life science lies of the san francisco estuary watershed

Recently, my boss stated that I was a "great scientist," and contrary to his intention to compliment, I felt disgusted, insulted, degraded, defamed by such an appellation. I yearned to vomit that stain off me. Never, during my often desultory/delusional adult life, have I considered myself a scientist. Even in my most ludicrous fantasies I didn't envision myself as one. In a few nonsense scenes, I saw myself as a big bad G-man with lots of independent power, in which I understood, through science, how the plants and animals and rocks and algae related, but the science was only a means for building fishy, self-perpetuating ponds and small lakes or dismantling dams for salmon sake, with me having vast knowledge of both the engineering and biological aspects of such big undertakings. In other words – me as demigod. Silly and sinister, I know. In a less fantastical mind-film, I'd many aquaria in my garage at my remote mountain cabin where I conducted experiments, experiments not destined for peer-reviewed scientific journals but merely to enhance my understanding of fishes so I could catch 'em better. And the truth for why I went to college and majored in fisheries science – it was only because I wanted to catch more fishes and more of each. That was it – purely selfish, no direct sanctimonious desire to do anyone else any good. After I'd earned my bachelor's degree and was working as, titularly, a "scientist" (I was mainly an environmental-document editor) with the California Department of Water Resources, my girlfriend asked me what my ideal job was, and it certainly wasn't the one I had or as some academic running experiments on fish and publishing papers in sci pubs and pontificating at conferences – it was to be a consultant to tackle manufacturers to craft more-effective lures. So science was never my main focus in my fantasies or daydreams but merely a tool for a greater purpose: as demigod, as lure-designer, as fisher, with the latter true, the former arrogant self-denial, the middle with some veracity (I frequently have to alter tackle to increase effectiveness). Even after earning a master's degree in ecology and embarking on a long-term career as a fisheries biologist in the San Francisco Estuary Watershed, I studied, performed, and communicated science, it occupied much of my time, but never was it an end, and never did I consider it my primary role – I was foremost a natural historian and fisher.

Still, while in college and then in my early fisheries career, had someone called me a scientist, I would've felt uneasy about it, but I wouldn't have loathed it like I increasingly have the last several years. Back then, I venerated science, prided myself on being associated with it. I assumed that if it was published in a peer-reviewed journal, then it was perfectly sound information, like gospel. Being insecure and desperate for some signs that I'd ascended a pecking-order ladder, I initially gobbled up with infatuation all the jargon of the discipline, shit such as "predating" (not *preceding*, but *to eat*), "metamorph" (frog), "ichthyofauna" (uh…fish). I genuflected to statistics. And the peer-reviewed stuff did help me catch more species of fish and more of 'em – did improve me as fisher.

Gradually, though, I felt something wrong with what was labeled "science" in my watershed. I can remember no threshold, no epiphany, just a slowly fermenting, uneasy, distasteful sense that something was seriously wrong with both the endeavor and its practitioners, finally reaching my current gangrenous agony and forcing me to extricate myself of it with this essay. I recall a few early warning signs. I reviewed a paper about San Francisco Estuary marsh fish assemblages (Gewant and Bollens 2012) destined for a reputable scientific pub, and the authors

misassigned life-history stages as well as ecological type to many fishes. A few examples: they classified yellowfin goby as a "resident" of freshwater marshes (yellowfin can't spawn in fresh water), and their "adults" were all juvenile fish; they also had the timing of king salmon runs totally wrong. It was clear that they knew very little about their study subjects, and yet here they were writing a tract to add to the canon. A few years later, Bill Fleenor, a warm, walrus-lookin', robust, ruddy, brilliant hydrologist highlighted even more the problem. A paper he'd rejected as a reviewer for one journal was resubmitted to another and published there (Fox *et al.* 2015). It calculated the evaporation rates of the pre-dam/diversion San Francisco Estuary Watershed riparian plants, which were far more abundant back then than now, and how that affected riverine outflow and thus saltwater intrusion. Their conclusion was that the evaporation rate of the plants was nearly the same as diversions out of the watershed today, and so the difference in saltwater intrusion before and after all the diversions was nearly the same. Internally, the paper reads well, but as Bill pointed out, it was all bullshit because they used the current channel network to model the pre-diversion period, and they are way different. Back then, the channels were much narrower, so it took considerably less fresh water to push the salt water downstream. That was why Bill rejected this paper – with sound truth – and yet, the writers didn't admit their mistake, but tried to find some other outlet to publish their bullshit.

A few more examples.

Striped bass in the San Francisco Estuary is a very popular non-native sportfish, which has predisposed 'em to much attention from fisherpeople as well as scientists, the latter of whom in the early years sought to understand 'em to increase their numbers for the fishery, and lately want to exterminate 'em because they wear today's pejorative of yesterday's "trash fish": non-native. Long ago in the early 1950s, the distribution of the bulk of the adults was well-known: they were in saltwater bays and in the inshore ocean during summer, the Delta and fresher-brackish parts of the estuary in autumn and winter, and in the rivers to spawn in spring. Calhoun showed that very well in his 1952 paper, and even Tom Stienstra, with whom I often disagree, knows the same thing (2012, pp 65-66). Most guides fishing for stripers parallel the location of the mass of fish: they're in the upper estuary in autumn and winter, in the rivers during spring, and either in San Francisco Bay or hugging the coast north and south of the Golden Gate by about 75 miles during summer.

So – a smart dude in my group, an outstanding hunter and fisherman and biologist, brought to my attention a paper about cues triggering stripers to migrate up the rivers here in the watershed (Goertler *et al.* 2021). He smelled something fishy (ha, ha) about it, and he was right. The lead author is a woman whose work is largely focused on salmon, and it's notable that much of the paper's introduction about migrating fishes references salmon studies, not striped bass studies. Anyway, they used a bunch of flow and temperature variables to see if they corresponded to catches of stripers in the spawning river, including river flow (no doubt important); mean springtime temperature in Suisun Bay (okay, though degree-days – in other words, the accumulation of heat – would've been a more appropriate choice since the more heat ya got, the faster reproductive development, and therefore the earlier fish can run up and spawn); and…spring ocean conditions at the Farallon Islands. Think about that for a second given the historical knowledge of both fisheries biologists, such as Calhoun, and fisherpeople, such as Stienstra. Where are the bulk of the adult striped bass in spring? When in salt water, where are they at?

What on earth do conditions at the Farallon Islands 30 miles out from the Golden Gate have to do with fish that are more than 50 miles *inside* Golden Gate?

Should I put snow chains on if I'm in Sacramento because it's snowing in Truckee? No, because what the roads are like in Truckee ain't got shit to do with what they're like in the capital city. And so what the temperature at the Farallons has to do with a fish in Montezuma Slough or Honker Bay or Cache Slough is…nothing. And they found it was a significant predictor, and it's obviously a totally spurious finding – it's nonsense.

Tellingly, the Calhoun paper wasn't cited at all.

And this was published in the revered *Nature*…

Here's some more nonsense, this time about the poor, abused Delta smelt, a showpiece of the Endangered Species Act. A paper came out in 2019 (Hammock *et al.*) examining whether Delta smelt ate better near tidal wetlands along the main waterways of the estuary, tidal wetlands the big government water agencies (California Department of Water Resources and the US Bureau of Reclamation) have been using as mitigation to keep diverting water out of the estuary. Something about this paper just didn't seem right to me, but it took me a while to figure it out.

