INITIATIVES POUR L'AVENIR DES GRANDS FLEUVES
INITIATIVES FOR THE FUTURE OF GREAT RIVERS

Synoptic sheets

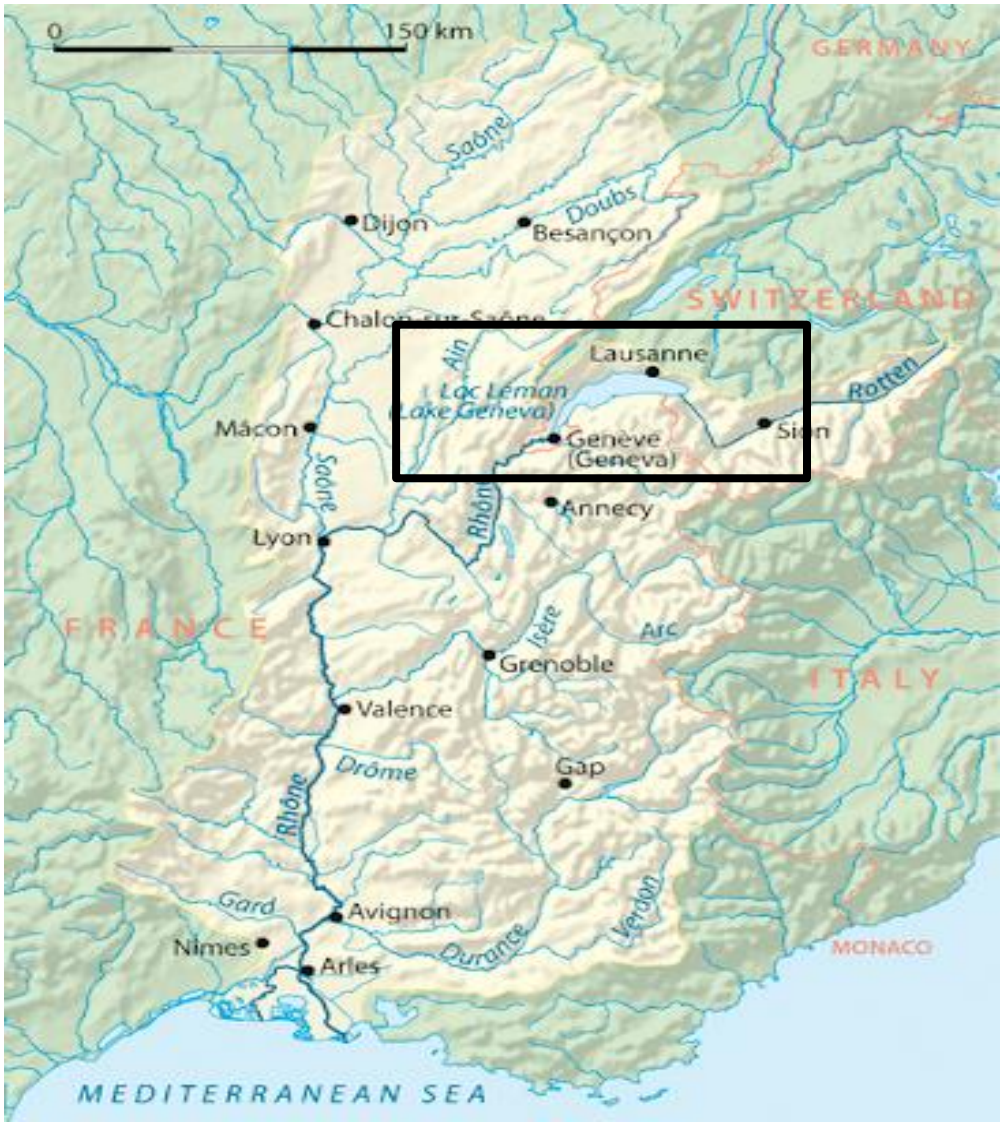
Rivers of the world

Lake Geneva

Initiatives pour l'Avenir des Grands Fleuves

Lake Geneva

Lake Geneva is the largest lake of Western and Central Europe. It covers a surface area of 580.1 km^2, for a total volume of water of 89 billion m^3. Shared by Switzerland (the cantons of Geneva, Vaud and Valais) and France (the departments of Haute-Savoie and Ain), the region is the home of more than 1.6 million people, and has been undergoing strong demographic growth over recent years. It is also affected by climate change. Many challenges must be overcome: the preservation of rare natural habitats and managing water resources, which will be subject to strong variations in the not too distant future.



