The Beginning and the End of the Colorado River: Protecting the Sources, Ensuring Its Courses

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Dedicated to Anita Alvarez de Williams, Nuestra Señora de la Delta

During the drought year of 2002, front-page headlines in Arizona's largest newspaper declared "Colorado River Not Doing Job." It was one of several notices making the national and regional headlines that year that referred to the worst drought to hit the bulk of the Colorado River basin in a century or more. In reading the Arizona Republic article that morning, I presumed that the journalists responsible for it understood the job of the Colorado River to be the filling up of reservoirs to allow further growth for Phoenix's golf courses, citrus orchards, fountains, and artificial lakes. Because of the pervasiveness of the drought that hit the watershed in September of 2001 and extended unabated into 2003, those reservoirs have had their water levels drop down to one-fourth or one-fifth of their holding capacity—the lowest since the eighty-some dams and water diversions were first constructed in the basin.

While inhabitants of Colorado River watershed towns such as Flagstaff and Moab have begun water rationing, Phoenix and Las Vegas have remained unbridled in their conspicuous consumption of water—consider, for example, the signature fountain of Fountain Hills, Arizona, shooting water a hundred meters or more into the air to quench the thirst of the Saints of Evaporation. These cities have also been unbridled in their growth; indeed, their metropolitan areas have led the country in percent population increases throughout most of the past two decades. In fact, in years when official proclamations of "drought" force the rationing of water among farmers, farmlands are more rapidly converted to subdivisions, fueling more urban growth and conspicuous consumption of water in fountains, golf courses, and parks. In an average year, the very same droplet of Colorado River water is used and reused seventeen times—but how many times is the same drop swallowed and expelled in a drought year, especially as the population of the region continues to rise, with no apparent ebbing of its tide?

Those headlines have encouraged me to ask three questions pertinent to the ever-moving waters of the big red river. First, just what is the "purpose" of the Colorado River? Second, where does the Colorado River actually begin and end? And, third, given its purpose, what is our stewardship responsibility to those beginnings and endings?

Much of the information that I will utilize in discussing these three questions comes from two very different sources, both of which I've been engaged with for much of my career as a conservation ecologist and nature writer. The first source is the literature on "the state of the headwaters," much of it recently summarized in an eco-regional report, *Safeguarding the Uniqueness of the Colorado Plateau*. The second source is the growing body of literature on the "state of the tailwaters," that is, the life of the delta of the Rio Colorado and the Sea of Cortés, into which it (sometimes) flows. Water policy analyst Michael Cohen reminds us that this watershed is but one of some 260 basins around the Earth in which flow allocations are internationally in dispute. Roughly one-twentieth of the watershed's 632,000 square kilometers lie within Mexico; its fresh water, nutrients, and biodiversity formerly fueled the natural and cultural communities of Sea of Cortés for hundreds of kilometers beyond the delta. Even within United States boundaries, flow allocations are in dispute among various cultures, with more than three cubic decameters (2.5 million acre-feet) of water rights still contested by Native American tribes in the watershed.

First, to consider the purpose of the river, I recently took heed of some lines from Jim Harrison's long poem, *The Theory and Practice of Rivers*:

to speak it clearly,
how the water goes
is how the earth is shaped.

Inspired by Jim's evocation—which gains some veracity by knowing that Harrison now lives up on Sonoita Creek in the Rio Colorado headwaters—I might express the purpose of the Rio Colorado in this manner:

To move downhill, by riffle, rapid, forceful flood, or oxbowed meander, on its inevitable way to the sea.

To carry with it the underlying bedloads, the suspended silts, the dissolved nutrients, the myriad microbes, the migrating creatures, the dead wood, and the wild lives who seek to raft their way along with its flows.

To carve and cut, to dump out sandbars, to build a delta, and to give back some of its moisture to the sky above and the aquifers below.

To sweetly hum and to roar, to overwhelm all people's imaginations, to be a multi-layered symbol and a multi-bladed tool, to muddle and befuddle us whenever we think we've gained consensus on what its highest and best use might be.

Now that our purpose has been defined, I'd like to dump you out and spill you into a raging river of controversy for the next few pages. I'd like you to lie back and keep your feet in front of you—in case we bump into any hard rock walls—and float with me downstream. We're going to go up to the headwaters of this river and ride down from there.

