ALP LAKES

ALPINE LAKES NETWORK

ALPINE LAKES

Survey between land and water

Water uses

Water Framework Directive

Monitoring

Catchment

Lakes types

Restoration measures

This project has received European Regional Development Funding through the INTERREG IIIB Community initiative

Alpine Space

Interreg III B

Lake Como

Presentation

In late 2004, the Rhône-Alpes regional council decided to become lead partner of the Alplakes project, a cross-border network of lakes in the Alps. The decision followed an in-depth exploratory mission that convinced regional politicians of the need to and advantages of widening to a European scale the approach to issues raised by the conservation and enhancement of these great lakes, exceptional features of our natural heritage.

The programme, backed by the European Union's Community Initiative Programme "Interreg IIIB Alpine Space" has for three years brought together a diversity of European partners having some of the largest lakes in the Alpine arc in their territory, including the regions of Lombardy and the Veneto, the Provinces of Trento and Belluno, the Tourist District of the Lakes of Piedmont, the Piedmont Regional Environmental Protection Agency, the National Institute of Biology of Slovenia, the Land and the Institute for Lake Research of Carinthia.

In Rhône-Alpes, the public interest group of the Great Lake Bourget, the Tourist Information Office of Aix-les-Bains, the Lake Annecy Mixed Syndicate and the Rhône-Alpes Tourist Engineering Mission (MITRA), all institutions that manage and enhance these sites' rich lakeside spaces and resources, are also involved in the network alongside the Regional Council. The Provence-Alpes-Côte d'Azur region and the Chablais inter-district planning authority have for their part joined the network as observers.

The main objectives around which the network has united were to encourage exchanges of experience between the different levels of local authorities involved in restoring and enhancing lakeside heritage locations, as well as to initiate joint promotion, awareness or pilot experimental initiatives based on sustainable development principles.

An initiative of this nature is always a gamble, insofar as the role of the different levels of local authorities and other public institutions varies considerably from one European country to another, which results in a great diversity of contexts in which public action is organized. The scope of the research conducted as part of a comparative approach can thus be limited at times.

That is why I am particularly happy to be given the opportunity to ask you to discover the results achieved by the operational working party attached to this document.

The work done, carried out according to a rigorous methodology and the fruit of a participatory approach, has produced very valuable results.

Thanks to it we now have a range of data which the network members will be able to use to inform their citizens in line with the principles of sustainable development.

For the Rhône-Alpes region, this work represents a contribution to the implementation of the general principles it has laid down, both to make Rhône-Alpes an "eco-region" and, through its regional mountain strategy, to enhance the specific assets of its mountainous areas while respecting their natural and cultural heritage.

I would like to warmly thank all our partners on the programme who have spared no effort to nurture this partnership and ensure a joint production of quality, of which this work is glowing proof.

Sylvie Gillet de Thorey

Vice President of the Rhône-Alpes regional council, responsible for tourism and the mountains

Lake Wörthersee

Presentation

In 2004, Lombardy Region joined the European project called "Alpine Lakes Network" – where Rhône Alpes Region is the lead partner – identifying it as a tool to protect its water resources that still represent a rich heritage for this territory and a key factor for a sustainable development.

At that time, Lombardy Region was engaged in two major projects regarding the lake topic: the River Basin Management Plan and the Lombardy's Lakes Observatory Project, both aimed at protecting and restoring lake environment in view of a multiple and sustainable long-term use of this natural resource.

Those projects have now been completed.

The Management Plan as stipulated by the Regional Act No. 26/2003 and the national regulations, was approved in 2006. In this Plan, general objectives on the management of water resources at regional level, and relevant measures to achieve them, were set with special regard to lakes and their multiple use.

The Lombardy's Lakes Observatory has implemented a system for collecting, storing and handling all data available on Lombardy lakes, thus becoming a useful tool to increase knowledge on water quality and highlight the critical aspects, as well as the priority steps to be taken for protection and restoration.

The Regional Department for Public Utilities, Networks and Sustainable Development – relying on the technical and scientific co-operation with IREALP – has joined the "Alplakes" project and mainly contributed to the topics concerning the quality of lakes and connected environments, by working closely with all the other project partners and sharing the latest know-how with them.

Centered on a common and shared approach, this activity has led to the development of a system with useful topics and indicators to characterize the lake territory as a whole, analyzing not only water quality but also the quality of the whole surrounding area and pinpointing the major anthropogenic pressures and their impact on water.

Thanks to this work we are able today to have this publication which gives a realistic picture of the status of lakes. It is targeted at the general public but it also contains plenty of detailed technical information as accurate as that usually provided to professionals.

As a matter of fact, we believe it is of fundamental importance that public opinion becomes increasingly aware of lake environmental quality, the activities carried out by the institutions involved in lake management, the actions currently taken as well as the principles of a sustainable development. Any citizen's behavior may contribute to the maintenance and improvement of such beautiful and frail environments if he/she knows and is fully aware of the best thing to do.

Massimo Buscemi
Regional Councillor
Responsible for Nets, Public Utilities, and Sustainable Development

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Photos

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Lake Ossiacher See

Lake Maggiore - Isola Bella

Survey between land and water

Why an "Alpine Lakes Network"?

Lakes within the alpine space have several aspects in common, thus featuring a specific identity. As a matter of fact, alpine lakes have common physical, ecological and socio-economic features: they are remarkably important as for culture and are particularly interesting from the economic and emotional point of view. Therefore, lake bodies are widely used in various ways, and large human settlements with high population density and many business activities developed in the surrounding areas.

The resulting pressures can have a negative impact on the territory and the lake itself, thus leading to a large-scale challenge: how can we reconcile the development of the areas around the lakes with preservation of their natural ecological and hydrological assets? Local and regional authorities have similar problems in managing lakes in the alpine area. Yet, the difficulties they run into and the solutions they adopted are relatively unknown to both the population and, too often, lake area managers. In this scenario, co-operation projects, like "Alplakes", can be a valuable instrument for communication and spread of knowledge.

Alpine lakes network was created in 2005, following the approval of "Alpine Lakes Network" project by the European Union that co-financed it through European Regional Development Funds.

This network encourages the exchange of information and managerial models among the various stakeholders at regional or local level through the network itself, so as to help them make strategic decisions, showing the advantages and drawbacks of each model in view of a sustainable development.

Project activities

The project has focused mainly on three important lake-related topics: quality, tourism and sustainable development of lake areas.

As for lake environmental characterization, a scientific approach has been developed to assess all the aspects relating to lake water quality and uses, pressures existing in the surroundings and problems resulting from exploitation of water resources.

Within this activity, one of the main objectives was to compare the different approaches and methods in use in the various participating Countries, by sharing a certain number of useful indicators to describe the various situations in the alpine region in an homogeneous and comparable way.

As a result of the characterization activity, two different products were published.

This document is for a wide public and contains a series of information on our lakes, which are reported in a simple but scientifically-rigorous way, so that whoever is interested can know the health conditions of the lakes studied under the project and can understand the most common issues, main water uses and human impact on lake ecosystem.

A more technical publication (atlas) is addressed to experts and lake managers and gives a résumé of all the activities carried out and a description of methods being used, in order to give a common characterization of lake environmental quality. In this way, sheets with detailed information could be then filled in for the project lakes that were selected as an example.

Project partners and lakes in the network

The project was defined and developed by a series of authorities and institutions working within the alpine space and representing almost all the Countries and regions in this area. Participants in the project are: for France, Rhône Alpes Region (project lead partner) and Rhône Alpes Regional Tourism Committee; for Italy, Piedmont Regional Agency for Environmental Protection (ARPA), Tourist District of Piedmont lakes, Lombardy Region, Veneto Region, Belluno Province and Autonomous Provincial Government of Trento; for Austria, Carinthia Province with Carinthia Institute for Research on Lakes; for Slovenia, the Slovenian National Institute of Biology.
Within one's own territory, each partner selected a series of lakes considered as representative, on which to apply the shared approach defined by the project.

List of lakes

Region/Province (Country)	Lake name	Region/Province (Country)	Lake name
Rhône Alpes (France)	1. Lake Bourget	Trento (Italy)	14. Lake Ledro
	2. Lake Annecy		15. Lake Terlago
Piedmont (Italy)	3. Lake Avigliana Grande		16. Lake Cei
	4. Lake Candia		17. Lake Caldonazzo
Piedmont and Lombardy	5. Lake Maggiore		18. Lake Levico
Lombardy (Italy)	6. Lake Varese	Veneto and Belluno (Italy)	19. Lake Alleghe
	7. Lake Como		20. Lake Santa Croce
	8. Lake Mezzola	Carinthia (Austria)	21. Lake Milstätter See
	9. Lake Pusiano		22. Lake Ossiacher See
	10. Lake Annone Est		23. Lake Wörthersee
	11. Lake Iseo	Slovenia	24. Lake Bohinj
	12. Lake Valvestino		
Lombardy – Trento - Veneto	13. Lake Garda		

Geographical location

Lake environment

In selecting the topics and indicators that could be useful to describe the features of a lake environment, attention was paid not only to lake waters but also to the catchment basin, i.e. the entire region of land upstream of the lake, which through watercourses conveys water into the lake itself.
Lake water quality is strictly affected not only by what happens in the water and lake surroundings but also – to a lesser extent – by what happens in the catchment basin. In other words, a strong exploitation of the territory that is spatially far from a lake, can worsen and deteriorate lake water quality.
Therefore, studying lake environment as a whole (lake ecosystem) cannot leave aside a careful characterization of pressures on water environment and their sources in the entire area connected to the lake by rivers, streams and groundwater that drain water into the lake.
This approach is also sanctioned by one of the main items in the European regulation on water protection (Water Framework Directive 2000/60/EC) where the river basin is identified as the basic reference unit for the best management of water resources.
The main objective of this Directive – transposed by now into the national law of all the Countries participating in the project – is to ensure all EU water bodies meet "good" quality status by 2015, by defining and implementing the necessary measures for limiting all those substances that are considered particularly hazardous for the environment. This quality status implies the possibility for lake biological, chemical and physical parameters to have just a slight deviation from the values associated with a condition showing no distortion resulting from human activity.
To this end, the Directive provides that each Member State is involved in the implementation of all those programs of measures needed for a correct river basin management so as to limit pressures and subsequent impacts to a level that does not jeopardize the environmental quality of water bodies.


Lake Mezzola

Another important aspect highlighted by the Directive is public involvement at various levels (national, regional and local levels): a good level of involvement and information on objective decision-making processes and implementation of legislative measures, is needed so that a greater communication transparency favors a greater sharing of the decisions made. Therefore, the "Alplakes" project aims at raising awareness among the public about current lake health condition, to better understand the decisions made by the various public organizations involved in lake management and protection.
Defining a common approach to characterize the lake environments included in the project, it was quite easy to select shared topics and indicators on lake water quality, for chemical and physical parameters. As for biological parameters and analysis on pressures and their sources at catchment basin level, the working out of a shared approach requested a greater effort due to the lack of methodologies or data.

Common problems

Pooling the various experiences at alpine space level made it possible to identify major critical factors, usually resulting from human exploitation of the catchment basin and lake water.

One of the most widespread problems is of course water **pollution** caused by discharging various substances into the water body.

Domestic, industrial and livestock farming wastewater contains high concentrations of pollutants that – because of their effects – can jeopardize water use and water quality.

One of the most well-known problems - probably the main one – linked to heavy anthropogenic impact and subsequent nutrient-rich (in particular nitrogen- and phosphorus-rich) discharges, is water **eutrophication**, a phenomenon already known since the 60s.

The term "Eutrophication" refers to an excessive nutrient enrichment in the water leading to the proliferation of algae and higher forms of plants so as to produce an undesirable change in the balance of water organisms and in water quality.

From an ecological point of view, eutrophication processes are highly complex. In a schematic way, the process may produce three different types of undesirable effects:

- production of a more or less considerable quantity of organic matter consisting of submerged plants (macrophytes) or microscopic algae suspended in the water mass (phytoplankton), or again consisting of both components, which can lead to real algal blooms;
- reduction in dissolved oxygen up to levels incompatible with survival of aerobic aquatic organisms;
- formation of compounds resulting from anaerobic degradation of chemical substances, as well as from a reduced amount of organic matter in the water and sediments, with appearance of or increase in substances such as nitrites, ammonia, hydrogen sulphide, methane, phosphorus soluble salts and other compounds arising from fermentation and decomposition processes.

According to collected data, phosphorus is in general the primary limiting factor capable of regulating plant productivity level. Therefore, it is important to concentrate efforts on phosphorus removal, in order to limit eutrophication. For this reason, this parameter is also considered a good lake environmental quality indicator and was one of the main elements under study during project activities.

High nutrient availability can also entail a change in algal blooms that occur naturally in a water environment when seasons change. This causes an abnormal development of few algal species that in particular conditions can produce toxins endangering life of lake animal organisms.

Another important aspect refers to health problems: when released into the water, pathogenic organisms (such as total coliforms, faecal coliforms, faecal streptococci and salmonella) can jeopardize water use for drinking water supply or bathing. Among diseases, we recall in particular cercarial dermatitis and bothriocephalosis that – even though with lower incidence than in the past – are still important critical factors as for bathing and fresh fish consumption.

Water use conflicts are another common problem in alpine lakes, especially where there is lake water **level regulation**. This is the case of large Italian lakes (having a barrage at lake inlet, capable of regulating water level by a few meters) but also of modified lakes or artificial lakes created by building a dam to use stored water for energy production.

The various users – according to the purpose they use lake water for – need water volumes that vary depending on the period of the year. Irrigation, for example, normally requires large water quantities in summer. Hydroelectric power production requires water especially in summer and winter when there is a higher demand for electric power, thus generating strong fluctuations in lake water level. Other lake water uses are mainly linked to the summer period, like bathing, navigation but also fishing, and they need to keep water level stable, as much as possible, so that the public can comfortably use lake shoreline, boats can easily moor to a landing stage or pier, and fish can reproduce (as fish life cycle can be strongly affected if during egg laying, eggs remain "in the dry" for long periods of time).

Lake Millstätter See

between

Because of these different needs, users' positions often get in conflict. A far-sighted management of water resources is the only way to make the different uses coexist.

Moreover, **shoreline occupation** – often shoreline artificialization – and management of lake surroundings are perceived as a further problem for lakes in the alpine area.

Managing the area directly close to a lake, may originate problems linked on the one hand to impoverishment of water body environmental quality and on the other to inability to gain access to lake shore and thus use the lake itself.

Shoreline artificialization due to a strong territorial urbanization means we are losing shoreline natural functions. As a matter of fact, lake shore morphology, features and habitats are usually of great importance for ecological dynamics of watercourses, as they function as a filter, protection against erosion, nutrient (nitrogen and phosphorus) removal, temperature control thanks to shading and regulation of natural habitats.

Presence of private facilities along the shoreline or of artificial retaining structures such as walls, barriers, etc., is also preventing the public from using lake shoreline. Consequently, lake use is no longer in the public interest and so the relationship between the public and the lake ends: people part with the lake and are no longer interested in lake quality.

