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Table of Contents

1	Abstract	4
2	Introduction	6
2.1	LAKE WATER MANAGEMENT IN EUROPE: AN INTEGRAL PART OF THE EUROPEAN WATER POLICY	6
2.2	OBJECTIVE AND APPROACH	7
3	Data collection	9
4	Environmental water characterisation	16
4.1	FLOOD AND MITIGATING MEASURES	16
4.2	GOOD WATER STATUS	17
4.3	MONITORING	21
5	Social, policy and economic aspects	24
5.1	REGULATING STRUCTURE	24
5.2	REPORTING	27
5.3	TRANS-BOUNDARY ISSUES IN LAKE CATCHMENT AND THE WATER FRAMEWORK DIRECTIVE	30
5.4	ECONOMIC ASPECTS	34
6	Discussion	36
6.1	FRESHWATER MANAGEMENT IN EUROPE: THE ENVIRONMENTAL STATE OF EUROPEAN RIVERS AND LAKES	36
6.2	INDICATORS ABOUT WATER AND LAKES AS CONSIDERED IN THE WATER FRAMEWORK DIRECTIVE	37
6.3	THE REGULATING STRUCTURE AND PARTICIPATION IN DECISION-MAKING	39
6.4	THE ROLE OF INSTITUTIONS IN TRANS-BOUNDARY CO-OPERATION	39
7	Summary and concluding remarks	41
8	Annexes: Questionnaire	47

Remarks

This report is the result of a joint collaborative effort of various EUROLAKES partners. Adeline Kroll (IPTS, JRC) was in charge of the general co-ordination, the introduction, the section on social and policy aspects of lake management and the conclusions. The following partners provided their information: Lake Geneva (Ulrich Lemmin, Ecole Polytechnique Fédérale de Lausanne), Bourget Lake (Claude Guilbaud, Catherine Freissinet, Sogreah and Dominique Fontivielle, Université de Savoie) and Lake Constance (Hans Güde and Bernd Wahl, ISF). Matt O'Hare and Gordon Dickinson (University of Glasgow) were both in charge of drafting sections related to water characterisation and were also involved in gathering data for Loch Lomond and Lake Längelmävesi-Roine (Ämer Bilaletdin, Victor Podsetchine and Tom Frisk, Ymparisto). Their inputs and help in the general report were also very important and highly appreciated.

Disclaimer: The views expressed in this report are purely those of the authors and may not in any circumstances be regarded as stating an official position of the authors' respective institutions.

1 ABSTRACT

The present work identifies policies affecting the management of five deep European lakes and their catchment. Five deep European lakes were chosen as case studies: Bourget Lake, Lake Constance, Loch Lomond, Lake Längelmävesi-Roine and Lake Geneva. Lake management is described using information about their environmental status and their legislation at the local, regional and national levels. In particular, the environmental aspects and water characterisation and the social, policy and economic aspects were considered to evaluate the conditions of implementation of the recent European water policy (Water Framework Directive 2000/60/EC).

Flood and mitigation measures, good water status (eutrophication, physical change and sedimentology, and chemical pollutants) and monitoring were used to characterise the status of each lake. Damage caused by flooding is a serious issue for the large European catchments. The recent trend observed over most Europe is the increased flood intensity. Alternative options to artificial channels and dykes are considered, however, this requires a complete change in engineering practices and traditional beliefs. Heavy damming is common in some of the focus catchments above and below the lakes for hydro-power production.

Although it is recognised that the state of eutrophication of the EUROLAKES lakes is much improved since the 1960s, there are still outstanding issues. In some cases, the reduction of phytoplankton production has not continued, despite further reduction in phosphate. Most nitrogen comes from diffuse sources (agricultural areas) on which sewage treatment has little effect, unlike the successful reduction in phosphorus loading. However, phosphate from non-point sources remains an important source of contamination. Deoxygenated sediments can release stored phosphate which acts as an eternal nutrient loading.

The shores of the main EUROLAKES sites have been extensively altered to prevent the natural process of erosion. Removing the alterations is politically sensitive due to the high commercial and real estate value of lakeside properties. Compromise measures have been sought, such as artificial stable beaches or protective reefs and exclusion zones for boating. The invasion of non-native species affects all the EUROLAKES sites. Despite the invasion of non-native fauna and flora is a threat to native species and affects the water quality, it is not addressed in the WFD. Chemical pollutants are a minor threat to most EUROLAKES sites. Agro-chemicals, pesticides and herbicides are detectable but usually do not exceed EU limits at most sites (except in Bourget Lake).

Monitoring of EUROLAKES sites covers almost all the biological and chemical elements listed in the WFD. Some parameters are even measured more frequently than required. The focus on the sites has been to detect eutrophication. At Lake Geneva, the CIPEL (International Commission for the Protection of the waters at Lake Geneva) is a joint French Swiss commission. At Lake Constance, the IGKB (International Commission for the Protection of Lake Constance) was founded in the 1960s as a result of the alarming eutrophic status of the lake. At Bourget Lake, monitoring is co-ordinated by the Cellule Technique du Lac). An element missing from the WFD is the monitoring of zooplankton in large deep lakes.

The WFD requests that when river basin districts extend beyond the territory of the Community, the Member States should establish appropriate co-ordination with relevant non-Member States (Art. 3, paragraph 5). Both lakes, Geneva and Constance, are transboundary lakes with proper cross-border alliances for water management in place. However, these alliances do not manage its catchment. The environmental regulation at Lake Constance is a good example of the social and policy cross-boundary framework in which the WFD will be implemented. The history of the environmental regulation of boating activities shows that transboundary action can not be explained only as the recognition of a problematic situation in which actors respond to self-interest. Instead, the emergence of a symbolisation of water at Lake Constance is the basis for cross-border action. The competition among institutions to capture the framing of issues to establish their own legitimacy and build shared identities provides a better explanation for cross-border action at Lake Constance.

At all EUROLAKES site, there is full cost-recovery for both water supply and water management agencies from end users. The full social cost pricing system as proposed in the WFD has yet to be applied. Water suppliers at Lake Constance and Lake Geneva are public-private consortia. Full cost recovery is applied through taxation for water quality monitoring and discharge licensing.

2 INTRODUCTION

This report is the result of Workpackage 38 (WP38) Analysis of Policies of the EURO-LAKES project. The previous WP 37 focused on the current EU regulations and provided a description of the policies and regulations influencing the management of deep lakes in Europe. Both workpackages are linked to WP 39 Recommendations that will be produced at the end of the EUROLAKES project. The results of other relevant WP have been used in the present work and are listed at the end of the project. Since a thorough analysis of EU regulations directly or indirectly linked to lake management was done in WP37, we shall recall the main points highlighted in the analysis:

- EU legislation is the same for all Member States, however, it is transposed differently into national law;
- formulating recommendations is only feasible with an in-depth knowledge of the current situation of the management of deep lakes and the issues faced for the management of their watershed;
- the new Water Framework Directive at the European level introduces new obligations for Member States to manage their water resources by river basin. For those Member States where no river basin management has taken place before, this new Directive will imply substantial changes and reorganisation of water management procedures (e.g. through participative approach);
- sustainable water management refers to the environmental, economic and social performance of the management system in place. The environmental performance considers the impact of water intakes and emissions to water on the environment. The economic dimension of sustainable water management evaluates issues such as water pricing, full costs recovery and the liberalisation of the water market. The social aspects refer to the right and equal access to water resources. The sustainable management of water implies the design and use of relevant institutional instruments;
- a number of sectoral policies have indirect but substantial impact on the management of water (e.g., regional policy, agriculture, industry).

2.1 LAKE WATER MANAGEMENT IN EUROPE: AN INTEGRAL PART OF THE EUROPEAN WATER POLICY

As explained earlier (WP37), Europe was provided with a new water policy as of December 2000. The fact that this new piece of legislation is based on innovative concepts such as river basin management or participatory involvement of all stakeholders will make its implementation quite challenging at all levels. It will trigger an interesting exchange of experiences between all Member States including the new Accession Countries (Kroll and Boymanns 2002). The problems of deep lakes are certainly part of the European-wide debate on freshwater management. In that sense, the estimated

500,000¹ European lakes threatened to various degrees by a multitude of human activities require specific attention (Stanners and Bourdeau 1995). However, in order to better understand and prevent further degradation of surface freshwaters, these changes must be considered at the catchment level, that is within the area that the river system drains and of which lakes, reservoirs and wetlands are constitutive parts. Human activities directly affect catchments (and hence lakes) in a number of ways: through afforestation or deforestation, urbanisation, agricultural development, land drainage, pollutant discharges and flow regulation (e.g., dams, channelisation). The Rhine catchment for instance, which has become the most important industrial agglomeration in Europe accounts for 20 % of the worlds chemical production and hosts several steel industries, coal mines and power stations (Lelek 1989). Until recently, many of these industries discharged untreated waste water directly to the river and its tributaries.

Land use in the catchment area which may have an indirect effect on the hydrological cycle (land drainage and irrigation) or on the water quality (eg. runoff of fertilisers and pesticides) are the object of local and national regulations and are subject to transboundary coalitions.

Transboundary issues are also an important issue. Evaluating whether and how the European water legislation could adequately be implemented in the case of deep European lakes is key to a sustainable management of water resources. However, in order to answer this question, it is essential to have a thorough understanding of lake management scheme in place. Sectoral issues and policies such as cross-border issues may be part of the lake management history and these aspects need to be carefully considered under the new management schemes proposed in the EU legislation.

2.2 OBJECTIVE AND APPROACH

In the present work, the intention is to **identify policies affecting the management of five deep European lakes and their catchment** (i.e. Bourget Lake, Lake Constance, Loch Lomond, Lake Längelmävesi-Roine and Lac Léman). In order to do so, the management of these lakes is described using information about their environmental status and their legislation at the local, regional and national levels. Where possible, links to EU legislation were also made by carrying an analysis of how requirements of EU environmental legislation, in particular of the Water Framework Directive (WFD) are taken into consideration by the relevant lake authorities. The main results from this work will be used as a basis for the recommendations part of the project (WP39).

The approach taken in this study was to consider policies affecting the management of deep European lakes through two main angles: 1) the **environmental aspects and water characterisation** and, 2) the **social, policy and economic aspects**. The questions used as indicators were grouped according to these topics and were discussed for each of the five lakes with the project partners (questionnaire presented in the section on Data Collection).

¹ It is estimated that there are in Europe more than 500 000 natural lakes (as opposed to reservoirs) larger than 0.01 km² (1 ha). Of these, about 80-90% are small with a surface between 0.01 and 0.1km² and only about 16,000 have a surface exceeding 1 km². Three quarters of the lakes are located in Norway, Sweden, Finland and the Karelo-Kola part of the Russian Federation. Of the 19 natural lakes larger than 400 km², three are located in central Europe: Lake Balaton, Lake Geneva and Lake Constance (Stanners and Bourdeau 1995).

Clearly, the water characterisation section was the best documented of all. The combination of pre-existing information in other project WP, the high level of answers (the natural science background of most project partners inclined them to better answer the first section in which they felt more comfortable with) and simply the fact that water characterisation has been widely documented in lake monographs allowed for wide coverage of that section.

The second section on lake' social, policy and economic aspects was less successful. However, some studies on issues like cross-border politics could be found in the socio-political arena and were of great help (e.g., Lake Constance). The less obvious section of all definitely concerned the economic aspects where first-hand information proved to be non-existent amongst partners and only general observations could be made. It is interesting to note that the contrasted level of answer on the water status, the social and policy aspects, and the economic ones somewhat reflects the management practices of the lakes themselves.

The **discussion** frames the water characterisation in each of the five focus lakes with the general of **freshwater management in Europe**. Despite the abundant literature on environmental indicators and without entering in a detailed discussion which is the scope of another EUROLAKES workpackage (WP18), we felt important to briefly discuss **the use of water (hence lake) indicators in the sense of the WFD**. Finally, we discuss our main findings concerning the social, policy and economic aspects on the five lakes and relate them to current paradigms about the **role of institutions in trans-boundary co-operation** (Lake Constance), **the regulating structure and participation in decision-making** (Loch Lomond and Lake Constance). We logically chose to discuss the questions and the lakes that were best documented. This choice also highlights the gaps in knowledge about some particular issues about lakes, hence advocating for multidisciplinary approach.

3 DATA COLLECTION

To identify the management schemes and priorities of the examined lakes and to draft general trends at the European level, a good starting point of the analysis is to describe first the environmental status of the lake and of its catchment. This requires a survey of the environmental, legal and socio-economic aspects of each lake before drafting management strategies and options in line with the implementation of the European water legislation. To do so, a questionnaire with simple, general questions/indicators was discussed with each "lake representative" of the project. The questionnaire was structured round three main topics:

- 1. Water characterisation (flood and mitigating measures, good water status, monitoring)**
- 2. Social and policy aspects (sectoral use of lake water, regulating and reporting structure, participation in decision-making)**
- 3. Economic aspects.**

Typically, the questions related to water characterisation were answered without too many problems. However, the questions on the social, policy and economic aspects were much more difficult to answer and often lead to extrapolation of grey literature and of personal knowledge. This may be due to the complexity of identifying the combination of social, legal and economic factors conditioning lake management and to the composition of Eurolakes group mostly represented, by engineers and natural scientists with no social scientists.

I *Have measures been undertaken to mitigate the effects of floods and droughts?*

How have the effects of floods and droughts have been changed. Can changes be related to measures aiming at the mitigation of effects?

1. Damage by Flooding /droughts
2. Mitigating measures

II *Has a "good water status" been achieved?*

Do measures for pollution control, remediation of morphology and dynamics show effects (agricultural, domestic and industrial sources)?

3. Good status
4. NO₃
5. Pesticides
6. Artificial or heavily modified water body
7. Monitoring
8. Designation of vulnerable zones
9. Codes of good practice
10. Action programmes
11. Reports
12. Treatment of domestic waste water
13. Designation of sensitive areas
14. Emission reduction of hazardous substances

III *Is water used in an efficient way?*

Are efficiency and re-use measures applied? Are requirements such as water-saving, low energy consumption, environmentally friendly considered?

15. Efficiency and re-use measures
16. Application of water-saving techniques
17. Efficiency of water use
18. Impact of water abstraction

IV *Is cost recovery for water services assured?*

Are all service costs covered by the end-user? Do they consider resource- and environmental costs? Has economic analysis been done?

19. Cost recovery
20. Resource costs
21. Revenues
22. Environmental costs

23.	Polluter-Pays Principle
24.	Resource-User-Pays Principle
25.	Sustainability
V	<i>Are decision-making processes based on dialogue and consensus?</i>
26.	Do conflicting users communicate with each other? Do administrations moderate the process?
VI	<i>Is decision-making calculable, reliable and has continuity?</i>
27.	Do decisions give enough information to the actors? Are decisions transparent and allow long time planning for investments, use of resources etc.?
VII	<i>Is the decision making process participative and transparent?</i>
28.	Is all information accessible to stakeholders? Do they have the possibility to present their concerns? Are concerns considered in decision making?
VIII	<i>Is the policy actively responding to legal requirements?</i>
29.	Are actions taken to implement and fulfil EU legislation?
IX	<i>Is decision making based on management and knowledge?</i>
30.	Is decision making based on existing data or does it require information gathering? Is the policy implementation actively managed?
X	<i>Are all relevant actors involved in decision making process?</i>
31.	Are stakeholders represented in the decision making process? Do actors show own activities in supporting the policy implementation?
XI	<i>Does a tight network exist between regulators and regulated?</i>
32.	Do regular consultation meetings, workshops, etc. between administration and actors' organisations. Is the setting up of actors' networks facilitated?
XII	<i>Is motivation promoted through the inclusion of stakeholders?</i>
33.	Is co-operation fruitful and not seen as a burden? Are contacts between administration and actors regular, positive and 'easy'?
XIII	<i>Is horizontal and vertical policy integration favoured and does an exchange between various regulatory authorities exist?</i>
34.	Are regular exchanges taking place outside direct concern of water policy and are different levels of policy making interacting?

Table 1. Questionnaire on driving forces influencing the implementation of EU water policy

Mitigating effects of floods and droughts

Floods and droughts cause severe problems in large parts of Europe and play a role for some lakes and their catchment (e.g. Alps-Rhine / Lake Constance). The damage caused by floods or droughts gives additional information on the effectiveness of measures done to mitigate these effects.

Measures to reduce these effects are necessary and requested by WFD.

Good status in all water bodies

Good water status refers firstly to the chemical status of the water, which suffers in many regions of pollution by various activities. Secondly it refers to the ecological status, i.e. the quality of the structure and functioning of aquatic ecosystems. The availability of enough water impacts both the chemical status and the well functioning of aquatic ecosystems. Concerning the quality of water, the combined approach for pollution control (Art. 10, WFD) needs to be respected. Avoid the use and reduce the use of hazardous substances, cessation of losses... Some water bodies may be designated as an "artificial or heavily modified water body"². Consequently there is no obligation that these water bodies should achieve a good status.

A "bad" performance occurs when legal requirements are not met. They are performing "good" when they are met. If the performance goes beyond the legally required level, they are performing "best". WFD does not oblige to restore or remediate impoundment that are build for the storage of water for irrigation services.

The nitrates directive aims at a reduction of Nitrates emissions from diffuse sources, i.e. agricultural use of fertilisers. The Directive provides for certain tools, i.e. monitoring, designation of vulnerable zones, definition of codes of good practice, designation of action programmes and reporting. Almost all Member States have designated.

Legal requirements also concern domestic waste water and emissions of hazardous substances.

Efficient water use

WFD asks for efficient water use and re-use. This concerns all uses of water by agriculture, industry and domestic users.

Measures for efficient water use can be characterised as "bad", an efficient system "good". A highly efficient system is performing "best".

The impact of water abstraction on the status of surface water and groundwater comprises the water level.

Cost recovery

Water Framework Directive aims at achieving cost recovery of water services including environmental and resource costs (Art. 9). An economic analysis needs to be done.

² Art. 4 (3) (a) (iii): "*Designation of a body of surface water as artificial or heavily modified, is possible when: activities to achieve good ecological status would have significant adverse effect for activities for the purposes of which water is stored, ...*".

It is still under discussion how this analysis should be done and what is considered as 'resource' or 'environmental' costs in this context. However, the following basic principles are relevant.