The trouble is that most people view the headwaters of the Rio Colorado as a little lake up near the Great Divide in Colorado's Rocky Mountain National Park, where the Grand spills down out of the raised-up rocks left behind by the Laramide Orogeny. Grand Lake, they say, is the source. Others, like my "river mother," Ann Zwinger, have reminded me that the Green is greater than the Grand, and longer too, so that the rivulets and lakes up in the headwaters of the Green at Knapsack Col—a saddle up in the Wind River Mountains above Peak Lake, Wyoming—are the best beginning, because they are farthest from the delta.

But my Hopi friend Vernon Masayesva of the Black Mesa Trust tells me that's wrong. The source of the Colorado River, he says, is the clouds. And the aquifers below. And every single spring within the watershed that bubbles forth to be drunk by fish and fowl. And every droplet sucked up by the roots of the tallest Doug-fir, and the hyphae of the lowliest, crustiest cryptogam. And the entire hydrological cycle spinning around the Earth.

Let's focus for a moment on just one set of those sources—the springs of the Colorado Plateau. As Vernon reminds me, those springs are considered by the Hopi the "breath holes" of the world, where the circuits of the hydrological cycle above and below the ground interconnect. As Grand Canyon Wildlands Council ecologist Larry Stevens reminds me, the Colorado Plateau has the greatest density of springs of any large region in North America, but now more than 80 percent of them outside of national parks and monuments have been diverted, appropriated for livestock, or have gone dry. Vernon concurs, noting that perhaps 80 percent of the springs that he knew as a boy on the Hopi Reservation have now dried up. At

one sacred spring to which he introduced me, a stone-lined reservoir the size of an Olympic swimming pool was normally filled to the brim throughout his childhood. For the last several years, no more than a bathtub full of water has lain at the bottom of that reservoir, a few prayer feathers left above it, blowing in the hot, dry wind.

This is particularly tragic when we consider that the Hopi Reservation had one of the highest densities of springs of any reservation and other land management unit in the headwaters. It would not be so bad if such springs were culturally or biologically insignificant, but few can argue that. Springs, seeps, and hanging gardens are many times richer in species than their surrounding uplands, and harbor a number of rare plants and animals that are hardly found anywhere else in the region: alcove bog-orchid, the Navajo sedge, southwestern willow flycatcher, and the Kanab ambersnail, among others. The wildlife and plants in Hopi spring habitats are also important ceremonially, nutritionally, and medicinally to the Hopi people.

Navajo tribal leader Joan Manygoats has talked about this loss in the following manner:

In the olden days, we had place names for springs and water. We had all these places with water that we knew well. When you go over there today, what do you see? There's no water. We now have names like Dead River, Dry Lake, Cactus Flats. This is what we have to think about. Nobody ever asks the Navajo people what they want to see. My passion is for restoring land and water. If we don't we're gonna be sitting on a pile of dirt.

It is clear that we, as Colorado River watershed citizens, have not adequately protected springs, legally or otherwise. As environmental lawyer Robert Glennon has conceded, they fall "between the cracks," as they are not adequately covered by either groundwater or surface water laws. The habitats associated with freshwater springs in our basin's headwaters are now imperiled by a number of insults: encroachment by invasive species such as tamarisk and Russian olive; aquifer drawdown to supply water for mining, slurrying coal, livestock, and domestic use; and contamination by uranium, benzene, selenium, and other toxins. The current drought has further depleted the flows of human-impacted springs that would otherwise provide the last safe harbors for a variety of wildlife that can't find moisture or forage anywhere else.

Nevertheless, the Supreme Court has ruled that isolated wetlands—including most of the springs in the West—cannot be protected by the Clean Water Act, and can therefore be converted to landfills, ice-skating rinks, or sewage ponds. Meanwhile, the Tenth Circuit Court of Appeals in Denver has been in the process of determining whether existing state and municipal contracts to withdraw water from springs, streams, and wetlands to provide for domestic and agricultural uses override any moral obligation to use the same water to protect rare and endangered fish and amphibians.

Fellow citizens, the source of the Colorado River is in a sorry state, not Wyoming, not Colorado. As I began the first poem I ever wrote on the banks of the Colorado during the vernal equinox of 1970:

The springs are drying up, snows are melting fast.
The way we are lapping them up surely cannot last.