A far-sighted management of lake shoreline – being in most of the cases a state property given in concession to private citizens – has to focus on area development to guarantee it is fully and actually used by the public. This is essential to improve health conditions of our lakes.

Guide to consult lake sheets

In lake sheets, you find aggregate information that even though resulting from the application of scientifically-developed indicators, is just for orientation purposes and does not replace official judgements by the various competent institutions. Therefore, for further details, refer to the other detailed publication or to specific publications published by the competent authorities.

Lakes are in geographical location order, from west to east.
Each sheet consists of the following sections:

- **Lake identity card:** it includes main morphometric and hydrologic data featuring the lake and its catchment basin.
- **A portrait of the catchment basin:** it gives a series of information on lake catchment basin, land cover, main pressures exerted on the lake, as well as an indication on wastewater collection system and treatment.
- **The lake and its surroundings:** you find information on lake water quality and trophic evolution, as well as information on lake shoreline and its level of artificialization.
- **Main uses:** you find information on main uses of lake waters, namely water intended for human consumption, bathing, fishing and other uses, such as industry, irrigation, hydroelectric power production and leisure time uses.

Most of the boxes also contain a short comment to better clarify a graph or a chart.

In "The lake and its surroundings" and "A portrait of the catchment basin" sections, phosphorus is the parameter taken into account to create graphs. As already stated in the introduction, phosphorus is the main parameter the eutrophication phenomena depend on, and its value in terms of concentration is a good indicator for lake water quality.

Lake Candia

Identity card

Catchment area: river basin surface expressed in square km. In case of reservoirs and if data are available, the connected basin area is indicated next to natural basin dimensions.
Lake area: lake surface expressed in square km.
Maximal depth: maximal lake depth expressed in m.
Average depth: average lake depth expressed in m and calculated as the lake volume divided by its surface area.
Volume: lake volume expressed in millions of cubic meters.
Average altitude: lake average altitude expressed in meters above sea level.

Water change time: theoretical change time expressed in years and calculated as the lake volume divided by annual average flow rate of the emissary.
Main tributary(ies): name or names of the main tributary or tributaries; when available, annual average flow rate in cubic meters/second is indicated.
Emissary: name of the lake emissary; when available, annual average flow rate in cubic meters/second is indicated.

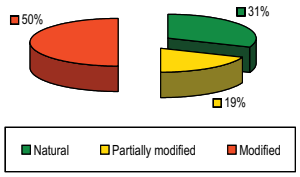
Identity card

Catchment area		6.599	km^2
Lake area		213	km^2
Maximal depth		370	m
Average depth		176	m
Volume		37.500	10^6 m^3
Average altitude		194	m s.l.m.
Water change time		4,1	years
Main tributaries	*Ticino river*	67	m^3/s
Emissary	*Ticino river*	292	m^3/s

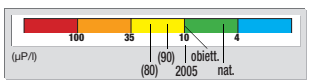
The lake and its surroundings

LAKE MONITORING - lis carried out by the Italian regional offices (ARPA) and Swiss cantonal offices in charge. Moreover, the lake has been under study for over 30 years now by the International Commission for the Protection of Italian and Swiss Waters.

SHORELINE
Only about 15 % of the lake shoreline is protected.



PRESENT CONDITIONS AND FUTURE OBJECTIVES



Current phosphorus concentrations (about 10 µg/l) in the lake show that conditions are close to oligotrophy, i.e. the natural condition of the lake. Starting from the 70s, such concentrations have consistently decreased and then stabilized at the values being found over the last few years.

The lake and its surroundings

WATER MONITORING: you find information on the authority or institution in charge of monitoring, on monitoring frequency and a broad indication of the parameters being monitored.
PRESENT CONDITIONS AND FUTURE OBJECTIVES: a graduated scale shows total phosphorus concentration values (expressed in micrograms of total phosphorus per liter, µg P/l) measured in the lake at different time intervals, according to available data. Each legend is different and pertaining to the lake being analyzed. In general, you find data on:
- concentration at different historical time intervals (the value between brackets indicates the average of the decade)
- current concentration
- natural concentration (nat.), i.e. the phosphorus value the lake would have if undisturbed, with no distortion resulting from human activity, estimated by using the Morpho-Edaphic Index (Vighi and Chiaudani, 1984)
- target concentration (obiett.): when provided for by regional or provincial regulations.

Intervals and colors refer to lake trophic state classification (OECD, 1982), as per the following table:

Total phosphorus (µg/l)	Trophic state
< 4	Ultraoligotrophic
4 - 10	Oligotrophic
10 – 35	Mesotrophic
– 100	Eutrophic
> 100	Hypereutrophic

SHORELINE: a pie chart shows the level of shoreline artificialization (by using data taken from Corine Land Cover 2000 project); classes being

considered are: natural, partially modified or modified. The length of shoreline that falls within a protected area, is also indicated.

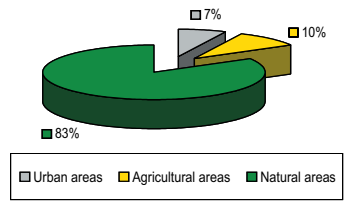
A portrait of the catchment basin

LAND USE AND PROTECTED AREAS: a pie chart shows the prevailing land cover (Corine Land Cover, 2000) broken down into urban areas, agricultural areas and natural areas. You also find an indication of the territory within the basin that is covered by protected areas and what type of area is (by a pie chart).
Types of protected areas are: national and regional parks (or provincial biotypes for Trento province), sites belonging to Natura 2000 Network (consisting of SCI – Sites of Community Importance, Directive 92/43/EEC and SPA – Special Protection Areas, Directive 79/409/EEC) and areas protected by international conventions (Ramsar Convention on Wetlands).
WASTEWATER COLLECTION SYSTEM AND TREATMENT: the first graduated scale shows coverage percentages as for wastewater collection and treatment service, in other words what percentage of resident population is served by the public wastewater collection system and what percentage of those connected to such sewerage system is also served by wastewater treatment plants.
The second graduated scale shows the percentage of main nutrient removal within the catchment basin. When the load generated is fully collected outside the basin by means of sewer pipes, a very high percentage is indicated (over 95%). When the load generated is not collected outside the basin but it is treated within the basin itself by public treatment plants, the % refers to nutrient removal capacity of treatment plants.
MAIN PRESSURES (P LOADS): a pie chart shows main pressure sources within the basin, broken down into point sources (localized discharges by treatment plants, collecting system, overflows, etc.), anthropogenic diffuse sources (agriculture and animal husbandry) and natural sources (natural soil runoff). The parameter being considered is the phosphorus load (expressed in tons of phosphorus per year, t P/a) that actually reaches the lake.
Instead, the graduated scale gives an indication on:

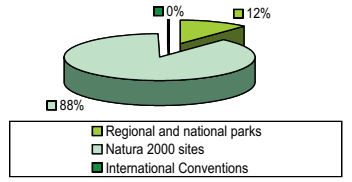
- potential load: load generated within the basin by various pressure sources, which can potentially reach the lake
- residual load: portion of potential load that actually reaches the lake,
- natural load: load that we would have if no sources of anthropogenic pressure were present
- target load: load established by regional or provincial legislation, where available.

A portrait of the catchment basin

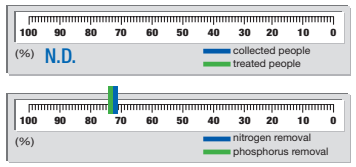
LAND USE AND PROTECTED AREAS



61% of the total area is protected

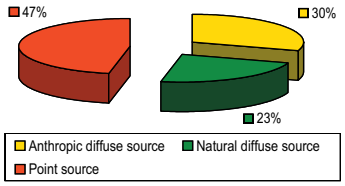


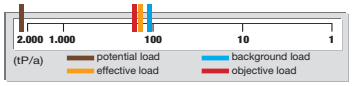
WASTEWATER COLLECTION SYSTEM AND TREATMENT



The catchment area hosts over 100 treatment plants serving about 545,000 population equivalents.
Thanks to the actions taken and the measures planned for, the nutrient removal percentage will reach 75% over the next few years.

MAIN PRESSURES





Pollutant loads decreased over the last few decades and at present they already correspond to the target levels being established.

Lake Bohinj

Main uses

DRINKING WATER SUPPLY

You find information on the existing points where lake water is abstracted for human consumption.

Number of abstraction points and location: number of abstraction points in the lake and, if available, their location

Volume of water extracted: volume of water abstracted and estimate on population potentially served by it

Number of Municipalities served: number of Municipalities where water abstracted from a lake goes into the water supply system after treatment

Classification of sampling: A1, A2 or A3 classification (under Directive 75/440/EEC), according to the processes to be carried out to treat and turn water into drinking water – the more you need to treat the higher the classification number.

BATHING

You find data with respect to the last available monitoring period, relating to the number of sites sampled and the percentage of law-compliant sites. There is also a graph showing law-compliant site trend over the years.

To this effect, when comparing the various lake bodies, it is necessary to note that current Italian regulations are more restrictive than the relevant European Directive the other project partners have transposed into their national law.

FISHING

Waters: information linked to water type (salmon fishing waters or cyprinid waters, according to Directive 78/659/EEC).

Type: type of fishing you can practise on the lake, divided into professional fishing (when available, the number of existing fishermen is indicated) and amateur fishing.

Main species: list of the main species in the water.

Quantity fished: when available, information on productivity in terms of lake fish fauna.

Bans or limitations: additional information on fishing bans and limitations linked to fish reproduction periods or to conferred exclusive fishing rights.

For detailed information, refer to provincial fish plans or specific publications.

OTHER USES

Information is given on possible other uses of lake water, namely:

- navigation
- industrial use
- irrigation
- energy production
- leisure time uses.

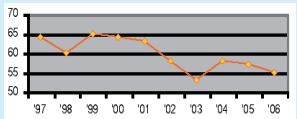
Main uses

DRINKING WATER SUPPLY

Number of abstraction points: 1
Location: Leggiuno
Water extracted: 20 l/s (~3,500 persons)
Classification of sampling: A2

BATHING

Number of sites monitored (2006): 68
Compliant sites: 81%
Trend over the years:



Number of sites where bathing is allowed

FISHING

Salmon fishing waters
Main species: lake whitefish, perch, lake trout, roach.
Type: Professional (35 fishermen) and amateur fishing
Bans: various bans exist, according to the period of the year and the species fished.
Limitations: as to the total quantity and minimum length (refer to provincial regulations).

OTHER USES

Navigation:
Allowed without restrictions
Public transport
Industry: water abstraction 66 l/s
Irrigation: water abstraction 522 l/s
Other leisure time uses: Sailing, canoeing, windsurfing, water skiing, diving.

Lake Bourget

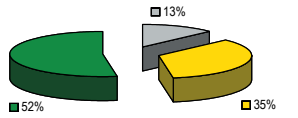
Lake Bourget, the largest natural lake in France, is located in the heart of Savoy. During the roman period there was an important development of the thermal baths, "Acquae" which became later Aix-Les-Bains.

Identity card

Catchment area		653,8	km²
Lake area		44,5	km²
Maximal depth		145	m
Average depth		81	m
Volume		3.600	10^6 m³
Average altitude		231	m a.s.l.
Water change time		7	years
Main tributaries	*Leysse, Sierroz*	6,11	m³/s
Emissary	*Canal de Savières*	9	m³/s

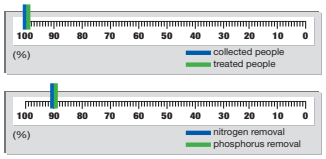
A portrait of the catchment basin

LAND USE AND PROTECTED AREAS



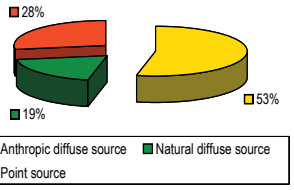
55% of total area is protected

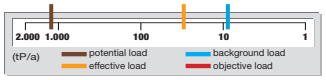
WASTEWATER COLLECTION SYSTEM AND TREATMENT



The catchment area hosts 25 treatment plants serving about 400,000 population equivalents: the 90% of their load is collected out of the basin through the Rhones
So the nutrients removal percentage are very good.

MAIN PRESSURES





Information not available.

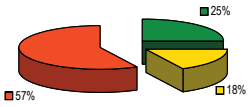
The lake and its surroundings

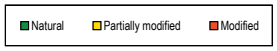
LAKE MONITORING

GIP Le Grand Lac

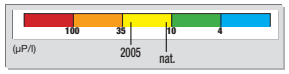
SHORELINE

100 % of lake shoreline is protected





PRESENT CONDITIONS AND FUTURE OBJECTIVES



Phosphorus concentrations decreased from the 50s, when the lake was in eutrophic condition. After infrastructure works and the construction of a vast ring of the main drains in 1980, the phosphorus values are decreased and now the lake is in a mesotrophic condition with P concentration of about 30 µg/l.

Main uses

DRINKING WATER SUPPLY

Number of abstraction points: 2
Location: Aix les Bains, Tresserve.
Water extracted: 54,5 l/s
Classification of sampling: A2 e A1

BATHING

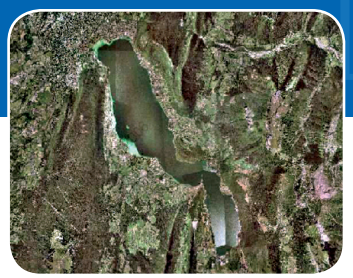
Number of sites monitored (2006): 10
Compliants sites: 100%

FISHING

Salmon fishing water
Main species: white fish, arctic char, lake trout, pike, perch
Type: professional and amateur

OTHER USES

Navigation:
Allowed without restrictions
Public transport
Other leisure time uses:
Sailing, canoeing, diving



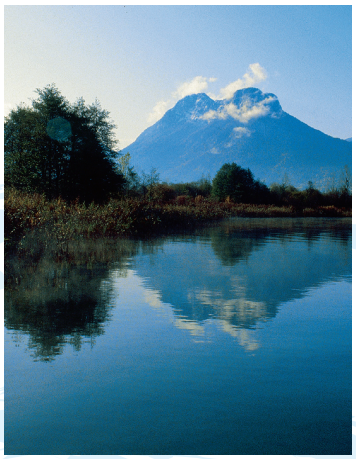
Lake Annecy

Lake Annecy (Haute-Savoie) is the second largest natural lake in France. To preserve its quality and uses, during the 70s, a ring of drains was built around the lake to convey and to treat wastewaters outside the basin.

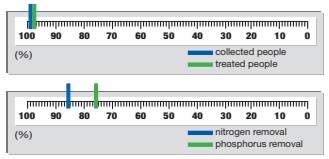
Identity card

Catchment area		278	km^2
Lake area		27	km^2
Maximal depth		65	m
Average depth		41	m
Volume		1124,5	10^6 m^3
Average altitude		446	m s.l.m.
Water change time		3,8	years
Main tributaries	*Eau Morte, Ire, Laudon, Bornette*		
Emissary	*Thiou*	8	m^3/s

A portrait of the catchment basin



WASTEWATER COLLECTION SYSTEM AND TREATMENT

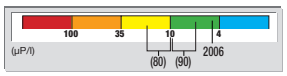


Within the lake catchment basin, there are no treatment plants: all discharges are collected, treated and conveyed outside the basin. The final receiver is the Fier, a tributary of the Rhône. The SILOE wastewater treatment plant is located in Cran Gevrier and has a capacity of 230,000 inhabitants, treating about 30,000 m3 effluents per day.