Basic Principles:

- **Cost Recovery:** costs should be covered by the user.
- **Polluter-Pays Principle:** who pollutes water should pay for the costs of treatment.
- **Resource-User-Pays Principle:** who uses a (water) resource needs to pay for that use.
- **Sustainability:** Respect of economic, environmental and social needs.

It would be important to describe how these principles are put into practice in the lake catchments and how they influence water use.

The cost recovery principle is one of the mayor requests of WFD for water services. In water supply this could be identified as falling into by three groups: subsidised services, cost recovery, i.e. the user pays all costs, or full cost recovery. The latter would go beyond the cost recovery, e.g. comprise costs that are indirectly linked to the water service.

The cost recovery is based on a simple basic principle that the revenues from the same service should cover all cost of water services.

The resource costs (costs for monitoring, protection, maintenance, treatment, water rights, fees, taxes, levies etc. - could be described as the costs paid for the resource. This would refer e.g. to a charge or a levy paid to the owner of the resource. In most of the cases these costs do not appear and therefore are not considered in the bill ("bad"). However, WFD demands to consider them ("good").

Of further relevance are information about the economic revenues. This relates turnover, production, contribution to GDP, etc. How the costs are covered? The key questions are: Which pricing system for users (fees, tariff system, taxes, subsidies etc.) exists and are applied? Which financial support (Government, Organisations, etc.) is paid by other sources? Finally the degree of cost recovery can be calculated by subtraction of revenues and costs.

Environmental costs (restoration, replacement, purification etc.) consider the costs that arise from impacts caused to the environment by water abstraction and irrigation. Those could either be effects due to lowering of the water table or due to contamination.

The polluter pays principle requires that the polluter covers all costs due to contamination.

The end-user-pays-principle requires that the end-user pays the costs due to the use of the water.

The principle of sustainability refers to the process that started with the Earth Summit 1992 in Rio de Janeiro. Sustainability became a declared aim for EU environmental policy with 5th Environmental Action Programme. It basically refers to find equilibrium

between environmental, economic and social activities. WFD promotes a sustainable development.

Policy Style

Water Framework Directive was set up on the background of environmental policy which is based on the Treaty of EU and the Environmental Action Programme. Water Framework Directive highlights the importance of close co-ordination between the various actors participating in the implementation of EU water policy and the fulfilment of its requirements.

- I This policy style implies *dialogue* and *consensus* in the decision making process in which government institutions can function as moderator.
- II Of especial importance for obeying decisions is that policy needs to be *calculable*, *reliable* and have *continuity*. Actors, such as farmers, water supply facilities etc., need to be able to plan their activities. This comprises planning of investments and the use of resources (e.g. personnel). Therefore policy needs to create a frame that gives a good ground for economic aspects.
- III A *participative* decision making process should provide all actors concerned with the necessary information and enable them to follow the process. Further actors should have the possibilities to present their concerns. Their concerns should be considered in decision making.
- IV A general interest to fulfil legal requirements should be given. Specific actions shall be taken to support the aims and objectives of this policy.
- V A *management oriented* policy style provides organisational services. An important aspect is the mobilisation and link to individual knowledge. River Basin Management Plans (WFD) and Plans of Measures (WFD) are used.

Configuration of Actors

- VI The *actors* concerned should be *involved* in the decision making process. Actors, e. g. farmers, stakeholders' organisations, concerned administrations, NGOs, consumers, should be represented in decision-making processes.
- VII A tight *network* between regulators and regulated should exist. Actors should be supported in the creation of actors' networks and capacity building (e.g. newsletters, seminars etc.). Regular consultation meetings and workshops should take place in order to explain requirements and exchange information.
- VIII Administration should *motivate* actors to participate in the process. Contacts between actors and administration should be regular, positive and easy.
- IX The implementation of new policy requires the co-operation of all concerned policies (horizontal integration of e.g. agriculture, industry etc.) and all levels (vertical integration, i.e. EU, national, regional and local).

Table 2. Explanations for the questionnaire used in WP38

4 ENVIRONMENTAL WATER CHARACTERISATION

4.1 FLOOD AND MITIGATING MEASURES

Damage caused by flooding is a serious issue for the larger Eurolakes catchments. Given that the recent trend, observed over most of Europe, is increased flood intensity - there have been two '100 year' floods in the Rhone in the last 10 years – the problem is likely to be an ongoing one. Here the methods used to control flooding, their impact on the environment and measures taken to mitigate those impacts are discussed. Information on the impact of other physical alterations to the system are briefly described.

The case of the “Alpine Rhine” which flows into Lake Constance is typical and illustrative of the rivers of the large Eurolakes catchments. Severe floods in previous centuries frequently caused damage to property and resulted in loss of life (Blank 2002). As a result, in 1910, the Alpine Rhine was canalised over a distance of about 100 km. This measure successfully alleviated flooding. In combination with reservoir construction for electrical power it also led to modification of the seasonal hydrological regime while the annual pattern remained mostly unchanged. Flood alleviation schemes tend not to take account of downstream impacts. The changes in the hydrological regime increased the efficiency of sediment transport down the channelled Alpine Rhine causing more sediment to reach the river's mouth where it is deposited. Concerned that this deposit would join an off-shore island to the mainland, the river is to be extended 2km further into Lake Constance (Internationale Rheinregulierung Österreich - Schweiz Plan Nr. 4893). Intra-annually, maximum water levels in the Lake Constance were dampened and the period of average water level extended, affecting the flooding of the riparian zone of the lake, a process important for sustaining fish and bird life. Recently changes in annual means have been observed too although they are possibly caused by climate change. Similar stories emerge for the other large Eurolakes sites where some innovative solutions may help to affect flood alleviation while aiming to provide environmental benefits.

Alleviation of flooding by river canalisation can cause serious damage to the environment when it disconnects the river from its floodplain and backwaters, it reduces habitat diversity (Doledec & Statzner, 1994; Junk et al., 1999). To mitigate this impact new side channels have been successfully created along the channelled Alpine Rhine and Rhone, and other types of flood alleviation devised which incorporate nature conservation (Piegay et al., 1997) (Blank 2002). Canalisation is found at Bourget Lake too. From Chambéry city to the mouth of the Leysse river, the lake's main inflow, there are dykes to alleviate flooding. These may be augmented by an artificial channel to which flood water will be diverted from the course of the Leysse river and then directly to the lake. This solution leaves the original channel intact which is good for sustaining biodiversity. At Lake Geneva administrators are considering new options which require a complete change in philosophy for engineers.

Up to now the aim was to move the water safely downstream which usually means moving it quickly as possible. This required channels with high lateral dams. In the new concept the river channel is widened to let the river find its own course. New flood plains and retention areas are foreseen which should help to locally absorb as much water as possible to reduce flood effects rather than sending it down river.

Heavy damming is common in some of the Eurolakes catchments above and below the lakes for hydro-power production. These alterations can and do effect the migration of fish from the sea to the lakes, e.g. migratory eels and salmonids have been lost from Bourget Lake.

Both damming and flood alleviation schemes alter the hydraulic regime of river. Such alterations can, in theory, alter key physical processes within a lake; including re-oxygenation of the lake by cold, oxygen rich river underflows. Oxygenated water prevents the release of phosphate, a pollutant, from sediment (Giovanolli, 1990).

Flooding not only effects the catchment but the lake shore too. It is integral to the natural functioning of the lake where it influences diverse elements of the system, e.g. plant community structure and fish breeding. At all the sites the lake shore is heavily modified and natural flooding is rare. Water level is controlled by dams or barrages at the outflow (D5). At Loch Lomond to regulate loch water level for water supply, and Bourget Lake to prevent flooding of the riparian zone. This aspect of water management is discussed further under section 4.1.2 Physical change and sedimentology.

The rivers flowing in and out from the main Eurolakes sites are physically altered. These alterations have impacts on the natural functioning of the rivers, themselves but also on the lakes too. It is clear from the descriptions above that some of the inflowing rivers to the Eurolakes sites are 'heavily modified'. It is not clear yet whether the relevant member states will ask for them to be recognised as such. More information is required before we can determine whether alterations to these inflows are adversely affecting the lakes, information which would have a bearing on the designation of both the rivers and lakes. As this document is being produced output from Eurolakes modelling work will begin to shed light on this issue.

4.2 GOOD WATER STATUS

The definition of 'good status' for lakes is still under discussion so here we report on the actual state of water quality at the Eurolakes sites and explain the progress local administrations have made toward defining good status.

Good water status for water quality at the Eurolakes sites is unlikely to be defined until the end of the 'Common Implementation Strategy' intercalibration exercise. Each member state shall have its own definition of 'good status' but it has been recognised that intercalibration is necessary for comparison at an EU level (EU Commission 2001). Guidance on setting reference conditions and by inference 'good status' is to be published in December 2002. The testing phase will begin the following year and a manual produced for 2004/2005.

For Lake Geneva reference conditions will be defined locally by expert panel, whilst at Loch Lomond they will be defined on a national level after public consultation (SEPA 2002a). Loch Lomond will be used to test sampling methods for the WFD elements by SEPA, (*Guthrie pers comm*) and may form part of their reference site network. Details of the implementation at the other sites is either not clear or the information was not available. It is expected that the INRA will set the definitions of good water status for Bourget Lake and Lake Geneva. The implementation of the WFD at Lake Geneva and Lake Constance will have to take into account existing transboundary agreements and standards between member states and Switzerland.

4.2.1 Eutrophication

Eutrophication is the unnatural fertilisation of lakes and the term refers to the damage the process causes too (Moss, 1998). Symptoms of the syndrome can include blooms of toxic algae, fish deaths and reduced species and plant diversity. For human use the lake water can become unusable for recreation and undrinkable, and less suitable for fisheries. Fixing the problem is expensive and technically difficult, preventing it is technically easier and cheaper.

Unfortunately there is a shared history of significant eutrophication between Bourget Lake and Lakes Constance and Geneva. All are recovering now. Loch Lomond shows some symptoms of the early stages of eutrophication.

During the 1950s, the nitrate loading from agriculture to Lake Constance doubled, and the mean loading of phosphorus was 90 mg/l (D5). The situation at Lake Geneva was similar. Worried that increases in phosphate and nitrate loading, resulting from intensified farming, would enrich the two lakes, surrounding nations formed transboundary authorities to tackle the problem.

Since then extensive efforts by those authorities, (CIPEL and IGKB at Lakes Geneva and Constance respectively), has lead to decreasing phosphate loading, reduced phytoplankton production and a shift back to a more oligotrophic type of plankton community, e.g. phosphate levels in Lake Constance are now 10 mg/l which is still double the historical value of 5 mg/l).

From 1986 onward, the composition of the algal community at Lake Constance, was concomitant with oligotrophic status and the original macrophyte community returned to the littoral zone. Since 1991, low average values in annual algal volume have been recorded too, (D5 p86). The remarkable reduction of phosphorus and nitrogen in the lake is certainly linked to the presence of sewage treatment plants built as a response to eutrophication. The same can be said of Lake Geneva where the combined effect of installing tertiary waste water treatment plants from 1972 and the ban on phosphates in detergents from 1986 improved the water quality and phosphorus concentrations significantly. Levels decreased from 89 mg/m³ in 1979 to 41 mg/m³ in 1995. Dramatic reductions in phosphate loading to Bourget Lake came about after sewage was routed away from the lake to the Rhone river (Vinçon-Leite Brigitte 2002).

Overall the opinion is that the state of these lakes is much improved. However, there are outstanding issues. In recent years the reduction of phytoplankton production in Lake Geneva has not continued, despite further reductions in phosphate (Anneville & Pelletier, 2000). The reasons are complex. The plankton have got better at recovering phosphate from the water column and there are still high levels of nitrogen which can encourage production of high levels of oligotrophic types of phytoplankton. There had not been the same success in reducing nitrates as there has been for phosphate. A similar picture may emerge from Lake Constance where the distribution and development of nitrogen shows a different pattern to that observed for phosphorus. Most of the nitrogen comes from diffuse sources (nitrates from agricultural areas, like in the Alpine Rhine catchment intensively cultivated). Sewage treatment has had little effect on nitrogen loading, unlike the successful reduction in phosphorus loading. Nitrogen elimination through sewage treatment is an expensive solution and would only achieve a 10% reduction in nitrogen load, it is being considered (D5 p82).

Finally phosphate from non-point sources remains an important source of contamination. Excess production is still so high in Lake Constance that its decomposition may still cause oxygen depletion in the lake's deep waters (D5 p84). There is also a concern that Lake Geneva is no longer mixing completely. This could lead to low levels of oxygen at the sediment. Deoxygenated sediment can release stored phosphate which acts as an internal nutrient loading. It is worth noting that a rapid response to an indication that eutrophication is beginning is important because the process can accelerate quickly, as happened at Lakes Geneva and Constance. The early indications are characterised by small changes within a system. When setting the boundary between good and moderate status these small but indicative changes should be taken into account.

4.2.2 Physical change and sedimentology

The shore of the main Eurolakes sites has been extensively altered to prevent the natural process of erosion, e.g. 75% of Loch Lomond's shore and 93% of Lake Geneva's shore are modified (D5). Given the commercial and real estate value of lakeside property, removing the alterations is politically sensitive. Compromise measures have been found. At Lake Constance retaining structures have been replaced by artificially stable beaches which provide some natural habitat (Seissegger, 2002). Reed beds are excellent habitat for birds and other wildlife and so their loss from Bourget Lake and Lake Geneva has caused concern. In 1942, the lacustrine reed belt of Lake Geneva covered 17 ha (roughly 5km of shoreline, Gangettes region of the lake). From 1942 to 1972, a zone of reeds 50 m wide retreated at sections of the shoreline. This resulted in modification of the shore topography. Various causes are invoked to explain this retreat of the reed-bed such as the driftwood from the river Rhône, the increased gravel extraction in the lower littoral zone, the reduced bedload transport from the river Rhône reducing compensation for bank erosion, eutrophication and the increased trampling and boat traffic from recreational use (report D5, page 62). So, the causes can be varied and site specific, e.g. at Bourget Lake water level regulation is thought to be key. At both Lake Geneva and Bourget Lake remedial measures include protective reefs and exclusion zones for boats.

Ecological parameters and biological communities

The WFD requires that the following biological elements be monitored; fish, phytoplankton, macrophytes and other benthic plants, littoral and profundal benthic invertebrates. All of these can and have been effected by eutrophication at the polluted sites. Details of the monitoring of these parameters has been reported in D2 'Existing Monitoring Strategies'. At Loch Lomond and Lake Längelmävesi Roine all of the biological groups are not or only minorly effected by eutrophication. The Scottish Environment Protection Agency (SEPA) have detected a slight increase in chlorophyll 'a' values (surrogate measure of phytoplankton production) over the last fifteen years (SEPA 2001). The changes in the phytoplankton community at Lake Constance and Lake Geneva are described above. Both lakes show phytoplankton communities returning to a type present before the 1950s. Bourget Lake is now less afflicted by cyanobacterial blooms. Since the mid-1980s macrophytes are returning to Lake Constance and Lake Geneva, colonising the littoral zones of the lake (Lehmann & Lachavanne, 1999; Schmieder, 1995). Invertebrates too have been responding to re-oligotrophication too (Lang, 2000;

Lang & Reymond, 1996). Benthic invertebrate community structure at Loch Lomond has remained constant since early studies in the 1950s.

At the three alpine sites commercial fishing affects stocks. Due to population fluctuations Bourget Lake is now stocked with the endemic corigonid, 'Laveret', to allow fishing to continue. At Lake Constance commercial fishery has a long history on the lake. Whitefish and perch are still fished commercially. Although fish catches show great annual variability, they have generally increased since 1995 (D5 p 92). At Lake Geneva there are also long records of human exploitation. The regulations applied to fish stock have notably differed between France and Switzerland. Excessively small size limits and abusive use of nets have repeatedly led to reductions of the most valued species. For instance, the French catch data over 70 years shows that the fluctuations are due to the combined effect of both overexploitation and eutrophication. Local eating habits markedly differ between French who prefer the coregonid and Burbot while the Swiss prefer perch leading to a differential exploitation pattern. Highest fish catch 88% is in Switzerland while the remaining 12% lies in France. There is a small commercial eel fishery at Loch Lomond which is thought to have little impact on the fish populations.

At all the Eurolakes sites almost all the communities of biological elements listed under the WFD have been significantly altered by the invasion of non-native species. The invasions of these species have resulted from the activities of man. Improved connectivity between water systems for transport has also facilitated the unnatural distribution of pest species. Pet fish, garden pond macrophytes, live fish bait have all escaped or been released to the detriment of native species. These invaders have the capacity to threaten native species and alter the fundamental functioning of the lake. At Loch Lomond the introduction of ruffe severely altered the population dynamics of the powan (Adams & Maitland, 1991; Adams, 1994). The Powan is a fish species which naturally occurs only in Loch Lomond and a few other sites. It is a species of high conservation status. The powan is now recovering its numbers but for a long period of time it was in serious decline. At Bourget Lake there are a large number of invasive fish species (D5). The effect they have had on native fish species is not known. Non-native crayfish occur in at least two of the Eurolakes sites, Bourget Lake and Lake Geneva (Largiader et al., 2000; Renz & Breithaupt, 2000). These invaders carry disease, 'crayfish plague' and aggressively out compete native crayfish, including the North Atlantic Crayfish, which is protected under the Habitats and Species Directive. All over Europe the native crayfish is in decline. Zebra mussel, an animal which has caused huge problems in the Great Lakes of North America is also present in some of the Eurolakes sites, Lake Geneva, Lake Constance and Bourget Lake (Schneider, 1992). It has an immense capacity to filter phytoplankton. It doubled the depth of clear water in Lake Erie. It is limited to the littoral zone so its impact in the Eurolakes sites, which have relatively small littoral zones is probably small.

Macrophyte communities have also been altered by the presence of competitive invasive species which can out compete natives. Members of the Eurolakes team at Glasgow University working on ECN monitoring sites at the loch have detected a shift in macrophyte community characterised by the appearance of *Elodea nuttalei*, which is now the fourth commonest species in the loch.

The WFD does not address the threat to native fauna and flora from invasive species nor does it suggest how they should be dealt with when assessing water quality.

