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Right to Clean Water: Lake Xochimilco, Mexico City

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ABSTRACT

Lake Xochimilco is in the region of the same name in Mexico City. The objective of this article is to tell about the serious contamination that this body of water presents. In the first part, is the theoretical elements. They are addressed about the right of any human being to clean water. Later, the geographical factors are mentioned about the location of Lake Xochimilco. Yet a comparison of economically important elements is made. Such as economic units, the value of production, the employed personnel, the remunerations of the other districts that make up Mexico City. Likewise, the elements of a social nature such as the total population in a situation of poverty at Xochimilco and the other demarcations. In the end the contamination of this lake is described, some proposals are presented to gradually solve the pollution of this place through good governance, which is not only the result of good governance, but of an interaction of government organization, the private sector and civil society.

Keywords: Water, pollution, lake, Xochimilco and sustainability.

INTRODUCTION

This article addresses the serious pollution experienced by Lake Xochimilco, it is located 28 kilometers from the Historic Center of Mexico City, this water resource has a great importance in ecological and cultural terms; it agglomerates more than 140 species of waterfowl and fishes like ajolotes, acociles, charales, and *chinampas*[1] help to reduce pollution a little by capturing carbon.

Xochimilco, currently presents ecological problems, such as the expansion of the urban spot, the drains of the homes are sent to the channels of the Lake, the incorrect or almost null operation of the sewage treatment plant at the Cerro de la Estrella, and its channels flow into the Lake of Xochimilco, as well as in the same way. I will mention the calamity of carp and tilapia that were housed in 1980. They are very harmful to acociles and ajolotes; they are mechanisms that favor the erosion of the bottom of the channels; in effect, they become factors that help this area will be destroyed by 2050.

In this article the following is proposed as a hypothesis: Xochimilco's mayoralty does not present an important economic activity, elements such as economic units, employed personnel, the value of production and fixed assets are used; with respect to social factors, this delegation does not have a large population mass and a considerable agglomeration of inhabitants living in poverty, compared to the other districts of Mexico City; within this economic and social

[1]Cultivation method to expand the territory in the lakes of the Valley of Mexico.

framework is located Lake Xochimilco, which is severely contaminated by the discharges it receives.

From my point of view as a proposal for sustainable development, I consider for the case of Lake Xochimilco to begin to reduce very slowly the problem of serious pollution, return to the production of *chinampas*, as was done in the past, prevent through the formulation of laws, the use of highly polluting agrochemicals, promote the increase in the population of the ajolote, acocil and charal, the first is a fish that is in danger of extinction. Given this situation, it is essential to try to educate the population about the care of water, not to throw garbage and to demand from the authorities the construction of the drain so that it does not discharge the waste into the Lake and the use of sewage treatment. I think it is very difficult and expensive, but if it is done gradually, perhaps gradually some positive situation would begin to arise in the future.

THEORETICAL ASPECTS

This article presents some theoretical elements on water degradation, pollution caused by toxic discharges in Lake Xochimilco.

Water is a fundamental element of the environment; it controls health in humans as in the ecosystem in general T.G. Kazi (2009). Its quality can vary as a result of the combination of natural factors: weathering, soil erosion, and the anthropic contributions that correspond to the discharges of waste from nearby localities such as industrial that create a constant source of pollution. And the surface runoff, is a seasonal phenomenon that is affected by the climate in the body of water where it is captured and in general terms is associated with rainy season. Zeng and Rasmussen (2005).

Climate change and water stress limit clean water reserves. The overexploitation of natural resources has led to an environmental imbalance. Lermontov (2011). However, the anthropic contributions of the various sources turn out to be the main elements that affect water bodies, those found in highly urbanized areas. Wen-Cheng (2011).

The use of water imposes numerous transformations on the configuration of rivers, lakes, lagoons, such as the construction of dams and irrigation canals. Land use influence water quality, as agriculture, industry, urbanization and deforestation are the main sources of point and diffuse pollution. Thus, aquifer storage and groundwater quality are affected. In fact, many activities on the surface of watersheds have an impact on groundwater. The lack of effective water management and overfishing, both commercial and sporting, as well as the introduction of exotic species, disturb aquatic ecosystems. Aguilar and Durán, (2010).

