A Future for the Dead Sea Basin: Water Culture among Israelis, Palestinians and Jordanians

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Summary

The Dead Sea basin plays a major role for regional economic development (industry, tourism and agriculture) in the Middle East. This potential is threatened by the steady disappearance of the Dead Sea. Since around 1930 the water level of the Dead Sea has fallen by about 25 m, about half of this alone in the last 20 years. The Dead Sea is a transboundary resource shared by Israel, the Palestinian Authority and Jordan. The Dead Sea is the terminal point of the Jordan River watershed and as such, it serves as a barometer for the health of the overall system. Its rapid decline reflects the present water management strategies of the riparian and upstream countries. This includes the different water cultures of the three countries. Throughout history, the Dead Sea basin has served as a source of refuge and inspiration for followers of Judaism, Christianity and Islam. Today, the religious significance of the Dead Sea is being overshadowed by its rapid disappearance. This may be explained in part by the water cultures of the three countries that influence water policy in the region. Ideology, together with culture and tradition, such as that of Zionism in Israel, has played a central role in water development in the region. In many cases, this has been at the expense of the environment. Elements pertaining to environmental security and water culture and tradition, whereby a sustainably managed environment provides for social, economic as well as environmental benefits are evident with regards the Dead Sea. The decline for example, undermines its potential as a tourist destination, despite the enormous investment in hotel and resort infrastructures in Israel and in Jordan. The decline also raises ethical issues about the exploitation of water resources by present generations at the expense of this natural heritage to future generations. This paper provides an analysis of a European Union funded project whose aims are to synthesize and assess existing physical and socio-economic data and to assess options for a better future for the Dead Sea. It will identify the patterns of water supply and use in the region, and the factors that control these patterns, including those of water culture. The underlying assumption is that solutions for a more sustainable development than today's scenario will not come from simply providing "more water for more development", but from a new land and water management system, indeed ethic, that is sensitive to social, cultural and ecological resources thereby providing security and stability across cultures, economic sectors and nations.

Keywords: Water Culture, Dead Sea, Stakeholder Analysis

JEL Classification: Q25, Q56, Q58

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Introduction

Both national policy and research focusing on water scarcity in the Middle East take a regional or national perspective, with emphasis in the literature on alternatives to conflict (Postel 1993; Lowi 1993; Gleick 1994; Gleick 1993; Frederick 1996; Flakenmark 1986; Feitelson 2000; Lipchin 1997; Postel & Wolf 2001). Studies have and are being conducted on hydro-economic and hydro-political approaches (Wolf & Lonergan 1995; 1994) or on technological fixes (Hamberg 1995; Gavrieli et al. 2002; Shelef 1995; Segev 1995) as ways of finding solutions to water scarcity in the face of increasing demand. This study explores an as yet little studied, but critical component of the water management system in the region: the influence of water culture on the public's perceptions and attitudes toward water use.

Resource use behavior of local communities is fast becoming realized as integral to the drafting of sustainable resource policy that is advocated at a national level but implemented at a local level. Policies and programs are strengthened when they can account for linkages between local communities and national policy. Increased local participation strengthens resource behaviors that are sustainable by making the policy process more responsive to local concerns. In addition, local ownership, involvement or participation can raise awareness about resource concerns such as that of water scarcity and in so doing make programs more sustainable. A first step in this approach is the assessment of the culture of water that may exist in the region and it's impact on the resource of concern.

Successful employment of preferred policy strategies and technologies will require an understanding of the social environment in which they are to be applied i.e.: the cultural context in which they operate. For example, the social drivers which promote involvement in recycling may vary between households and cultures, and will certainly be different for domestic, commercial and industrial users. In particular, the application of water recycling systems (i.e. the procedure of locating and operating them) within households or communities, can be severely disrupted if some understanding of key factors such as perceived need and benefit and cultural sensitivities towards using recycled water is not acquired (Jeffrey 2000; Jeffrey 2000; Jeffrey & Seaton 1998). Our focus is on the variability in perceptions of, and attitudes towards, water use and the impacts of use on the ecosystem among three water cultures: Israeli, Palestinian and Jordanian, and how this is manifested in the Dead Sea basin..

Understanding the social and cultural dimensions of water use and management are now seen as central to the development of sustainable water management practices (Lipchin 2000; Hellstrom et al. 2000). At a practitioner level, knowledge derived from cross-cultural studies is of increasing relevance to those charged with managing and preserving our natural resources. Indeed, Hoekstra (1998) has suggested that many of the current controversies among water researchers and policy makers can be explained by the existence of different cultural perspectives

(Hoekstra 1988). These perspectives differ in their underlying basic values, beliefs and assumptions (perceptions and attitudes). He also points out that many water issues are not only technical problems but are also value laden. Hence, the path toward a solution is more complex than a simple technological "fix".

This is because irrespective of what conclusions the scientific evidence leads to, the impressions and attitudes which the public hold can speedily and effectively bring a halt to any project or scheme (Jeffrey 2000; Jeffrey & Seaton 1998). The issues here are both complex and complicated, having to do with beliefs, attitudes and trust. Furthermore, it is important to expose the public's own agenda for discussing and debating water problems and solutions. By conducting social enquiry at an early stage, we can test how policies and technologies might be received by individuals or groups of individuals. Subsequent feedback into technology or project design (perhaps in terms of appropriate scale, technology or location preferences) can forestall ineffective or inefficient application when the public is an equal partner in the decision making process.

Although the increasingly heterogeneous nature of our societies (at both nation state and regional levels) presents new challenges in managing water resources within a culturally diverse setting, research which can provide guidance to practitioners on such issues is sparse. As Dr. Mahmoud Abu-Zeid, president of the World Water Council has noted:" The cultural and socio-economic values of water are still a very elusive subject" (Abu-Zeid 1998).

Studies of cultural influences on water quality and water use have been carried out since the late 1950's (originally in the USA, but lately in Europe, Central America and Africa). None to this author's knowledge have yet been conducted in the Middle East.

The link between cultural context and attitudes to environmental and technological risk, for example, has been well articulated by Douglas & Wildavsky (1982). A review on the social bases of public concern with environmental quality has been carried out by Van Liere and Dunlap (1980). They examined the explanatory power of several sociodemographic and socioeconomic variables in explaining environmental concern. The results indicate a complex picture where it is not only the young, well-educated and liberal segments of society that display environmental concern (Van Liere & Dunlap 1980). What this and other studies show is that society is more complex than many policy makers care to consider (Jeffrey & Seaton 1998).

In water and natural resource exploitation studies in particular, cultural or ethnic background has been identified as a key indicator of both attitudes and behaviour. In a broad context, Panday (1990) has addressed the cross-cultural psychology of environmental perception and behaviour in an effort to understand how different societies relate to their physical environments (Pandey 1990). The precise influence of cultural variables in individual attitudes towards and interactions with the water environment have been partially investigated by several authors (Murdock et al. 1988; Burmil et al. 1999), highlighting in particular, the multi-faceted role which water plays in arid and semi-arid environments. But studies which look at specific

technological applications are few (for a rare exception to this trend see (Fry & Mingledorff 1996)). Ethnicity has been shown to be a predictor of actual water conservation behaviour in the United States (Oliver 1999), with Anglo's responding relatively poorly to voluntary conservation programmes as compared with non-Anglo populations, but equally well to mandatory conservation initiatives. Cultural factors have recently been identified as a key moderator in wastewater reuse for fish farming in Egypt (Mancy et al. 2000).

I argue therefore that projects for sustainability require a holistic and integrated approach that takes into account the overall cultural context in which and by which, water is used. Community measures (income, health, education) and resource measures (quality, quantity, consumption) coupled with the participation and empowerment of local communities (Hoon & Singh 1997) should be the preffered methodological approach in water management.

The aim of this study is to consequently explore how differences *and* commonalties in water culture influence attitudes and perceptions toward water use. The field of study was the Dead Sea basin. The Dead Sea basin is a transboundary resource shared by Israelis, Palestinians and Jordanians.

The study sought to explore the following question: How does one's cultural context correlate with the attitudes and perceptions people hold toward water resources and water use policies in the region in general and in the Dead Sea basin in particular?

Study Area

The Dead Sea basin has a size of about 44,000 km² and its watershed is shared by Israel, Jordan and Palestine (Figure 1).