Changes to legislation and management have been suggested for protecting endangered fish species in the UK from a variety of threats including invasive species (Maitland, 1995; Maitland & Lyle, 1992). Controls mainly addressing the uncontrolled movement of invasive species by man could be applied to plants and invertebrates too. Given their unique natural assemblages of organisms, the Eurolakes sites should be protected from further invasion.

4.2.3 Chemical pollutants

Chemical pollutants are a minor threat at most of the Eurolakes sites. Agriculturally derived chemicals, pesticides and herbicides, are detectable but do not exceed EU limits at most of the sites. At Lake Constance, the pathway for pesticides to the lake is mainly through air (aerosol after rains) and as point sources when farmers wash pesticide out of their spray tanks. Pesticide level has now fallen under level of detection possibly due to a German ban on the application of atrazine and its metabolites. In the catchment of Loch Lomond there have been isolated incidents of 'sheep dip' (potent organophosphate based insecticides) polluting water courses. Heavy metals do not exceed EU standards at Lake Constance, Lake Geneva, Loch Lomond and Lake Langemalvesi Rhone. At Bourget Lake high levels of herbicides have been recorded, e.g. Diuron at 150 ng/l (threshold is 100ng/l). In the lake's catchment herbicides are used in the vineyards and orchards; Diuron, oxadiazon, atrazine, simazine and carbetamine and have all been recorded. This application is thought to be the main source and now that it has decreased in the last few years herbicides concentrations in the lake itself are far below the legal threshold (DF in 2001, pers.comm.). Diuron, oxadiazon and carbetamine are found in the catchment area at very high concentrations, which can reach 50 times the EU threshold. There is a feeling at both Lake Constance and Lake Geneva that the focus of public interest is moving from phosphorus to other pollutants, e.g. endocrine disruptors and heavy metals.

4.3 MONITORING

There is a detailed review of monitoring at the Eurolakes sites in 'D2: Existing Monitoring Strategies'. What follows is a short synopsis of the findings of that report. Monitoring of the Eurolakes sites covers most, if not all, the biological and chemical elements listed in the WFD. It is so intensive that it is likely to exceed the basic requirements of the WFD for these elements, e.g. parameters are already measured more frequently than required under the WFD at Lake Constance and Lake Geneva. This reflects the long history of research at these sites, e.g. the first systematic study of Lake Geneva was carried out at the end of the 19th century by Forel (1892), who investigated the lake system dynamics. Nowadays, research is mainly carried out, under CIPEL's direction, by three institutions: 1) the Hydrobiological Research Centre, Thonon and University of Savoie (biology, chemistry, ichthyology), 2) the University of Geneva and the Forel Research Centre (geology, sedimentology, biology and chemistry) and the University of Lausanne and Ecole Polytechnique Fédérale de Lausanne (biology, toxicology, ichthyology, sedimentology, geophysical and physical sciences).

The focus at all the sites has been on detecting eutrophication. CIPEL (International Commission for the Protection of the waters of Lake Geneva, 1963) is the joint French Swiss Commission which has the responsibility for monitoring the water quality of Lake

Geneva and more recently of its catchment. Its primary objective since its creation has been to reduce the phosphorus concentration in the lake. CIPEL does not carry monitoring itself, it sub-contracts to various laboratories around the lake. The monitoring programmes are lead by CIPEL (3 main programmes, biological, chemical and some basic physical parameters for lake sites and littoral sites), the State Authorities (but their work is not highly co-ordinated, river sites) and the Swiss Hydrological Service (lake level, river gauging stations).

In the 60s, IGKB was founded by countries surrounding Lake Constance as a result of the alarming eutrophic status of the lake. Its task is to launch studies on the improvement of the lake' status and watershed. Monitoring programs exist for many parameters (D02). Although the IGKB does not substitute any national programme, it co-ordinated a series of studies on the lake eutrophication the last four decades. The IGKB has regular monitoring programs (mentioned in the D02 report) and sometimes special campaigns. Among others the Institute for Lake Research (ISF) is responsible for the monitoring. The main organisations monitoring the water quality of the lake are 1) IGKB (routing monitoring programmes), 2) University of Constance (cycling of matter and food web interactions), and 3) BWV (largest water supplier, microbial contamination and pollutants). It is important to note that all German rivers are subject to an automatic sampling system. In Switzerland and Austria, similar systems exist (D2, p 48).

At Bourget Lake since 1981 water quality monitoring is co-ordinated by the Cellule Technique of the lake. This involves weekly and monthly monitoring programmes done by the Cellule Technique itself and occasionally involving CARRTEL (University of Savoie and INRA) or other scientific research teams (CEREVE, Paris for example). SOGREAH is also involved on the development of a lake and catchment model with an integrated decision support system tool for choosing management strategies.

Biological and chemical elements are monitored in an integrated manner and intensively; fortnightly at Lake Constance, Lake Geneva and Bourget Lake, and monthly at Loch Lomond. This is not the case for physical parameters unless they were very basic, e.g. conductivity or temperature.

The lake catchments are heavily monitored too, except at Bourget Lake. At Lake Constance and Lake Geneva a large proportion of the river monitoring is automatic providing excellent data for analysing the relationship between the catchments and the lakes. The physical elements, hydrological regime and morphological conditions are partially monitored. Monitoring of the physical structure of the shore and the pressures exerted on it is limited. At Lake Constance there is monitoring of the pressures on the shore but at the other sites work has mainly involved intermittent survey work. Lake depth is monitored at all the sites but substrate type is not. Output from this project should help clarify the importance and role of the physical elements that are not monitored in the functioning of these lakes.

All the Eurolakes sites have been centres for lake research. Our understanding of how large European lakes function is mainly based on research at these sites. However, to continue to do this greater integration of physical measures in their monitoring regimes are necessary. Furthermore this integration is essential if we wish to move to a system which can be modelled and predict water quality. Modelling based on existing data and

physical data collected outside the catchments of Lake Constance show that it is possible to partially predict zooplankton and phytoplankton dynamics based on Atlantic weather patterns up to 3 months in advance.

5 SOCIAL, POLICY AND ECONOMIC ASPECTS

The social, policy and economic aspects of the lakes are all linked in a complex manner. In order to highlight the social, policy and economic drivers of lake management, we have focused on how lakes are regulated, how the public is kept up to date with the lake status (we have already seen earlier how the lakes were monitored), and which are the pathways for participation in decision-making. Since two of the five case studies are common waters shared by several countries, Lake Geneva and Lake Constance, we have also devoted a section on cross-border water issue. This will help us understand the frame of implementation of the WFD under cross-border situation. This particular section is based on a study of environmental regulation at Lake Constance (Blatter 2000).

5.1 REGULATING STRUCTURE

There is a requirement that 'Competent Authorities' carry out the day to day work of the WFD. Here we outline the management structures that already exist at the sites. Within the current systems there is a degree of co-ordination of catchment or lake management already. However for most of the sites some form of structural reform will be necessary before the organisations can be thought of as 'Competent Authorities'. It is also important to recognise that any 'Competent Authority' will need to function with the power and management structures existing within the catchments.

At all the sites power stems from a combination of regional and national democratically elected bodies. At Loch Lomond there is a new National Park which covers part of the loch's catchment area. At Bourget Lake there are a number of co-ordinating plans among the local administrations. Co-ordinated management of the lakes is recognised as essential and at Lake Constance and Lake Geneva there are international bodies for managing water quality and fishing. Given the requirement of the WFD Article 3 Paragraph 5, that member states should attempt to co-ordinate with non-member states, when a River Basin District extends beyond the territory of the European Community, the existence of CIPEL and IGKB is fortuitous as we will see in Section 4.4.

The normal mode of operation appears to be that the co-ordinating bodies, which have representatives of the elected bodies agree on common strategies and plans. Advice is then issued which is not necessarily binding but tends to be implemented none the less, e.g. CIPEL has no executive power, however, it does produce recommendations for water and catchment management. Another commission at Lake Geneva is responsible for fisheries issues. However, local governments remain responsible for the management of the lake. At all the sites there are local, regional and national plans, which may integrate with the EU at any level. Bourget Lake provides a good example of this type of structuring and shows the integration of an EU LIFE project at the local level. At the national level, there is the Loi sur l'Eau (French Water Regulation). At the regional level there is the Water Agency (RMC) and the SDAGE (Master Plan for Water Development and Management). Finally at the local level there are; SAGE (Local Plan for Water Development and Management), Grand Lac Framework, Contract Plan Etat-Région and EU LIFE programme. A local commission has been set up in which the 61 communes concerned are represented. This commission is charged with management tasks also covering socio-economic and cultural aspects.

For Loch Lomond we give a detailed example of the power and administrative structure for the loch. The Westminster Parliament is the national parliament of the UK. Government which is answerable to the Westminster parliament has powers over Scotland which control the allocation of the majority of financial resources and international relationships (including formal relationships with the EU). The Scottish Executive is responsible to the Scottish parliament in Edinburgh. It is responsible for all domestic legislation and has tax varying powers. Both of these parliaments and the local government councils are elected bodies. The Scottish Parliament has devolved power over environmental issues and it is this body which will enact supporting legislation for the WFD. Although the Environment is a devolved issue on the UK and the implementation of the WFD will be carried out by the SE, the Westminster Parliament retains power over catchment management through other non-devolved issues, e.g. defence.

The National Park is a mixture of elected and appointed posts, mainly the latter. The National Park will implement the structural plan for the area as designed by the Regional Councils but will also attempt to mesh it with their own National Park Management Plan. In doing so they will be influenced by the Catchment Management Plan which has been created for the area. This plan is a trial implementation of the WFD, see below.

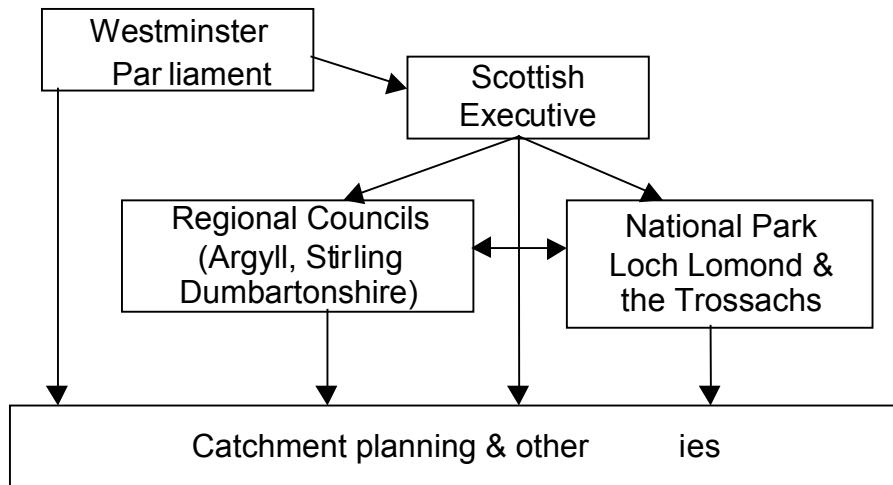


Figure 5.1. Government structure for catchment planning of Loch Lomond

Planning is in turn influenced by a number of government agencies, see Figure 5-2. These agencies co-ordinate environmental management in Scotland. They can influence planning and are active in water quality monitoring and managing the nation's biodiversity. Based on draft legislation for the implementation of the WFD in Scotland, the Scottish Environment Protection Agency (SEPA) will be the main Competent Authority, with Scottish Water, Scottish Natural Heritage, the National Parks and other also involved.

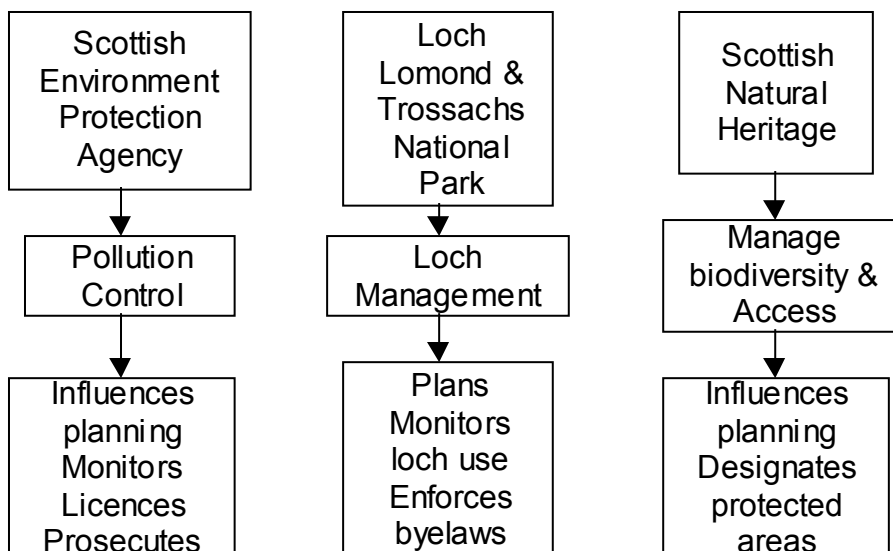


Fig. 5.2. Some state bodies with duties of protection of Loch Lomond and its catchment, showing their main activities

Although complex the two examples, from Bourget Lake and Loch Lomond given above illustrate catchments within single countries. The situation is much more complicated for the transboundary sites, Lake Geneva and Lake Constance. The existing co-ordinating bodies concentrate on the management of the lake not its catchment. It is likely that this situation will have to change if the WFD is to be implemented, given that Catchment Management is integral to it. At Lake Geneva (Lac Léman) this will not be possible because 88% of its catchment lies in Switzerland and outwith the EU (D5 p62). The remainder lies in France and so it will be up to the French to implement the WFD at Lake Geneva. CIPEL, as has always been the case, will help co-ordinate the activities of the two countries. It already has a working group on the implementation of the WFD. The Swiss are in some respects more advanced in co-ordinating their catchment management than EU member states. CIPEL has for some time co-ordinated management of the Swiss catchment with that of the lake, mainly to treat eutrophication.

At Lake Constance, two member states are involved with Switzerland in managing the lake, through IGKB. They are Germany and Austria. No single organisation manages the catchment. If it did it would co-ordinate the activities of Switzerland, Germany, Austria, Liechtenstein and Italy, all of which have land within the catchment of the lake. There are organisations which co-ordinate the activities of the Alpine Rhine but these are mainly concerned with the physical structure of the river and its rehabilitation. They are the International Commission for Regulation of the Rhine (IRR), International Government Commission of Alpine Rhine (IRKA) and IGKB. They are currently putting together an integrated management plan for the Alpine Rhine between the lake and Reichenau. IGKB is scoping the implementation of the WFD using the Alpine Rhine -Lake Constance as a sub-basin unit. In 2001, they brought together all member states and the two non-member states with in the lake's catchment with representatives of all the international commissions. It was agreed at the meeting that they would begin the implementation by describing all the water bodies within the sub-basin, defining the catchment area and registering and assessing point source inputs and register protected areas (Fuhrmann 2002).

5.2 REPORTING

All the monitoring agencies mentioned above inform the public of lake status. Information is presented in a summarised format, digestible to the general public, and more detailed scientific reports too. Occasional publications tackling specific issues, such as a report of a phosphate loading model for Loch Lomond, are also produced.

Annual reports are the norm at Lake Geneva and Lake Constance while reports have been less frequent for Loch Lomond. We give a detailed example for Lake Constance below.

Lake Constance Reports

IGKB produces 3 serial publications:

"Lake Constance Mirror", ("Seespiegel"): which is issued twice a year and reports about current topics concerning Lake Constance. It is more a leaflet than a report as it has only a few pages. The Seespiegel is published on the internet www.seespiegel.de

Green Report (Grüner Bericht): This is the annual report describing the limnological state of Lake Constance. This report is not designed for the public but for scientists, managers and politicians.

Blue Report (Blauer Bericht): This is for scientific, management and decision making purposes. Its issues are irregular.

The blue and green reports you can at least find the titles in the Internet (www.igkb.de). The dissemination is organised separately by each of the IGKB member states. In Baden-Württemberg many authorities and some university libraries obtain these reports. The "Seespiegel" is disseminated to numerous tourist offices and is therefore more available to the public. All of these three reports have ISSN-numbers.

Dissemination of hard copy reports has tended to be in response to requests from the public. IGKB and CIPEL both release annual reports on water quality. As does the Swiss Hydrological Service for the River Rhone flowing in to Lake Geneva. Loch Lomond is included in SEPA's West Area review. The review is available on the internet and has been distributed to the general public, schools and public libraries for consultation. It contains some raw data.

Modern technology has provided all the major agencies with a useful means of disseminating information to the general public. SEPA have started to use a multimedia CD-ROM for their West Region Reports. The west region includes Loch Lomond. The CD-ROM contains summaries of water quality, general background on the lake and specialist reports. It has been sent out to the public on demand and supplied to all primary schools and libraries.

All the organisations have web sites, which either provide reports in downloadable format or contact addresses from which they can be obtained. These web sites also allow the organisations to be more transparent. They can provide background information on the organisations structure, general information leaflets and advice for the public and consultation documents.

Lake	Organisation	Web site
Constance	IGKB	http://www.igkb.de/
Geneva	CIPEL	http://www.cipel.org/
Bourget Lake	CEREVE Cellule Tech- nique	http://www.enpc.fr/cereve/cereve-english.html
Loch Lo- mond	SEPA	http://www.sepa.org.uk

5.2.1 Participation in Decision-making

Member States shall encourage the active involvement of all interested parties in the implementation of this Directive, in particular in the production, review and updating of the River Basin Management Plans. Member States shall ensure that, for each River Basin District, they publish and make available for comments to the public, including users. WFD Article 14 Paragraph 1

The rate and quality of response to this point has been very low. We will therefore take the example of Loch Lomond to illustrate the relationships between decision-making processes and stakeholders' participation. Under the WFD member states are to encourage all interested parties in the creation of River Basin Management Plans (RBMP), WFD Article 14 paragraph 1. At SEPA they have decided to use sub-basin plans, which are usually based on actual river catchments. These are allowed under the Directive, Article 13, paragraph 5.

