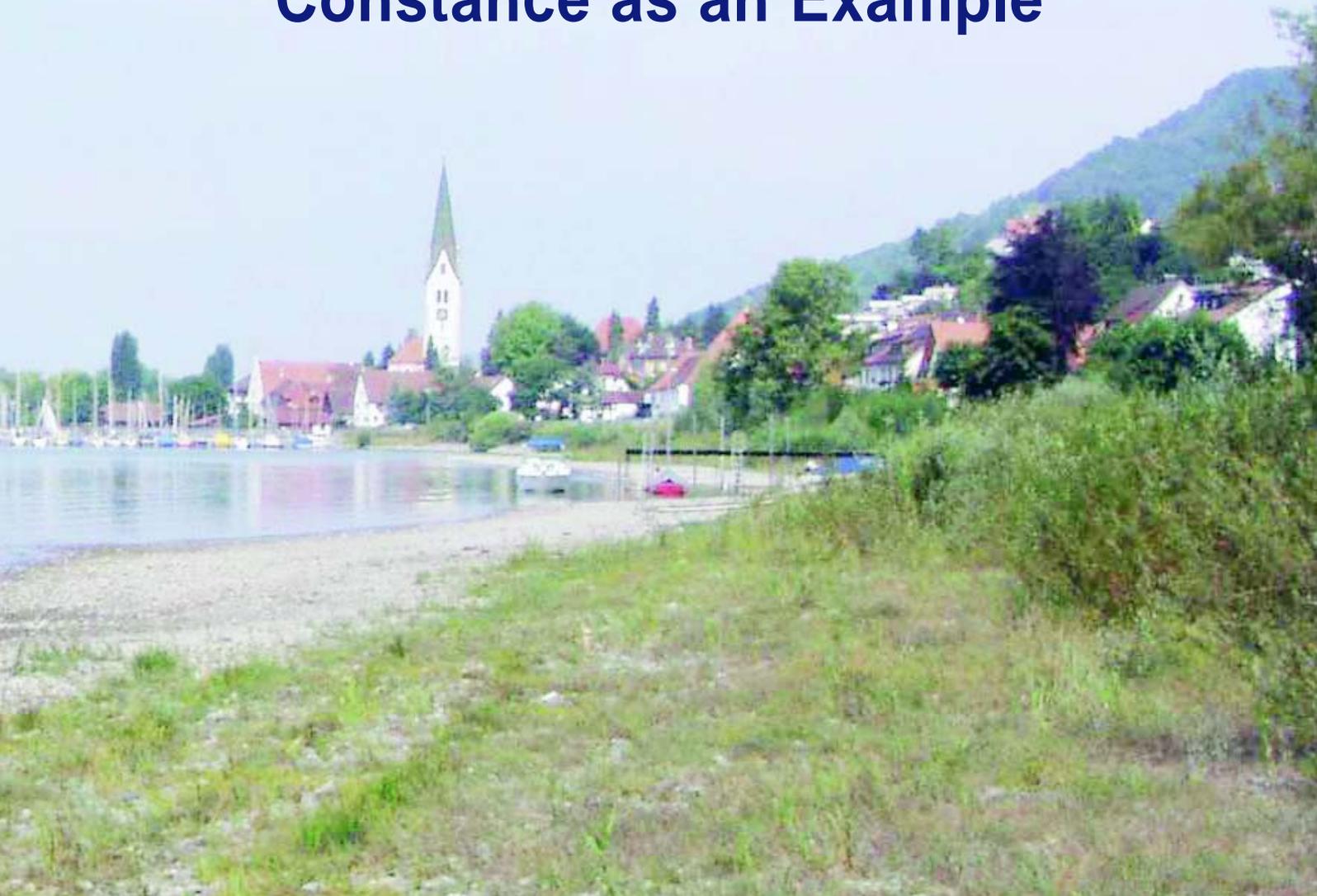


# **General Framework for a Professional Evaluation System for Lakeshore Conservation and Water Body Protection, using Lake Constance as an Example**



**Expertise of the Arbeitsgruppe Bodenseeufer (AGBU)  
for the Bodensee-Stiftung, Konstanz  
and the Global Nature Fund, Radolfzell**

## Impressum

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**The Arbeitsgruppe Bodenseeufer (AGBU) e.V. (Working Group for the Lake Constance Shore)** is an association of scientists and engineers from various fields. Their aim is the promotion of practically-oriented research on the shores of Lake Constance, in order to gain a deeper knowledge about its ecology. This will enable better protection and a more sustainable and environmentally-sound use of the shore. They have their own research projects and they also advise public and private clients about shore ecology, shore protection and shore restoration. The AGBU is part of an international information network, which connects researchers from universities, public and private research institutions with professionals from consulting offices, associations and authorities.

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**The Bodensee-Stiftung (Lake Constance-Foundation for Nature and Culture)** was founded in 1994 as the „International foundation for nature and culture“ by the following environmental organisations from the three countries bordering Lake Constance: Deutsche Umwelthilfe (German Environmental Aid Association), BUND (Friends of the Earth Germany), NABU (Birdlife International Germany), Österreichischer Naturschutzbund (Austrian League for Nature Conservation), Pro Natura Switzerland and WWF Switzerland, which are represented by their countries and regional groups respectively. The aim of the non-profit foundation is the development of an ecological model region Lake Constance. The major focuses of the work are the areas of settlement development, agriculture, tourism, mobility, environmental education, conservation and integrative projects. 18 environmental protection organisations belong to the advisory committee of the foundation.

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**The Global Nature Fund (GNF)** is a non-profit, international foundation for the environment and nature. The GNF is non-governmental and does not have any financial aims. In 1998 the GNF initiated a network of important lake regions called 'Living Lakes', with the foundation lakes Lake Constance, Mono Lake in California, St. Lucia Lake in South Africa and Biwa Lake in Japan. Today the network includes 30 lakes on five continents. The aim of the global environmental initiative Living Lakes is to highlight ways by means of which an effective protection of lakes and drinking water reservoirs of our planet can be achieved. A central task is the sustainable development of lakes and wetlands in various climatic zones and the formulation of functional models, which implement the Local Agenda 21.

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## Short summary :

***In this expertise the overall importance of the lake shore zone for nature conservation and water pollution control is investigated and presented, with respect to the EU-Water Framework Directive and the Natural Habitats Directive or the NATURA 2000-Reserve Network System, respectively. Although both directives aim to contribute to an improvement of the situation on e.g. the lake shore, already at the start of the implementation, there is a deficit in coordination and agreement. An example of this can be found in the ecological description of the condition and the evaluation of lake shores. In this report an evaluation system is recommended, according to the guidelines of the Water Framework Directive, but, which also takes the uses and influences from the land side, as well as conservation aspects, into account. The expert knowledge of local nature conservation associations (NGO's) could be useful in the development of such an evaluation system. Thus, they should become more involved in the regional implementation of the Water Framework Directive than they are at present.***

## Foreword from the editors

The shore and the shallow water zone is the most diverse, and at the same time, the most endangered part of the ecosystem of Lake Constance. Here the conflict between protection and the interests of users is particularly large. As a result, it is also a major focus of interest for water pollution control and nature conservation.

Since the 1960s the work of water pollution control has focussed on the reduction of the over-fertilisation of the lake. The declaration of protection areas in the shore zone stood at the forefront of nature conservation. In the last years a change in circumstances has become apparent. This is characterised by the fact that the free water body has been successfully restored, in consequence of new guidelines from the EU, but it is also characterised through the continuing intensification of use of the lakeshore zone.

As a result, the Bodensee-Stiftung and the Global Nature Fund share the view point, that the legal and professional necessity of a unified approach towards nature and water pollution control urgently needs to be recognised.