Let us come quickly to the end, then. By that I mean the tailwaters that now barely even trickle across the U.S.–Mexico border. Over twenty-five years in the

past four decades, less than 2 percent of the river's estimated undepleted flow has even reached the delta. That is because Colorado River water is now "served" to some 30 million people in the U.S. and Mexico every day, and is diverted onto some 750,000 acres of irrigated lands as well. But it is not just water that has been held back from the delta; the delta and the upper Sea of Cortés are also starved of nutrient-laden sediments that formerly fueled the estuarine and marine food chains of that region.

I have personally experienced the tremendous decline of the delta and the upper region of the sea over my 32 years of visiting the coast of Sonora as a field biologist. When I first seine-netted with the *ejidatarios* of Kino Viejo in the winter of 1972, we could catch more than a panga-load of corvina, mackerel, and totoaba in less than an hour off the shores of Isla Tiburón; today, the same waters hardly render a bucket-load of fish for the same effort.

It is easy for Americans to blame the fisheries decline below the delta on over-exploitation alone; indeed, shrimp trawling has played a major role in breaking the food chain of the Alto Golfo. By 1992, more than two hundred trawlers working out of Puerto Peñasco, Guaymas, and other port towns went belly-up—either bankrupt or defaulted on their loans—due to a halving of the shrimp and fish catch over the previous decade. The giant totoaba had declined due to aggressive fishing for their vitamin-filled bladders in the 1930s; by the 1970s their smaller kin, the corvina, had begun to decline, as had the five species of sea turtles that formerly reached the Alto Golfo. As a result of fisheries declines, island-nesting birds of the region, such as the elegant tern, have also declined precipitously, and the same cause-and-effect chain has led to declines in fledgling success of ospreys nesting on cliffs or giant cacti edging the Sonoran coast.

These fisheries were once dependent not only on the river's seasonal flushes of fresh water, but also on the massive loads of nutrient-rich sediments that fertilized seagrasses, mangroves, and marine algae in the Alto Golfo. Prior to the closure of upstream dams, the river at Lee's Ferry carried sediment concentrations exceeding 10,000 parts per million; today, it seldom carries more than 200 parts per million. The upstream dams capture so much sediment that only 870 metric tons reach the Imperial Dam, just above the delta, on the average day. Compare that to what one of the few undammed minor tributaries of the Colorado regularly carries to its mouth—the Virgin's load alone averages some 50,000 metric tons per day. Some estimate that the Colorado River as a whole annually dumped as much as 85 million metric tons of nutrient-rich sediment out at the delta before it was dammed. This loss of delivery of sediments to the delta means that the Alto Golfo's tidal actions now remove more material from the delta than the two percent of extant river flows can replace.

Today, all of Sonora's and Sinaloa's rivers are dammed just as the Colorado River is, and the entire Alto Golfo is starved of nutrients from the watersheds above it. I did not recognize how important such nutrients and freshwater flows were to the productivity of the marine community until I flew over it during the winter of 1993, when nearly 5 billion cubic meters of water entered the Alto Golfo due to unusually high winter rainfall regimes triggered by El Niño. After a week of constant rains, turbid flows from usually dry watercourses draining undammed watersheds flowed directly into the sea. Flying over the Alto Golfo with MacArthur Award–winning environmental pilot Sandy Lanham, I saw the most remarkable biological phenomenon I had witnessed over my entire life. Huge algal blooms and huge eelgrass yields had stimulated invertebrate reproduction and a resurgence of corvina to the degree that we could see massive green patches out in the sea, streaming with enormous schools of fish. Thousands of dolphins and even whales had congregated around each of these patches of productivity. A feeding frenzy was going full tilt, the likes of which the Alto Golfo had experienced perhaps only

five times over the previous thirty-five years. It became painfully clear to me that U.S. federal and state policies—later echoed by Mexico's own policies—have contributed to the devastation not only of the fisheries, but also of the seabirds of the Sea of Cortés, to a degree that over-fishing could have never done by itself.

To give an indication that species other than trawl-able, net-table ones have declined in the Alto Golfo due to depleted water and nutrient flows, consider just three: Sonoran panicgrass, Palmer's saltgrass, and the Colorado River delta clam. Sonoran panicgrass, once a staple of Lower Colorado River tribes, was formerly semi-cultivated on hundreds of hectares of the floodplain from the Fort Mohave area southward toward the delta. Caches of its grain have been found where the Mohave or Quechan must have stored them in the Trigo and Chocolate Mountains north of Yuma. The Cucupa of the delta sowed its seeds by blowing them out of their mouths while wading through nutrient-rich muds as the winter-spring floodwater receded on the inundated floodplain, and harvested metric tons of its seed up until the dams were built upstream. Today, Sonoran panicgrass is extinct both as a native wild species and as a cultigen in the United States, and it is endangered in Mexico, persisting in only a few cultural refugia in the Rio Mayo watershed of Sonora and Chihuahua.