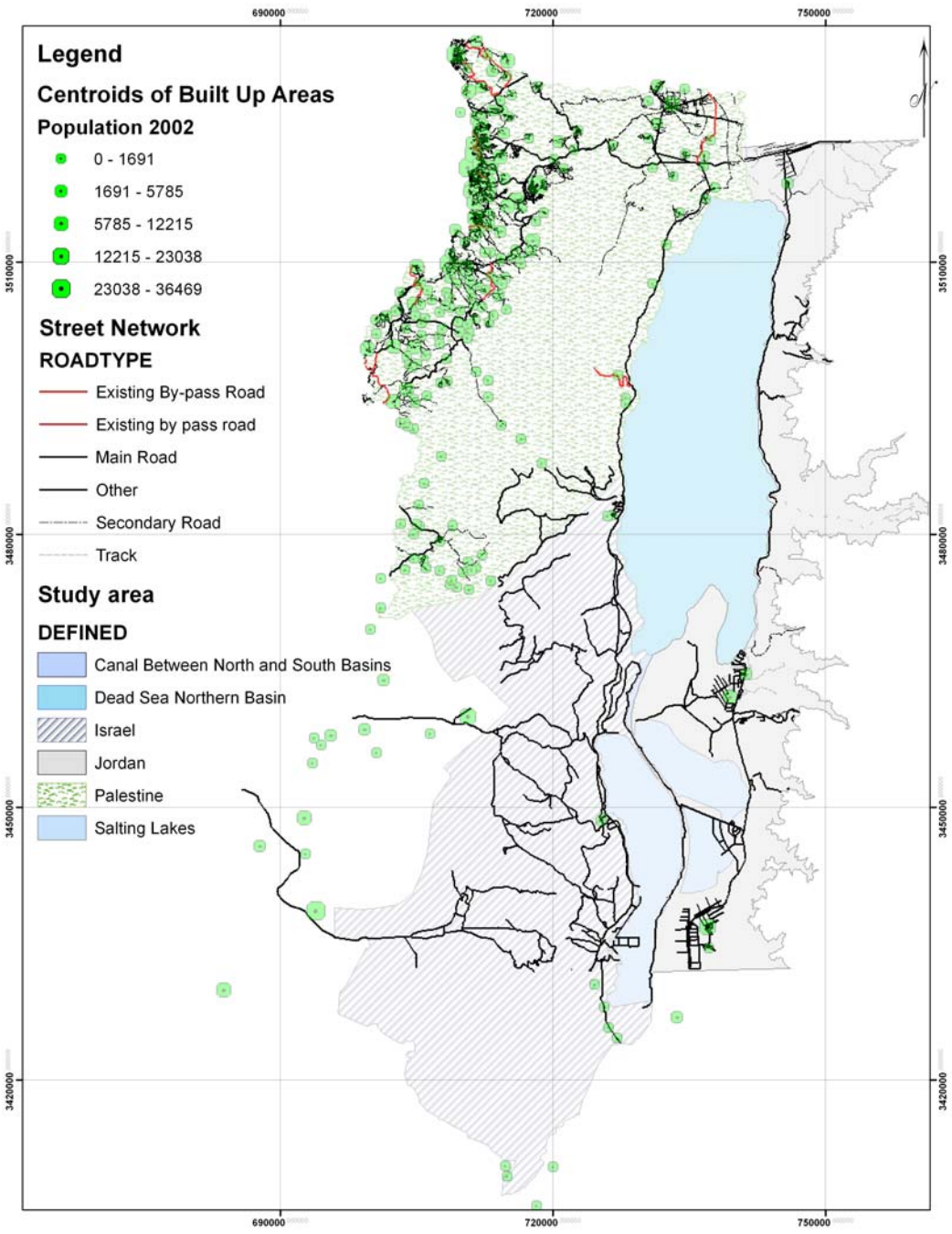

Figure 1. The Dead Sea watershed (Source: Dead Sea Project, www.deadseaproject.org)

The basin plays a major role for regional economic development. Current economic activities in the basin are industrial (mineral extraction and water bottling), tourism and agriculture. The Dead Sea's mineral composition and the unique climate provide treatment for skin diseases, especially for psoriasis and atopic dermatitis (Schempp 2000). The health and cultural features plus the unique landscape have made the area attractive for tourism. Besides the regional relevance, the basin has a global importance. Since 1998 there have been efforts to promote the Dead Sea basin as a UNESCO Man and Biosphere Reserve and a World Heritage site (Abu-Faris et

al. 1999) because it is a both a unique habitat for wildlife (particularly important around springs and wadis (e.g. Ain Fashkha, Ain Gedi, Wadi Mujib) and a global cultural heritage site with some of the world's oldest human settlements (e.g. the city of Jericho and the mountain fortress of Masada).

The Dead Sea is the terminal lake of the Jordan Rift Valley. Its surface is currently about 417 m below sea level which makes it the lowest point on earth. With a salinity of about 3,000 mg/l it is also the most saline water body in the world (Gertmann 1999). Rainfall is limited to winter months; it varies from about 500 mm/yr in the north-western highlands to less than 100 mm/yr in the valley floor (Al-Weshah 2000). Perennial storage in surface and underground water reservoirs is limited and vulnerable to pollution and depletion. Potential evapotranspiration in the valley floor is about 2,000 mm/yr, and actual evaporation from the Dead Sea surface is about 1,300-1,600 mm/yr (Stanhill 1984). The temperature is about 40°C in summer and 15°C in winter (Assaf et al. 1998). At the east and west there are steep escarpments, while in the north and south, the valley stretches gently upward along the Jordan River and along the Wadi Araba, respectively.

The historical Dead Sea consisted of two basins: the deep northern basin (which is now the only remaining Dead Sea proper), and the shallow southern basin from which the Dead Sea has retreated since 1978. The two basins are divided by the Lisan Peninsula.

The land cover is mostly open with little vegetation. Sensitive areas include the Lisan peninsula area, marshlands and wetlands at the northern and southern ends of the Dead Sea, the Wadi Mujib, the Ain Gedi oasis, and the Dead Sea itself (Fariz 2002). Lack of natural freshwater, expansion of human settlements, and inappropriate land use has affected these areas (Gebetsroither et al. 2004).

Waste waters from local domestic, agricultural, industrial and tourist activities flow directly into the Dead Sea. Raw sewage flows into the Dead Sea from Jerusalem-Bethlehem urban areas via the Wadi Nar (Kidron valley). Water shortage and land degradation are a problem all over the basin and these are likely to exacerbate with population growth (Rishmawi & Hrimat 1999).

The most visible and most disturbing degradation is the decline of the Dead Sea water level and volume. Since around 1930 the water level of the Dead Sea has fallen by about 25 m, about half of this alone in the last 20 years (Anati. D.A. & Shasha 1989; Assaf et al. 1998). In the past few years the rate of decline was 80-100 cm per year. The last available data from mid-2003 indicate a water level of -417 m (Figure 2). As a result of this decline, in the last 20 years the Dead Sea surface area has shrunk by about 30 %, and its north-south extent has shrunk from over 75 to 55 km (Anati. D.A. & Shasha 1989). Since 1978, the Dead Sea has completely retreated from the southern basin, which presently consists only of artificial evaporation ponds used by the mineral extraction industry.