We've tons of data about lots of stuff in the San Francisco Estuary; my main job for 17 years was continuing that data collection with the Suisun Marsh Fish Study. So light could be shed on most hypotheses or questions with data already available. And for this paper, much could've been – *should've* been – quarried or considered. First, a very simple deduction – if tidal wetlands are really good for Delta smelt, and tidal wetlands, by definition, are shallow and *the* shore – then Delta smelt catches should increase with decrease in both depth and especially distance to shore. However, one of the better Delta smelt ecology papers published (Bever *et al.* 2016) that considered those two variables found that distance to shore had nothing to do with abundance and that shallower water was weakly related to higher catches, but mostly because the water was slower where shallower, and water speed affected abundance substantially. That no relationship existed between distance to shore and abundance alone suggested that tidal wetlands were unimportant to Delta smelt. Second, they could've used Suisun Marsh Fish Study data. It's simple deduction that if Delta smelt really dig tidal wetlands, then they should be most abundant at sites in Suisun Marsh where the area of adjoining tidal wetlands relative to the area of the slough should be greatest, First Mallard and Peytonia sloughs especially [*i.e.*, "marsh to open water (OW)"; Table 1 (from Colombano *et al.* 2020)]. But that's not the case – in the entire study's history, they were most abundant in bigger, deeper sloughs bordered by diked wetlands (mainly lower Suisun Slough) and often close to the estuary's mainstem: Suisun Bay (Figure 1, Table 1). And across sites of the smaller sloughs, the one that had the most Delta smelt (GY3) was the small-slough site closest to the bay…and it was surrounded *exclusively* by managed wetlands (just take a gander at any Google Earth image to see that), not tidal (it's also noteworthy that two-thirds of the Delta smelt catch in First Mallard Slough were netted at the downstream site (SB2), which is just a stone's throw from big ol' Suisun Slough; Figure 1). And that's acknowledging that, yeah, our ability to catch 'em at the bigger, deeper sites is less than the shallower, narrower ones – even more Delta smelt were in the big diked sloughs than our catches showed. And we've seine data, too, for Suisun and Denverton sloughs, and of the two, Denverton should've had more fish, being shallower and having its whole river-left side bordered by tidal wetlands – but it didn't, the big slough, Suisun, did (Figure 2). So that doesn't agree with tidal wetlands being super-duper for Delta smelt, either.

THIRD – and yeah, there's a third – is an omission of history. Yep, the SFE had lots of tidal wetlands for thousands of years, coinciding with Delta smelt, and yep, most of those tidal wetlands were transformed into something else, mostly farmland but some managed wetlands, most notably in the marsh. So it's easy to reason that there were lots of tidal wetlands before the Gold Rush, no doubt there were more Delta smelt, now there're few tidal wetlands and NO Delta smelt (at least *real* ones – wild fish, not domesticated hatchery fish), so bring back the tidal wetlands and – ta da! Delta smelt should follow. Big problem: the landscape of the estuary has been pretty much the same now for nearly 100 years, and it was in that landscape that many Delta smelt were *still* swimming around back in the early 1960s when Cal Fish and Game did a ton of surveys (Kelley 1966, Turner and Kelley 1966) prior to the State Water Project being built. It wasn't until diversions south really began increasing, overbite clam was introduced, the water really began to warm, and then, in the early 2000s, when the watershed became sediment-limited and began to clear, then clearing further with increased aquatic plant growth, which converted pelagic habitat into littoral, that THEN Delta smelt really took a huge blow. Note tidal wetlands had no role there.

Table 1. Landscape and waterscape features of Suisun Marsh sloughs ("OW" = open water; from Colombano *et al.* 2020).

Slough	Code	Marsh:OW	Pond:OW	Upland:OW	Land:OW	Wetland:OW
Boynton	BY1/3	2.2	7.7	0	9.9	9.9
Cutoff	CO1/2	5.55	3.91	0.13	9.59	9.46
Denverton	DV2/3	3.27	3.07	2.2	8.54	6.34
Goodyear	GY1/2/3	7.04	9.18	0.17	16.38	16.21
Montezuma	MZ1/2	0.26	3.18	0.26	3.71	3.45
Nurse	NS2/3	1.45	1.95	0.04	3.45	3.41
Peytonia	PT1/2	8	5.08	0	13.08	13.08
First Mallard	SB1/2	14.25	0	2.24	16.49	14.25
Suisun Upper	SU1/2	0.9	1.26	0	1.94	1.94
Suisun Lower	SU3/4	0.68	1.18	0.15	2.22	2.08

The people on this paper didn't consider any of that, and, indeed, they found that the greater the tidal wetland area close to Delta smelt, the more Delta smelt ate. This is another paper that *internally* reads well, and though I didn't believe it, I couldn't figure out why. Then it dawned on me. Delta smelt like the water muddy. Three areas where these people caught their fullest fish are frequently the muddiest throughout the northern estuary: western Montezuma Slough, Suisun Bay, and Liberty Island. What those locations also have in common is that they are most exposed to the prevailing southwesterly winds that muddy up the water – like Bever *et al.* (2016) noted, but, further – and which wasn't considered – is that they develop windrows more than other areas, and windrows concentrate plankton – Delta smelt food.

Years ago a dude wanted me to get him zooplankton for biochemical analyses. I dragged my net in Montezuma Slough, right where the government agencies sample, but unlike them, I *only* dragged it through windrows. He was always blown away by how many more zoops I got him than the others.

Tidal wetlands had nothing to do with those stuffed Delta smelt in that paper – it's because the wetlands were close to the muddy water where windrows formed most frequently and made it easier for the little fish to catch food (check out Figure 1 again – note the orientation of the NS3 site…southwest to northeast). And the ironic reality is that that little fish is most at home in big water (again, take a look at Figure 1, especially the NS and DV sites), partly because bigger waterways are more exposed to the wind than smaller waterways.

