

Current Pollution Situation of the Lake Chapala, México

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Abstract: This article will discuss the current pollution problem that Lake Chapala is living in, then some proposals will be put forward to start solving this problem.

Key words: industrial pollution, water, lake, nature

1. Introduction

The current situation of the lake is overly complex, the extent of the entire basin involves factors of water exploitation, pollution, mud, and climatic effects. In addition, the lake is lost day by day, because the only thing that saves its water level is the rainy storm.

2. Pollution of Lake Chapala

The main problem of the lake is the water pollution. It has modified the place, usually caused by humans, which makes it unbecoming or dangerous for person consumption, agriculture, the fishing and recreational activities, as well as for animals.

Although water pollution, according to theory, can come from natural sources such as the ash of a volcano [1]. But, most of the current contamination comes from human activities. Development and industrialization have done a greater water usage, a large generation of waste threw to river. The use of boats for transport people and merchandises which means the cause of river pollution. Surface water is generally more vulnerable to pollution of anthropic origin than groundwater. The first is direct exposure to human activity. On the other hand, a

surface source can be restored faster than an underground through seasonal cycles.

However, in the case of Lake Chapala, there is no official statistical, information on the sources of water pollution, it is not known, the impact of the different activities in the quality of this body of water. For determining the presence of pesticides requires a specialized search, that is generally not covered by monitoring systems. The National Water Commission (CONAGUA for its acronym in Spanish) recognizes that agriculture, deforestation, and poor garbage management are responsible for 70% of water resources contamination [2].

Water impurity is a major problem in our country; about 40% of monitoring stations report contaminated and heavily polluted water measured by biochemical oxygen demand. Generally, there is no information from official agencies as of the sources that generate uncleanness, as well as no report on specific contaminants such as pesticides.

About water recycling companies “in the past 50 years, many of them have been built, but 100, 70 or 80 percent are abandoned. In general, they use a tank to accumulate rainwater and contaminated water which go through together, in addition, the mechanism does not work. What is the cause of this situation? They have been built by CONAGUA with public money and must be operated by the districts. The operating costs should be paid by the communities. They are built with

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high technology, that to function properly the cost of energy is awfully expensive. They do not have enough money or do not want to pay for it.

Therefore, they are out of control. In short, where many treatment plants have been built over the past four or five decades, most are abandoned for that reason. There is a fine for not operating with water recycling, and throwing contaminated water at bodies of water, but that fine is much less than the cost of functioning them.” [3].

In Mexico, agriculture needs 78% of the water that is extracted; references from countries with information on this, indicate that, this economic activity is also the main source of contamination of water bodies. However, in Mexico, the diffuse discharges generated by agriculture is the lack of environmental regulations.

The causes of agricultural water pollution include inadequate agrarian practices, public policies that encourage inconvenient water use, biases in farmer's perception of the problem, the need to produce food and other supplies, even at a high ecological cost [2].

There are no agri-environmental strategies in this country that aim to reduce the pollution generated by wrong agrarian practices; therefore, the implementation of communal rules is an urgent need.

The uncleanness is a serious thing in the lake. It is necessary to analyze the water conditions of the two rivers: Lerma and Grande Santiago. The Lerma River crosses the Bajío Region¹, where the torrent receives all kinds of urban and agricultural waste. The Grande de Santiago River flows into Lake Chapala. Here, the pollution is so strong, it collects the drainage waters of the City of Guadalajara and nearby villages. All the debris in the rivers, come together and make the current slow and the water is stalled out on the ground, and must be added the existing dams in the Lerma River [4].

¹ Bajío Region is a geographical, historical, economic, and cultural region of Mexico's North-West Center, located at the north of the Lerma River. It comprises the following entities: Aguascalientes, Guanajuato, Michoacán (north only), Queretaro, San Luis Potosí (center only) and Jalisco (Altos de Jalisco only), Wikipedia, retrieved January 29, 2021.

The region of the Lerma-Chapala-Santiago Basin exhibits various problems, surface water pollution, overexploitation and contamination of some aquifers, the deforestation and soil erosion in the upper parts of the basin, as well as the decrease in water levels of Lake Chapala.

One of the most important is the serious imbalance in the hydraulic balance, as well as for surface water and groundwater. The population of the basin demand more water than available. The use of the liquid for the consumers and the industries are excessive for the natural supply, with effects negatively impact on the hydrological system, future development of the region

The users exceed the use of the surface and groundwater in various cavities of the two rivers and the lake. In the northern part mainly, this imbalance leads to over exploding aquifer mantle.

