BRILL

Worldviews 17 (2013) 150–160

WORLDVIEWS

brill.com/wo

Making Sense of Water Quality: Multispecies Encounters on the Mystic River

Caterina Scaramelli
Massachusetts Institute of Technology
77 Massachusetts Avenue, Cambridge, MA 02139, USA
scaramel@mit.edu

Abstract

This paper takes water quality as an ethnographic subject. It looks at how water quality monitors in Boston make sense of the quality of water through mundane engagement with three non-human beings who they encounter during their monitoring activities: herring, bacteria and water lily. Each of these organisms suggests a different understanding of water quality for the monitors and poses a dilemma. Water quality monitors who contribute to the production of water quality data come to know water quality as through direct interactions with these beings, mediated by both sensorial experience and laboratory data. These experiences, at the same time, confuse and redraw relationships between science, water flows, non-human vitality, including that of invasive species, and people.

Keywords

science; sensing; non-human; water quality; citizen science

Walking with Roger on the Mystic River in Boston is no easy stroll. Roger pays attention: he stops suddenly to smell something and asks me what I think the smell means. We climb over fences and walls, making our way through slippery and bushy terrain. Close to the river, Roger examines the color of the water, looking for green cyanobacterial blooms, and for the white filaments of anoxic bacteria. He climbs down to peek into an outfall pipe. "It's a very faint odor, not so much sweet, more on the sour side of sewage." I ask him to say more about this smell. "Sewage has its own distinctive odor. . . . It actually doesn't smell so bad, but it smells sickly sweet." Roger knows that the waters of the Mystic River are intimately connected to the underground flows of sewers in the city. By paying attention to the smells, colors, and to the presence or absence of organisms in the river, Roger assesses the quality of water.

DOI 10.1163/15685357-01702006

Roger can often be found in the laboratories of the Environmental Protection Agency (EPA) and the Massachusetts Water Resource Authority (MWRA), bringing in coolers filled with bottled water samples. Watershed associations coordinate sampling and analysis and compile water quality databases. "Citizen scientists," as the Mystic River Watershed Association (MyRWA) calls volunteers like Roger, regularly collect samples from different sites on the Mystic River and its larger watershed. They trust that their efforts will prove useful and become political tools to improve their lived environments. In this context, sensing water conjoins "folk" and "scientific" assessments of water quality; furthermore, as I will suggest here, work such as Roger's makes the distinction collapse.

How do monitors learn what counts as good water? Inspired by scholarship on human bodies as repositories of social relationships, memories, and ideologies (Merleau-Ponty 2003 [1962], Bourdieu 1977, Connerton 1991), anthropologists have looked at the role of sensorial engagements in learning social practices and power relations, self formation, and in making sense of place (Stoller 1989, Howes 1991, 2003, Seremetakis 1991, Feld 1996, Desjarlais 2006). The materiality of water becomes meaningful to humans through both sensorial and technological interactions; it has often worked as inspiration for discourses about identity (Strang 2004) and metaphors for social theory (Helmreich 2011). The multiple and powerful meanings of water emerge in sensorial interplay with the mutability of water's forms (Strang 2004, 2005). Ethnographies of water quality (e.g., Alley 2002) attend to the multiplicity of competing interests, embodied practices, and values attributed to water by different groups situated in complex relationships of power and identity.

Taking the notion of water quality in Boston as an ethnographic subject complicates the sensorial approach to water and meaning: water quality is always produced by interplays—often rife with tensions—between socially learned sensorial perceptions, and scientifically produced knowledge. Perception and scientific measurement are not the stable ends of a dichotomy; rather, they interact and produce one another: environmental tests are called to respond to and account for bodily sensations, and sensorial perceptions are re-learned in changing environments, informed by data on toxic hazards (see Corburn 2005, Murphy 2006, Nash 2006, Parr 2010). The notion of water quality speaks to conceptions of water as an enabler of life, human and non-human. This paper draws attention to water quality monitors' relationships (Haraway 2008, Kirksey and Helmreich 2010, Bear and Eden 2011) with non-human beings in the river: fish, plants and bacteria.[1] Water quality monitors come to know water quality as living water through direct interactions with these organisms, mediated by both sensorial experience and laboratory data. The following section will introduce the regulatory context of the waters of the Mystic River. Then I will analyze the monitors' relations with herring, water lily and bacteria and consider how encounters with water organisms revitalize the meaning of data, work as powerful symbols for the monitors, and produce enduring sensorial experiences, central to people's attachment to the river.