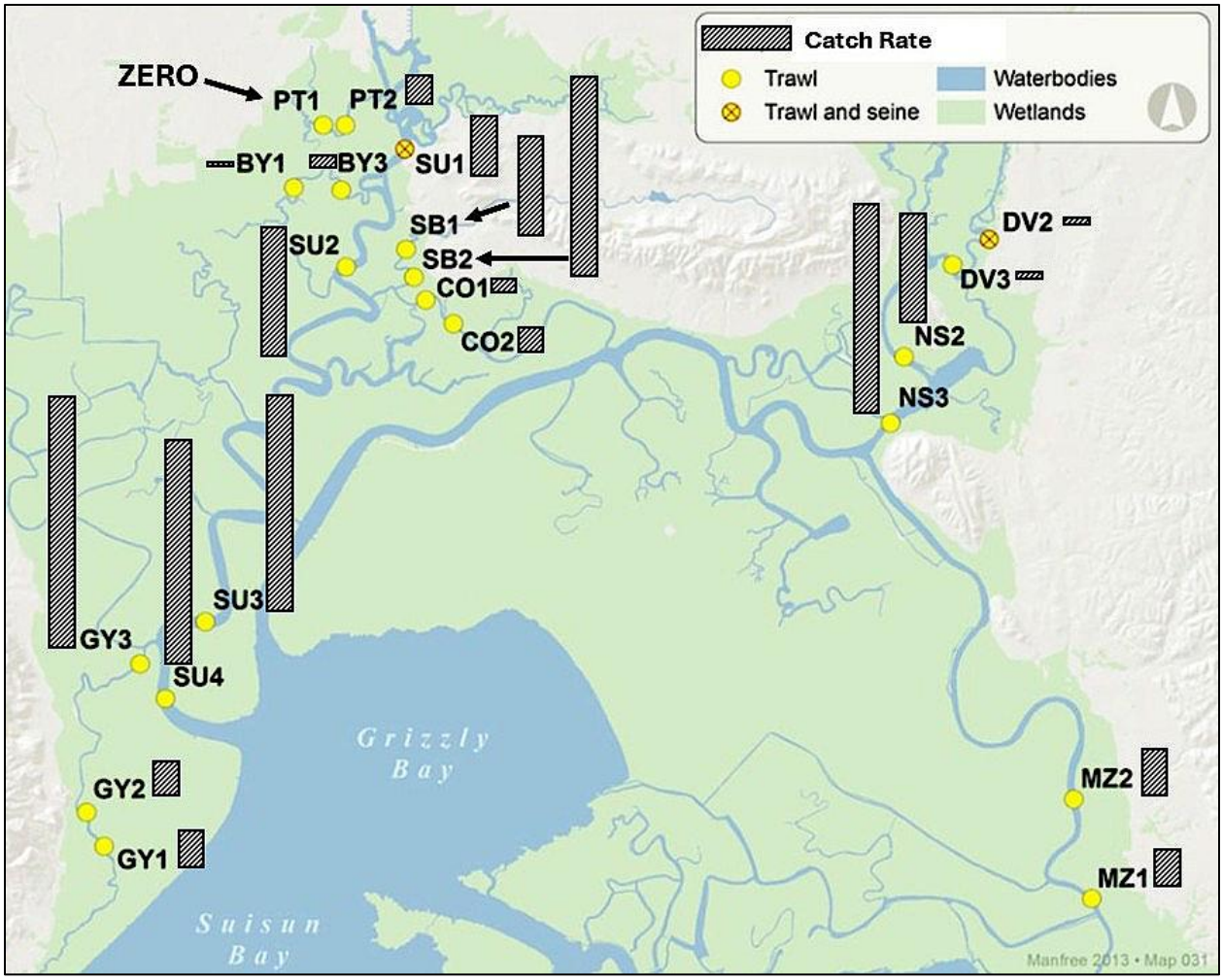

Figure 1. Catch rate of Delta smelt (fish per trawl-minute) at stations in Suisun Marsh, 1980 – 2024. Note Denverton (DV2/3) and Nurse sloughs (NS2/3) were sampled inconsistently from 1980 – 1993, but the pattern remains the same as on Suisun Marsh's west side: more fish in bigger water, unrelated to tidal-wetland presence (codes in Table 1). And don't forget, you poor social-media attention-deficit-addled screen suckers: catches in the bigger waterways are biased low.

An assumption is that our science is supposed to help endangered fishes. It sure as fuck doesn't seem to be helping this animal but, if just following the correlation between number of papers published and their abundance, harming them (Figure 3).

And, by the way, Delta smelt are actually extinct – domesticated fish dumped into the water don't fucking count.

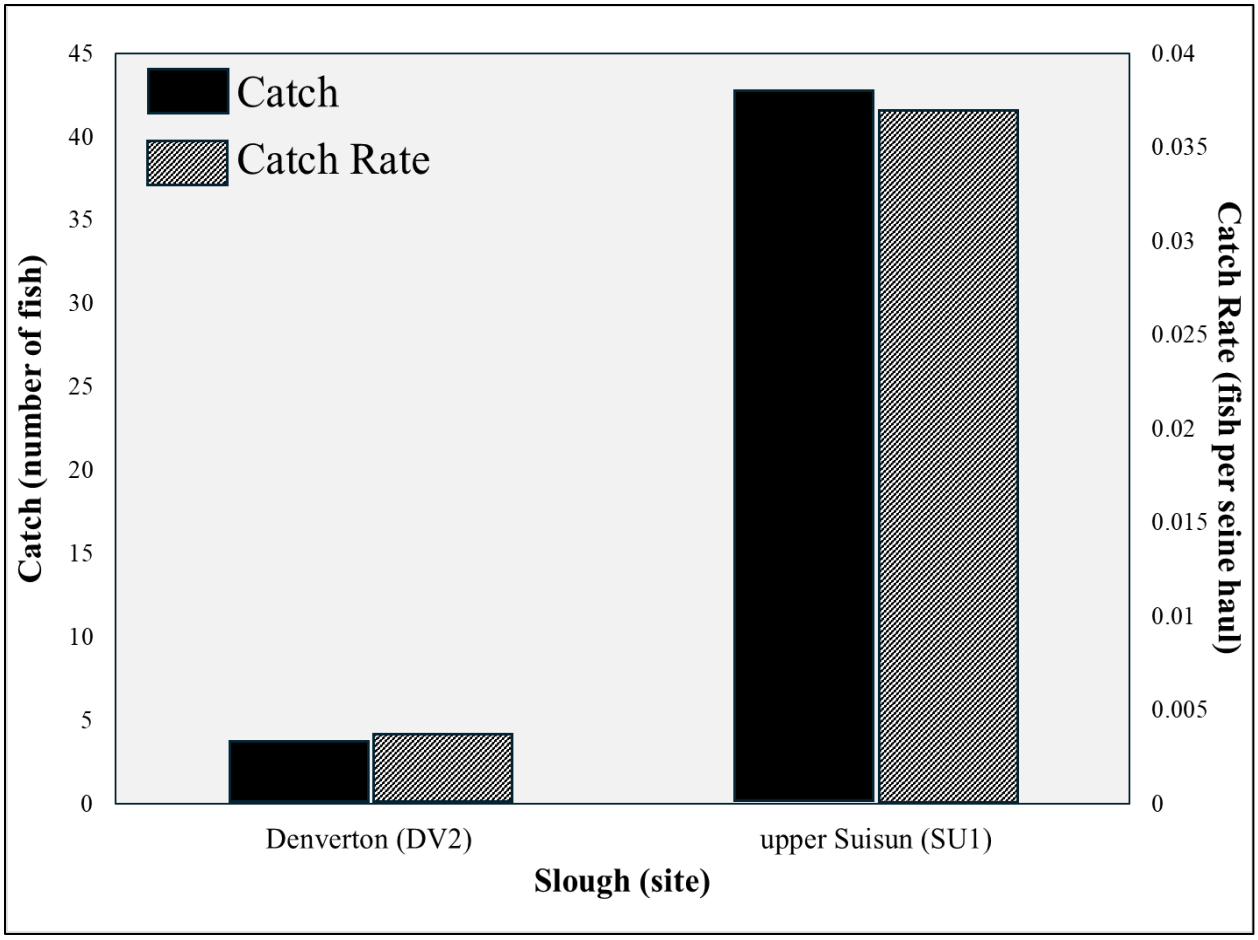

Figure 2. Beach seine numbers of Delta smelt in Denverton and upper Suisun sloughs (see Figure 1 for exact locations; 1,020 and 1,167 seine hauls for each site, respectively) from 1994 – 2024 [1980 – 1993 weren't considered since Denverton was both seined way less than upper Suisun (60 versus 389 seine hauls) and not at all in some years].