The lake and its surroundings

LAKE MONITORING - It is carried out by SILA - Syndacat Mixte du Lac d'Annecy.

PRESENT CONDITIONS AND FUTURE OBJECTIVES



Over the last 10 years, phosphorus concentrations have reached stable values, between 3 and 8 µg /l. Such full oligotrophic value corresponds to values measured before the 70s.

Main uses

DRINKING WATER SUPPLY

Number of abstraction points: 6
Location: Annecy, Annecy-le-Vieux, Menton-St-Bernard, Talloires, Saint Jorioz, Veyrier-du-lac
Water extracted: 349 l/s
Number of municipalities being served: 10
Classification of sampling: A3

BATHING

Number of sites monitored (2006): 13
Compliant sites: 100%
Trend over the years: In 2002-2006 the sampling of the 13 sampling points always provided positive results as to bathing permission

FISHING

Salmon fishing waters
Main species: lake whitefish, arctic char, lake trout, pike, perch
Type: professional (4 fishermen) and amateur (~2.000 fishermen) fishing
Quantities fished: the lake has a production of over 12 kg/ha in noble species, with a good halieutic production.

OTHER USES

Navigation: Allowed without restrictions
Public transport
Other leisure time uses: sailing, canoeing, diving.

Lago Grande di Avigliana

Lake Grande di Avigliana is located within the Parco Naturale Laghi di Avigliana [Natural Park of the Avigliana Lakes]. Tourism has significantly developed in the area around the lakes – an area that is remarkably interesting for historical and naturalistic reasons: north-west of the lake, there is the Mareschi area, the most western Italian wetland.

Identity card

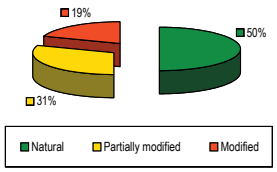
Catchment area		11,5	km^2
Lake area		0,89	km^2
Maximal depth		26	m
Average depth		19,5	m
Volume		17,2	10^6 m^3
Average altitude		346	m s.l.m.
Water change time		2,3	years
Main tributaries	*Rio Meana*	-	m^3/s
Emissary	*C. Naviglio*	-	m^3/s

The lake and its surroundings

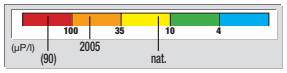
LAKE MONITORING - Since 2000, monitoring is carried out on a monthly basis by Piedmont Region - ARPA Piedmont, as to both chemical-physical and microbiological parameters.

SHORELINE

100 % of lake shoreline is protected



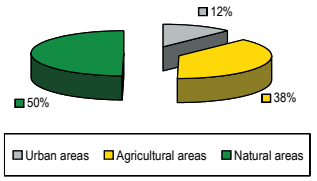
PRESENT CONDITIONS AND FUTURE OBJECTIVES



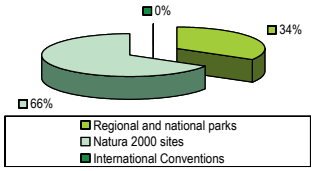
Total annual average phosphorus concentration shows a definite decreasing trend. From maximal values measured during the 80s (average values in circulation 250 µg/l), we moved to values below 150 µg/l in 1999 and values around 70 µg/l in 2002. This value is still widely above the value indicated as natural, i.e. 16 µg/l.

A portrait of the catchment basin

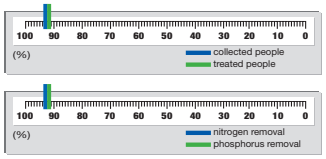
LAND USE AND PROTECTED AREAS



35% of the total area is protected

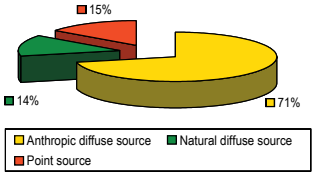


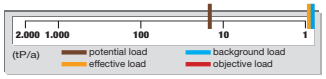
WASTEWATER COLLECTION SYSTEM AND TREATMENT



The catchment basin does not host any treatment plant: Avigliana wastewater collection system convey sewage to the Rosta consortium treatment plant, discharging outside the basin. In this way, in the catchment basin we can obtain excellent load reduction percentages.

MAIN PRESSURES





The pollutant loads decreased over the last years and the target levels indicated in regional regulations (environmental quality condition, sufficient level and good level respectively) are expected to be reached by 2008 and 2016.

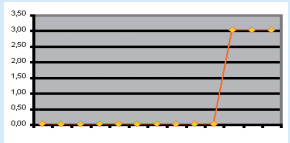
Main uses

DRINKING WATER SUPPLY

Lake waters are not used for human consumption.

BATHING

Number of sites monitored (2007): 3
Compliant sites: 100%
Trend over the years:



Number of sites where bathing is allowed

FISHING

Salmon fishing waters
Main species: carp, chub, tench, bleak, eel, black bass, European perch
Type: professional and amateur
Bans: none

OTHER USES

Navigation: allowed to electric motor boats up to 5 Km/h speed
Forbidden to boats with spark-ignition engines (except for boats for public transport)
Irrigation: 225 l/s of water abducted from the lake
Other leisure time uses: canoeing, kajacking, windsurfing, water skiing, sailing, speedboat racing.

Lake Candia

Lake Candia belongs to lake water bodies of the moraine Amphitheater of Ivrea. The lake is in the Provincial Natural Park of Lake Candia and is among the most important wetlands in Piedmont region (classified as SCI).

Identity card

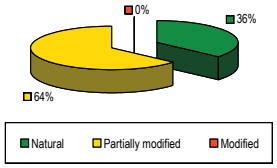
Catchment area	8,1	km^2
Lake area	1,35	km^2
Maximal depth	8	m
Average depth	5,9	m
Volume	8,1	10^6 m^3
Average altitude	226	m s.l.m.
Water change time	6,7	years
Main tributaries	*Underground sources, R. della Motta*	
Emissary	*C. Traversaro*	

The lake and its surroundings

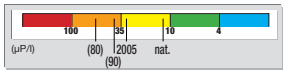
LAKE MONITORING - Since 2000, monitoring is carried out on a monthly basis by Piedmont Region - ARPA Piedmont, as to both chemical and microbiological parameters.

SHORELINE

About 71% of the lake shoreline is protected



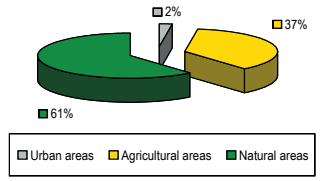
PRESENT CONDITIONS AND FUTURE OBJECTIVES



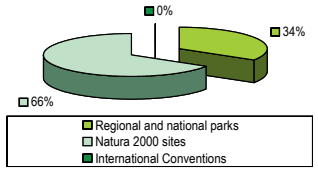
Ecological restoration measures undertaken on Lake Candia in 1986- 1996 period, led to a regression in lake eutrophication. Among indicators of trophic condition, phosphorus is the one that had a less definite decreasing trend. As a matter of fact, in that period of time, annual average total phosphorus concentration only changed slightly, maintaining values close to 30 µg/l, yet halved with respect to early 80s (65 µg/l in 1983).

A portrait of the catchment basin

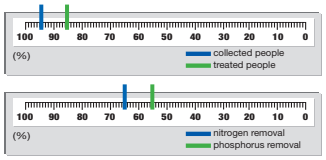
LAND USE AND PROTECTED AREAS



30% of the total area is protected

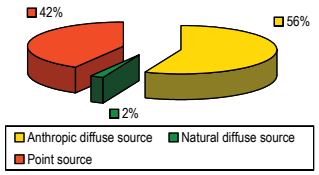


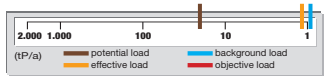
WASTEWATER COLLECTION SYSTEM AND TREATMENT



The catchment area hosts 2 treatment plants serving about 1,400 population equivalents.
Measures being implemented should ensure the nutrient removal percentages to reach over 75% by the end of 2008.

MAIN PRESSURES





Over the last 20 years, the lake has been submitted to important activities for ecological restoration, with a clear-cut reduction in inlet loads. At present, these loads do anot diverge much from values being considered as natural.

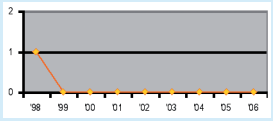
Main uses

DRINKING WATER SUPPLY

Lake waters are not used for human consumption.

BATHING

Number of sites monitored (2007): 3
Compliant sites: 0%
Trend over the years:



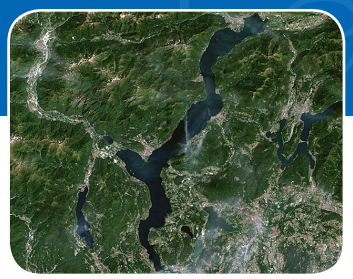
Number of sites where bathing is allowed

FISHING

Main species: pike, tench, catfish, rudd.
Type: Amateur fishing
Bans: none
The imminent approval of Fishing Regulations will allow a careful control on fishing activities in the lake.

OTHER USES

Navigation:
Motor boats are forbidden (with some exceptions – see draft bill "Regulations on how to use and exploit the Provincial Natural Park of Lake Candia").
Other leisure time uses:
canoeing, triathlon.



Lake Maggiore

Lake Maggiore, or Verbano, is the second Italian lake as for its dimensions and volume. It is at the frontier between Italy and Switzerland: 80% of the lake surface is within the Italian territory, while its catchment basin is equally distributed between these two Countries.

Identity card

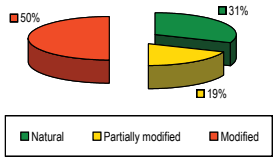
Catchment area		6.599	km^2
Lake area		213	km^2
Maximal depth		370	m
Average depth		176	m
Volume		37.500	10^6 m^3
Average altitude		194	m s.l.m.
Water change time		4,1	years
Main tributaries	*Ticino river*	67	m^3/s
Emissary	*Ticino river*	292	m^3/s

The lake and its surroundings

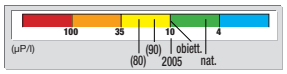
LAKE MONITORING - lis carried out by the Italian regional offices (ARPA) and Swiss cantonal offices in charge. Moreover, the lake has been under study for over 30 years now by the International Commission for the Protection of Italian and Swiss Waters.

SHORELINE

Only about 15 % of the lake shoreline is protected.



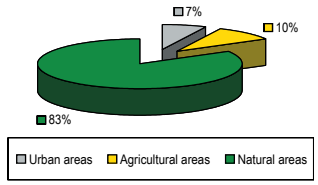
PRESENT CONDITIONS AND FUTURE OBJECTIVES



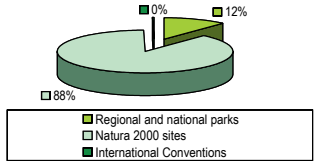
Current phosphorus concentrations (about 10 µg/l) in the lake show that conditions are close to oligotrophy, i.e. the natural condition of the lake. Starting from the 70s, such concentrations have consistently decreased and then stabilized at the values being found over the last few years.

A portrait of the catchment basin

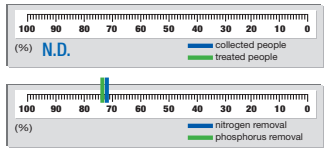
LAND USE AND PROTECTED AREAS



61% of the total area is protected

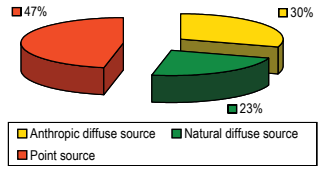


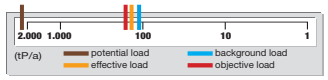
WASTEWATER COLLECTION SYSTEM AND TREATMENT



The catchment area hosts over 100 treatment plants serving about 545,000 population equivalents.
Thanks to the actions taken and the measures planned for, the nutrient removal percentage will reach 75% over the next few years.

MAIN PRESSURES





Pollutant loads decreased over the last few decades and at present they already correspond to the target levels being established.

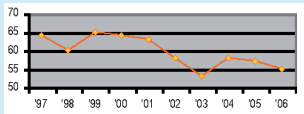
Main uses

DRINKING WATER SUPPLY

Number of abstraction points: 1
Location: Leggiuno
Water extracted: 20 l/s (~3,500 persons)
Classification of sampling: A2

BATHING

Number of sites monitored (2006): 68
Compliant sites: 81%
Trend over the years:



Number of sites where bathing is allowed

FISHING

Salmon fishing waters
Main species: lake whitefish, perch, lake trout, roach.
Type: Professional (35 fishermen) and amateur fishing
Bans: various bans exist, according to the period of the year and the species fished.
Limitations: as to the total quantity and minimum length (refer to provincial regulations).

OTHER USES

Navigation:
Allowed without restrictions
Public transport
Industry: water abstraction 66 l/s
Irrigation: water abstraction 522 l/s
Other leisure time uses:
Sailing, canoeing, windsurfing, water skiing, diving.

Lake Varese

Lake Varese is located in a green trough, in the eastern part of the basin of Lake Maggiore, near Lake Comabbio and Lake Monate. In the past, an important action was taken to restore lake water quality.

Identity card

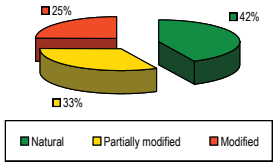
Catchment area		113,8	km²
Lake area		14,52	km²
Maximal depth		24,5	m
Average depth		11	m
Volume		153,65	10^6 m³
Average altitude		238	m s.l.m.
Water change time		1,9	years
Main tributaries	*Brabbia*	0,75	m³/s
Emissary	*Bardello river*	3	m³/s

The lake and its surroundings

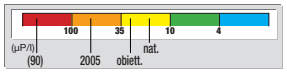
LAKE MONITORING - ARPA Lombardy carries out monitoring 4/6 times per years depending on the ecological parameter to be monitored; the Local Health Authority ASL carries out the microbiological monitoring

SHORELINE

All the lake shoreline is protected



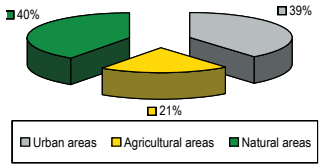
PRESENT CONDITIONS AND FUTURE OBJECTIVES



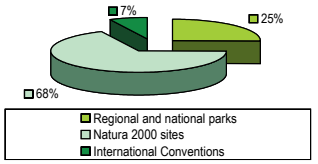
Lake conditions had a clear improvement starting from the 70s, also thanks to actions taken for wastewater collection system. Nonetheless, the lake is now in a trophic condition: measures provided for by the regulations in force should allow reaching the objectives indicated by 2018.

