded in it.

Summary data about the biodiversity of Srebarna

Data about the biodiversity of Srebarna (Fig. 1) was found in 273 sources (books, articles, communications, reports). Most of them were published after 1960. Therefore, most of the knowledge on the animals and plants of Srebarna are results of the efforts of the present generation of Bulgarian biologists.

The known taxonomic diversity of Srebarna (Table 1) consists of 2,748 species-group taxa (species, subspecies, varieties and forms), 1,166 genera, 47 classes and 24 plant divisions and animal phyla.

The general number of plant species (Table 2) is 1,430. The algae, with their 1,123 species, are the most abundant group. The richest divisions are these of the green algae (with 555 species) and of the blue-green algae (with 231 species). All the data about algae originate from studies on the plankton and on the benthic species. Major ecological groups, such as the soil algae, were never studied.

The lichens are almost entirely studied (15 species). However, the data on the fungi and mosses are based on sporadic investigations and the expected number of species is about 10 times greater.

All the data about the ferns (4 species) and the flowering plants (275 species) originate from studies on the aquatic vegetation. Further studies on the plant associations in the buffer zone (meadows, oak forests, arable lands) and on the Danubian island Devnya may show the presence of numerous further species.

The general number of the animal species in Srebarna (Table 3) is 1,318. The species composition of the vertebrates is studied relatively well (ignoring some unresolved taxonomic problems with several species of small mammals).

Among the invertebrates (with 1,000 species in the reserve), only few groups are well studied. These are protozoan parasites and parasitic worms of mammals, aquatic molluscs, crustaceans and rotatorians in the plankton, benthic annelids and nematodes, spiders, ticks, and a few groups of insects (dragonflies, carabid beetles, butterflies and fleas).

Some major invertebrate groups have never been studied or have been insufficiently studied in the reserve. These are the free-living protozoans; the parasitic protozoans of fishes, birds and invertebrates; hydrozoans; free-living flatworms; helminth parasites of fishes and many bird species; soil nematodes; terrestrial gastropods; myriapods; large insect orders like the Heteroptera, Hymenoptera and Diptera. Therefore, it could be supposed that the real number of the invertebrate species in the reserve is between 5,000 and 10,000.

Significance of the Srebarna Biosphere Reserve for the biodiversity conservation

The summary data obtained are a reliable basis for a more comprehensive evaluation of the significance of Srebarna for the biodiversity conservation (Table 4).

Considering the status of the species recorded in the reserve, the following major issues should be emphasized.

The species recorded at Srebarna and included in the Red Data Book of Bulgaria are 13 vascular plants and 69 vertebrate animals (2 fishes, 1 amphibian, 1 reptile, 59 birds and 6 mammals).

There are 20 species recorded at Srebarna included in the *European Red List of Globally Threatened Animals and Plants* (1991). These are the leech *Hirudo medicinalis*, the freshwater molluscs *Segmentina nitida* and *Unio crassus*, the dragonfly *Gomphus flavipes*, the carabid beetle *Calosoma sycophanta*, the cerambycid beetles *Cerambyx cerdo* and *Morimus funereus*, the birds *Pelecanus crispus* (nesting), *Phalacrocorax pygmaeus* (nesting), *Anser erythropus*, *Branta ruficollis*, *Aythya nyroca* (nesting), *Haliaeetus albicilla*, *Aquila heliaca*, *Falco naumanni* and *Otis tarda*, and the mammals *Mesocricetus newtoni*, *Nannospalax leucodon*, *Vormela peregusna* and *Lutra lutra*.

The animal species originally described (Table 5) from the reserve are 8: 3 protozoans, 4 flatworms and 1 nematode. Therefore, due to the existence of Srebarna, unknown members of the global biodiversity were discovered during the last 30 years. For one of these species, *Eimeria micromydis*, Srebarna continues to be the only known locality in the world.

All these data provide an additional support for the great significance of the Srebarna Biosphere Reserve for the biodiversity conservation in both local and global scale.