A Catchment Management Plan has been assembled for the Loch Lomond catchment, as part of a trial implementation of the WFD. The project was initiated by SEPA, SNH and Scottish Water. The first stage in the process was the production of an issues report, then a consultation report and finally a Catchment Management Plan. Using data collected with a questionnaire and face to face interviews the issues report summarising the main concerns of the public and managers of the area. To produce the consultation report groups of experts were set up with knowledge of the issues identified. They reviewed the actual status of the various issues and decided whether they thought work was need to rectify associated problems in the short, medium or long term. They also identified areas which they believed research was need and suggested bodies which could carry out the work necessary to rectify the problems. The document was then sent out for consultation to the public, and their comments taken on board. The Catchment Management Plan will be a revised version of the consultation document, taking the public's and management bodies comments into consideration.

5.3 TRANS-BOUNDARY ISSUES IN LAKE CATCHMENT AND THE WATER FRAMEWORK DIRECTIVE

In Europe, the four largest river basins are shared by 4 or more countries. These are subject to at least 175 treaties (Gleick 2001). These treaties prevent potential conflicts within the river basin, across countries and between water users. Equally important, they also provide a basis for political institutions to increase their profile and legitimacy, thereby creating their own regional identity. We will use the well documented Lake Constance as an example of cross-border environmental regulation to understand the framework in which the implementation of the Water Framework Directive will take place. The following includes a summary of Blatter' analysis on Lake Constance cross-border environmental regulation (Blatter 2000).

5.3.1 Pollution of the lake by boats at Lake Constance: contextual factors for a cross-border water issue

Co-operative effort of Lake Constance (LC) is recognised worldwide as one of the most successful examples of international environmental regimes. The lake was close to biological collapse in the 1960s, 30 years later its waters are sold as high-quality table water. This environmental success story has been achieved through co-operation between the riparian states of Germany, Switzerland and Austria. These countries never formally agreed on a clear-cut boundary on the lake, a puzzling aspect of this trans-boundary co-operation. Blatter takes the case study of regulation of boats on the lake to show that a post-modern cross-border environmental politics deviates in many ways from the conventional modern concepts of international environmental regimes.

LC is the second largest lake in central Europe after Lake Geneva and covers an area of 539 km². It is the only region in Europe in which borders of the neighbouring countries were never formally delineated. LC mainly served as a storehouse for drinking water and has been a regional focal point for tourism since the XIXth century. In 1895, the canton of Saint Gallen put a waterworks service, the first far-reaching water distribution system from LC. Now, about 4 millions users consume, annually, 180 million m³ of water. Since 1908, the number of leisure boats activities has significantly increased.

The meanings of water held by civil actors involved in LC water governance vary according to their interests. In that respect, water at LC is constructed as a:

1. cultural specific good by boaters and the tourism industry
2. natural specific good by environmentalists
3. central symbol for building a cross-border "Euro-region" by politicians around the lake.

The extent to which boating pollutes LC is contested. There are basically two types of degradation emanating from boating. A structural, ecosystemic pollution affects the shores through waves production. This environmental degradation is easily quantifiable and does not affect common waters. By contrast, the chemical pollution is difficult to measure in a consistent manner and hence is contested by some social actors. It consists of emissions of hydrocarbons by motorboats, carbon monoxide, sulfur dioxide, lead, nitric oxide released in water and air and phosphates used in antifouling. This type of environmental degradation directly affects common waters.

Blatter explains how the development and success of cross-border co-operation in regulating boating in LC and environmental political results. According to him, trans-boundary action can not be explained as the recognition of a problematic situation in which rational actors respond to self-interest. The modern notions of interest aggregation at national level, the expression of national-state interest at second international level and process do not explain the water politics at LC. In fact, a close examination of the alliances and linkages created within the cross-border issues provides the understanding of water-related conflicts and resolution at LC.

The question is whether boating issue at LC is consistent with a "collective action" problem (Orstom 1990) where efforts of positive and negative externalities need the construction of cross-border institutions. Although the toxic water pollution occurs in common waters, boats are not a collective action problem since they move on water,

which is not allocated to a single country. Instead of some territorially specific interest, the emergence of a natural specific or symbolisation of water at LC is the basis for action. The strongest demands for a common regulation came when data on chemical pollution was not available. The scientific evidence that motorboat emissions represent a real threat to lake water quality is not compelling. Political cross-border co-operation first concentrated on material emissions of sport boats, while their impact is relatively minor compared with other sources of pollution. The competition among institutions to capture the framing of issues to establish legitimacy provides a better explanation of cross-border action.

5.3.2 "Waves" of institution building in the Euregio Bodensee and the environmental regulation at Lake Constance

The cross-border boat regulation has taken a very prominent position in political agenda of LC the last 30 years. The examination of contextual factors provides the understanding of the nature of cross-border water issues at LC. In the 1960s, the institutionalisation and professionalisation of emerging environmental organisations accompanied the emergence of ecological problems attributable to boat use in LC. These environmental organisations pointed out the structural damages caused by shipping on lake and were successful in impeding the proposal to make River Rhine navigable between Basle and Constance. Blatter has identified three types of cross-border alliances (Table 3).

In the 1970s, the discussion of LC water protection was mainly about regulation of boats on the lake. The Council of Europe triggered a wave of initiatives for cross-border regulation. The European Year of Nature Protection declared in 1970 saw the unification of 33 private nature protection and citizen initiatives under the ANU (Arbeitsgemeinschaft Naturschutz Bodensee, Study Group for the Environmental Protection of LC) which grouped about 18.000 members. That same year, the First European Conference of Ministers of Spatial Planning passed cross-border spatial planning recommendation. The battle began at LC for institutional ownership of this field of political activity. Municipal politicians attempted to form a cross-border planning group named "Euregio Bodensee". New institutions searched for targets for their efforts. Sport boats were seen as a suitable field for political action. In 1992, the ICPLC (International Commission for the Protection of LC, IGKB) issued a report on limnological effect of shipping on LC. This report was instrumental to shift the attention from the structural damages to the chemical pollution of LC waters by chemical pollutants. During the 1980s, the scientific and technical investigation looked for technical decrease of boat emissions.

Transgovernmental Commissions³

IBB	International Commission of Fisheries of LC
IGKB	International Commission for the Protection of LC
ISB	International Shipping Commission for LC
DSR	German Swiss Spatial Planning Commission

Transnational Coalitions

AWBR	Environmental Council of LC
IB	International LC Association (tourism industry)
ABIH	Association of Chambers of Commerce and Industry

Regional Associations

IBK	IBK (LC Conference of Government Leaders)
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Table 3. Cross-border alliances formed at Lake Constance

The European Community induced a renewed competition for institutional ownership on this field by convening the European Single Market of 1982 in creating assistance program for border regions (INTERREG) in 1990. IBK (LC Conference of Government Leaders) was challenged by a second attempt at grounding of a regional cross-border institution, the LC Council. As a result, IBK reshaped itself by creating an innovative cross-border institution committed to impose boat emissions standards. Since 1990s, IBK expanded its agenda to all policy fields, especially in economic development.

Hence, the succession of cross-border coalitions is the primary source of the thematisation of environmental problems, rather than answering such problems. The theme of cross-border co-operation offers great political reward by which institutions compete by installing their own legitimisation. A common problem was created, water pollution, as political cross-border institutions searched for field of activity with high symbolic value. For instance, the residents of LC resent their perceived domination by yacht owners coming from national (Vienna) and sub-national centers (Stuttgart, Munich). The construction and the need for building shared identities often form the impetus for cross-boundary water issues. Water of LC is used as an identifying symbol for building cross-border communities and institutions when new policy ideas challenged the predominance of nation-state. This will determine when an environmental problem will be

³ Adapted from Blatter et al. 2000

placed on the political agenda, how it will be defined and which position political actors will take.

We have seen that two "waves" of institution building within the Euregio Bodensee took place since the 1960s. The first wave initiated by the Council of Europe (1970), while the second wave came from the European Community efforts to set up the Single European Market (1992) and the subsequent community initiative with financial aid for cross-border collaboration through INTERREG. In that respect, the implementation of the WFD may well represent a third wave of initiative for the protection of LC. According to the Water Framework Directive:

'Where a River Basin District extends beyond the territory of the Community, the Member State or Member States concerned shall endeavour to establish appropriate co-ordination with the relevant non-Member States, with the aim of achieving the objectives of this Directive throughout the River Basin District. Member States shall ensure the application of the rules of this Directive within their territory.' WFD, Article 3 paragraph 5.

Although the actors and cross-border networks are all in place in both cross-border lakes (Lake Constance and Lake Léman), their management is based on the lake itself and not on the catchment as requested through the WFD. We have seen how the alliances and networks were formed in LC. According to Blatter, these cross-border alliances were formed primarily on the need for institutions to increase their profile and legitimacy. As mentioned earlier, the CIPEL at Lake Geneva had already set up a working group on the implementation of the WFD. For Lake Constance, IGKB is making sure that the existing instruments for a coherent watershed management amongst the three countries at the legal level can be warranted also in future under the new conditions given by WFD. In view of such provisions, the management of cross-border waters at Lake Constance and Lake Geneva according to their river basins is not expected to create major problems.

5.4 ECONOMIC ASPECTS

Overall there was a low response rate to questions relating to economic aspects of the catchments. It is clear that there is full cost recovery for both water supply and water management agencies from end users. What is equally clear is that full social cost pricing as defined in the WFD is yet to be applied.

At Lake Constance and Lake Geneva water suppliers are public-private consortia, at Loch Lomond there is a public water authority and at Lake Langemalvesi Rhone there is a private company. All these organisations charge consumers and industry for water. The private company wishes to make a profit so there is always full cost recovery. The state bodies are supported by taxes as well as water charges so there can be both direct and indirect cost recovery. As water quality monitoring and discharge licencing are carried out by state bodies there is also full cost recovery through taxation for these activities. There is direct cost recovery in Scotland for the administration of discharge consents.

The concept of social cost includes the concept of water quality. That is the economic value of water includes all the possible uses it could be put to in a catchment. When the

water is used or polluted its value becomes downgraded; there is an associated cost. Costing of water in this manner is required by 2010 under WFD. The economic value of water uses within the EU area must be carried out by 2004. Member states have very limited experience of this type of costing. Environmental taxes are rare, e.g. in the UK only landfill, waste and quarrying are taxed in this manner. The process is likely to be contentious with industry loathe to pay additional taxes and technically difficult. The Scottish and Northern Ireland Forum For Environmental Research (SNIFFER) have identified the implementation of full social cost pricing as their top research priority over the next two years. At some of the sites water charges to consumers include part of the cost of sewage treatment, e.g. Lake Geneva and Lake Constance.

6 DISCUSSION

6.1 FRESHWATER MANAGEMENT IN EUROPE: THE ENVIRONMENTAL STATE OF EUROPEAN RIVERS AND LAKES

If the ecology, physics and chemistry of European rivers and lakes are rather well known, their management at catchment level is much less known. In general, the environmental state of rivers and lakes are described according to ecological, physical and chemical parameters. An overview of the main pan-European problems faced in freshwaters management is a good starting point to understand the problems faced in the management of European freshwaters, and in particular of lakes.

A general description of the environmental state of European rivers and lakes typically includes information on nutrient and organic concentrations (trends in eutrophication), heavy metals and other toxic substances and acidification (especially for Nordic countries, part of the Central Europe and Northwestern part of the Russian Federation). This description would not be complete, however if the physical degradation of rivers, lakes and their catchment as a whole was not taken into consideration.

Although methods and measurements somewhat differ between countries, monitoring nutrient and organic concentrations in European rivers and lakes is included in most national programmes for surveying the state of the environment. Nutrients from wastewater and agriculture cause widespread eutrophication in European lakes and rivers. Trends in eutrophication (mainly phosphorus concentration levels) have been largely documented for most European lakes. Even if eutrophication remains an issue of major pan-European concern, the combined effects of both substituting phosphorus in detergents and of improving wastewater treatment have greatly decreased the phosphorus levels in many European rivers and lakes over the last 20 years. It was observed that the measures put in place to reduce phosphate concentrations since the last two decades or so can not reduce further phosphate concentrations to a level reversing the eutrophication status. Instead, phosphorus is constantly put back into circulation through sediments bounds and inputs from diffuse sources.

Organic pollution of freshwaters (increased ammonium concentrations, presence of pathogenic microorganisms, oxygen deficiency and degraded living conditions for biotic communities) is also directly linked to the management of freshwaters. These problems mostly occur in densely populated areas with no or insufficient treatment of sewage effluents, like it is the case of the majority of Eastern and Southern European countries and a few Western European countries.

With respect to the concentration of heavy metals in European rivers, it is below that set by drinking water standards (EEA, 1995). However, aquatic biota are affected at much lower concentrations. In some EU countries, high concentrations of heavy metals are observed in rivers and catchments receiving mine effluents and discharges from metal processing industries. The use of toxic substances (e.g., DDT, PCBs) has been restricted and/or banned in several European countries during the last 25 years. However, micro-pollutants are suspected to have detrimental environmental effects, most of them still unknown. Nuclear accidents, due to low safety standards at nuclear power plants and careless handling of nuclear waste are also another potential source of freshwater contamination. River regulation works (reservoir construction and channeli-

sation) have severely degraded physical conditions of rivers, leading to a reduction of their self-purification capacity and impeding fish migration of salmonids and sturgeons. In Europe, the percentage of rivers still in natural state is less than 20% in densely populated areas with intensive agriculture (Belgium, Denmark) to above 70% in lower population densities or less intensive agriculture (Poland, Estonia, Norway, EEA 1994).

6.2 INDICATORS ABOUT WATER AND LAKES AS CONSIDERED IN THE WATER FRAMEWORK DIRECTIVE

The European Union Water Framework Directive (WFD: 2000/60/EC) requires Member States to employ ecologically-based classification systems (“broad, integrated biologically-based systems which provide an assessment of ecosystem health”) for surface waters. Therefore, biological monitoring procedures to assess system biointegrity have recently assumed a much greater importance than was previously the case.

General reviews of the state of the art in freshwater biomonitoring in the 1980-90s were provided by Hellowell (1986) and Rosenberg & Resh (1993), although the latter was concerned primarily with the use of benthic macroinvertebrates. Since then numerous schemes for classifying and monitoring the biointegrity of lakes, ponds and reservoirs have been examined to varying extents: e.g. using macrophytes (Palmer et al., 1992, Kennison et al 1998 in the UK; Canfield et al 1983 in the USA); phytoplankton or periphyton (Muratori & de Grossi 1997 in Italian reservoirs; Nixdorf et al 2001 in German lakes; Eloranta 2001 in Finnish lakes and rivers); and chironomids and other benthic invertebrates (in Scandinavian lakes: Wiederholm 1973, 1980; Lang 1990; in UK lakes: Jackson 1998; Ruse 2000); or combinations of biota (e.g. Biggs et al 2000; Xu et al 2001; Skriver 2001). A useful review of current developments is provided by Bäck & Kartunnen (2001), while a thorough review of the current development and application of ecologically referenced monitoring procedures for freshwaters globally is provided by Murphy et al (2002). Increasingly, such schemes utilise the changed-state approach, or incorporate comparison with “pristine” baseline sites, (e.g. the river environmental monitoring scheme RIVPACS: Wright et al 2000).

Biological monitoring programmes fall within the framework of the three types of monitoring (surveillance, operative and investigative) prescribed by WFD. These have differing aims and intensities of sampling (see Foster et al, 2001):

- **Surveillance monitoring** (1 year in 6): aims to validate impact assessment, assess longer term changes and inform the design of operational monitoring programmes.
- **Operational monitoring** (5 years in 5): aims to establish the actual status of waterbodies identified as being at risk of failure to meet environmental objectives, and to assess the effectiveness of ameliorative or other programmes.
- **Investigative monitoring** (carried out as and when required): to ascertain impacts of an accidental pollution, or to determine the reasons for failure of WFD environmental objectives.

Current monitoring operations at the Eurolakes sites are best described as intense operational monitoring. With regard to standing freshwaters, the objectives of the monitoring programmes which must be defined and “ready for commencement” by 2007 by Member States are to:

- provide a coherent and comprehensive overview of ecological and chemical status of lakes and other standing waters;
- permit classification of standing waters into five classes of ecological status: high, good, moderate, poor and bad;
- be based on characterisation and impact assessment carried out for each River Basin District);
- cover parameters which are indicative of the status of each relevant quality element.

Monitoring of a variety of biological elements (alongside physico-chemical and hydro-morphological elements) is prescribed by the WFD to permit overall assessment of the ecological status of surface waterbodies for reference-based classification. The WFD specifies monitoring of the composition and abundance of benthic invertebrate fauna, aquatic flora (phytoplankton, phytobenthos and macrophytes), and the composition, abundance and age structure of fish communities.

A recent report aimed at identifying existing biomonitoring schemes which might be adapted to the requirements of the WFD (Murphy et al, 2002) focused upon three key groups of aquatic biota: invertebrates, macrophytes and phytoplankton. With regard to these groups, Foster et al (2001) comment that the RIVPACS-based system of river classification in use in England and Wales meets the reference-based requirements of the WFD. No similar comprehensive classification / monitoring scheme is in place for lakes in the UK.

The Eurolakes sites all have good historical information on lake status and because of this they have always used systems which can be regarded as 'change state'. At Lake Constance and Lake Geneva detailed information exists the status of the biological elements at these sites before eutrophication in the 1950s. Pre-eutrophication status for biological elements has been an implicit goal in the work of lake managers at these sites. These sites are among the most intensively monitored in the world.

The main recommendation to be extracted from the existing monitoring programmes at these sites is that the more intensive the monitoring the better one understands the system and the better one can manage it. Having said that there is a consensus of opinion that zooplankton should be included in monitoring of large deep lakes. An element missing from the WFD. Furthermore the project is currently working on a detailed list of essential parameters, based on experience gained at the Eurolakes sites and our improved understanding of lake physics, which can be applied to large deep lakes through out Europe.

The use of indicators has been reviewed extensively within Eurolakes. New criteria have been drawn up for identifying indicators which focus on the usefulness of indicators to managers (D1 D12 D16). The biological elements specified in the WFD are good at picking up adverse changes to a system. Many different pressures can be detrimental to biological elements and it is not always possible to identify from the effect on the indicator which pressure is responsible. Therefore other indicators with powers of discrimination are necessary. In the case of eutrophication models of nutrient run off can identify the main culprit by assessing the relative importance of point and non-point sources and different types of agriculture. Knowledge of how water moves through

lakes will help to identify the spatial sources of pollutants. Such discrimination will help to fulfil the WFD that development is sustainable.

