

Desiccation in the Caspian Sea

On the Need to Implement Domestic and Regional Countermeasures

Rodrigo Labardini, Nazrin Baghirova

Ждать у моря погода.

– Russian proverb

The Caspian Sea lies at the center of the Silk Road region and represents the hinge between the East (Central Asia and China), the West (the Caucasus, the Black Sea, Anatolia, and Europe), the North (the Baltic Sea), and the South (the Persian Gulf and the Indian Ocean). As with any large geographical feature, the Caspian Sea serves both as a connector among—and a divider between—sub-regions. These characteristics have been in place for millennia. Today, however, as does the rest of the world, the Caspian Sea faces daunting environmental challenges, including water level fluctuation, pollution, the introduction of exotic or invasive species, the loss of flora reservoirs, and eutrophication. A clear indicator is the oscillation of the Caspian Sea Level (CSL), which will have intimidating effects in the time ahead amidst extreme changes.

Whereas the level of most of the world’s oceans and seas is forecasted to rise with global warming, the opposite seems to be happening to the Caspian Sea, which is the largest endorheic basin of the world. This situation will negatively affect in various ways all five Caspian Sea riparian states (i.e., Azerbaijan, Iran, Kazakhstan, Russia, and Turkmenistan).

Rodrigo Labardini is Diplomat-in-Residence at the Institute for Development and Diplomacy (IDD) and Professor of Practice at ADA University. Prior to joining IDD and ADA, he served as Ambassador of Mexico to Nicaragua and later to Azerbaijan. ORCID: 0000-0002-2547-0549. He can be contacted at rlabardini@ada.edu.az and rodrigo.labardini@live.com.mx. Nazrin Baghirova is a Research Fellow at the Institute for Development and Diplomacy (IDD) of ADA University and a Lecturer at ADA University. She is a former Chief Policy Adviser to the Ministry of Education of Azerbaijan. She can be contacted at nbaghirova@ada.edu.az. The views and opinions expressed herein are solely those of the authors.

The rapid oscillation of the CSL has been a growing concern in recent decades and the subject of research conducted by a plethora of scientific centers and academic experts. For example, Lidiya Parkhomchik of the Eurasian Research Institute indicates that the decline in CSL between 1930 and 1977 led to the shallowing of coastal waters, especially in the northern part of the Caspian, which never reaches a depth of more than 25m and is less than 5m deep over two-thirds of this area. A publication issued by the international association Advancing Earth and Space Sciences (AGU) found in 2017 that the CSL hit a record low of 29m below median sea level (bmsl) in 1978. This was followed by a continuous annual rising trend of 12cm until 1995, which indicates that the Caspian reached 26.69m bmsl.

According to AGU, the latest CSL's decreasing trend of 7cm annually started in 1996, achieving a reduction of 1.5m in 2015. Numerous sources now speak of a regional environmental crisis due to a sharp decrease in CSL, with several even predicting the CSL is likely to drop by an additional 9-18m by the end of the twenty-first century, following a steady annual drop of 6-7cm. This would effectively result in the disappearance of the Northern Caspian Sea. The situation seems dire. Several causes affect the CSL, including water evaporation, not enough refill of the Caspian's waters, the building of dams in the rivers feeding into the Caspian, strong winds evaporating the Caspian waters, tectonic plate movements, and the exploitation of hydrocarbons. Irrespective of the causes, such changes will affect all five Caspian states but will be initially felt the most in Kazakhstan and Russia.

This IDD Analytical Policy Paper analyzes several issues affecting CSL fluctuation. It also provides two alternative responses to anticipate the adverse impact of the Caspian's predicted water shortage.

Serious Challenges Ahead

Studies indicate different causes for CSL fluctuation. One issue is the inflow of waters, coming from some 130 rivers, but mainly from the Volga in its delta with Akhtuba (83 percent of the water flowing into the Caspian Sea), the Kura (5-6 percent), and the Aras. While the Caspian Sea is an endorheic basin and thus has no outflow to any ocean, there are still discharges to the Kara-Bogaz-Gol Bay, a hypothetical connection through underground flows to the Aral Sea, and the ecological/environmental/industrial situation of the Caspian Sea itself. The latter is due to the presence of hundreds of industrial enterprises in the five riparian states, the inflow of sewage from Iran and Russia, and chemical pollution (including those from the Aras originating in Armenian factories along the Okhuchay (or Okhchuchay or *Voghji*) river, which feeds into the Aras.