Regulatory Water Quality

The name Mystic River is said to derive from a Native American word, "missituk," large tidal river. From the first colonial settlements of fishermen and shipbuilders the catchment grew into a thriving, densely populated industrial area throughout the nineteenth and early twentieth century, resulting in high levels of pollution. In the late nineteenth century, the city designated sections of the riverbanks as urban parks; in the last few decades there has been a debate among city and non-profit institutions about ongoing problems of pollution and inaccessibility to the river for residents. In 1966, the construction of the Amelia Earhart dam changed the interaction of ocean and river flows, transforming the Mystic from a tidal river into a freshwater river (Mass DCR 2009, Haglund 2003, Schneider 1997). Citizen groups in the 1970s started to use water quality analysis as advocacy tools in their watersheds. MyRWA, which emerged from an umbrella configuration of such groups in the Mystic Watershed,[2] coordinates volunteers' sampling efforts, laboratory analysis, and data gathering, alongside outreach and education activities.[3]

MyRWA's production of water quality data takes place in the wider context of State regulations. Following EPA requirements, the Massachusetts Department of Environmental Protection (MassDEP) provides general

[1] The vitality of non-humans is outside of the scope of this which focuses on the monitors' perspective rather than on the coproduction of people and water beings.
[2] Mystic River Watershed Association, *Records 1967-2001.*
[3] The data collected has been officially recognized since 2000, when MyRWA stipulated a "Quality Assurance Plan" with the Environmental Protection Agency (EPA) and the State Department of Environmental Protection (MassDEP).

benchmarks for assessing water quality of each inland watercourse.[4] This assessment is relative to how the State classifies each water body; the classification is based on its designated uses. For each set of uses the State recommends the minimum water quality criteria[5] to support them. For instance, class A water bodies provide drinking water, excellent animal habitat, and are safe for both primary (e.g. swimming) and secondary (e.g. canoeing) recreation. The Mystic River is designated as class B:

> These waters are designated as a habitat for fish, other aquatic life and wildlife, including for their reproduction, migration, growth and other critical functions, and for primary and secondary contact recreation. They shall be suitable as a source of public water supply with appropriate treatment. Class B waters shall be suitable for irrigation and other agricultural uses and for compatible industrial cooling and process uses. These waters shall have consistently good aesthetic value.[6]

Illich (1985), and more recently Linton (2011) have problematized the notion of universal water, urging that it is always produced by particular ways of knowing. Illich's project was to go beyond the reduction of water to matter in the form of H_2o and to historicize its symbology, materiality, and uses. Linton traced the historical emergence of scientific ways of knowing water as an abstract quantity in the nineteenth century; this notion, he argued, was instrumental to the consolidation of regulatory state apparatuses, and it became hegemonic: "modern water is the presumption that any and all waters can and should be considered apart from their social and economic relations and reduced to abstract quantities" (Linton 2011: 14). Linton revealed the social and cultural relations embedded in allegedly objective, universal and apolitical ways of knowing water. We might say, however, that State criteria for water quality do not so much take water apart from social and economic relations but rather redefine their connections. They redraw relationships between water flows, human bodies, practices, industrial and agricultural technologies, and non-human organisms. For instance, industrial cooling has to be balanced with the requirement of particular cycles of water temperature that support wildlife; irrigation has to be balanced with criteria for nutrients content. Water is never completely fixed.

---

4) Code of Massachusetts Regulations, Water Pollution Control: "314 CMR 4.00 Surface Water Quality Standards."

5) Dissolved oxygen; temperature; pH; bacteria; solids; color and turbidity; oil and grease; taste and odor.

6) 314 CMR 4.05: Classes and Criteria.

Fish: Flow and Habitat Quality

Every spring adult blueback herrings and alewives leave the ocean and move upstream; the operators of the Amelia dam open the locks to let them pass to the Lower and Upper Mystic Lakes, where they spawn, and then die. The quality of water that constitutes fish habitat and the ease of flow of fish through locks and dams from the harbor to the lakes are connected: people's stories about their experience with fish speak to their concerns with water quality as well as with public access to the river.