Key to this approach has been the application of the DPSIR model developed by the EEA (European Environment Agency). It can be used to link driving forces within a catchment to pressures on the systems and the socio-economic impacts they might have. Finally it identifies responses such as legislation.

6.3 THE REGULATING STRUCTURE AND PARTICIPATION IN DECISION-MAKING

Usually, at all examined lakes, some form of information is available to the public. Annual reports are the norm at Lake Geneva and Lake Constance and are less frequent for Loch Lomond. Web sites are usually informative and available for Lake Geneva (CIPEL), Lake Constance (IGKB), Bourget Lake (CEREVE) and Loch Lomond (SEPA). As for the requirement from the WFD on participation in decision-making, the example of Loch Lomond illustrated how River Basin Management Plans (RBMP) would be designed through the creation of sub-basin plans usually based on actual river catchments.

6.4 THE ROLE OF INSTITUTIONS IN TRANS-BOUNDARY CO-OPERATION

The cross-border co-operation analysis on regulation of boats on Lake Constance has illustrated the type of environmental politics to be expected with growing multi level governance. The basic motivation for cross-border environmental policy is not the recognition of common-pool problems by actors as demonstrated by Blatter (Blatter 2000), but rather the need of institutions to increase their profile and legitimacy. For the politicians at LC, the central meaning of the lake's water is not so much a natural gift that has to be saved, but rather a valuable symbol to create identity and legitimacy for political institutions within the Eurogio Bodensee. Water quality negotiations are no longer restricted to sectorally bounded institutions, nor characterised only by territorially defined interests. Instead, a broad range of autonomous cross-border networks and institutions gather the field of trans-boundary resource policy. In that sense, the implementation of the WFD may well represent a third wave of initiative for the protection of LC and its implementation between EU (Germany, Austria) and non-EU Member States (Switzerland) is not expected to be problematic.

The case study on motorboat pollution of LC also argues for the influence of ideas and institutions. The rational approach which conceptualises institutions as structural environments that constrain strategic action is inappropriate. Rather, a focus on context and institutions points to a new political landscape where political actors, communities and organisations are embroiled in dynamic processes of change and reconstruction. The diminution of the hegemonic position of the nation-state increase both the complexity of political structures and the level of institutional competition, opening up new opportunities for environmental policy and rendering outcomes more difficult to calculate. Therefore, recognising the importance of post-modern, nonmaterial, symbolic meanings and issue framing becomes especially important.

At present, both Lake Constance and Lake Geneva are not managed according to their hydrologic basin, as requested by the WFD. However, the two major institutions for

protection of shared waters at Lake Geneva (CIPEL) and at Lake Constance (IGKB) have already set up working groups on the implementation of the WFD. The complex alliances already in place in both cross-border lakes should allow the implementation of the WFD without major problems.

7 SUMMARY AND CONCLUDING REMARKS

The new European water policy passed on December 2000 is based on innovative concepts such as river basin management and participation of stakeholders in decision-making. An estimated 500,000 European lakes are central to the Europe-wide debate on freshwater management. They are threatened through land use practices in their catchment areas, practices which affect their hydrological cycle (land drainage and irrigation) and their water quality (run off of fertilisers and pesticides). These practices are the object of local and national regulations and are also subject to rulings by trans-boundary coalitions. In order to evaluate how deep European lakes will be managed under the Water Framework Directive (WFD), an appreciation of various environmental, social, policy and economic drivers was made for five case study lakes and their catchments. This survey included Lake Geneva, Lake Constance, Loch Lomond, Lake of the Bourget and Lake Längelmävesi-Roine.

Environmental aspects

Water characterisation

Flood and mitigation measures, good water status (eutrophication, physical change and sedimentology, and chemical pollutants) and monitoring were used to characterise each lake's status. Damage caused by flooding is a serious issue for large European catchments. The recent trend observed over most Europe is increasing flood intensity, as showed by the two "100 year" floods in the Rhône in the last ten years. At Lake Constance, inter-annually, maximum water levels were dampened and the period of average water level extended, affecting the flooding of the riparian zones. Recent changes in annual mean water levels observed at Lake Constance may be caused by climate change. Alleviation of flooding by river canalisation can cause serious damage to the environment when it disconnects the river from its floodplain and backwaters, reducing habitat diversity. Downstream of Lake Geneva, alternative options to artificial channels and dykes are considered, however this requires a complete change in engineering practices and traditional beliefs. Under the new concept, the river channel is widened to let the river find its own course. New floodplains are foreseen which should help to locally absorb water and reduce flood effects rather than sending it down to the river. Heavy damming is common in some of the focus catchments above and below the lakes for hydro-power production. At Bourget Lake, this has dramatically affected the migration of fish to the sea, eels and salmonids have been lost to Bourget Lake. Some of the inflowing rivers to the lakes considered are "heavily modified", however it is not clear whether the relevant member states will recognise them as such.

The definition of "good water status" is discussed in other workpackages of the EUROLAKES project. Here, only an attempt was made to identify the progress local administrators have made towards defining good status. Good water status for water quality at the EUROLAKES sites is unlikely to be defined until the end of the "Common Implementation Strategy" intercalibration exercise lead by the EC. The EC will publish the guidance document on setting reference conditions to define "good status" (to be published by December 2002, manual to be produced by the EC by 2004-5). At Lake Geneva, reference conditions will be defined by an expert panel, while at Loch Lomond, they will be defined at national level, but with local input, after public consultation, by

SEPA. It is expected that the French INRA will set the definitions for good water status for Bourget Lake and Lake Geneva.

Eutrophication is the non-natural fertilisation of lakes. Symptoms can include toxic algae blooms, fish deaths and reduced species diversity. For human use, the lake water becomes unsuitable for drinking, fishery and recreational purposes. Remedial measures are technically difficult and expensive. Preventing eutrophication is technically easier and cheaper. Lakes du Bourget, Constance and Geneva share a common history in eutrophication which are under similar anthropogenic pressures. The last three decades, extensive efforts were made by CIPEL at Lake Geneva and IGKB at Lake Constance to study the process and identify routes for decreasing the impact of nitrate and phosphate loading. The remarkable reduction of phosphorus and nitrogen in Lake Geneva is linked to the combined effect of tertiary waste water treatment plants built as a response to eutrophication as from 1972 and a ban on phosphates detergents from 1986. Although it is recognised that the state of these lakes is much improved, there are still outstanding issues. The reduction of phytoplankton production in Lake Geneva has not continued, despite further reduction in phosphate. There has not been the same rate of success to reduce nitrates as there has been for phosphate. This may be due to the contrasting distribution and development between nitrogen and phosphorus. Most nitrogen comes from diffuse sources (agricultural areas) on which sewage treatment has little effect (a 10% reduction), unlike the successful reduction in phosphorus loading. However, phosphate from non-point sources remains an important source of contamination. Low levels of oxygen in Lake Geneva and Constance deep waters have been recorded. There is the concern that Lake Geneva is no longer mixing completely. Deoxygenated sediments can release stored phosphate which acts as an internal nutrient loading.

Physical change and sedimentology

The shores of the main EUROLAKES sites have been extensively altered to prevent the natural process of erosion. Almost all of Lake Geneva's shores are modified. However, removing the alterations is politically sensitive due to the high commercial and real estate value of lakeside properties. Compromise measures have been sought, such as artificial stable beaches at Lake Constance, protective reefs and exclusion zones for boating at Lake Geneva and Bourget Lake. The causes of shore topography can vary and are site-specific. At Lake Geneva, the retreat of the reed-bed is linked to driftwood from the Rhône, the gravel extraction in the lower littoral zone, trampling and boat traffic. Since the mid-1980s, submerged plants are returning to Lake Constance and Lake Geneva, colonising the littoral zones of the lakes, a direct benefit of reduced nutrient loadings.

At the three Alpine sites, commercial fishing affects stocks. Regulations concerning fish stocks have notably differed at Lake Geneva between France and Switzerland, which has the highest fish catches. The combined effect of eutrophication and over exploitation has determined the fish fluctuations over the last 70 years at Lake Geneva. The invasion on non-native species affects all the EUROLAKES sites. Improved connectivity between water systems for transport has facilitated the unnatural distribution of pet fish, garden pond macrophytes and live fish bait. The most famous examples are the non-native crayfish aggressively competing with the native species, like the North Atlantic Crayfish and the zebra mussel, which has caused great problems in the Great Lakes of

North America. Despite the invasion of non-native fauna and flora is a threat to native species and affects the water quality, it is not addressed in the WFD.

Chemical pollutants

Chemical pollutants are a minor threat to most EUROLAKES sites. Agro-chemicals, pesticides and herbicides are detectable but usually do not exceed EU limits at most sites. At Lake Constance, the pathway for pesticides to the lake is mostly through air (aerosols after rain) and as point sources when farmers wash pesticides tanks. The use of some pesticides like atrazine and its metabolites are prohibited in Germany. In Loch Lomond, there are isolated incidents of "sheep dip" (organo phosphate based insecticide) polluting water courses. At Bourget Lake high levels of pesticides have been recorded as herbicides are used in the lake's catchment in the vineyards and orchards. Diruon, carbetamine and oxadiazon are found in the catchment at concentrations which can reach 50 times the EU threshold. At Lakes Constance and Geneva, the public interest seems to have shifted from phosphorus to other pollutants, like endocrine disruptors and heavy metals.

Monitoring

Monitoring of EUROLAKES sites covers almost all the biological and chemical elements listed in the WFD. Some parameters are even measured more frequently than required. The focus on the sites has been to detect eutrophication. At Lake Geneva, the CIPEL (International Commission for the Protection of the waters at Lake Geneva) is a joint French Swiss commission. At Lake Constance, the IGKB (International Commission for the Protection of Lake Constance) was founded in the 1960s as a result of the alarming eutrophic status of the lake. Its task is to improve lake' status and watershed. It is important to note that a water supplier (BWV) is involved in the monitoring of the water quality of the lake and that all German rivers are subject to an automatic sampling system. At Bourget Lake, monitoring is co-ordinated by the Cellule Technique du Lac. Modelling based on existing data and physical data collected outside the catchments of Lake Constance shows that it is possible to partially predict zooplankton and phytoplankton dynamics based on Atlantic weather up to 3 months in advance.

Social, policy and economic aspects

Regulating structure

The management structures already include co-ordination of catchment and stem from a combination of regional and national democratically elected bodies. However, most sites will need structural reform in order to be labelled as "Competent Authorities" at the sense of the WFD. Detailed examples are given for the power and administrative structure of Bourget Lake and Loch Lomond as catchments within single countries. Bourget Lake shows the integration of an EU LIFE project at the local level, meaning that local, regional and national plans may integrate with the EU at any level. Lakes Geneva and Constance are transboundary sites. Their existing co-ordinating bodies concentrate on the management of the lake and not on its catchment. At Lake Geneva, the CIPEL is the central authority co-ordinating the activities of France and Switzerland. At Lake Constance, there is no single organisation to co-ordinate the activities of Swit-

zerland, Germany, Austria, Liechtenstein and Italy, all of which have land within the catchment of the lake.

Reporting and participation in decision-making

All the monitoring agencies inform the public about the lake status and have updated web sites. Both IGKB and CIPEL release annual reports on water quality, as does the Swiss Hydrological Service for the River Rhône flowing in Lake Geneva. The WFD requests the active involvement of all interested parties in the implementation of the Directive (Art. 14, paragraph 1). Only the example of Loch Lomond could be documented to illustrate the relationship between decision-making processes and stakeholders' participation.

Trans-boundary issues

The WFD requests that when river basin districts extend beyond the territory of the Community, the Member States should establish appropriate co-ordination with relevant non-Member States (Art. 3, paragraph 5). Both Lakes Geneva and Constance are transboundary lakes with proper cross-border alliances for water management in place. However, these alliances do not manage its catchment. The environmental regulation at Lake Constance is well documented by Blatter from the University of Constance. It is a good example of the social and policy cross-boundary framework in which the WFD will be implemented. Lake Constance is the only region in Europe in which borders of the neighbouring countries were never formally delineated. The history of the environmental regulation, in particular the boating regulation shows that trans-boundary action can not be explained only as the recognition of a problematic situation in which actors respond to self-interest. Instead, the emergence of a symbolisation of water at Lake Constance is the basis for cross-border action. The competition among institutions to capture the framing of issues to establish legitimacy provides a better explanation for cross-border action at Lake Constance.

Two "waves" of institution building in the Euregion Bodensee have taken place at Lake Constance for cross-border water issues. Since the last 30 years, the cross-border boat regulation has taken a very prominent position in the political agenda of Lake Constance actors. The first wave of institution building took place in the 1960s when ecological problems were firstly associated with boat use and with eutrophication. This also coincided with the institutionalisation and increased professionalism of the emerging environmental organisations. Three main types of cross-border alliances were identified: trans-governmental commissions, trans-national coalitions and regional associations.

The second wave was triggered by the Council of Europe through events such as the European Year of Nature Protection and the First European Conference of Ministers of Spatial Planning. The 1970s saw the unification of green and citizen NGO's. The battle for political institutional ownership round the topic of boat regulation started at Lake Constance. One consequence of this was the creation of the Euregio Bodensee, a cross-border planning group formed by municipal politicians. This battle culminated in 1992 when the IGKB issued a report on the limnological impact of boating on Lake Constance. The attention was shifted from structural damages to the chemical pollution affecting common waters. Through the establishment of the European Single Market and assistance program for border regions like INTERREC in 1990, the European

Community renewed competition by Lake Constance cross-border institutions. Hence, the theme of cross-border co-operation offers great political reward by which institutions compete by installing their own legitimisation. The construction and the need to build shared identities often form the impetus for cross-boundary water issues.

The third wave may well be the implementation of the WFD, that is managing the lakes according to their basins. This however, should not be problematic since the cross-border alliances are already in place and some of them have recently initiated discussions on this topic.

Economic aspects

At all EUROLAKES site, there is full cost-recovery for both water supply and water management agencies from end users. The full social cost pricing system as proposed in the WFD has yet to be applied. Lakes Constance and Geneva water suppliers are public-private consortia. Full cost recovery is applied through taxation for water quality monitoring and discharge licensing. The concept of social cost includes a water quality aspect. The economic value of water uses within the EU should be carried out by 2004. Environmental taxes are still rare in Europe and water taxing will be a challenging task for most Member States. It is clear that this aspect needs a lot more information and thinking in order to grasp what would be the impact of water pricing for deep European lakes.

Indicators about water and lakes as considered in the Water Framework Directive

The WFD requires Member States to employ ecologically-based classification systems for surface waters. Biological monitoring to assess system biointegrity has therefore gained in importance as compared to the previous "old" European water directives now integrated into the WFD. Three types of monitoring fall within the WFD proposed system: surveillance, operational and investigative monitoring. Current monitoring operations at the EUROLAKES sites are best described as intense operational monitoring. An element missing from the WFD is the monitoring of zooplankton in large deep lakes. In the EUROLAKES project, the use of the indicators has been extensively reviewed. New criteria have been drawn up to identify indicators most useful to managers (D1, D2, D16). However, it is not always possible to identify from the effect on the indicator which pressure is responsible for detrimental impact. Other more discriminative indicators are necessary. Assessing the relative importance of point to non-point sources of agricultural pollution could be used in eutrophication models of nutrient run off. The DPSIR model developed by the EEA is also a potential tool to be used.

From the assessment of Water Framework Directive implementation in EUROLAKES sites to guidelines for management of deep European lakes

In the original brief for this work package, comment on the implications of deep lake phenomena for management, policy and legislation was requested. From the survey of the characteristics of the sites carried out here, it is clear that phenomena extend beyond the scientific realm to the political.

There are the purely physical phenomenon, for example deep water renewal of the lakes, an aspect of their physics which underlines the link between catchment and lake function, indirectly emphasising the importance of catchment management. The problems associated with nutrient loading from human activities in the catchment puts even

more weight on the importance of catchment management and suggests that there are broader policy issues to be addressed, especially those relating to agricultural practice as sanctioned by EU legislation.

There is the rare phenomena of well-monitored and studied sites, which all the lakes included here are. The insights gained in to the functioning of these sites help us identify possible limitations in the WFD methodology. Sensitivity is the main attribute of the elements chosen for monitoring in the WFD. They will be sensitive to drivers not included in the WFD such as invasion by non-native species and climate change. Questions must also be raised regarding the exclusion of zooplankton from the WFD monitoring scheme given their importance in determining the start of the clear water phase. It is clear from all the sites that the connections between catchment planning and the ecologically expert organisations are weak. Large lakes have large catchments, which in Europe often equates to trans-boundary issues, increasing the complexity of catchment management. As exemplified by the Lake Constance model, it appears people feel responsible for their lakes and are willing to compete to show the level of their affection, even on a national level. The task for managers will be to induce that feeling of responsibility catchment wide.

8 ANNEXES: QUESTIONNAIRE

"Driving Forces influencing the implementation of EU water policy?"

LAKE GENEVA

Tel conversation with AK and U. Lemmin (06/09102, comments of 09/09/02 and 16/09/02 included). Final version established 20/09/02.

Have measures been undertaken to mitigate the effects of floods and droughts?
How have the effects of floods and droughts have been changed. Can changes be related to measures aiming at the mitigation of effects?

Damage by Flooding: fairly regularly; two centennial floods during the last 10 years

The potential impact of global warming may have been documented for the lake and its catchment. This is not explicitly a concern right now but the planned river channel modification (below) works in the same direction.

Mitigating measures: correction of the Rhône river to be executed over the next 30 years

This goes with the river renaturalisation programmes. The philosophy up to now was to move the water as quickly down the river as possible. This means straight channels with high lateral dams. In the new concept the river channel should be widened letting the river find its course in there. New flood plains and retention areas are foreseen which should help to locally absorb as much water as possible to reduce flood effects rather than sending it downriver.

Has a "good water status" been achieved?

Do measures for pollution control, remediation of morphology and dynamics show effects (agricultural, domestic and industrial sources)?