Within the framework of the freedom of human beings to have access to water, as it is a fundamental right: people have the right to access clean water no one neither the State nor people should allow or prevent, Ibáñez (2016). Indeed, as Sen says, (2004) freedoms, conceived from the perspective of knowledge, they agree with the material object of human rights, in their double aspect of progress and congruence. In this sense, in our country Mexico, the right to access to water is presented in this way:

The development that has occurred in Mexico in terms of the relationship with nature has been anthropocentric, which has caused the destruction of forests, rivers, deserts, jungles,

mangroves, estuaries and, in general, of our environment and the living beings that inhabit it, all for the vision of "progress" that has not brought the benefits that were proclaimed. This issue is not only concerned with the well-being of natural systems but also with the proper development and with justice towards people. Another aspect to highlight in the history of our country has been the unfair distribution of wealth; in the area of water, there have been direct consequences on the health and development of individuals. For this reason, it is essential that the human right to water be recognized and protected. The Mexican State is obliged to recognize and protect this right, since it has signed the International Covenant on Economic and Social Rights, from which Observation Number 15, which refers to the human right to water, is derived. There is still much to be done about it... At first glance, the human right to water might seem like a matter of purely legal importance, yet it goes much further. Recognize the human right would lead to a fairer distribution of the resource and benefit populations that have traditionally been marginalized. (Mexican Center for Environmental Law, 2006: 9, 10).

In Mexico, the unacceptable relationship of water with nature not only has to do with deforestation, the extinction of species and ecosystems, it also has to do with human activities that alter the quantity and quality of water, harming the natural hydrological cycle. Thus, among the main problems are the contamination or poisoning of water by industry and agriculture, mainly. The desiccation or overexploitation of water resources. The alteration of watersheds (construction of dams, diversion of rivers, changes of land use, etc.). Global climate change, deforestation, in Mexico, industry and agriculture are the culprits for most pollutants, and less than 25% of the wastewater discharged into rivers and lakes is treated, according to the National Water Commission (Conagua). For its part, the National Commission for the Knowledge and Use of Biodiversity (Conabio) states that only 15% of wastewater is treated and that industry consumes 6 km^3 throughout the country and discharges 53 km^3 of wastewater, in fact, 70 percent of our water bodies are contaminated. (Mexican Center for Environmental Law, 2006, Lichtinger Waisman, 2020).

I consider it fundamental to conserve ecosystems: to ensure their integrity, through sustainable management of water resources: to promote peaceful cooperation and to hold meetings between stakeholders or affected to determine the different uses of water at all levels. Valorize water: manage water in such a way that it expresses its economic, social, environmental and cultural values for all its uses, and value water services to show the cost of their provision. This approach must consider the need for equity and the basic needs of the vulnerable poor. Take wise care of water: govern good management so that the commitment of the public and the interests of all the groups involved are included in the management of water resources. (www, 2000).

From an ethical point of view, hydric security is linked to the human right to water, it is necessary to highlight the protection of individuals and groups (and therefore human integrity), the satisfaction of essential needs and the provision of water through sustainable management of ecosystems. Achieve hydric security is possible, to the extent that countries recognize these rights; agree economic with social and environmental objectives; reorient production and consumption models on a logic of sustainability; and act in solidarity, through international cooperation and the observance of agreements of global importance such as climate change. (Ávila García, 2020).

The human right to water, (Gleick, 1999), is to satisfy the basic needs of the human being to cover personal and domestic use (consumption, personal hygiene, cooking food). No person can be excluded from this basic condition (a minimum availability of water) to maintain a dignified life. It is therefore ethically and morally unacceptable to remove individuals and groups from this indispensable right, whether for economic, political and/or cultural reasons. (Martinez, 2014).

In this same sense, to admit that access to clean and sufficient water is a fundamental right of every human being; it is a moral conquest of humanity, but the acceptance of this human obligation by nature is not only an ethical triumph, but the condition of possibility that this right reaches to be fulfilled: human rights and environmental responsibility, to be achieved in its entirety, will have to be realized jointly. (2014, Martínez Ruiz, J.).

In Mexico, the human right to water is embodied, since the reform published in the Official Gazette of the Federation on February 8, 2012, this right is enshrined in article 4 of the Political Constitution of the United Mexican States, on the right to a healthy environment, water and sanitation. In its core part with respect to the subject, this article establishes that:
Everyone has the right to a healthy environment for their development and well-being. The State shall guarantee respect for this right. Environmental damage and deterioration will generate responsibility for whoever causes in terms of the provisions of the law. Everybody has the right to access, dispose of and sanitation of water for personal and domestic consumption in a sufficient, healthy, acceptable and affordable manner. The State shall guarantee this right and the law shall define the bases, supports and modalities for access, equitable and sustainable use of water resources, establishing the participation of the Federation, the federative entities and the municipalities, as well as the participation of citizens for the achievement of these purposes. (Martínez Ruiz, Jorge, 2014: p. 22).

