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The Disappearance of Salt Lakes:
Two Case Studies, Two Possible Futures

Boats in the Aral Sea (http://www.harleytourism.com/aral_sea.shtml)

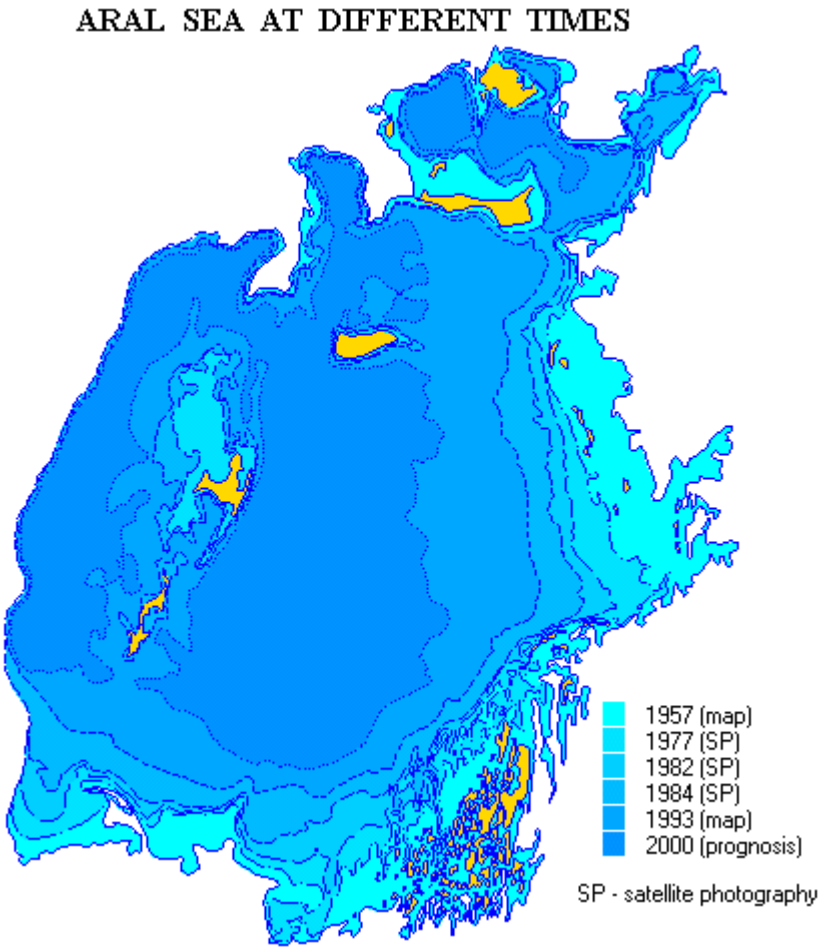
Water is one of the most precious resources on the planet. While it doesn't take long without it for us humans to remember how important water is to us, and how we cannot survive without it for more than a few days, we can often forget or overlook how intricate a part it plays in the survival of the rest of earth's inhabitants. Often through history, it seems to me that humans will pollute and disrupt water systems as much as they can or need to until it affects them directly. Most people you ask will probably be aware that there is a water crisis facing much of the world, or at least how important access to drinkable water is and that many countries in desert climates have very serious problems with it. However, many less are aware of the crisis that we are and will continue to be facing in relation to our salt lakes, or the reasons and possibilities for saving them.

While salt lakes are not as obviously or directly important to us humans as potable water sources, they hold a very key place in the world's ecosystems, and in our lives.

Due to various human factors including water pollution and diversion, many salt lakes across the globe are dropping and disappearing, leaving in their wake a slew of problems which humans must deal with. Sometimes, to put it lightly, these problems are dealt with better than others. Mono Lake in California is one place where enough people spent enough time and energy to stop and begin to reverse the lake's disappearance, evading what could have been a very serious disruption to the food chain and environment. Water was being carelessly diverted from Mono's tributaries for use in the city of Los Angeles and it took a monumental legal case brought about by a collection of concerned individuals to force the city to make certain changes that would be required to bring the lake back up to a certain level and to the restore the damaged environment. On the other hand, the Aral Sea, which lies in between Uzbekistan and Kazakhstan in central Asia, has been nearly eliminated due to diversion for agriculture creating what has been called "one of the greatest environmental catastrophes ever recorded" (http://www.american.edu/ted/ARAL.HTM). The consequences of this have included the complete shutting down of a large fishing industry, change in the regional climate, and huge dust storms carrying dangerous chemicals that created many health problems (american.edu/ted/ARAL.HTM). To illustrate their importance, this papers sets out to illustrate examples of what happens when our salt lakes are saved or destroyed.