Answers to these questions may be found in reports from D5 (WP30) and D12 (WP14), D2 (WP23)

In order to answer the question of good water status, it is useful to identify the water users and their past and current impact on the lake. It is important to keep in mind that this lake has got a transboundary watershed being shared by two countries (France and Switzerland) which also influences its management design.

The environment is no longer a top priority in Switzerland: It is important to note the somewhat different trend in environmental awareness occurring in Switzerland as compared to European countries. If the environment was a priority issue 10 or 20 years ago, making Switzerland one of the pioneers in that area which have led to significant improvements in environmental issues (example: sewage treatment efficiency and connection to treatment plants in the Swiss part of the lake/catchment area is well ahead of France). Now other social and economic issues, such as unemployment or health have become the priorities, down grading environmental matters. This is related to the actual socio-economic situation of a country that did not use to have problems of unemploy-

ment, immigration or economic failures, while European countries have been facing socio-economic issues since 20 years. Also, recent political and financial scandals have eroded the almost blind trust that the Swiss citizens had for their administration. A number of NGO's with environmental concerns have always been active to complement the tasks that the authorities should be doing, like regular public environmental information on the status of the lake. Therefore, it is foreseen that large-scale actions to protect the lake and its catchment for environmental purposes will not occur in the near future. It can be said that environmental matters in Switzerland have moved out from the public interest while organisation such a CIPEL are still very active in environmental restoration of rivers and the lake. In any case, the momentum gained in the past is still moving matters at a good speed.

The lake shifted from an oligotrophic status before 1950 to a meso-eutrophic status until the 80ies with a ban on phosphorus detergent and the installation of tertiary treatment plants.

Most of the phosphorus load to the lake comes from the Rhône. Between 1970 and 1980, the lake went through a eutrophic phase. However, the combined effect of the installation of tertiary wastewater treatment plants from 1972 and the ban on phosphates in detergents from 1986 further improved the water quality and phosphorus concentrations significantly decreased from 89 mg/m³ in 1979 to 41 mg/m³ in 1995. However, the rate of water quality improvement has fallen in recent years due to the difficulties in reducing the phosphorus load through the control of diffuse sources.

Biological water quality: The need to further reduce phosphorus load in the lake was indicated by strong development of filamentous algae in late summer. The phytoplankton has shown little clear response to the decrease in phosphorus load to the lake. However, in contrast to phytoplankton, the zoobenthos has responded rapidly to the decrease in phosphorus load. For instance, the mean relative abundance of oligotrophic indicator species in the oligochaete communities has increased from 17% in 1989 to 41% in 1991. The fish of the lake have long records of human exploitation. However, it is interesting to note that the regulations applied to fish stock have notably differed between France and Switzerland. Excessively small size limits and abusive use of nets have repeatedly lead to reductions of the most valued species. For instance, the French catch data over 70 years shows that the fluctuations are due to the combined effect of both overexploitation and eutrophication. Local eating habits markedly differ between French who prefer the coregonines and burbot while the Swiss prefer perch leading to a differential exploitation pattern. Highest fish catch 88% is in Switzerland while the remaining 12% lies in France.

Shoreline: as for the shores, a decline in areas of reed-beds has been recorded in the lake. In 1942, the lacustrine reed belt covered 17 ha (roughly 5km of shoreline, Gangettes region of the lake). From 1942 to 1972, a zone of reeds 50 m wide retreated in some parts of the shoreline. This resulted in modification of the shore topography. Various causes are invoked to explain this retreat of the reed-bed such as the driftwood from the river Rhône, the increased gravel extraction in the lower littoral zone, the reduced bedload transport from the river Rhône reducing compensation for bank erosion, eutrophication and the increased trampling and boat traffic from recreational use. A number of remedial measures were taken (report D5, page 62).

Population density and settlements around the lake: The Alpine areas are the most sparsely populated parts of the catchment, while the river valleys and lake surroundings are densely populated. The catchment has a resident population of 904,550 people and a tourist capacity of a further 627,880.

Industrial development and hydroelectric power plants in the catchment are mainly local industries including chemical, cement and engineering works, iron smelting and watch making. Most industrial activities are located in the catchment and may be withdrawing water from the lake and discharging and emitting substances to the lake, however, no information is available at this stage. However, most industrial activities are hooked up to the public network or have their own waste water treatment system.

Drinking water withdrawal: (D12 p54) Lake Geneva is one the largest fresh water reservoirs of Western Europe. It supplies more than half a million people with drinking water. The recent algae proliferation may cause problems to assure drinking water quality (to supply 0.5M, about 529.000 M3/day or 360 m3/sec, that is roughly the same amount of water withdrew from the lake is pumped out from rivers for domestic use). In 1999, 221 sewage treatment stations were in operation round the lake and its catchment area. However, it is important to note that the citizens tend to prefer the water withdrawn from the aquifer (this is also true for lake Constance where the villages situated nearby the lake prefer to pump water from the groundwater rather than withdraw it from the lake). Also, there is no public information concerning the private waste water plants and their efficiency index most of them are located in the catchment area.

Conclusions: The main threat to the ecological status of the lake is perceived to be the eutrophication caused by an excess of phosphorus entering the lake from its catchment. Other factors, such as overfishing is also of concern. Managing these problems is further complicated by the nature of the transboundary catchment shared by two countries with different legal and cultural background. France as a EU Member State falls under the European legislation, not Switzerland. Up to now, an indication of the lake water quality was mostly based on the phosphorus content. Using the concepts derived from classical limnological sciences, the phosphorus load ranges from eutrophic (poor water quality) to oligotrophic (good water quality). Recently, however, there has been a shift from classical indicators such as phosphorus load to the study of the effects of contaminants such as endocrine disrupters, heavy metals and their still largely unknown impact of the ecology and biocenosis of the lake. Managing the lake and its catchment is therefore not only related to water management but closely associated to the socio-economic dimension which directly impact on them (e.g., land use, infrastructure and industrial development).

A further decrease in phosphorus load is still the main concern. However, it is realized that the measures taken up to now (improvements in sewage treatment) may not be sufficient to bring the phosphorous further down.

Good status (see above)

NO₃: In the CIPEL annual report, it can be found for instance that winter concentration is. 550 µgN/l. During summer stratification it varies with depth because it is temperature dependant.

Vulnerable zones: there are only very few public zones and amongst them those being conserved for ecological purposes. The shoreline is developed at 93%, most of being private lands.

Artificial or heavily modified water body: the lake does not have the characteristics of a heavily modified water body

Monitoring

The CIPEL is a joint French Swiss commission (International Commission for the Protection of the waters of Lake Léman, 1963) and has been responsible for monitoring the water quality of the lake since 1957 and more recently of its catchment. Its primary objective since its creation has been to reduce the phosphorus concentration in the lake. It has no executive power and its role does include now to produce recommendations for water and catchment management. A second commission is responsible for fisheries issues. However, local governments are responsible for the management of the lake. CIPEL does not carry monitoring itself, it sub-contracts to various laboratories around the lake taking physical, chemical and biological water quality measurements.

Basically, the monitoring programmes are lead by CIPEL (3 main programmes, biological, chemical and some basic physical parameters for lake sites and littoral sites), State Authorities (but their work is not highly co-ordinated, river sites) and the Swiss Hydrological Service (lake level, river gauging stations).

The first systematic research on the lake was carried out at the end of the 19th century (Forel, 1892) who investigated the lake system dynamics. Nowadays, the research is carried out by mainly three institutions: 1) the Hydrobiological Research Centre, Thonon and University of Savoie (biology, chemistry, ichthyology), 2) the University of Geneva and the Forel Research Centre (geology, sedimentology, biology and chemistry) and the University of Lausanne and Ecole Polytechnique Fédérale de Lausanne (biology, toxicology, ichthyology, sedimentology, geophysical and physical sciences).

Designation of vulnerable zones there are only very few public zones and amongst them those being conserved for ecological purposes. The shoreline is developed at 93%, most of it being private lands.

Codes of good practice: there are some recommendations produced by CIPEL for agricultural practices protecting the quality of waters (all superficial waters, lake and rivers). Some recommendations are related to the use of lands (e.g., leaving some non productive zones). It is important to note that in Switzerland, the so-called organic agriculture (agriculture biologique) is increasing, a sign that there is now a good economic niche, a market for it. Therefore, some farmers are encouraged to produce according to the environmental recommendations, allowing their goods to be sold at higher prices than the non-organically grown goods. Some external factors, such as the BSE crisis or other recent food-related crises have lead to the clear decrease in meat production, hence the decrease in corn production (the basis for meat production). This is having a positive environmental impact as less agricultural lands are producing corn, which is related to heavy use of pesticides and fertilisers (U.Lemmin pers. comm.).

Action programmes

Management plan (D13, p51): For the lake and its catchment area it consists of a list of objectives and actions for the long-term management. CIPEL and all its partners collaborate to elaborate, promote and execute the proposed actions. Public hearings and regular meetings are also organised.

Plan of action: It is defined through CIPEL and its partners. It includes action at the source (information to producers), urban drainage, agriculture (diffuse pollution sources, education and information campaigns), actions to rivers (renaturalise the streams, canton of Geneva, Vaud and Vallis), public awareness campaigns (e.g., for bathing season, citizens groups are heavily implied in rivers restoration for instance).

Reports (see 10). The data is not public (D2 p14) and no systematic reporting is carried out. However, occasionally the evaluation of a river system is reported in a CIPEL annual report. The Swiss Hydrological Service publishes a yearbook with tables and statistics regarding water quality of the river Rhône.

Treatment of domestic waste water (see above)

Designation of sensitive areas: 93% of the lake shoreline is developed, therefore there are very few protected areas and a tendency to protect the remaining sites available.

Emission reduction of hazardous substances: no information (see above)

Is water used in an efficient way?

Are efficiency and re-use measures applied? Are requirements such as water-saving, low energy consumption, environmentally friendly considered?

General tendency >>>yes; water/energy distributors and NGO's run campaigns to alert the public/schools to potentials

Efficiency and re-use measures

Application of water-saving techniques, even if the water quantity is not a problem in lake Léman, water/energy distributors and NGO's run campaigns to alert the public/schools to potentials

Efficiency of water use

Impact of water abstraction (see 16)

Is cost recovery for water services assured?

Are all service costs covered by the end-user? Do they consider resource- and environmental costs? Has economic analysis been done?

The water companies are semi-public consortium which include the representatives from the communes. No private partner is allowed to be part of the consortium. However, the price of a M3 of drinking water will vary according to its treatment level, its transport cost (geographic location), the water quantity and the network losses. As mentioned earlier, consumers choice goes to using water pumped from groundwater table. The water bill does not include environmental cost, however, it does include an indication of the contribution to sewage treatment with the goal to make sewage treatment self-paying.

Resource costs
Revenues
Environmental costs
Polluter-Pays Principle
Resource-User-Pays Principle
Sustainability
There are no big conflicts between France and Switzerland around the water of the lake and its uses (e.g., fisheries, water quality, water withdrawal). This is due to the composition and consultative role of the CIPEL. All decisions regarding the surface waters from the watershed are discussed and debated before they are recommended to the federal/central authorities. Actually, representative from both countries from various state authorities are part of the consultative process of CIPEL. In terms of institutional description, this decision-making process would be a bottom-up approach.
Are decision-making processes based on dialogue and consensus? Do conflicting users communicate with each other? Do administrations moderate the process? <i>Not clear from the info in other WP, please explain</i>
Is decision-making calculable, reliable and has continuity? Do decisions give enough information to the actors? Are decisions transparent and allow long time planning for investments, use of resources etc.?
Is the decision making process participative and transparent? Is all information accessible to stakeholders? Do they have the possibility to present their concerns? Are concerns considered in decision making?
Is the policy actively responding to legal requirements? Are actions taken to implement and fulfil EU legislation?
Is decision making based on management and knowledge? Is decision making based on existing data or does it require information gathering? Is the policy implementation actively managed?
Are all relevant actors involved in decision making process? Are stakeholders represented in the decision making process? Do actors show own activities in supporting the policy implementation?
Does a tight network exist between regulators and regulated? Do regular consultation meetings, workshops, etc. between administration and actors' organisations take place? Is the setting up of actors' networks facilitated?
Is motivation promoted through the inclusion of stakeholders? Is co-operation fruitful and not seen as a burden? Are contacts between administration and actors regular, positive and 'easy'?
Is horizontal and vertical policy integration favoured and does an exchange between various regulatory authorities exist? Are regular exchanges taking place outside direct concern of water policy and are different levels of policy making interacting?

LAKE CONSTANCE

Tel conversations (30/08/02 and 02/09/02) with Hans Güde and Bernd Wahl, final version of 05/09/02

I. Have measures been undertaken to mitigate the effects of floods and droughts?

How have the effects of floods and droughts have been changed? Can changes be related to measures aiming at the mitigation of effects?

1. Damage by Flooding /droughts

The example of the "Alpine Rhine" is quite illustrative of the severe floods occurring in past centuries. As a result, the Alpine Rhine was canalised at 1900 over a distance of about 100 km--This measure was successful with respect to flood prevention but (in combination with the reservoir construction for electrical power) it led to modification of the seasonal hydrological regime (mainly dampening the maximal water levels but extending the period of average water levels), while the annual pattern remained mostly unchanged (except of some recent hints presumably caused by climate changes. (more information available in D5, Chapter 5.3), p75).
What about global climatic change?

2. Mitigating measures

The Alpine Rhine has been channelled. In addition the inflow of the Alpine Rhine has been relocated to increase the flow velocity by means of a shortcut. Also other rivers have been channelled.

II. Has a "good water status" been achieved?

Do measures for pollution control, remediation of morphology and dynamics show effects (agricultural, domestic and industrial sources)?

Information from D5 (WP30) and D12 (WP14), D2 (WP23)

To answer the question of good water status leads to identify the various uses of the water from the lake. It is also important to keep in mind that Lake Constance has got a transboundary watershed being shared by five countries (Germany, Austria, Switzerland, Lichtenstein and Italy). The lake is a tri-national water body. Various national institutions (governmental, federal and regional) are in charge for the water management. The main uses for water intake from the lake are for *drinking water* and to a lesser extent for industrial cooling purposes and agriculture. The annual mean water intake for drinking water is roughly 0,139 km³/year (see D5 chapter 5.3, and distributed to 3.7 M consumers by BWV which is allowed to extract about 2% of the water balance of Upper Lake Constance, D2 p75), while the annual mean intake for cooling purposes is *about?*

Agriculture and eutrophication: Antibiotics are found in very small quantity in the lake. Their impact on the ecology of the lake and its fauna: There is intensive agriculture being practised in the vicinity of the lake, however, there is little and mainly extensive agriculture in the higher Alpine region. As almost 50 % of the watershed is above 1800 m altitude, a significant part of the watershed includes lands improper to agriculture. Half of the catchment land use is represented by agriculture (pasture, cattle, orchards, vineyards, hops, cereals), the remaining being woodlands, urban or unused (mountainous regions, D5 table 5.3). Vineyards are known to be associated to the use of pesticides.

The area used for agriculture is not meant to increase and has been stable the recent years. However, since the 50ies, there has been a net increase in nitrogen (the nitrate load has been doubled in agriculture during the 50ies). The problem of eutrophication is directly linked to the load of nitrogen and phosphorus and in the beginning of the 50ies, the mean load of phosphorus was 90 mg/l while it is now roughly 10 mg/l (however, still double the historical value of 5 mg/l). In the past, eutrophication was the focus of the ecological concerns about the lake, now since the eutrophication is not a major problem, the debate has recently shifted to the presence of xenobiotics such as endocrine disruptors and other substances (e.g., EDTA still largely unknown. The remarkable reduction of phosphorus and nitrogen in the lake is certainly linked to the presence of sewage treatment plants built as a response to eutrophication. The current reduction in phosphorus concentration in the lake may not be sufficient to avoid oxygen depletion in the lake's deep waters (D5 p84).

Biological water quality: Since 1991, low average values in annual algal biovolum have been recorded (D p86). Since 1986, the composition of the algal community reflect the oligotrophic condition of the lake. Since the mid-1980s also the original macrophyte community has returned to colonise the littoral zones of the lake, contrary to the past situation of eutrophication.

Fishery: Commercial fishery has a long history on the lake. Whitefish and perch are still fished commercially. Although fish catches show great annual variability, they have generally increased since 1995 (D5 p 92). The littoral zone of the lake provides a vital spawning habitat for fish.

Population: The vicinity of the lake is densely populated with > 250 persons/km² (D5 table 5.3) with higher concentration zones located in Bregenz, Friedrichshafen / Ravensburg, Constance. The population density notably decreases in the alpine and northeast pre-alpine areas of the watershed. It is interesting to note that total population more than doubled in one century (from 0.5 M in 1900 to 1.2 M in 2000). The tourist capacity has been estimated to 8M.

Industrial use of water: in the recent past, the pulp and paper industry was still operational and used water for their activities, leading to water contamination. Since the late 70ies, this industry has mostly concentrated in the Scandinavian states (Finland and Sweden) and has severely been reduced in other European regions, including Germany. The remaining industrial activity, e.g. textile (Austria) and engine and plane do not have a significant impact on the quality and quantity of water of the lake.

Physical modifications of the shore lake due to the development of private settlements (e.g., modification of biocenosis). The development of the touristic sector peaked after the German reunion in the 80ies and is still increasing. For instance, on the Swiss side of the lake, the plans for a large-scale marina has brought some controversy as its construction may impact the shore lakes. The marina itself would have the capacity of several thousands visitors. As a result of these touristic infrastructures, the population density is seasonally increasing. The type of population (e.g., retired and young wealthy professionals) increases the demand for leisure activities based on the lake, contribut-

ing to an even greater population pressure.

1. Good status

As for nutrients in the tributaries and the lake a rather good status has been achieved by means of building sewage plants.

2. NO₃

The concentration of nitrate doubled in Lake Constance between 1961 and 1987 and remained approximately constant since then at about 1 mg/l. Sources of nitrate have been identified as sewage effluent, agriculture runoff and atmospheric long-distance of inorganic N (D5, p 81). The distribution and development of nitrogen shows a different pattern to that observed of phosphorus. Most of the nitrogen source comes from diffuse sources (nitrates from agricultural areas, like in the Alpine Rhine catchment intensively cultivated). Sewage treatment has had little effect on nitrogen loading, unlike the successful reduction in phosphorus loading. Nitrogen elimination through sewage treatment is an expensive solution, though it is considered and in any case would only achieve a 10% reduction in nitrogen load (D5 p82).