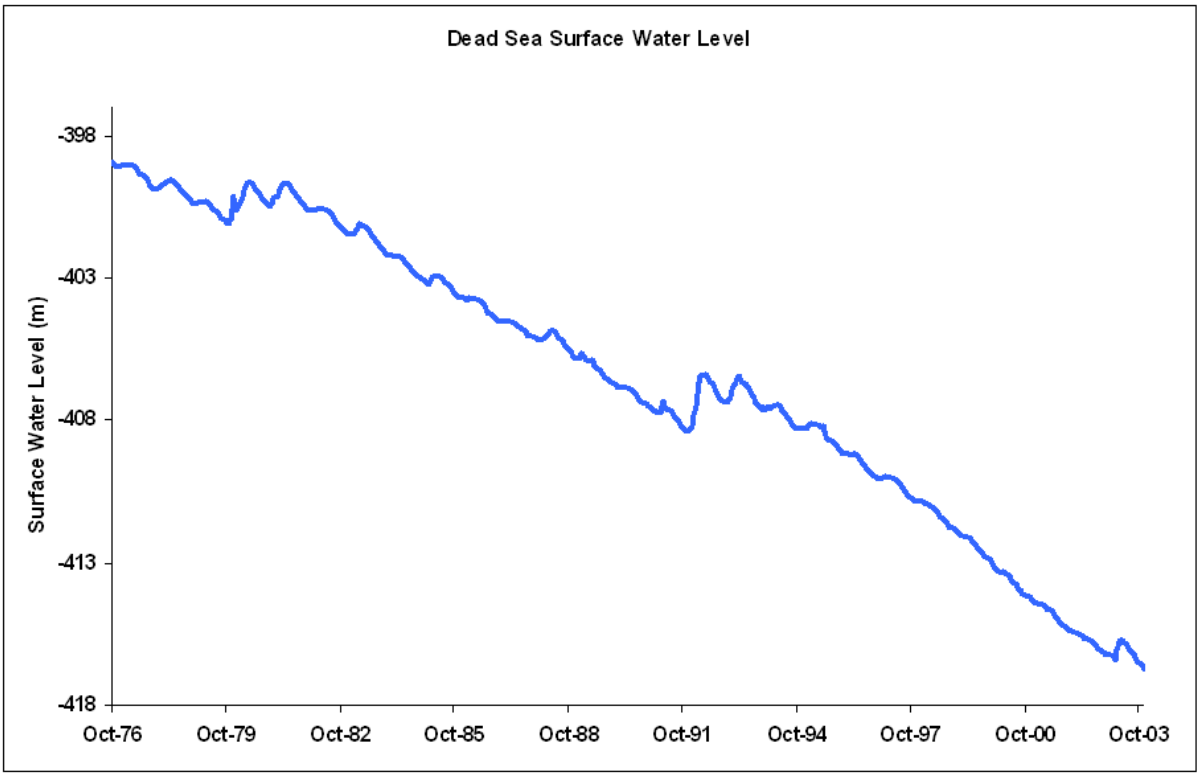

Figure 2. Decline of Dead Sea water level 1976-2003 (Data from Israeli Hydrological Service)

The reasons for this decline are well-known. First and foremost, the decline is a direct consequence of the declining freshwater input: this includes decreasing discharge from the River Jordan, increasing water use from natural springs and side wadis, and extensive use of aquifers that provide secondary water input (Klein 1985). Of all these factors, the River Jordan probably plays the biggest role (Lipchin 1997). It may be said that the Dead Sea's steady disappearance is a direct result of the water management strategies of the River Jordan riparians (Tal 2001). While 100 years ago the River Jordan's discharge into the Dead Sea was about 1,200-1,300 million cubic meters per year (MCM/yr) of freshwater, it has been reduced to about 900 MCM/yr by the 1940's and now is not more than 100-200 MCM/yr of saline and polluted water (Orthofer 2001; 1994; Al-Weshah 2000; Orthofer et al. 2001; Rabi 1997 ; Shavit 2001). The main reason for this decline is that water from the Upper Jordan River as well as water from the Lower Jordan River tributaries (e.g. Yarmouk, Zarqa) has been blocked and diverted for urban and agricultural uses inside and outside the watershed by the basin riparians.

On top of the reduced freshwater input, more than 200 MCM/yr water are pumped out of the Dead Sea into evaporation ponds in the shallow southern basin. It is estimated that the salt industries contribute 25 to 30 % of the present total evaporation rates (Wardam 2000).

It is not clear whether the Dead Sea water level has now come to equilibrium between the reduced surface and a reduced evaporation, or if it will continue to

decline. As a result of the lowering of the water level, the adjacent aquifers are seriously affected (Yechieli 1996). Sinkholes have opened up along the shoreline, caused by lowered water tables and groundwater over-exploitation (Baer et al. 2002; Bowman et al. 2000). These sinkholes are a serious threat to infrastructure around the basin and have essentially halted future development plans such as the building of new hotels (Figure 3). Furthermore, the decline of the Dead Sea also affects the freshwater springs on its shores (e.g. Ain Fashkha and Ain Turiba) that support a unique biodiversity (Friends of the Earth Middle East 2000; EcoPeace 1998). The decline of the water level has also had a serious effect on tourism due to the disappearance of the shoreline close to the hotels.

Figure 3: A series of sinkholes on the exposed shoreline on the western shore of the northern basin of the Dead Sea (Photo: Clive Lipchin).

Without some form of intervention, the current trend is expected to continue with potential disastrous effects for the future. The growing population in all three countries will increase the pressure for the freshwater that currently remains unused. The possible re-settlement of returning Palestinian refugees will also increase demand in Palestine. Palestinians demand as part of a regional water agreement that more water should be allowed to the Lower Jordan River and that this additional water should be usable for the Palestinian population. This, of course, means that the Dead Sea would not benefit. The declining Dead Sea undermines the potential as a tourist destination, despite the enormous investment in hotel and resort infrastructures in Israel and in Jordan. Over the next few years, there are plans for further tourism and industrial development including the construction of over 50,000 new hotel rooms (Meunier 1999). For the fledgling Palestinian economy, the present state of the Dead Sea suggests that Palestinians may never have the opportunity to develop what should

have been one of their more attractive tourist locations that could provide critical employment to a growing workforce.

In all three countries, development policies have disregarded impacts on the environment, indigenous people and small farmers. Essential water needs for nature were neglected; policies lacked incentives to promote local forms of environmental security and equitable access to natural goods and services. Water is increasingly allocated to the urban sector and to large-scale agriculture at the expense of the needs and rights of the rural and indigenous people. Consequently, the rural poor and indigenous are overexploiting land resources to sustain their livelihoods.

Furthermore, the decline of the Dead Sea raises ethical issues regarding the exploitation of present generations of water resources at the expense of the natural heritage in the future. Many would argue that it represents an intolerable violation of the rights of future generations.

Nonetheless there is concern in the region about the threat of a disappearing Dead Sea (Coussin 2001; EcoPeace 1998), but very little progress. Most options for solving the environmental and economical problems focus on the provision of "new water from outside", particularly through the building of a canal that will connect the Red Sea with the Dead Sea ("Red-Dead Conveyance Project") (Gavrieli et al. 2002). This is a classical technological "fix" solution indicative of a centralized management structure with little public involvement. Both Israeli and Jordanian governments support this type of option (recently, the Israeli government has shown less enthusiasm as it explores desalination plants on the Mediterranean coast). This 240 km conduit is expected to replenish the missing inflow from the Jordan River through brine discharge from desalination, use the gravity pressure for desalination through reverse osmosis for drinking water, and for production of electricity. Costs are estimated to be around 3 billion dollars (Pearce 1995). Financing for the project may come from the World Bank. Among the questions which remain unclear are the environmental impacts of the canal, e.g. the chemical changes of the water and the economic viability of the project.

This study seeks to go beyond the centralized and technological approach to saving the Dead Sea by approaching the problem from a more holistic and inclusive perspective. It seeks to find out from the public (residents of the Dead Sea basin) where they stand on the issues. What are their needs and priorities? What is important to them and what alternatives are they willing to support? The study also seeks to understand how one's social context influences one's perceptions and attitudes towards the declining water levels of the Dead Sea basin. In other words, how does a society's water culture shape how a society approaches an issue such as that of the disappearing Dead Sea. In responding to the crisis in the Dead Sea basin one needs to examine the historical context of how each riparian's water culture evolved and in what direction it is headed in the future. This socio-cultural approach is valuable to policy makers in providing clues on what types of interventions and programs may elicit society's acceptance or rejection.

Water Culture in the Dead Sea Basin

Water Culture in Israel

With at least 60% of water going to agriculture in Israel, its unique role in local Israeli culture and heritage must be understood and the practical manifestations integrated into an assessment of water culture in Israel. Agriculture has historically enjoyed a privileged place among Israeli decision-makers. Explanations for this were somewhat self-evident during the 1950s and 1960s when agriculture provided some 30% of the country's GNP and most of the top political leadership had either immediate or historical connections with agricultural communities (Hillel, 1994).

Zionism, the nationalistic ideology of the Jewish people always elevated agricultural pursuits, encouraging "pioneer" immigrants to establish new settlements. A variety of philosophers, most notably A.D. Gordon, espoused a Tolstoyic perception that only through work connected to the land and soil could personal redemption be achieved (Tal, 2002). Among agriculture's additional merits that were traditionally cited are: its contribution to "food security," as a means of self-sufficiency, its role in stymieing land claims by Arabs (in particular Bedouins), establishing territorial claims in the periphery of the country and in the past, socialising new immigrants and reducing unemployment.