The International Commission for the Protection of Lake Constance (IGKB) quite rightly determined in their action programme 2004-2009, that the largest deficiencies refer to the shore and shallow water areas. We highly appreciate the action programme of the IGKB, with its major focus on shore and shallow water areas, and we have determined, that the IGKB recognises that „cooperation with other conservation groups that are also active on Lake Constance should be intensified“ and that „the action programme, when considering its aims and contents, is predestined to encourage such cooperation ...“.

In the future, we pursue a complementary cooperation between governmental and non-governmental organisations, in order to work together towards the greater aims of sustainable regional development and especially to guarantee the natural functions and the ability of the ecosystem of Lake Constance to regenerate as the basis for a continual assurance of the Lake Constance region as an attractive living, business and cultural area.

We hope that this expertise from the Arbeitsgruppe Bodenseeufer (AGBU, Shore of Lake Constance Workgroup) will contribute to discussions leading to a better understanding of the ecological importance of the shore and shallow water zone and to its professionally integrated evaluation.

Constance, October 2004

Bodensee-Stiftung



Harald Jacoby

Global Nature Fund



Marion Hammerl-Resch

# 1. Motivation

The demands for integrated water body protection, with the inclusion of the shore area of flowing water bodies and lakes and with consideration being given to the wetlands, have gained momentum due to the introduction of the European Water Framework Directive (WFD).

Only a few years earlier, on the basis of the Natural Habitats Directive (Dir 92/43/EEC) and the Wild Birds Directive (Dir 79/409/EEC), the organisation of the reserve network NATURA 2000 was started. A substantial proportion of the species and habitats, which are to be protected, in accordance with the appendices of these Directives, can be found in wetland areas, which also include the lakeshore zones above and below the mean waterline.

The tasks of water body protection and species and habitat protection overlap in the shore areas of rivers and lakes. As a result, the programmes of measures, which will be required in the future in order to fulfil the environmental quality aims of the EU-WFD, also concern the shore habitats and the species bound to them. They particularly investigate in the field of conservation.

Lake Constance is particularly affected by these developments - some of which have partially already been introduced, some of which remain desirable. Lake Constance has special significance, since it is the third largest lake in central Europe, and because of its distinguished function in water management and its large, internationally important nature conservation areas.

In order to identify and localise deficits and aberrations in the lake shore zone and in order to trans-regionally evaluate them from a water pollution control and environmental conservation point of view, a targeted compilation, representation and evaluation of suitable quality elements, as well as a transparent, scientifically based and



*The Water Framework Directive aims at preventing deterioration of the status of all bodies of surface water and achieving good water status for all waters by 2015.*

professionally agreed upon evaluation procedure is required. The purpose of this evaluation is to represent a basis for the development of such a compilation and lakeshore evaluation system, and to discuss this critically. This will put environmental organisations and the interested public in a better position to develop and represent their own conclusions about the improved protection of the lakeshore, about a consolidated shore restoration concept and improved interlocking between water pollution control and nature conservation concerns. The evaluation is specifically relevant to the situation on Lake Constance. However, it should be of interest for other European lakes.

We have summarised the most significant results and conclusions of a technical and unpublished expertise from the Arbeitsgruppe Bodenseeufer (AGBU, Lake Constance Shore Workgroup), which was made for the Bodensee-Stiftung (Lake Constance fund) and the Global Nature Fund (GNF, Radolfzell). Main statements and recommendations are summarised in the 'Result' paragraph at the end of each chapter.

## 2. The lakeshore as a transitional habitat

Lake shores form a transitional habitat (ecotone), which solely connects terrestrial areas with the shallow water areas of lakes (pelagial). The character of ecotones describes a local peak of biodiversity formed within these areas. In central Europe approximately 185 orders of flora and fauna can be found in these areas (excluding fungi and lichens), while in the open water area only approximately 37 orders can be found.

Lake shores are mostly comparatively narrow, but very elongated ecosystems. The total shore length of the large, natural lakes of Germany amounts to approximately 6,000km. This thread-like character means that landward and lakeward uses and disturbances can particularly quickly lead to the constriction and fragmentation of the shoreline.

Lake shores can be fundamentally divided into three concentric belts: the sub- or infralittoral, the zone between mean low and mean high water level (eulittoral) along the shoreline and the landward shore zone. The land and lake side borders are often not clearly drawn, so that from a practical point of view a common definition is needed.

We understand the lakeshore zone to be a belt-like zone around the lake, which extends towards both sides of the long-term average waterline. The lake shore zone is delimited on the lakeside either (a) through the maximum depth at which macrophytes (submerged vascular plants, moss and/or stonewort (Charophyceae) can be found, if the lake is in its potential close-to-natural condition (in particular, its trophic condition), or (b) through the depth, at which, in the event of heavy waves (that is the design wave), the deep water waves transform into shallow water waves, developing their morphogenetic effects (e.g. the formation of



*Lake shores form a transitional habitat (ecotone).*

basin slope ledge). The largest water depth from the two options, (a) and (b), is applicable. In the first case the lakeward zone is described as the sublittoral zone. In the second as the shallow water zone. The landward's border is given by the border of influence of the lake during a 25 year flood high water level, when the lake is in a potentially natural condition (particularly its hydrological regime); additionally the area of increased ground water level landwards of the 25 year high water mark should also be considered. For Lake Constance, this corresponds approximately to the 397.50m ASL-line. In a close to natural condition this border can be determined by the presence of hygrophilous, flood tolerant vegetation. The shore area is described as a belt, on both sides of the average waterline, in which significant pressures through human use develop on the shore zone, and it is defined as the area between the lakeward border of the lake shore zone (see above) and the landward borders of the shore communities. These definitions contain the essential elements of previous definitions concerning Lake Constance, the WFD-documents and the limnological and hydrological scientific literature, as well as the relevant DIN (German Institute for Standardization)-standards.

***Result: The lakeshore zone should be understood as one unit in its vertical extent. When considering the aims of lakeshore evaluation and lakeshore conservation, we think that it is not appropriate to use definitions which separate the lakeshore into a landward and a lakeward area, as is used today in the description of the areas of responsibility of water management and conservation authorities, councils and regional planning organisations. Firstly, this does not acknowledge the present scientific understanding of the lakeshore as a transitional habitat. Secondly, the areas of cause and effect, with regard to significant anthropogenic pressures, are separated from another in this approach.***

### 3. Uses and disturbances in the lake shore zone

In a densely populated landscape, such as in central Europe, the lake shore zone plays an important role in nature and landscape conservation, water pollution control, agriculture, industry and for the existential needs of people. In detail these are

- a transport area (public and freight water traffic, recreational boat trips),
- private and public areas for recreation and relaxation (e.g. swimming and many varieties of popular types of sport)
- private and public areas for settlement use (including marinas) and transport, as well as the related construction infrastructure,
- private and public areas for recreational and tourism use, including the construction infrastructure that goes along with these (e.g. promenades, harbours, jetties, buoy fields, bathing areas, camp sites, etc.),
- fishing (professional) and recreational angling,
- agricultural uses for the production of feed (especially grass land) and as a receiving area for the drainage of low-moor areas,
- asthetical value as a scenic landscape

- deposit of cultural heritage and artifacts, including their protection and preservation, as well as for archaeological research
- protection of species (until this point mostly bird and vascular plant species have been considered), with the aim to protect rare and endangered species and the maintenance of a high diversity of species,
- habitat conservation, especially „highly protected biotopes“, in accordance with § 24a NatSchG BW (nature protection legislation in Baden-Wuerttemberg; e.g. close to natural alluvial forest, wet litter meadows, reed beds and sedge meadows, shore zones of still water bodies, shore areas in a close to natural state and close to natural areas of the shallow water zone of Lake Constance)
- A buffer zone between land and free water, with a probably high „self-purifying capacity“ and the ability to retain nutrients and pollutants that diffuse into it from the landside.

Aside from the conservation of species and biotopes, other aspects, direct (e.g. tourism and recreational industries, rent and land prices) or indirect (here: long distance water supply from Lake Constance), can create a considerable added value, which is well recognised by the individual users.