An important aspect about Mexico City, which is made up of a dispersed and disordered urban pattern, this has caused an important growth of urbanized areas with multiple risks within the territory of the metropolis of this city, there are no agreements that recognize where and in what way to carry out urbanization or where urban areas with less economic, social and environmental impact can be extended. That jointed and coordinated measures are carried out within the different mayor's offices that make up the city, that it is not individually and without any coordination with the others, that is, not taking separate measures from the rest, are decisions that are taken without any prior consultation, neither interinstitutional and / or social, limiting in many of the cases, only in isolated decision-making. If the metropolis is the power established. Within this problem is also the environmental issue of these spaces built or rebuilt within the city, the same that in the long run they become destroyers or predators of their environment that is close to them, from the dispossession and appropriation of natural resources, this is seen as a natural process and the transformation of the rural landscape to urban, to which is added the devastation of its natural spaces that is observed as a natural process and conceived in a way typical of the dynamism of cities. In addition, it is not foreseen in the long term to solve the needs of the population in its different settlements, without the extinction of the natural capital, the environmental costs of other areas should not be minimized because sustainability is not protected in the future. (Torres Rodríguez, 2013).

GEOGRAPHICAL LOCATION OF LAKE XOCHIMILCO

Lake Xochimilco is in the southeast of Mexico City. Xochimilco has an area of more than 2,428 hectares of swamps, surrounded by dense streets. The territorial area of this mayoralty is 125.2 km2, which represents 8.4% of Mexico City. It borders the mayoralties of Tlalpan, Coyoacán, Tláhuac and Milpa Alta. See map 1 and map 2.

The accelerated process of urbanization of this region presents a dynamic of change of land use, where from traditional cultivation it is passed to technician cultivation, the lands are abandoned and then the construction of greenhouses is carried out, which need certain infrastructure and services such as concrete foundations and well water that must be protected, therefore in a short time they become inhabited lands. From this moment the greenhouses become the origin to urbanize the *chinampera*[2] area. Within this framework:

Since the sixties and seventies, in the eastern area of Xochimilco there is an uncontrolled expansion and an accelerated disintegrated occupation, with a mixture of different urban patterns in the occupation of the territory, as well as the modification of the *chinampera* zone, with the corresponding expansion of the urban spot (Bazant 2001). Since 1957, the tributaries of the canals have been recharged with different sources and qualities of water, which include wastewater with and without treatment, which has gradually increased their degradation due to the high concentration of nutrients. Currently, the wetland formed by the canal zone presents severe environmental problems, related to the quantity and quality of the water it receives. From the microbiological perspective, the presence of harmful microorganisms increased, among which enteric bacteria and viruses have been detected (Aguilar and Mazari-Hiriart, 2003, Espinosa, 2008, Mazari-Hiriart, 2008); as well as the concentration of organic matter; nutrients and chemical compounds (Bojórquez and Villa 1995, Unesco-Xochimilco 2006, Solís et al. 2006). The increase of these components causes habitat degradation (Zambrano, 2009), which is critical, because this water is used for irrigation of the *chinampas* and intervenes in the quality of the products that are still caught in their channels. The agricultural tradition of Xochimilco is an example of the use of ancestral agricultural and water use technologies, which is being lost in an accelerated way. (Mazari Hiriart, Zambrano González, 2016: p. 242).