Other impacts on CSL derive from precipitation, wind intensity, and evaporation due to natural and anthropogenic changes in the climate. The temperature of Caspian waters has increased by 1°C between 1979-1995 and again between 1996-2015, which

is likely due to climate change. CSL has also varied due to human activities, such as petroleum drilling. Additionally, one hypothesis describing causes affecting the Caspian Sea is something called the Atlantic Meridional Overturning Circulation (AMOC)—a vital component of the Earth’s global ocean circulation, encompassing a network of surface and deep currents within the Atlantic Ocean and characterized by a northward movement of warm, saline surface waters and a southward flow of colder, deep waters; another is the better-known El Niño phenomena. Furthermore, water is prevented from flowing into the Caspian as inflowing rivers have to accommodate irrigation and other land-use purposes, and is also restrained due to the proliferation of dams on those same rivers. Lastly, the issue of tectonic movements and hydrological hypothesis—evinced by water budget (i.e., the accounting of all water stored and exchanged on the land surface, subsurface, and atmosphere), the effects of atmospheric circulation over the surface area of the Caspian and surrounding areas, the intensification of solar activity, and technogenic processes on the Earth’s surface.

CSL fluctuation has had an impact on the environment, socio-economic conditions, and geopolitical developments. Each will be briefly discussed.

An immediate adverse environmental impact of the CSL’s decrease is on marine life, resulting in migration and infrastructure degradation affecting aquatic biodiversity, which reduces unique and autochthonous species in the Caspian Sea. This process will further eutrophication, which is caused by higher levels of chlorophyll-a and contributes to harmful algal blooms, mainly in the northwest—i.e., toward the Russian Volga delta. This in turn will inhibit the Caspian’s critical sturgeon-fishing industry and lead to more severe stock declines, especially in the Russian portions (i.e., in the northern part) of the Caspian. Strong winds also contribute to evaporation and decreasing precipitation, which in turn will create a drinking water shortage. Environmental vulnerabilities are further compounded with contamination and destruction as military “collateral damage” from the Russia-Ukraine war as Caspian biodiversity was seemingly affected by X-101 and X-555 cruise missiles launched from Russian Airspace Force’s long-range strategic bombers—this according to our colleague Jahangir Arasli in his 23 June 2023 IDD paper, who provides one telling example: “often-malfunctioning missiles [...] have fallen into the water [, causing] the mass death of Caspian seals after being exposed to the leaking propellant.”

The socio-economic environment is also impacted by CSL changes, causing the flooding of large areas of agricultural land as well as the destruction of roads, power transmission lines, and both industrial and fish-breeding enterprises. Parkhomchik indicates that “due to a sharp increase in the level of the Caspian Sea in 1978-1995, over 400,000 hectares of coastal areas were flooded, the high-ranking authorities of the coastal states put the creation of the flood hazard maps on the agenda.” According to the same source, just in Azerbaijan, damage to agricultural concerns in coastal areas due to drops in CSL is estimated to be \$2 billion. This in turn has a negative impact on health, employment, and so on. The fishing industry, in particular, has been significantly affected. The receded

Caspian Sea waters also adversely impact on the health of the population inhabiting the coastal areas. Researcher Henna Moussavi indicates that in 2022, it was estimated that current levels of heavy metal contamination increase the risk of cancer in adults by up to 6 percent. This risk rises up to 18 percent in the case of swimmers undergoing long periods of exposure, “indicating the local population is at a higher risk.” Rural littoral towns have seen increases in cases of asthma, tuberculosis, and rheumatism emerging from CSL decrease, and a rise in invasive snakes and bugs “due to a proliferation of swampy areas formed by receding sea water,” as indicated by a Social Assessment in Caspian Sea Communities in Azerbaijan, which was carried out within the framework of Azerbaijan’s National Environment Action Plan (NEAP).