The shore of Lake Constance can be compared with a densely populated urban area, with an average population density of 585 pers./km<sup>2</sup> (for comparison: the state Baden-Württemberg 297, canton Thurgau 264 pers./km<sup>2</sup>). The German shore of Lake Constance is situated



*Spots on the lake shore are in hot demand: recreational uses on Lake Constance.*

in an area of no less than four axes of urban development and with this in the densely populated areas of Konstanz, Überlingen, Friedrichshafen, Bregenz, Rorschach and Romanshorn. The structure of area use in the lakeshore areas corresponds to the population density: In these areas, building over by settlement and traffic areas, in total 18.2%, is 51% larger than that of communities in the hinterland; the percentage used by agriculture is 24% less.

The German shore is an particularly popular holiday destination for short and long term travellers, as well as for the visitors of many large expositions and cultural events. In the German tourism region of Lake Constance, a total of 7.6 million overnight stays and 14 million day-trippers can be expected every year. The highest proportion of recreational activities is naturally concentrated on the shore. Here, there are approximately 97 harbours and jetties for sport boats and more than 20 buoy fields and 24 docking sites for passenger boats. In addition, there are approximately 73 bathing areas, 29 official access sites for windsurfers and 42 camping sites. Boat numbers amount to around 58,130 registered watercraft. 23, 680 boat ramps are available for accommodation (from these approximately 73% in harbours and approximately 12% on jetties and in buoy fields). The remaining boats are kept on private or public landing sites. The average



*First filled in and then used: 'Event' activity on the shore of Lake Constance.*

space requirement per boat is around 35 - 100 m<sup>2</sup> for a lake landing site and a further 50 - 100 m<sup>2</sup> for boating supply facilities on the land. More than 50% of the shore line is „moderately“, „heavily“ or „very heavily“ built over by shore walls and filling in with gravel. These shore constructions are often held responsible for shore erosion on the lakeward surf zone, as well as for cliff erosion on unfortified and close to natural shore sections located downwind. In the landward areas bordering the shore zone, residential constructions, including related privately owned land and boating supply facilities, dominate the land use. Bathing areas and other recreational facilities cover much less space.

***Result: The complex overlapping of uses in the lake shore zones leads to the direct destruction of the biotopes and the fragmentation of shore sections, which have remained in a close to natural state. The specific indirect effects of human influence on the composition and ecological functions of the shore biocoenoses are, however, largely unknown, so that possible strategies for the reduction of interferences and pressures (e.g. lakeshore restoration) can only be based on insufficient data. We see an urgent need for applied research in this area. Large scale plans of action (e.g. lakeshore restoration and similar plans) should only precede once sufficient results, which can be discussed among professionals, authorities and the interested public, have been derived.***

## 4. Lakeshores and their relevance in water pollution control

When considering the significance of the lake shore zone for water pollution control on Lake Constance, the „self-purifying ability“ and the role as a „buffer zone“ (nutrient retention capacity) or as a source of water polluting substances (in the case of intensively used shore zones, including harbours, jetties and buoy fields) are the most important functions.

Since the beginning of the 1980s the role of the littoral in the self-purifying ability of Lake Constance in response to nutrient impacts has been emphasised by water management authorities, even though the sub- and eulittoral only add up about 13.5% of the lake's surface area and only 0.6% of its total volume. In international literature, however, the sub- and eulittoral are more often regarded as a source of biomass production, than as a place where biomass is broken down. Evidence about which of these ecosystem functions predominantly takes place in the littoral of Lake Constance has not yet been found. Furthermore, the majority of the investigations have arisen in the years after 1994. At that time the nutrient pressures had already largely been eliminated.

Few data about Lake Constance is available about the buffer function of the shore zone.



*The lake shore as a source of nutrients or as a nutrient sink? Filamentous algal development in reeds during the eutrophication phase*

However, numerous international publications have pointed to the effectiveness of a buffer zone along running water and wetlands. In view of the relatively small extent of lake shore reeds and sedge meadows and the constructional changes to the river deltas on the upper lake, this function should not be overestimated.

The land side sections of the lake shore zone can act as sources of nutrients and pollutants. The majority of pressures probably arise from intensively used areas. Whether the nutrients and pollutants that come into the lake are at the least of local importance, or whether they have caused significant disturbances in the past, is not known.

***Result: Independently of whether the Lake Constance lakeshore zone had an impact-alleviating function during the eutrophication phase, the pressure-intensifying effects, which arise from the shore zone, seems to remain at the forefront today. A reduction of these pressures would be possible in urban areas through the effective treatment of rain water and in the rural areas by means of a reduction in the application of fertilisers and insecticides on agricultural land.***

## 5. The lakeshore conservation of species and habitats

The transitional habitat 'lake shore zone' is regarded as a local centre of high biodiversity. Through the lateral gradients of the (ground-) water levels and periodical disturbances through high and low water phases as well as through belt-like arranged vegetation formations, a large number of ecological niches are created, which are inhabited by aquatic, semi-aquatic and terrestrial plants and animals. In addition to this, there are several animal species (e.g. singing bird species and birds of prey), which only spend part of their life cycle on the lakeshore. However,

for many organism groups no or only very few recent publications, which have catalogued species, have investigated zootic structures or which are devoted to the problems of species conservation, are available.

On the shores of Lake Constance the majority of species diversity should be found within the 29 nature reserves, which make up a total surface area of 53.6 km<sup>2</sup>. On the other hand many rare and endangered species can also be found outside of such sanctuaries.

We have attempted, through the use of the available literature, unpublished data and our own surveys, to create an overview of the species of selected taxonomic groups and their degree of endangerment (see Table).

Group	Total species number (recently proved to exist)	extinct or in endanger of extinction	very endangered and endangered	Potentially endangered, pre-warning stage	Source for the degree of endangerment
stoneworts (Characeae)	16 (8)	2	4		D; BW
mosses	11 (10) <sup>(d)</sup>	1	2		D; BW
vascular plants (Pteridophyta+Spermatophyta)	ca. 1000	50	229	35	CH, CH-Ost, A, BW, AV
.... from these: aquatic plants	30 (24)	4	26	3	
.... from these: helophytes	12 (10)	2	9	2	
.... from these: endemic dwarf Littorelletea species	30 (28)	7	4	0	
Invertebrates	no data	no data	no data	no data	general low level of knowledge
.... of these: ground beetles (Carabidae)	230	20	65	28	D, BW, CH
Fish	17 (17)	0	3	1	BW
Amphibians	11(11) <sup>(a)</sup>	1	8	2	CH, CH-Nord, CH-Ost, D, BAY, BW, A, VB
Reptiles	3 (3) (b)	0	3	0	CH, CH-Nord, CH-Ost, D, BAY, BW, A, VB
Birds (only breeding birds)	52 (51)	14	25	6	D, BW, CH
Mammals	7 (6)	2	3	0	D, CH

(a) of these 7 species in the waterward section; (b) of these 1 species in the waterward section; (c) 'red lists' used: CH - Switzerland-complete, CH-North - Northern Switzerland, CH-East- eastern central Switzerland, D -Germany, BW - Baden-Württemberg, AV -pre-alpine region, BAY - Bavaria, A -Austria, VB - Vorarlberg; (d) Moss only in the flooding area

This orientating summary emphasises the high importance that the Lake Constance shore has for endangered and threatened plant and animal species. This fact has been acknowledged since the middle of the 1930s through the stepwise establishment of nature reserves. The density of reserves is high in the western part of Lake Constance and particularly here in the Constance region, with an NSG (nature reserve) portion of 5.0% of the regional area, giving Constance a leading position in Baden-Württemberg (2.11% of the land surface area). As the result of other conventions, several of these areas, as well as other areas, are protected, e.g. as „Important Bird Areas“ (IBA) and as „special protected areas“ in Austria and Germany at the same time, in accordance with the EU Wild Birds Directive. As such they have been integrated into the reserve network „NATURA 2000“. These and some other shore sections are protected under the Ramsar-convention as „wetlands of international importance“. Especially in the western region of Lake Constance a large section of the shore zone, along with the bordering land side parties and the lake area, has been declared a reserve, in accordance with the Natural Habitats Directive and the Wild Birds Directive. In the spring of 2004 land and water areas, with a total area of approximately 130 km<sup>2</sup>, were declared to Natura 2000 reserves, and registered with the EU commission. However, only a small part of these areas represents lakeshore zones.