This ideological and cultural bias provides some explanation for present water policies, which today are frequently inconsistent with economic and environmental considerations (Lipchin, 2003). To begin with, the economic contribution of agriculture to Israel's economic profile has fallen to 3% of GNP and 2% of overall employment. Crop subsidies nevertheless remain high for certain crops. Large-scale water diversions for agriculture have also left a hydrological legacy of dry streams and depleted aquifers (Lipchin, 2003 and Zaslavsky, 2002). None more so is the National Water Carrier that diverts water from the Sea of Galilee in the northern part of the Jordan river watershed to the south of the country for irrigation. This large scale diversion scheme plays an important role in reducing the flow of water in the lower Jordan and hence the amount of water that can reach the Dead Sea.

Part of the reason can of course be attributed to the political elites who continue to dominate governmental decision-makers. Senior politicians and government officials are disproportionately affiliated with the agricultural sector, affecting their decisions about water allocation, pricing and distribution. The political patronage of Israel's top leadership to agricultural interests continues and they remain protected in recent years regardless of party affiliation. For example, past Prime Minister Ehud Barak, a "leftist" politician, was raised on an agricultural kibbutz, while recent Prime Minister Ariel Sharon, head of a "right-wing" party makes his home on a ranch in the Negev. Recently, a plan by the Israel Treasury to raise water prices by 70% for the agricultural sector was tabled after intervention from the Minister of Agriculture.

While the general public is increasingly urban in its domicile (over 90% of the population in Israel live in moderate to large cities) Zionist's veneration of ruralist

living remains a critical factor in the water culture of the national psyche. This is true from an ideological perspective, with farming still considered among the more admirable (albeit barely profitable) professions. Youth movements, a critical socialisation factor for large segments of upper-middle class Israeli youth, still spend considerable time in summer work camps in agricultural communities.

Agriculture also holds a place in the national aesthetic psyche. A recent study by Fleisher et. al. (2001) from the Hebrew University in Jerusalem based on a "willingness to pay" survey suggests that the value for passive use (among tourists) for agricultural production in Israel's Jezreel valley and Israel's Huleh valley exceed the actual production amounts. This is not inconsistent with similar preferences in England, which has protected its bucolic countryside with legislation to subsidise rural landscapes. Quite simply, Israelis like farms, and farmers have convinced decision-makers (and to a certain extent the public at large) that the resulting prodigious water consumption is justified (Lipchin, 2003).

Hence, it can be argued that there are dominating "ideological and cultural" factors that explain the country's ongoing commitment to agriculture and that by association, water is just too valuable to flow freely in the country's rivers and streams. By this logic, the price now being paid by the Dead Sea is due to the veneration of water for agriculture among all other needs. Within this context however, the agricultural sector has increasingly come to understand that fresh water is a scarce resource that will be largely replaced by treated wastewater and desalination. At the same time, the growing of certain crops may become prohibitively expensive or impossible due to the salinity levels in effluents and available brackish waters (Schwartz, 2001). The transition to drip irrigation for many crops from the 1970s onward has allowed many Israelis farmers to maintain productivity even as actual allocations were cut periodically.

Reductions in allocations of water to agriculture were primarily enacted in the face of droughts but also reflected a growing domestic demand for water. The adaptability of Israel's agricultural sectors and the relatively consistent fluctuations in allocations over the past decade confirm that while agriculture's general support is fairly unquestioned, the actual quantity of water consumed is open to change and influence of additional factors. In fact, recent data show that water consumption in agriculture is declining.

	1983	**1993**	**2003**
Agriculture	71	64	56
Domestic	23	29	38
Industry	6	7	6
Total	100	100	100

Table 1: Potable water consumption by purpose in percentages (Source: Israel Central Bureau of Statistics, 2004)

Not only the actual magnitude but also the form of the agricultural community's water portfolio can be considered a dynamic factor. Past experience suggests that it is a nimble sector that has frequently changed its crop profiles in order to exploit market opportunities or to respond to the agronomic constraints posed by different water qualities. This same flexibility can be seen in its utilisation of wastewater, which as already mentioned provides it with a growing percentage of its hydrologic needs (Table 2). Cultural resistance to wastewater, that has been an obstacle to its utilisation in certain Arab societies, constitutes less of a barrier among Israeli communities. Although the use of wastewater for domestic purposes has been shown to be unpopular (Lipchin, 2003). The amount of fresh water (potable) being consumed by agriculture is declining somewhat, although the savings of fresh water in agriculture are being rapidly consumed by the growing domestic sector.

	1993	**2003**
Potable	71	56
Effluent	12	24
Brackish	6	11
Surface	11	9
Total	100	100

Table 2: Water production in agriculture by type in percentages (Source: Israel Central Bureau of Statistics, 2004)

From an empirical perspective, the primary factors that can be associated with any reduction in agricultural productivity, and hence water, involve land conversion. For many years, the powerful stature of agriculture in Israeli political culture was bolstered by the Planning and Building Law (1965) that gave agricultural zoning preference as a "default" to any land that was not designated otherwise. During the 1990s, a series of decisions changed that and led to a softening of zoning lines, which had previously locked farmers into agricultural usage. At the same time, economic conditions and high inflationary loans pushed many farmers to take advantage of the new "speculative" opportunities and sell out (Feitelson, 1997). This transformation can be seen in such regions as the Sharon and Galilee. It also changed the perception of farmers among environmentalists, who increasingly valued agriculture as a hedge against urban sprawl.

Israel's national water management system since its inception has been designed to subsidise agricultural production. Water prices constitute one of the clearest economic manifestations of the aforementioned ideological commitment to agriculture. Under Israel's Water Law (1959) farmers pay a low-base price for the first 50% of their water allotment. The price increases for the next 30% and 20% respectively. Water prices for water with high concentrations of salinity or effluents can be as much as 100% cheaper. This provides a disincentive to water conservation,

as low-grade saline water is cheap to use. Urban uses can be charged as much as eight times more. In recent budgets, the cost of water subsidies has been roughly 73 million dollars (U.S.). As one commentator explained, frequently, the most expensive water that is actually delivered will be priced at the lowest level (Plant, 2000).

In the past, drops in domestic water use came through moral suasion. When the Israeli public was convinced that the water shortage was acute and genuine, it responded by reducing their consumption. Lawns were dried up and even cemented over, shower times shortened, and water saving devices installed in bathrooms etc. The agricultural sector was also politically more willing to accept water allocation reductions. For example, when Israel's Supreme Court disqualified spartan water quotas issued by Water Commissioner Dan Zaslavksy in the early 1990s, left with little alternative he made a direct appeal to the public. Given the three successive years of drought that had depleted and overdrawn Israel's fresh water resources considerably he asked Israelis to cut back. The public responded positively. Subsequent to Zaslavksy's request, some 10% drop in overall use was recorded (Tal, 2002). Albeit, this drop was temporary, as the following above average rainfall years resulted in cut backs to be withdrawn.

In other areas, Israelis have shown a great willingness to pay for public natural resources when they felt they were threatened, their crushingly high tax burden not withstanding. For example, in the wake of arson in the Carmel forests, citizens made substantial donations to telethon campaigns designed to cover the replanting expenses (Shechter, 1996). Entrance fees to nature reserves and parks have not excessively deterred visitation rates. As the availability of desalinated water increases, Israelis will, for the first time be able to manifest their "willingness to pay for water," with a potentially unlimited supply of water, but for a price. Here, societal support for alternative users of water (nature, agriculture) can be expected.

Ironically higher rainfall may have an important role in influencing this particular factor. That is to say, when there is drought, the predictable efforts to galvanise the public to reduce water consumption have varying degrees of success, depending on the integrity of the appeal and the message. During wet periods, however, while there are basic infrastructure improvements (for example dissemination of two tank toilets, etc.) there is less of an actual appeal for restraint and conservation and the issue of demand management remains tucked far away from public consciousness. In other words, a crisis management response dominates the public's behaviour. The challenge is to convert this response to a sustainable one that pre-empts crisis rather than responding to it.