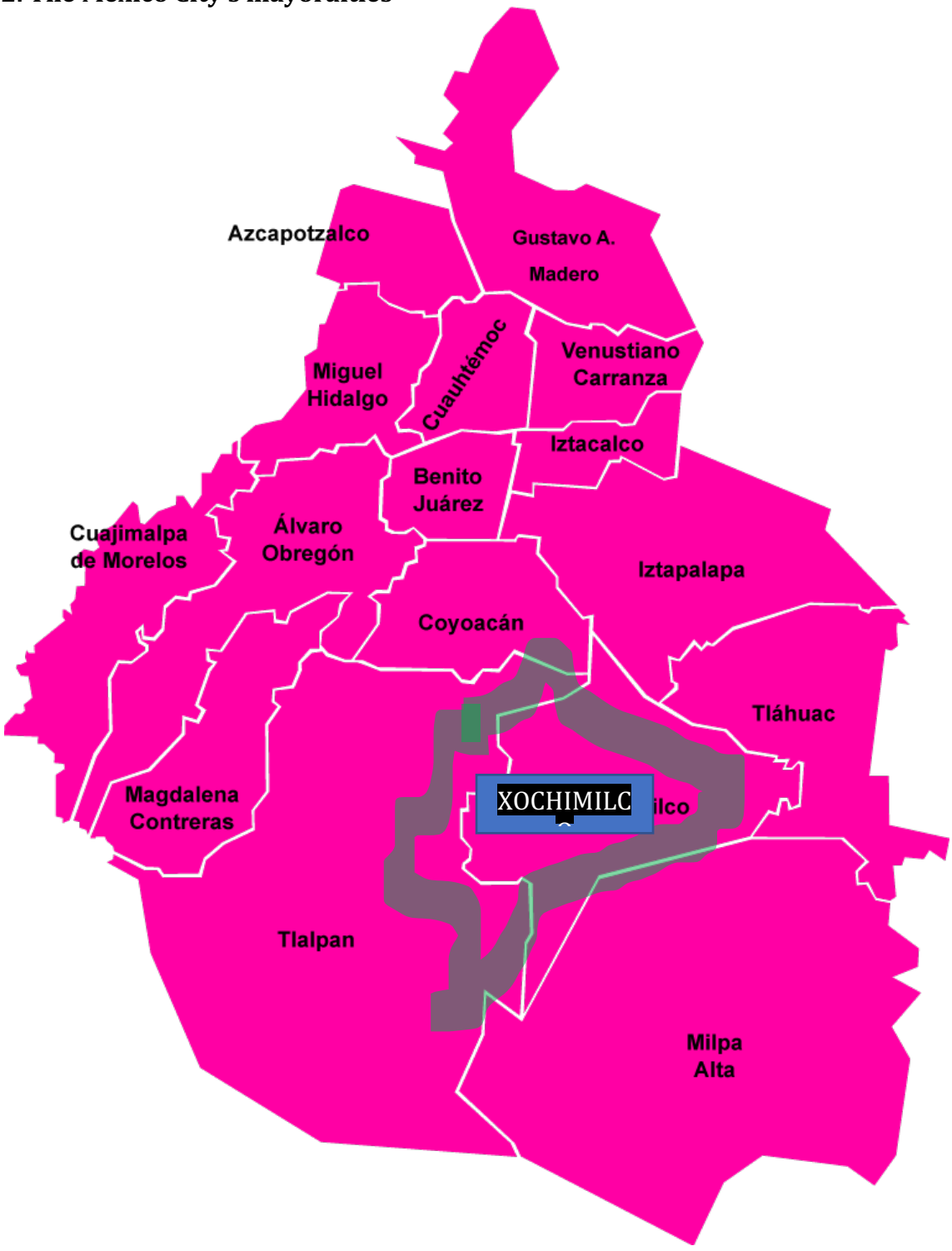
[2] Vegetables producer in chinampa

Map 1. Mexico



Source: https://es.dreamstime.com/photos-images/mapa-de-mexico.html

Map 2. The Mexico City's mayoralties



Source: https://es-mexico.com.mx/mapas-virtuales-de-la-ciudad-de-mexico/

SOCIO-ECONOMIC ASPECT OF XOCHIMILCO'S MAYORALTY IN RELATION TO THE OTHER MAYORALTIES OF MEXICO CITY

Xochimilco has a population of almost 445 thousand inhabitants by 2020, which represents 4.8% of the total population of Mexico City. How you can observe the population agglutination

is very little, compared to the mayoralty of Iztapalapa with 19.9% and Gustavo A. Madero with 12.7%. See Table 1 and Figure 1.

Table 1. Population of the mayoralties of Mexico City, 2020

Town hall	Number of people
Alvaro Obregon	759,137
Azcapotzalco	432,205
Benito Juarez	434,153
Coyoacan	614,447
Cuajimalpa	217,686
Cuauhtémoc	545,884
Gustavo A. Madero	1,173,351
Iztacalco	404,695
Iztapalapa	1,835,486
The Magdalena Contreras	247,622
Miguel Hidalgo	414,470
Milpa Alta	152,685
Tláhuac	392,313
Tlalpan	699,928
Venustiano Carranza	443,704
Xochimilco	442,178
Total	9,209,944

Source: INEGI. Sociodemographic panorama of Mexico City.
Available in: Sociodemographic Panorama of Mexico City 2020 (inegi.org.mx)
Retrieved 22 March 2022.

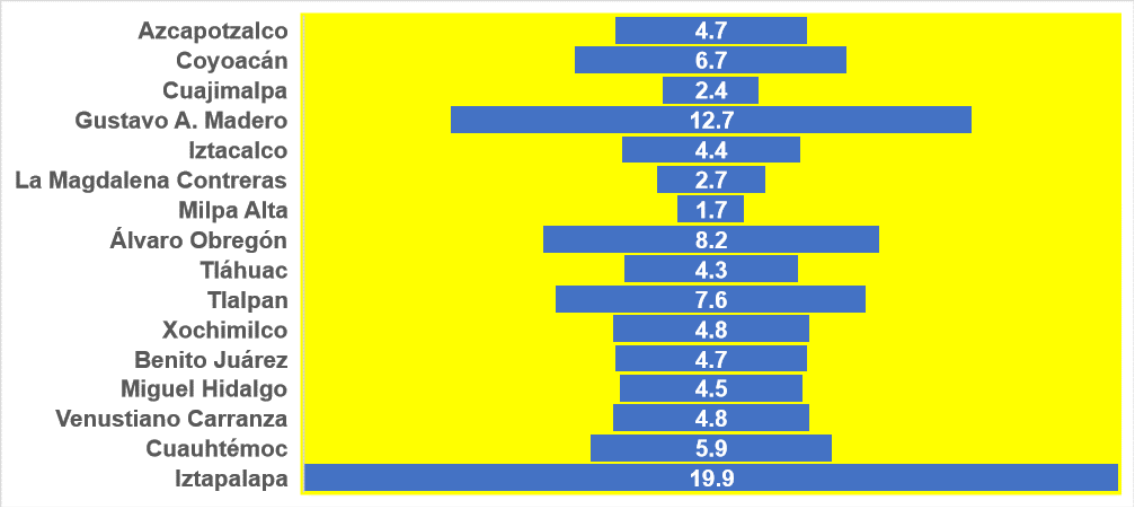


Figure 1. Population in Mexico City, by mayoralties in percentages with respect to the total population of Mexico City, 2020
Source: Own elaboration of the percentages based on the information provided in Table 1