A dam between the lakes used to block fish access. Responding to citizens' pressures, the city eventually agreed to build a fish ladder there. Before the ladder was completed, MyRWA performed water quality tests to assess the water habitat in the Upper Lake. The study compared the results of water quality analysis in the lake to the standard biochemical values used as indicators of optimal herring freshwater habitat. The waters of the Upper Mystic Lake were shown to be impaired for all parameters, except temperature and pH.[7] Despite the laboratory assessment of lake water quality as inadequate for herring habitat, fish do indeed thrive and reproduce successfully in the Mystic lakes. Yet, bio-chemical changes in the water affect how and where they can swim, confusing arguments about optimal habitat.

Fish feature in many of the stories monitors recounted about sensorial and emotionally powerful encounters.[8] Before the fish ladder was built, volunteers would scoop up herring at the dam with buckets and would throw them into the lake, an event called the "bucket brigade." John, MyRWA's president, recalls walking to the dam with his recalcitrant nephews, and how excited the children became when they started helping him to throw fish across the dam, scooping them up with their hands. The fish ladder is important for John because, "it has to do with how *viscerally* people react to see fish swimming upstream. And that is one piece of accessing community."

Humans and fish come together in a moment of life-and-death, when people scoop them up to the lake to continue their reproductive cycle. At

---

7) The deeper layers of the lake have a very low oxygen concentration because of the accumulation of old industrial sediments, and processes of eutrophication caused by the excessive release of nutrients from fertilizers: fish can only swim and spawn near the surface (see Chase et al 2010).

8) These stories contrast with the nationalist discourse used by organizations like the Herring Alliance, that trace a direct connection between Native Americans and colonial settlers through herring fisheries (Schick Kenney 2007:4).

the same time, humans and fish are both seen as being impaired by badly maintained public infrastructure. The campaign for the ladder speaks to a recurrent concern: lack of public access to the river. John's account moved from fish to people: "It's the lack of responsibility when investing in community structures. It's the lack of infrastructure. It can be improved, even these very commonsense things: essentially, improved access." In a moment of "becoming fish" (Bear and Eden 2011) the flow of fish merges with that of people alongside the river, which is central to what constitutes good water in Boston.

Invaders and the Ambiguous Water Lily

Where spawning herrings are a strong symbol of the vital power of water, blooming aquatic plants occupy a more ambiguous space. As they expand on the water surface and deep into the bottom sediments, quickly growing "invasive" plants might hinder the flows of organisms and people. However, the status of invasive plants is unstable, and it generates contradictory attachments. As Steven put it,

> [The Japanese Knotweed] really is a pretty plant, it's got gracefully shaped leaves and the flowers are easy enough to look at, but it's just so damn invasive and so I am torn when I see it. And the same with the bittersweet. It is pretty, it's orange and yellow, but it climbs up into the other trees and I guess it chokes them out. So that makes it kind of difficult to enjoy, but difficult to despise it too, because it looks nice.

In 2010 MyRWA scientists measured the expansion of water plant blooms in the past ten years. They discovered that water lilies have been expanding on the river surface at a yearly rate of 25%. Every summer volunteers work to eradicate water chestnut, an invasive plant introduced in the nineteenth century. Water lily, instead, is native to the East Coast of the United States. Both plants grow in dense patches on the water surface, and blossom in early summer. Their decomposition decreases dissolved oxygen concentration, which in turn favors toxic algae blooms, kills fish, and creates stagnant areas attractive to mosquitoes. At a committee meeting in spring 2010, a water quality scientist asked the monitors "What position should we take on water lily? Is it invasive?"

The committee discussed the possible causes and what should, or could, be done. Roger explained that water lily tubers "want" a soft, murky bottom to reproduce. The construction of the Amelia dam on the Mystic River in the 1960s stopped the daily tides that flushed off sediments. More plants create more sediment, which in turn protect the plant's tubers. If the dam were open, salty water would kill the plants. So should water lily be eradicated, and if so, how? John summarized:

> Conceptually we would want to go to a situation where the plants are in balance: water lily is there, but it's not a detriment to the ecosystem. We don't even know what that means right now. So water lily just showed up in 2001, or did it? If it did, then is it native? *What magnitude is native?*

