Restoring the Garden of Eden: Negative Impacts

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Abstract:

Widely known as the "Garden of Eden", the extensive Mesopotamian Marshes in Iraq once teemed with life. The marshes were the source of the Shatt Al Arab River and provided fresh water and aquatic resources to many communities downstream. Almost half a century of poor management and intentional drainage by military campaigns, government diversion and irrigation usage have resulted in a substantial deterioration of water quality and subsequent loss of wildlife and habitat. With good intentions, inundation efforts were implemented and additional measures are planned by the Iraqi government to regulate water flow; however decisions have not been based on sufficient scientific data and the complex marshland interactions have not been fully understood. A common misconception is that salinity increases have resulted from Arabian Gulf salt intrusions. Field studies conducted through the Marine Science Centre at the University of Basrah (Iraq) investigated various environmental parameters pertaining to hydrology, water quality, ecology and sedimentology between 2004 and 2013 within the Shatt Al-Arab. The data highlights the integral role of the marshes in maintaining water quality in the Shatt Al-Arab and that the marshes are the main source of salt upstream of the Shatt Al-Arab.

Key words:

Mesopotamian marshlands, restoration impact, Shatt Al-Arab River, salinization, re-flooding

Introduction

Historically, the Mesopotamian marshlands are the most extensive wetlands in Iraq and one of the most important aquatic systems in the Middle East (Kubba, 2011) These marshes previously sustained several important habitats that provided resources for local communities and maintained significant populations of wildlife including endemic and endangered aquatic and semi-aquatic species (Scott, 1995). Unfortunate practices over many years, including intentional drainage and misguided diversions of waterways resulted in a substantial loss of marshland and extensive desiccation. Decades later, potential inundation of the dried marshlands brought hope for restoring the valuable and unique "Garden of Eden". Although parts of these marshes were successfully

inundated (Douabul, et al., 2012; Al Maarofi et al., 2013), the chaotic re-flooding processes still threaten the entire marsh system (Richardson et al., 2005; AlMaarofi et al., 2012).

Salinization of the marshes and downstream in the Shatt Al-Arab is now evident mainly due to thoughtless desiccation methods (i.e., as a result of economic sanctions and military activities; AlMaarofi et al., 2012). The Mesopotamian marshlands also suffered as a result of other anthropogenic activities including a reduction in water supply due to dam construction which disrupted the annual hydrological cycle and deteriorated water quality (Partow, 2001; IMET, 2006). These impacts affected the function of the marshes and changed their role from being a sink for salts and pollutants to becoming a source (Mahamed, 2008; Douabul et al., 2012; Al Maarofi et al., 2013). Unintentionally disorganized and unsystematic efforts have been undertaken to understand and investigate the restoration potential of the Mesopotamian marshlands, however, the ecological and hydrological limitations need to be considered more carefully (Richardson et al., 2005).

Field studies conducted through the Marine Science Centre at the University of Basrah (Iraq) investigated various environmental parameters pertaining to hydrology, water quality, ecology and sedimentology between 2004 and 2013 within the Shatt Al-Arab. These data identify critical interactions within the marshes and the Shatt Al-Arab.

The Mesopotamian marshlands discharge water to the Shatt Al-Arab River, which is the sole fresh water supply to the City of Basra. The Shatt Al- Arab River extends southeast approximately 200 km from the confluence of the Tigris and Euphrates rivers at the City of Al-Qurna, through the City of Basra and continues along the Iranian-Iraqi border before draining into the Arabian Gulf. Although, the Shatt Al-Arab is an estuary, the salt wedge prior to 1980 extended less than 30 km upstream (Rzoska, 1980). Before draining the marshlands (1993-200), the Shatt Al-Arab River at the City of Al-Qurna received more than 500 m3/sec of fresh water with a concentration of less than 0.5 g/L dissolved salt (Rzoska, 1980). In 1996 fresh water discharges into the Shatt Al-Arab River were dramatically reduced to less than 100 m3/sec with dissolved salt concentrations exceeding 1.5g/L (Al-Yamani et al., 2006). Currently, the Shatt Al-Arab River receives less than 50 m3/sec with an average dissolved salt concentration of more than 2 g/L (Isaev & Mikhailova, 2009). Figure 2 illustrates the situation in the Hammer and Central Marshes. The increasing salt concentration and decreasing water volume has adversely impacted the local population and their livelihoods, regional agriculture and industries and has destroyed habitat for flora and fauna (Nielsen et al., 2003).

