



**LEbanese Water
Actors Platform**



Overview of pollution in the Qadisha River

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Assessing the sustainability of the water resources : the case of Qadisha River

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صباح الخير

Bonjour – Good Morning

Qadisha Valley

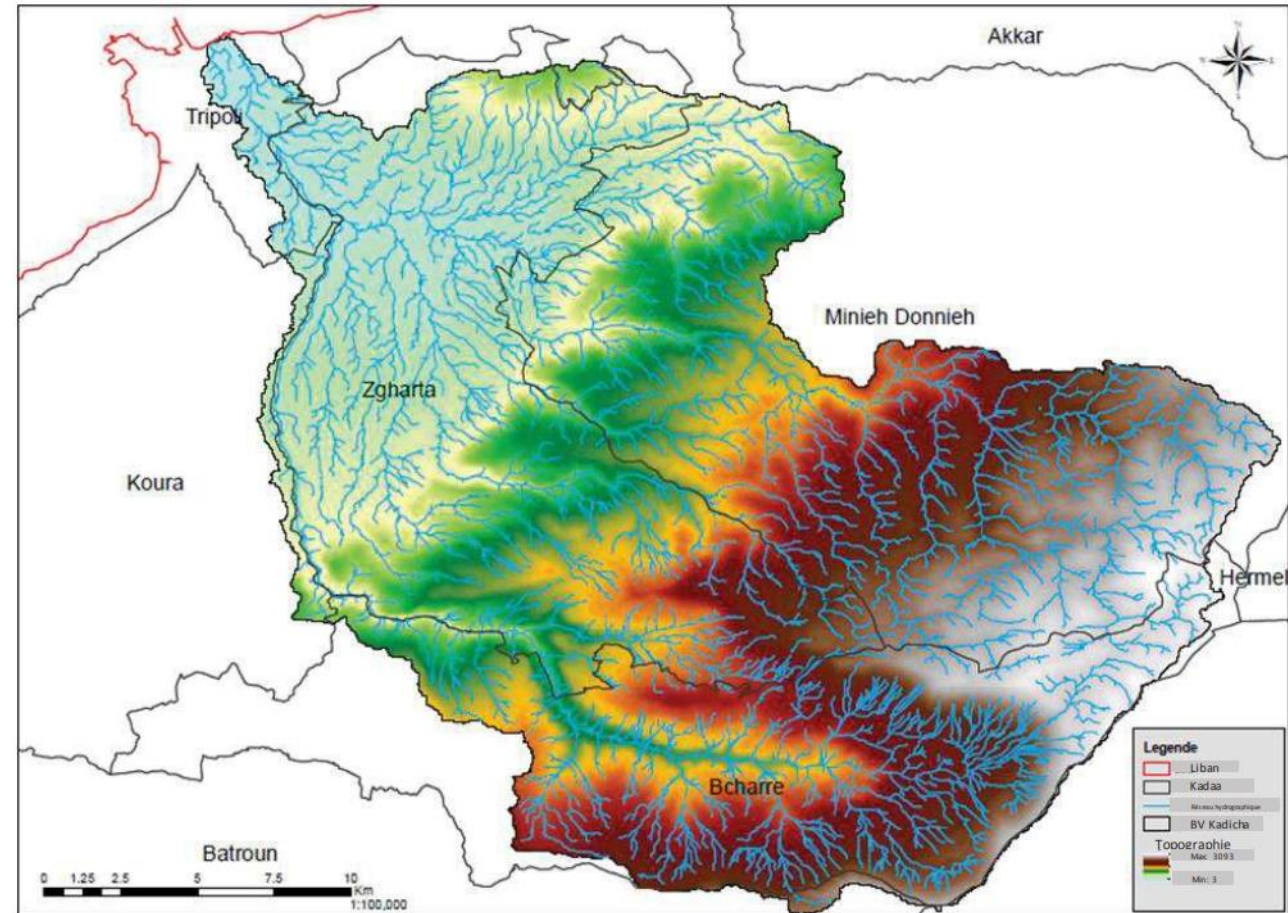
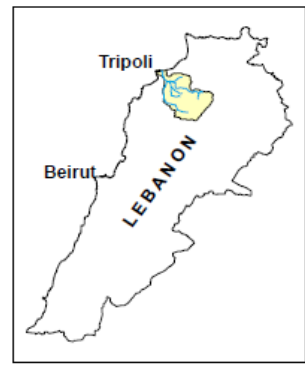
Qadisha River Basin

The Qadisha River also called "Abou Ali" located in northern Lebanon has a length of 44.5 km and an average annual flow of 262 million m³.

Its catchment area, extending over an area estimated at 484 km², of which 97% is mountainous areas, encompasses 236 municipalities and villages distributed among several administrative districts.