The water quality committee had to assign a status to water lily. The plant occupies an ambiguous category: it is native, but it behaves like an invasive plant. Seen in another way, the plant remains "native." However the water habitat on the Mystic has changed from meandering tidal rivers and salty marshes to a freshwater contained riverbed with a slower, more regular flow. In a guide book, invasive plants are defined as a "species that is able to invade and alter or disrupt an ecosystem. Many exotic plants grow rapidly, displacing the native plants and animals" (Mass DCR 2007). Is the water lily, conversely, a native plant that has invaded an exotic environment? This makes it more complex than "matter out of place" (Douglas 1966), for both matter (water lily) and place (the nature of the Mystic River) are unstable. The monitors' attitudes suggest that the plants' behavior and its effects on water quality—as habitat—are more important than its origins. This is complicated by the elusive idea of a balanced relationship between different life forms, which has to be constantly constructed by naturalizing the state of things of a particular moment. The question moves beyond categorization and becomes one about practice[9] of both plants and humans: what does water lily *do*, and what can humans, water monitors do?

Stories of fish and the ambiguities of water lily show that in the notion of good water, what is considered a proper flow is as important as the life-enabling biochemical properties of water. The Mystic has been changed from a meandering watercourse with a large tidal influx to a linear riverbed with canalized tributaries. As water monitors see it, changes in the flow have created an environment that has made native and exotic plants take too much space on the water, making it difficult for water beings to live and for humans to navigate or swim, and they have stopped fish routes to their spawning grounds; the locally specific politics of urbanization of the Mystic River have also made it difficult for people to get to the river and follow its flow.

---

[9] See also Helmreich (2005) on how the categorization of native/invasive in Hawaii depends on evaluation of the presence or absence of human agency.

Sensing and Counting Unwanted Bacteria

Bacteria thrive in the Mystic River. *E. coli* are the red flag of water quality: every recreational facility makes the result of bacteria counts available to the public: as one of the scientists at MyRWA said, bacteria counts are used as a simple, direct way to tell people about the state of water quality.[10] How do invisible bacteria become perceptible in the Mystic River? Bacteria counts are routinely performed on the water samples collected by members of watershed associations. Roger kayaks weekly on the Charles and Mystic River, collecting samples from spots he thinks might be contaminated. Roger, who is trained in computer and natural sciences, often performs the counts himself. For Roger, water quality sampling has a very important sensorial dimension: bacteria are not just invisible organisms that are simplified and visualized in a lab. Rather, he engages with them guided by his sense of smell. He related a story about seeing a tank overflowing into the river:

> So I got one cup out—I had one of those shoulder-length gloves on—held it out there in the stream flowing off, and yes, I could smell some sewage. But my whole body just started shuddering. Have you ever had your muscles involuntarily shudder? Just holding it there . . . water was running into the cup but also over the fingers in my gloves, I just couldn't stop my body from shuddering. And I attribute that to the smell. I mean, if nothing else, the old, old reptilian part of your brain knows that it's sewage, and so knows that you shouldn't be sticking your hand in that. So I have always trusted my sense of smell ever since.

This account speaks of the role of bodily responses to water and sensorial modes of attention. In this case, experiential knowledge and laboratory quantifications are not in opposition but are coproduced. Roger explained the relationship between what he senses and the results of counts in the lab: by repeating bacterial counts from the same spots on the river over the years, he "calibrated" his nose and can now smell the presence of sewage "down to 500 bacteria colonies per 100 ml."[11] Bacteria counts in the labs are performed via successive dilutions; the higher the numbers of bacteria the

---

[10] Between 2004 and 2007 fecal coliform bacteria counts were substituted with *Enterococcus spp*. in seawater and *Escherichia coli* in freshwater (source: MyRWA).

[11] This result already exceeds state regulations: In the class B water bodies like the Mystic River the geometric mean of (at least five) *E. coli* samples taken within six months should not exceed 126 colonies per 100 ml, and no single sample should have more than 235 colonies per 100 ml (314 CMR 4.05).

more dilutions are necessary to distinguish them from each other.[12] Whenever Roger perceives a very intense odor, he "feels" a particular high concentration, so he asks the laboratory to perform an additional dilution. In this way, bacteria colonies can be counted up to two million per 100 ml. Without this extra dilution, the microscope count can "see" only up to about 250.000 bacteria colonies. Thus, perceived smells can change water quality data. In her work on exposure to toxic substances in office buildings and the politics leading to the emergence of "sick building syndrome," Murphy (2006) suggested that things that are perceptible set the terms for what is not. In her account, technologies of measurement of environmental quality can change "'experience' into quantitative evidence" (Murphy 2006:72). Roger's story shows that sometimes what is sensorially perceptible sets the standards of what it countable.

