

## INTRODUCTION

The hunter's eye holds a look of obsessed concentration. Ankle-deep in water, the great blue heron waits for its prey. Imitate: stand still, keep silent, watch. The bird's head shoots forward on its long neck, moving so fast the details of the action cannot be comprehended by human sight. A splash. Now the heron grasps a struggling fish cross-ways in its bill. The victim's tail fin twitches, the fish translates into a silver flash falling into the bird's gullet. A brief digestive pause, then the heron launches into the air, tucking its lanky legs up against its body, folding its neck into a compact S-curve (Fig. I.1).

At the Arcata Marsh and Wildlife Sanctuary a few blocks from downtown Arcata, on California's north coast, it's easy to stumble into scenes like this one. I first explored the place as a wildlife fanatic. River otters played together, gliding across the water, diving without a splash. Thousands of sandpipers burst into a whirl of coordinated flight, startled by the passage of a hunting peregrine falcon. A short-eared owl cruised over the reeds at dusk, listening for the tell-tale splash of a frog moving in the shallows.

This habitat, crowded with birds, hikers and picnickers, is fueled by sewage. In the 1970s, a handful of activists in this town on the shore of Humboldt Bay fought a years-long political battle with state officials. They rejected the state's plan for an expensive, energy-intensive regional sewage system. In the process, they stumbled on the idea of using wetlands to filter pollutants out of their wastewater. It's a notion so simple and so effective that it's since been adapted at tens of thousands of constructed wetland projects worldwide.

The marsh is a place of paradoxes: a wildlife sanctuary awash in sewage, a habitat that exists because environmentalists fought state officials enforcing the Clean Water Act. It's one of my favorite places to walk, to look at life, to ponder. It's also become a door, a portal into the past and potential future of our relationship to wetlands and to water itself.

We need constructed wetlands like Arcata's because humanity has a penchant for destroying natural ones. The Earth has seen the loss of more than 64 percent of its native wetlands since 1900.<sup>1</sup> In major agricultural states like California, Ohio and Iowa, the figure is closer to 90 percent. Swamps and marshes have been drained to create farmland and destroy mosquito habitat. They've been paved

over with concrete, replaced by shopping malls and suburban neighborhoods, their disappearance considered a victory.

Wetlands develop at the edges between earth and water: at the shallow margins of bays, lakes, ponds and rivers. Their plants, adapted to soggy conditions, grow with their roots underwater. A swamp is dominated by trees. A marsh grows grasses, sedges, wildflowers. Wetlands capture pollutants, absorb rising waters in times of flooding, stabilize shorelines, act as an important sink for carbon in the era of global warming, and serve as crucial wildlife habitat.

Conservationists first began to advocate for wetland protection when populations of North American waterfowl began to plummet early in the twentieth century. Migratory ducks need wetlands to shelter and feed them during their long journeys to and from their breeding grounds. Human welfare, it turns out, is also tied to the boggy landscapes we'd long condemned as wastelands and sources of disease. It just took a long time for us to notice.

While humanity was busy making wetlands disappear—a major undertaking from the mid-nineteenth century onwards—we were adding mass doses of sewage to the waterways that sustain us. The evolution of sewage reveals urban *Homo sapiens* bumbling along in a struggle to evade the stink and disease carried in its own wastes.

Along the way came flashes of brilliance. Observers in Europe and the US began to realize that benign bacteria can break down the pollutants in sewage, that these microbes can be harnessed to treat our endless flow of fouled water.

The basics of conventional wastewater treatment were worked out at the turn of the twentieth century, but would not be widely used until the 1970s, when an army of citizen activists began to fight for clean water. At the same moment, a handful of ecologists began to recognize the ability of wetlands to capture and break down pollutants. This startling revelation hit scientists working in Germany, the Netherlands, North Carolina, Massachusetts, Florida. The habitats we had forced out of the landscape were revealed as key to controlling the overload of waste and nutrients flowing out of cities, industries and farm fields.

In 1974, two newly-elected members of Arcata's city council began to resist the state's plan for a regional system that would have ringed Humboldt Bay with miles of sewer lines. They didn't know much about wetlands, but they could see that the project as proposed would be the biggest energy consumer in Humboldt County, that it would spend millions of dollars to pump sewage across long distances, that it would lead to urban sprawl. Those were the reasons they started to fight.

Arcata's sewage resisters stumbled onto the low-cost, environmentally friendly concept of wetland treatment, propelled by political pressures. In a way, they were like William Dibdin, the nineteenth-century London bureaucrat. To save the city of London money, he'd set out to argue that its deluge of raw sewage did not harm the Thames River. He ended up showing, through careful observation and experimentation, that managed communities of microbes could cleanse sewage before it reached the river. Those same microbes are at work in every healthy wetland.

Arcata's activists of the 1970s set out to stop a big steel-and-concrete sewage project and ended up building a marsh that has become the city's most beloved



**Figure I.1** Great blue heron hunting at the Arcata marsh. Photo by Leslie Scopes Anderson.

park. Tens of thousands of people hike there every year, and most of them have no clue that they're walking through part of a wastewater treatment plant. They're too busy watching the birds to notice. Many long distance migrants find shelter among the reeds. Three hundred thirty-four species of birds have been sighted at the marsh.

Beneath its calm surface, Arcata's marsh holds lessons on the intertwined histories of wetlands and water pollution. More than 150 years after the first sewage treatment techniques were invented, it's become clear that conventional systems won't be enough to keep our lakes and bays healthy, or our drinking water safe. We have transformed whole landscapes to sustain our way of living, fouling vast watersheds in the process. Solving the problem will take many kinds of change. Wetlands, great and small, will be part of the answer.

#### NOTE

1. Ramsar Convention on Wetlands. "Wetlands: a global disappearing act." Fact Sheet 3.2 ([http://www.ramsar.org/sites/default/files/documents/library/factsheet3\\_global\\_disappearing\\_act\\_0.pdf](http://www.ramsar.org/sites/default/files/documents/library/factsheet3_global_disappearing_act_0.pdf))