The section of the river that crosses the city of Tripoli is called "Abu Ali".

The river has its source at an altitude of 1850 m in Qadisha Grotto (Becharri). The estuary is in Tripoli on the Mediterranean Sea.



Lebanese University research on Water Quality in Qadisha River

Water quality is one of the most important factors in aquatic ecosystems and ensuring water is safe for human use.

Actions made on land have a major effect on what happens in water-based ecosystems which is why monitoring water quality levels is so important.

Since 1996, in Lebanese University, we work on the pollution of water resources in North Lebanon, and particularly Tripoli area.

In 2009, we have started a doctoral program with French universities to studied the type of pollutants existing in Qadisha Basin.



Doctoral thesis on water pollution in the Nahr Abou Ali watershed (Qadisha River) during the last 10 years in Lebanese University

PhD Student	Doctoral Thesis Title	Partner University	Date of Defense
Helmieh AMINE	Exposure assessment of organic contaminants in Mediterranean transition zones	Montpellier 1 University	18 September 2012
Fatmeh MERHABI	Contamination by Persistent and Emerging Organic Pollutants. Case Study: Kadicha River	Montpellier University,	6 December 2019
Rachad AL-HAJ	Hydrogeochemical study of groundwater in the Abou Ali River Basin Aquifer	Lille University	17 December 2021
Rosette MANSOUR	Assessing the chemical contamination and the Extended-spectrum beta-lactamase (ESBL) - and carbapenemase-producing Enterobacteriaceae of Rachiine spring water and sediments	Beirut Arab University	November 2023 (expected)

Papers published during the last 10 years

1. HIJAZI F., HALWANI J., DAYE M., BAROUDI M., (2012). Hydrogeology and Contamination of the Basin of Tripoli. Hydrogeology of Arid Environments. Rausch & al eds., Borntraeger Science Publishers, Stuttgart, Germany.
2. AMINE H., GOMEZ E., HALWANI J., CASELLAS C., FENET H., (2012). UV filters, ethylhexyl methoxycinnamate, octocrylene and ethylhexyl dimethyl PABA from untreated wastewater in sediment from eastern Mediterranean river transition and coastal zones. *Marine Pollution Bulletin*, 64, 2435–2442
3. AMINE H., MERHABI F., HALWANI J., ROSAIN D., CASELLAS C., FENET H., GOMEZ E. (2018). Alkylphenols and Alkylphenol Polyethoxylates levels in a Mediterranean developing country context: contamination of rivers and coastal sediments. *Research Journal of Chemical and Environmental Sciences*, Volume 6 [2] April, 21-33
4. AMINE H., HALWANI J., GOMEZ E., MERHABI F., (2018). Etude de la contamination en hydrocarbures aromatiques polycycliques dans les sédiments et les eaux au nord Liban: rivières, zones de transition et sites portuaires. *Journal Scientifique Libanais*; 19(3): 388-417.
5. MERHABI F., AMINE H., HALWANI J. (2019). Evaluation de la qualité des eaux de surface de la rivière Kadicha. *Lebanese Science Journal*, Vol. 20(1): 10-34.
6. MERHABI F., GOMEZ E., AMINE H., ROSAIN D., HALWANI J., FENET H. (2021). Occurrence, distribution, and ecological risk assessment of emerging and legacy contaminants in the Kadicha River in Lebanon. *Environmental science and Pollution Research*. <https://doi.org/10.1007/s11356-021-15049-0>
7. MERHABI F., GOMEZ E., CASTRO N. A., AMINE H., ROSAIN D., HALWANI J., FENET H. (2021). Occurrence and ecological risk assessment of pharmaceutical products in the Kadicha river in Lebanon. *Emerging Contaminants*. Volume 7, Pages 196-203. <https://doi.org/10.1016/j.emcon.2021.09.001>
8. HALWANI, J., EL-HAJJ, A., HALWANI B., (2022). Hydro-geochemical Study of the Coastal Aquifer in Tripoli (Lebanon). *Research Journal of Ecology and Environmental Sciences*. 2(4), 103– 117. DOI: 10.31586/rjees.2022.212 .

Main results concerning the water quality

The Qadisha River is subject to urban, agricultural, and industrial pressures; chemical and microbiological analyses have shown that surface and underground waters are highly polluted chemically and microbiologically.

- ✓ Significant microbiological contamination below 800 meters above sea level, due to the discharge of wastewater from the villages located on the banks of the river.
- ✓ Chemical contamination by pesticides and several emerging pollutants in several sites which becomes worrying, and which threatens the quality of water especially if it is used in irrigation.
- ✓ High chemical contamination due to discharge of effluents from agriculture farms, olive mill effluents and solid waste leachate.
- ✓ Multiplication of private wells without any official control for agricultural and touristic uses.