The meaning of data is then interpreted in particular contexts and for different audiences. Concerns about the health of the body, the community, and the watershed converge in the practices, discourses, and representations of microbiopolitics. Paxson (2008) has written about microbiopolitics, in the context of regulations for artisanal cheese making in the United States, as the regulations of encounters between humans and microorganisms. Monitors aim to produce a convincing database to persuade communities to take a stance on water quality issues, cities to repair and maintain water infrastructure, and the State to enforce environmental regulations. On the Mystic River, care of the river, care of the body, and care of the data (Fortun 2005) come together.

Conclusion

Monitors form and enact water quality as a particular category and a subject (Raffles 2002:8). Water quality operates as a malleable concept that connects different social contexts, organisms, ways of knowing, technologies, and institutions,[13] but also creates divides between them. The

---

12) Without dilutions, high concentrations of bacteria would form an undistinguished, uncountable mass. The number of bacteria counted on the plate is divided by the dilution factor so that the result is always expressed in terms of bacteria concentration in 100 water ml regardless of the number of dilutions performed.

13) This speaks to the concept of "boundary object," which sociologists of science Star and Griesemer (1989) used to describe loosely defined entities around which heterogeneous social actors can coalesce and cooperate, with each maintaining their own viewpoint. However, water quality never ceases to be constantly remade and renegotiated even within the community of MyRWA's water quality monitors.

process through which data collected from each site is made to say something about the Mystic River is mediated by State parameters, laboratory practices, political commitments, experiential knowledge, and emotional or sensorial connection with living water beings like herring, water lily, and *E. coli* bacteria. Water quality is constructed as a combination of laboratory data and judgment of the presence of particular living beings in the river. These riverine engagements influence the way data is obtained, how it becomes meaningful, and may even bypass it.

For my informants, water enables connections between human and non-human organisms: they construct scientifically legitimized assessments of water quality by paying attention to the social and ecological balances and relationships between them, and through this they also think about the quality of human life. These practices speak to the "materiality of scientific experimentation: how criteria for what counts as ecologically and/or politically relevant get built into scientific experiments" (Schrader 2010:3). Water monitors draw parallels between movement, form, and quantity of water beings and water flows to construct forms of water quality in a process of sense-making (Fortun and Fortun 2005). The river, for the monitors, is made of those living encounters mediated by matter and flows.

References

Alley, Kelly D. 2002. *On the Banks of the Ganga; When Wastewater Meets a Sacred River*. Ann Arbor: University of Michigan Press.

Bear C, Eden S. 2011. "Thinking Like a Fish? Engaging with Non-human Difference through Recreational Angling." *Environment and Planning D: Society and Space* 29.2: 336-352.

Bourdieu, Pierre. 1977. *Outline of a Theory of Practice*. Cambridge: Cambridge University Press.

Chase, Brad et. al. 2010. *River Herring Habitat Spawning and Nursery Habitat Assessment: Upper Mystic Lake, 2007-2008*. Massachusetts Division of Marine Fisheries.

Classen, Constance, David Howes and Anthony Synynott (eds). 1994. *Aroma: A Cultural History of Smell*. New York: Routledge.

Connerton, Paul. 1989. *How Societies Remember*. Cambridge: Cambridge University Press.

Nash, Linda. 2006. *Inescapable Ecologies: A History of Environment, Disease, and Knowledge.* Berkeley, Los Angeles, London: University of California Press.

Douglas, Mary. 1966. *Purity and Danger: An Analysis of Concepts of Pollution and Taboo.* New York: Routledge.

Desjarlais, Robert. 2003. *Sensory Biographies: Lives and Deaths among Nepal's Yolmo Buddhists*. Berkeley and Los Angeles: University of California Press.

Feld, Steven. 1982. *Sound and Sentiment: Birds, Weeping, Poetics, and Song in Kaluli Expression*. Philadelphia: University of Pennsylvania Press.