One will have to assume that several of the endangered and threatened species mentioned above do not only occur within the reserves, so that limiting the tasks of the species and habitat protection to the designated protected areas is not effective. On the contrary, large scale environmental protection is particularly required on the shore of Lake Constance.

In opposite to comparatively good floristic, vegetation and faunistic research on Lake Constance, which partially dates back to the late 19th century, is scarce. These are of importance with respect to the evaluation of lakeshores and the planning of programmes of measures (e.g. shore restoration, among others):

- The species and their distribution of the majority of invertebrate groups, including important environmental indicators, such as molluscs, crustaceans, beetles, butterflies, dragonflies; there are also many neozoic species within this groups, which have immigrated or are likely to immigrate to Lake Constance;
- the distribution of the populations of the surveyed animal and plant species on the nature reserves and on the unprotected shore areas;
- the reaction of representative species to specific human disturbances and encroachments on the shore zone, as far as these do not simply consist of direct habitat destruction.

A further deficit, which may be addressed and removed in the future, is the composition of Lake Constance specific taxa-lists, „Red Books“, habitat characterisation and conservation objectives. In a first step, the available data could be reviewed and critically evaluated.

A further weakness is the difference between the fact that conservation laws and regulations in the countries around Lake Constance. Additionally, there are deficits in their practical realisation and in cooperation on concepts and the declaration of protected areas across country borders.

***Result: The shore of Lake Constance is of considerable importance for the protection of species and habitats. The existing nature reserve system provides a good foundation for the preservation of threatened and endangered populations. Although the potential for the declaration of new reserves of significant size is limited, in view of the human pressures to the lakeshore, we think that improvements are needed and realisable. Herein included are the harmonisation of existing border crossing protection measures, as well as reserve concepts, which also include the landward areas and corridors into the hinterland. In the future more attention should be given to animals, which have so far been neglected from a conservation point of view (especially invertebrates), and to large scale environmental protection on Lake Constance. The immigration of neozoa, which has most recently accelerated, should be monitored, with the aim of minimizing possible sources of immigration.***

## 6. The analysis of pressures, conflicts of use and programmes of measures

For many years, the shore areas of many large central European lakes have been especially attractive areas for settlement, transport, local recreation and tourism. This is especially applicable to the Lake Constance region. An evaluation of human activities and their effects, as well as the planning of possible protection programmes and measures, can be made using the DPSIR-method. This method is recommended for the implementation of the WFD and it is also used in a modified form by the IGKB. DPSIR stands for driving force (activity relevant to the environment) - pressure - state - impact - reaction (that is, the need for action and necessary measures). The examination of pressures and impacts takes place in the view of the background of the natural composition of the water body, and of anthropogenic pressures which may have occurred before. The lake shores in the densely populated regions of central Europe are subjected to approximately 14 groups of different, environmentally relevant activities, which lead to approximately 50 different uses and pressures. With this, it becomes clear that the uses and pressures in the lake shore zone are more complex and diverse than those in the free water zone. Many environmentally relevant activities in the shore area of Lake Constance have undergone dramatic increases in their intensity during the last two decades.

Examples for these are

- an increase in the population and settlement density, especially in the communities on the shoreline.
  - the dedication of land, in favour of transport and settlement areas, and to the detriment of agricultural areas,
  - the increasing number of overnight stays of tourists, which can be used as an indicator for daytrip numbers,
  - the recently increased number of registered boats,
  - the remaining high number of boat landing places and docking sites,
- the consistently high degree 'hard' waterway engineered constructions on the shore of Lake Constance, and
  - the intensification of agriculture, especially concerning fruit plantations and special cultures.

The sole breakthrough was the cessation of the pressure from phosphorous from communal sewage, which was responsible for the bad trophic condition of the lake up until the middle of the 1980s.

Prominent areas of conflict between uses or users respectively, are in the area of water supply (especially the Lake Constance distant water supply), the nature reserve-orientated conservation at the Untersee in particular, watersports and the private use of shore properties and boat facilities, as well as in the areas of shore restoration measures, which are mandated by the „Bodenseeuferpläne“ (Lake Constance shore regional plans) of the two regional councils and according to the visions of the IGKB.

The water engineering concept of shore restoration was developed at the Institut für Seenforschung (ISF, Institute for Lake Research) and it was improved by implemented measures from day to day in cooperation with the water management authorities. The immediate objectives are to (i) balance out the - probably anthropogenically caused - bank erosion, and (ii) to prevent further erosion of the shore through constructed fixtures. Restoration has often been coupled with other measures, e.g. the removal of harbour mud, the laying of service pipes or with the construction of shore paths. At the moment, on the Baden-Württemberg shore of Lake Constance there are 70 (from these 13 are in planning stage) and on the Bavarian shore there are 4 completed restoration projects. On the Austrian shore 5 further projects are planned and in the cantons of St. Gallen and Thurgau there are 7 (from these 4 have already been realised). Only 14 of the completed and 8 of the planned measures have been documented.

***Result: The forms and impacts of human uses and pressures in the lakeshore zone are very complex. Up until now this complexity has not been adequately considered, investigated and documented. Up until this point, the shore restoration concepts have expressed a one-sided limnological or hydraulical perception, which furthermore, in specific cases, mixes with objectives of different nature. The environmentally scientific basis and reasoning, as well as the guidelines for quality control, are as a whole so poor, that a restoration concept can not be pursued without a moratorium. This applies especially when considering the effects on biocenoses and populations, which are important from a conservation point of view.***

## 7. The description and evaluation of the status of water bodies and water body borders

In water pollution control moving and still water bodies and their water body borders are evaluated from different points of view. Mostly the values of certain human uses or interests play a role, in which traditionally the obtainment of drinking and industrial water was the most prominent. Examples for this are the assessment of the trophic status of free water bodies, and the sublittoral of lakes and the assessment of saprobity of running water bodies. In the context of structural quality evaluation of river beds the protection aim of „aquatic organisms and biocenoses“, as well as biotope networking in river and wetlands, has gained importance. We have investigated several methods in order to assess whether some basic ideas and procedural elements could serve as a model for the description and/or evaluation of lakeshores from a aquatic ecological point of view.

The basis of new evaluation methods is „Leitbild“ orientated, and water body type specific. The „Leitbild“ (=reference condition) is the potential natural or the close to natural condition of a water body, in accordance with the premises that ecosystems in close to natural conditions are best able to support sustainable development.

The Länderarbeitsgemeinschaft Wasser (LAWA, Working Group of the Federal States on Water Issues) defines the ‘potential natural condition’ as a „pressure free condition of a water body, which is consistent with its natural (geological, geographical and climatic) constraints“, whereas „certain factors, which are man-made, irreversible and those where change is, for practical reasons, impossible“ may remain. However,



*For the evaluation of lake shores a lot of faktorens have to be considered.*

„pressures“, or demands on a water body, which lead to „it being harmed in the sense of § 1a WHG [...], i.e. they lead to serious change in the system“, must be excluded.

Hydromorphological descriptions and evaluation procedures („structural quality surveying and mapping“), which have, until now, only been developed for river beds, are of special interest. By the notion of river bed structure the LAWA understands „all spatial and material differentiations of the water body bed and its surroundings [...], as long as they are hydraulically, water body morphologically and hydrobiologically active and that they are important for the ecological functions of the water body and the floodplains.

Consequently, the structural quality of a river bed is „a measure of the ecological quality of the water body structures and the dynamical processes indicated by them“, including the „ecological ability of the water body to function as indicated by these structures“. The methods can be split

into an „overview procedure“ and a more detailed „on-site-procedure“, where the former relies on the evaluation of aerial photographs, maps, etc and the other is based on extensive field work.

