Is there a "Technological Fix" in High Conflict Transboundary Basins? The Impacts of Desalination on Hydropolitics of the Jordan River Basin

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1. Introduction

Deep-rooted political disputes over the Jordan River waters are some of the most symbolic manifestations of the historical conflict between co-riparians states, only amplified by water scarcity, environmental changes, and power dynamics (Zawahri 2010). Further, the region's transboundary water management is clearly no easy task as "the water crisis still remains the most predominant risk in the Middle East." (Shah et al. 2018, 121), leaving negotiations for this highly politicized and securitized resource within the realm of high politics (Shah et al. 2018). Therefore, it comes to no surprise that a heavy reliance on the development of "new water," by way of desalination has emerged. In fact, desalination is put forward as a conflict-free and resilient solution that offers a seemingly unlimited supply of high-quality water; overcoming dwindling freshwater supplies and is seen as an agent for improved cooperation (March 2015). While desalination has been praised as a "technological fix" for highly scarce and securitized transboundary basins, this paper argues that desalination is rather a "technological shift", catalyzing the transference of issues to a wider playing field. In the case of the Jordan River Basin, desalination creates space for increased noncooperation and "forced" cooperation. Ultimately, it does not resolve conflict, but displaces it.

This paper will first review both the hydrological and hydropolitical background of the Jordan River Basin and its riparian states. It will then provide a general overview of water desecuritization and desalination, and contextualize them within the hydropolitics of the Jordan River Basin, thereby analyzing the impacts of desalination on cooperation, conflict and non-cooperation within the shared resource. Finally, this paper will be followed by a discussion revealing findings uncovered throughout our research

2. Background

2.1 The Jordan River Basin & its Riparian States

In comparison to other shared international river basins, the Jordan River is a relatively small stream shared between five riparian states: Israel, Jordan, Lebanon, Syria and Palestine (Zawahri 2010). However, this stream is vital to the survival of its riparians given its semi-arid climate, extremely high level of water stress, as Israel, Jordan and Palestine's only perennial river (Zawahri 2010). The Jordan River headwaters (Hasbani, Banias and Dan) are fed by groundwater and surface runoff. While the flow of the Upper Jordan River into Lake Tiberias remains mainly natural, the greatest impacts are felt downstream where the river quality and quantity has sharply decreased in the last 50 years, as a product of water infrastructure, diversions, pollution and overexploitation. In fact, the Lower Jordan River had an average historic flow that was estimated at 1,300 MCM and now stands at 100-200 MCM (UN-ESCWA & BGR 2013). It has been a known fact since the 1920s that the Jordan River will fail to meet current and future water demand and domestic needs (World Bank 2007).

Israel is the largest user of water from the basin and is also the only user of water from Lake Tiberias. Jordan has minimal access, while Palestine has no access to the river with the state's only available water source, the Coastal Aquifer, under the control of Israel and is severely polluted. Jordan runs on an annual deficit with the government compensating by establishing substantial limitations on water, transferring water from the agricultural sector, extracting non-renewable fossil water, and relying on its neighbours for water transfers (Zawahri 2010). It comes to no surprise that in order to meet these growing water demands alternative sources of water such as virtual water, desalination and wastewater reuse are growing in popularity and reliance.

2.2 Hydropolitics of the Jordan River Basin: A Brief History

As a highly politicized shared water resource, the Jordan Basin is subject to a complex history of violence and conflict. Israel has established itself over the years as the basin hegemon using various forms of both hard and soft power, leaving the non-hegemonic actors with little or no access to the resource (Zeitoun & Warner 2006).

Following the 1948 Arab-Israeli War and the signing of the General Armistice Agreements in 1949 to formally end the war and violent hostilities, regional tensions over issues of water allocations of the Jordan River did not subside. Moreover, the United States appointed ambassador Eric Johnston to build and foster a unified multilateral water allocation plan for the Jordan Valley, which was later known as the Johnston Plan (UN-ESCWA & BGR 2013), but was never ratified due to persisting political conflicts between the states.