The Caspian Sea has been an essential geographical point in the Silk Road region and has been a clear element in framing regional geopolitics and geoeconomics of the littoral states and other powers. As an inland body of water, it borders five littoral states and can only be accessed from the world’s oceans through Russia’s Volga-Don canal system, which connects to the Black Sea, the Baltic Sea, and the Sea of Azov. The Caspian Sea still has rich fish stocks, including sturgeon and its valuable caviar (it is the source of an estimated 80-90 percent of the world’s caviar, with numbers falling over the past few decades). Moreover, after the breakup of the Soviet Union, the Caspian Sea recaptured the world’s attention due to its vast hydrocarbon deposits. These resources, along with its strategic situation—it is the crux of geopolitically significant transport corridors (e.g., the Middle Corridor, the Belt and Road Initiative, the International North-South Transport Corridor)—have raised the Silk Road region’s geopolitical and geoeconomic standing. In 2018 the five leaders of the Caspian littoral states signed the Convention on the Legal Status of the Caspian Sea (CLSCS), which has not yet been ratified by Iran. CLSCS established the first mutually-agreed legal regime for this body of water. According to that document, each riparian state has full jurisdiction over 15 nautical miles of “territorial waters,” plus an additional 10 nautical miles of “fishery zones” where a given state may harvest aquatic biological resources, whilst the rest of the body of water is stated to be a “common maritime space” with “normal baselines” at minus 28m. With the desiccation of the Caspian Sea, borders may theoretically be subject to change as exploitation of oil and gas deposits may become physically closer to the “original” shore and baseline.

First Option: No-Action Alternative

If no meaningful action is taken to manage CSL, further detrimental environmental, socio-economic, and geopolitical effects are to be expected. Water eutrophication, including blooming algae, will drastically decrease the Caspian’s biological resources—both plant and animal. Moreover, due to the drying up of the Kura River for seven consecutive years, in 2020 waters from the Caspian started flowing into the river—even with decreased CSL. This would be unlikely to cease.

Another effect of decreasing CSL can be summarized in the words of Baku State University's Chingiz Ismayilov: "at present, the declining water level in the Caspian Sea is hampering the work of the Caspian ports (Alat, Anzali, Aktau, Astrakhan, Turkmenbashi, etc.). In this situation, large tonnage ships designed for deeper waters will not be able to bypass the ports. In this regard, the joint efforts of the Caspian littoral states to address the existing problems are among today's most important tasks. Only in this case, the companies that order the transportation of goods will not seek alternative routes."

In fact, Ismayilov estimates that 80 million people could benefit from an optimal level of water in the Caspian Sea, making the Caspian Sea more significant than the Aral Sea and the Dead Sea, where water levels have also dropped significantly. Some of his suggestions to compensate for water loss in CSL would be to decrease the "amount of water used from the rivers for agriculture and electricity. However, it would create new problems, namely food and energy security threats," encompassing numerous coastal cities (including, presumably, Baku).

The Tehran Convention and CLSCS contemplate cooperation areas for future collaboration. However, all cooperation, environmental, ecological, political, and legal mechanisms will need to drastically adjust to the situation, dealing with its climate effects, water management issues, and its legal-political implications. In the CLSCS case, Iran needs to ratify it in order for its provisions to enter into force.

Second Option: Paying Attention and Preliminary Mitigation Activities?

Scientists confirm that the level of the Caspian Sea has evolved through history, at times increasing and at others decreasing. Scientists suggest that the Caspian Sea may be in a long-term descending process whilst also accounting for the possibility that, in the very distant future, it may rise sufficiently to rejoin the waters of the Black Sea. Just consider that in 1978, scientists recorded the Caspian's lowest surface level at 29m bmsl, and then in 1995 they recorded its highest (26.69m bmsl). Irrespective of whether the Caspian Sea is in whichever long-term trend, the littoral governments have to deal with the consequences stemming from short- and medium-term fluctuations, for they have to tend to their population's needs and concerns in the here and now. Thus, while in scientific terms the current Caspian situation may not be so relevant, today the littoral states and their respective populations are facing formidable ordeals, which are becoming paramount for policymakers. There needs to be a general understanding of the issues, a common mindset to deal with them, and a cooperative environment that includes all stakeholders.