And salmon – ah, salmon. King fuckin' salmon, the SFE Chinook, man – another fish plastered with the endangered label (from both state and country) and likewise used and abused despite the professed love of everyone, including fisheries biologists. I love 'em, too – I love all fishes, just my love runs stronger for some more than others, strongest always for wild fishes, especially natives but non-natives as well, mainly stripers, spotted bass, minnows (carp are fucking awesome, as well as our big native minnows: hardhead, splittail, pikeminnow, hitch), and salmonids (mackinaw and red salmon are my soul). And so much research is thrown at kings in our watershed, and yet not only has the recreational ocean fishery been closed the last two years (2023 and 2024), but the river fishery, too. So something, like for Delta smelt, seems seriously broken with our salmon science, and something is – it's not focusing on the main problem. Oh, it goes into deep dives on who eats salmon (uh, everyone, though stripers get the worst press because they're non-native), the thiamine deficiency killing baby salmon from momma salmon excessively eating anchovies, that too much of the SFE is too much like Lake Okeechobee (and that lake ain't salmon habitat), that food's lacking in fresh water (mainly zooplankton) for 'em. And actions have been taken to address these issues based on "science." The agencies collaborated to "remove" (read: eradicate and kill) non-native fishes in the fuckin' sump of Clifton Court Forebay (among

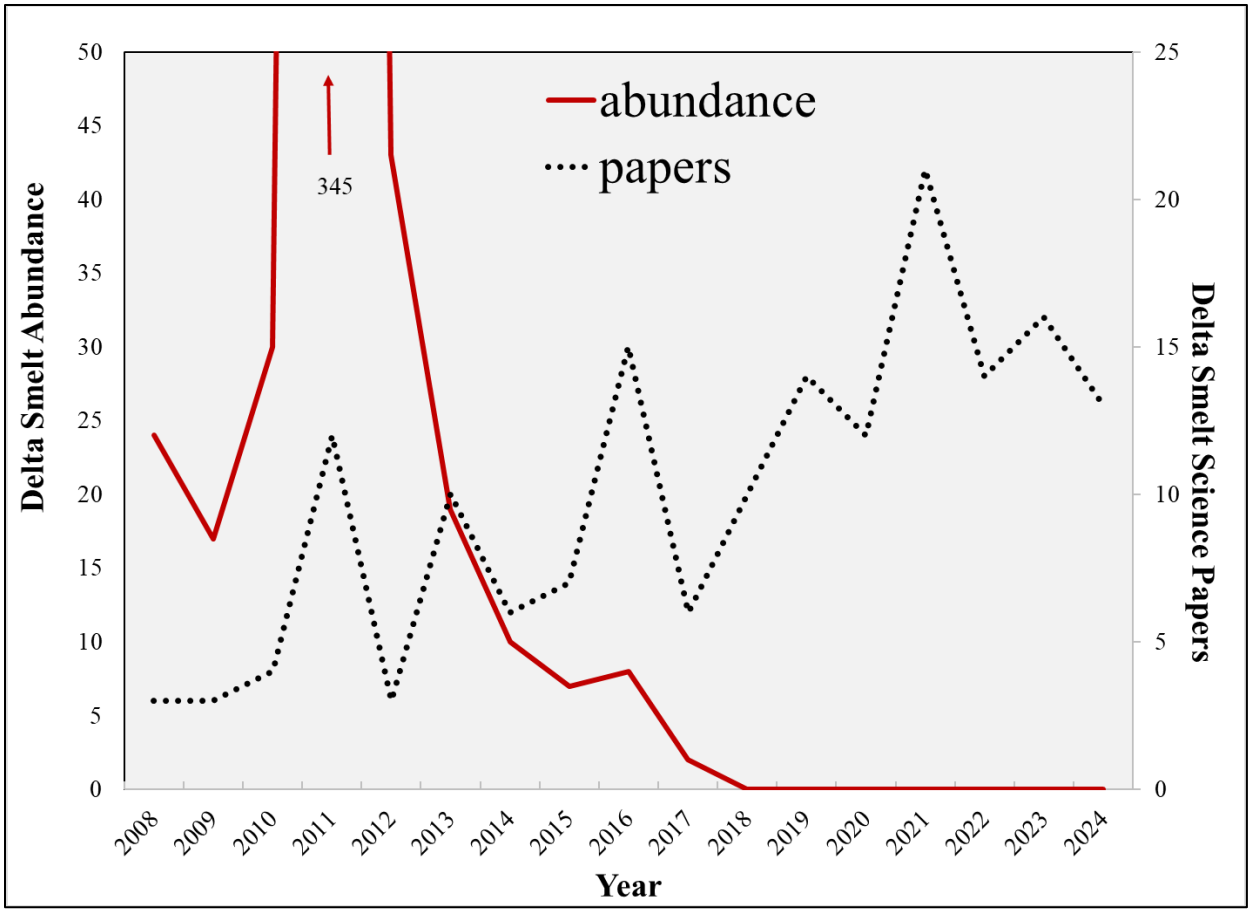

Figure 3. The benefit of science for an endangered fish[1].

other places); people spike returning adults with thiamine like junkies hitting veins; water gets moved around more, mainly on floodplains, to bolster zooplankton; holes get punched in levees to create floodplains and shallow tidal wetlands, the latter of which, for the most part, will become littoral, with submersed aquatic plants (*e.g.*, Brazilian waterweed, coontail) in the Delta and emergent (tules, common reed) in Suisun. And yet, and still, two years of no fisheries.

The problem isn't stripers, it isn't too many anchovies, it really isn't not enough food, and even the encroachment of the littoral is only partly to blame. Because "non-native" typically comes with the implication that the plant or animal or alga is an addition, stripers get a bad rap when they shouldn't – they were a *replacement* for the thicktail chub and Sacramento perch, two other top-dog fish-eating fish, that I aver were wiped out by hydraulic-mining sediment. Hard to fathom that in the thousands of years that salmon have been running up and down the SFE that there haven't been years when 'chovies were dominant. And it's not just kings that'll mow 'chovies, but also California halibut, many rockfish species, stripers when in salt water, calico bass, sand bass, lots of birds, too…and yet, I've not heard a single instance of thiamine deficiency in any of these animals. For sure the estuary don't produce the plankton it once did, but kings range up the Pacific all the way to Alaska, and lots of those rivers ain't got fuck-all for floodplains or estuaries, particularly those flowing down the Coast Range, and so clearly, kings can survive on other bugs.