Origin of the pollution

Human activities are responsible of the contamination of Qadisha River.

Water status is largely influenced by inputs of pollutants, particularly organic material, nutrients, and hazardous substances.



The main industrial activities of the region are related to agriculture, there are about several farms for chickens, pigs, cows, goats, and sheep.

In addition, there are wastewater from olive presses, dairy and agrifood industries, slaughterhouses, furniture and woodcrafts establishments,

Wastewater resulting from these facilities is discharged into the Qadicha River without any treatment.

These are added to the irrigation water from agricultural land rich in fertilizers and pesticides, which in turn joins the watercourse.

Wastewater treatment in Qadisha watershed

At present, there are 2 sewage treatment plants in the whole watershed:

- Tripoli which treats about 60% of the sewage from the 4 cities of the Union of Al-Fayhaa Municipalities (the rest is discharged directly in the Mediterranean Sea or in the river that flows into the sea)
- Becharri which treats only the wastewater from Becharri area,

The rest of the wastewater from all the agglomerations of the catchment area is discharged into the course of the river.



Tripoli Wastewater Treatment Plant

General Description

- Population equivalent: 1,000,000 PE
- Total daily design flow: 135,000 m³/d
- Design peak flow: 9,263 m³/h
- 3 phases of treatment: Pre-treatment, biological treatment and UV sterilization
- 120,000 m² of plant area, out of which 40,000 m² is reclaimed land



N.B. The WWTP was designed to treat sewage from the Nahr Abou Ali watershed, it currently operates in primary treatment with 20% of its capacity.

Contamination of the River by solid waste leachate

- One of the major sources of pollution of the Qadicha River is the existence of some illegal dumps of urban solid waste on the banks of the river.
- In addition, the population adjacent to the river uses the water stream for waste littering resulting in the accumulation of refuse on both sides of the river with all the negative impacts .
- The leachate issued from these illegal dumpsites and the leaching of these mountains of waste by rainwater are carried directly into the river without forgetting the risk that waste could flow into the watercourse.



Kadisha Hydropower Plants

- The 4 hydropower plants are under the jurisdiction of an old concession named 'La Kadisha' that is fully owned by EDL and are among the oldest in Lebanon constituting about 7.5% of the installed hydro capacity in the country.
- Due to their old age, the Kadisha plants are running at significantly reduced efficiency levels. Whereas the technology of the hydro turbine itself did not evolve much during the last decades, the improvements in the injectors' technology, regulation valves, controls and protection systems have been significant & can, in many cases, enhance the energy production of an old hydro unit to levels that are close to that of a new unit of the same size.
- Improvements of the plants can lead to significant capacity increase and power output, and as the same contribute to the modernization of water infrastructure around the plants.



Plant	New units	Current average MWh/year	New Average MWh/year	Gain in power (%)
Becharri (1920)	New 1.8 MW unit possible	5,904	6,702	13.5%
Abou Ali (1932)	New 3 MW unit possible	21,649	42,313	95.4%
Mar Licha (1936)	New 2 MW unit possible	10,924	14,508	32.8%
Blaouza (1961)	-	33,352	34,978	5.0%

Conclusions

- A sustainability assessment of water resources is essential for maintaining regional sustainable development.
- In this study, main challenges concerning the water quality in Qadisha River Basin was presented which reflect the impacts of humans on the pollution of water.
- Water status in the Qadisha River Basin is largely influenced by inputs of pollutants, such organic material, nutrients, and hazardous substances.
- The sustainability of Qadisha River could only be achieved through actions aiming to stop the origin of the pollution.
- Therefore, we formulate medium - and long-term recommendations which could contribute to the sustainable utilization of water resources.

Recommendations

1. Accelerate the construction of wastewater networks in the villages located on the banks of Qadisha River and ensure conveying sewerage to the main pipeline which leads to the existing Tripoli WWTP. This action will have a positive impact on public health and the environment by reducing the discharge of untreated wastewater to Qadisha River.
2. Oblige pig farms to have unsealed pits for slurry and treat them on site or empty them regularly in the Tripoli WWTP.
3. Find a quick solution to the solid waste management crisis that threatens the quality of the river's waters.
4. Implement the principles of integrated water resource management in the basin and install meters with tariffication based on the volume of water consumed and its use.
5. Rehabilitate and renovate the hydroelectric power stations and the related infrastructures.
6. Take advantage of the declaration of the Qadisha Valley by the UNESCO as a World Heritage Site in 1998 to ban all activities that can pollute the environment and ensure financial aid to assess the sustainability of the water resources .

**Thank you for your
Attention**