A portrait of the catchment basin

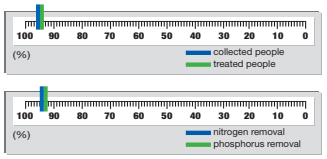
LAND USE AND PROTECTED AREAS



46% of the total area is protected

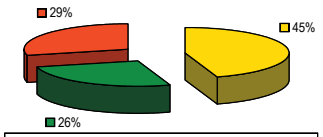


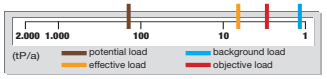
WASTEWATER COLLECTION SYSTEM AND TREATMENT



Within the catchment basin, there are no treatment plants.
Since 1986, there is a ring of main drains around the lake that convey discharges to Gavirate treatment plant, equipped with advanced systems. This implies an almost complete nutrient removal.

MAIN PRESSURES





The nutrient loads decreased over the last few decades and the target level indicated in regional regulations is expected to be reached by 2016.

Main uses

DRINKING WATER SUPPLY

Lake waters are not used for human consumption.

BATHING

Number of sites monitored (2006): 0

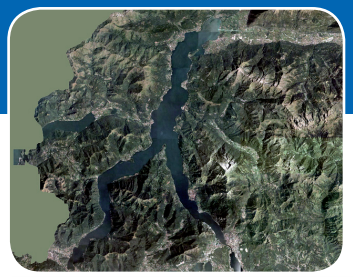
Trend over the years:
Over the last 10 years, just in 2001 and in 2002 one of the two stations being monitored gave results favorable to bathing. Since 2004, the lake is no longer sampled.

FISHING

Salmon fishing waters
Main species: pike-perch, perch, rudd and tench.
Type: Professional (8 fishermen) and amateur fishing
Bans: various bans exist, according to the period of the year and the species fished.
Limitations: as to the total quantity and minimum length (refer to provincial regulations)

OTHER USES

Navigation:
Allowed for motor boats, with restrictions (see Provincial Fish Plan)
Industry: water abstraction 23 l/s
Irrigation: water abstraction 6 l/s
Other leisure time uses:
Sailing, canoeing



Lake Como

Lake Como, or Lario, is the deepest Italian lake, reaching – according to a recent bathymetric study – a 425 m depth, as well as the third Italian lake as for its dimensions and volume. Its catchment basin includes the entire Sondrio province and in part Como and Lecco provinces.

Identity card

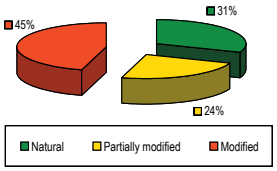
Catchment area		4.508	km^2
Lake area		145	km^2
Maximal depth		425	m
Average depth		155	m
Volume		22.500	10^6 m^3
Average altitude		198	m s.l.m.
Water change time		4,4	years
Main tributaries	*Adda river*	90,2	m^3/s
Emissary	*Adda river*	161,3	m^3/s

The lake and its surroundings

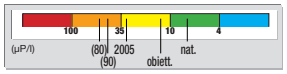
LAKE MONITORING - ARPA Lombardy carries out monitoring on a monthly basis since 2000 as to ecological parameters; the Local Health Authority ASL carries out the microbiological monitoring.

SHORELINE

nly about 3 % of the lake shoreline is protected



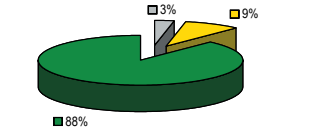
PRESENT CONDITIONS AND FUTURE OBJECTIVES



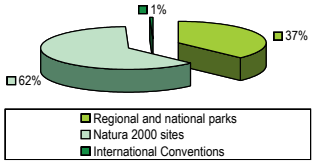
The lake is shaped like an upside-down "Y" and so there is a quality difference between the Como (closed) branch and the Lecco branch. In any case, thanks to consistent improvements over time, the intended objectives are expected to be reached within 2023-28, after the application of measures indicated in the regional regulations.

A portrait of the catchment basin

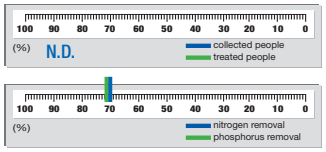
LAND USE AND PROTECTED AREAS



37% of the total area is protected

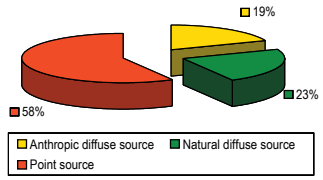


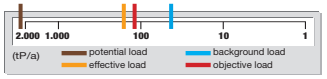
WASTEWATER COLLECTION SYSTEM AND TREATMENT



The catchment area hosts 72 treatment plants serving about 640,000 population equivalents.
Measures planned will ensure the nutrient removal percentage to reach 75% for N and over 80% for P by the end of 2008.

MAIN PRESSURES





The nutrient loads decreased over the last few decades and the target level indicated in regional regulations is expected to be reached by 2016.

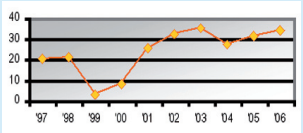
Main uses

DRINKING WATER SUPPLY

Number of abstraction points: 7
Location: Bellagio, Como, Griante, Pognana Lario, Valmadrera
Volume of water extracted: 39.4 10^3 l/s (~280,000 persons)
Classification of sampling: A2

BATHING

Number of sites monitored (2006): 46
Compliant sites: 74%
Trend over the years:



Number of sites where bathing is allowed

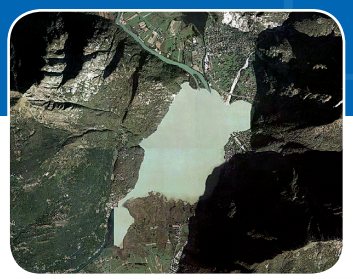
FISHING

Salmon fishing waters
Main species: lake whitefish, lake shad, perch, burbot
Type: Professional (75 fishermen) and amateur fishing
Bans: various bans exist, according to the period of the year and the species fished.
Limitations: as to the total quantity and minimum length (refer to provincial regulations).

OTHER USES

Navigation:
Allowed without restrictions
Public transport
Industry: water abstraction 698 l/s
Irrigation: water abstraction 108 l/s
Other leisure time uses:
Sailing, canoeing, windsurfing, kitesurfing, water skiing

Lake Mezzola



Lake Mezzola is located at the end of Val Chiavenna and is connected to lake Como by Mera river.
The lake territory and the neighboring Pian di Spagna form a wetland acknowledged by the international Ramsar convention.

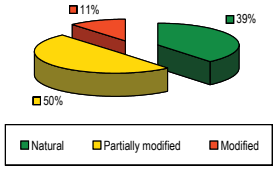
Identity card

Catchment area		721	km^2
Lake area		5,85	km^2
Maximal depth		69	m
Average depth		26	m
Volume		149	10^6 m^3
Average altitude		199	m s.l.m.
Water change time		0,2	years
Main tributaries	*Mera river*	20,3	m^3/s
Emissary	*Mera river*	29,8	m^3/s

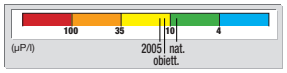
The lake and its surroundings

LAKE MONITORING - ARPA Lombardy carries out monitoring 4/6 times per years depending on the ecological parameter to be monitored; the Local Health Authority ASL carries out the microbiological monitoring.

SHORELINE
All the lake shoreline is protected



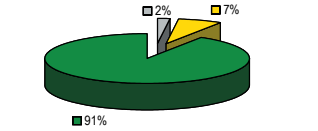
PRESENT CONDITIONS AND FUTURE OBJECTIVES



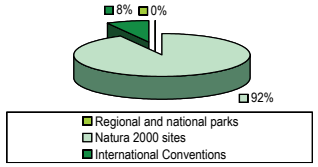
Present lake quality conditions are close to the objectives defined at regional level, where the oligo-mesotrophic condition is the objective to be reached for the lake.

A portrait of the catchment basin

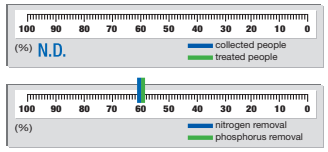
LAND USE AND PROTECTED AREAS



17% of the total are is protected

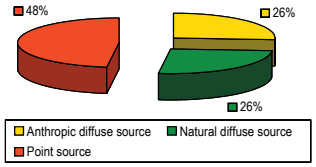


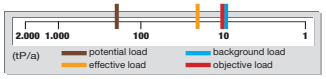
WASTEWATER COLLECTION SYSTEM AND TREATMENT



The catchment basin hosts 11 treatment plants serving about 66,000 population equivalents.
By the end of 2008, the nutrient removal percentage at basin level is planned to reach values close to 75%.

MAIN PRESSURES





The total load produced within the catchment basin must be further reduced, by the end of 2016, to reach the target levels indicated in regional regulations

Main uses

DRINKING WATER SUPPLY

Lake waters are not used for human consumption.

BATHING

Number of sites monitored (2006): 3
Compliant sites: 100%
Trend over the years:
After years during which the lake was no longer sampled, in 2006 monitoring started in three places, with positive outcome

FISHING

Salmon fishing waters
Main species: lake whitefish, burbot, lake trout, perch
Type: Professional (5 fishermen) and amateur fishing
Bans: various bans exist, according to the period of the year and the species fished.
Limitations: as to the total quantity and minimum length (refer to Sondrio provincial regulation).

OTHER USES

Navigation:
motor boats are forbidden
Other leisure time uses:
boat racing

There are no water diversions from the lake.

Lake Pusiano

It is called also Eupili and it is one of Brianza's lakes that include the lakes Pusiano, Alserio, Annone Est and Annone Ovest. Among them it is the biggest and it has the largest catchment basin. It is fed by Lambro river.

Identity card

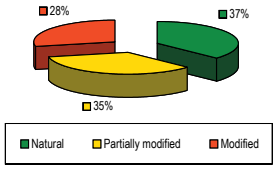
Catchment area		93,8	km^2
Lake area		4,95	km^2
Maximal depth		24	m
Average depth		14	m
Volume		69,2	10^6 m^3
Average altitude		259	m s.l.m.
Water change time		0,8	years
Main tributaries	*Lambro river*	1,4	m^3/s
Emissary	*Lambro river*	2,7	m^3/s

The lake and its surroundings

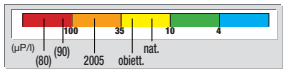
LAKE MONITORING - ARPA Lombardy carries out monitoring 4/6 times per years depending on the ecological parameter to be monitored; the Local Health Authority ASL carries out the microbiological monitoring.

SHORELINE

All the lake shoreline is protected



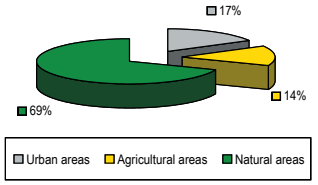
PRESENT CONDITIONS AND FUTURE OBJECTIVES



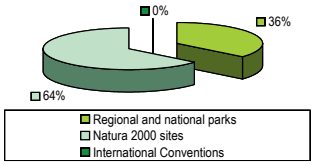
Phosphorus concentrations had a decrease starting from the 80s, thanks to actions taken for wastewater collection system. Nonetheless, the lake is now in a trophic condition, also due to the internal loads. Measures provided for by the regulations in force should allow reaching the objectives indicated by 2016.

A portrait of the catchment basin

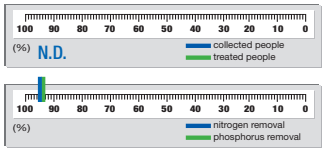
LAND USE AND PROTECTED AREAS



18% of the total are is protected

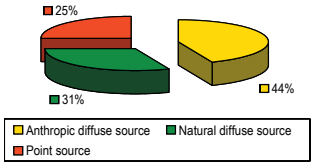


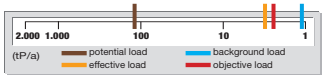
WASTEWATER COLLECTION SYSTEM AND TREATMENT



The catchment basin does not host any treatment plant and the waste waters are collected and discharged outside the basin. However there are a lot of overflows. Nevertheless the removal level of nutrients loads is high.

MAIN PRESSURES





The present effective loads are closed to the objective. By the end of 2016, the target levels indicated in regional regulations would be reached.

Main uses

DRINKING WATER SUPPLY

Lake waters are not used for human consumption.

BATHING

Number of sites monitored (2006): 4
Compliant sites: 100%
Trend over the years:
Over the last 10 years, none of the sampling points provided positive results as to bathing permission. Starting from 2002 the monitoring was stopped, until the positive results found in 2006.

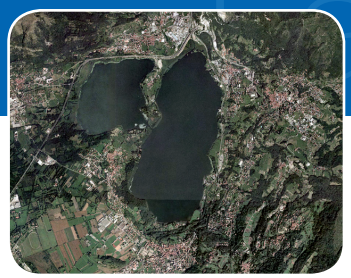
FISHING

Main species: perch, black bass, pike
Type: Amateur fishing
Bans: various bans exist, according to the period of the year and the species fished.
Limitations: as to the total quantity and minimum length (refer to provincial regulation).

OTHER USES

Navigation:
Reserved navigation rights
Tourist transport with electric boat
Other leisure time uses:
canoeing, water skying

Lake Annone Est



Lake Annone Est, named also Oggiono, is separeted from the twin lake Annone Ovest, by the Annone promontory and the small peninsula of Isella.
An important restoration work is just started in order to improve the quality of water.

Identity card

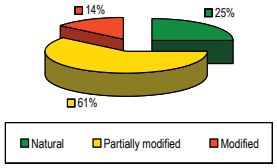
Catchment area		26,9	km^2
Lake area		3,81	km^2
Maximal depth		11	m
Average depth		6,3	m
Volume		24	10^6 m^3
Average altitude		224	m s.l.m.
Water change time		1,3	anni
Main tributaries	*Underground sources, small streams*		
Emissary	*Rio Torto*	0,6	m^3/s

The lake and its surroundings

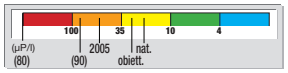
LAKE MONITORING - ARPA Lombardy carries out monitoring on a seasonal basis from 2000 as to ecological parameters; the Local Health Authority ASL carries out the microbiological monitoring.

SHORELINE

0% of the lake shoreline is protected



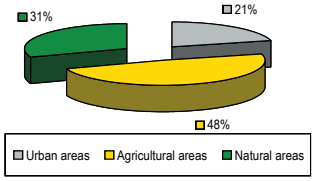
PRESENT CONDITIONS AND FUTURE OBJECTIVES



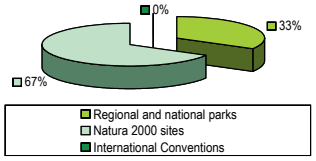
Phosphorus concentrations had a decrease starting from the 70s and 80s, but at the moment the lake is still in a eutrophic condition. At the moment a direct restoration intervention has been carried out to decrease internal loads and to meet the indicated quality objectives by the 2016.