These problems aren't the real problems, composition and shape and flows of the waterways aside: they're symptoms of the main problem, and that problem is domestication. The problem is the hatcheries, the problem is the smolt-trucking, the problem is the random spawning in the hatcheries. Little kings get eaten because they've lost the sense to avoid being eaten. Little kings starve because they can't recognize real food. When in salt water and they do find food, they focus on that one prey too much (where'd they learn that? Where were they fed only ONE thing? Take a tour of the Nimbus Hatchery raceways, and you'll learn the answer). Any local adaptation gets wiped out by the flood of lost hatchery strays, care of the smolt-trucking. Domestication is the biggest problem - throwing domesticated fish repeatedly into an environment that resembles less and less that in which the wild ancestors evolved and thinking they'll flourish is clearly ineffective, exemplified by the fisheries closures – and insane, as the misattributed Einstein quote summarizes ("The definition of insanity is doing the same thing over and over again and expecting different results").

And man, there seems an infatuation with excessive statistics, an obsession, a seeming need that scientists now feel that to be considered good, they gotta glob up their research with as many arcane analyses and indecipherable metrics as possible. Just a few examples. I had to slog through nearly 40 pages of a food-web paper (Howe *et al.* 2014 – a very pleasant lady, by the way) to learn that cold-blooded aquatic invertebrates are affected by temperature, salinity, and what plants are around, and that little fishes (yellowfin goby, mosquitofish, and Mississippi silverside) eat invertebrates, identity of which depends on the environmental conditions…and figuring that out only took a Macy's Parade of statistics acronyms (ANOSIM, DISTLM, MDS, IS, LFS; the whopping sample size of 37 for the mosquitofish was subjected to that combined-arms action). I have actually been regretfully involved in such submission to modern science's technology-eased orgasmic statistics barrage. We examined the relationships between little aquatic critters (small bottom fishes such as gobies, shrimps) and substrate type – rock, mud, plants (Young *et al*. 2017). Matt, our lead on the paper, ran wonderfully simple statistical tests, simple correlations, that showed prickly sculpin and Oriental shrimp love rock, yellowfin goby dig mud, shimofuri goby don't care, and Siberian prawns really don't, either, so long as Oriental shrimp ain't around. Well – that wasn't good enough for one reviewer, who desired GLMMs with HMCs (don't ya love the acronyms? Don't they seem a bit too frequent to be merely a shorthand, as if they're serving some other purpose?), so poor Matt had to burn another month running all these fuckin' models that showed, well, the same fuckin' thing as the simple correlations.

I could imagine far more valuable things Matt could've done with that month – likewise the additional time readers have had to waste fighting through textbook-length math prose to find out a critter eats food that's nearby or prefers one environment over another.

When my old boss (Moyle) published his big book in 2002, he wrote that Delta smelt like the water cool and fresh or a touch salty. Bill Bennett did, too, in 2005. A few years later, Fred Feyrer and chums (2007) found that, uh, yeah, Delta smelt like it cool and pretty fresh, as well as muddy, as did Matt Nobriga and many of the same people a year later. Fred had to say it again in 2011. Ted Sommer and Francine Meija summarized all this in 2013. Bever and crew's 2016 paper – same thing, with the bonus that they like the water slower. Polanski *et al.* (2018) found the little

fish likes it (er, *liked* it by then) pretty fresh and muddy; Hung *et al.* (2022), cool and pretty fresh; Hendrix *et al.* (2023) – cool and pretty fresh and muddy; and far many others that show, from different angles, well, the same fucking thing[1]. And these are sound papers written largely by smart, decent folks.

As time wore on, reading these papers sure felt more and more like watching TV reruns. After a while, I wondered how much more efficient it would've been if some Patwin and Miwok had been left to live their fisher-hunter-cultivator lives, and if they'd just been asked what Delta smelt dig, I betcha they would've told us Delta smelt like it cool, fresher, and muddy. And I betcha those Americans would've caught 'em better than us Euro/Asia/Afra-mericans.

I've also learned that more king salmon smolts survive migrating through the San Francisco Estuary Watershed when flows are high and directed to the ocean rather than low and to the pumps in the South Delta. Cavallo *et al.* 2013. Michel *et al.* 2015. Plumb *et al.* 2016. Cordoleani *et al.* 2018. Perry *et al.* 2018. Henderson *et al.* 2019. Michel 2019. Notch *et al.* 2020. Zeug *et al.* 2020. Hassrick *et al.* 2022. Wohner *et al.* 2022. Wang *et al.* 2024. Those are just the papers in peer-reviewed sci pubs during my tenure as fisheries biologist and don't include reports and memos and theses and dissertations. Oh, sure, each paper adds a touch more to the pattern of more flow equals better survival – that some reaches are safer than others, that more fish-eating fish equates to lower survival (especially near structures that constrict and funnel the water, such as weirs), but the incremental addition to knowledge, the increasingly narrow focus, recalls words from Lorenz: "Scientists are people who know more and more about less and less, until they know everything about nothing." Isaiah Berlin, too: "…you are trying to catch the uncatchable…wherever you try to nail it down, new abysses open, and these abysses open to yet other abysses" (1999, p 140).

The causes of this bad science in our watershed – and no doubt existing in many other watersheds – are myriad. A big one is context. Bill, at least implicitly, highlighted that in the evaporation paper: the scientists had insufficient temporal context - the history - as did the paper on stripers and the Delta smelt one about tidal wetlands. Lack of history has been a nearly continuous flaw with studies about salmon predation because they don't even consider absence of thicktail chub and Sacramento perch – those papers beam the vibe that the San Francisco Estuary Watershed was an Edenic bastion of peace before the "malignant" striped bass was introduced. Also, scientists lack spatial context, so beautifully criticized by a *real* scientist of the watershed, Jim Cloern, in his 2021 essay. Specifically, he argued that ya gotta *examine the full body of evidence* and ya gotta think critically, which wasn't well-applied to the wetlands Delta smelt paper (they didn't consider all Suisun Marsh, only Montezuma Slough; too, that paper violated a fundamental rule of statistics – you can't leave out any important variables, such as, in that case, the wind). Wordsworth said it from a different direction but much more succinctly: "We murder to dissect" (1798).

Hinged to the lack of context is the statistics avalanche. An increasing number of papers are ever-more bloated by indecipherable statistics, to where the papers are more about the math than the animal or plant or alga, and I doubt many scientists really understand the equations or the

meaning of the metrics. Why? The food-web and marsh-fish-assemblage papers show part of the answer: a lot of biologists, they don't know their subjects – they've little experience with 'em, little context. In both of those papers, the biologists were hired guns from Washington state, flying down to grab samples, then flying back. To negate that ignorance, they ran mountains of statistics, like ignorant mechanics firing off the parts cannon at a car problem – neither is efficient.

While the stats addiction isn't explicitly a lie – results from these papers are often sound – implicitly they reflect a lie, the lie that for science to be good, it has to have a battleship load of statistics. Look: people, life, all are hierarchical, and yeah, scientists are no exception – they wanna be recognized. Unfortunately, rather than taking the magnanimous route and following Einstein's apocryphal quote ("If you can't explain it to a six year old, you don't understand it yourself") and maximizing the spread of their knowledge with plain language and simple graphs and math – and it ain't hard being that most life, such as our fishes, need all we do: a shelter, clean fluid to breathe, food, a mate – eh, they fall into the obscurantist hole of rendering their work as nebulous as possible with the math: it's a status symbol, a sign of belonging to an elite.