The population that is in a situation of poverty for the year 2020, is in the most important population conglomerate, logically it is Iztapalapa, with almost 773 thousand people, which represents almost 25.9% of the total population in poverty of Mexico City and is followed by Gustavo A. Madero with 12.8%.

In Mexico City, in relation to the total population in a situation of poverty, we find that almost 32.3% of the total of its inhabitants live in an environment of poverty. In Xochimilco the total population of this delegation, live in poverty almost 48% and in extreme poverty 9.2%. Even though this region has a low concentration of population and a natural wealth, the Lake Xochimilco. The serious pollution that this water mirror suffers, does not help to alleviate this situation of poverty of its inhabitants. It is necessary to try to alleviate these serious circumstances that this Lake suffers. See table 2.

Table 2. Population in Mexico City in a situation of poverty, extreme poverty in absolute numbers and in percentage, 2020

Town hall	Population in poverty	Percentage of the population in poverty in relation to the total population of the mayoralties	Population in extreme poverty	Percentage of the population in extreme poverty in relation to the total population of the mayoralties
Alvaro Obregon	273,656	36.0	40,958	5.6
Azcapotzalco	97,943	22.6	9,990	2.5
Benito Juarez	29,466	6.7	1,167	0.3
Coyoacan	154,045	25.0	16,777	2.9
Cuajimalpa	64,917	29.8	8,902	4.5
Cuauhtémoc	102,753	18.8	12,053	2.5
Gustavo A. Madero	381,752	32.5	41,672	3.7
Iztacalco	95,006	23.4	9,856	2.6
Iztapalapa	772,584	42.0	115,470	6.6
The Magdalena Contreras	102,723	41.4	16,224	6.7
Miguel Hidalgo	49,100	11.8	3,406	0.9
Milpa Alta	88,193	57.7	14,755	9.1
Tláhuac	160,199	40.8	19,315	5.1
Tlalpan	274,221	39.1	48,938	7.1
Venustiano Carranza	124,431	28.0	12,066	2.9
Xochimilco	210,781	47.6	40,693	9.3
Total	2,981,770	32.3	412,242	

Source: National Council for the Evaluation of Social Development Policy (CONEVAL).

The percentages are self-prepared.

In relation to economic activity is, for the year 2019 in Iztapalapa with almost 79 thousand economic units, which represents 18.3% of the total of Mexico City, Xochimilco corresponds to 4.4%. In proportion to the total gross production, it is Cuauhtémoc with almost 30.4% and Xochimilco with 0.7%, it does not achieve even one percent, it does not have an important economic activity. From the above it can be deduced that where Lake Xochimilco is located, it does not have a transcendence in the economic aspect. See table 3.

Table 3. Mexico City. Main variables of economic activity, 2019

Town hall	Economic units	Economic units in percentages	Total gross production. Millions of dollars	Total gross production in percentages Employed personnel in percentages
Alvaro Obregon	23,013	5.4	29,966.2	13.2
Azcapotzalco	17,250	4.0	10,872.3	4.8
Benito Juarez	24,516	5.7	16,369.1	7.2
Coyoacan	22,793	5.3	8,493.4	3.7
Cuajimalpa	7,923	1.9	10,066.5	4.4
Cuauhtémoc	62,557	14.6	69,021.2	30.4
Gustavo A. Madero	48,064	11.2	4,691.2	2.1
Iztacalco	15,970	3.7	3,172.6	1.4
Iztapalapa	78,490	18.3	7,898.0	3.5
The Magdalena Contreras	7,210	1.7	754.6	0.3
Miguel Hidalgo	23,209	5.4	50,235.6	22.1
Milpa Alta	6,951	1.6	122.2	0.1
Tláhuac	16,883	3.9	764.0	0.3
Tlalpan	24,683	5.8	8,532.3	3.8
Venustiano Carranza	29,293	6.8	4,463.6	2.0
Xochimilco	19,154	4.4	1,706.1	0.7
Total	427,959	100.0	227,128.8	

Source: Government of Mexico City. *Economic analysis of Mexico City*. Available in: https://www.sedeco.cdmx.gob.mx/storage/app/media/uploaed-files/análisis-de-la-ciudad-de-mexico.pdf
Retrieved 23 March 2022.