The water exploitation to meet needs in the region stimulate severe conflicts among the habitants. The pollution levels limit the possibilities of harnessing it, in other productive uses. Extracting surface water or groundwater anywhere in the basin necessarily involves affecting the use of the liquid located downstream or that is shared with the renewable resources of the aquifers. This has put at risk the development achieved in the region and the conservation of Lake Chapala, in its ecological regulation function.

The environmental problems of the Lerma Chapala Basin are reflected and magnified when arrived Lake Chapala, which is the refiner of all materials carried by the Lerma River. Thus, the lake presents eutrophication namely biological problems with development aquatic weed, the life of plants and animals, impediments to the safe use of water, by the presence of sedimentation, garbage urban, waste industrial, and agricultural pollution.

This represents enormous economic social, environmental costs reflected in the disproportionate increase in the opportunity cost of natural resources. In this case the water, that need expenditures for the

rehabilitation of the reservoir, impediments to basin development, health problems and in general, unflattering prospects for the potential of natural resources to establish sustainable development due to the emergence of various important externalities and marginal costs.

The Basin has been subjected to an intensity of occupation and land use, that bears a demographic and socio-economic burden greater, than the capacity of its ecosystem under current technological and institutional conditions.

Lake Chapala is affected by high levels of pollution mainly due to industrial discharges, as well as the lack and good management of wastewater treatment centers, are some of the main problems affecting Lake Chapala. This was noted by Marion Hammerl, President of Global Nature Found and the Living Lakes Network. The risks facing the lake are the amount of water, extraction. The quotas are not being respected, there is not carried out, the possibility of saving this liquid either in the agricultural and domestic field. The water quality of the lake is that of being very contaminated.

There is the possibility of treating water in industries and it is recognized by the authorities, this is not a new or unknown problem, water sanitation is essential, this factor should be found in number one on the priority list, that is the solution, explained Marion Hammer, who believes that the problems of the lake and its Basin are an international issue.

In addition, companies, which are the main responsible for lake pollution, must comply with the environmental laws.

After having made a visit to the Santiago River, Hammerl commented that “what comes out of the lake makes us deeply sorry because it is dirty. I haven’t even seen in third world countries”. It added that there was no lack of research or information for to act and implement strategies. Rain has helped the lake to have a good water level and not the hand of the human being [5].

2.1 The Main Polluting Bodies of Lake Chapala

Lake Chapala, Llamas (2009) [6] has non-metallic components such as phosphorus, sulfur, fluoride, and some metals have been found, according to Pedro Faustino Zarate del Valle, this situation is the result of abuse in the use of fertilizers on the upstream of Lake Chapala. In Michoacán and Guanajuato, is by industrial and municipal discharges with high content of these elements.

The minerals lead to the eutrophication of the lake resulting in excessive production of organic matter microorganisms and macro -organisms.

Some identified metals can be toxic to living things and the environment, they are indicative of water quality.

The government of Jalisco, through the Research Center for Technological Assistance and Design, published a study on pollution in Lake Chapala, this found the substance dichlorophenoxyacetic. It is an herbicide used by farmers of the area, and the product of the landslide that cause rain or irrigation itself. These elements are present from 2 to 50 micrograms, above the acceptable limit.

Dichlorophenoxyacetic is related to problems with cancer and human reproduction as well as consequences of hormonal changes in the thyroid.

It should be noted that Lake Chapala is in a difficult pollution control system: the Lerma and Santiago River have factories on the Santiago River side is full of industries, including two nuclear reactors [7].

The problem of Lake Chapala is historical, it is at least 25 years old [8]. Manuel Villagómez, president of The Cuenca Lerma Chapala Santiago Foundation describes: The reservoir has always been stripped of its water: It currently supplies water to 60 percent of the population of Guadalajara City, located in the Jalisco State. Moreover, it is important to mention the conflict for liquid between the States of Jalisco and Guanajuato.

Villagómez says in an interview that Lerma River’s water (which is born in the State of Mexico) is contaminated by industry and pork farm. This channel

pass through Guanajuato State. Here loses abundance, 90 percent of the runoffs that should be go directed to the lake, remain in Guanajuato State, in the Solís Dam or in the Yuriria lagoon.

At the end of the nineteenth century, the lake had an area of 164 thousand 659 hectares; then, between 1902 and 1910 dikes were built at the eastern side end of the reservoir and the heading of the Lerma River on the confluence section with Lake Chapala. At that time, some 50 thousand hectares of wetlands were drained and dried.