Technical data

Length: 73 km

Hydrographic basin: 7,975 km²

Surface area of lake: 580.1 km²

Residence time of water: 11.3 years

Rainfall: 1,500 mm/year

Main cities and towns: Geneva, Lausanne, Vevey, Montreux, Evian-les-Bains, Thonon-les-Bains

Main tributaries: Rhone (75%), Dranse, Venoge

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Lake Geneva

Origins

Located in a former glacial valley, the lake lies at an altitude of 372 m. It is 72.3 km long and 13.8 km wide, with a maximum depth of 309 m. Its main tributary is the Rhone, which enters it at the eastern end, at Bouveret, after having crossed the canton of Valais and a section of the Vaud canton.

The arc formed by Lake Geneva is in a region characterised by a continental climate. However, due to the large mass of water contained, it has a more temperate microclimate, with milder winters and cooler summers. The region receives a relatively substantial rainfall, averaging about 1,500 mm/year.

Lake Geneva lies between France and Switzerland: 347 km^2 of its surface area is in Switzerland compared to 234.8 km^2 in France. Its northern, eastern and western banks are in Swiss territory (142.2 km), mainly in the canton of Vaud, whereas the southern bank lies in France (58 km). **The region of Lake Geneva is densely populated and the banks have been heavily developed.** Only 3% remain in a wild state. Nearly 1.6 million people live in the catchment area of the lake, in particular in the cities of Geneva, Lausanne, Vevey and Montreux on the Swiss side, and the towns of Evian-les-Bains and Thonon-les-Bains on the French side.

History of Lake Geneva, from the palaeolithic period to today

The intermountain basin in which Lake Geneva lies at present was gouged by the Rhone glacier during the major successive ice ages. Indeed, the Rhone glacier has repeatedly covered the Geneva region by about 700 metres. **Thus, it was at the end of the last ice age, more than 12,000 years ago, that Lake Geneva took its present form.**

The first traces of human life in the Genevan arc go back to the Upper Palaeolithic (17,000-12,000 BC). Traces of camps to the south of Geneva have been found dating from this period**. But is above all the vestiges of prehistoric pile dwellings built on the banks (about 4,000 years ago) that provide proof of settlements in the region**. Up to the end of the 19th century, the level of the lake varied considerably from season to season, forcing the population to adapt accordingly.

The early Middle Ages was a period of relative peace and stability for the Genevan region. It belonged to the Kingdom of Burgundy (888-1032) before being absorbed into the Holy Roman Empire. The banks of the lake came under the authority of the bishops of Lausanne, Sion and Geneva and the feudal lords of Versoix, Morges, Rolle, Hermance and La Tour-de-Peilz**.** During the 11th century, the Counts of Savoy settled on the south bank – from Saint-Gingolph to Geneva – before gaining control of the north bank in 1207. The House of Savoy dominated the entire Genevan basin for three centuries. **The period from the 13th century to the beginning of the 19th century saw fierce conflicts between the Swiss – Geneva and the Confederation – and the Dukes of Savoy.** The lake represents a major asset for whoever controls it. The economic wars around Lake Geneva stopped when, in 1803, the country of Vaud joined the Swiss Confederation, later joined in 1815 by Valais and Geneva, formerly annexed to France. Lastly, in 1860, Sardinia and Savoy separated. The former belonged to Italy and the latter to France. The sharing of the territory was determined definitively with Lake Geneva forming the junction between France and Switzerland.