In correspondence with the employed staff, it is the Cuauhtémoc's mayoralty has the highest agglutination, with 20.4%, followed in order of importance by Miguel Hidalgo with 15.8%, Xochimilco only concentrates 1.3% of the total of this city. From the above it can be deduced that where Lake Xochimilco is located, it does not have an importance in this aspect. In compared to the remuneration factor, Tlalpan concentrates 36.2%, Iztapalapa, 12.3, and Xochimilco only achieves 2.6%, it is not a significant in this particularity. See table 4.

Table 4. Mexico City. Total and percentage employed staff. Remuneration, total millions of dollars and in percentages, 2019

Town hall	Personal busy	Personal Occupied in percentages	Remunerations. Millions of dollars.	Remunerations. In percentages.
Alvaro Obregon	404,344	9.4	1,212.25	4.8
Azcapotzalco	380,625	8.9	734.62	2.9
Benito Juarez	426,927	9.9	798.45	3.2
Coyoacan	182,751	4.3	543.69	2.1
Cuajimalpa	162,144	3.8	371.98	1.4
Cuauhtémoc	878,704	20.4	1,089.83	4.3
Gustavo A. Madero	202,580	4.7	82.57	0.3
Iztacalco	92,490	2.2	12.52	0.0
Iztapalapa	360,147	8.4	3,088.85	12.3
The Magdalena Contreras	32,532	0.8	90.79	0.3
Miguel Hidalgo	681,883	15.8	482.40	1.9
Milpa Alta	14,483	0.3	162.75	0.6
Tláhuac	46,392	1.1	1,639.46	6.5
Tlalpan	214,209	5.0	9,044.85	36.2
Venustiano Carranza	159,275	3.7	4,922.47	19.7
Xochimilco	57,648	1.3	663.72	2.6
Total	4,297,134	100.0	24,941.21	

Source: Government of Mexico City. *Economic analysis of Mexico City.*
Available in: https://www.sedeco.cdmx.gob.mx/storage/app/media/uploaded-files/analisis-de-la-ciudad-de-mexico.pdf
Retrieved 23 March 2022.

THE SERIOUS CONTAMINATION OF LAKE XOCHIMILCO

The importance of the geographical area of Xochimilco is:

Xochimilco has 17 neighborhoods and 14 villages, historically a center of agricultural activity, dedicated mainly to the cultivation of legumes and flowers through the system of *chinampas*, indigenous legacy of the Mexica empire. *Chinampas* are the last living footprint of what was the Anahuac Valley, however, from the original 400 square kilometers that existed more than 400 years ago*, the chinampas* have been reduced to only 25 square kilometers located precisely in Xochimilco, where hundreds of families cultivate in them agricultural products that supply Mexico City. Currently, the area of *chinampas* and other agricultural systems associated with lake soil, have been overtaken by urbanization, which has turned them into an island of traditional urban agriculture in Mexico City... Although specifically the case of Xochimilco, it does not fit within the environmental impact itself (this being a modification of the environment caused by the action of man or nature) it results in a series of plots created from a system of modified aquifer channels; in this sense, in accordance with current regulations, there is a very important emission of pollutants to the aqueous channels that surround all of Xochimilco coming, on a larger scale, from irregular human settlements or the use in *chinampa* of agrochemicals, affecting the ecosystem that surrounds this practice (Ministry of the Interior, 2018: p.p. 2 and 3)

Faced with the decrease in the water level in Xochimilco and its imminent desiccation, from 1953 the Federal Government declared as a remedy to irrigate the lake and therefore *the chinampera* area with treated waters that came from the Churubusco and San Buenaventura rivers, which although they granted poor quality water to the sub-basin, altered the ecosystem, in particular by the high rates of industrial waste, saline substances, heavy metals, which have damaged soil and water; however*, the chinampero* peoples accepted the sewage to have the lake suppressed. In addition, we must add the increasing discharges without any treatment and the garbage that is scattered in the canals coming from houses room of both regular and irregular settlements. This transformation in the quality of lake water has ended up seriously affecting the continuity of the ajolote and therefore the viability of the ecosystem and sustainability of Lake Xochimilco. (Martínez Ruiz, J. 2017).

Lake Xochimilco is seriously contaminated, here farmers cultivate rosemary, corn and chard in *chinampas,* islands formed with a technique dating from the time of the Aztecs, from willows, lilies and mud.

The intense exploitation of water aquifers over the past 50 years has depleted the springs, so authorities have had to refill waterways from a nearby wastewater treatment plant. (Burnet, 2017).

Xochimilco has 116 kilometers of channels in the northeastern zone divided into 253 sections, it was detected that in its margins there are a total of one thousand 374 discharges, of which 603 are of black water and 771 of gray, according to the researchers of the Institute of Engineering of the National Autonomous University of Mexico, Rosa María Flores Serrano, Guillermina Pérez Casimiro and Rosario Iturbe Argüelles. (Institute of Engineering, UNAM, 2017).