A portrait of the catchment basin

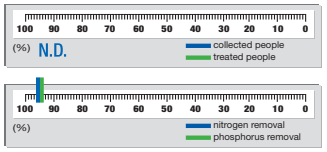
LAND USE AND PROTECTED AREAS



3% of the total are is protected

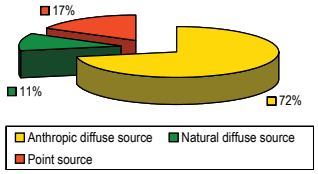


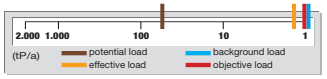
WASTEWATER COLLECTION SYSTEM AND TREATMENT



The catchment basin does not host any treatment plant and the waste waters are collected and discharged outside the basin. This enables to reach high percentages in pollutant load decrease.

MAIN PRESSURES





The present effective loads are closed to the objective. By the end of 2016, the target levels indicated in regional regulations would be reached.

Main uses

DRINKING WATER SUPPLY

Lake waters are not used for human consumption.

BATHING

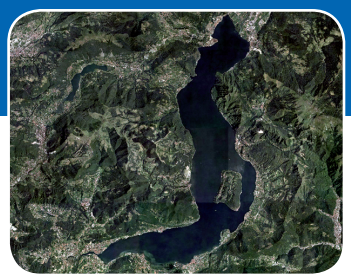
This lake is not a water body for bathing.

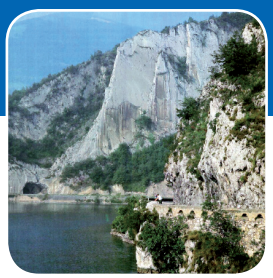
FISHING

Main species: perch, black bass, pike
Type: Amateur fishing
Bans: various bans exist, according to the period of the year and the species fished
Limitations: as to the total quantity and minimum length (refer to provincial regulation).

OTHER USES

Navigation:
Exclusive navigation rights
Use of canoes and kayak is allowed
Other leisure time uses:
canoeing





Lake Iseo

Lake Iseo, or Sebino, is the fourth largest Lombardy lake and is located at the border between the provinces of Bergamo and Brescia. Its main island, Monte Isola, is the largest and higher island among the lakes of the alpine arch.

Identity card

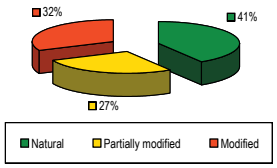
Catchment area		1.801	km²
Lake area		61	km²
Maximal depth		251	m
Average depth		125	m
Volume		7600	10^6 m³
Average altitude		186	m s.l.m.
Water change time		4,2	years
Main tributaries	*Oglio river*	-	m³/s
Emissary	*Oglio river*	57,1	m³/s

The lake and its surroundings

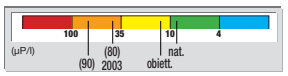
LAKE MONITORING - ARPA Lombardy carries out monitoring on a monthly basis since 2000 as to ecological parameters; the Local Health Authority ASL carries out the microbiological monitoring.

SHORELINE

Only about 4 % of the lake shoreline is protected



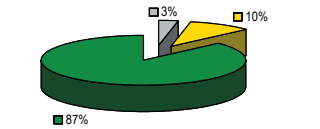
PRESENT CONDITIONS AND FUTURE OBJECTIVES



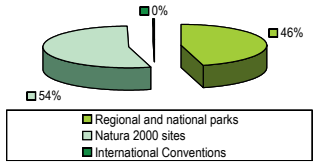
Present conditions are not very good but improvements are consistent over time. The intended objectives are expected to be reached by 2018, after the application of measures indicated in the regional regulations.

A portrait of the catchment basin

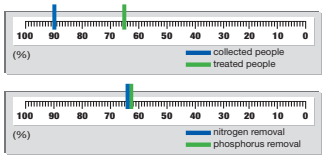
LAND USE AND PROTECTED AREAS



23% of the total area is protected

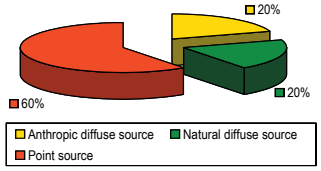


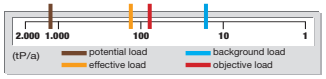
WASTEWATER COLLECTION SYSTEM AND TREATMENT



The catchment area hosts 35 treatment plants serving about 150,000 population equivalents.
Measures planned will ensure the nutrients removal percentage to reach 70% for N and over 80% for P by the end of 2008.

MAIN PRESSURES





The pollutant loads decreased over the last few decades and the target level indicated in regional regulations is expected to be reached by 2016.

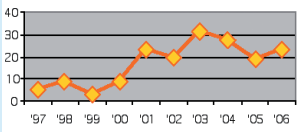
Main uses

DRINKING WATER SUPPLY

Number of abstraction points: 1
Location: Monte Isola
Water extracted: 12 l/s (~2.000 persons)
Classification of sampling: A2

BATHING

Number of sites monitored (2006): 42
Compliant sites: 49%
Trend over the years:



Number of sites where bathing is allowed

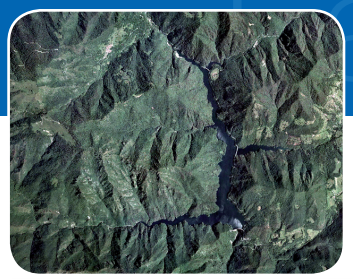
FISHING

Salmon fishing waters
Main species: lake shad, lake whitefish, tench, perch
Type: Professional (44 fishermen) and amateur fishing.
Bans: various bans exist, according to the period of the year and the species fished.
Limitations: as to the total quantity and minimum length (refer to provincial regulations)

OTHER USES

Navigation:
Allowed without restrictions
Public transport
Industry: water abstraction 818 l/s
Other leisure time uses:
Sailing, canoeing, windsurfing, water skiing

Lake Valvestino



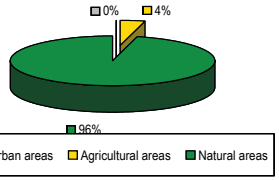
Lake Valvestino is a reservoir, formed by the construction of the Ponte Cola dam, a 122 high dam, on the Toscolano stream, in 1962. It is located in a valley called Valvestino, between the lakes Idro and Garda.

Identity card

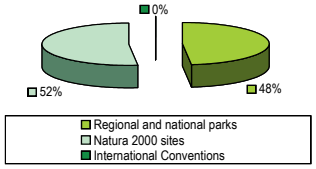
Catchment area		97,2+24,6	km²
Lake area		1,38	km²
Maximal depth		-	m
Average depth		38	m
Volume		52,3	10^6 m³
Average altitude		503	m s.l.m.
Water change time		0,61	anni
Main tributaries	*Toscolano stream*	-	m³/s
Emissary	*Toscolano stream*	2,73	m³/s

A portrait of the catchment basin

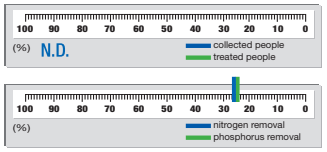
LAND USE AND PROTECTED AREAS



100% of the total are is protected

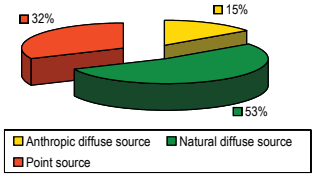


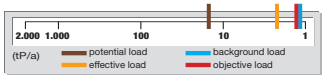
WASTEWATER COLLECTION SYSTEM AND TREATMENT



The catchment basin hosts some small treatment plants, but the construction of a sewage system and the collection to a treatment plant is difficult due to the land morphology. For this reason the nutrient removal percentages are low.

MAIN PRESSURES





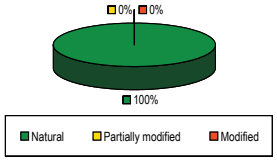
The present effective loads are closed to the objective. By the end of 2016, the target levels indicated in regional regulations would be reached.

The lake and its surroundings

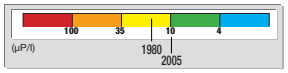
LAKE MONITORING - ARPA Lombardy carries out monitoring on a seasonal basis from 2000 as to ecological parameters.

SHORELINE

All the lake shoreline is protected



PRESENT CONDITIONS AND FUTURE OBJECTIVES



At the moment the lake is in a mesotrophic condition, probably close to the natural one. Nevertheless the lack of chemical, physical and biological data of the water doesn't allow to express a reliable evaluation of the quality of the water.

Main uses

DRINKING WATER SUPPLY

Number of abstraction points: 1
Location: Gargnano
Water exstracted: 12 l/s (~ 2.000 persons)
Classification of sampling: A2

BATHING

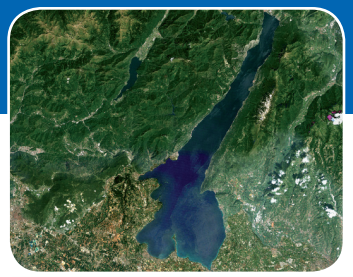
This lake is not a water body for bathing

FISHING

Main species: lake shad, brown trout
Type: Amateur fishing
Bans: various bans exist, according to the period of the year and the species fished.

OTHER USES

Energy production: water abstraction max 36,5 10^3 l/s
Other leisure time uses: canoeing



Lake Garda

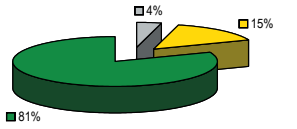
Lake Garda, also named Benaco, is the first Italian lake as for its surface and volume. It is astride three different Italian provinces located in different regions: Brescia province on the Lombard side, Trento province on the Trentino side and Verona province on the Veneto side.

Identity card

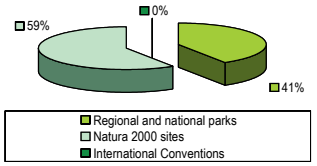
Catchment area		2.360	km^2
Lake area		368	km^2
Maximal depth		350	m
Average depth		133	m
Volume		49.031	10^6 m^3
Average altitude		65	m s.l.m.
Water change time		26,8	anni
Main tributaries	*Sarca river*	29,8	m^3/s
Emissary	*Mincio river*	58,0	m^3/s

A portrait of the catchment basin

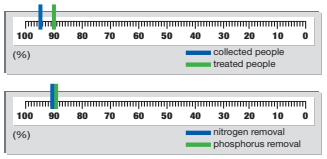
LAND USE AND PROTECTED AREAS



39% of the total area is protected

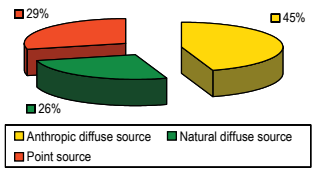


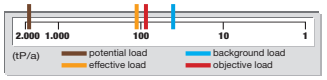
WASTEWATER COLLECTION SYSTEM AND TREATMENT



The catchment area hosts 17 treatment plants serving about 115,000 population equivalents.
Almost all loads generated in Lombardy and Veneto regions are conveyed outside the basin, to Peschiera del Garda plaant (in operation since 1981). This enables to reach high percentages in nutrient removal.

MAIN PRESSURES





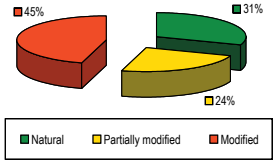
Measures indicated in regional plans led to and will lead to a further reduction in lake phosphorus loads in order to reach the target quality levels established.

The lake and its surroundings

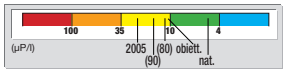
LAKE MONITORING - ARPA Lombardy, ARPA Veneto and APPA Trento carry out monitoring on a monthly basis since 2000 as to ecological parameters; the Local Health Authorities ASLs carry out the microbiological monitoring.

SHORELINE

Only about 37 % of the lake shoreline is protected



PRESENT CONDITIONS AND FUTURE OBJECTIVES



Over the last few decades, phosphorus concentrations remained more or less stable, around values equivalent to a mesotrophic condition and higher than values in the 70s relating to a full oligotrophic condition, i.e. the natural condition of the lake. Non-homogeneous distribution of loads with high peaks in summer, could be one of the possible causes of such problem.

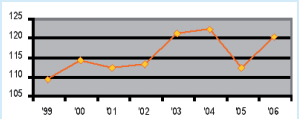
Main uses

DRINKING WATER SUPPLY

Number of abstraction points: 12
Location: Desenzano, Gargnano, Manerba, Moniga, S. Felice, Sirmione, Brenzone, Garda Torri del Benaco and S. Zeno in Montagna.
Volume of water extracted: 3,370 l/s (~550,000 persons)
Classification of sampling: A1 or A2

BATHING

Number of sites monitored (2006): 124
Compliant sites: 97%
Trend over the years:



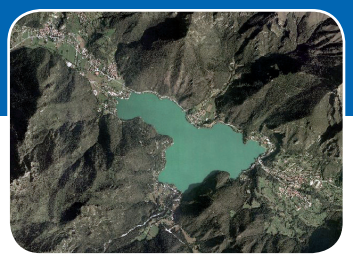
Number of sites where bathing is allowed

FISHING

Salmon fishing waters
Main species: lake whitefish, lake shad, perch, eel.
Type: Professional (53 fishermen) and amateur fishing
Bans: various bans exist, according to the period of the year and the species fished.
Limitations: as to the total quantity and minimum lenght (refer to provincial regulations)

OTHER USES

Navigation: allowed without restrictions (unless the water under the competence of Trento Province) - Public transport
Industry: water abstraction 6.2 l/s (Lombard side)
Irrigation: water abstraction 4.8 l/s (Lombard side)
Other leisure time uses: Sailing, canoeing, windsurfing, water skiing, diving.



Lake Ledro

Lake Ledro is located in the valley with the same name, in the south-western part of Trentino region and at an altitude of 650 metres. It is well known for the lake dwelling palafitta village found on its eastern shore.

Identity card

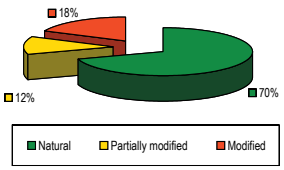
Catchment area		102	km^2
Lake area		2,2	km^2
Maximal depth		48	m
Average depth		35	m
Volume		75,8	10^6 m^3
Average altitude		655	m s.l.m.
Water change time		<1	years
Main tributaries	*Underground sources, Massangla, Assat di Pur, Assat di Pieve*		
Emissary	*Ponale stream*	-	m^3/s

The lake and its surroundings

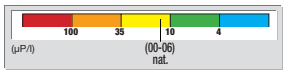
LAKE MONITORING - Since 2000 APPA-TN deals with the monitoring of the environmental quality of the lake. The APSS of the Autonomous Province of Trento carries out bathing permission control tests.

SHORELINE

The lake shoreline is not protected.



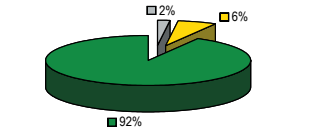
PRESENT CONDITIONS AND FUTURE OBJECTIVES



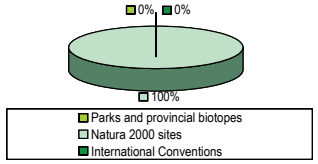
The average value of total phosphorous concentration during spring mixing over the period 2000-2006, was 14 µg/l. The natural theoretical value is 15 µg/l.