In sum, the water culture in Israel is driven by the hegemony of agriculture that is rooted in Zionist ideology. Demand management and conservation are retroactive and are short term responses to crises and not proactive and long term. Supply side management dominates with special attention being focused on technological panaceas to the water crisis such as the building of desalination plants on the Mediterranean coast and the proposed Red-Dead Conveyance project already discussed above.

Water Culture in Palestine and Jordan

There are several objective differences between the water resources in the Palestinian and Jordanian sectors and those in Israel. The most obvious one involves absolute quantities of available water. Israel currently has the upper hand in control of both surface and ground waters of the Jordan River watershed. At the same time, water delivery infrastructure in Jordan and Palestine is not as developed as it is in Israel. This means that water quality is not a high concern in Israel but it is for Jordan and Palestine. The discrepancy in both water quantity and quality is an important factor in the water culture of Jordan and Palestine. The consumption patterns of water by Palestinians is thus due in part to political constraints (Hosh, 1995). The most basic disparity between Israeli and Palestinian attitudes towards water can be traced to how much they receive, or "per capita" allocation rates. The average Israeli consumes roughly 350 cm/year while Palestinians roughly 100 cm/year.

Use	1995	1996	1997	1998
Domestic	44	45	48	44
Agrarian	56	55	52	56
Total	100	100	100	100

Table 3: Water consumption in Palestine in percentages (Source: Palestinian National Information Center)

Sector	1985	1989	1995	2005
Domestic	24	25	22	22
Agricultural	76	75	78	78
Total	100	100	100	100

Table 4: Water consumption in Jordan in percentages (Source: Shannag and Al-Adwan, 2000)

In absolute terms, agriculture is a far smaller consumer of water in both Jordan and Palestine than in Israel. The division between domestic/industrial and agricultural usage is roughly 89 MCM for agriculture with 57 MCM for the domestic sector, ironically making Palestinian agricultural a *relatively* greater consumer of water than the Israeli sector. Of course the water management profile of agriculture in the West Bank is completely different than in the Israeli sector. For example, irrigation techniques in the West Bank do not rely on capital intensive drip systems, although this depends on the region and crop. Indeed, traditional Palestinian reliance on rainfall and streams, and lack of an irrigation-based agricultural sector is considered by leading Palestinian experts to be an ecological advantage (Assaf, 1994).

Another difference is the relative contribution of surface water to overall resources. Roughly 70% of Jordanian waters (747 MCM) is surface waters with only 389 MCM coming from groundwater while there are some 527 known springs in the West Bank, providing roughly half of domestic consumption. As these springs historically were not regulated by the Israeli authorities, historic rights remained in force. Some 67% of these streams are utilised – roughly two-thirds by agriculture in the West Bank with the other third used for domestic purposes. Wastewater reuse in Jordan is still fairly minimal. As of 2000 wastewater generated only some 13 percent of the 521 MCM being utilised for irrigation in agriculture, largely for trees and fodder (Al-Shreideh, 2000).

The enormous magnitude of lost water to delivery systems has been documented in a number of contexts (Palestine Hydrology Group, 2000) with as much as 30% loss of local waters attributed to leaky pipes (Palestine Academic Society for Study of International Affairs, 2002). Jordan suffers from similar problems with frequent pipe bursts and seepages through ageing water systems considered a major source of water loss (Khatib, 1998). While theoretically, this problem falls in the technological rather than the social realm, clearly expanding water efficiency in the municipal sector through investment in infrastructure is driven by social/political considerations. For example, the hesitancy of Palestinians to rely on Israeli technology as this may indicate recognition of Israeli sovereignty of water resources in Palestinian territory.

In general, the relative scarcity of water (both in terms of quantity and quality) in Jordan and Palestine drives local perceptions and attitudes towards this resource. An additional factor driving attitudes is the traditional use of water in some villages in the West Bank and Jordan. Where local control of water still remains, water allocations for agriculture are socially determined. Unfortunately, these systems are under threat as centralised authorities such as the Palestinian Water Authority begin to assume control. Further, the dominant role of political instability and the recent Intifadah within the day-to-day reality of Palestinians has enormous manifestations within the social dynamics of this society regarding water. In fact, it is a key element in the water culture of Jordan and Palestine due to the hegemonic position of Israel.

While Israelis are vaguely aware of the geopolitical conflict in the area as a source of tension regarding water allocations, these issues are extremely high in the perceptions of Palestinian communities. The Oslo accords brought with them a spate of public works projects, largely American funded, with the goal of strengthening the water infrastructure of the West Bank.

The impact of the military activities of the Israel Defence Forces (IDF) on water infrastructure is frequently cited as exacerbating a situation that was already extremely deficient. The freezing of critical water infrastructure projects (e.g., the sewage treatment plant in Hebron or Sulfit) as a result of the present hostilities suggests that to a large extent there is justification for linking water policies with the broader context of Israeli-Palestinian relations. In a word, for the West Bank, the

present round of hostilities affects everything, with water management and perceptions of water issues being no exception.

During periods of curfew, water delivery becomes a critical issue for all Palestinian citizens, regardless of socio-economic class. Basic access to drinking water becomes the primary focus of households. Showers and personal hygiene are delayed so as not to waste valuable water. As bottled water is too expensive for most of the population, tap water (or delivery in trucks for the 200 villages that remain without running water) is the critical resource, and during summer months, supply is sometimes interrupted.

As such, Palestinians tend to blame Israel for water scarcity problems. A pervasive sense of injustice in the allocation of water resources is a common feature of almost all Palestinians' personal ideology, regardless of the individual's political or theological inclinations.

While the Jordanian population has less direct contact with Israelis and its water resources, for many years geo-political forces have only indirectly or "historically" affected them. Hence while their attitudes on the subject are less passionate, there are varying degrees of blame apportioned to Israel and their upstream neighbour, Syria for the shortages. Overall scarcity constitutes the basic common factor in Jordanian perceptions. There is of course, a solid objective basis for this. With water delivery in Amman only reaching homes once a week in many neighbourhoods, significant planning is necessary to meet basic domestic needs (laundry, hygiene, cooking, etc.).

Cisterns and storage of rainwater constitutes a basic element in many Palestinian and Jordanian homes. This direct involvement by citizens offers a constant reminder of perennial shortages. In other words, the citizens experience in generating their own water, makes them appreciate the resource and they are acutely conscious of its value as opposed to residents of Israel that are buffered from personally experiencing scarcity due to efficient water distribution infrastructure.

With scarcity dominating local perceptions, other uses of water are often perceived as frivolous or irrelevant. For example, should a conflict between nature and human needs arise, the acute shortage among Palestinian and Jordanian communities makes concern for natural values, such as that of the Dead Sea, considered to be a "luxury" with the expansion of supply for basic human needs considered to be the pre-eminent priority in discussions. A peace treaty that included a redistribution of water for the region that included allocations for nature (as well as generating expanded supply) may be able to change this perception by leveraging a parallel increase in water allocations to consumers in Jordan and Palestine.

Water prices are set at an artificially low level in Jordan and Palestine in order to ensure universal access, regardless of economic capabilities. Bottled water, although widely available in stores, is only utilised by a small percentage of the local population due to the high (relative to income) associated costs. Tap water is sufficiently expensive, and unavailable to justify a variety of "collection" activities by

local populations in both Jordan and Palestine, where individuals drive to springs or private treatment centres and fill up containers.

Farmers typically do not pay for water at all in either Jordan or Palestine. Stream-supplied irrigation is received free of charge, due to the persistence of historical rights. This suggests that any direct expenses assigned to them for water usage will have an immediate affect on their agronomic decisions.

Water conservation is a highly developed ethos in both Palestinian and Jordanian societies whereas it is lacking in Israel. Regulation of agricultural utilisation is often done by social pressures, with the wasting of water considered to be an inappropriate behaviour which brings with it social repercussions.

The government in Jordan has invested considerable energies in promoting conservation practices and the public has been largely responsive. Calls for installation of water saving devices in toilets, baths, showers and sinks have been effective.

Unlike Israel where there exists a certain level of animosity towards the agricultural sector for “wasting” limited water resources, Palestinian and Jordanian farmers do not appear to be the subject of resentment by their urban countrymen. The general public is aware of the poor quality of effluents, which are occasionally used by the agricultural sector, and tends to have an “inflated” view of its contribution to irrigation supply. As such, most city-dwellers have little desire to “compete” for these sources of water.