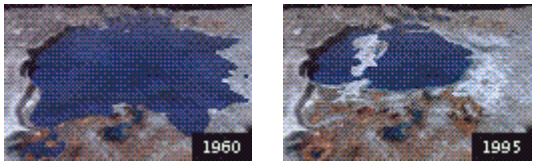
Because of its islands, previously numbering 1,100, the lake got its name "Aral" meaning "island" in Kazakh (http://www.livinglakes.org/month/2-aralsea.htm). The Aral has two major tributaries: the Amu Darya, coming into it from the South and the Syr Darya, which flows in from the North (american.edu/ted/ARAL.HTM). Through most of its history, the lake rose and dropped relative to the melting and reformation of glaciers,

and would be rising today, as the nearby Caspian Sea is doing if it were not for the unsustainable methods of humans.



(http://www.grida.no/aral/aralsea/english/arsea/arsea.htm)

State of Aral Sea in 1969 and 1995

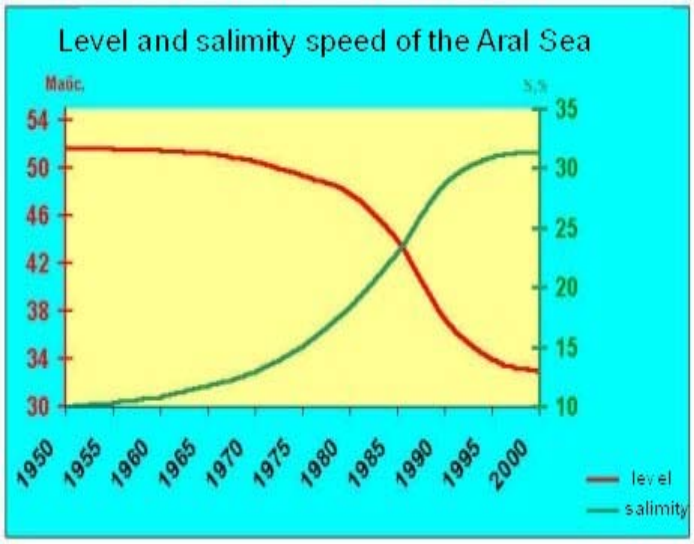


(www.dfd.dlr.de/app/land/aralsee/)

Central Asian civilization, one of oldest in the world, has always centered around its water resources. In fact, irrigation started to be used in the region around the 6th or 7th century BC (http://www.grida.no/aral/aralsea/english/arsea/arsea.htm). Agriculture was practiced at a sustainable level until the twentieth century, when the Soviets began

industrializing cotton in the 1940s. New canals opened up diverting large amounts of water away from the Aral's two main rivers, and millions of hectares of desert came under irrigation (american.edu/ted/ARAL.HTM). In 1965, the lake had lost over 75% of its volume (http://www.livinglakes.org/month/2-aralsea.htm) yet it was still receiving fifty cubic kilometers of water per year. By the early 80s, this had dropped to zero (american.edu/ted/ARAL.HTM).

Until 1960, the Aral Sea was the fourth largest lake in the world, it is now the world's eighth largest (uky.edu/ArtsSciences/Geology/rimmer/110/AralSea.pdf). As the lake dropped, its salinity increased ten fold to the point where the lake could no longer support its previously rich fish population. In the 1980s the commercial fishery had been eliminated, totally closing an industry that had employed 60,000. The increase in salinity drove some of the lake's 24 species of fish to extinction while others can be found elsewhere. Wetlands and oases around the lake disappeared with the receding lake and falling water table. Many of the area's mammals and 173 species of birds were driven away due to habitat loss (american.edu/ted/ARAL.HTM).



Salinization increased from 10 g/l to 40-50 g/l because of lack of fresh water inflow.(http://www.grida.no/aral/aralsea/english/arsea/arsea.htm)

The implications of this for the health of human life have been very serious. The Aral Sea disaster has "caused a decline in the productive capacity and social conditions of the 5 million people living in the region of the Sea due to the degradation of the quality of their drinking water and health, the salination of agricultural lands, a reduction in biodiversity, pollution due to the run-off of pesticides, fertilizers, etc and local climatic changes" (http://www.environmonument.com/Aralsea.htm). An increasingly continental climate change was problematic because it shortened the growing season, which forced some farmers to replace cotton with rice, which required even more water. The blowing of this toxic salt and dust is leaving nearby land uncultivable.