3. Pesticides

Many pesticides and/or their metabolites can be found in the lake water. However, the existing thresholds are not exceeded. The pathway for the pesticides is mainly through air (aerosol after rains) and as point sources (along with fertilisers) when the farmers wash their tanks off pesticides. Their level has now fallen under level of detection possibly due to a German ban on the application of atrazine and its metabolites.

PCBs although not detected in the lake are everywhere in the environment and are likely to be present in the lake.

4. Artificial or heavily modified water body

As well many tributaries, the inflow of the Alpine Rhine and much of the shoreline have been artificially modified, but probably not in the sense of a heavily modified water body. One of the concerns related to the ecology of the lake is the development of private settlements on the shores. There is an accumulation of sediments in some places, while at some other, there is a loss of sediments due to increased erosion. Due to these disturbances, these settlements also indirectly affect the biocenosis.

5. Monitoring

In the 60s, IGKB was founded by neighbouring countries as a result of the alarming eutrophic status of the lake. Its task is to launch studies on the improvement of the lake' status and watershed. Monitoring programs exist for many parameters (D02). Although the IGKB does not substitute any national programme, it co-ordinated a series of studies on the lake eutrophication the last four decades. The IGKB has regular monitoring programs (mentioned in the D02 report) and sometimes special campaigns. Among others the Institute for Lake Research (ISF) is responsible for the monitoring. The main organisations monitoring the water quality of the lake are 1) IGKB (routing monitoring programmes), 2) University of Constance (cycling of matter and food web interactions), and 3) BWV (largest water supplier, microbial contamination and pollutants)

It is important to note that all German rivers are subject to an automatic sampling system. In Switzerland and Austria, similar systems exist (D2, p 48).

Monitoring of potential user conflicts is not subject to quantified sampling. Since the lake is one Germany's most visited recreation areas during the summer, potential conflicts between the tourist and other sectors may arise. Shore and reed-beds destruction and erosion phenomena are typical indicators of the recreational pressure. Some statistics exist between boat leisure, tourism, fish management and population growth.

6. Designation of vulnerable zones

Several concepts for the protection of vulnerable zones exist: e.g. nature reserves, water protection areas, landscape protection area. In the WFD, Annex IV *vulnerable zones are designed as "nutrient-sensitive areas, including areas designated as Vulnerable Zones under Directive 91/676/EEC and areas designated as Sensitive Areas under Directive 91/271/EEC"*. In addition, there are plans for the protection of the German shoreline area, the so-called "Bodenseeuferpläne". Protection plans for the Swiss and Austrian shoreline parts do exist. Details of these plans can't be assessed here as they are too complex.

The lake is an important site for both plants and birds communities as reflected in the various designations (SCI of Habitat Directive, SPA of Birds Directive, European reserves, National Nature Reserves, D5 p 94).

Codes of good practice

Codes of good practice exist for instance for the agriculture sector (e.g. use of pesticides, fertilizers). A guideline of the IGKB (International Commission for the Water Protection of Lake Constance) called "Richtlinie für die Reinhaltung des Bodensees (vom 27.Mai 1987)" also serves as code of good practise dealing with various aspects of water protection. Some compensation funds exist like in Baden-Württemberg to promote the reduction in use of nitrates by farmers. This is however not the common line of all regional authorities around the lake.

Action programmes

Numerous action programmes exist. Many of them are described and bundled in the so-called "Umweltprogramm Bodensee Raum (UBR)" (see: <http://www.rp.baden-wuerttemberg.de/tuebingen/abteilung5/projekte/ubr/ubr.htm>), which is a program for the integrated protection of the region of Lake Constance.

<p>Reports</p> <p>Among many other documentations and reports e.g. annual reports as for the status of Lake Constance do exist. Although a lot of data exist, the information content is sometimes poor or scattered.</p>
<p>Treatment of domestic waste water</p> <p>Most of the domestic waste water is treated in sewage plants</p>
<p>Designation of sensitive areas</p> <p>(see 0. 6. Designation of vulnerable zones)</p>
<p>Emission reduction of hazardous substances</p> <p>Emission reduction measures exist e.g. as for industrial emissions or motor boat emissions (two strokes engine are now forbidden, only allowing for 4 strokes engine).</p>
<p><i>Is water used in an efficient way?</i></p> <p>Are efficiency and re-use measures applied? Are requirements such as water-saving, low energy consumption, environmentally friendly considered?</p> <p>These issues are dealt at the national level and not so much at the regional level. The general willingness to save water and energy exist in theory but less in practice.</p>
<p>Efficiency and re-use measures</p> <p>(no information)</p>
<p>Application of water-saving techniques</p> <p>(no information)</p>
<p>Efficiency of water use</p> <p>(no information)</p>
<p>Impact of water abstraction</p> <p>The abstraction of water amounts to less than 1% of the water input to the lake by tributaries and precipitation. Negative impacts from this have not been reported yet.</p>
<p><i>Is cost recovery for water services assured?</i></p> <p>Are all service costs covered by the end-user? Do they consider resource- and environmental costs? Has economic analysis been done?</p> <p>In Germany, the water company is a semi-private body. The rights are under the authority of a public consortium. However, some recent moves in the company indicate that it could become completely private. The water withdrawn from the lake is transported about 300 km (map) to the North to supply mainly the densely populated Stuttgart region which due to hydrogeological characteristics is a water-poor region.</p>



Source: <http://www.zvbvw.de/>

The riverine population uses mainly water from groundwater supply and not from the lake. The total population in the watershed is about 1.2 M in 2000 while it amounts to 5 millions. Therefore, the population that uses water from Lake Constance is mainly outside the watershed. Both on the Austrian and Swiss sides, the communities withdraw water from groundwater and to a smaller extent from the lake. This may be linked to the willingness to be independent from the lake as a reservoir and to the water quality parameters of groundwater believed to be better than surface water.

The price domestic users are paying is mainly for infrastructure maintenance and does not include substantial environmental cost. The polluter-pays principle does exist in theory but in practice, it is difficult to implement. It would be interesting to see how and if the new European Directive on environmental liability coupled with the WFD could impact the management of water lake when accidental pollution event has occurred and there is no clear responsibility.

Cost recovery (no information)
Resource costs (no information)
Revenues (no information)
Environmental costs (no information)
Polluter-Pays Principle (no information)
Resource-User-Pays Principle (no information)
Sustainability (no information)

Are decision-making processes based on dialogue and consensus?

Do conflicting users communicate with each other? Do administrations moderate the process?

The role of the IGKB in co-ordinating the efforts of lake Constance management by the three countries is increasing. In the last decade, it has shifted from a purely water management institution to a more policy oriented institution. In terms of conflicts, since there is no problem over the water quantity, however, the issues tend to concentrate in three areas: 1) the development of the shores by private settlements and public pressure (e.g. leisure activities etc.), 2) the fishery sector and 3.) the preservation of the water quality. The fishermen are arguing that fish are starving due to a decrease in phosphorus load, leading to an oligotrophic situation.

There is a lot of pressure coming from the development from small private settlements. However, this is unaccounted for in the general management of the watershed and its impact is unknown. Only large developments such as "Marina Congress Center" project are mentioned to the public and give rise to controversy.

In general, there is no roundtable gathering all stakeholders, but the compromise seems to be more informally lead amongst certain stakeholders in isolation from the others. The involvement of the users is poor as there is no scheme to involve them at the decision-making process. The regional authorities have got the obligation to settle disputes between conflictive sectors, but this does not involve a participatory scheme at the sense of the WFD. Reference to a recent Master thesis (Wageningen) on the role of participation within the watershed of lake Constance. Abstract:

The Impact of Phosphorus Management on the Artisan Fishery of Lake Constance

- Study on the impact of the water quality management regarding Phosphorus on the artisan fishery in the German part of Lake Constance and the negotiation position of this interest group.-

by Adriana Begeer

This research seeks to answer the question what the effect of eutrophication and sub-sequent re-oligotrophication of Lake Constance has been on the fishery yields in the lake and whether and how fishermen have sought to defend their interests in this change process. What makes this theme interesting is that around Lake Constance there are many different interest groups, with specific priorities (e.g Lake Constance is a source of drinking water for over 4.5 million people). To answer the question literature research has been done and interviews have been taken from several representatives of the fishery organisations and fishermen. The researcher has further tried to support the available data through personal observation. The general conclusion of this research has been that the fishermen have not been able to effectively steer the decision-making process (especially on water quality management) so to secure their interests. Reasons for this may be:

- An analysis of some water quality parameters in the lake (Phosphorus levels, Phytoplankton, Zooplankton and Fishery yields) has shown that the

used form of data visualisation does not provide enough information based on which causal relations between P levels and fishery yields (especially of Whitefish and Perch the economically most important fish in the area) can be established, (whitefish yields seem to stabilise at relatively high levels);

- The main decision-making party with regards to phosphorus management (IGKB) has been successful in excluding itself from pressure from economical interest groups;
- The function of Lake Constance as a source of drinking water. In order to secure this function the need for good water quality seems indisputable;
- The professional fishermen in Lake Constance form a relatively small group (140 people) without support from scientists, and whose interests seem less important than interests such as drinking water and tourism.

This research is valuable as it is an example of the position of small interest groups in relation to strong interests and as it shows that sustainability goals can comprise political interests as well. It remains however a site-specific study and therefore the conclusions cannot be extrapolated to other scenarios without further consideration.

It is interesting to note that the waters from the lake are not under the same international jurisdiction. As European Member States, Austria and Germany are to implement the WFD, that is European law, while Switzerland is outside of these requirements. Recently, a committee was set up at the IGKB to make sure that the hitherto existing instruments for a coherent watershed management amongst the three countries at the legal level can be warranted also in future under the new conditions given by WFD legislations.

The land ownership patterns are also worth mentioning as they directly affect the management of the shores, often under a private regime. There is a debate between the public, semi-public or private access to the lake and its impact on shore conservation. The integration amongst sectoral policies is still insufficient. Most decisions concerning the lake are taken at the local level. The co-ordination procedures with other sectors or levels are suboptimal.

Is decision-making calculable, reliable and has continuity?

Do decisions give enough information to the actors? Are decisions transparent and allow long time planning for investments, use of resources etc.?

Is the decision making process participative and transparent?

Is all information accessible to stakeholders? Do they have the possibility to present their concerns? Are concerns considered in decision making?

Is the policy actively responding to legal requirements?

Are actions taken to implement and fulfil EU legislation?

Several working groups exist to support the implementation of the Water Framework Directive.

Is decision making based on management and knowledge?

Is decision making based on existing data or does it require information gathering? Is the policy implementation actively managed?

Are all relevant actors involved in decision making process?

Are stakeholders represented in the decision making process? Do actors show own activities in supporting the policy implementation?

Does a tight network exist between regulators and regulated?

Do regular consultation meetings, workshops, etc. between administration and actors' organisations. Is the setting up of actors' networks facilitated?

Is motivation promoted through the inclusion of stakeholders?

Is co-operation fruitful and not seen as a burden? Are contacts between administration and actors regular, positive and 'easy'?

There is no in-depth campaign towards a sustainable management of the lake watershed. However, there is some public outreach about the ecological value of the lake.

Is horizontal and vertical policy integration favoured and does an exchange between various regulatory authorities exist?

Are regular exchanges taking place outside direct concern of water policy and are different levels of policy making interacting?

BOURGET LAKE (Lac du Bourget)

Version of 09/09/02

1 **Have measures been undertaken to mitigate the effects of floods and droughts?**

How have the effects of floods and droughts been changed? Can changes be related to measures aiming at the mitigation of effects?

1. Damage by Flooding /droughts

For flooding : there are some dykes from Chambéry city to the mouth of the Leysse river to prevent from flooding events. At the present time, an artificial channel is studied in order to divert part of the course of the Leysse river from "Le pont du Tremblay" (between Chambéry city and the lake) directly to the lake during flooding events. The Leysse is protected from the floods from the Rhone since there is a dam regulating the inflow from the Rhone to the lake.

For droughts : no

2. Mitigating measures : no

2 **Has a "good water status" been achieved?**

Do measures for pollution control, remediation of morphology and dynamics show effects (agricultural, domestic and industrial sources)?

Information from D5 (WP30) and D12 (WP14), D2 (WP23) compiled by AK

The lake is the largest reservoir of fresh water in France. The main pressures on the water quality from the lake are the pesticides and the cyanobacteria. There is no significant pressure coming from the agriculture, industrial and domestic sectors. The lake is important for supplying drinking water to local municipalities and is regarded as an economic asset by both the Savoie Departement and the Rhône-Alpes Region. Its recreational use is high with a variety of tourist activities.

Industrial use: there is no significant industrial impact on the lake (nor water withdrawal nor industrial emissions to the lake)

Drinking use water abstraction is done in two points: one for the Aix les Bains, one for Tresserve village both are occasionally impaired by the cyanobacteria developments.

Agriculture use one (small) fish farm north the Gresine bay. Use of pesticides (orchards and vineyards).

Fishery: The lake is subject to commercial fishing for perch and roach (about 30 tonnes mean annual catches). An average of 80 tonnes caught every year (*contradiction? D5 p 41*) with an estimated value of 300,000 Euros.

Biological water quality and biological communities: Although the lake is renowned for its fish and wildfowl populations, its biology is poorly known (D5, p39). Observations of microbial and phytoplanktonic communities indicates that the lake is currently of meso-eutrophic status. Some measures have been undertaken to protect reed-beds and to enhance their development (south part of the lake).

Physical characteristics, shore protection objectives are for the time being intentions but are not put in practice as to reverse certain developments of land use to more natural conditions.

Population: The demographic pressure on the lake has grown by 57% over the last 30

years and represents half of the Savoie population. The infrastructures surrounding the lake generate intense traffic (railway, roads and highways, airport). The population of the watershed of the Bourget Lake is roughly 170.000 inhabitants (61 communes).

Conclusions: Pressures on the lake are mainly on its water quality (domestic and industrial effluents), diffuse agricultural pollution, transport related pollution. There is some evidence of eutrophication in the lake. The population growth on the lake' shores has dramatically increased (50% in the catchment over the last 30 years). Threat on reed-beds have been eased and general habitat degradation seems to be currently stabilized. (Of course this opinion is not shared by all users of the lake...)

3. Good status (see below)

4. NO₃ : (this analysis refers to the field measurements 1995-1996). D.Fontvieille has observed that the concentration in NO₃ and PO₄ has markedly decreased from 1996 until now.

The Bourget Lake catchment area is not located in a vulnerable zone (Nitrate directive)

The main catchment areas from the lac are the Leysse and the Sierroz.

Leysse catchment area :

minimum value 0.5 mg/l and maximum value 1.5mg/l, and mean value 1mg/l
the EU threshold is 50 mg/l and the recommended value is below 25mg/l

Best status

Sierroz catchment area :

Mean value : 1.3 mg/l

Best status

Lake :

Mean value : 0.65 mg/l

Best status

5. Pesticides

Apparently the farmers round the lakes have been using pesticides for vineyards and orchards and this use has been decreased the last few years

Lake : Diuron, atrazine, simazine

Among all pesticide found in the lake, Diuron have the highest concentration.

Diuron : 150 ng/l

The threshold is 100 ng/l

Bad status

Catchment area : Diuron, oxadiazon, atrazine, simazine and carbetamine

Diuron, oxadiazon and carbetamine are found in the catchment area with a very high concentration, which can reached 50 times the European threshold. Pesticides concentrations in the lake itself are far below legal threshold (from the seen by DF in 2001, pers.comm.)

5'. Cyanobacteriae. Their toxicity is linked to the presence of toxic substances like microcystin (actually some of them produce microcystin). The level measured in the lake can go up to 20.000 cells/ml (which corresponds to cutaneous and digestive problems for human beings). (more on cyanobacteriae in the intro of the report!). Processus that generate blooms of cyanobacteriae are currently not known precisely. Blooms still occur (or re-occur) in water body where PO₄ concentration has been lowered to the values of the time there was no large development of cyanobacteria.

6. Artificial or heavily modified water body: the lake has not been heavily modified for years (the Quatre Chemins harbour built during the 70's)

7. Monitoring : (definition from the WFD?).

The measurement campaigns exist during the course of the year and are performed once a month. However, fortnight measurements are made for physico-chemico and biological parameters to control the cyanobacteriae blooms (basically from end of summer to December). Actual monitoring involving data analysis and dissemination at a public level do not exist.

All water quality monitoring is co-ordinated by the Cellule Technique of the lake and this since 1981. This involves weekly and monthly monitoring programmes done by the Cellule Technique itself and occasionally involving CARRTEL (University of Savoie and INRA) or other scientific research teams (CEREVE, Paris for example). A LIFE project allowed a study to be done on the restoration of aquatic reed-beds. As lake water and sediment were considered satisfactory, priority was given to study the physical factors (e.g., water level). SOGREAH is also involved on the development of a lake and catchment model with an integrated decision support system tool for choosing management strategies.

Management of the lake occurs at national, regional and local levels. At the national level, there is the Loi sur l'Eau (French water regulation), followed by the regional level with the Water Agency RMC and the SDAGE (Master Plan for Water Development and Management) and finally the local level with the SAGE (Local Plan for Water Development and Management), Grand Lac framework, Contrat plan Etat-Région, Digramme of coherence and EU LIFE programme. A local commission has been set up in which the 61 communes concerned are represented. This commission is charged with management tasks also covering socio-economic and cultural aspects.

8. Designation of vulnerable zones : no vulnerable zone (Nitrate directive)

9. Codes of good practice : There is no code of good practice. The actions are on a case by case basis. For instance, discussions took place during a few years between the farmers cultivating vines and heavily using pesticides and the local authorities (Conservatoire NP). The objective of these discussions was to demonstrate to the farmers that by using pesticides, there was no vegetal cover to retain the soils, therefore losing soils and humic acids down to the lake with heavy rains. Farmers now physically remove the grass within the vineyards and use less pesticides.

10. Action programmes: Not yet. One of the missions of the Grand Lac project is to design an action programme. There is for the moment no concerted catchment management of the Bourget Lake. This may be due to the fact that there is no conflict over the use of its water and that the pollution levels are not outstanding compared to other European lakes. Also, it is not a transboundary lake.