Moreover, there is no “perceived” agricultural lobby driving public policy in water in these sectors as it in Israel. In fact “agri-business” in Jordan is likely to exert considerable influence on the thinking of the Minister of Water and the Minister of Agriculture. The poorly organised subsistence farmers (fellahin) are less likely to wield direct influence in the corridors of power, but at the local level they can be a powerful force (Trottier, 1999). In either case, the political process in Palestine and Jordan does not lend itself to making water a “hot” political issue in the domestic context, if for no other reason, because of the issue’s public persona as one of many areas of conflict involving Israel.

There are great gaps in the availability and quality of water in both Jordanian and Palestinian societies. Palestinian communities without access to running water are typically more indigent and rural. More importantly, they are more vulnerable to contamination of springs, which provide a sole source of water for the at least 200,000 people in these villages. There are growing number of reports of utilisation of polluted streams by Palestinians, notwithstanding their classification as a resource unfit for consumption.

In Jordan it is more difficult to generalise regarding the rural sector. In the area of Ghor Safi on the southern shore of the Dead Sea, for example, where subsistence farming provides most of the livelihood, water quality is relatively poor. It has been suggested that there is an attempt to provide “reverse discrimination” to balance overall economic inequities. Hence, the poorer sections of East Amman are thought to receive water of better quality than the wealthier sections because they have the option of purchasing bottled water as an alternative.

Historically, personal gardens have never been an important factor in the household sector for most Palestinians and Jordanians. Although in West Amman there are irrigated lawns, these are limited to among a very select, affluent sector, and as the phenomenon remains marginal, their contribution to overall consumption is minimal.

Residents of the Dead Sea Basin

Israelis, Palestinians and Jordanians reside within the Dead Sea basin. The three publics differ culturally, economically and politically which in turn influences their water culture. The Israeli public has by far the lowest population density within the basin. The total population of residents is approximately 1,500 individuals. The majority of the residents reside in agricultural settlements (kibbutzim or moshavim in Hebrew). The region is divided into two regional authorities. The southern Tamar regional authority is located within Israel's pre-1967 borders whereas the northern Megillot regional authority is beyond the post-1967 borders. Any peace agreement with the Palestinians will most likely result in a shift in Israeli demographics in the basin. Date farming for export is the most profitable agricultural activity. Food crops, primarily vegetable crops, are also grown. The largest industrial activity, located at the southern basin, is the Dead Sea Works which extracts minerals from the Dead Sea and is the world's fourth largest producer and supplier of potash products. Tourism is also an important contributor to the local economy and is well developed with a string of high class hotels along the western shore of the southern basin. Most of the employees of the Dead Sea Works and of the hotels however, come from outside of the basin.

The Palestinian population in the study area resides in urban and rural communities as well as in refugee camps. The total Palestinian population in the study area as of 2002 was 512,238. Most of the communities are located in the western part of the Dead Sea basin, whereas the eastern part is sparsely populated. Economic activities are local scale agriculture including livestock farming (sheep and goats), stone quarrying and olive oil pressing. Manufacturing and service related industries are practiced in the urban centres.

On the Jordanian side of the Dead Sea population estimates are approximately 54,000 people. Rural farming is the dominant activity. Both fruits and vegetables are grown. According to land area cultivated: lemons, olives, tomatoes and beans are the dominant crops. The rural farming community is estimated at 53,000 people. The Arab Potash Company is located at the southern end of the Dead Sea and produces similar products to that of the Dead Sea Works in Israel. The company employs 300 people who live on the premises. There are also three hotels located on the northern basin on the Jordanian side of the Dead Sea.

Water consumption by sector varies for the three riparians. The dominant sector in Israel is the industrial sector, primarily that of the Dead Sea Works. In Palestine and Jordan agriculture is the dominant sector (Figure 4).

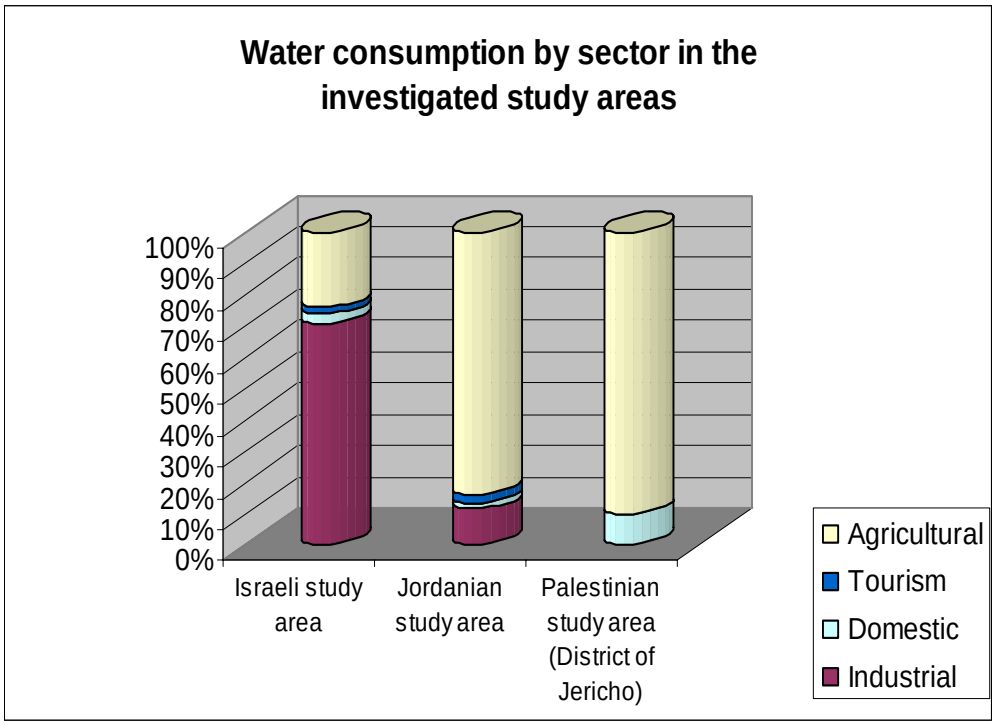

Figure 4: Water consumption by sector in the Dead Sea basin (Source: Elisha, R, 2006)

The variability in water use across sectors and countries of the basin poses a challenge for integrated water management. It is therefore essential that as a first step towards integration a stakeholder assessment is carried out.

Assessing Local Attitudes Towards Water Use in the Dead Sea Basin

The following is an exploration of water culture at a local level among the three nationalities of the Dead Sea basin with an attempt to compare the degree of conformity of local attitudes to national positions. This analysis is also of value to any decision support system for integrated water management in the region. The research was conducted using two instruments. The first was a survey questionnaire targeted at the residents of the Dead Sea basin in Israel, Palestine and Jordan. The second was a series of focus group meetings (FGMs) with a select group of stakeholders in the region.

The survey data are meant to assess the public's point of view on the decline of the Dead Sea. However, caution must be exercised in interpreting the survey data due to the fact that people may interpret the questions posed by the survey differently, many people may lack sufficient knowledge to answer a question correctly or truthfully and many biases that may influence how a person responds may be present and often unavoidable. This being said, surveys can provide some insight on where the public stands on an issue and what they may be willing to accept and/or reject. The data therefore are of use as they help frame the debate on an issue.

Focus groups are a powerful means to evaluate where a particular group stands on an issue. A series of meetings with a select group of stakeholders were held across the basin to provide a more in-depth look into the fate of the Dead Sea. The FGMs were held over a period of seven months. The FGMs were held respectively in Israel, Palestine and Jordan. The FGMs were facilitated by an expert facilitator and were conducted in the local language (Hebrew for Israel and Arabic for Palestine and Jordan).

A total of seven FGMs took place: two in the West Bank with representatives from the governmental, non-governmental and research/science sectors, and farmers, three in Jordan with participants from the private, research/science and governmental sectors, and two in Israel with representatives from the farming and kibbutzim communities, governmental representatives and NGOs. The Jordanian FGMs offer a more complete sample of the interests and opinions held by the various stakeholders involved as participants from all the sectors involved were present. The views expressed the attendees were summarized according to the following topics:

- Water Shortages – General Perceptions
- State of the Dead Sea
- The Role of Agriculture
- The Red Sea – Dead Sea Canal
- New Water Investment
- Cooperation

Survey Results

The survey instrument consisted of a combination of dichotomous choice and close-ended questions to address (a) water use and consumption habitats, (b) knowledge of water supply and demand infrastructure in the Dead Sea basin, (c) support for conservation practices and willingness to pay for such practices and, (d) the importance of international cooperation in future management of the Dead Sea.