Figure 1: Iraq Map indicating Mesopotamian marshlands (HZ= Al-Hawizeh, CM= Central, HM= Al-Hammar), Marshlands outlets into Shatt Al-Arab, Al-Hartha, Shatt Al-Arab upstream and downstream and the Arabian Gulf; (source: Data SIO, NOAA, U.S. Navy, NGA, GEBCO 2013Google Image Landsat U.S. Department of State Geographer)

Believing that the main source of elevated salt concentrations in the Shatt Al-Arab River was a result of salt water intrusion from the Arabian Gulf (Al Maarofi et al., 2012), the Iraqi government is considering constructing a regulator (dam) within the river. However, based on several extensive surveys and monthly monitoring programs between 2004 and 2012, the main source of salinity within the north section of the Shatt Al-Arab River is actually the re-flooded marshes (Al Maarofi et al., 2012). Mapping of the Shatt Al-Arab River salt content (Figure 3) clearly shows maximum salt concentrations at Hartha village during August and November 2008. This is further supported by the salt budget of the marshes for May 2006 to March 2007 illustrated (Figure 4). Although the salt budget of Mesopotamian Marshes is for the year 2006-2007, the salinization problem has been magnified. Thus, salinity of > 12 g/l was recorded at the exit of the marshes during 2012-2013.

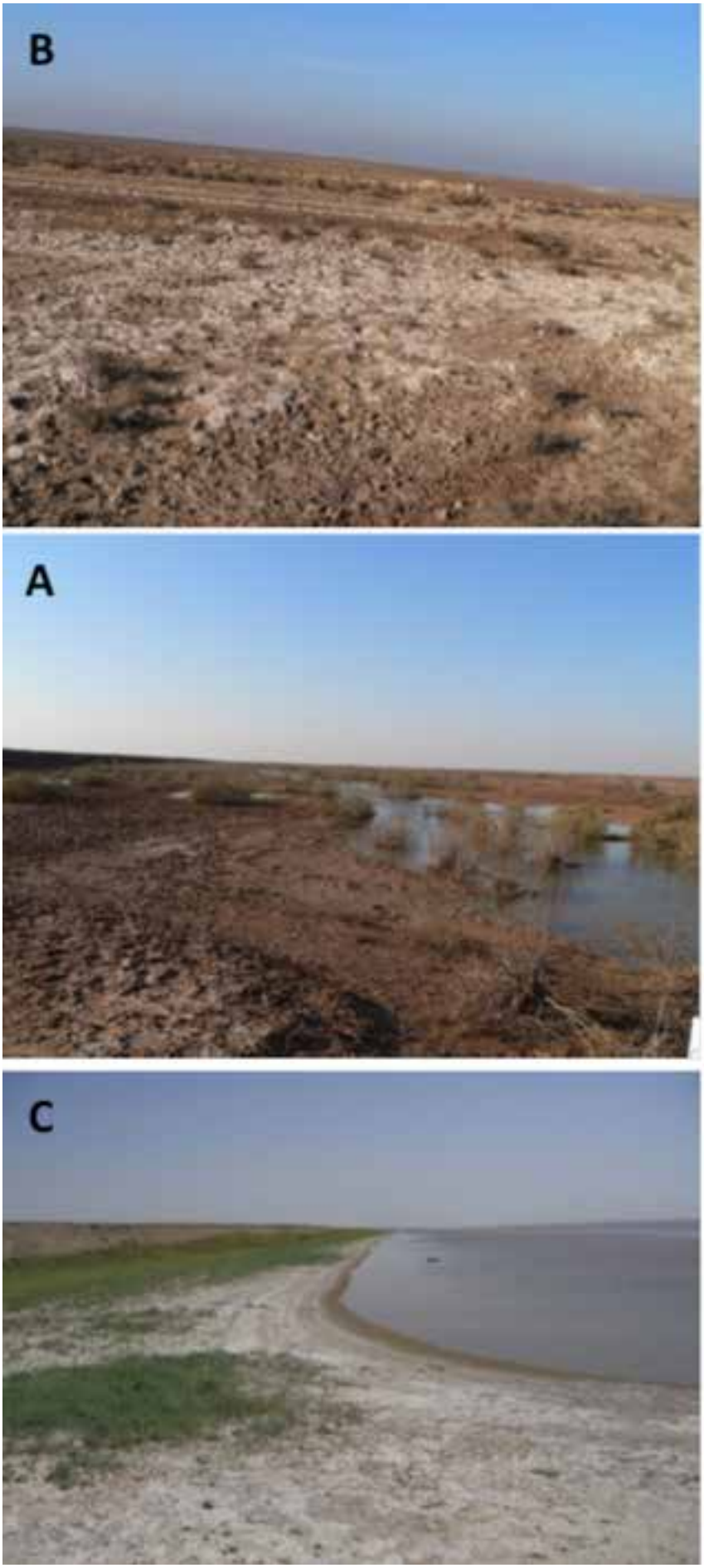

Figure 2: Salt accumulations on dried marshes sediment; (A) Saroot marsh 32”20’52°N 46 47 56° E in Hammar marshes, January 2007, (B) Al-Seiniya marsh 31”55’10°N 46”45’50°E and (C) Al-Rayan marsh 31”34’42°N 47”2’0°E in the Central marshes, January 2007.