What follows is a preliminary list of issues that may give way to more detailed activities, undoubtedly by the national efforts of individual littoral states, but which ultimately need to be executed in a common fashion and in developing cooperation schemes that are

replicated and shared by all the littoral states but also that involve, in one way or another, all the states that belong to the Caspian Sea basin (i.e., Armenia, Georgia, Türkiye).

1. Determine the extent of the Caspian Sea basin and formally establish it. The Caspian Sea is not just the riparian area of this large body of water. Integral and essential to it are the rivers feeding into it, various underwater reservoirs and rivers, and the precipitation that falls onto it. One should take heed of the judgment made by a prominent scholar that “governance at international, national, and regional levels for Caspian-wide adaptation measures to CSL decline are lacking.”
2. Establish a best-in-class regional (and perhaps even international) team of scientists that would forecast—as precisely as possible—the anticipated decrease in the amount of water in the Caspian Sea. Such forecasts should take into account, at a minimum, the following:
 - a. The effects of the dams built on all the rivers feeding into the Caspian Sea, particularly those located along the Volga, Kura, and Aras.
 - b. The Caspian’s accelerating evaporation and how this is influenced by climate change.
 - c. The discharge of pollutants into the relevant feed-in rivers and the sea itself by littoral and non-littoral states belonging to the Caspian Sea basin.
 - d. The mismanagement of water resources due to agricultural irrigation and land-use purposes.
 - e. Technogenic processes and the deleterious influences of the sun, AMOC, and El Niño.
3. Multidisciplinary working groups—both national and regional—to assess and forecast the areas most likely impacted. These groups would provide mitigation strategies for collaboration.
4. The CSL fluctuation evidences one apparently unavoidable future: there will not be enough water. We must stress that this is not linked to lack of water in and of itself, but that the available water will not be sufficient to satisfy different human and environmental needs: drinking, agriculture, industry, population growth, and environment and subsoil ecology (amongst others). Hence, water management and conservation measures need to be developed.
 - a. It is essential to ascertain the amount of water available and contrast it with past assessments. This would comprise not only the waters in the Caspian, but several linked items, including volumes in the rivers that feed into it, available underground water (reservoirs and rivers), and precipitation trends.
 - b. It is vital to apply and monitor the latest technology available and apply the contemporary solutions on offer for effective water resources management, including use and reuse.
 - c. Develop domestic state water saving and purification policies and actively promote them among the population (e.g., incentive programs, media

propagation, education and training programs). This would also have to be regionally coordinated to enhance and mutually affect results. An example of such policies is the Cape Town water crisis in South Africa. While dam water levels had been decreasing since 2015, the crisis peaked in 2017-2018, and became a period of severe water shortage in the Western Cape region, most notably affecting Cape Town, where water levels hovered between 14 and 29 percent of total dam capacity. Authorities implemented a “Day Zero” water savings program, which succeeded in reducing daily water usage by more than half. The drop in Cape Town’s water usage led to revising the estimate for the onset of “Day Zero.” Strong rains started in June 2018, allowing dam levels to recover.

- d. Water-saving and precision irrigation technologies must be applied in all agricultural endeavors.
 - e. Similar mechanisms must be implemented in industrial, general city, and household environments.
5. Solutions to these and other problems will depend on the capacity of the Caspian Sea littoral states to build their port economy in accordance with the current situation.
 6. Legal aspects need to be taken into account.
 - a. Will borders be affected by a drop in CSL? Will the Caspian Sea legally change? It is defined in the CLSCS as a body of water identified by three charts located in Saint Petersburg, but with “normal baselines” that depend on currently rapidly receding waters.
 - b. How will the definition of “territorial waters” and “fishery zones” in the CLSCS be affected by a drop in CSL? Seemingly, they require the use of “normal baselines” based on water currently receding and presumably affecting the issue of sovereignty and the exploitation of biological resources.
 - c. What are the consequences under international law of military activities in the Caspian Sea when these affect the environment and health of the Caspian Sea? Particularly when Article 3 of CLSCS provides that the parties shall carry out activities “using the Caspian Sea for peaceful purposes, making it a zone of peace, good- neighborliness, friendship, and cooperation”?