Each year Lake Chapala receives about 17 thousand tons of pollution from materials used for agricultural production: herbicides, fertilizers, and pesticides.

The water mirror has a diversity of aquatic and terrestrial birds, residents and migratory animals. There are threatened or endangered fishes, such as charal, campamacho, and white fish. They are affected by unstable water flows, more than 10 species of fish, especially white fish has disappeared years ago. See Figs. 1-3.

The director of the First Institute of Environmental Heart of the Earth. Alejandro Juárez Aguilar emphasized that the economic activities approximately of 98 thousand 733 hectares of the sub-basin generated



Fig. 1 Pelican Borregón. Migratory fowl that arrives at the Lake Chapala in winter, from the United States and Canada.²

² <http://michoacan.travel/es/eventos/migracion-del-pelicano-borregon.html>.



Fig. 2 White fish. Augustine of the castle³.

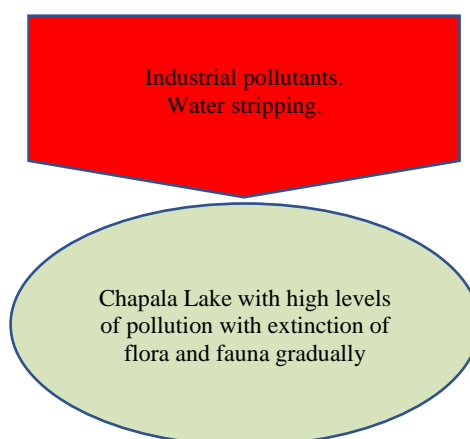


Fig. 1 Some species disappeared because of the water pollution.

about 101 thousand 87 tons of land that went to the bottom of the lake in 2011.

The plus serious thing is that the most precarious agriculture economy is the greatest destructive: as well as the mountainous hillside plantings.

The conclusions reached by the Institute are as follows:

- * There is high use of pesticides in agricultural areas, including high toxicity substances such as methyl parathion and carbofuran.

- * According to scientific reports, several of the products found have negative effects on living beings, (affectation of native species and the volume of the production of the fisheries with economic, social, and

³ <https://imagenes.milenio.com/DzcYJAVHy5C9VHKvK3IveR7ztjs=/936x566/https://www.milenio.com/uploads/media/2014/05/22/pez-blanco-especie-nativa-lago.jpeg>.

environmental effects); there are also reports of human health involvement.

* The effect of lethal products in the ecosystem of Lake Chapala and its tributaries is unknown.

* Agrochemicals are used in the area even above the concentrations recommended by producers, which reveals the limited technical advice for the use of the toxic products.

* The use of fertilizers is high in the loss of soil fertility, which generates a pauperization effect of the agricultural sector.

* Hillside crops use the most agrochemicals per hectare and lose more soil from water erosion (600% more than temporary cultivation).

* Despite the high volume of nitrogen and phosphorus provided by agricultural and urban activities and are swept away by rain, the lake remains in an oligotrophic-mesotrophic state (medium-low level).

* Due to low light penetration into water, nutrients are not used by algae.

* The saturation point of the sediments is unknown: a sharp change in lake conditions is possible [9].

Continuing the presence of high pollution rates, it can be observed in the existence of harmful chemical compounds that exceed environmental standards. The pollutants cannot be eliminated under water purification processes [10]. Of course, the villagers near the lake have presented damage to their health.

Enrique Lira Coronado, coordinator of Socio-Environmental Forum at Guadalajara City recognized that cholera has been one of the diseases that has attacked especially populations of extreme poverty.

3. Pollution Taxes

Mexico raises extraordinarily little for environmental taxes, for 2017 it accounted for 0.1% of GDP, compared to what is collected in Germany and Australia, 1.9% of its GDP.⁴

In this sense, Carlos Cárdenas, a tax specialist, determined that Mexico's GDP environmental taxes almost do not exist at the federal level, only reach 0.1 of GDP by 2017 [11].

The extraction and water pollution charges have long Organization for Economic Co-operation and Development, (OECD, 2014 for its acronym in English) as an effort to reflect the value of this resource and must to apply the slogan: "the polluter pays". However, it is important to note that the pay no restore the damage to the nature.

Another problem is the presence that water use charges vary significantly depending on use. Water extracted for agriculture is mostly not charged. In general, water extraction costs do not provide sufficient incentives to reduce liquid losses and improve use, which remains exceptionally low in both agriculture and urban areas. The role of the incentive is also virtually nullified by the implementation of some subsid, especially in the agricultural sector.