A portrait of the catchment basin

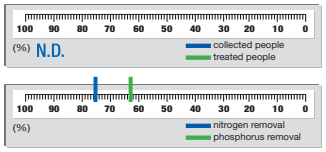
LAND USE AND PROTECTED AREAS



19 % of the total area is protected

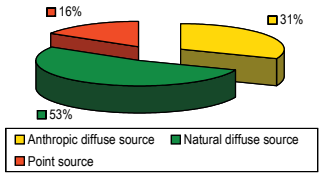


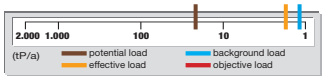
WASTEWATER COLLECTION SYSTEM AND TREATMENT



Starting from August 2006, the sewage system going into Mezzolago treatment plant, discharging into the lake, was diverted to Pieve di Ledro treatment plant. Presently, the only plant discharging into Lake Ledro is Pieve di Ledro treatment plant. Phosphorous removal efficiency reaches 75%, nitrogen removal reaches 62% (2005).

MAIN PRESSURES





Since 2005, the Autonomous Provincial Government of Trento identified the whole area of the province as environmentally sensitive, defining limitations for total phosphorous levels in urban and industrial wastewater.

Main uses

DRINKING WATER SUPPLY

Lake waters are not used for human consumption.

BATHING

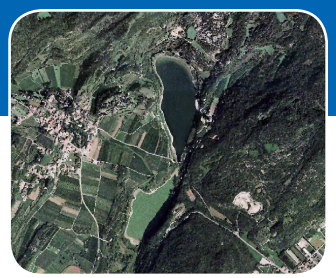
Number of sites monitored (2006): 3
Compliant sites: 100%
Trend over the years: Over the observation period 2001 - 2006 monitoring of the 3 sampling points always provided positive results as to bathing permission.

FISHING

Cyprinid waters
Main species: bleak, rutilus aula ray-finned fish, chub, rudd, European perch, burbot, lake trout
Type: Amateur fishing
Ban: fishing is forbidden when most of the surface of the lake is frozen.

OTHER USES

Navigation: allowed to motor boats with less than 3 kW power
Energy production: water abstraction 2500 l/s
Other leisure time uses: windsurfing, sailing and canoeing.



Lake Terlago

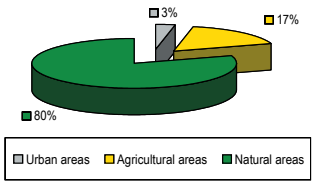
Lake Terlago is located in the wonderful Valle dei Laghi (Lake Valley), only 10 Km away from Trento.
Lake Terlago has an "8" shape: it is formed of two small basins connected by a narrow canal.

Identity card

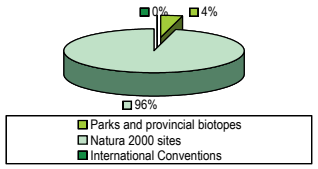
Catchment area	28	km^2
Lake area	0,12	km^2
Maximal depth	11	m
Average depth	3,8	m
Volume	0,4	10^6 m^3
Average altitude	414	m s.l.m.
Water change time	< 1	years
Main tributaries	*Fosso Maestro, Roggia Terlago*	m^3/s
Emissary	-	m^3/s

A portrait of the catchment basin

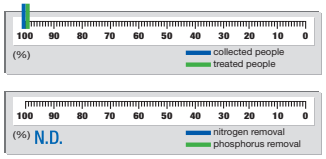
LAND USE AND PROTECTED AREAS



5% of the total area is protected



WASTEWATER COLLECTION SYSTEM AND TREATMENT



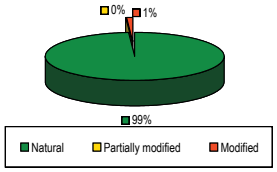
There are no wastewater treatment plants in the catchment basin of Lake Terlago. Both urban and industrial wastewater is collected and discharged to Trento Nord plant.

The lake and its surroundings

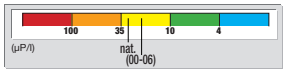
LAKE MONITORING - APPA-TN monitors the environmental quality of the lake. The APSS of the Autonomous Provincial Government of Trento carries out bathing permission control tests.

SHORELINE

All the lake shoreline is protected

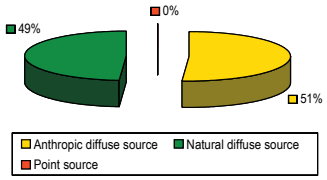


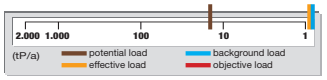
PRESENT CONDITIONS AND FUTURE OBJECTIVES



The average value of total phosphorous concentration during the spring mixing is 25 µg/l. The theoretical natural value of phosphorous is about 29 µg/l.

MAIN PRESSURES





Since 2005, the Autonomous Provincial Government of Trento identified the whole area as environmentally sensitive, defining limitations for total phosphorous levels in urban and industrial wastewater.

Main uses

DRINKING WATER SUPPLY

Lake waters are not used for human consumption.

BATHING

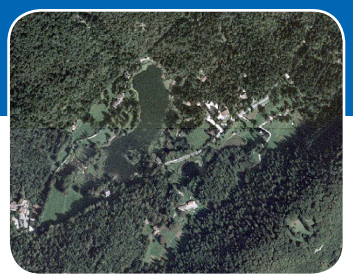
Number of sites monitored (2006): 1
Compliant sites: 100%
Trend over the years:
Over the observation period 2001 - 2005 monitoring of the sampling point always provided positive results as to bathing permission.

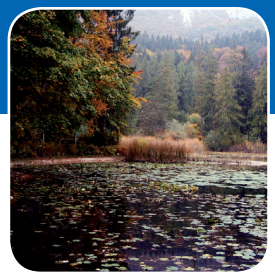
FISHING

Cyprinid waters
Main species: rudd, European perch, tench, pumpkinseed sunfish, pike, crucian, carp, chub, rutilus aula ray finned fish, Italian nase.
Type: Amateur fishing
Bans: fishing is prohibited when most of the lake surface is frozen

OTHER USES

Navigation: Navigation by motor boats is not allowed.
Irrigation: water abstraction 2.8 l/s





Lake Cei

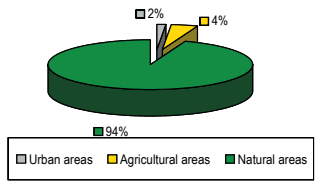
Lake Cei, at an altitude of about 900 m, is renowned for its charming landscape and ecological richness. The charm of this stretch of water is due to its deep green-blue colour and the presence of nenufars and water lilies.

Identity card

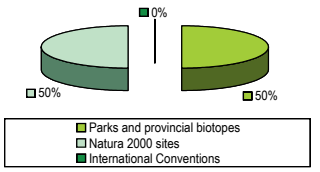
Catchment area		1,22	km^2
Lake area		0,039	km^2
Maximal depth		7	m
Average depth		2,2	m
Volume		0,0875	10^6 m^3
Average altitude		920	m s.l.m.
Water change time		-	years
Main tributaries	*Underground sources*	-	m^3/s
Emissary	*Airone stream*	-	m^3/s

A portrait of the catchment basin

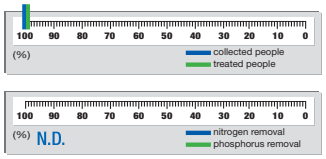
LAND USE AND PROTECTED AREAS



5% of the total area is protected



WASTEWATER COLLECTION SYSTEM AND TREATMENT

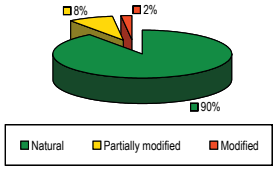


There are no water treatment plants in lake Cei catchment basin.

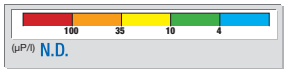
The lake and its surroundings

LAKE MONITORING - The APSS of the Autonomous Provincial Government of Trento carries out bathing permission control tests.

SHORELINE
All the lake shoreline is protected.

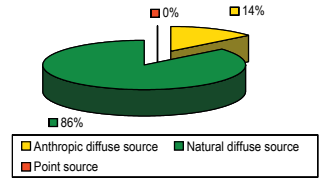


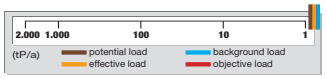
PRESENT CONDITIONS AND FUTURE OBJECTIVES



No information on water quality is currently available.

MAIN PRESSURES





The Autonomous Provincial Government of Trento identified the whole area of the province as environmentally sensitive, defining limitations for total phosphorous levels in urban and industrial wastewater.

Main uses

DRINKING WATER SUPPLY

Lake waters are not used for human consumption.

BATHING

Number of sites monitored (2006): 1
Compliant sites: 100%
Trend over the years:
Over the observation period 2001 - 2006 the monitoring of the sampling point always provided positive results as to bathing permission.

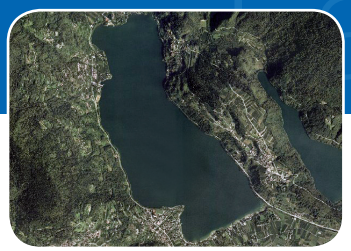
FISHING

Cyprinid waters
Main species: rudd, European perch, pumpkinseed sunfish, rutilus aula ray-finned fish, pike, chub, tench and bitterling
Type: Amateur fishing
Bans: fishing allowed in the indicated areas, with the exception of periods when most of the surface of the lake is frozen.

OTHER USES

Navigation:
boats are not allowed.

There are no water diversions from the lake.



Lake Caldonazzo

Lake Caldonazzo is the largest lake of Trentino among those completely included into the provincial borders. It is located in Valsugana, only 15 Km away from Trento. Lake Caldonazzo is a relevant tourist resort.

Identity card

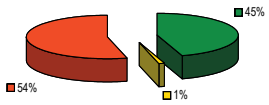
Catchment area	49,3	km^2
Lake area	5,3	km^2
Maximal depth	49	m
Average depth	27	m
Volume	149,0	10^6 m^3
Average altitude	449	m s.l.m.
Water change time	3,6	years
Main tributaries	*Rio Mandola, Fos dei Gamberi, Fos del Lavatoio, C. Mandoletta, Rio da Ischia*	
Emissary	*Brenta river* -	m^3/s

The lake and its surroundings

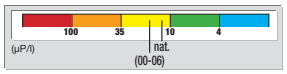
LAKE MONITORING - APPA-TN has been dealing since 2000 with the monitoring of the environmental quality of the lake. The APSS of the Autonomous Provincial Government of Trento carries out bathing permission control tests.

SHORELINE

9 % of lake shoreline is protected



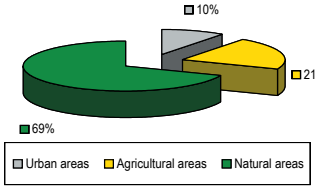
PRESENT CONDITIONS AND FUTURE OBJECTIVES



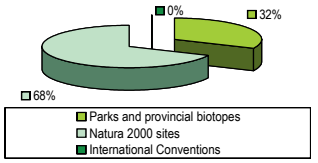
Total phosphorous concentration during the spring mixing over the period 2000-2006, ranged from 17 to 25 µg/l. The theoretical natural value is about 16 µg/l.

A portrait of the catchment basin

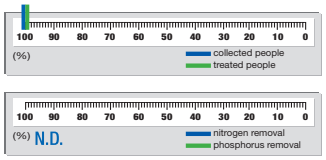
LAND USE AND PROTECTED AREAS



0.5% of total area is protected

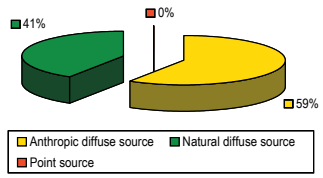


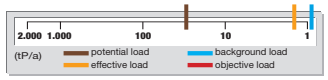
WASTEWATER COLLECTION SYSTEM AND TREATMENT



There are no wastewater treatment plants in the catchment basin of Lake Caldonazzo. Both urban and industrial wastewater is collected and discharged in Levico Terme plant, located outside the basin.

MAIN PRESSURES





Since 2005, the Autonomous Provincial Government of Trento identified the whole area as environmentally sensitive, defining limitations for total phosphorous levels in urban and industrial wastewater.

Main uses

DRINKING WATER SUPPLY

Lake waters are not used for human consumption.

BATHING

Number of sites monitored (2005): 9
Compliant sites: 100%
Trend over the years: Over the observation period 2001 - 2005 the monitoring of the 9 sampling points has always provided positive results as to bathing permission.

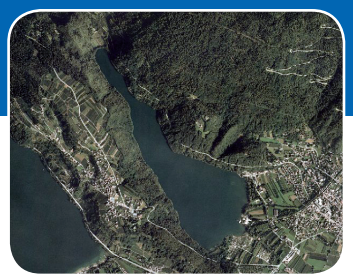
FISHING

Cyprinid waters
Main species: rudd, European perch, pumpinkseed fish, catfish, tench, chub, carp, pike, bleak
Type: Amateur fishing
Bans: fishing is prohibited when most of the lake surface is frozen and in provincial biotope areas.

OTHER USES

Navigation: allowed to motor boats with less than 3 kW power. Exceptions are envisaged for water skiing school boats.
Irrigation: water abstraction 39.6 l/s
Other leisure time uses: Water skiing, sailing, surfing and canoeing.

Lake Levico



Lake Levico is located in Valsugana, a valley in the western part of Trentino region. The Tenna isthmus separates it from the nearby Lake Caldonazzo. The landscape around the lake is charming: most of its shoreline is natural.

Identity card

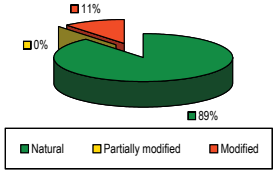
Catchment area	22	km^2
Lake area	1,1	km^2
Maximal depth	38	m
Average depth	11	m
Volume	13	10^6 m^3
Average altitude	440	m s.l.m.
Water change time	1,1	years
Main tributaries	*Roggia, Rio Vignola, Rio Maggiore*	
Emissary	*Brenta river* -	m^3/s

The lake and its surroundings

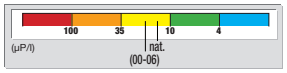
LAKE MONITORING - APPA-TN has been dealing since 2000 with the monitoring of the environmental quality of the lake. The APSS of the Autonomous Provincial Government of Trento carries out bathing permission control tests.

SHORELINE

11 % of lake shoreline is protected



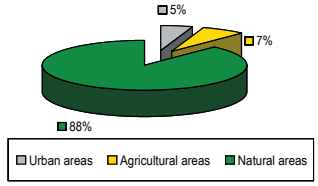
PRESENT CONDITIONS AND FUTURE OBJECTIVES



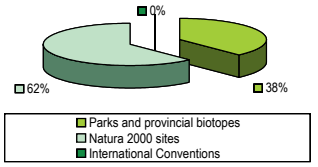
Total phosphorous concentration during the spring mixing over the period 2000-2006, was 23 µg/l. The theoretical natural value is 18 µg/l.