The dichotomous choice section on water use and consumption habitats used a 5-point Likert scale (1 for strongly agree to 5 for strongly disagree with 3 being neutral). The other sections of the questionnaire used close-ended questions. Responses were coded for statistical analysis. The final section of the questionnaire gathered socioeconomic and sociodemographic information from the respondents. Pre-testing of the survey was conducted with an expert evaluator from Tel Aviv University. The questionnaire was translated into Hebrew and Arabic with slight variations in survey design according to cultural norms. A group of volunteers, residents of the basin, and supervised by the author, disseminated the questionnaires to the residents who were asked to fill out the questionnaire and return it the next day. A random representative sample of both urban and rural residents of the basin were selected (Table 5). Cross-cultural analyses were conducted among Israeli, Palestinian and Jordanian respondents.

Country	Population	Sample Size
Palestine	512,238	741
Israel	1,408	176
Jordan	53,300	623
Total	566,946	1,540

*Population sizes were independently selected by experts from the three countries

Table 5: Population Surveyed in the Dead Sea Basin*

A series of statements were posed to respondents on their water use habits, their attitudes to the shrinking Dead Sea and the importance for transboundary cooperation to save the Dead Sea.

According to the statement: Most families use more water than they need, most respondents from all three countries acknowledged they uses more water than was perhaps necessary. However, close to a third of Palestinians and Jordanians disagreed with this statement whereas less than a third of Israelis disagreed (Table 6).

Most families use more water than they need			
	IL	PA	JO
Agree	74	73.2	69
Neutral	12	3.6	3
Disagree	14	23.2	28
	100	100	100

Table 6: Most Families Use More Water Than They Need

A corollary to the above statement was what people thought about their availability of their local water supply. For all three countries people were relatively evenly split between confidence in local water supply meeting current needs versus mistrust in local supplies meeting the communities' needs (Table 7).

There is enough water to meet your community's needs			
	IL	PA	JO
Agree	49	36.6	34
Neutral	13	15.8	13
Disagree	38	47.6	52
	100	100	100

Table 7: There is Enough Water to Meet Your Community's Needs

In terms of being able to reduce the amount of water people use, over 50% of respondents from all three countries admitted that this would be difficult to do. Approximately 30% of the respondents said that their household water use could be reduced (Table 8).

It would be difficult to reduce the amount of water used in your household			
	IL	**PA**	**JO**
Agree	54	56.8	55
Neutral	13	9.5	10
Disagree	33	33.7	35
	100	100	100

Table 8: It Would be Difficult to Reduce the Amount of Water Used in Your Household

The above statements reflect that although there are differences in national water cultures, at the local level in terms of household water use, these differences are less apparent.

The following statements attempted to reflect the resident's perception on the state of the Dead Sea.

Declining water levels are a cause for concern			
	IL	**PA**	**JO**
Agree	93	85.1	83
Neutral	6.1	6.2	6.6
Disagree	1.2	8.7	11
	100	100	100

Table 9: Declining water levels are a cause for concern

According to Table 9 the vast majority of residents across the basin all agree that the declining water levels of the Dead Sea are a cause for concern. Going deeper, how do people think about available water supplies in the region to meet demand both now and in the future for agriculture, industry and domestic needs?

There is enough water in the Dead Sea region to support agriculture now and in the future			
	IL	**PA**	**JO**
Agree	23	32.3	44
Neutral	25	30.9	21
Disagree	52	36.8	34
	100	100	100

Table 10: There is enough water in the Dead Sea region to support agriculture now and in the future

According to Table 10, approximately 50% of Israelis believe that there is not enough water to meet the needs for agriculture whereas Palestinians and Jordanians mostly either agreed or disagreed with this statement. Tentative conclusions to be drawn are that Israelis are more aware of the status of water availability in the region but also that their water consumption for agriculture is greater than in either Palestine or Jordan.

In terms of water needs for industry, all residents mostly agree that water supply will continue to meet water demand (Table 11). This result may reflect the economic importance attributed to the industrial sector in the basin, at least for Israel and Jordan. The importance of the mineral extraction industries in the basin cannot be underestimated both in terms of their economical importance to the countries but also in their impact on the Dead Sea. The evaporation ponds managed by the industries contributes to an increase in the evaporation rate of the Dead Sea, exacerbating the water level decline of the sea. It will be imperative for any integrated management plan to include directly the industrial stakeholder community in the future management of the basin.

There is enough water in the Dead Sea region to support industry now and in the future			
	IL	**PA**	**JO**
Agree	52	58.9	79
Neutral	19	23.3	8.9
Disagree	29	17.8	12
	100	100	100

Table 11: There is enough water in the Dead Sea region to support industry now and in the future

In terms of the domestic sector, some differences come to light. Israelis are slightly optimistic that municipal water needs will meet demand whereas Jordanians are not as sanguine (Table 12). Interestingly enough, it is the Palestinians, who face

water scarcity directly, to be the most optimistic. This may reflect the low population density of Palestinians living near to the Dead Sea or in the fact that their domestic water is low with little capacity for it to increase in the near future.

There is enough water in the Dead Sea region to support your community now and in the future			
	IL	**PA**	**JO**
Agree	48	56.5	35
Neutral	15	9.4	13
Disagree	38	34.1	52
	100	100	100

Table 12: There is enough water in the Dead Sea region to support your community now and in the future

A vital water resource in the basin is groundwater. Most local water sources come either directly from groundwater or from where groundwater comes to the surface as springs. Agricultural use in the Palestinian sector is heavily dependent on groundwater use and the Dead Sea Works in Israel gets most of its freshwater, which is used for cooling purposes in its industrial processes, from groundwater. Water for agriculture in Israel and Jordan on the other hand comes mostly from outside the basin in terms of surface water diversions that brings water to the farmers from either outside or from the northern portion of the watershed. People's perceptions of groundwater is therefore crucial for integrated management. It seems that only Israelis favor a "keep pumping" option on groundwater use whereas many Palestinians and a majority of Jordanians favor a "reduce pumping" option (Table 13).

This result may indicate the proximity the Palestinian and Jordanian populations have on the dependence of groundwater and that many groundwater wells are locally managed and knowledge of water levels is therefore necessary. In Israel, on the other hand, groundwater pumping is centrally managed by a far off ministry and the local population has little or no input. Their awareness therefore of the important linkage of groundwater to the health of the Dead Sea may be minimal as well as to ground water levels in general.

Opinions on groundwater pumping			
	IL	**PA**	**JO**
Keep pumping	54	44.6	36
Reduce pumping	46	55.5	64
	100	100	100

Table 13: Opinions on groundwater pumping (Data are percentages)

Any integrated management plan for the Dead Sea basin will require by default some form of cooperation by the riparians. It is therefore important to assess the willingness of the population to work together in achieving this aim. The following data sought to address the level to which the population of the basin is willing to work together. In the data presented in table 14, respondents were asked to consider who they felt to be the most responsible for the Dead Sea's decline. They were offered the following categories:
Palestine, Jordan, Israel, All of the countries, None of the countries, Don't Know.

A large percentage of all respondents said that Israel was to blame (26% of Israelis, 42% Palestinian and 23% Jordanians). However, many also said that all the countries were to blame (41% Israelis, 37% Palestinians, 36% Jordanians). It is not surprising that many feel that Israel is to blame as it is the hegemonic water user in the basin. Nevertheless it is also encouraging that many consider all of the countries equally responsible. This is an optimistic assessment on which an integrated management plan could be built.

In your opinion, the entity most responsible for the Dead Sea's decline is…			
	IL	**PA**	**JO**
PA	1.8	3.6	3.1
JO	6.7	0.7	18
IL	26	41.6	23
All	41	36.5	36
None	6.7	3.7	5.8
Don't know	18	13.9	14
	100	100	100

TABLE 14 In your opinion, the entity most responsible for the Dead Sea's decline is…

Finally, we asked the respondents their viewpoint on cooperation in the basin (Table 15). The overwhelming response was yes; cooperation with the neighbours is favored in helping to address the decline of the Dead Sea. With such data in hand, one may now begin to move forward on exactly how such cooperation will come about as the data lead toward some kind of a mandate by the public for cooperation.

