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# How I found my path in fisheries

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As with so many environmental scientists, I was raised by parents who thought children should spend a lot of time outdoors. We were fortunate to have woods, fields, and a pond, so I had plenty of places to explore. I should also comment that with a smaller world population size in the 1950s and '60s, massive housing developments in our part of New York were in the future. And we saw that land get sold off and change.

I have a Swedish mother, and we ate a lot of seafood in my childhood. In those days, seafood was cheap, diverse, and plentiful. My mother would always go to a fish market where sawdust coated the floor, some fish products were salted in barrels, and most of the fish was fresh-caught and local to Long Island Sound. The biggest treat was when blue crabs were available; my mother would bring back a shopping bag full of them, and we'd throw them into a pot of boiling water. Occasionally one would drop onto the floor and scuttle off; it was a challenge to retrieve the fugitives.

Our pond was connected to the Mianus River; I think a neighbor upstream may have stocked another pond with brook trout. My brother and I baited hooks with worms we dug up, tossed lines into the water, and waited until our bobber floats were pulled under – oh, the thrill of engaging! My first encounter with fishing regulations was my father measuring my catch and returning the undersized trout to the pond.

As I grew older, my interests turned to water itself. Pollution had become a serious problem and was growing nationwide. Water pollution was visible, at times smelly, and caused people to turn their backs on water and try to ignore it. The first Earth Day in 1970 was an environmental awakening for me and many others. This theme of caring enough for Nature to do something about it expanded through the 1970s, resulting in the U.S. in the passage of landmark legislation: the National Environmental Policy Act, the Clean Water Act, the Clean Air Act, and other important laws.

I arrived at Vassar College in autumn 1973. This was still a time of great political upheavals, protests, and actions. I took my classes but was somewhat directionless. As luck would have it, the job-seeking letter I wrote in the spring to the non-profit Hudson River Sloop Restoration, Inc.,<sup>1</sup> was answered by Tom Whyatt. Tom was a young environmental lawyer who had been hired by a small consortium of nascent environmental groups to serve as the first Hudson Riverkeeper, inspired by the British river keepers who minded the health of rivers and streams. An old Federal law, the 1899 Rivers and Harbors Act, was still on the books and forbade the pollution of navigable waters; furthermore, it provided a generous bounty—half of the fine—to those who turned in polluters. Tom's position had been funded by such a bounty, and he set out to develop a community based program to catch and stop polluters of the Hudson and its tributaries.

<sup>1</sup> This was the original name of the NGO Clearwater. Its original mission was to build a replica of a 19<sup>th</sup> century Hudson River sloop, sail it up and down the river holding festivals, and draw people down to the river to appreciate its beauty and inspire them to support cleanup. Many musicians were brought in to perform at the festivals.

I was hired for the summer along with John Harris-Cronin, an unemployed dancer who'd become friends with the folk singer Pete Seeger and his family. Together we formed the field team of Tom's "People's Pipe-Watch" program; we were paid (not much) from the proceeds of one of Pete's concerts. Tom received mailings of permits issued by the then-new Environmental Protection Agency's National Pollutant Discharge Elimination System or NPDES. These were essentially permits to pollute, but were meant to put industries on a schedule to get rid of their discharges. Tom used the permits to identify local companies that might be particularly problematic. John and I, sometimes taking John's canoe, would scout out these companies from their lackluster back-sides (or undersides) facing the Hudson or a tributary. But also, we would try to schedule a meeting with a company engineer to discuss their problem and ask to see their regulated discharge. If we saw something, we would return uninvited and sample the discharges. We drove them on ice down to Yorktown Heights, to a lab set up in a trailer in Dick Knabel's backyard. Dick, who served on the Sloop Restoration's board, was a high school chemistry teacher with a passion for the environment. He took his best students and trained them in analytical chemistry in this lab, which was certified by the New York State Health Department, so had legal acceptance. The lab was called the Student Educational Workshop in Environmental Research, or S.E.W.E.R. (you can't make this up!).

It was a pretty amazing summer for a soon to be college sophomore. Our investigations led to two Federal prosecutions under the Clean Water Act—although not the first, they were very early in the history of that act's implementation. The most egregious polluter, a tape manufacturer, settled out of court, though I had been prepared by the prosecution to testify. They impounded my notebook, but I still possess the copy they made for me. This taste of direct engagement with environmental action set my direction at last, and I majored in Ecology/Conservation, eventually picking up a double-major in Biology.

I dwell on this part of my life because these experiences had such a large impact on my career direction; and it was so different in a world without smartphones, let alone internet and the widespread availability of data resources that we have now. Thinking back on my driving around in a 1963 VW beetle that broke down a lot, that activist summer taught me to be resourceful and improvise where needed, among many important lessons.