Another cause, more subtle - and insidious - is the government's selfishness.

Governments are more than willing to point out when some other group is doing something wrong, but almost never point the finger at themselves. I mean, how many governments started a war and said it was their fault? To address the main problem with salmon would mean that US Fish and Wildlife Service, California Department of Fish and Wildlife, and National Marine Fisheries Service admit that they are now the biggest factor harming salmon through their domestication. The San Francisco Estuary no longer has the ability to support Delta smelt, but for US Fish and Wildlife Service to admit that, they'd have to admit defeat – and that if they'd restricted diversions out of the estuary sooner, they could've retained more Delta smelt in the estuary and thus a greater chance of them being able to adapt to warmer, clearer water and avoid extinction. Even though admitting mistakes is a mature act and allows improvement, is a sign of integrity that builds trust, I've no doubt that the agencies sense being honest would cost 'em: why give money to a group to solve a problem when they're the problem or have already failed? So they scapegoat non-natives and predators and competitors and complain about "knowledge gaps," all these supposedly overwhelming blights on *their* endangered fishes, which, to combat, of course requires more science and money. The result is that so much of the science, performed or funded nearly exclusively by the government, has been focused on these few endangered fishes (smelt and salmon) in just a few places (Yolo Bypass, the Delta) to where many papers are largely redundant, and still those fishes continue to suffer (I hear echoes of the axiom that doctors earn no money when all their patients are well). Even worse, US Fish and Wildlife Service compounds the problem by going down the same hatchery hole with Delta smelt as California Department of Fish and Wildlife has with salmon, which requires even more bucks to "save the species"; I'm not the only one who thinks this is stupid (Kibel 2020), and apocryphal Einstein'd nod his head in amazement and agree with me for a second time.

The science then is a red herring, is no longer science, but instead is propaganda, an example of which I had the misfortune to suffer just the other day (Kerlin 2025).

Putah Creek is a nice little stream that flows off the inner North Coast Range, beginning near Whispering Pines, flowing through grey-pine/oak woodlands until hitting big ol' Berryessa Reservoir, then out the big waterbody through a perennially cold-water section to an afterbay

(Solano Reservoir), then splitting into the South Putah Canal and, flowing to the east, the creek, who – for her bane and boon – rolls by UC Davis and then empties into Yolo Bypass. The creek's proximity to the UC has made her subject of intense legal disputes and research – I once led two field trips to it annually. Peter Moyle arm-twisted the water agency to send more water down that section, which has certainly been worthwhile – the creek now has lots of suckers and pikeminnow, as well as largemouth bass and carp and bluegill and redear sunfish, and, further upstream, numbers of tule perch…lots of birds, too. The creek also now gets pulse flows in spring and autumn to serve as mating/migrating cues for native fishes. The creek was re-waterscaped recently near Winters, transforming it from a big, slow, warm pool environment into a faster, cooler waterway, thereby favoring natives over non-natives, and it worked: many tule perch and pikeminnow and suckers and sticklebacks inhabited that section after the change. And another critter was found up there – king salmon.

Kings got – and get – nearly all the press, with the press touting the kings as a success of restoration, of a job well-done, of the value of all the money and energy (and water) thrown at the creek. The problem, however, is that nearly all those kings – they're not from the creek, they're hatchery strays from other rivers, the Feather, American, Mokelumne, *ad infinitum*. This article went wild because 11 of 407 fish examined from the creek had actually been spawned there – three percent. In other words – 97 PERCENT of the fish were hatchery strays. So nearly all fish were hatchery strays, and yet one egghead considered it a "…growing, stable population…" and riddled throughout was referring to that three percent as "wild." Question 1 of 2: how many kings would be in the creek if none of the smolts were trucked and so knew their way back to their home stream? Question 2: even if smolt-trucking continued, how many kings would end up in Putah Creek if they threw pulse flows down the American and Feather and Mokelumne like they do Putah?

The answer should be obvious – virtually none. And that reflects that the MAIN reason why so many kings are in Putah Creek isn't because of the improved flows and reconfiguration of the channel, worthwhile though those changes have been, it's because of the mismanagement of salmon throughout the San Francisco Estuary Watershed. Most of those fish should be in the American and Feather and Mokelumne, not in the creek…and if that were the case, then the few that DID swim up Putah Creek WOULD have a chance to become wild. But not when they're a measly three percent getting flooded out by the other 97. (And that three percent may be biased high – the potential contribution of kings washing in from Berryessa wasn't even considered.)

And the egghead suggested that hatcheries may help because so many fish stray…uh, wild fish, without all the damning effects of hatcheries, stray too.

This article was far less about science – it was about self-promotion. Propaganda. Yeah, it's cool because it proves that Putah Creek-born salmon can complete their lifecycles by returning to their parent stream, but it's so exaggerated it becomes shameful because the real signals of the intervention's success – the glorious suckers and pikeminner and tule perch and sticklebacks – they get flooded out by the flooding domesticated kings, too. It's kind of insulting.

That, regrettably, highlights that the only fishes really deemed worthy of science are the ones listed on the endangered species acts – those that are legislated, the government's babies. If the critter ain't on there, the critter's assumed to be worthless and not worth research dollars, unless it can be distorted to be an enemy, such as striped bass. The deficiency with this incredibly narrow focus is that it denies the fact that all lifeforms in a place, such as the San Francisco Estuary, are

connected. Yeah, some connections are so weak that you can consider 'em negligible, but many aren't, and if you don't have your finger on the pulse of 'em, then you may conclude wrong answers and commit actions contrary to intentions – such as the Mississippi silverside wonderland that is Blacklock Island in Suisun Marsh (Williamshen *et al.* 2021), which was breached for Delta smelt…and silverside weren't even considered in the planning documents.

No one knows the basic biology of red swamp crawdads in the estuary, which are all over the place and feed so many other animals: largemouth, stripers, pikeminnow, redear sunfish, all heron species, otters, raccoons, and people. No one knows the basic biology of crappie in the estuary, despite their being found in unprecedented salinities. No one knows a damn thing about Sacramento blackfish, a native fish absolutely requiring plankton, despite all the focus on the pelagic smelts. (You'd think they'd receive more attention since so much effort is being thrown at increasing plankton densities – their abundance would be a good index of success.) But we know Delta smelt like cool, fresher, muddy water - again and again and again – and that more little salmon make it to salt water when the rivers are running high and to the ocean – again and again and again.

The tragedy is that it ain't just the aquatic critters that get screwed. I know many of these scientists, most are decent people, they got hearts and souls, but they're being implicitly, insidiously influenced to *not* examine all the evidence or consider all possibilities…and, I fear, maybe a little explicitly, too. It's as if these poor salmon and smelt are whores, and scientists shitting out papers and reports and presentations on 'em are pimps.

What took me a while to realize was that before college, I already was very good at catching many fishes, and that was mainly because of years of attuned observation and experience. And much of the science really added nothing new to what I'd learned on my own but merely corroborated what I'd learned through that attuned observation and experience. And that fact highlights one of the deeper problems underlying the lie of science in our watershed: failure of applying the scientific method.