Conflict persisted after the proposed Johnston Plan, in fact some scholars theorize that water-related conflict in the basin was a major cause of the Six-Day War in June 1967, whereby Israel gained control of the Golan Heights, the West Bank and the Gaza Strip, as well as the headwaters of the Jordan River, the Lower Jordan River, along with several groundwater resources such as the Mountain Aquifers (Shah et al. 2018). These events stand in the way of a basin-wide multilateral agreement among all parties. With that said, international peace-building efforts have emerged by way of bilateral agreements. However, these bilateral agreements can lead to inefficiencies in the management of a shared resource and complicate future negotiations (Zawahri 2010). In short, current use of freshwater among the riparians of the Jordan River Basin and the inequitable distribution unsustainable and a significant cause for concern that will perpetuate future political instability and prevent peace within the region (Phillips et al. 2009).

3. Water Desecuritization & Desalination

3.1 Desecuritizing Water

Researcher Aggestam (2015) conceptualizes securitization theory as the process of framing an issue as a national security threat usually enforced by policy makers, influential elites, experts and scholars. Securitizing an issue enables exceptional measures to manage said security issue, leading to elite-oriented decision-making with lowered transparency. Desecuritization is overall understood as a positive process where an issue is no longer treated as an existential threat and returns to the normal spheres of politics. “Securitized” water resources make negotiating virtually impossible. Thus, any proposed changes to allocation is met with high contestation and conflict, causing inefficient, inequitable and unsustainable transboundary water management (Brooks & Trottier 2014). Notably, desalination has been praised as a transformational technology that can promote water desecuritization in transboundary water management, seeing as it can de-escalate the perception of water scarcity as an existential security threat (Katz 2021). However, we will discuss how desalination is not a “technological fix” to foster cooperative and effective transboundary water management in the following sections.

3.2 Desalination

"The purification of saline ocean water marks the beginning of the age of abundance; the apparent emancipation of human society from resource scarcity, drought and famine; the triumph of science and engineering over nature" (Williams & Swyngedouw 2018, 1). The use of large-scale seawater desalination has rapidly taken off globally. In 2013, there were over 17,000 active desalination plants providing roughly 80 × 106 m3/day water to 300 million people in 150 countries. It is estimated that production capacity is set to increase to 192 × 106 m3/day by 2050 (Darre & Toor, 2018). Many countries around the world, particularly in the Middle East, are ramping up their use of desalinated water to supplement or even replace the water supply of cities and regions. For instance, Israel operates 31 desalination plants, treating nearly a million cubic meters of seawater water every day, relying on desalination for 75% of its drinking water supply. Even with Israel's expanded capacity, the population is growing at a rate of 2% annually along with rising standards of living. Consequently, it has been projected that production will need to grow from 750 MCM per year to approximately 1600 MCM per year (Tal 2018).

Nevertheless, a highly securitized water resource such as the Jordan River Basin, allows for the promotion of desalination as a viable and sustainable solution given the significant "improvement" in quality of life (Williams & Swyngedouw 2018). Additionally, the added volume of desalinated water allows for added recycled water volume in arid and semi-arid regions (Aviram et al. 2014). While providing a "fix" to the issue of water scarcity, it also creates a host of significant problems that will only be exacerbated with time.

Environmental	***Economic***	***Social & Institutional***
- Large-scale desalination plants require astronomical rates of energy for the seawater treatment & transportation - In Saudi Arabia and Kuwait, it is estimated that 50% and 70% of the domestic fossil-fuel produced electricity is dedicated to desalination plants (Darre & Toor 2018) - Disposal of its main waste product, brine, is a cause for concern as it is being discharge it back into the ocean. - Increased salinity poses a substantial threat to our fragile marine ecosystems (Williams & Swyngedouw 2018).	- Capital costs involved in desalination infrastructure, along with energy demands, are astronomical - Water sector becomes subject to price volatility due to increased energy use (Katz 2021) - The vulnerable marine life ecosystems constitute sources of livelihoods for many coastal communities around the globe (Katz 2021) - The development of desalination by energy scarce countries, such as Jordan, could result in interchanging issues of water insecurity with energy insecurity (Katz, 2021)	- Perception of abundance is also a cause for social and institutional concern - In Israel, reliance on desalination is undermining demand management efforts as the population now views water as no longer scarce, increasing wasteful consumption, and limiting adaptive management responses (Katz 2021) - Desalination may lead to a neglect of structural issues and institutional mechanisms to enable stable water governance, thereby enforcing path dependencies (Katz, 2021)