The transition from the simple surveying and documentation of the 9 (overview procedures) and the 25 (on-site-procedures) variables, respectively, to the actual evaluation requires professionally based background knowledge. This is predominantly in the allocation of quality scores to certain features, ‘damage structures’ and ‘value structures’, as well as in the aggregation rules, which are not, however, always sufficiently explained. The ‘minimum-principle’, the ‘pessimum-principle’ and the graduated aggregation of evaluation figures are of methodological interest. As a result, the river bottom, shore and surrounding land (flood plains) receive approximately the same weighting.

The aggregation rules are based on scientific background knowledge and not on „blind“ algorithms, such as averaging. We consider these methods to be scientifically verified, so that they can be further developed for the hydromorphological evaluation of lakeshores. Conceptual weaknesses can be found in the following two areas: (a) the connection between hydromorphological descriptors and biocoenoses, and potential indicators and objective types. The urgent need for applied research in this area has not adequately been considered, (b) approaches for the validation of the results and inter-laboratory calibration and quality assurance are missing. For nature and species protection, the methods as well as the results (for the time being only on small water courses and rivers and their flood plains) are important, especially when hydromorphological features are successfully connected with the requisite-profile of the species of interest, or with the local prerequisites of the biocoenoses.

While in water pollution control and management multimetric and at the same time water body type specific model based procedures have been developed, there are a variety of approaches in nature conservation and landscape protection, without any widely accepted specific procedural elements. For almost every project a suitable choice of survey variables and survey and evaluation methods have to be developed and tested.

In the daily routine of practical conservation „rarity“ and „endangerment“ are the most important. As criterion the ‘Red Books’, which play an important role in the evaluation of habitats, are available. They provide important justifications, especially for the declaration of natural reserves. ‘Red Book’ data are not scientifically reproducible, as they are based on the opinions of experts (expert convention as a methodological procedure). However, they are, once they have gone through the normative steps, objective criteria.

With the Natural Habitats Directive and the formation of the ‘NATURA 2000’ network a surveying and evaluation of the preservation status of habitat types and habitats of particularly protected animal and plant species has been carried out for the first time. A binding obligation to report has followed from this. The normative evaluation takes place using a three-level scale, with ‘excellent’, ‘good’ or ‘average or partially damaged’. Many procedures, which have been differentiated according to habitat type or species or taxonomic group, have been suggested for the scientific implementation, which are predominantly based on the opinions of experts. Since conservation is the responsibility of individual federal states, the evaluation procedures can differ throughout Germany. Whether the method, which has been suggested for Baden-Württemberg, will fulfill the objectives will be tested during the testing phase 2004.

As well as the ‘close to natural’ condition or ‘originality’ of a landscape section and its suitability as a habitat for plant and animal species, the surveying and evaluation of landscape elements also takes historical, aesthetical and socio-cultural, as well as use-orientated aspects, into careful consideration. The evaluations mostly relate to a specific planning and implementation project. Evaluations are preferably done verbally-argumentative. Sometimes they are supplemented by a formal aggregation of the evaluation scores, which have been assigned to the individual evaluation variables.

Only a single procedure from the area of nature protection and landscape conservation has been developed and tested in view of aquatic ecosystems. This is an evaluation procedure used for the declaration of ‘valuable stretches of national water bodies’ in the Federal Republic of Germany, which, however, has never been implemented.

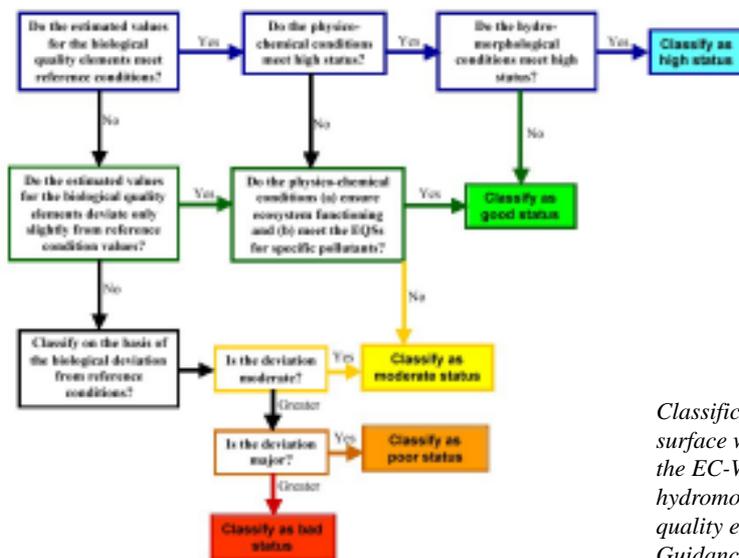
**Result:** In conventional water pollution control, in nature protection and in landscape protection different methods for surveying and evaluation are in use. In water body conservation, unified and professionally well worked out procedures have been established for the three large scale core problems - trophic, saprobic and structural pressures. In contrast to this, in nature protection and landscape conservation, a large methodological variety prevails. The methods used are neither compatible with each other nor with the methods of water body conservation. With one exception, none of the procedures is specific or directly applicable to professional surveying and evaluation with regard to the water body and nature protection of lakeshores.

## 8. The EU-Water Framework Directive (RL 2000/60/EG) and its implementation documents

After more than ten years of deliberation, the „Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for Community action in the field of water policy“, abbreviated to WFD, came in to force on the 22nd of December, 2000. The directive undeniably represents the most important European document in this sector and it will considerably change the water body policies of the member countries during the next decades. In contrast to most European directives concerning water pollution control and management, which up until this point have been very limited in scope, this directive takes a wide view of the management of water and water bodies. Its objective is to prevent the further deterioration of the condition of water bodies, and that all more or less strongly impaired and disturbed water

bodies achieve the „good“ status (broad water body protection) within a certain timeframe.

The status of a surface water body is not primarily determined by its usefulness to humans instead. It is considered from an ecological perspective. This means that it will be judged on its ability to accommodate a natural flora and fauna. The basis of this is the ideal of sustainability represented by the 5th and 6th Environmental Action Programme of the European Community: Minimally disturbed and untouched water bodies satisfy the needs for drinking water, water for transport, industrial production, energy production, and also for recreational purposes and to fulfil aesthetical demands and the ethical objectives of future generations. Through its foundation and its future implementation there are numerous interfaces between the WFD and other conservation and environmental protection legislation of the EU and of the member countries. The summary of discussions from nature conservation authorities and non-governmental conservation groups has made clear that the



*Classification of the ecological status of surface water bodies according Annex V of the EC-WFD based on biological, hydromorphological and physico-chemical quality elements (source: CIS REFCOND Guidance, 2003)*

EU-Water Framework Directive is not a conservation directive per se. However, it does contain numerous conservation specific characteristics. If it is documented, it will be of integral importance for the conservation of running and still water bodies, as well as for wetlands, including the lakeshore.

As a general document the WFD can, only make approximate, normative specifications, that must be more closely specified through documents on a lower administrative level on both European and national levels. For the time being, this is the Common Implementation Strategy (CIS), which the member states, new and candidate states, the EFTA-states and the European Commission agreed on during their meeting in Sweden in May 2001, and during later meetings. It is of interest to Lake Constance that Switzerland and Liechtenstein, as non-EU-members, have accepted the implementation guidelines of the WFD and have joined the other EU-members on the administrative level of Water Directors. The CIS Horizontal Guidances build the foundation, which was drawn up by various workgroups or will be drawn up or modified in the future. Furthermore, the suggestions and guidelines of the German Working Group of the Federal States on Water Issues (LAWA) as well as umbrella norms and standards must be noted, which at the moment are being developed by the CEN (Comité Européen de Normalisation) and by the DIN (Deutsches Institut für Normung, German Institute for Standardisation).