The scientific method begins very simply with observing a phenomenon, and here, at the start, is where our current life science has failed the most. The classic perception of the first step of the method is that you're hanging out in the Wild, in the woods, on a boat on a lake, wherever, and something notable happens, and a desire to understand it is born, a question is raised. But that don't happen near enough here in our little spot on Earth. No, for way too many biologists, their version of "observation" is reading a bunch of papers – many haven't even spent a day in the environment where their study critter lives (I'd had several "biologists" out on Suisun Marsh for one day because they'd never been where their study critter lived). Yeah, many scientists would consider reading papers a form of observation, but just as anything can vary in quality, it's the poorest form of observation you can get, and that seems a perversion of the definition of *observation*. Seems that this form of "observation" is just studying, preparation. And the problems with this "observation" are myriad. First – just as a map is not the territory, so the paper is not the lifeform or place. It is impossible to fully represent the animal or place with fuckin' digits and letters on paper – all the data can give is a very rough outline, and it takes actual experience with the life to color in those outlines. Second – the data, the numbers, are limited in their ability to

explain a phenomenon because the math is insufficient – so many variables are important, but the math ends up stepping all over itself when trying to calculate their importance. Third – scientific papers, certainly in their current excessive statistics intoxication, will never provide the holistic qualitative context necessary for delineating all possible hypotheses – they can never capture the totality of the place, the smells, the textures, the swish and sway of the water, the shifting light, all of which could be important to our fishes. So if someone ain't out there and frequently engaged in that place, there's a good chance they're gonna miss an important factor affecting their critter (such as the wind and Delta smelt).

And there's even a deeper problem – and yeah, I admit that this is a mouthful - the persistent, intractable dominance of determinism.

A lie has been perpetuated now for over 200 years: the lie that knowledge of life can be perfect, that life is just like a factory, and once you know all the components and how they relate numerically, you'll have all the answers – you'll know the Laws, the deterministic Enlightenment view still informing and infecting biology, and the route to such perfection is science. Assuming such for fields focused on inanimate stuff, such as physics or chemistry, is relatively safe since that stuff is pretty much static, which lends those subjects to time-consuming, step-by-step, logical examination – ya got the time. And the laws of those knowledge fields are awesome, have really enhanced our understanding and thus allowed us to live better in our world. Rare is the day when I'm working on a boat trailer or car when I don't bow my head in deference to Newton and rotational laws. The power and usefulness of this computer I type on now, a result of physics, especially that ever-useful Ohm's Law, is amazing. But that assumption don't work for life because life is ever-evolving, in each unique place of latitude and longitude and elevation, so fast and at so many different levels and in the bodies of all lifeforms and in their connections, an ever-changing flow connected by myriad nodes birthing and dying. By the time you figure out exactly how many fish are in a waterbody, your answer is obsolete 'cause they're rolling along in their next generation already, along with all the other lifeforms they've relationships with. Paraphrasing Berlin – you'll end up in an abyss that you can't see your way out of – you'll end up in the darkness, ironically ignorant in your pursuit of perfect knowledge. And because all life evolves simultaneously, if you just focus on one strand, then you become ignorant of all the others that are important to that strand, and then you end up with a bullshit answer. Paraphrasing Wordsworth: we dissect, we murder.

Now I ain't going off on some cliff dive by saying that science is worthless for life – of course it's valuable. Science can delineate great similarities, very strong patterns, generalities, of which there are many. Those similarities can be used to identify groups of lifeforms and places, though the places and lives are never the same and continually evolve, and so those groupings may disintegrate and prove false in the future. I doubt I'd've caught so many fishes and so many of each at this point without science. But it's insufficient, and that I caught so many *before* I got a few college degrees in the subject, plus the dismal state of salmon and smelt in the San Francisco Estuary Watershed despite the colossal research focused on each, further proves the point. And that highlights that what we should really be after isn't science – no, it's *wisdom*, of which science is just a necessary part. The other comes from attuned experience and from art – like, literally, drawing and painting – the qualitative aspects of the place or critter, a form of understanding the demigod Humboldt valued (2018, p 461, pp 752-765). And the acceptance that since perfect life

knowledge doesn't exist, and that life is an ever-evolving flow, then life wisdom, of which science is a part, is a continual action, relationship, with our fellow creatures and our place.

Summarized: quantity *and* quality, qualitative *and* quantitative information, pattern *not* perfection, context *not* isolation – all are requisite to life wisdom.

And another problem stemming from the deterministic perspective of life – eliminating the cruelty rampant throughout our place. The fishes and plants and mammals and birds – again, they are *life*, not just mass-produced items rolled off an assembly line, they are unique, have value, and they, too, have emotion – they, too, *feel*. Oh, sure, I know, not with as much variety and color as humans do, but take a look at your cat or dog – that affection your kitty or pooch offers you *not* love? When a crappie swings her tail up when being lipped, is that not her way of expressing that that hurts? Is not a striper thrashing when being lipped a sign she's terrified? Some may criticize me for anthropomorphizing these animals, but that's just a deterministic denial (read: two disparate categories – humans and all other animals - as if humans don't share so many characteristics with other animals) through a fancy word – dismissing that other animals feel besides humans denies the fact that the elephant clearly weeps, the cat loves, and the striped bass hurts. I kill a lot of fish – being a fisher, that's the only meat allowed on my supper table – and though I've killed, fuck, maybe tens of thousands of fish, man, you can see that life energy, that light, that spirit – spirit we all have, too – vanish from their eyes when the billy club hits home.

But that's little accepted in our watershed so long as a lifeform has the right label on it. The most commonly used bad label these days, the license to kill, is "non-native" – and then, fuck, then scientists just fucking commit crimes against Mother Earth when they injure and poison and kill these animals when nearly invariably the ultimate cause of a native's decline is a change in geology or hydrology – a human cause [Stromberg (2022) expresses it beautifully: "We don't need yet one more study on the best way to kill"]. I knew one biologist who conducted wars against carp because they "eat sucker eggs" – behavior he'd never seen before nor had evidence of – and who then dumped their carcasses on a fuckin' hillside, no longer available to all the working-class/poor fisherpeople – and increasingly middle/upper class fly-guys – who'd love to catch and release 'em to catch again, or to eat 'em, nor the scavenging birds that feast on the winter-killed dead. I knew another biologist who spat how much she hated carp, and I found that totally senseless since that fish had done nothing to her. That was on my boat when I was captain, and the only time I chastised another for their language was that instance. I've a friend who regrettably had to participate in that horror down at Clifton Court Forebay where they were removing non-native "predators" (another label that gives license to murder), ostensibly to move 'em to the California Aqueduct, and many of his coworkers abused the fishes, handling 'em roughly, stuffing so many into a livewell that they used up all the oxygen and suffocated, shit like that. And "endangered," ironically, also gets the license. I was instructed to kill any hatchery Delta smelt I caught in my nets in Suisun Marsh so the agencies could do "science" on 'em to see how they were doing (a pointless exercise since extinction of the wild fish already told the story that the estuary is no longer hospitable for the species – how the fuck could a domesticated one do better? Further – a closely related non-native smelt more tolerant of warm water (wakasagi) than Delta smelt continually introduced into the estuary from reservoirs can't even build a decent population). Yeah, those fish are domesticated, but again, all fish, all life, have value, they're still rare and precious, and if they've a really favorable environment (ahem, such as the mid-elevation Sierra

reservoirs, like those where wakasagi flourish), they might be able to win out on their own. One biologist in the estuary, a bona fide psychopath, was at least honest once during a conference when he lamented that some fish were released when we could've killed 'em for "science" – in other words, another addition to his publication list [ol' Ed called that "scientism" (Abbey 1971, pp 305-306; 1991, p 19)].