These data indicate that the historical role of the Mesopotamian Marshes in regulating the concentration of salts become limited. Consequently, the impacts on the marshes have caused them to be a source of dissolved salts in the surface waters, especially Shatt Al-Arab River. We suggest that the main source of salt upstream of the Shatt Al-Arab is the drained marshes. Based on the findings of this study, we recommend that future decisions taken by the Iraqi government regarding the Shatt Al-Arab waterway should consider all factors related to the provenance of increasing dissolved salt concentrations.

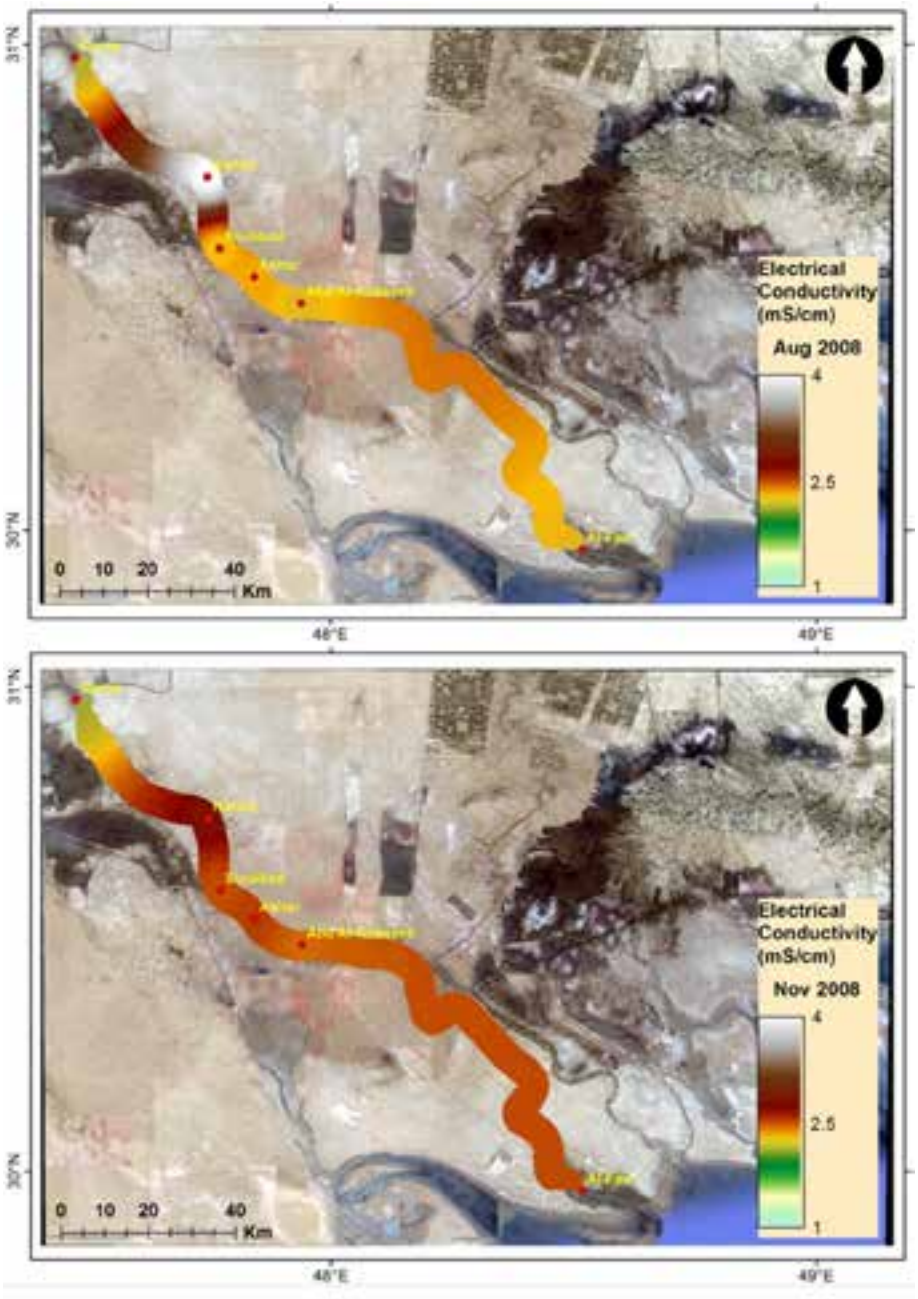

Figure 3: Shatt Al-Arab electrical conductivity concentration mapping. Maps were generated using Arc-GIS 10 software.