"The exposed area of former seabed was now over 28,000 square kilometers, from which winds picked up and estimated 43 million tons of sediments laced with salts and pesticides," creating terrible health consequences including respiratory and eye illnesses and throat cancers, for people all the way from the Aral basin to the Artic and to Pakistan. (american.edu/ted/ARAL.HTM). Tuberculosis and anemia are now quite common in the region as are birth defects and high infant mortality (livinglakes.org/month/2-aralsea.htm). The worsening situation has also been linked to rises in leukemia and liver and kidney diseases (american.edu/ted/ARAL.HTM).

The five Central Asian countries that share the Aral region have made agreements concerning solutions to the situation. A document in 1992 demanded water to be brought the sea and its deltas. In 1993, the countries formed The International Aral Sea Rehabilitation Fund which set out the following objectives: "stabilization and improvement of management of the Aral Sea Basin's environment; rehabilitation of

disaster zones surrounding the Aral Sea; improvement of management of scarce water resources in the region; capacity building of local and state institutions on planning and implementation of regional programs" (livinglakes.org/month/2-aralsea.htm). The next year, the countries pledged to donate one percent of their gross national product to the fund, and agreed to cut down on irrigation water. However, getting the resources for completing these objectives has been quite difficult, and no money was reported to have reached the fund by late 1994 (american.edu/ted/ARAL.HTM). This is understandable as the Central Asian countries are the poorest of those in the former Soviet Union. In 1991, the GNP per person ranged from $2,030 in Kazakhstan to $980 in Uzbekistan.

The most likely path to stabilization would be through improving the area's irrigation infrastructure, which is currently what was developed in the Soviet era and is very uneconomical and ineffective. "Israeli engineers experimenting on an Uzbek cotton farm [in the mid 90s] claimed they had increased yield by forty percent while reducing water consumption by two-thirds." Such improvements would surely lead to huge improvements in the future life of the lake, the surrounding environment and thus it's people. Since these countries have barely any money to spend on improving irrigation, I believe that it will take an international fund to make any serious attempt to save and/or restore the area.

Another complication is that while humans have suffered severe health effects as a result of the lake's diversion, there have also been many positive economic benefits as well, creating a very difficult situation to resolve. So much has been put into the region's agriculture industry that it is practically impossible to return the lake to its original level, making "it is necessary to explore solutions to problems affecting the people of the region

that would allow the Aral Sea to at least stabilize" (environmonument.com/Aralsea.htm). The people at LivingLakes.org put it simply that while any real solution to the problem would be difficult and expensive, "in the long run moving toward sustainability will be the least costly," which I certainly believe to be true.

One excellent example of where a threatened lake and ecosystem has been put on a sustainable path that will prevent the type of damage just discussed to both humans and the environment is the case of Mono Lake.

At its current state, Mono Lake covers about 70 square miles and is at it's deepest point 150 ft, but averages only 60. Because of its general shallowness, when Mono drops vertically, the effect on its surface area is quite drastic. Mono Lake has five main tributaries: Lee Vining Creek, Parker Creek, Walker Creek, Rush Creek, and Mill Creek. Along with the lake itself, "habitats in the basin include alkaline shoreline, pinyon pine-sagebrush, and riparian forest." (http://www.livinglakes.org/mono/) As is characteristic of a salt lake, Mono is a terminal lake, meaning its waters have no means of escaping except by evaporation. This is common for salt lakes because as evaporation occurs, the salt in the water remains and builds up as opposed to being washed out. The high salinity of Mono Lake, which is about twice that of the ocean, supports a fairly simple yet extremely active food chain. There are two main animal species who live in the lake, brine shrimp and alkaline flies. These animals exist in seeming infinite amounts and provide practically that extensive of a food source for the lakes other main inhabitant, birds. Among those birds are one of the world's few largest nesting California gull populations and "hundreds of thousands of migratory shorebirds"

(http://www.livinglakes.org/mono/). Many of these migratory birds use the lake as stopping and refueling grounds on their way to South America.