Lake Geneva

Trading and tourist activities around the lake have intensified since the 12th century. Hence the presence of numerous ports including Vevey, Villeneuve, Morges and Geneva. The latter accommodated international fairs as early as the 13th century. Vines were planted on the southern slopes, encouraging urban densification. The development of the banks and demographic growth had a direct impact on the lake's landscape. **It is thought that only about thirty kilometres remain in their natural state at present** – mainly on the French side because the "coast law" of 1986 allowed for protecting and controlling urbanisation around the lake. Furthermore, as from the 20th century, people began talking about eutrophication, meaning the strong concentration of nutrient substances such as nitrogen and phosphate. These substances originate from wastewater and agricultural nitrates, leading to the pollution of the groundwater and threatening biodiversity. The CIPEL (International Commission for Protecting the Waters of Lake Geneva) was founded in 1962. Switzerland and France set up drainage facilities with 158 sewage plants. Despite this improvement in the quality of its waters, Lake Geneva remains fragile.

The fair of Saint-Martin in the Place du Marché of Vevey. Photographer unknown, 1898 (History Museum of Vevey).

Lake Geneva

Using the lake

Tourism

The tourism potential provided by Lake Geneva and its surroundings was not exploited until 1830 when the first wharves were built, near Geneva. International visitors made the region's inhabitants aware of the aesthetic nature of the lake landscapes, the mountains vineyards, the hills and its heritage, with the Château de Chillon, symbol of the hegemony of the counts and Dukes of Savoy.

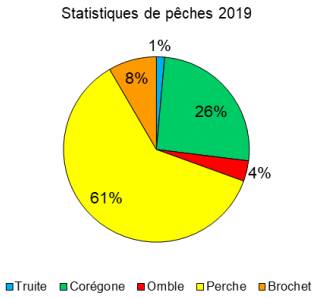
The tourist industry then developed until it imposed itself as the most profitable activity. **Today, the region of Geneva is well-known for its luxury tourism** (hotels, restaurants, hosting attractions such as international conferences, cultural and sports events, festivals). Geneva's water jet is a good example. Initially engineered to control the pressure of the water of the hydropower plant of Coulouvrenière, it became a tourist attraction at the end of the 19th century. A host of nautical activities are also available such as windsurfing, canoeing, diving and rowing. **There are now 64 marinas, 52 in Switzerland and 12 in France, and nearly a hundred good quality beaches,** proving the eagerness of the local authorities to develop tourist infrastructures, despite the artificialisation of lake's banks and the disturbances caused for the fauna and flora.

The water jet of Geneva and excursions on cruisers.

The vineyards of Lavaux listed among the UNESCO world heritage sites.

Lake Geneva

Fishing



Fishing in the waters of Lake Geneva is both an advantage and a reason for conflicts due to overfishing. This has led to the regulation of fishing activities, especially concerning mesh size and the fish species that can be caught. Among those consumed most are the perch, arctic char, trout, burbot, true fera, pike, crayfish and common roach.

Although fishermen were numerous from the Middle-Ages to the 1980s, their numbers have decreased considerably, giving way to pleasure boating. Fishing is becoming a recreational activity and today there are more than 6,500 amateur fishermen all around the lake. As for professional fishermen, their number has slightly decreased over the last 15 years and there are 131 of them practicing this activity in Lake Geneva.

Navigation

Navigation on Lake Geneva developed in parallel with the tourism boom. On 18 June 1823, the diplomat and businessman Edward Church inaugurated the first steamboat, the William Tell, capable of carrying 200 passengers. Its success led to the launching of the "fireworks boats". Navigation became a profitable activity, spurring the launching of a large number of commercial companies. The "Belle Epoque", a fleet like no other in the world, was launched in 1910. All competing companies eventually merged to become **the Compagnie Générale de Navigation sur le lac Léman (CGN) in 1873**.