A portrait of the catchment basin

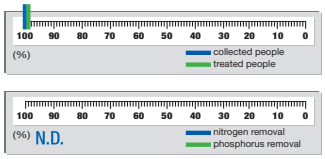
LAND USE AND PROTECTED AREAS



2% of the total area is protected

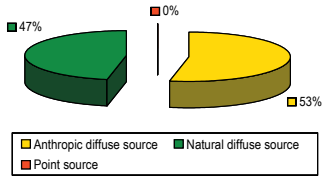


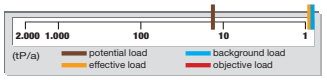
WASTEWATER COLLECTION SYSTEM AND TREATMENT



There are no wastewater treatment plants in the catchment basin of Lake Levico. Both urban and industrial wastewater is collected and discharged in Levico Terme plant, located outside the basin.

MAIN PRESSURES





Since 2005, the Autonomous Provincial Government of Trento identified the whole area as environmentally sensitive, defining limitations for total phosphorous levels in urban and industrial wastewater.

Main uses

DRINKING WATER SUPPLY

Lake waters are not used for human consumption.

BATHING

Number of sites monitored (2006): 2
Compliant sites: 100%
Trend over the years:
Over the observation period 2001 - 2006 monitoring of the 2 sampling points always provided positive results as to bathing permission.

FISHING

Cyprinid waters
Main species: rudd, European perch, pumpkinseed sunfish, tench, brown trout, chub and Italian nase
Type: Sport fishing
Bans: fishing is prohibited when most of the lake surface is frozen and in provincial biotope areas.

OTHER USES

Navigation: allowed to motor boats with less than 3 kW power.
Other leisure time uses: Sailing, surfing and canoeing.

Lake Alleghe

Lake Alleghe was formed on 11 January 1771 after a landslide from Mount Piz, which blocked the flow of the River Cordevole and created the lake basin. A second landslide on 1 May 1771 fell directly into the lake and did not overlap the previous one, therefore causing an enormous displacement of the water and the formation of a peninsula in front of the town of Alleghe. The lake is also used for the hydroelectric station. Lake Alleghe is one of the most popular tourist attractions in the Dolomites, as the beautiful slopes of Mount Civetta are reflected in its surface.

Identity card

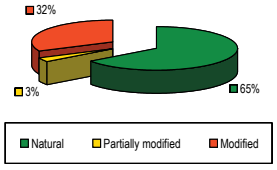
Catchment area		254	km^2
Lake area		0,48	km^2
Maximal depth		10	m
Average depth		6	m
Volume		2,7	10^6 m^3
Average altitude		966	m s.l.m.
Water change time		0,0119	years
Main tributaries	*Cordevole*	-	m^3/s
Emissary	*Cordevole*	-	m^3/s

The lake and its surroundings

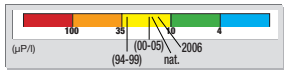
LAKE MONITORING - The lake was monitored between 1994 and 2004 as part of the Multiyear Monitoring Plan by the Province of Belluno. Since 2003 it is monitored twice a year by Arpav.

SHORELINE

65% of lake shoreline is natural



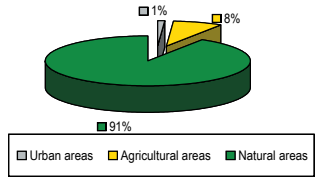
PRESENT CONDITIONS AND FUTURE OBJECTIVES



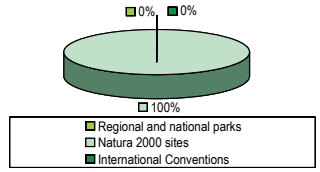
In 2006 the environmental state was considered sufficient with average concentrations of P (calculated in the previous 5-year periods) between 25 and 35 µg/l and in 2006 slightly higher than 15 µg/l (mexotrophic state). In recent years there has been an improving trend which means the quality objectives should be reached in 2015.

A portrait of the catchment basin

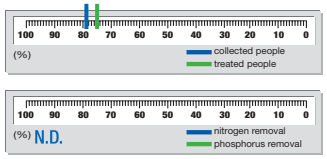
LAND USE AND PROTECTED AREAS



33 % of the catchment area is protected

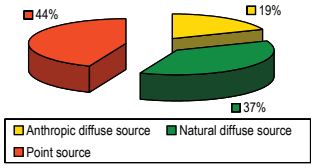


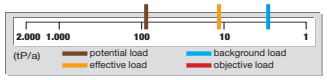
WASTEWATER COLLECTION SYSTEM AND TREATMENT



In the basin there is just one purification system with secondary treatment. There are also 27 Imhoff tanks. This means the nutrient removal percentages are low.

MAIN PRESSURES





Over the last decades the loads have decreased and by the end of 2015 should reach the quality levels for the lake as established by legislation.

Main uses

DRINKING WATER SUPPLY

Lake waters are not used for human consumption.

BATHING

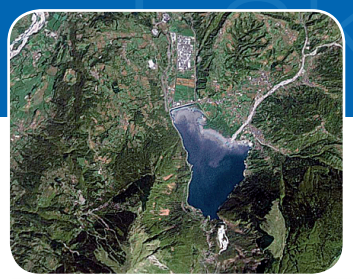
Lake Alleghe is not a water body for bathing.

FISHING

Salmon fishing waters
Main species: trout
Type: amateur fishing.
Bans: fishing is allowed between May and September

OTHER USES

Navigation:
Navigation is only allowed in electrically powered vessels.
Energy production: water abstraction 6572 l/s
Other leisure time uses:
canoeing and competition fishing



Lake Santa Croce

Lake Santa Croce has glacial origins and is the largest natural lake in the province of Belluno. Between 1926 and 1928 it became a reservoir by building a soil dam in the northern part near the natural effluent, the River Rai. Since then the lake has been used for the hydroelectric station. The lake is a very important tourist attraction in the Veneto, because if offers the possibility of various sports such as sailing, windsurf and canoeing. Special mention should be made of the fishing which attracts people from all over the country, as here white-fish and other important species can be found, and it is also very popular for carp-fishing.

Identity card

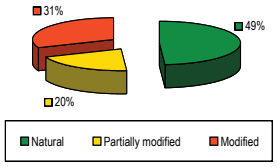
Catchment area		154	km^2
Lake area		7,05	km^2
Maximal depth		41	m
Average depth		13	m
Volume		89,6	10^6 m^3
Average altitude		386	m s.l.m.
Water change time		0,092	years
Main tributaries	*Tesa*	-	m^3/s
Emissary	*Rai*	-	m^3/s

The lake and its surroundings

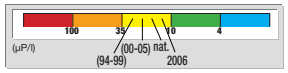
LAKE MONITORING - The lake was monitored between 1994 and 2004 as part of the Multiyear Monitoring Plan by the Province of Belluno. Since 2003 it is monitored twice a year by Arpav.

SHORELINE

49 % of lake shoreline is natural



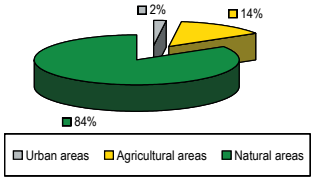
PRESENT CONDITIONS AND FUTURE OBJECTIVES



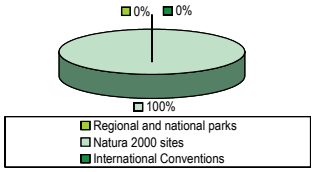
In 2006 the environmental state was considered sufficient with average concentrations of P (calculated in the previous 5-year periods) between 20 and 30 µg/l and in 2006 slightly higher than 10 µg/l (mexotrophic state). In recent years there has been an improving trend which means the quality objectives should be reached in 2015.

A portrait of the catchment basin

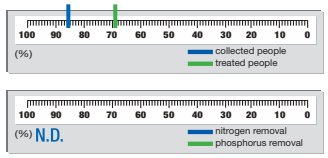
LAND USE AND PROTECTED AREAS



19 % of the total area is protected

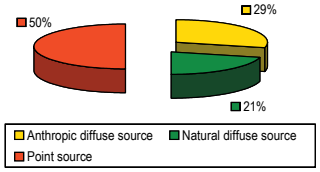


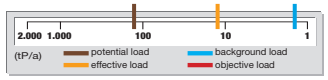
WASTEWATER COLLECTION SYSTEM AND TREATMENT



There are no purification systems in the basin area but there are 30 Imhoff tanks. This means the nutrient removal percentages are low

MAIN PRESSURES





Over the last decades the loads have decreased and by the end of 2015 should reach the quality objectives for the lake as established by legislation.

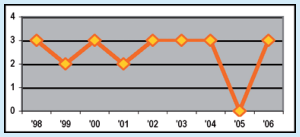
Gli usi principali

DRINKING WATER SUPPLY

Lake waters are not used for human consumption.

BATHING

Number of sites monitored (2006): 3
Compliant sites: 100%
Trend over the years:



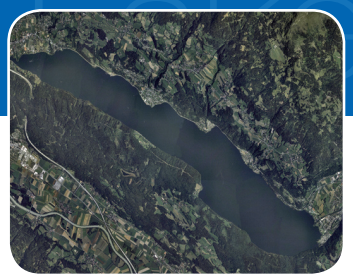
Number of sites where bathing is allowed

FISHING

Cyprinid waters
Main species: whitefish, perch, carp, trout, chub, pike, pigo and barbel.
Type: Amateur fishing

OTHER USES

Navigation:
Navigation is only allowed in electrically powered vessels.
Energy production: water abstraction 30,9 10^3 l/y
Other leisure time uses:
Sailing, canoeing, windsurf and competition fishing.



Lake Millstätter See

Lake Millstätter See is the second largest natural lake in the southern area of the Austrian province of Carinthia. It is located south the National park of Nockberge Mountains and is a relevant tourist attraction for hiking and bathing.

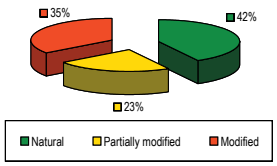
Identity card

Catchment area		284	km^2
Lake area		13,3	km^2
Maximal depth		141	m
Average depth		88,6	m
Volume		1204	10^6 m^3
Average altitude		588	m s.l.m.
Water change time		7,5	years
Main tributaries	*Döbriacher*	3,2	m^3/s
Emissary	*Millstätter Seebach*	5,09	m^3/s

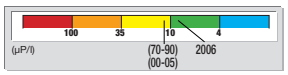
The lake and its surroundings

LAKE MONITORING - Since 1970, monitoring is carried out on a seasonal basis by the Carinthia Institute for research on lakes, and it concerns chemical, physical and biological aspects.

SHORELINE
45% of lake shoreline is protected



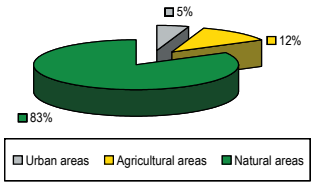
PRESENT CONDITIONS AND FUTURE OBJECTIVES



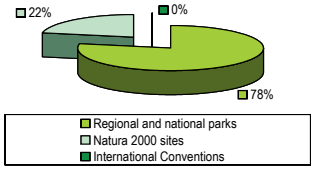
The lake has a meromixing nature, therefore only the superficial layer of water circulates. As a consequence of the reclamation programme applied, the epilimnion reached the oligotrophic level, a symptom of water good quality.

A portrait of the catchment basin

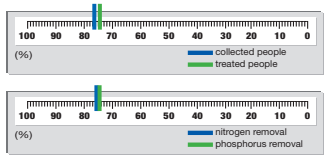
LAND USE AND PROTECTED AREAS



37% of the total area is protected

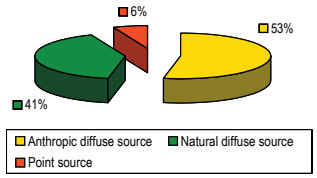


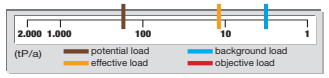
WASTEWATER COLLECTION SYSTEM AND TREATMENT



The load generated by the basin is collected and conveyed outside to 5 different wastewater treatment plants, four of which are equipped with advanced systems.
This allows a very considerable decrease of the load at basin level.

MAIN PRESSURES





Over the last few decades, the loads from point sources and widespread anthropisation decreased thanks to a reclamation programme that will be achieved by the end of 2015, as established by the regional water plan.

Main uses

DRINKING WATER SUPPLY

Lake waters are not used for human consumption.

BATHING

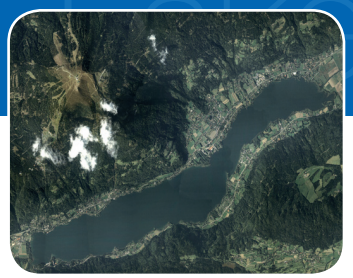
Number of sites monitored: 11
Compliant sites: 100%
Trend over the years:
Over the last 10 years, the sampling of the sampling points always provided positive results
as to bathing permission

FISHING

Salmon fishing waters
Main species: lake whitefish, pike, lake trout
Type: Professional and amateur fishing
Bans: there are bans according to the period of the year and species fished.

OTHER USES

Navigation: Allowed but with some limitations for private citizens.
Industry: water abstraction 7 l/s
Other leisure time uses:
Sailing, water skiing, diving



Lake Ossiacher See

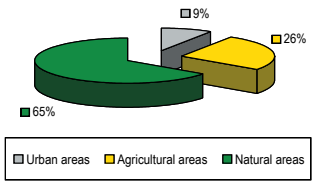
Lake Ossiacher See is the third largest natural lake in the southern area of the Austrian district of Carinthia.
The lake is very famous and largely used for bathing in summer.

Identity card

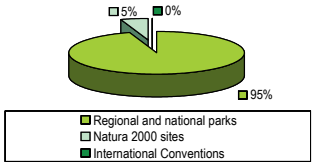
Catchment area		163	km^2
Lake area		10,8	km^2
Maximal depth		52,6	m
Average depth		19,9	m
Volume		206	10^6 m^3
Average altitude		600	m s.l.m.
Water change time		1,8	years
Main tributaries	*Tiebel*	1,8	m^3/s
Emissary	*Ossiacher Seebach*	3,32	m^3/s

A portrait of the catchment basin

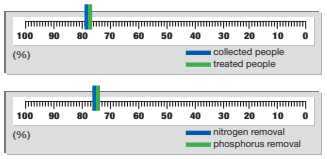
LAND USE AND PROTECTED AREAS



21% of the total area is protected

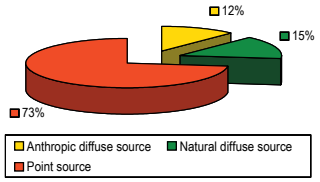


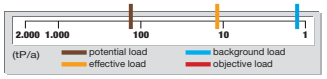
WASTEWATER COLLECTION SYSTEM AND TREATMENT



The catchment area hosts just one wastewater treatment plant, equipped with advanced systems. Part of the load generated, is collected and conveyed outside the basin to other two treatment plants. In general, percentages reached in nutrient load removal are above 75%.

MAIN PRESSURES





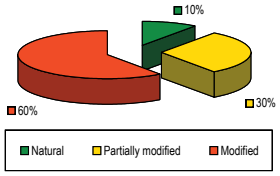
Over the last few decades, the loads from point sources and widespread anthropisation decreased thanks to a reclamation programme that will be achieved by the end of 2015, as established by the regional water plan.