If it is even possible to imagine this, Palmer's saltgrass has fared far worse than Sonoran panicgrass. Once abundant on the islands of the delta and occasionally found farther south on the coasts of both Baja California and Sonora, it had a grain several times larger than the related, widespread species of saltgrass. A cereal grain that was perhaps harvested only by the delta Cucupa but was also traded to adjacent tribes, it was thought to be extinct until biologist Nick Yensen diligently searched its remaining delta habitat and regenerated it in experimental plots outside Tucson and Mexicali. Nevertheless, like Sonoran panicgrass, it went "culturally extinct" among the indigenous people of the delta, except in their oral history. Both of these grains have been reintroduced to the Cucapa, but have become little more than fondly regarded curiosities among contemporary generations of that tribe. Without regular flows of fresh water or nutrients, the reliability of their harvest would be too low to attract much stewardship.

The third species in this triad of delta demises is a shellfish that was once represented by three trillion clamshells at the mouth of the Colorado River. Historically, it proliferated in densities exceeding fifty clams per square meter. Today Carl Flessa and his colleagues cannot find more than three clams per square meter. It too is endangered by the lack of fresh water and nutrient flows to the delta. Unfortunately, the list could go on much longer—the endangered "vaquitas" or gulf harbor porpoises, river otters, beavers, muskrats, delta desert pupfish, Yuma clapper rails, roseate spoonbills, long-billed sparrows, and the like—but for many of these species the tracks are colder than the rest I've mentioned.

The state of the tailwaters is a salty one. They are regularly fed only by depleted flows from the mountains, and by slightly saline drainage from the Wellton-Mohawk Irrigation District, which is now aiding in the restoration of some 4,200 hectares of the Cienéga de Santa Clara in the recently designated Biosphere Reserve of the Colorado River Delta and Alto Golfo. The courageous effort to restore even more of the delta, led by Jose Campoy, Ed Glenn, Carlos Valdes, Jesus Garcia, Dale Pontius, Eric Mellink, and Richard Felger, is one of the most laudable and ingenious habitat recovery efforts in North America at this time. It has tremendous implications for cultural restoration, as Anita Alvarez de Williams, Nick and Susanna Yensen, and several Cucupa leaders have suggested.

Other comparable restoration efforts, also initiated against seemingly insurmountable odds, are now well established in the river's headwaters. Spring

restoration efforts among the Hopi, White Mountain Apache, and Zuni, while smaller in area than the delta effort, are just as culturally significant. Riparian restoration efforts by Fred Phillips, Ann Hadley, Larry Stevens, and others at Lee's Ferry, Parker, and Yuma Crossing are removing hundreds of hectares of tamarisks and replacing them with native cottonwoods and willows. These efforts not only work for people—making those places walkable and even habitable once more—they also work for wildlife. And any plan that truly benefits wildlife as well as the many cultures of watershed has my pledge of allegiance.

I feel such restoration efforts are the keys to our future in the watershed, while other people might dismiss them as nothing more than a drop in the proverbial bucket. At last reckoning, 60 percent of planet's fresh water is already being used exclusively for humans. If recent UN resolutions result in tangible resource development actions so that another billion people are provided with the same basic amounts of drinking water that most Americans expect to have accessible to them every day, then 90 percent of the planet's freshwater will be funneled toward one species, our own—at the expense of all others. As Trappist monk Thomas Merton prophesized almost a half century ago, "… someday they will even try to sell you the rain." All over the world, water supply and delivery systems are becoming privatized, and biodiversity has yet to gain much buying power: southwestern willow flycatchers, alcove bog-orchids, Navajo sedges, totoabas, Sonoran panicgrasses, Palmer's saltgrasses, and delta clams are sitting across the negotiating table from Fountain Hills, the Arizona Snowbowl, the Las Vegas Strip, Rio Salado Park, the Imperial Valley lettuce fields, and Mexicali's *districto del riego*. It is time to decide that wildlife in wild habitats is worthy of a share of that water—on both sides of the border—and that unbridled human population growth cannot go on indefinitely in our watershed without those wild lives being snuffed out. We will make that decision, one way or another, by the way we tend to the state of the headwaters and the tailwaters over the next quarter-century.