Over 760,000 years old, Mono Lake is one of North America's oldest sources of life, supporting human life for over five thousand years. Paiute Native Americans living around the lake used to collect the pupae of the lakes alkali flies and were thus given the name Monache, meaning "fly-eaters". In the 1850s, explorers shortened Monache to Mono, which has since been applied to the region and its inhabitants (USDA "Mono Basin" flyer). It took less than a hundred years after their discovery of the lake for these European settlers to begin diverting its waters. In 1941, the city of Los Angeles began diverting water from Mono Lake, unknowing and uninterested of its ecological significance. Within forty years, the lake had dropped nearly fifty vertical feet, lost half its volume and doubled in salinity, threatening the ability of the lake to support life (http://www.livinglakes.org/mono/).

Photos of Mono Lake in 1962, 68, 95 following the lake dropping from 25 to 40 ft
(http://www.monolake.org/politicalhistory/index.html)

Unlike with the tragic story of the Aral Sea, Mono Lake was fought for and somewhat saved by the interest and dedicated of the Mono Lake Committee and other environmental organizations who were aware of the possible future damage to the lake and its possible repercussions. However, it would certainly be incorrect to say that now harm was done or that none of the damage is still felt. When the Los Angeles Aqueduct dried up the lake's main rivers, aside from the previously mentioned damage to the lake

itself, “riparian vegetation died, fisheries were destroyed, and occasional floods tore through the desiccated floodplains plugging up side channels and turning the main channels into wide, straight washes… The result was a fragmented and poorly functioning ecosystem.” Winds blew toxic salt and dust from exposed seabed, similar to with the Aral, but on a lesser scale and without the addition of pesticides. Another effect of the lake’s large dropping was that islands where birds would nest and lay eggs, became linked by new land bridges giving accessibility to predators. Unable to have safe breeding ground, the numbers of geese and ducks plummeted 99% (http://www.monolake.org/restoration/index.html).

Starting in 1979, the Mono Lake Committee, along with the National Audobon Society, and two local fishing clubs, filled a series of lawsuits over 10 years against the Los Angeles Department of Water and Power (DWP) on the basis that the diversions violated the Public Trust Doctrine, which protects navigable bodies of water for the use and benefit of all the people. (http://www.monobasinresearch.org/timelines/polchr.htm) Finally, after quite a fight, it was decided by the state in 1994 that the DWP is responsible to implement a restoration plan including restoration of waterfowl and stream habitat, and a raising of the lake’s level to 6392 feet above sea level, which will reduce salinity, decrease dust storms, and reconnect the lake to its springs and deltas. It was decided that the cheapest and most effective way to repair the ecosystem is to restore its natural processes. Creating such environments in the lake’s rivers will “will provide the dynamic energy needed to rebuild deep stream channels and pools, re-grow riparian forests and reestablish healthy floodplains” (monolake.org/restoration/index.html).

The agreement allows LA to continue diverting some water in this process and one-third of its previous use once the decided lake level is established. Because so much of the city's water came from the lake, the city has found it cheaper to promote water conservation and recycling than trying to purchase the whole other two-third from other sources. Today, even with a population increase of one-third, Los Angeles uses no more water than it did in the 1970s. Since the DWP began its reduction of water diversion, Mono Lake has risen ten feet.

However, Mono Lake and its surrounding area will not be completely restored. The lake will remain 25 feet below its pre-diversion level, with a lesser annual stream flow as well. Certain riparian forests will take half a century to grow back and other regions such as the Rush Creek delta are permanently beyond restoration (monolake.org/restoration/index.html). The upside to the story is much more powerful. The case of Mono Lake sets a impressive precedent for lake preservation and restoration, that will be referenced not only by others trying to save lakes in different parts of the world, but regular students and citizens like me who can begin to learn about not only the importance of salt lakes, but the importance and possibility of saving them. The problems of both Mono Lake and the Aral Sea started with unsustainable human diversion and the world has seen two ways such a story can pan out. Now it is up to us to choose.

Biography

Aral Sea

http://www.environmonument.com/Aralsea.htm
http://www.american.edu/ted/ARAL.HTM
http://www.livinglakes.org/month/2-aralsea.htm
http://www.uky.edu/ArtsSciences/Geology/rimmer/110/AralSea.pdf
www.dfd.dlr.de/app/land/aralsee/

Mono Lake

www.monolake.org/
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http://www.monobasinresearch.org/
http://www.monolakecommittee.org/