We have investigated these documents in the view of the guidelines for a professional evaluation system of nature protection and water body protection of lakeshores.

## 9. EU-Water Framework Directive, Nature Protection and the Lake Shore

The WFD is based upon an ecological definition of water bodies. This definition does not reduce the water body just to the actual water, but it also includes the interactions between the water bodies and the habitats that it influences or that depend on it. The directive gives more consideration to the ecological function of the water body, including its importance as a habitat for animals and plants, than it has been the case with respect to national legislation. This also includes the terrestrial ecosystems, which are particularly dependent on aquatic ecosystems. Thus, temporary flood water bodies and wetlands, such as fens and bog mire and the landwards sections of the lakeshore, are also included into the WFD's water body definition.

Included in the objectives of the WFD is also the achievement of all objectives and norms up until 2015, which apply to special „protected areas“. This includes the Natural Habitats and the Wild Birds Directives designated NATURA 2000-areas, with all of the species and habitats, for whom the retention and improvement of the water body condition is an important factor. However, there are still differences and areas of disagreement:

- Nature conservation in Germany has, in addition to the conventional segregative components, which relate to reserves, also a broader approach (integrative conservation), in which smaller wetlands are presented as well.
- Many of these wetlands and lake shores are not recognised they deserve as a result of their relevance (e.g. as reserves under national legislation) and functions (e.g. for the continual development of wild plants and animals, protection of the character, diversity and beauty of nature and the landscape, etc.), as they are, due to their small size (e.g. lakes with < 0.5 km<sup>2</sup> surface area), outside of the spatial scope of the WFD.
- Additionally, for example in the course of the setting up of reserves or by the implementation of population protection measures for certain priority species of the Natural Habitats Directive (common river mussel, *Unio*

crassus and the bullhead, *Cottus gobio*), not every case exhibits aims, which are in agreement with the WFD.

- When considered in detail, the Natural Habitats Directive and WFD have different structures: Under the WFD, the surveying and further measures take place on the basis of river catchment areas; under NATURA 2000 the surveying takes place using administrative areas, organised according to political units.
- This also results in - for each federal state - different responsible parties for the same ecosystem units:

A close cooperation between water pollution control and nature protection authorities, and also between these and the large, private nature protection organisations as well as local nature protection groups is already indispensable in the starting phase of the implementation of the WFD. It is also indispensable on all other levels of the (partial) river catchment areas and areas of work, respectively. It is a matter of a regular exchange of information, disclosure of individual aims and agendas, the voting over the steps and time plans and the agreement on regular interim results. The non-governmental nature protection organisations in the state of Baden-Wuerttemberg have to judge, whether the local participation structures and the restrained participation policy of the Ministry of the Environment and Transport - comparable with those in the state Nordrhein-Westfalen - lives up to their expectations. On the other hand, on the part of the responsible authorities there are no concepts about how the potential of the nature protection organisations and groups (introduction of professional competence and manpower, among others, for press and public work, campaigning ability, as a counterbalance for other represented interests) can be used to achieve common goals.

This state of knowledge, which we have described in general, also applies to the lakeshores of many large lakes, and especially to the shores of Lake Constance. Our analysis of potential anthropogenic pressures and their impacts on the lakeshore (see above) have shown that the spectrum of the forms of pressures exceeds the frame considered by traditional water management and water pollution control. This prohibits a lakeshore concept, which is solely limited to the aquatic zone, a purely limnological evaluation

and a measures programme orientated purely towards the water side. A future orientated lake shore concept must be orientated on the ecotone definition, like it has been used for a long time in ecosystem research, and which best depicts the special character of the lakeshore. In detail, this means that

- the landwards zone, as a source of pressures and as an area that should be protected, should be included in a differentiated way; we have reconstructed this with the definition of the „lakeshore zone“ described at the beginning.
- certain socio-economical (e.g. strengthening of traditional professions and business) and sociocultural ‘beneficiary effects’ of the lakeshores (e.g. protection of cultural monuments, beauty of the landscape) and environment ethical obligations (e.g. protection of biodiversity and populations)

need to receive more attention.

The lake shores, their status description and their ecological evaluation are mentioned in the WFD on different levels:

- their flooded areas, according to the basic understanding, are part of the water body sensu WFD: accordingly for a state evaluation indicators for biological quality elements ‘macrophytes’, ‘macrozoobenthos’, ‘fish-fauna’ as well as hydromorphological quality elements such as „quantity, structure and substrate of the lake bed“ are used.
- The zone between low and high water level (eulittoral zone), as well as the immediate landside shore areas as „aquatic ecosystems associated with surface waters“, belong to the water body, since pressures can arise here, which can prevent the environmental objectives (the ‘good’ status up until 2015) from being achieved. As a result, they have to be included in the programmes of measures.
- The landward sections of the lakeshore zone, which are rarely flooded but still affected by the lake water level or indirectly by the ground water level induced by it, belong to the „wetlands directly depending on the aquatic ecosystems“. For this, standardised habitat lists for practical implementation exist; this includes several habitat types, which can be found at Lake Constance.

All mentioned lake shore sections can be part of the NATURA 2000 protection area system, as it is the case, for example, at Lake Constance; their protection and conservation aims are

mandated to be integrated into the „programmes of measures“ of the WFD. In the case of conflicting aims, the more rigid or far reaching requirements apply.

***Result: The WFD mandates consideration of other European legislation, among others, the Natural Habitats and the Wild Birds Directives with the NATURA 2000 network, whereas the more rigid protection objectives must be observed. With this the tasks of nature protection authorities and the interests of the non-governmental nature protection organisations are also addressed on a local level. In the case of the lakeshore these also include the permanently flooded area, the zone between the low and the high water level and the part of the landwards area, which is not flooded any more, as all three zones are also under the rules of the WFD. Therefore they must also be included in the programmes of measures, e.g. shore restoration. Attention should be given to possible conflicts between the objectives of both of the EU-legislations during the conceptional phase.***

## 10. EU-Water Framework Directive and Lake Shore Evaluation

Reaching the global objectives of the WFD, which is a general wide area 'good' status of the surface water bodies in particular, requires status description and evaluation procedures, which operate on „a discrete and significant element of surface water such as a lake“. A lake is awarded the „good“ status, when both its „ecological status“ and „chemical status“ are at the least „good“. Otherwise the status of the worst evaluation determines the status.

While the chemical status is determined by the concentration of pollutants, the „ecological status“ contains „the quality of the structure and functioning of aquatic ecosystems associated with surface waters“. With regard to water bodies of natural origin, the WFD provides five evaluation levels: „high“, „good“, „moderate“, „poor“ and „bad“.

The „high“ status corresponds to the reference condition of the water body type concerned. This means a minimally disturbed condition, in which „no, or only very minor anthropogenic alterations“ to the characteristic physico-chemical, hydromorphological and biological properties can be observed. In the 'good' status larger but still only „slight“ anthropogenic deviations can be observed, while the „moderate status“ shows „moderate signs of distortion“ and significant disturbances.

The description and evaluation of the ecological status is made using measurement and survey variables, that makeup certain „quality elements“, from which it is expected that they reflect the level of anthropogenic pressures; in the case of lakes these are

- biological components (phytoplankton, aquatic flora, benthic invertebrates, fish fauna),
- hydromorphological components (quantity and dynamics of water flow, residence time, connection to the groundwater body, lake depth variation, quantity, structure and substrate of the lake bed, structure of the lake shore),
- chemical and physio-chemical components, respectively (light transparency, temperature profile, oxygen budget, salinity, acidity, nutrient concentration as well as the concentration of specific pollutants).

The main focus is on the biological quality elements, from which the water body flora (that is the submerged macrophytes and the benthic algae), and partially also the benthic invertebrate fauna and the fish fauna, are relevant. In contrast, the hydromorphological quality elements only play a role in the „high“ status.