Feld, Steven and Keith Basso (eds). 1996. *Senses of Place*. Seattle: School of American Research Press.

Fortun, Kim and Mike Fortun. 2005. "Scientific Imaginaries and Ethical Plateaus in Contemporary US Toxicology." *American Anthropologist* 107.1: 43-54.

Fortun, Mike. 2005. “For an Ethics of Promising, or: A Few Kind Words About James Watson.” *New Genetics and Society* 24.2: 157-173.
Haglund, Karl. 2003. *Inventing the Charles River*. Cambridge: MIT Press.
Haraway, Donna J. 2008. *When Species Meet*. Minneapolis: University of Minnesota Press.
Helmreich, Stefan. 2005. “How Scientists Think; About ‘Natives,’ for Example. A Problem of Taxonomy among Biologists of Alien Species in Hawaii.” *The Journal of the Royal Anthropological Institute* 11.1: 107-128.
——. 2011. “Nature/Culture/Seawater.” *American Anthropologist* 113.1: 132-144.
Howes, David (ed). 1991. *The Varieties of Sensory Experience: A Sourcebook in the Anthropology Of the Senses*. Toronto: University of Toronto Press.
——.2003. *Sensual Relations: Engaging the Senses in Culture and Social Theory*. Ann Arbor: University of Michigan Press.
Kirksey, Eben S. Stefan and Helmreich. 2010. “The Emergence of Multispecies Ethnography.” *Cultural Anthropology* 24.5: 545-575.
Linn Geurts, Kathleen. 2002. *Culture and the Senses: Bodily Ways of Knowing in an African Community*. Berkeley, Los Angeles: University of California Press.
Linton, Jamie. 2010. *What is Water?* Vancouver: University of British Columbia Press.
Massachusetts Department of Conservation and Recreation (Mass DCR). 2007. *A Guide to Selected Invasive Non-Native Aquatic Species in Massachusetts.* Boston: DCR.
——. 2009. *Mystic River Master Plan.* Boston: DCR.
Merleau-Ponty, Maurice. 2003 [1962]. *Phenomenology of Perception*. Trans. C. Smith. New York: Routledge.
Murphy, Michelle. 2006. *Sick Building Syndrome and the Problem of Uncertainty: Environmental Politics, Technoscience, and Women Workers*. London, Durham: Duke University Press.
Mystic River Watershed Association, *Records 1967-2001*, Digital Collections and Archives, Tufts University.
Parr, Joy. 2010. *Sensing Changes: Technologies, Environments, and the Everyday, 1953-2003*. Vancouver: University of British Columbia Press.
Paxson, Heather. 2008. “Post-Pasteurian Cultures: The Microbiopolitics of Artisanal Raw Milk Cheese in the United States.” *Cultural Anthropology* 23.1: 15-47.
Raffles, Hugh. 2002. *In Amazonia: A Natural History*. Princeton: Princeton University Press.
Schick Kenney, Amy. 2007. *Empty Rivers; the Decline of River Herring and the Need to Reduce Mid-Water Trawl Bycatch*. Herring Alliance.
Schneider, Khrista L. 1997. *The Mystic River Inventory, Analysis, and Opportunity Issues Facing the Design and Development of a Comprehensive Master Plan*. Boston: MDC.
Schrader, Astrid. 2010. “Responding to PfiesteriaPiscicida (the Fish Killer): Phantomatic Ontologies, Indeterminacy, and Responsibility in Toxic Microbiology.” *Social Studies of Science* 40.2: 275-306.
Seremetakis, Nadia. 1991. *The Last Word: Women, Death and Divination in Inner Mani.* Chicago: University of Chicago Press.
Star, Susan, and James Griesemer. 1989. “Institutional Ecology, ‘Translations’ and Boundary Objects: Amateurs and Professionals in Berkeley’s Museum of Vertebrate Zoology, 1907-39.” *Social Studies of Science* 19.3: 387-420.
Stoller, Paul. 1989. *The Taste of Ethnographic Things: The Senses in Anthropology.* Philadelphia: University of Pennsylvania Press.
Strang, Veronica. 2004. *The Meaning of Water.* Oxford, New York: Berg.
——. 2005. “Common Senses: Water, Sensory Experience and the Generation of Meaning.” *Journal of Material Culture* 10.1: 93-121.