Thus, Lake Geneva is a well-known place for practising nautical activities and excursions on cruisers. **In addition to leisure, navigation is also a means of transportation used to connect towns located on both sides of the lake.** CGN-Mobilité operates a large fleet of boats capable of transporting a considerable number of passengers. It makes close to 100 crossings a day thanks to the establishment of three regular lines: Lausanne-Evian (N1), Lausanne-Thonon (N2), and Nyon-Yvoire (N3).

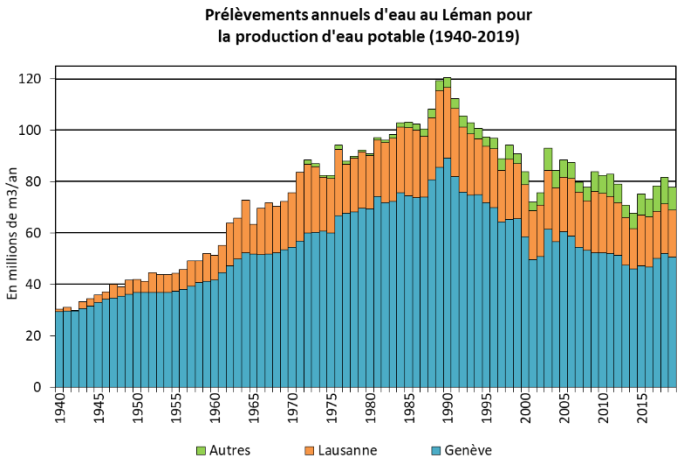
Transport by boat is considered faster and more ecological: it substantially reduces road traffic, especially that of the busiest places like Saint-Gingolph, Geneva and the city of Lausanne. **The CGN makes it possible to avoid the presence of 1,600 cars a days between the Canton of Vaud and Haute-Savoie, and to reduce by five greenhouse gas emissions** - i.e. 20,000 tonnes of CO_2 if all the region's inhabitants use their cars, versus 3,500 tonnes of CO_2 by lake transportation. Between 2016 and 2017, two million passengers benefitted from the services of this company.

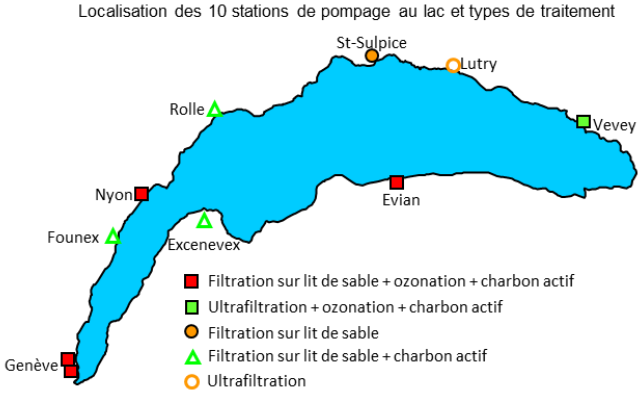
Lake Geneva

Drinking water

10 pumping stations supply the water of Lake Geneva to nearly 900,000 people. The Canton of Geneva extracts 80% of its drinking water from the lake while the remining 20% is drawn from groundwater. The water is treated and stored in reservoirs before being used by households, farmers, industry and hospitals.

The objectives of protection of the waters of the lake have made it possible during the last 60 years to improve the quality of the waters of the lake, to guarantee and maintain a use of the water for the production of drinking water by means of an appropriate treatment in spite of the emergence of new pollutants such as pesticides and other products of synthesis.





Lake Geneva

Governance and international cooperation

Governance

The International Commission for the Protection of the Waters of Lake Geneva (CIPEL)

The CIPEL is a French-Swiss intergovernmental organisation founded in 1963. It gathers elected representatives, civil service agents, scientists and experts from the departments of Ain and Haute-Savoie, the Region Auvergne Rhône-Alpes on the French side and the cantons of Vaud, Valais and Geneva and the Confederation on the Swiss side.