4. Desalination, Water Desecuritization and Hydropolitics along the Jordan River Basin

4.1 Desalination & Conflict, Cooperation, and Non-Cooperation

While conflict and cooperation are often viewed as a dichotomy, it is more accurate to capture them as a spectrum (Zeitoun & Mirumachi 2008). This is because in transboundary basins, there are usually several interactions across the spectrum occurring concurrently (Zeitoun & Mirumachi 2008). While conflict is easy to identify, cooperation requires a critical assessment. True cooperation evokes harmony and mutual influence (Zeitoun & Mirumachi 2008). Token cooperation, on the other hand, is where little efforts are made to give the illusion of cooperation, but in fact perpetuate power asymmetry (Zeitoun & Mirumachi 2008). In high-conflict zones, there

is a tendency to view token cooperation as true cooperation, as international actors provide uncritical support to any sign of cooperation (Zeitoun & Mirumachi 2008). This results in promoting the signing of treaties, however ambiguous, rather than addressing more pressing goals such as equitable water management (Zeitoun & Mirumachi 2008). Cooperation, therefore, should be viewed within the larger sphere of politics, and should not be uncritically celebrated (Zeitoun & Mirumachi 2008).

An example of token cooperation is the Joint Water Commission (JWC), formed by Palestine and Israel to oversee water infrastructure of Palestine (Katz 2021). It could seem cooperative, and is seen as such by academics and politicians (Zeitoun & Mirumachi 2008). However, with critical assessment, it becomes unrealistic to label the JWC as a form of cooperation, since all infrastructure activities require approval from the Israeli Civil Administration (Katz 2021). It allows Israel to veto any Palestinian water projects, and there is "domination dressed up as cooperation" (Zeitoun & Mirumachi 2008). For instance, in the early 2000's and with the uptake of desalination, the Palestinian Authority submitted a project proposal to unilaterally desalinate brackish water from its Mountain Aquifer (Katz 2021). After long delays and unnecessary protests, including inviting the United States Agency for International Development to support the PA's position, the Israeli Civil Administration denied the request (Katz 2021). It is worth emphasizing that the refusal came from the Israeli Civil Administration, not the Joint Water Commission, illustrating the politicization of the project (Katz 2021), and the securitization of the technology. The motivations of the PA for the project were not only to increase its water supply, but to politically establish a stronger presence in the region, and to reduce its reliance on the Israeli water supply (Katz 2021), thereby denoting an act of (justified) non-cooperation. This is therefore an example of how token cooperation initiatives could lead to contestation and conflict, and how introducing technology in high-conflict transboundary basins has the potential to pave new paths to conflict instead of cooperation and peace (Katz 2021).

This critical assessment of conflict and cooperation creates space for introducing a third position: non-cooperation. Non-cooperation occurs when parties do not engage in either conflict or cooperation, and proceed to act independently. In the case of transboundary waters, this is usually caused by ambiguous agreement clauses, as is the case of the Oslo Accords (Zeitoun & Mirumachi 2008). Israel's first desalination plant in Ashkelon, which started operation in 2005, was closed 11 years later due to non-cooperation (Katz 2021). The plant is proximal to the Gaza Strip, where the sea water is highly contaminated due to poor sanitation infrastructure and importation sanctions of basic materials on the Gaza Strip (Katz 2021). Despite being an opportunity for cooperation between Israel and Palestine to improve sanitation infrastructure, and consequently reducing marine pollution to avoid water contamination for Israel, Israel chose a position of noncooperation. This resulted in adverse implications for Israel, which led it to minimally adjust its position to allow for more cooperation by increasing its supply to the Gaza strip to 10 MCM (Katz 2021). Thus, although desalination allowed for non-cooperation, it also pushed states to cooperate. This is because desalination increases inter-dependency across boundaries, and water flows and interests increase (Katz 2021). Palestine, therefore, is gaining soft negotiation power that could be used to promote cooperation or decrease conflict.

Non-cooperation is also propelled by stark power asymmetries. While Palestinians demand that desalinated water should be considered a substitute for desalinated water, Israel views desalination as an industrial product and not a shared water source (Feitelson & Rosenthal 2012). Despite the storage capacity of desalination, Israel insists on unilaterally controlling the storage capacities of the Sea of Galilee and the western Mountain aquifer as a contingency for increased demand or reduced supply (Feitelson & Rosenthal 2012). In fact, Israel promotes that each state should have its own desalination plant (Feitelson & Rosenthal 2012); a position of conflict dressed up as non-cooperation, since the Israeli Civil Administration has proven to make it challenging to approve infrastructure development projects by the PA.