11. Reports : there are some field measurements reports did by CISALB. However, there is no public dissemination

12. Treatment of domestic waste water : There is a waste water treatment plant for the city of Chambéry which releases the waste water through a 12-15km pipeline through the L'Épine mountains to the Rhone. Therefore, in principle the waste water does not reach the lake, but the Rhone. (at the exception of the periods when the STP is overloaded by water because the sewers are partly only separated from the rain collectors.

13. Designation of sensitive areas : mainly urban areas (Chambéry city and Aix les Bains city). The industrial pressure round the lake is low. There are some industries like glass and agro food, but they do not use the water from the lake. One threat is coming from the roads and high traffic along the east coast of the lake.
14. Emission reduction of hazardous nothing special about this: no factory producing hazardous substances
3 Is water used in an efficient way? Are efficiency and re-use measures applied? Are requirements such as water-saving, low energy consumption, environmentally friendly considered? No for the lake itself. In the watershed nearby the lake heat pumps are now forbidden
15. Efficiency and re-use measures
16. Application of water-saving techniques
17. Efficiency of water use
18. Impact of water abstraction. The water abstraction from the lake is minimal and only for drinking water purposes. The intakes takes place in two places of the lake and amount to about 73.000 m ³ /year (Vivendi cie). Otherwise, water is also abstracted from the Chambéry groundwater through 3 pumping wells. These 3 pumping wells induce about 1m groundwater lowering. Before the water abstractions there were several natural springs downstream the Leysse river (from Bissy till the Bourget du Lac), and now most of these springs are dried up (as documented by the studies on the groundwater level).
4 Is cost recovery for water services assured? Are all service costs covered by the end-user? Do they consider resource- and environmental costs? Has economic analysis been done?
19. Cost recovery :
20. Resource costs
21. Revenues
22. Environmental costs
23. Polluter-Pays Principle
24. Resource-User-Pays Principle
25. Sustainability
5 Are decision-making processes based on dialogue and consensus? Do conflicting users communicate with each other? Do administrations moderate the process? There is apparently no conflict between users of the water abstracted or used from the lake. The main sectors using water from the lake are the domestic and leisure sectors. However, the attention has been recently brought on the lake through three new projects, namely Grand Lac, Eurolakes and Sacytox. The Grand Lac project emanates from the DDE and Conseil Général de Savoie, its aimed is to develop economically the lake and its surroundings with tourist infrastructure. The Eurolakes project had been presented to some local stakeholders during its first meeting, it resulted in attracting projects for Sogreah about the lake management. Finally, the aim of the Sacytox project (lead by SOGREAH, CARTEL and CERREVE) is to study and propose remedial measures for the blooms of toxic cyanobacteriae. These projects trigger the debate about modalities of the lake catchment management.
6 Is decision-making calculable, reliable and has continuity?

<p>Do decisions give enough information to the actors? Are decisions transparent and allow long time planning for investments, use of resources etc.?</p> <p>Currently no decisions or advices have been given to the actors. The Grand Lac decision board is still in the phase of collecting data and stimulating the achievement of further information where it is needed</p>
<p>7 Is the decision making process participative and transparent?</p> <p>Is all information accessible to stakeholders? Do they have the possibility to present their concerns? Are concerns considered in decision making?</p> <p>Too early speak about that.</p>
<p>8 Is the policy actively responding to legal requirements?</p> <p>Are actions taken to implement and fulfil EU legislation?</p> <p>Yes, but it is not really the local water authorities responsibility. The French government and the regional water agencies (6 agences de bassin in France which are in charge of the 6 main hydrographical districts, in the present case the waters are managed by the RMC) are in charge of the application of the WFD.</p>
<p>9 Is decision making based on management and knowledge?</p> <p>Is decision making based on existing data or does it require information gathering? Is the policy implementation actively managed?</p> <p>Yes at the national and hydrological districts' levels (See question VIII) Decision-making is structured amongst the following various actors:</p> <ol style="list-style-type: none"> 2. Conseil Régional de Savoie 3. DDE (Direction Départementale de l'Equippement) 4. Agence de bassin RMC (funding and water management agency) 5. CISALB (association of mayors, those who pay for the water) 6. Conservatoire National de Protection de Savoie (in charge of ecological rehabilitation of the lake)
<p>10 Are all relevant actors involved in decision making process?</p> <p>Are stakeholders represented in the decision making process? Do actors show own activities in supporting the policy implementation?</p> <p>Yes (See question V) The new French Water Law envisages to implement such measures by 2015.</p>
<p>11 Does a tight network exist between regulators and regulated?</p> <p>Do regular consultation meetings, workshops, etc. between administration and actors' organisations. Is the setting up of actors' networks facilitated?</p> <p>In the framework of the Grand Lac project there are several meetings. These meetings present the main management strategies of the water both in the lake and in its catchment area and the results of the different studies on the site.</p>
<p>12 Is motivation promoted through the inclusion of stakeholders?</p> <p>Is co-operation fruitful and not seen as a burden? Are contacts between administration and actors regular, positive and 'easy'?</p> <p>Yes (See question V and XI)</p>
<p>Is horizontal and vertical policy integration favoured and does an exchange between various regulatory authorities exist?</p> <p>Are regular exchanges taking place outside direct concern of water policy and are different levels of policy making interacting?</p>

Lake Längelmävesi-Roine

Interview with Matt O'Hare and Victor Podsetchine and Ämer Bilaletdin (PREC).

Pressures on the Finnish lake are relatively weak in comparison with the other Euro-lakes sites making the requirement for intensive management less. Summer use of holiday villages around the lake shore lead to recreational use of the lake, boating, swimming and fishing. The use of composting toilets mitigates against nutrient input from these seasonal dwellings.

Recently control of water supply from the lake has been privatised. By definition there is now full cost recovery of water supply costs through water charges.

The current status of the WFD legislation in Finland is yet to be ascertained, although administrative bodies have been preparing for it. The suitability of applying various 'codes of good practice' are currently being assessed by our Finnish partners.

<p><i>Have measures been undertaken to mitigate the effects of floods and droughts?</i> How have the effects of floods and droughts have been changed. Can changes be related to measures aiming at the mitigation of effects?</p>
<p>Damage by Flooding /droughts: no damage by floods have been recorded during last two hundred years</p>
<p>Mitigating measures:</p>
<p><i>Has a "good water status" been achieved?</i> Do measures for pollution control, remediation of morphology and dynamics show effects (agricultural, domestic and industrial sources)?</p>
<p>Good status: According to monitoring results the status of the lake is mainly good. There is a risk of eutrophication which is caused by phosphorus loading. Cyanobacterial blooms occur now and then. The main loading factor contributing to eutrophication is agriculture. The contributions of domestic and industrial wastewaters are small.</p>
<p>NO₃ : Nitrate is no big problem compared to phosphorus. It is not the most important limiting factor of phytoplankton growth.</p>
<p>Pesticides: No information is available. According to some accidental samples the concentrations are very small. So pesticides are most probably no big problem.</p>
<p>Artificial or heavily modified water body: Not artificial nor heavily modified</p>
<p>Monitoring: There is regular monitoring of the most important chemical variables from 1960s. During the study periods monitoring has been more intensive.</p>
<p>Designation of vulnerable zones: There is no such industry or chemical use in the catchment area of Lake Roine that the designation of vulnerable zones would be needed.</p>
<p>Codes of good practice: According to the Water Framework Directive the codes of good agricultural practice have been designed. Key messages in the codes are connected to level of fertilisation, slurry, solid manure, filter strips, riparian zones etc.</p>
<p>Action programmes: Water protection plan was written in the beginning of the 1990s. A new one is being made.</p>
<p>Reports: Längelmäveden reitin vesiensuojelututkimus (The water protection investigation of the watercourse of Lake Längelmävesi; in Finnish, no English summary) (Bilaletdin, Frisk, Koskinen & Wirola 1992)</p>

Treatment of domestic waste water: Treatment of domestic water is very efficient. In the watershed of Lake Längelmävesi the average reduction values for phosphorus, nitrogen and BOD are 94 %, 40 % and 95 % respectively.
Designation of sensitive areas: The designation of sensitive areas is followed by Urban Waste Water Directive.
Emission reduction of hazardous substances: According to the Finnish legislation
<i>Is water used in an efficient way?</i> Are efficiency and re-use measures applied? Are requirements such as water-saving, low energy consumption, environmentally friendly considered?
Efficiency and re-use measures: City of Tampere takes most of its water from Lake Roine. The waste water does not come back to Lake Roine.
Application of water-saving techniques: Sufficiency of water is no problem.
Efficiency of water use: According of our ideas, water use is efficient. In occasional circumstances it is possible to use another raw water pumping station.
Impact of water abstraction: No harmful impacts have been found
<i>Is cost recovery for water services assured?</i> Are all service costs covered by the end-user? Do they consider resource- and environmental costs? Has economic analysis been done? Water supply is organized by the City of Tampere. Water users must pay full price for the services. Raw water itself is free. The city does not have to pay for it. Wastewaters are discharged to another lake and they must be treated very efficiently. Water users also pay for this. Tampere Water Works (of the city) is carrying out economic analyses.
Cost recovery: Costs are recovered by users
Resource costs: Costs for monitoring, protection, maintenance etc. are not totally considered in the users costs. Finnish water and environmental administration participates in the measures and costs.
Revenues:
Environmental costs: yes
Polluter-Pays Principle: Who pollutes water needs to pay for the costs of treatment
Resource-User-Pays Principle: Inhabitants who use water resource need to pay for it
Sustainability: The activities are regulated by the Finnish water and environmental legislation which is based on the concept of sustainability.
<i>Are decision-making processes based on dialogue and consensus?</i> Do conflicting users communicate with each other? Do administrations moderate the process? According to the water and environmental legislation as well as EIA legislation , different stakeholders can participate in the process, regulated by authorities, mainly regional environmental centres.
<i>Is decision-making calculable, reliable and has continuity?</i> Do decisions give enough information to the actors? Are decisions transparent and allow long time planning for investments, use of resources etc.? From our point of view yes, but it has not been studied, if the different stakeholders agree.
<i>Is the decision making process participative and transparent?</i> Is all information accessible to stakeholders? Do they have the possibility to present their concerns? Are concerns considered in decision making? The same as in VI.
<i>Is the policy actively responding to legal requirements?</i>

Are actions taken to implement and fulfil EU legislation? Yes, they have mainly been adopted and partly they are being prepared.

Is decision making based on management and knowledge?

Is decision making based on existing data or does it require information gathering? Is the policy implementation actively managed? Yes to both questions. The Lake Roine has been monitored during many decades and the knowledge of the state of the lake is reliable. The policy implementation is carried out (managed?) by the communication of different stakeholders.

Are all relevant actors involved in decision making process?

Are stakeholders represented in the decision making process? Do actors show own activities in supporting the policy implementation? Yes.

Does a tight network exist between regulators and regulated?

Do regular consultation meetings, workshops, etc. between administration and actors' organisations. Is the setting up of actors' networks facilitated? Co-operation might be better organized.

Is motivation promoted through the inclusion of stakeholders?

Is co-operation fruitful and not seen as a burden? Are contacts between administration and actors regular, positive and 'easy'? The same as in XI.

Is horizontal and vertical policy integration favoured and does an exchange between various regulatory authorities exist?

Are regular exchanges taking place outside direct concern of water policy and are different levels of policy making interacting? Yes.

LOCH LOMOND

Information supplied by Dr Gordon Dickinson.

There is significant pressure on the waters Loch Lomond mainly from agriculture and forestry in the loch catchment, but also to an increasing extent, from recreational activities on and around the loch. There is concern about the increasing numbers of power craft using the loch, especially jetskis with 2 stroke engines which are responsible for considerable inputs of hydro-carbons into the loch. Impacts due to water abstraction and inflows from hydro power generation are negligible. Unlike the rest of the UK, water supply from the loch remains under public control, as is the situation throughout Scotland. Scottish Water is the supply agency for all categories of water use, other than the very small proportion of water used in Scotland which comes from privately owned sources, and which is used by the owners.. This is unlikely to change at least in the short term. There is the intention of full recovery of water supply costs through water charges in the near future. Water charges have risen sharply in the past decade. The current status of the WFD legislation in Scotland is that it is being adopted currently into Scottish law by the Scottish Executive. It is envisaged that this legislation will be in place in the first half of 2003

<p><i>Have measures been undertaken to mitigate the effects of floods and droughts?</i> How have the effects of floods and droughts have been changed. Can changes be related to measures aiming at the mitigation of effects?</p>
<p>Damage by Flooding /droughts: there has been significant damage due to floods in the past 3 decades, particularly in 1990. Frequency and severity of flooding has increased during this time.</p>
<p>Mitigating measures: none</p>
<p><i>Has a "good water status" been achieved?</i> Do measures for pollution control, remediation of morphology and dynamics show effects (agricultural, domestic and industrial sources)? Yes; there has been improvement in some water status measures</p>
<p>Good status: According to monitoring results the status of Loch Lomond is good. However monitoring does not have an extensive spatial coverage in the loch. There has been a declining risk of eutrophication caused by phosphorus loading. Improved sewage treatment in the catchment has been undertaken.. The main loading factor contributing to eutrophication is agriculture. The contribution of domestic waste waters is small. and that of industrial are non-existent</p>
<p>NO₃ : Nitrate is probably the main problem now and in the future, though it is not yet very serious. Decline in agricultural activity around the loch may reduce this impact.</p>
<p>Pesticides: No information is available. There is some concern about pesticide use (mainly in the form of sheep dip)..</p>
<p>Artificial or heavily modified water body: Neither artificial nor heavily modified</p>
<p>Monitoring: There is regular monitoring of the most important chemical variables from 1960s. Since 1980 monitoring has been more intensive.</p>
<p>Designation of vulnerable zones: There is no such industry or chemical use in the catchment area of Loch Lomond such that designation of vulnerable zones would be needed.</p>

Codes of good practice: Policies incorporating codes of good practice are being developed to meet the requirements of the Water Framework (Loch Lomond Catchment Management Plan).
Action programmes: These will follow the completion of the Loch Lomond Catchment Management Plan
Reports: Loch Lomond Issues Report (undated – appeared 2001) East of Scotland Water, West of Scotland Water (now Scottish Water), Scottish Natural Heritage, Scottish Environmental Protection Agency
Treatment of domestic waste water: Treatment of domestic water is generally efficient. In the Loch Lomond new sewage works have resulted in reduction for phosphorus values in the past decade
Designation of sensitive areas: None yet notified
Emission reduction of hazardous substances: Must meet the requirement of current Scottish legislation which will shortly be identical to the WFD.
<i>Is water used in an efficient way?</i> Are efficiency and re-use measures applied? Are requirements such as water-saving, low energy consumption, environmentally friendly considered? To a limited extent. The amount of water currently abstract is below the permissible level.
Efficiency and re-use measures: Most water from Loch Lomond goes to west and central mid-Scotland, but not to the city of Glasgow and its suburbs. No waste is returned to the loch from areas supplied..
Application of water-saving techniques: Sufficiency of water is no problem.
Efficiency of water use: Generally water use is efficient. Loch water levels can be regulated by the barrage on its outflow, the river Leven. This is infrequently used.
Impact of water abstraction: No harmful impacts have been found
<i>Is cost recovery for water services assured?</i> Are all service costs covered by the end-user? Do they consider resource- and environmental costs? Has economic analysis been done? If in the past this was not the case, the situation is changing and full implementation of these will come about in the next 5 years.
Cost recovery: Costs are now recovered by users
Resource costs: Costs for monitoring, protection, maintenance etc. are only partly contained in the users costs. The Scottish Environmental Protection Agency which undertakes these measures bears a significant part of the costs from its revenue grant from the Scottish Executive.
Revenues:
Environmental costs: yes
Polluter-Pays Principle: applies
Resource-User-Pays Principle: water resource costs are borne fully by users
Sustainability: is governed by various pieces of water and environmental legislation which is based on the concept of sustainability. (e.g. SNH charter, WFD adopted as Scottish water legislation)
<i>Are decision-making processes based on dialogue and consensus?</i> Do conflicting users communicate with each other? Do administrations moderate the process? According to the water and environmental legislation as well as EIA legislation

<p>, different stakeholders are required to participate in the processes, mainly through local government (which is a major player in Scottish Water, and which is responsible for planning issues.</p>
<p><i>Is decision-making calculable, reliable and has continuity?</i> Do decisions give enough information to the actors? Are decisions transparent and allow long time planning for investments, use of resources etc.? Not calculable yet, though this principle is being adopted. So far it appears to be reliable and consistent, though there is very limited information on this.</p>
<p><i>Is the decision making process participative and transparent?</i> Is all information accessible to stakeholders? Do they have the possibility to present their concerns? Are concerns considered in decision making? Yes and increasingly so.</p>
<p><i>Is the policy actively responding to legal requirements?</i> Are actions taken to implement and fulfil EU legislation? Yes.</p>
<p><i>Is decision making based on management and knowledge?</i> Is decision making based on existing data or does it require information gathering? Is the policy implementation actively managed? Yes to both questions. There is a generally good information base, and a high degree of co-operation between involved agencies</p>
<p><i>Are all relevant actors involved in decision making process?</i> Are stakeholders represented in the decision making process? Do actors show own activities in supporting the policy implementation? Yes.</p>
<p><i>Does a tight network exist between regulators and regulated?</i> Do regular consultation meetings, workshops, etc. between administration and actors' organisations. Is the setting up of actors' networks facilitated? There have been (recent) problems in this area, which are now being addressed with some urgency..</p>
<p><i>Is motivation promoted through the inclusion of stakeholders?</i> Is co-operation fruitful and not seen as a burden? Are contacts between administration and actors regular, positive and 'easy'? Yes; this has been a recent positive development.</p>
<p><i>Is horizontal and vertical policy integration favoured and does an exchange between various regulatory authorities exist?</i> Are regular exchanges taking place outside direct concern of water policy and are different levels of policy making interacting? Yes. This is very much the case particularly following the inclusion of Loch Lomond and most of its catchment in the Loch Lomond and Trossachs National Park, which was designated in July 2002</p>

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