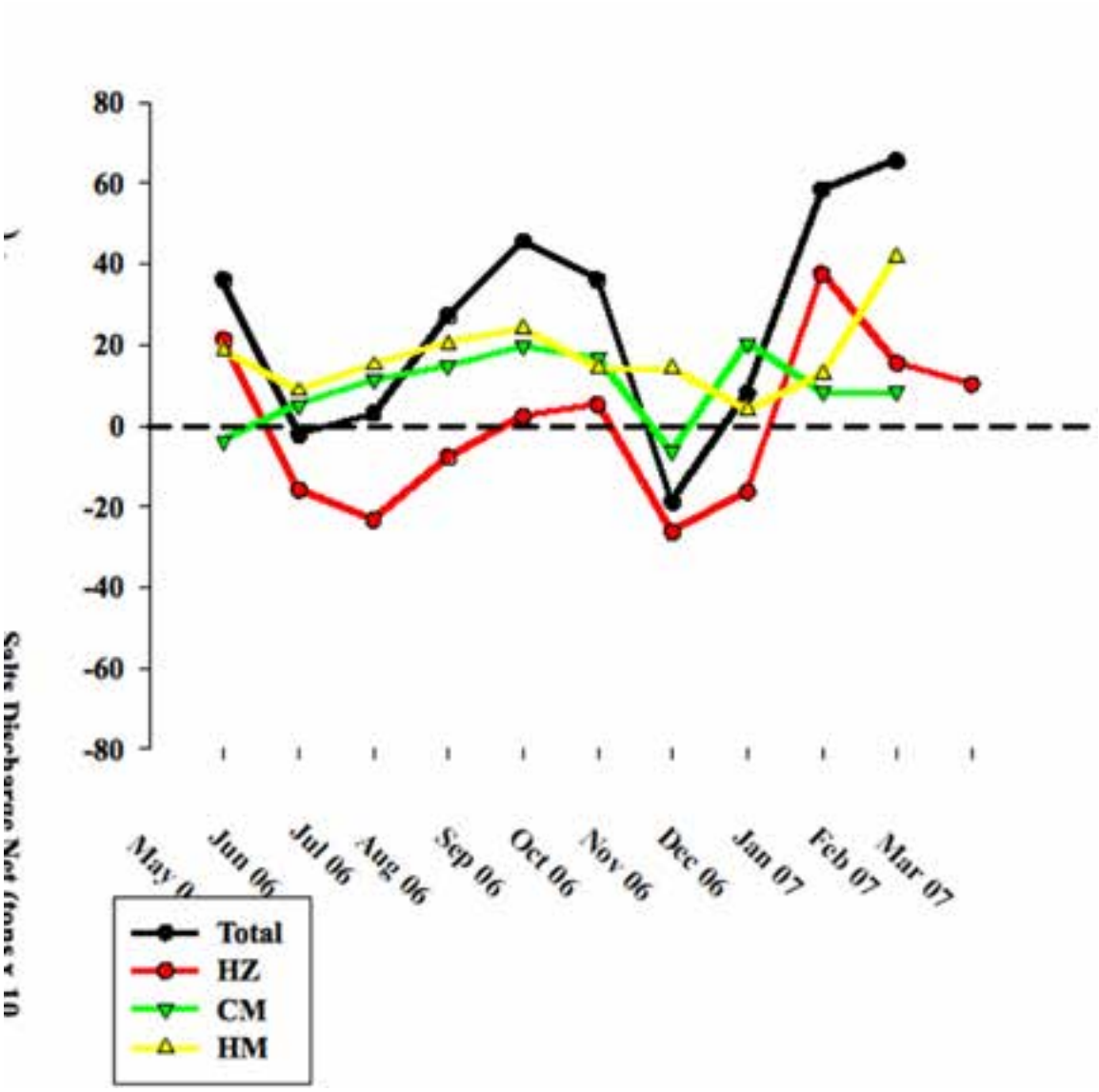

Figure 4: Mesopotamian Marshes salt budget (HZ= Hawizeh marsh, CM= Central marshes and HM= Hammar marsh, see Fig. 1 for locations).

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