Biodiversity of the Srebarna Biosphere Reserve

by T. Michev, B. B. Georgiev, A. V. Petrova & M. P. Stoyneva

Aims:

- (1) Presentation of a summary about the biodiversity of the reserve as a part of its general characteristics
- (2) Analysis of the conservational significance of the reserve in view of the new data on its biodiversity

Taxonomic diversity of the Srebarna Reserve	
Species-group taxa	2748
Genera	1166
Classes	47
Divisions and phyla	24

Plant species recorded in the Srebarna Reserve

Plants - general number	1430
Algae	1123
Cyanophyta	231
Prochlorophyta	1
Glaucophyta	1
Euglenophyta	154
Pyrrhophyta	17
Chrysophyta	140
Cryptophyta	19
Chlorophyta	555
Rhodophyta	1
Fungi	16
Lichens	15
Mosses	1
Ferns	4
Flowering plants	275

Animal species recorded in the Srebarna Reserve

Animals - general number	1318
Sporozoans	14
Myxozoans	1
Flat worms	117
Round worms	125
Acanthocephalans	6
Molluscs	48
Annelids	29
Arthropods	660
Vertebrates	318
Fishes	23
Amphibians	12
Reptiles	15
Birds	221
Mammals	47

Globally Threatened Animals recorded in the Srebarna Reserve (according to *European Red List of Globally Threatened Animals and Plants, 1991*)

Leeches	1
Snails	1
Bivalves	1
Dragonflies	1
Beetles	3
Birds	9
Mammals	4
General	20

Species included in the Bulgarian Red Data Book

General number	82
Vascular plants	13
Vertebrate animals	69
Fishes	2
Amphibians	1
Reptiles	1
Birds	59
Mammals	6

Species originally described from the Srebarna Biosphere Reserve

Sporozoan parasites

Eimeria arcutinae Golemansky, 1978

Eimeria micromydis Golemansky, 1978

Isospora talpae Golemansky, 1978

Cestodes

Paranoplocephala aquatica Genov,
Vasileva & Georgiev, 1996

Catenotaenia matovi Genov, 1971

Hilmylepis prokopici Genov, 1970

Digeneans

Troglotrema srebarni Genov, 1964

Parasitic nematodes

Paracrenosoma kontrimavichusi Genov,
1978

Hydrological Characteristic of the Srebarna Lake Reserve Ivan Diadovsky

Summary

The establishment of the water balance is based on the hydrological characteristics of the Lake and the watershed. Both the surface and underground inflow in the watershed determine the water balance of the Lake in the incoming part. The outgoing part is determined by their evaporation. The rivers Srebarnenska and Kapneja ensure the outflow. Those rivers have very unstable water regime and during the summer-autumn periods their waters almost dry up. In 1978 a part of the Danube River dyke was removed and the systematic water entrance from the Danube was recovered especially during the spring.

The following geological and morphological characteristics give the expression of the existing status of the Lake: height of the water column goes between 30 and 150 cm; the depth of the sediments goes to 1,5 to 1,7 m and etc. The dry summer seasons 1988-94 impacted very negatively the morphometric indexes of the lake.

The built channel creates a successful regulation of the water level in the Lake. The ecological station at the CLGE carries out systematic observations of the water level dynamics 4-5 times monthly since 1990. A statistic model is created for determination of basic tendency of water level changes. The trend's function is represented as polynom of 9th degree and it shows a stable water level during the last two years after the channel has been constructed. The water level regulation up to 13.30 m increases the green cover of the Lake, which additionally purify the Lake waters.

A retrospective analyses of the water pollution of the Danube is also made at the control station at town of Silistra for the period 1986-93. All the data collected show that the periodically inflow of the Danube waters does not impact negatively the hydrological characteristic of the Lake.

LONG-TERM CHANGES IN THE ORNITHOFAUNA OF SREBARNA BIOSPHERE RESERVE

Tanyo Michev & L. Profirov

The main changes in the species composition of birds during three period of time have been reported. It has been established that during the first and third period the number of the breeding bird species is almost the same and close to the normal situation. During the critical second period (1991-1994) the number of the breeding bird species has dropped significantly.

One of the greatest value of the Srebarna biosphere reserve is the breeding colony of Dalmatian pelican - globally threatened species. During the last several years the number of breeding pairs, the number of the chicks, and the breeding success as well, have increased significantly.

As a final conclusion we could say that the Srebarna biosphere reserve's ornithofauna has considerably changed during the last 20 years. After a period of unfavorable ecological conditions during the period 1991-1994, the ornithfauna of the reserve has recovered to a great extend.

MAMALS OF THE SEREBARNA BIOSPHERE RESERVE

Svetoslav Gerasimoff

Summary

Almost half of the 42 Bulgarian mammals are reported in the Srebarna Biosphere Reserve and the vicinity. Those are 7 species of insect-eating mammals, 2 species of bats, 11 species of predators, 3 species of ungulates, 18 species of rodents 1 rabbit species.