In the case of the Jordanian-Israeli dynamic, states continue to choose various positions along the conflict-cooperation-noncooperation spectrum. In the 2000s, when the Red Sea-Dead Sea canal project was being discussed, Jordan came to the conclusion that it would unilaterally fund the project to allow for its sovereignty over water (Feitelson & Rosenthal 2012). Despite the fact that this is a more expensive project than the Mediterranean to Dead Sea canal that was proposed as a joint project between Jordan and Israel, Jordan continued to pursue the more difficult solution to avoid having Israel as an upper riparian on its canal (Feitelson & Rosenthal 2012). Desalination has not only created a new path of non-cooperation, but in fact allowed for an elimination of power, allowing some states to have more independence over their water.

Desalination also has the potential to create conflict. Israel's large-scale desalination plants rely on natural gas and coal (Feitelson & Rosenthal 2012; Tal 2018). Additionally, Israeli government consultants forecast that energy efficiency for desalination is unlikely to improve drastically in the future (Tal 2018). As desalination is energy-demanding, large-scale projects will aggravate climate change. Moreover, discharges from the desalination plants of brine, heavy metals and other chemicals are discharged back into the Mediterranean Sea, spurring environmental concerns about marine life (Tal 2018). Although Israel's desalination plants must submit environmental performance reports bi-annually to the Ministry of Environmental Protection, the ministry never claimed an objection to desalination (Tal 2018). Even though some policies pose challenges for desalination, they are mild ones as all policies are in place to promote and facilitate desalination (Tal 2018). These factors could lead to environmental conflict and redirect the water conflicts to climate-related ones.

4.3 Co-existence of Conflict and Cooperation in the Jordan River Basin

The above narrative displays a clear interplay between the three aspects of conflict, cooperation, and non-cooperation (Zeitoun & Mirumachi 2008). This is captured in the adapted Transboundary Waters Interaction Nexus (TWINS) matrices in Figures 1 and 2, which plots the history of interactions in chronological order. The Jordan River Basin presents a unique transboundary waters situation, with intense conflict, violence, and scarcity, making it difficult to comply with transboundary water governance norms. As such, the TWINS matrix has been adapted from Zeitoun & Mirumachi's (2008) expanded matrix. Additionally, due to the bilateral nature of interactions in the basin, we have plotted interactions on two matrices, highlighting Palestinian-Israeli interactions in Figure 1, and Jordanian-Israeli interactions in Figure 2. Each matrix also displays the equilibrium of water interactions before and after desalination.

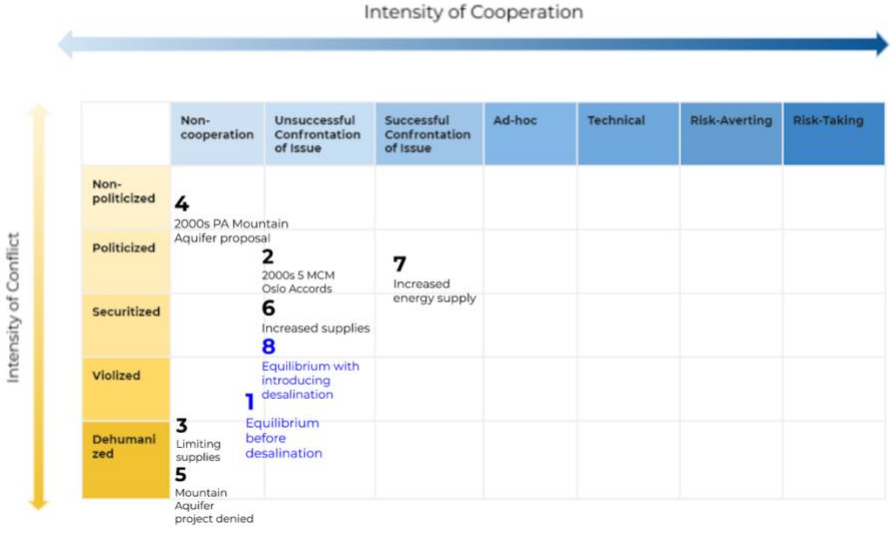
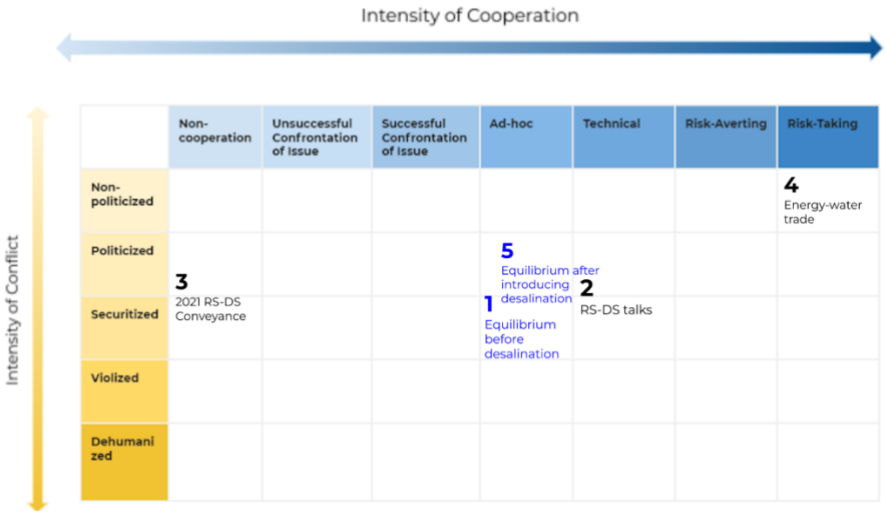


