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Reclamation

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"By choice, or catastrophe, we will one day live with less."
Cleo Woelfle-Erskine

A young girl and her mother walk across the beach, flipping over logs and debris which have washed ashore, inspecting anything of interest. A chilly east wind blows, lightly scuffing their faces with gray sand. A fresh bank of fog follows the wind, smelling of salt and earth, gently rolling inland across the sand and gravel into the forested mountains. Flanking the mother and daughter on either side, the redwood bluffs of Northern California and the Pacific Ocean.

Muffled rays of light stream through the banks of fog combing through the treetops and spiraling into eddies, filling the open spaces between trees and rock. A black crow emerges from a dark corner, capturing the girl's attention. Soaring in the air without moving a muscle, the crow rises into the fog, disappears, then banks hard, reappearing in a downward spiral only to turn and rise again into the fog. Captivated by its flight, the girl takes off in a chase. The crow cocks its head and laughs in amusement, beginning to meander in the air, allowing the girl to barely keep pace. The mother, in a peaceful walk, keeps an eye on the pair as they run up the beach towards a second body of water.

Breathing hard with sand filling her shoes, the girl chases the crow. The soft sound of footsteps in sand turns to loud gravel, shifting and giving way to the weight of each stride. After climbing a pile of large rocks and jumping onto a fallen log, the girl lunges for the crow who is now only a few feet away. Missing the tar colored feathers by an inch, she barely catches her balance at the end of the log. The crow, laughing even louder now, cocks its head at the girl, but her attention was now

elsewhere. Instead, she was looking to the massive river expanding before her. The crow banks again, lazily floating about the fog, gliding upstream as if taunting the girl.

Seeing her daughter jump from the log and landing only feet from water, the mother quickens her pace – the girl resumes her pursuit of the crow, inland, up the gravel bars of the Klamath River. Losing sight of her mother, the girl continues running upstream along the banks, occasionally looking skyward for the crow. But there was no sign of the black silhouette against the foggy daylight, or among the treetops and rocky outcrops lining the river. Slowing her run to a walk, the girl takes time to catch her breath by sitting on the bank of California's second largest river. Listening to the rush of freshwater meeting salt at the mouth of the Klamath, the girl scans the horizon.

While watching the grayish-black water turn and bubble, a flash of something in the wind catches her eye. A tar colored feather lands at the water's edge, flickering in the breeze as if about to take flight again. The girl quickly gets to her feet and leaps, but before she could grab the feather, it explodes into the air, wafting downstream towards the ocean. Before the girl could resume her chase, her mother snatches the feather out of the air and focuses back on her daughter, now standing in awe.

The sun breaks through the fog and illuminates the water, reflecting back into the mother and daughter's faces. Both now focus on the black feather, spinning it in their fingers and watching the oily tint in the sunlight. Kneeling down to brush the sand off her daughter's cheek, the mother notices the girl's gaze captured by something in the water. A shimmering silver orb, dancing at the water's surface only feet away from where they stood, as if someone had dropped a slick piece of metal now briefly visible in the sunlight. A second silvery orb appeared, but farther from the bank, in deeper water and moving steadily downstream. And a third, farther still from the bank

and moving even faster.

The mother stood, now focusing her full attention on the water. While leaning forward, trying to make sense of the dancing orbs, a loud "Squawk!" startled her and broke her gaze. The crow, now flying above, circling in interest. Looking back and gesturing expectantly for her daughter's hand, only the tar colored feather lay in the gravel where her daughter stood. Slightly panicked now, the mother looks upstream and sighs in relief, finding her daughter kneeling by the water's edge, a few yards upstream. As the mother approaches the girl, the crow lands farther up the gravel bank and resumes squawking. The mother calls out to her daughter but stops mid-sentence. The girl, squatting and reaching out a hand, was surrounded by at least a dozen silvery orbs, all shimmering in the sunlight and dancing on the surface of the water. Now running, the mother reaches out for her daughter and pulls her away, finding a silvery body partially emerging from the water's surface.