It is important to cooperate with your neighbors in managing the Dead Sea			
	IL	**PA**	**JO**
Agree	95	79.8	72
Neutral	3.7	10.4	11
Disagree	1.2	9.8	18
	100	100	100

Table 15: It is important to cooperate with your neighbors in managing the Dead Sea

Focus Group Meeting Results

Water Shortages

All of the participants from all of the FGMs agreed that there is a water shortage in the area both in terms of quality and quantity. However, the understanding about the reasons and implications of this water shortage varied. For instance, the private farmers in Jordan whose water is supplied regularly by the Jordan Valley Authority believe that the shortages they experience are not critical and are due mainly to the lack of maintenance or technology. Conversely, their scientific and governmental counterparts are aware that the region is in fact water scarce along with understanding the reasons for this both in terms of water diversion projects in the upper Jordan watershed and regional climatological and meteorological conditions.

The participants from Palestine believe that they experience water shortages due to both their location within the Eastern Mediterranean region and the current geopolitical situation. Additionally, they believe that the lack of integrated trans-boundary water management has added to the uneven allocation of resources.

The Israeli residents from the Dead Sea Basin also see the water shortage problem as one of allocation as there is competition for resources mainly between industry and agriculture.

The State of the Dead Sea

All the participants believe that without intervention the future of the Dead Sea is precarious. The disappearance of the Dead Sea will damage the region not only economically but psychologically as well in terms of the loss of a unique ecosystem. Thus all participants agreed that any solution to the decline in the Dead Sea must be on a national (respectively) level with a balance met between industrial, agricultural and private needs, with the Jordanian scientific representatives noting that the solution must be holistic as the issue has an impact at both the regional and national levels.

The Palestinian representatives believe that the decline of the Dead Sea Basin is mainly due to the unilateral management of the Jordan River by Jordan and Israel.

While the participants from the scientific community in Jordan assert that it is also due to decreased precipitation and the diversion of surface water bodies in the upper part of the watershed.

The farming representatives from both Jordan and Israel mentioned the diversion of water resources to serve the industries (chemical, tourism) within the area playing a major role in the sea's decline. Moreover the Jordanian farmers felt that while there are some negative impacts such as lack of humidity and the appearance of sinkholes, they also believe that there are potential benefits in the way of increased land for agriculture.

The Role of Agriculture

With regard to the role of agriculture in the decline of the Dead Sea and the future of agriculture in the area, there were differing opinions and beliefs. Most participants agreed that current practices are not the most water efficient and changes need to happen both in terms of crops being grown (Jordan no longer grants licences to high water consumption crops like bananas) and technology being used.

Though drip irrigation is already currently used, there is a need for more education about additional water resource alternatives. For instance the Jordanian farmers were not aware of the possibility of using treated wastewater to irrigate their crops. After a brief description was given of this technology, they were mostly opposed as they felt it would harm their crops marketability. It is clear that there is a need for more information and education about alternatives to be disseminated from the "experts" (i.e. policy-makers and scientists) to the practitioner in order to implement lasting change.

Current agriculture depends on European markets where prices change rapidly, thus making it difficult for farmers to make long term plans. This economic instability also creates uncertainty about the future of agriculture on a local level, as the younger generations do not necessarily have the desire/ability to carry on the family business. There is the additional belief of the farmers, both from Jordan and Israel, that agriculture will become more industrialized in the future with the number of farmers decreasing as the size of farms grow.

Most participants were of the opinion that investment in new technologies (desalination, treated waste water) as well as new industry (biotechnology, gypsum, tourism) would serve this region both in terms of water conservation and as way to increase the economic viability of the communities living within the region.

Red Sea-Dead Sea Canal

At this point it is not clear whether this project is a reality due to the high cost and potential environmental impact of such a project. If the canal is built the role that it will play in the region will depend on the particular point of view of each stakeholder.

The impact on the various stakeholders is not yet clear, and will be clarified with the aid of the feasibility studies to be carried out soon by the World Bank. However, the World Bank's studies will not include social and environmental impacts so the comprehensiveness of such studies is in some doubt.

The farmers in Jordan were interested in the project but expressed concern about their land being damaged. The Palestinians on the other hand have rejected the project in spite of their attempts to support the Jordanians without affecting their water rights and the final status negotiations with the Israelis. Their rejection was a response to the Israeli position towards considering the Palestinians as beneficiary partners in the project and not as full partners. The participants believe that the project will not be implemented without the acceptance of the three parties as required by the World Bank.

New Water Investment

Aside from the proposed Red Sea-Dead Sea Canal, desalination, dams, artificial recharge of the aquifers, micro scale water management, improvements in irrigation technologies and the reuse of treated wastewater were mentioned as areas for further development. However it was also noted that it is imperative to invest in education: not only to educate the public, and future generations, about water shortages but also to raise awareness about implications of not conserving this resource and to provide effective methods for conservation.

The case of treated waste water serves to highlight the disparity in knowledge and awareness between the public and the scientific community: the scientists and environmentalists are all in agreement that the reuse of treated waste water should become standard procedure in agriculture whereas the local farmers were less sure of the concept, especially in Jordan. The perceived stigma of irrigating crops with treated waste water is a concern among farmers who consider the practice to adversely effect the acceptance and price of their crops in overseas markets. Social understanding of the farmer's point of view needs to go hand in hand with investment to spread awareness about potential new water sources and to allay any concerns or questions the farmers and public may have.

Cooperation

While the future of the Dead Sea Basin is unclear, it is clear from the responses of the stakeholders that any resulting cooperation that will occur between the three nations involved must be of obvious benefit to all those involved.

The benefits, for example, to Palestinians and Jordanians of working with Israel, a country with high water productivity and water saving in agriculture, could lead to exchange in the technologies and the know-how of efficient agriculture. This could come as a benefit to the whole water thirsty region. The Israeli farmers, for their part, would need assurance that a genuine division of the resources between the states

is not a threat to the Jewish settlements in the area, as is their concern about finding a solution with Palestine.

It is the belief/hope of the Israeli and Jordanian environmentalists and policy makers, at least, that the cooperation would result in a more stable region, bringing in more settlement, investment to the area and helping the economies of the region.

Discussion

People think differently about water. Differences and similarities can be found among Israelis, Palestinians and Jordanians. The data also reveal a complex picture where in some cases there is agreement on issues while on other topics there is disagreement.

The results from both the survey and the focus groups are meaningful. Besides providing insight into the water culture of the three countries, they offer insight into what kinds of policies may be acceptable for the management of the Dead Sea. For example, education programs and conservation campaigns that consider the viewpoint of the public and the various stakeholders may prove to be more successful than those that do not consider these views.

In many cases the data reveal more questions than answers, specifically from the survey data. But perhaps what the data do offer is what questions need to be asked next and in what direction one should be headed in formulating an integrated management plan for the Dead Sea. Teasing apart the reasons behind the responses presented in this paper will require more in-depth anthropological and sociological study. What has simply been revealed here is the complexity inherent in a society where one's social context is an important predictor or "shaper" of one's perceptions and attitudes about water. What one can say is that society, any society, should not be seen as a homogenous unit, as was once considered by early anthropologists, but that there are important individual differences within a society. This is especially germane for a transboundary water resource such as the Dead Sea basin. I suggest therefore that policy makers take a closer look at the heterogeneity in society and the ways in which this heterogeneity shapes perceptions and attitudes.

Institutional, social, gender and economic issues related to water management options for the Dead Sea basin are thus far more complex than what is currently envisioned by engineers and policy makers. These issues need to be addressed adequately to achieve equitable and sustainable water management. As we tease apart the many layers by which people in any society act and interact, we need a greater degree of precision on how people think about an issue.

In the case of the Middle East in general and the Dead Sea basin in particular, the centralization of the water management system provides policy makers with a clouded lens on how people respond to current policies of water management. This lens hampers consideration of new policy structures, including more "disaggregated" (often more local) policies that may be highly effective. This study provides a starting point for such disaggregation by considering the water culture of communities as the foundation upon which to build sustainable water policies—rather than as passive end points of a centrally determined system.

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