In the „good“ and in the „moderate“ status, the hydromorphological elements only have to be of a quality, which allows the biological quality elements to develop, in accordance with the status of the water body. With respect to the situation on Lake Constance, this means that it

is impossible for the lake, because of constructions in the littoral (harbours, jetties, dredging of harbours etc) and in the landward shore zone (shore construction, sealing over, obstructions of the groundwater flow, etc), to achieve the „high“ status.

The taxonomic composition of the fauna and flora of close to natural water bodies depends on many characteristic properties, which can be summarised as the water body type. According to the German typology, Lake Constance is in category „9.4 - mostly gravel, deep lake, partially with ground water influence“ or „lakes in glacier

tongue basins“. According to the Austrian typology, it is of type „A 1.1.2 - lakes in glacial rock valleys or other depressions of glacial origin“.

The evaluation of the ecological condition of a surface water body is made in front of the background of the (water body) type specific reference conditions; this means, that when the water body of a certain type fulfils the reference conditions it is of „high“ status. In principle, for each quality element, which is used for the classification of a water body type, and for each water body type, type specific reference conditions have to be determined.

***Result: It appears to us, that the conceptional specifications of the WFD, with the lakeshore specific expectations, has to be urgently amended, especially in the area of habitat and species protection, starting with the description of the condition, monitoring and evaluation. We are aware of the fact that in the case of the evaluation of lake shores - in contrast to the situation for moving water bodies - a new level has been achieved, especially concerning approaches to the harmonisation of nature conservation and water pollution control. The cooperation between ecological research and professional water pollution control and the rich nature protection infrastructure -public and private- at Lake Constance is of particular importance.***

## 11. Available methods for the evaluation of lakeshores

At the moment there are only a few methods, which deal, at least superficially, with the surveying, description and evaluation of the ecological quality of lake shores.

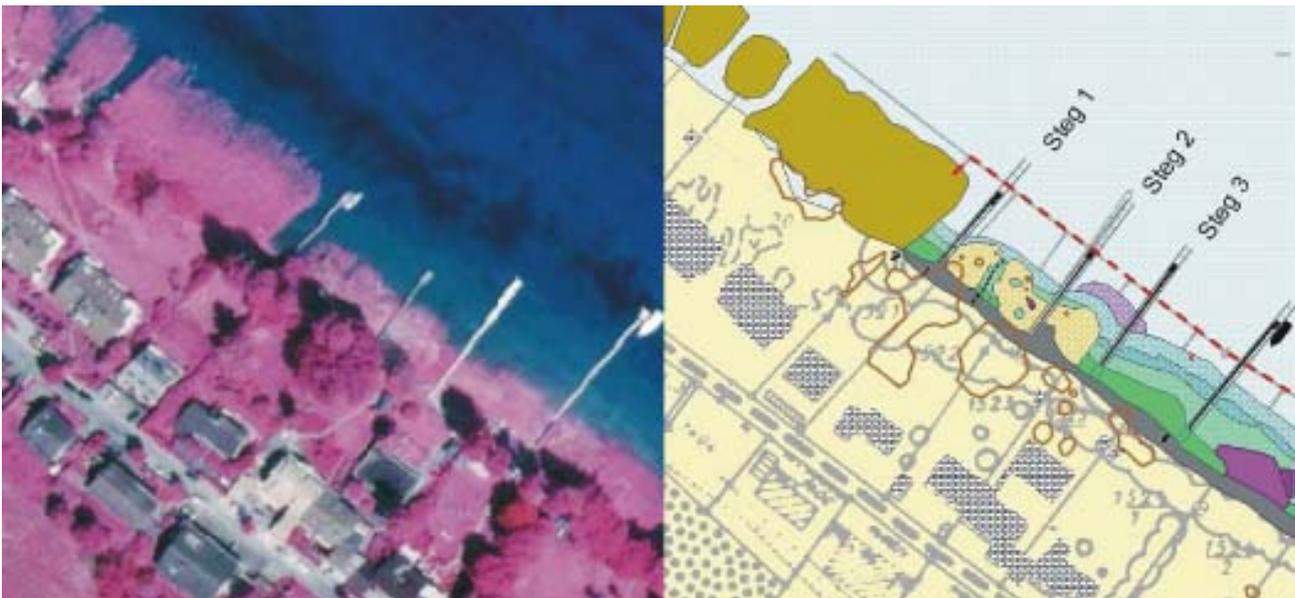
We have investigated

- the 'Lake Habitat Survey' (LHS)-procedure (at this time being tested by the Scottish Natural Heritage),
- the Austrian standard ÖNORM M6231,
- the evaluation concept of the Ministry for Agriculture, Environment and Forests Baden-Wuerttemberg from 1981, and the resulting Lake Constance shore plans.
- the 'littoral-module' of BUWAL (CH, Bern), developed as a provisional draft by the EA WAG (CH, Dübendorf), as well as
- the present limnological evaluation procedure of the Internationalen Bodensee-

Konferenz (IBK, International Lake Constance Conference) and the International Commission for the Protection of Lake Constance (IGKB).

Among the mentioned documents, only the LHS procedure and the approach by IBK/IGKB can be considered to be consistent evaluation procedures. Particularly interesting is the attempt that the LHS procedure makes to integrate professional water pollution control and nature conservation viewpoints into an evaluation scheme. On the other hand, from a professional, practical and evaluation-strategic point of view, it is hardly useful for the documentation of the very heterogeneous pressure situations encountered in central European lakes. The IBK/IGKB procedure would be of particular interest to Lake Constance. It has been in development for the last few years by a small workgroup within the 'Lake Section' of the IGKB under supervision of the Institut für Seenforschung (Institute for Lake Research). As far as we know, a manual will be published regarding lake shore mapping and evaluation will begin in 2004.

***Result: From the information that we were able to obtain, we must conclude that presently only two consistent procedures for lake shore evaluation are available. We cannot endorse the LHS procedure for further development and adaptation to Lake Constance parameters and we could not obtain detailed information on the IBK/IGKB procedure.***



*Aerial photography, land register data and Geographic Information Systems (GIS) create new possibilities for the description of the condition and the evaluation of lake shores*

## 12. Summary and Conclusions

Today, water bodies in a close to natural state have scarcity value in central Europe. The landscape is dominated by large-scale drainage, river bed straightening, the strengthening of the shores, as well as by flood areas, which had to make way for agricultural landscapes and so forth. Overall, these are interventions, which have caused destruction and fragmentation of habitats and decreased biodiversity. Lake Constance is also affected by these developments, since - with the exception of the pressure through eutrophication - the pressure indicators have increased during the last decades. The Natural Habitats and the Wild Birds Directives, the NATURA 2000 network and the WFD are trying to reverse this trend. Concerning the effects on the ecological conditions in the shore zones of lakes, the WFD could turn out to be a more comprehensive and effective tool, because it

- states clear environmental objectives and, where necessary, programmes of measures that demand the achievement of specific objectives within given time limits,
- demands transparent, very detailed evaluation procedures, which assess numerous biological, physico-chemical and hydromorphological 'quality elements'.

These procedures are presently being developed;

- not only considers the surface water, but also the water body borders, riverines and lakeshores, as well as landward wetlands,
- integrates the objectives of the Natural Habitats and the Wild Birds Directives and the NATURA 2000 network into its own measures programmes, whereas in conflicting cases the more severe objectives will be targeted.

With this, especially in wetland areas and riparian areas, among these lakeshores, the tasks and objectives of water pollution control overlap with those of nature protection, - especially on Lake Constance, with its wide nature reserve areas and its threatened or endangered flora and fauna.

This requires early and intensive cooperation between nature conservation and water pollution control in the Lake Constance region. Cooperation should not only start with the implementation of measures programmes, but already beforehand with the evaluation of the ecosystems that will be mutually taken into consideration. Going further than Art. 14 (Public Information and Consultation) of the WFD, competence of regional non-governmental nature conservation organisations needs to be incorporated early into the process. The involvement of nature protection is not only needed in reserve areas, but it is also necessary outside of these areas, in the sense of a broad and wide area protection of the environment, especially since many endangered and threatened populations (among others several 'Appendix'-species from the Natural Habitats Directive) can also be found outside of the reserve areas.