About the drain, in San Gregorio, there is one that begins in the upper area of San Pedro Atocpan, in Milpa Alta's mayoralty and flows directly to the lake area of Xochimilco. In addition, of the four water treatment plants installed, the delegation authorities relegated their proper functioning and three of them do not work. (Fernández, 2015).

Xochimilco currently presents ecological problems, such as the increases of the urban spot, the drains of the homes are directed to the canals, the deficient functioning of the treatment plant of the Cerro de la Estrella that is very close to Xochimilco, are favorable elements to erode the bottom of the channels; they also become factors that favor that this area will be totally destroyed by 2050.

In the process of urbanization in Mexico City where Xochimilco is located, forms of informal land occupation have predominated. Especially in the process of urbanization of Mexico City, there has been an increase in informal occupation in ejido and communal lands that over time have been regularized together with the formal land market in an evolution that is linked in a combined way. This informal market is part of the privatization by the owners of these lands and that the sale of subdivided lots, of collective rural ejido lands, is carried out. An irregular settlement is the place where a person or community is established outside the rules established by territorial planning.

The irregular settlements that are established in conservation soils in inadequate areas, such as ravines, hills, high quality soils to carry out urban development, represent a high environmental cost, there is also a high risk for the population that is established in these areas, this situation implies losses of areas with forest potential and with enormous infiltration capacity, the aquifers are also contaminated, from which much of the water used in Mexico City is extracted. (Pérez Corona, 2017)

Another very important factor, which just happened a few months ago, within this framework of devastation, is "the construction of the vehicular bridge in the southern area of Mexico City, the Periférico Sur – Cuemanco vehicular is a small sample of the loss suffered by Lake Xochimilco, the irregular settlements on conservation land, the continuous discharges of sewage into the riverbed, the dispossession of the *chinampas* and the abandonment of the lands, in addition to the lake deterioration". (Saldivar, 2021).

In the same way the plague of carp and tilapia that were introduced in 1980, are predators of the ajolotes, acociles and charales endemic species in danger of extinction, which inhabit in the Lake of Xochimilco. See photos 1, 2 and 3.



Photo 1. Mexican ajolote inhabitant of the canals of Xochimilco.
Source: Photo by Miguel Angel Sicilia Manzo.
Female specimen of ajolote, in danger of extinction. Getty Images/I Stock photo.
https://www.lavanguardia.com/natural/20220104/7965263/ajolote-anfibio-mexicano-peligro-extincion-nbs.html



Photo 2. Acocil. Inhabitant of Lake Xochimilco.
Source: https://insectura.blogspot.com/2014/04/acociles.html



Photo 3. Charal. Inhabitant of Lake Xochimilco.
Source:https://www.google.com/search?q=charales&rlz=1C1UUXU_esMX992MX992&biw=1920&bih=969&sxsrf=ALiCzsZ4mwTbO2bEBppvhfxROFZTqEiPug:1655422334680&tbm=isch&source=iu&ictx=1&vet=1&fir=IVbkwJyC0SjUM%252CKXyYLfrkOWxz2M%252C%252Fm%252F02wxvlm%253BtvdC4smTGJ4kGM%252CBAn67ZCsxKGr6M%252C_%253B-ciKo38HaXpkFM%252CpbQPu2xUm45c1M%252C_%253B4h9zCTUAXGkWM%252ClTC4cc8YeE6bFM%252C_%253BOvaCkzg8Yk7jFM%252C0sVwhMUR1U-zHM%252C_%20&usg=AI4_kSZD1u_ZeY3hH8yfxR_2F6x9YF4Pw&sa=X&ved=2ahUKEwi62djhkLP4AhWiDkQIHXNdAnQQ_B16BAh6EAE#imgrc=jXMvbz-8J_m7WM

At present, the lake is made up of canals that show serious environmental problems, related to the quantity and quality of the water it receives without treatment. From the microbiological perspective, the presence of harmful microorganisms increased. (Mazari, Zambrano, 2016).

The National Autonomous University of Mexico (UNAM), affirms that the contamination in *the chinampas* of Xochimilco is critical, concludes in a study, which specifies that the 183 kilometers of canals have slowly lost the quality in their water due to the poor management of solid waste, the indiscriminate use of pesticides, zero control in land use changes, the aggression to the protected natural area and the drying of canals to expand plots and streets.

Lake Xochimilco is one of the five lakes that formed the lake area of the Valley of Mexico, in the center of this country. It is currently attached to a few canals that irrigate the northern half of the Xochimilco delegation and the west of Tláhuac its surface covered an important extension of what at this time are the mayoralties of Iztapalapa and Coyoacán.