Figure 1. *Palestine-Israel water interactions plotted on a TWINS matrix*

Details:
1: Equilibrium state before desalination - 1940s-1990s
2: Israel is obliged to supply 5 MCM of desalinated water to the Gaza Strip under the Oslo II agreement (Katz, 2021)
3: Despite rapid population growth in the Gaza Strip, Israel refuses to increase its supplies (Katz, 2021)
4: The Palestinian Authroity submits a project proposal to the JWC. The project aims to desalinate brackish water from the Mountain Aquifer to gain some independence from Israel (Katz, 2021)
5: Israeli Civil Administration denies approval for Mountain Aquifer project
6: US pressures moved Israel's position in regard to water supplies. Israel increased its water supplies to the Gaza Strip to 10 MCM in 2016 (Katz, 2021)
7: US pressures move Israel's position once again. Israel commits to supply more electricity to the Gaza Strip to enable the operation of a new wastewater plant, thereby reducing marine pollution that impacts Israel's desalination efforts (Katz, 2021).
8: Equilibrium of interactions between Israel and Palestine with the introduction of desalination.



Details:
1: Equilibrium state of interactions before desalination - 1940s-1990s
2: Jordan and Israel hold multiple discussions around a joint project for sharing water (the Red Sea-Dead Sea Conveyance project). The proposal is that Jordan desalinates water and supplies them to southern Israel, and Israel would supply water from the Jordan River to Jordanian population centers (Aviram et al., 2014)
3: Jordan decides to unilaterally implement the Red Sea-Dead Sea project (The Times of Israel, 2021a).
4: Jordan, Israel, and the United Arab Emirates enter into an agreement around trading energy and water. The UAE will build an electricity plant in Jordan which Israel will buy from, and Israel will sell desalinated water to Jordan (The Times of Israel, 2021b).
5: Equilibrium of interactions between Israel and Palestine with the introduction of desalination.

Figure 2. *Jordan-Israel water interactions plotted on a TWINS matrix.*

5. Discussion

Technological advancements within transboundary water management have a number of benefits that should not be discounted as very important pieces of the puzzle. With that said, the world appears to be blinded by the water scarcity narrative, thereby securitizing much of the world's water sources, and leading to extensive daily reliance on unsustainable water resource management strategies. In other words, desalination promotes linear water consumption patterns without acknowledging environmental limits to growth for a water-secure future.

In the case of the Jordan River Basin, to adequately assess the impacts of technological innovations on transboundary water conflict and cooperation, cooperation should be approached from a targets-lens. That is, as Zeitoun and Mirumachi (2008) emphasize, cooperation should not be celebrated unless it is effective, and the international community should not applaud any signing of an agreement. This is because it is possible for a hegemon to impose an agreement that may appear to be cooperative, but when unpacked is in fact coercive (Katz 2021). While desalination has provided new opportunities for cooperation, it certainly is not a "fix" to politically-motivated water conflicts. This is evident through the persistent dehumanized and violized water conflicts Israel has with Palestine. Additionally, the persistence of conflict implies that its intensity could be reduced, but not obliterated. Moreover, the failure to achieve multilateral agreements within the riparian states of the Jordan River Basin prove that desalination has not substantially increased cooperation. While it could provide new avenues for cooperation, a change in power dynamics, and new arguments for water equity, it could similarly pave new paths to conflict.