We can see here, - at least concerning the Lake Constance shore zone-, a considerable backlog demand, which we trace back to a traditional lack of cooperation between (private) nature conservation and water pollution control and management. An example for this is the fact that the IGKB is preparing a purely limnological lakeshore evaluation procedure, in the development of which no nature conservation professional competence, for example from the pool of private nature conservation, has been consulted.

## 13. Recommendations

### **(a) Integration of the objectives of professional nature conservation and water pollution control**

The EU-Water Framework Directive is not a conservation directive per se. However, it has many conservation-specific qualities. As a consequence, an implementation, will have considerable importance for the conservation of moving and still water bodies as well as wetlands, including the lake shore. As a result, a better integration between water management and conservation objectives is urgently required. However, we have the impression that -especially in Baden-Württemberg- the nature and environmental protection non-governmental organisations are, at the best, only superficially involved in the development of implementation strategies.

We plead for a stronger engagement of nature conservation, and here in particular also more involvement of the private conservation sector on regional and local levels in the implementation process of the WFD. The aim is to increase the involvement of conservation objectives in all implementation steps, starting with the surveying and evaluation, as well as in the monitoring, of water bodies.

### **(b) Development of an evaluation procedure for lakeshores on the basis of the WFD-concept**

In water pollution control there are many multi-metric, water body type-specific evaluation procedures, which are currently being developed and tested, and which use the potential close to natural condition as a reference and use the multi-metric distance between the as-is-condition and the reference as an evaluation measurement. We assume that this concept will find acceptance in the medium-term. In spite of many questions and problems in the details, we consider this method to be convincing, transparent, easily communicated and extensible. We would like to incorporate evaluation methods that can be used for riverine and lakeshore wetlands to be incorporated into this structure, as far as this is advantageous for the mutual interests of water management and conservation. We recognise that this requires extensive conceptual work and discussion. However, we believe that integrative

environmental protection is needed, and that the synergies, which can arise through the evaluation of water bodies in practise, justify the efforts.

The WFD and its CIS-guidance documents offer a wide-reaching, integrative approach. However, in view of the special features of the lake shore zone they are not detailed enough. Status description and evaluation systems for the lakeshore can profit from the conceptual guidelines of the WFD, as well as from concepts for the evaluation trophic status and from the evaluation of hydro-morphologic status of running waters. In detail these are

- clear separation of the description of the status and the evaluation,
- 'Leitbild' orientation (the reference condition is the close to natural condition),
- the determination of the reference condition and its range not only through the use of measured values, but also through the use of visual examples and verbal descriptions (german „Steckbriefe“, 'Wanted' posters),
- an evaluation scale with five levels (in contrast to the 3-level [Natural Habitats Directive] or the 7-level [LAWA] scales),
- Aggregation of the index valuations not arithmetically (e.g. by averaging or similar), but through professional and ecological arguments,
- consideration of the „minimum“ and the „pessimum“ principles in the aggregation,
- probabilistic (and not static) understanding of an 'ecological condition',
- an initial and approximate evaluation procedure for small scale work, primarily based on aerial photography and planning documents, as well as any other available information, possibly supplemented by expert based procedures,
- more emphasis on the water body structure and the hydrological relationships, in relation to the biological quality elements,
- explicit requirements for quality assurance at the field work level (e.g. teaching, inter-laboratory calibration, intercalibration) and at the data processing level (data control, data-bases), as well as on the evaluation itself (analysis of variability, confidence levels and stability of evaluation data),

- practical and implementation orientated research, e.g. about the relationship between environmentally relevant activities of humans, forms and intensities of pressures and their impacts on the lakeshore ecosystems.

We are convinced, that in the meantime a large amount of knowledge and experience has been gathered about the „design“ of multimetric evaluation procedures, so that the preliminary work for a lakeshore evaluation procedure can be started without delay.

**(c) Realisation of public participation during the implementation of the WFD on Lake Constance**

Public participation, in accordance with Art. 14 WFD, does not directly affect the status description and evaluation of surface water bodies. However, it does affect the way in which the nature and environmental protection non-governmental organisations can participate in the implementation process of the WFD.

We agree with the CIS „Guidance on public participation in relation to the Water Framework Directive“, that the earliest possible participation of interested parties can have positive effects on the quality of status surveys and monitoring programmes.

Public participation can be broken down into three intensities:

- access to background information for the „wider public“ and „interested parties“
- Consultation of the „interested parties“ (=the lowest level),
- active involvement of the „interested parties“ (=higher level)

Not only professional organisations from the public sector (e.g. the large, professional nature and environmental protection non-governmental organisations) and the private sector (economic and industry groups, research institutions) belong to the „interested parties“, but also local, non-professionally organised groups with locally bound interests.

We see the following advantages of increased public participation

- the awareness of the public concerning water pollution control and environmental protection topics will be increased,
- the responsible authorities recognise that the experience and the initiatives of the interested parties, among others the nature and environmental protection NGOs, can be useful

*Scientific research on the shore of Lake Constance: Research divers at work*



- the acceptance, concern and support from the public about decisions will be strengthened,
- the implementation will be more time and cost efficient, because the number of misunderstandings and legal conflicts is kept to a minimum.

We expect that these positive effects will not only occur on a wide scale, that is on a national level or on the level of river catchment areas, but also on a regional level of partial catchment areas and river basin (sub-)districts.

In view of the great importance of the lakeshore zone for water pollution control and nature conservation and in view of the fact that the IGKB has declared that the shore and shallow water zones are to be the main emphasis of the Aktionsprogramms Bodensee 2004 bis 2009 (Action Programme Lake Constance 2004-2009), the involvement of nature conservation and the rich infrastructure in nature protection NGOs is long overdue. In detail:

- the local and regional subsections of large nature protection organisations (e.g. BUND [Friends of the Earth Germany], NABU [Bird-life International Germany], Bund Naturschutz Bayern [Bavarian Nature Protection Association], Österreichischer Naturschutzbund [Austrian League for Nature Conservation], Pro Natura Switzerland) and fishing organisations (e.g. Landesfischereiverbände Sued baden and Suedwuerttemberg-Hohenzollern) as well as locally active groups,
- the state-run and private conservation centres (Mettnau, Wollmatinger Ried, Eriskircher Ried, Vorarlberger Rheindelta),
- the border crossing cooperation structures (in particular the Ornithologische Arbeitsgemeinschaft Bodensee [Ornithological Workgroup of Lake Constance], Umweltrat Bodensee [Environmental Council Lake Constance], Bodensee-Stiftung [Lake Constance Foundation for Nature and Culture], Global Nature Fund, Verein für die Geschichte des Bodensees und seiner Umgebung [The Society for the History of Lake Constance and its Surroundings], Arbeitsgruppe Bodensee ufer [Working Group for the Lake Constance shore]) and their members and staff, as well as

- the museums of natural history (e.g. Inatura Dornbirn, the museums of natural history in Konstanz, Kreuzlingen, St. Gallen and Frauenfeld, Hegaumuseum Singen) and their supporting scientific communities

The IGKB emphasises in its action programme, that „the cooperation between other nature protection organisations, which are active on Lake Constance must be intensified“ and that the „the action programme, according to its objectives and contents, are predestined to support such cooperation...“. An important first step could be the joint formulation and implementation of a lake shore evaluation procedure on Lake Constance. In view of this, we believe that the conservation groups should consider taking the initiative and approaching the IGKB with their ideas. The Internationale Kommission zum Schutz der Donau (IKSD, International Commission for Protection of the Danube) and the Internationale Kommission für den Schutz des Rheins (IKSR, International Commission for Protection of the Rhine) can serve as examples. The conservation groups have access to all information and are allowed to speak at meetings, even if they are not allowed to vote.