That should not be the main point of science, let alone wisdom – a fuckin' ego boost. The point of wisdom, and therefore science, should be enhancement of our relationship with the world. Doing nearly duplicate studies, ignoring all the life within a place that ain't wearing a fashionable label, trying to reduce life down to a half-dozen numerical variables, killing and killing and killing non-natives and predators because they're a symptom of a problem (and often a solution – one of a predator's roles is to hone and thereby strengthen their prey), and even killing rare fishes for essentially getting more fuckin' impact-ranking points on your paper – that ain't enhancing our relationships, but instead, degrading 'em.

So what are the remedies? With the problems exposed above, deducing the cures is fairly easy. A key prescription: getting people fuckin' out there a lot, in all types of conditions, doing continual surveys (*continual* because there is no end point for life until the Big Crunch) across lifeforms, from algae to big fishes to *us*, people – get the experience of the place, genuine observations, all senses energized. The more senses ya got engaged, the better you learn and remember. Too, you out there when it's hot, cold, wet, dry, light, dark – with prudence and strategy and tactics, meaning you're bold, not reckless – you get stronger, too: people improve. And this has to include people outside the government and the universities (which are really quasi-extensions of the government…and, really, people outside big organizations – Big Pharma and Big Food certainly haven't presented holistic, comprehensive information, to the detriment of so many) and their hired-gun consultants, people untainted by the corruption of those self-interested institutions: fisherpeople, hunters, loggers, farmers, ranchers, birders, anyone and everyone who has a modicum of connection to the Wild, especially older people who've been imbedded in the place for many years – and artists. From such surveys should come comprehensive, qualitative descriptions of the place, its vegetation and critters – both in science (such as a report) and in art (a painting, a photo album) – in addition to simple quantitative info (*e.g.*, who, how many, how big and small, etc.). From there, resolving the relationships and patterns, and where they are most nebulous – that's where you narrow down, such as delineating the relationships of red swamp crawdads with both plants and animals. And emphasizing here that illuminating the pattern is the goal, not eliminating uncertainty, which is not only impossible for life, but "uncertainty" is the wrong word for "unexplained variation" – what that unexplained variation is is evolutionary potential. Once the pattern's well-understood, move to the next set of relationships, knowing the pattern may change, which is what the continual surveys will reveal. And when the time comes for a sci pub with stats, at the very least, having a longer introduction and/or study area/community/assemblage/species section that provides more of a qualitative context, and specific to the place, the community, the species, because each is unique. A mother document freely available could be hyperlinked in the paper. All of that should be in plain fuckin' language. And, perhaps most importantly – minimizing the killing. If a good understanding can be realized about some animal or plant through existing non-lethal surveys or observation, that should always, always come first, and should death be deemed necessary, then it damn well better add

considerably to the fabric of wisdom, and, as the Plains Americans used near every scrap of all the buffalo they killed, so, too, should we use as much of the animals and plants we kill – eat what's left.

Simple actions, but, I regrettably aver, impossible implementation. The increasing dominance of the technocracy, coupled with ever-expanding domestication of humans and the hangover still smoldering from the recent viral plague – they've paralyzed people, coddled 'em, numbed 'em, engulfed 'em with fear, and now so many clamor for safety, and given the fear instilled by lawyers and big organizations, they capitulate – they "comply" (no dirtier word in my lexicon). And "safety," really, it's stagnation, it weakens people, they atrophy, makes 'em more dependent, immature, infantilized, unrealized. And the real fuckin' insult – it takes only one person who complains about something being "unsafe," which then gets perverted into "discrimination," and then the other 99% who, though at first fearful, suddenly are jolted alive when out in that rain and wind (and I'd seen it repeatedly during my UC career) – they get fucked when the survey gets curtailed or abolished. Although a rare bright spot of the idiotic academic critical-theory dogma has been appreciation of the knowledge of people engaged with a place, like all the rest of that deterministic gaggle of Ivory Tower thoughts, such people are only "natives" – as if humans on all continents but Africa didn't emigrate and therefore were colonists. And so I can envision it being far more difficult to include a Euromerican, such as many of the brilliant wetland caretakers in Suisun Marsh or ol' Bob Lord lording over the Dixon Boat Club and North Delta, who've lived a life or beyond in generations in a wild place in the task of wisdom than, for example, the American cat I saw recently at a rural greasy spoon, feather in hair denoting his race, doing nothing but staring at his smart-phone. Too – those academic totalitarians have usurped that part of wisdom into jargon, swept it up into elitism: it's no longer prolonged, attuned engagement and experience and observation, but "traditional ecological knowledge," hidden in the coded acronym as "TEK." And with the ever-increasing rise of equations that ever influence our lives, those insidious, poisoning algorithms, plus the cloistering of people indoors never away from their screens for "safety," I can't see how the value of the quantitative info can be moderated to where it's not God but a dancing partner of the qualitative. And the government? Fuck, they ain't gonna change themselves (and the Endangered Species Act desperately needs to be revised, but admitting so, well, that's like saying you made a mistake…) - it only really changes when a people outside it forces 'em to. I mean, LBJ got elected on a peace platform, yet he exploded the Vietnam War; Nixon, a warhawk, ended that crime. It took the broke-ass laboring women of Paris to boot out the deaf and dumb and numb Louis XVI.

But just as life is not deterministic, neither are our actions: though there is never total promise, nor is there ever total despair. Each day, us lonely, largely meaningless humans can do better. Just take a fuckin' walk in the forest – including when it's raining. Be gentle with those plants and animals, and if you're gonna kill, kill with conviction, meaning, respect. Burn less time listening to that bird call on your app and more time out there listening to the bird himself. Take up the pen and write what you saw, felt, heard – take up the pencil or brush and draw or paint it, or some clay and sculpt it. And, yeah, do some science, record some numbers on your own, whip up as many possible explanations as the place provides, then test 'em, run some stats, and couple that with your description. That's the change, that's the healthy use of science, wedded to art and experience to serve the greater goal, the greater good: wisdom.

[1]For this figure, I queried Google Scholar for the period I was a fisheries biologist (2008 – 2024) and only included documents from peer-reviewed journals. Too, I didn't include those where the bias was egregious [*i.e.*, those funded by water agencies and authored by people outside/peripheral to the San Francisco Estuary Watershed. An example: Hamilton *et al.* 2020. They considered variables in their equation that "…had signs inconsistent with previous work" false, indicating problems with their equation – and then they re-ran the equation after removing the "false" variables. I can't see how it follows that the "true" values would be more reliable than the worthless "false" ones. (By the by, I hung out with Scott, and he was a pleasant guy, and he really shouldn't be doing such "science.")]

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