The jackal (*Canis aureus*) inhabits constantly the region after its invasion during the 60-es in high number of its population in the Lake region. *Ondatra zibethica* is an introduced species since the 50-es. *Nyctereutes proclonoides* is a new alien from the Danube estuary that has entered the Reserve's area.

From the ecology point of view water-loving mammals dominates and in the vicinity of the Lake some step species are found. Very specific could be considered the presence of *Sorex araneus*, *Sorex minutus* and *Pitymus subterraneus* which are typical for the mountain regions.

Among the resource species the largest number has the wild boar which inhabits the Oak Forest of Dumus Kulak nearby the Reserve. Both the wild boar and the jackal have negative impact on the Reserve's fauna especially on the waterfawls.

The biodiversity of the mammals is increased with some step species that inhabit the buffer zone such as: *Mesocricetus newtoni*, *Nannospalax leucodon*, *Mustela eversmanni* and *Spermophilus citellus*.

Vormela peregusna and *Lutra lutra*, which are protected mammals for Europe, are also reported in the Reserve.

A general view on the researches of the mammals of the Reserve dated from the 60-es and 70-es shows that the existing data of the fauna has predominantly systematical character or the information comes from indirect investigations such as helminthological epizootological and etc. It is obvious that detailed ecological analyses are needed on the mammals in the Reserve's region, which will contribute the Management Plan of the Reserve.

On the present state of the ichthyofauna in the Srebarna Lake and its changes in recent years (preliminary results)

Summary

Luchezar Pehlivanov

According to the data from the literature and fishery statistics, 23 fish species, belonging to the Danubian ichthyofauna, were founded in the Srebarna Lake till 1949 (Table). About 20-30 t of fish for year has been caught there. In the catches predominate valuable species as *Cyprinus carpio*, *Esox lucius*, *Abramis brama*, *Silurus glanis* and *Stizostedion lucioperca*. Both *Anguilla anguilla* and *Alosa pontica pontica* have been caught too. The fish population has been seriously stressed in 1942 when by reason of the thick ice it became necessary to catch all fish. Some years later, in 1949, the lake has been isolated from Danube river by a dike.

The first more detailed ichthyological investigation of the Srebarna Lake has been carried out in 1952-53 by Bulgurkov (1958). The author notes drastic impoverishment of the fish stock and associate it mainly with expressed changes for the worse of some hydrological and hydrochemical indices. He finds 19 fish species (Table) but small-sized ones have already expressed superiority. The same author suggests to restore the former connection between the lake and the river as a resolution of the problems. Unfortunately, the data of accidental observations show that during the next years the situation in Srebarna continuously aggravates for the ichthyofauna as well as for the whole water ecosystem. After all, during the period 1991-1993 the heavy blooms of algae as well as the decreasing of the water volume provoke high fish mortality and almost total destruction of the ichthyofauna.

The present study was carried out during the spring and summer of 1998 - 4 years after putting in train the new canal between Srebarna Lake and Danube River. In the lake proper 14 fish species from 5 families (Table) were founded. All they are representatives of the Danubian ichthyofauna. Two species (*Pungitius platigaster* and *Carassius auratus gibelio*) are founded for the first time in Srebarna, but they are common species in the Danube. The most numerous species are *Carassius auratus gibelio*, *Rutilus rutilus* and *Perca fluviatilis*. *Esox lucius* is in comparatively high number too. The most part of species are presented by different age groups - from juveniles to mature specimens. The presence of *Misgurnus fossilis* (Fam. Cobitidae) is very probable, although unproved, since this species is quite tolerant to the unfavourable conditions of the environment. It impresses that *Carassius auratus gibelio* is displace *Carassius carassius*, which was not founded in the catches. It is possible that this species still may be found in the lake but in quite low number. Only in the canal out of the lake were caught *Alburnus alburnus* (Fam. Cyprinidae), *Neogobius fluviatilis* and *Neogobius melanostomus* (Fam. Gobiidae). These species are also potential inhabitants in the lake. *Hypophthalmichthys molitrix* penetrate

accidentally in the lake, but the high quantity of suspended matters, obviously, does not give a possibility of survival to this species.

The results obtained show that the ichthyofauna gradually restores after putting in train the new canal, This process is doubtless closely connected with the penetrating of fishes from Danube. At the same time, the change of conditions evidently gives to almost all species founded a possibility to reproduce into the lake. In the water basin adequate conditions exist for the both *Pungitius platigaster* and *Chalcalburnus chalcoides*, included in the Bulgarian Red Book as "endangered" species. Thus at this stage the attempts on management of the water rate of Srebarna Reserve exert a positive influence on the ichthyofauna.