In the absence of true cooperation, desecuritizing the resource by way of desalination only creates a transference of problems and reordering of relative scarcities. For instance, Israel's large desalination capacity has not led to Palestine becoming more water-secure, and considering the environmental ramifications of desalination, the technology only puts significant pressure on the long-term human security of all three states from a health, environmental, economic and social perspective. It should also be noted that desalination is not a viable option for energy scarce nations, transferring the issue of water scarcity to an issue of energy scarcity. Nevertheless, desalination will only go so far without deliberate, political peacemaking and sovereign acknowledgements. As such, this research has found that desalination may appear as "fix" but is in fact only a "shift." It has not led to any progression in the regional conflict.

Further, desalination creates space for an autarkic economic order and noncooperation, as states can unilaterally implement individualized solutions and become self-sufficient in their water supply, decreasing the need for water negotiations. This is evident in each country's efforts

in building independent desalination plants, thereby reducing incentive for cooperation. Furthermore, a heavy focus on supply-side solutions that inherently does not challenge sovereignty leaves little room for real cooperation and problem-solving. However, with deeper analysis, it is found that cooperation is fundamental to sustained seawater supply, due to the interlinkages of environmental elements between and within the states. This is expected to not only increase incentive for cooperation, but also change power dynamics. That is, Palestine and Jordan can gain more soft negotiation powers to encourage Israel to cooperate with them equitably, as poor environmental conditions in any one country will impact the rest. The extent of this negotiation power is hard to estimate because of the uniqueness of the case of the Jordan River Basin states but it appears that the political asymmetry of the regional conflict has seeped into the sector of desalination.

Finally, desalination certainly plays an important role in resolving issues of water scarcity, particularly in cases of national emergencies. However, it cannot be the sole solution to supplying water as we strive to live in a more just and sustainable world. Currently, the technology is not in line with the principles of the 1997 United Nations Convention on the Law of the Non-Navigational Uses of International Watercourses as it has the potential to cause significant harm to the Jordan River Basin along with other water sources and the environment. Further, it does not guarantee equitable and reasonable use of the Jordan River Basin as Israel argues desalination to be an industrial product and not a shared water source, thereby maintaining control over the Jordan River allocation. Finally, while Jordan and Israel exhibit one of the first benefit-sharing examples across the basin, the highly individualized nature of this technology allows for further noncooperation without necessarily engaging in potential benefit-sharing or trust-building initiatives. As such, without substantive changes to replace token cooperation with true cooperation, integrating more sustainable water management strategies and using desalination to foster benefit-sharing opportunities, desalination will only reinforce unsustainable consumption patterns and will not serve as a “technological fix” to transboundary water management.

6. Conclusion

This paper examined the impacts of desalination on the hydropolitics of the Jordan River Basin. It surveyed the situation among the main actor states on the river (Jordan, Palestine, and Israel), and explored the environmental, economic, social, and institutional impacts of desalination as well as the concepts of water desecuritization, conflict, cooperation, and non-cooperation. Though desalination is a technology that holds much potential, it is a tool that could be used strategically for cooperation, conflict, and environmental (in)action. The findings and analysis of this research indicate that desalination, while an agent for marginally improved cooperation and slightly less intense conflict, is not a solution to the conflict in the basin. It also finds that desalination is not a fix to water scarcity, and in fact increases anthropogenic reliance and path dependency on technology, ultimately impacting the environment and numbing the urgency of climate action and environmentally-conscience action.

Desalination is a technological solution that will aid with current and pressing issues, and should be further studied in relation to transboundary and environmental contexts. Specifically, future research could focus on how desalination could contribute to SDG 6.5 in high-conflict basins, its role in international water law and its potential in resolving water-related disputes, and its impacts within the Hydro-Hegemony Framework. Additionally, similar research could be expanded to other technological solutions such as wastewater reuse. In light of the many advancements on the horizon and the momentum of their uptake, existing norms and principles such as Integrated Water Resource Management should be revisited.

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