Its main missions consists in monitoring establishing a regular assessment of the quality of the water of Lake Geneva and implementing drainage measures. A Technical Sub-Commission, made up of two sub-bodies, ensures the proper functioning of the Commission. The first one, the Operational Committee, assumes a transversal mission which consists in guaranteeing the missions of the CIPEL and in ensuring the implementation of the action plan. The second, the Scientific Council, coordinates the research and study programs on the waters of Lake Geneva and ensures a scientific watch, through seven study groups that work more specifically on the protection of the waters of Lake Geneva. Finally, the CIPEL includes a permanent Secretariat since 1972 which ensures the good functioning of the Commission and deals with the administrative, technical, financial and scientific management.

Besides the role of monitoring the water of Lake Geneva, benchmarking and expertise, **the Commission sends recommendations to the French and Swiss governments to combat current and future pollutions. It carries out actions to inform the population and make it aware** in order to encourage environmentally friendly behaviour. Finally, it leads a vast network of actors to promote the exchange of experiences throughout its territory.

A cross-border organisation, it receives 30% of its funds from the Swiss Confederation, 23.85% from the canton of Vaud, 9.45% from the canton of Valais, 11.7% from the canton of Geneva and 25% from France.

The Council of Geneva

The Council of Geneva, founded on 19 February 1987, is an organisation whose purpose is to promote French-Swiss economic, social, cultural, infrastructural and ecological cooperation. Like the CIPEL, it is composed of the French departments of Ain and Haute-Savoie as well as the Swiss cantons of Vaud, Valais and Geneva. The roles of the Swiss Confederation, the French Republic and the Auvergne-Rhône-Alpes Region are confined to those of observers. Various projects are supported and funded to build and strengthen Genevan identity. They are carried out in five main areas: the economy and tourism, transport and communication, cross-border populations and social affairs, education and culture, the environment and territorial development.

Lake Geneva

Governance and international cooperation

International cooperation

1 – Agreement on navigation on Lake Geneva of 7 December 1976

This agreement gave rise to a joint commission that brings together the Swiss Federation and the French government. It was set up to regulate navigation on Lake Geneva, that is to say developing the Lake Geneva basin, to diversify tourist facilities, guarantee safety for all and maintain a balance between environmental challenges and the different activities proposed around the lake. **Good practices are determined by the RNL (French-Swiss Navigation Regulations on Lake Geneva)**, a bilateral agreement between the authorities of the two countries to harmonise the rules governing navigation on Lake Geneva.

2 – Agreement on fishing on Lake Geneva of 20 November 1980

An international advisory commission on fishing monitors the effective implementation of this cross-border agreement. Its purpose is to reconcile fishing activities with the potentialities of Lake Geneva. **Its role is also to assign boundaries to biotopes and protect fish species.** To ensure this, it sets the number of fishing permits to be issued, the size of the fishes caught and the fishing seasons.

In France, this agreement is implemented in parallel with regulations on fishing in the Environment Code and the internal rules of the AAPPMA (Certified Angling and Aquatic Habitat Protection Association). In Switzerland, fishing permits - daily, weekly and monthly – can be ordered online from the prefecture, in tourist offices and fishing tackle stores. Regarding annual permits, the person requesting must hold a SaNa competency certificate.

3 - Franco-Swiss agreement on the intervention of the bodies in charge of the fight against accidental pollution caused by hydrocarbons or other substances which can alter waters of May 5, 1977

Within the framework of this agreement, a Franco-Swiss working group attached to the CIPEL has the task of drawing up and updating a detailed intervention plan and of testing its effectiveness by means of alert or alarm exercises.