The lake and its surroundings

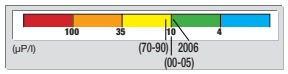
LAKE MONITORING - Since 1970, monitoring is carried out on a seasonal basis by the Carinthia Institute for research on lakes, and it concerns chemical, physical and biological aspects.

SHORELINE

10% of the lake shoreline is protected



PRESENT CONDITIONS AND FUTURE OBJECTIVES



The superficial layer of the lake (epilimnion) has reached good quality conditions evidenced by an oligotrophic condition, thanks to the actions taken over the last 40 years under the reclamation programme.

Main uses

DRINKING WATER SUPPLY

Lake waters are not intended for human consumption

BATHING

Number of sites monitored: 6
Compliant sites: 100%
Trend over the years:
Over the last 10 years, the sampling of the 6 sampling points always provided positive results as to bathing permission.

FISHING

Salmon fishing waters
Main species: bream, pike
Type: Professional and amateur fishing
Bans: there are bans according to the period of the year and species fished.

OTHER USES

Navigation:
Allowed but with some limitations for private citizens.
Industry: water abstraction 43 l/s
Other leisure time uses:
Sailing, water skiing, diving.

Lake Wörthersee

Lake Wöthersee is the largest natural lake in the southern area of the Austrian province of Carinthia.
The lake is of meromixing nature and it is very famous for bathing in summer.

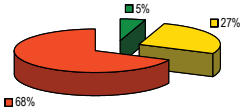
Identity card

Catchment area		162	km^2
Lake area		19,4	km^2
Maximal depth		85,2	m
Average depth		41,9	m
Volume		816	10^6 m^3
Average altitude		439	m s.l.m.
Water change time		10,5	years
Main tributaries	*Reifnitzbach*	0,63	m^3/s
Emissary	*Glanfurt*	2,46	m^3/s

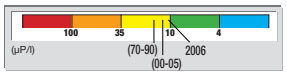
The lake and its surroundings

LAKE MONITORING - Since 1970, monitoring is carried out on a seasonal basis by the Carinthia Institute for research on lakes, and it concerns chemical, physical and biological aspects.

SHORELINE
Only 5% of the lake shoreline is protected.



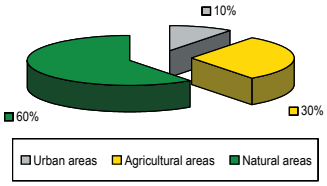
PRESENT CONDITIONS AND FUTURE OBJECTIVES



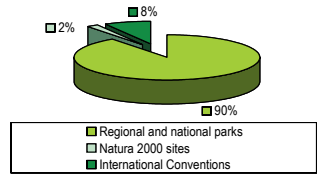
The superficial layer of the lake (epilimnion) is in a mesotrophic condition. Due to the meromixing nature of the lake, it is difficult to think that it will eventually reach the oligotrophic level.

A portrait of the catchment basin

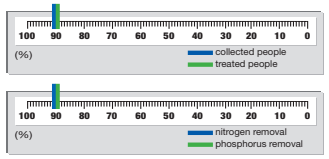
LAND USE AND PROTECTED AREAS



37% of the total area is protected

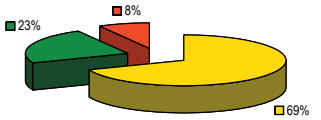


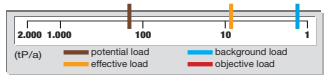
WASTEWATER COLLECTION SYSTEM AND TREATMENT



The load generated by the basin is collected and conveyed outside to 4 different wastewater treatment plants, three of which are equipped with advanced systems.
This allows a very considerable decrease of the load at basin level.

MAIN PRESSURES





Over the last few decades the loads from point sources and widespread anthropisation decreased thanks to a reclamation programme that will be achieved by the end of 2015, as established by the regional water plan.

Main uses

DRINKING WATER SUPPLY

Lake waters are not used for human consumption.

BATHING

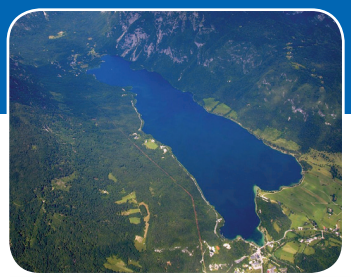
Number of sites monitored (2006): 22
Compliant sites: 100%
Trend over years:
Over the last 10 years, the sampling of the 22 sampling points always provided positive results as to bathing permission

FISHING

Salmon fishing waters
Main species: lake whitefish, pike
Type: Professional and amateur fishing
Bans: there are bans according to the period of the year and species fished.

OTHER USES

Navigation: Allowed but with some limitations for private citizens.
Industry: water abstraction 10.4 l/s
Other leisure time uses: sailing, water skiing, diving



Lake Bohinj

Lake Bohinj is the largest natural and permanent lake in Slovenia. It formed by glacier action about 10,000 years ago. It is located in the upper Bohinj valley, in the north-western part of Slovenia. This lake is the cleanest Slovenian lake and its catchment basin is located within Triglav National Park.

Identity card

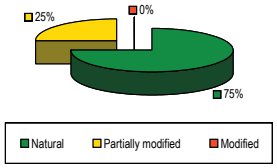
Catchment area		107	km^2
Lake area		3,3	km^2
Maximal depth		44,6	m
Average depth		29,5	m
Volume		99,7	10^6 m^3
Average altitude		526	m s.l.m.
Water change time		0,3-0,5	years
Main tributaries	*Savica*	4,6-5,6	m^3/s
Emissary	*Sava Bohinjka*	6,6-9,9	m^3/s

The lake and its surroundings

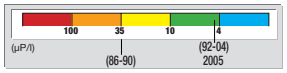
LAKE MONITORING - Since 1997, the Slovenian Environmental Agency carries out monitoring on water quality all year long as to ecological parameters, and since 2004 during summer as to microbiological parameters.

SHORELINE

100% of the lake shoreline is protected



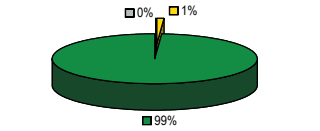
PRESENT CONDITIONS AND FUTURE OBJECTIVES



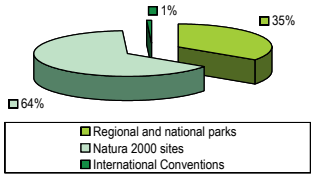
Lake condition is relatively good – the lake being classified as oligotrophic. Objectives provided for by the regulations will be reached in all likelihood by 2015.

A portrait of the catchment basin

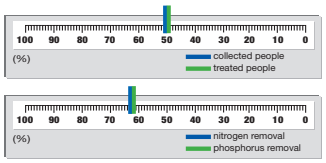
LAND USE AND PROTECTED AREAS



The entire catchment area is protected

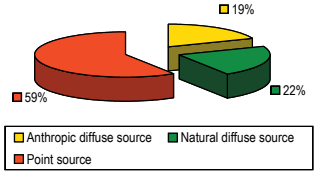


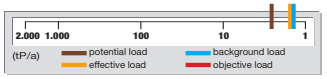
WASTEWATER COLLECTION SYSTEM AND TREATMENT



Within the catchment basin, there are no treatment plants. Almost all discharges are treated using septic tanks. Connection for all discharges to a wastewater treatment plant outside the catchment basin has been planned for over the next two years.

MAIN PRESSURES





Main uses

DRINKING WATER SUPPLY

Lake waters are not used for human consumption.

BATHING

Number of sites monitored (2006): 1
Compliant sites: 100%
Trend over the years: Monitoring carried out since 2004, on a sampled site, has always given a result favorable to bathing.

FISHING

Salmon fishing waters
Main species: Arctic Char, Brown trout, Rainbow trout, chub, burbot
Type: Professional and amateur fishing
Bans: no fishing from mid November to March, for all species.
Limitations: as to the total quantity and minimum length (Bohinj angling club)

OTHER USES

Navigation: using motor boats is forbidden (except for lifeboats)
Public transport (two electric boats)
Other leisure time uses: sailing, canoeing, diving.

Results

The analysis of all data collected shows an improvement in trophic conditions in most of the lakes investigated: over the last few decades, water trophic level (especially regarding Phosphorus value) in lake basins which have been monitored for a longer time has recorded a non-stop positive trend. There are cases of values being very close to lake natural level or however close to the target limits set by the various local regulations (for instance Annecy, Maggiore, Ossiacher See, Millstätter See, Wörthersee, Bohinj, Mezzola, Segrino and Ghirla lakes, just to mention those with a longer data collection history). Other lakes show a steady improvement in their conditions and a decrease in eutrophication even though their values are not yet as good as they should be (for ex. Como, Varese, Pusiano, Bourget, Avigliana and other lakes).

In some lakes among those just having more recent data collection (Ledro, Cei, Levico and Terlago lakes), trophic conditions are presently close to lake natural level.

In recent years, in general no water quality deterioration has been observed: this is the proof that water restoration plans and programs (wastewater collecting and treatment) that have been carried out over the last few decades by European Countries have significantly contributed to lake water quality improvement.

Nevertheless it must be said that some lakes have not reached optimal levels yet for various causes: high internal loads, unfinished infrastructural works as for wastewater collection and treatment facilities, difficult management of tourist peak seasons during the year.

In some cases, the improved condition also results from direct actions taken on lake water, aimed at solving specific critical issues (hypolimnetic withdrawal, water aeration, addition of particular substances).

It must be emphasized that forms of prior pollution either localized or related to internal loads (as in the case of small-medium lakes) still persist and along with the onset of health issues jeopardize the lake health condition as well as some types of water uses such as bathing or human consumption.

Analyzing the use of lake basin area and its surroundings, it must be noted that the lake shoreline is often impaired by infrastructural works, thus losing its main ecological function. This latter point has proved to be an issue in most of the investigated basins (in most of the large lakes, over 50% of their shoreline shows changes and alterations in its original morphology) and needs to be carefully handled by the competent authority.

Land cover, use and management may vary: there are lakes – usually of small dimensions – where the anthropogenic impact is low as they are subject to environmental restrictions, but there are also lakes with high urbanization and land exploitation rates because of their age-old history.

Wastewater collection system and treatment are homogeneously developed and nearly always average over 75 %. There are some excellent cases with values close to the 90% but there are also catchment areas where major actions are still needed to date. Nutrient removal from the catchment basin is often at optimal levels in small lakes, where the waste waters are transferred out of the catchment area; while in the basin where there are a lot of scattered houses and it is very difficult to collect their waste water by the urban collection system, the nutrients removal percentage are lower. In large catchment basin, often connected to the biggest lakes, difficulties in creating large-sized rings of main drains around the lake, and the presence of high density of population (with a large anthropogenic impact), cause a low nutrient removal capacity.

As a whole, however, nutrient removal capacity is good or fairly good.

Apart from a very few exceptions, agriculture and livestock farming are not responsible for main pressures on lakes. However, cases are reported of a percentage incidence in terms of phosphorus loads, mostly where there are good domestic and industrial wastewater collection systems.

Concerning the main uses, many large lakes provide water for human consumption (like Annecy, Como, Maggiore, Iseo and Garda

lakes) and bathing is allowed in most of the cases. As mentioned before, however, the conditions of certain lake bodies (Alleghe, Candia, S. Croce and Pusiano) are still critical and so such water use is restrained. Virtually all lakes host leisure activities among which fishing ranks first, of course. In those areas where professional fishing is performed, this activity is also of economic importance (Annecy, Maggiore, Como, Iseo, Garda, Ossiacher See, Millstätter See and Wörthersee).

Notwithstanding a general trend of improvement in water quality everywhere, much effort is still needed. Water quality improvement and the achievement of targets set by national and European regulations are closely connected with an appropriate management and development of lake basin area to reduce pressures and impact on the water ecosystem. Valorization of the lake as a resource altogether, by developing an increasingly aware tourism and sustainable management practices, is essential to let such primary and strategic water reserves reach conditions close to natural values and be preserved for the future.

Glossary of limnology

Algal bloom: very high phytoplankton concentration in a certain area of the water body, caused by a sudden development of organisms – often of the same species – capable of producing clear changes in water (color) or toxins.

Catchment basin: a region of land drained by surface hydraulic network (streams and rivers) conveying water into a lake.

Chlorophyll: group of pigments used by plants to absorb light energy during photosynthesis.

Ecosystem: the complex of living (biotic) and non-living (abiotic) components in a community.

Epilimnion: top-most layer in a thermally stratified lake, occurring above the metalimnion, that separate it from the deepest layers (hypolimnion).

Eutrophic: highly productive. Water bodies that are rich in nutrients (nitrogen and phosphorus) and thus capable of supporting rapid algal growth.

Eutrophication: condition in a water body where progressive nutrient enrichment stimulates algal population increase, due to natural or anthropogenic causes.

External load: amount of nutrients or pollutants delivered to the lake from external sources, for example through its tributaries.

Hypolimnion: the bottom layer of water in a thermally-stratified lake. It is separated from the epiliminon by the metalimion.

Imhoff tank: named from the engineer Karl Imhoff, chamber suitable for the biological treatment and the clarification of sewage, often used in built up area without public sewage system.

Internal load: amount of nutrients or pollutants released into water from deep sediments.

Lake basin: area in which lake water is accumulated. It can be of various origins (depression, landslide, glacial excavation, volcanism, etc.).

Limiting factor: a substance that depending on its quantity decides speed and maximum arrival point of the process it is involved in.

Limnology: the scientific study of inland bodies of salt and fresh waters. It deals with the physical and chemical aspects pertaining to such bodies of water, as well as biological and ecological conditions of organisms therein.

Mesotrophy: trophic condition of a lake that is moderately rich in algal nutrients. A mesotrophic condition is an intermediate trophic state between oligotrophic (poor in nutrients) and eutrophic (excessive nutrients).

Metalimnion: layer within a body of water between the top-most layers (epilimnion) and deepest layers (hypolimnion). It is determined by the position of the thermocline.

Microgram: is 1/1,000,000 of a gram (abbreviated µg).

Nutrient: any element or substance that is essential to any living organism. Carbon, nitrogen, phosphorus are essential nutrients for all algae, while silicon is essential for Diatoms.

Oligotrophy: condition where a lake has a limited algal nutrient content.

Photosynthesis: biochemical process which results in the production of carbohydrate molecules starting from carbon dioxide (CO_2) and water (H_2O) in the presence of chlorophyll, using light energy and releasing oxygen (O_2).

Phytoplankton: the vegetable component of plankton. They are photosynthetic organisms.

Plankton: organisms that inhabit freshwater or seawater. Their mobility is not enough to resist water mass movements. In lakes, plankton group includes microscopic or few millimeter-long plants (phytoplankton) and animals (zooplankton) and other living organisms.

Pollutant: any chemical substance that has a negative effect on general environmental quality.

Population equivalent: technically, it means the organic biodegradable load having a five-day biochemical oxygen demand (BOD5) of 60 g of oxygen per day. It is a standardized unit of measure (corresponding to the organic load produced per person) and is useful to compare loads coming from different sources (for ex. industrial load or animal load).

Zooplankton: the animal component of the plankton community.

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