This reservoir was fed by the waters of numerous springs that came down from the Sierra de Ajusco – Chichinauhtzin and the Teuhtli volcano. However, from the Porfiriato period (at the beginning of the twentieth century), the springs were channeled to supply water to Mexico City. It is now restricted to canals that are fed with treated water from Cerro de la Estrella. (Wikipedia, 2022).

The destruction of the lake system of Xochimilco, which is the last remnant of the set of lakes that housed the basin of the Valley of Mexico, is definitive. It is immersed between irregular settlements and the discharges of waste to its canals, are factors that contribute to put at risk its international qualification as Cultural Heritage of Humanity.

Within this context, the water of the Xochimilco canals is a danger to the health of visitors, since coliform bacteria have been found, which is a sign of fecal contamination, reported specialists from the Autonomous Metropolitan University (UAM), in addition to the fact that the system itself is being contaminated. Only with the breeze of the lake itself does it make us contaminate our skin and even reach our mouths, running the risk of getting sick to our stomach, said María Guadalupe Figueroa, a biologist at the Autonomous Metropolitan University.

The sanitary standard establishes a limit of 2 thousand coliform units per 100 milliliters of water and in the Cerro de la Estrella treatment plant that supplies the Xochimilco there are 14 thousand units. (UAM, 2017).

The water in the canals of Xochimilco is contaminated. The treated water that is pumped into the canals from Iztapalapa contains heavy metals. The worst thing is that illegal settlements in the chinampas dispose of sewage in the canals, which affects fish and crops. Now, much of the tilapia that is fished from the canals is used as an ingredient for cat food, Figueroa said.

PROPOSALS FOR SUSTAINABLE DEVELOPMENT IN LAKE XOCHIMILCO

The degradation of soils and the poor management of solid garbage and wastewater have overtaken the authorities, in the case of Lake Xochimilco you can see areas invaded with garbage. In the case of wastewater that is spilled into this aquifer, it is not treated water because the water treatment plants are broken down or do not work well.

In the case of Lake Xochimilco that is severely contaminated by different causes, among them, the most important has been human activity, the following should be considered:
Having good governance, in fact, the poisoning of water through industrial and agricultural pollution, mainly overexploitation, waste and misuse of water, is also present the change that has been caused in the climate of the planet, it is necessary to consider having a convenient governance, not only is it the result of good governance, but of an interaction between government agencies, the private sector and civil society, which empowers the structuring of social rules for a just coexistence. Inevitably, this idea includes an open participation of society in the decision-making of the issues that interest it. (Mexican Center for Environmental Law, 2006).

Within this framework, the State must create the right financial, legal mechanisms and correct dispositions so that citizens have the means and support that allow them to have and conserve the appropriate technology, to have access to the right to clean water. (Martinez, 2014).

It is fundamental, the construction of a responsible citizenship, which is actively inserted in public affairs and co-responsible with the protection of resources, is essential for the consolidation of democratic, inclusive and sustainable practices of water resources management (Castro, 2006; Hall and Lobina, 2006). To enable adequate social participation and surveillance, that people must have the necessary tools to fulfill their role and, essentially, that the deep inequality gaps in correlation with the satisfaction of basic needs are reduced (Helfrich, 2006:25; Soares, 2014). That is, governance must understand as the conformation and conservation of the authorities that exercise the power that make decisions and assign policies that are linked to individual and collective protagonists within territorial limits, such as the State, the federative entities and the municipalities. (Caldera Ortega, A., 2013).

Within this governance framework it is of vital importance to try to educate the population about the care of water, not to throw garbage and to demand from the authorities the construction of the drain so that it does not discharge the waste into the Lake or the use of sewage treatment. I think it is very difficult and expensive, but if it is done gradually, perhaps very slowly, some positive situation could arise in the future.

In this case of Xochimilco, as a proposal, sustainability can be achieved as mentioned by the researcher Zambrano, with the return to *chinampera* and agricultural production without agrochemicals, fertilizers and pesticides for the cultivation of plants, and the growth of native species. In this same sense, Pedro Méndez Rosas*, chinampero* producer, maintains that the various sectors must help to take care of Xochimilco, with practices such as the closure of household discharges and as well as the releases of contaminated water from homes, not throw garbage into the canals, it is very difficult to achieve these objectives, however, you have a precious good, which is a treasure. (Burnett, 2017).

CONCLUSIONS

Xochimilco's mayoralty where this lake is located does not have an economic importance nor does it present an important population agglutination compared to the other delegations of Mexico City.

Lake Xochimilco is very polluted, and because of this situation it is not used in terms of improving the socio-economic conditions of the population; therefore, it is essential to close the excessively polluted discharges and not throw the garbage into the canals, I think it is very difficult, but we must try to raise awareness in the population because the Lake of Xochimilco will be totally lost. I also reflect, in relation to sustainability, how the State must be aware of the great importance of creates an education of water care, because it is a vital liquid for the population.

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