A massive salmon, a Chinook salmon, easily the same size as the girl, lay beached, gasping and flexing its gills on the gravel bank. In an instant, the crow flies and lands on the dry, scaly body, still flexing its gills in hopes of cool, fresh water. Dwarfed by the mass of the salmon, the crow cocks its head and sinks its beak deep into the flesh, revealing bright pink muscle and a streak of blood. Leaping forward, the girl scares the crow from the bloody bank and watches it take off, landing a few yards away. Now the salmon lay motionless, with adozen more dead and dying salmon floating downstream, their silvery reflections on the water's surface and twice as many crows now perching in the treetops. The mother looks farther upstream and gasps in horror, finding hundreds, if not thousands, of silvery orbs slowly dance their way down the Klamath River to a cacophony of squawks.

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On September 19, 2002, reports of dead and dying Chinook

salmon began circulating among tribal and fishing communities on the lower Klamath River in Northern California. By September 20, 2002, an estimated 34,000 Chinook salmon carcasses were counted by the Yurok Tribal Fisheries Program, the Hoopa Valley Tribal Fisheries Program and US Fish and Wildlife. These estimates are conservative. Among the men and women who live on and tend to the Klamath River, even among biologists of the fishery agencies, it's believed more than 70,000 steelhead, Chinook and Coho salmon may have perished. These estimates make the incident the single largest fish kill in the history of the Western United States.

How could this happen? What circumstances led to the death of so many spawning steelhead and salmon? The official story is complicated and avoids pointing fingers, but suggests that an unusually large migration of salmon was stuck in the lower Klamath River, a section between its confluence with the Trinity River and the Pacific Ocean. The Trinity River is a tributary to the Klamath, meaning the two join before flowing out to the Pacific Ocean. In between these two points, the convergence of the two rivers and the ocean (lower Klamath), is where the 2002 fish kill occurred.

Due to a lack of fish passage, less water during a drought year and high temperatures, the salmon were stressed. What makes for a stressful environment for salmon tends to make a perfect environment for parasites, which are particularly abundant in the lower Klamath. So a combination of water, temperature, parasites and bad timing led to the death of over 70,000 spawning salmon. However, the tribal and federal fishery agencies identified management of Iron Gate Dam and Lewiston Dam as the only controllable human action which may have prevented the fish kill (Belchik et al. 2004).

Hundreds of kilometers upstream of the lower Klamath are the Iron Gate and Lewiston Dams on the Klamath and Trinity Rivers respectively, both representing impassible fish barriers and the end of salmon migration in the Klamath Basin. Both dams were constructed in the 1960's by the federally funded

Bureau of Reclamation, at the end of a period representing the largest push for dam construction in the history of the Western United States. Among the rapidly growing communities in California's Central Valley, dams were a popular way to accommodate for the enormous population growth and agricultural development of the West. This period in time, 1930-1970, resulted in the construction and operation of 492 high-head dams in the Western United States (BOR, 2019). Water that should have been used to maintain temperatures and a healthy environment for migrating salmon on the Klamath and Trinity Rivers, was instead diverted through thousands of miles of irrigation canals, watering crops for agriculture and acting as a source for municipal water. That is what killed 70,000 salmon on the Klamath River; prioritization of water allocation in California.

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Do you have any idea what it takes to construct a dam? First, you have to move a river. A combination of excavators, hydraulic jackhammers, and dynamite must be used to either blast or dig a new river channel. Two "coffer" dams are then put in place, acting as temporary dams or bookends with the actual dam construction site in between. Then you must drain the space between the two coffers, and remove any loose rock or sediment. Once you've removed every trace of a free-flowing river, you can then begin laying millions of cubic meters of sand, rock, or cement (or some combination of the three), making sure to reinforce with steel along the way. The process takes years to complete, after which large volumes of water are stored behind the newly constructed dams, creating massive reservoirs. When the Bureau of Reclamation was organized by Congress in 1902, this is what was meant by "reclamation" – taming a river by building a dam, controlling seasonal floods and supplying millions of cubic feet of water for irrigation, creating artificial gardens in the middle of a desert. To this day, as much as 50% of the flows annually incurred in the reservoirs at Iron Gate and

Lewiston Dams may be diverted for agricultural use (TRRP, 2019).