From the other hand, the considerable superiority of the small-sized groups in the species-size composition of ichthyofauna and the absence (or the quite low number) of some typical Danubian fish species give a reason to conclude that the negative tendencies in the dynamics of the water ecosystem are not break, the environment is not stabilised and the optimal conditions for normal development of the ichthyofauna are not formed yet.

"SREBARNA" BIOSPHERE RESERVE MANAGEMENT PLAN

SCOPE OF WORK

Climate

A. Specialized climatic characteristic in both national and regional scale.

1. Classic climatic characteristic with description of the regime of the general meteorological elements
2. Estimating of some complex indexes for analyses of the humidity degree of the region that is still considered as a wetland
3. Assessment of the long-term changes and variations of both the temperatures and rainfalls as well of some humidity indexes.

Geology and hydrology

1. Geological character of the region. 1.1. Put in order of the data received from the researches;
2. Geomorphologic characteristic of the region;
3. Hydrological characteristic of the region. 3.1. Put in order of the data received from the researches; 3.2. Quantitative and qualitative characteristics of the underground waters that are connected with the water-exchange processes of the Lake; 3.3. Assessment of the nature and using resources of the underground waters in the region;
4. Interconnection between surface and underground waters in the region
5. Utilization of the underground waters;
6. The underground waters use impact on the ecological status of the Lake;
7. Program for hydrological monitoring;
8. Recommendations for action plan for improvement of the ecological status of the Lake.

Hydrology

1. Hydrological characteristic of the watershed of the Srebarna Lake. 1.1 Outflow regime of the rivers Kalneja and Srebarnenska for the 1998; 1.2. Determination of the water volumes at high levels of the Danube waters that flow into the Lake; 1.3. Hydrological characteristic of the Lake - automatic measurement, Technical University.
2. Quantitative and qualitative characteristics of the surface waters going into the Lake; 2.1. Surface waters from the Lake watershed. 2.2. Rivulets going to the Lake - monitoring and qualities.
3. Quantitative and qualitative characteristics of the Danube waters going through the channel into the Lake; 3.1. Assessment of the possibilities for water inflow from the Danube ; 3.2. The impact of the Danube waters going into the Lake on the water-exchange; 3.3. Assessment of the possibilities for export of insoluble matter from the Lake in the time of reverse action of the channel that connects the Lake with the Danube.
4. Hydrological impact on the ecological status of the Lake.

Soils

Types of soils - application of the existing maps; characteristics, nutrient status of the different soil types; erosion, drainage; biogene analyses in soils and sediments.

Water quality

Chemical contents, biogenes - old data.

Monitoring: oxygen regime - vertical and horizontal distribution; pH, conductivity, NO₂, NO₃, NH₄, PO₄

Seasonal analyses including wider spectrum of substances (SiO₂, Cl, Na, K, and etc.)

Biogenes in the water when the channel is open.

PROJECT: Management Plan of the Biosphere Reserve Srebarna - development and work out

Ecology, habitats

Basic communities, habitats - map.

Out of the lake and inside the lake.

Flora, vegetation structure

Nationally significant flora: rare, endangered, of biogeography importance.

Inventarization: floristic analyses - rare and protected categories of species.

Phycoecological character - vegetation map

Hydrobiology

Functional structure, basic hydrobiological processes: primary production

Destruction of organic matter

Trophic structure

Phytoplankton

species structure - abundance, biomass, number, diversity - assessment

seasonal dynamics

FAUNA

Zooplankton

species structure - abundance, biomass, number.

seasonal dynamics

Zoobenthos

abundance, diversity

Fish

Size spectrum, - abundance, diversity

nutrition, movement through the sluse of the channel, data for the fishing in the past

nutrition of the fish-eating birds

Invertebrates, reptiles and amphibians

Helminths inventarisation and their vertebrate hosts

Assessment of the impact on vertebrates

Parasitological risk for the population.

Inventarisation of species number of protected and rare reptiles and amphybians

Mamals

Basic, rare and important species for the Srebarna Biosphere Reserve.

Diversity.

Birds

Species inventarisation, abundance, diversity. Nature-protection status of the bird species

Characteristic of the breeding season, migration and wintering

Pelicanus crispus - number and nesting success

wtarfowls: nesting success, nutrition

Project for the pelicans colony

Socio-economy aspects

kadaster, land tenure

landuse

economic interests - fishing, trades, tourism