At the same time, difficulties in apply charges of contamination affect their effectiveness. In addition, water tariffs are not systematically adjusted to inflation. As a result, water extraction revenues and pollution charges were reduced as a percentage of GDP.

4. Different Opinions on the Pollution Status of Lake Chapala

After, having presented the conditions of Lake Chapala, there are two positions regarding the contamination of this body of water 1. Specialists and authorities of the State Water Commission and the Intermunicipal System of Drinking Water and Sewerage Services (SIAPA for its acronym in Spanish) recognize that there are discharges in Lake Chapala; However, they say that the contamination does not put the population at risk.

Eduardo Juárez Carrillo, director of the Institute of Limnology of the University of Guadalajara, Jalisco, stresses: "the glass water functions as a treatment plant

⁴ Center for Economic and Budgetary Research.

naturally, the movement of water, oxygenation and its depth make some of these pollutants are dissipated.”

For the Secretary of Integral Water Management of Jalisco, Jorge Gastón points out that more control is required in the usage of pesticides, but it also says that the 19 water treatment plants of the coastal municipalities fulfill their function [11].

The other position on water contamination is as follows:

The lake has revealed by studies that the liquid contains higher average concentrations of: Fecal Coliforms, E-Coli, Arsenic, Chromium, Nitrogen in the form of Ammoniacal Nitrogen, Chemical Demand of Oxygen and Total Nitrogen, Mercury, Nitrates and Nitrites, and Total suspended solids [12].

In response, the members of the Socio-Environmental Forum and Citizen Network demanded to the authorities to declare the entire basin as a health emergency zone.

Enrique Lira Coronado, liaison coordinator with the affected peoples. He asked to attend and detect of persons suffering diseases derived from contamination is also requested, as well as providing healthy drinking. Water not only to those living in the basin, too throughout the Jalisco State. He recalled there are about 800 thousand peoples with kind of kidney damage in the State, 8 thousand of them live around Lake Chapala, 600 thousand in the zone of Mezcala, Itzicán, Agua Caliente, places where there is no drainage.

The representative of affected assured there are 10,000 companies. Located on 384 municipalities along the rivers and the lake. The river spring is in Almoloya del Río in the State of Mexico, it runs thru some States of the country until to arrive to Nayarit State. It received discharges of polluted water with heavy metals [11].

The Jalisco State Commission on Human Rights (CEDHJ for its acronym in Spanish) issued the *special report Area of Influence for Primary Pollutants present*

in the Santiago River and Lago de Chapala, which analyses 67 indicators showing the effect of pollution.

Indeed, this study concludes the recognition of the conditions arising from environmental damage in which nearly a quarter of a million people live. Most of them, girls, boys, and adolescents.

Also proposed to declare moratorium to contain the growth of the industrial sector in the municipalities near Lake Chapala, these are: El Salto, Juanacatlán, Poncintlán and Tonalá. With highly polluting discharges dumped into the Santiago River, which flows to the lake, so the pollution of industrial waste generated is four times greater than agricultural activities and 30% more than urban ones [13].

Finally, it is important to mention that access to healthy water. It is a right indicated in Mexico's Constitution, in fact, Articles 4, 127 and 115 affirm that everyone has the right to use uncontaminated water, disposal and sanitation of the liquid for personal and domestic consumption in a sufficient, healthy, acceptable manner [14].

5. Conclusions

Lake Chapala has high levels of pollution generated by industrial, urban, agricultural and livestock discharges. In particular, the Lerma River, from birth to before reaching Lake Chapala, passes through highly industrialized States, such as the State of Mexico, Michoacán, Guanajuato, where industrial activity emits amounts of pollutants that significantly destroys this important natural resource that the country possess.

6. Proposals

I think it is important to mention that it is essential to carry out public policies on the part of the government. This would be the beginning of trying to solve the problem. In this sense, I am agreeing with Zarate's approach [6] which affirms the following: it all started with the development of the industry in Mexico, the specialist continued, about 50 years ago... although annual downloads vary from year to year. The

consequences of these contaminants in Lake Chapala, explains the expert is an alarming sign which must be thoroughly evaluated. The presence of metals should be measure and their potential risk to living beings and the environment. This requires the application of sequential extraction techniques of the metals.

Some of the alternatives proposed by the Zarate to reduce the damage, the current regulations issued by the authorities of The Secretary of Environmental and Natural Resources (SEMARNAT for its acronym in Spanish) must be complied with. Includes the prohibition of contribution of water untreated to rivers and lakes. It is urgent, the installation and operation of treatment water centers in the industries and in the municipalities.

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