Lake Geneva

Enhancing and preserving Lake Geneva

The development and the protection of rare natural "windows"

The biodiversity of Lake Geneva is considerable despite the urbanisation of its banks: it includes a wide variety of migratory and sedentary birds and around thirty fish species. Its ecological wealth has led to the classification of certain of its areas as natural zones of ecological interest for animal and plant life (ZNIEFF) and Natura 2000 – a network gathering natural sites in the European Union**. Wetlands continue to exist, despite the increasing pressure of property development.** This development is accentuated by the cross-border context of industrial and tourism development with agricultural spaces much sought after. Furthermore, between 1975 and 2009, the National Institute of Statistics and Economic Studies (INSEE) observed that the coastal population had swelled by 20,000 inhabitants.

This dual equation between the protection of natural spaces and the diversification of tourist facilities highlights the need to strengthen the bonds of cooperation. The measures taken already prove the desire of both French and Swiss municipalities to preserve the lake's rare natural habitats. For example, in France, the Coastal Conservatory carries out actions on the western part of Lake Geneva to enhance lake-land farming areas, protect wooded areas and wetlands, and preserve water resources.

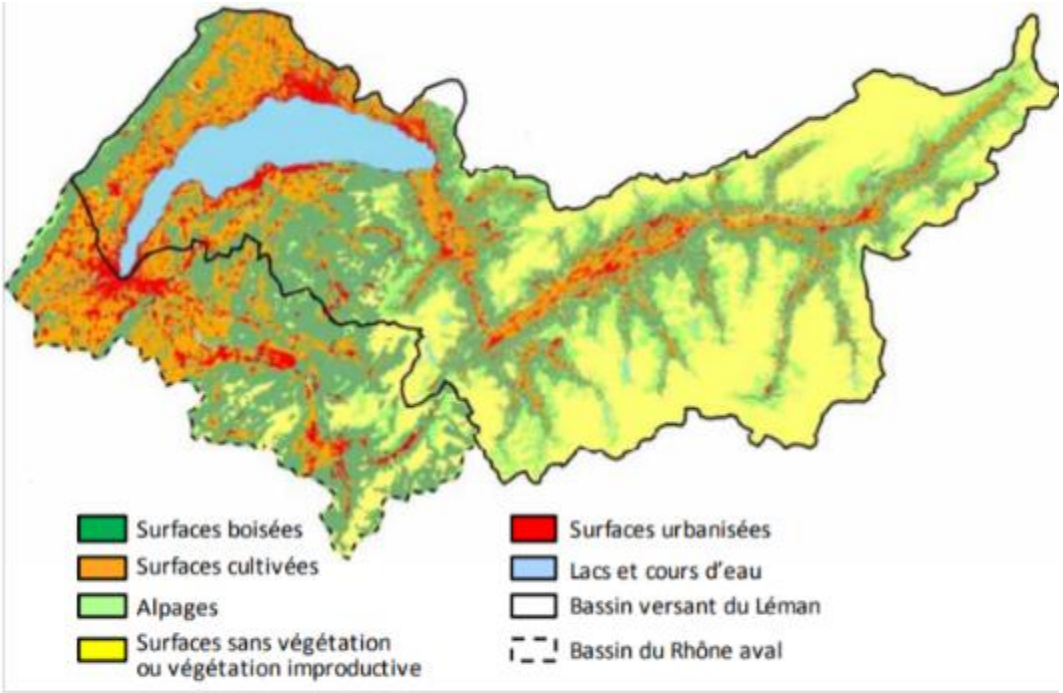


*Figure 3 : Occupation des sols du territoire couvert par la CIPEL (CH : GEOSTAT, 1997 ; FR : Corine Land Cover, 2000) **

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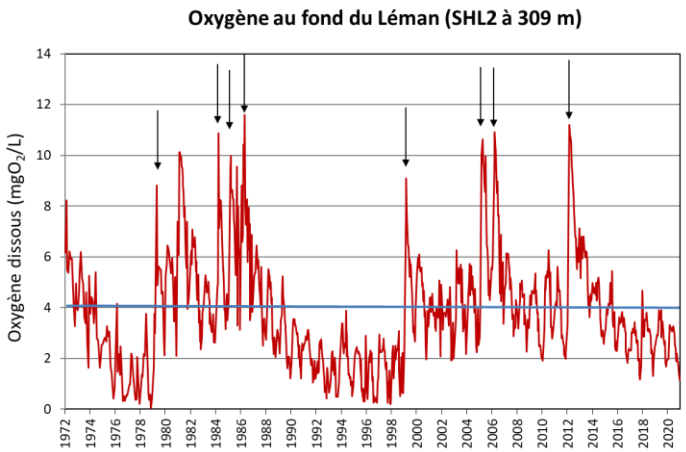
Enhancing and preserving Lake Geneva