Skip forward to my Master's program in Environmental Engineering Sciences at the University of Florida. I was privileged to study under Howard T. Odum, a "giant" in the field of ecology. What eventually morphed into ecosystem science was called Systems Ecology, and in Odum's group we studied ecosystems through the lens of energy flow. This numeraire permitted inclusion of human dominated systems as subsets of ecosystems and enabled comparisons across systems.

Through Odum, I was introduced (again by a letter, as this was long before email) to Ann-Mari Jansson at Stockholm University. Ann-Mari and her husband Bengt-Owe had come to the University of Florida to learn Odum's whole-system modeling approach; they brought the paradigm back to Sweden and set up a long-term study of the Baltic Sea that produced many PhD dissertations and served as a regional model itself.

Ann-Mari had initiated her own interdisciplinary study of the intertwined ecology and economy of Gotland; Jim Zucchetto, who received his doctorate under Odum, was the co-principal investigator and chief modeler. Ann-Mari invited me to come spend time working on the project; she was good at finding money, and so I was supported with unspent funds from the Swedish Institute. She asked me to study Gotland's fisheries as a coupled ecological-economic system; this became part of my Master's thesis. But overall, the Gotland Project was, unknowingly, an incubator for what became the field of ecological economics, blending with the works of Robert Costanza, Herman Daly, and others. It added new dimensionality to my interdisciplinary training.

Eventually I returned Stateside, and found a job up at Cornell University at the Ecosystems Research Center (ERC). Funded by a long-term EPA grant, the Center's mission was to provide guidance and advice to the EPA on relevant topics. I was hired in to help finish a book on the role of science in environmental impact assessment, using the Hudson River as case study.

My boss at the ERC, the great mathematical ecologist Simon Levin, recruited me to become his Ph.D. student. By this time, I had decided that any further graduate study that I would engage in would have to involve active field work, experimentation, and theoretical modeling. I had been a "desktop ecologist" for too long, sifting through and synthesizing data that others had gathered. It was time for me to develop my own project. This was no trivial task, and took me a number of tries before something started to click.

I ended up taking a 90-degree turn in ecology, diving into population ecology and life history theory. It brought me into contact with the anadromous herrings, a taxonomic group with richly diverse life histories. My dissertation focused on the spectacular emigration of juvenile American shad (*Alosa sapidissima*) from freshwater nursery grounds out to the sea. Wanting to track the migrations of these delicate fish, I ended up learning from Ed Brothers how to locate, prepare, and read their otoliths. This was grunt work at its best (or worst).

At one point, after examining many hundreds of samples, I encountered an otolith that "told" a story of growth that was completely different from anything I'd seen. I couldn't believe that it came from the same river. Eventually, I was put in touch with Dave Secor, a new post-doc at the Chesapeake Biological Lab. Dave had pioneered using otolith strontium:calcium ratios to track migrations of striped bass out of estuaries. In our phone conversation, Dave encouraged me to go down to Cornell's Geology Department to see if they had an electron microprobe to analyze my strange sample. Sure enough, I found one, and what a thrill it was to see that the strontium:calcium data showed that the fish had started out in fresh water, moved to sea, and then returned to brackish water where it had been trawled up by the Hudson River Fisheries Unit of the state agency.

My excitement, running up from Geology with my new data, inspired a faculty member to write to the Dean and obtained \$400 for me to continue this work. I loved this analysis, because it brought together my background in ecosystems together with my



FIGURE 1  
Photo of the author and a cod.

new world of fisheries. Little did I suspect that this would become a foundational pillar of my later career.

There are too many threads to cover in a short essay, but since this could be read by early career scientists, I want to mention a few more differences between then and now. In early days, mostly in college and in my Master's program, discrimination and harassment of women students was commonplace. I wasn't paid the same as men doing the same job, and faced harassment both subtle and overt. It was the same for my female peers, and unheard of amongst my male fellow students. Second, in grad school it was a luxury to be supported on a research project. At UF, Odum was great at putting students on projects so they could buy groceries and pay the rent, even if the project did

not form the basis of the thesis. At Cornell, we grad students had to fend for ourselves a little more; many Ph.D. students were teaching assistants, but also applied on their own for small grants. I was fortunate to find funding for my shad research, but could not have done it without guidance from outside. So some advice for students today: not everyone can land full funding on a faculty research project, and you have to keep your eyes open for opportunities.

As my career developed, I am thankful to the many, many people who opened doors for me and allowed me to pass through. I had no inkling as a Master's student that I would end up as a fisheries professor (Figure 1) at an environmental school, but it has been a pretty cool journey.

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