The construction and operation of so many dams between 1930-1970, the end of World War II and the mass use of artificial fertilizers led to the perfect storm of population growth in the Central Valley of California, filling the vacuum of space created by an abundance of food, water and employment. Today, we are living with the consequences of over 100 years of reclamation: direct ecological impacts downstream of dams, physical changes to a river's channel due to flow suppression, declining fish and wildlife populations, prolonged periods of drought impacting water allocation, broken promises made to Native Americans regarding sustainable fishery management and water rights, loss in profits in commercial fisheries, inability to adapt to climate change and more extreme weather patterns – the list goes on.

California finds itself between a rock and a hard place. The changing ecological, political and cultural climates demand adaptive management to rethink the way we allocate water in the Western United States. However, altering flow allocation in California jeopardizes the delicate, artificial gardens, built in the middle of a desert. Millions of people and agricultural communities now depend on water allocated from Northern California. Yet, Native American and fishing communities have been devastated by stark crashes in fishery populations due to an intensely violent history of mining, logging, over-harvesting of salmon and the reclamation of the Klamath basin. Not to mention the dramatic increases in unregulated acquisition of water by independent cannabis cultivation in Mendocino, Humboldt and Trinity counties in Northern California – further depleting water available to salmon while injecting poisonous fertilizers and pesticides into the water. It's a hard conversation to have when so much is on the line, one that often leads to a cacophony of debate.

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Fifty years ago, the idea of removing a beloved dam constructed by the Bureau of Reclamation would have received immediate criticism by the majority of white communities in the Central Valley. Today, more than 1,400 dams have been removed for restoration purposes and more are being considered for removal as traditional ecological knowledge and western science are used to apply pressure on water managers regarding the long-term impacts dams have on society (Bellmore et al. 2017; Bellmore et al. 2019). For obvious reasons, large-scale disturbances occur downstream after a dam is removed, sometimes resulting in prolonged periods of decreased water quality due to extremely large volumes of sediment that accumulates behind dams (East et al. 2015). This decrease in water quality can seriously dampen a river's ability to sustain a healthy ecosystem, in some cases resulting in decreased fishery populations for as much as 10-15 years after a dam is removed (Burroughs et al. 2010). Any conversation on dam removal should note that removing a dam can be just as large of a perturbation as constructing a dam, but I would rather live in a world where we work to restore a river, not maintain a dam.

On February 18, 2010, members from over 50 organizations signed the Klamath Hydroelectric Settlement Agreement which outlines plans to remove four dams on the Klamath River (Gosnell et al. 2010). In a more recent landmark decision, the four dams on the Klamath River including Iron Gate Dam have been scheduled to be removed as early as 2022. The removal represents the restoration and re-birth of more than 570 miles of historical salmon habitat in the Klamath Basin (Allen 2012). It would be hard to overstate the importance of this decision in the history of the Klamath Basin and water allocation in California. The Klamath and its tributaries have been home to hundreds of years of conflict and hardships on Native communities, fishing communities and endangered species (Gosnell et al. 2010). Not to mention the removal of four dams has never been

attempted before; there is no rulebook or example to follow. Although there are many unknowns in the dam removal process, dam removal represents an ambitious new field that has never been possible until now. There are many questions that must be answered regarding the removal process, and the lessons learned from removing the dams on the Klamath River will undoubtedly contribute valuable information to the field of stream restoration. It'll be a hard journey, but it makes for a hell of a better reclamation story.

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