The impacts of climate change on the waters of Lake Geneva

Temperatures affect the movement of water, with negative impacts on the lake's ecological functioning. This is characterised by two phenomena. The first is "thermal stratification", that is the say the warming of surface waters from the beginning of springtime, producing layers between the deeper cooler water and the surface water and limiting their mixture. Starting in autumn, the water cools until the end of winter, when it becomes colder and denser than the deeper water at the bottom of the lake and thus sinks and mixes with it, permitting the reoxygenation of deeper layers and the circulation of nutrients. However, the winter mixing of the waters of Lake Geneva does not take place every year and **climate change may modify this cycle – lengthening the period of stratification and reducing the mixing period, thereby having an impact on aquatic life.**



Year with complete mixing of the lake waters

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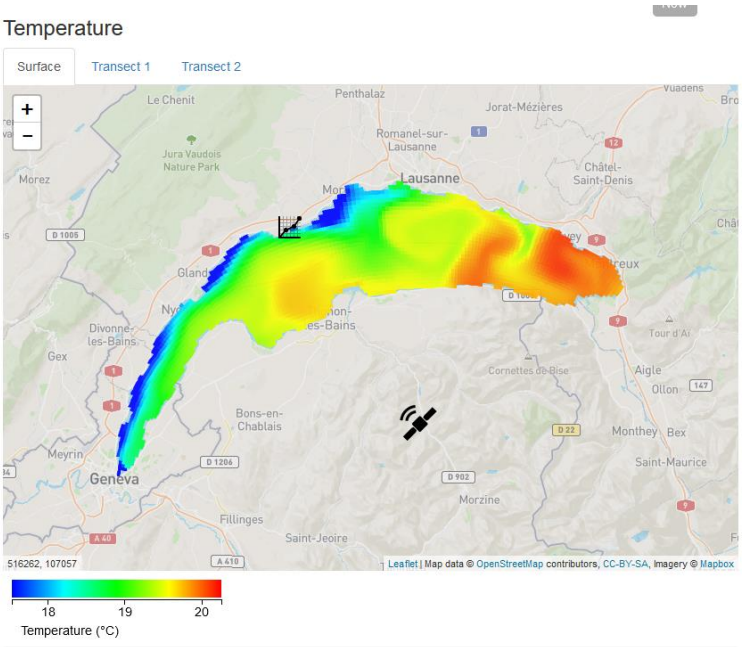
Lake Geneva

The temperature of the water of Lake Geneva has been increasing since the 1970s. One example of this is the lake whitefish, also called féra. They are the fish most commonly caught in Lake Geneva. Today, climate change is beneficial to this species since the early production of zooplankton and phytoplankton provide abundant food for the young fish which develop more rapidly. However, **warmer water could lead to the whitefish's disappearance. Indeed, it can reproduce only if the temperature of the water is below 5°C.** In 2018, the number of whitefish caught fell by 66% in comparison to 2015. The same trend will probably be observed for the arctic char, whose spawning dates will be modified. Thus cold winters are essential for aquatic life.

An online platform, *Meteolakes*, funded by the European Space Agency and developed jointly with the National Institute of Agronomic Research (INRA) at Thonon-les-Bains in France, allows monitoring the evolution of the lake's biology and physics, and establishing forecast models based on simulations and measures performed in the lake.



Plateforme Meteolakes http://meteolakes.ch/#!/hydro/geneva