A Letter to a Nervous Steward

Imagine waking up one morning to find yourself in possession of a flock of sheep. Assuming you know little to nothing about sheep this would be a rather alarming development. Knowing your own ignorance you’d probably hit the web to find out basic things like what sheep drink out of, what they eat, and what’s required for their shelter. At this point you are still largely ignorant of how to care for sheep but at least they won’t die in the next few days. Next you might try to figure out how to give them a pen so they don’t go wandering off, sort out how to protect them from predators, look into basic medical care, and so on. Later on you’d probably end up learning how to shear them, what to do when they start getting pregnant, and might have to deal with some outbreaks of infectious diseases you didn’t even know existed. Each and every day you’d become a better steward of your sheep and while mistakes will certainly be made and disasters dealt with no one is going to accuse you of not caring for your sheep.

The state of fisheries is not so different. Fishing and seafood in the United States is worth over 100 billion dollars so it’s not going anywhere. Whether we know what’s going or not people will continue to push ecological buttons – i.e., the flock of sheep has been handed to us. Likewise, we know tremendously little about how to “raise” our “sheep”. Most fisheries knowledge is single stock, spatially uniform, and filled with uncertainties and biases. But the current state of our knowledge is not what determines whether we are good stewards or not. It’s whether we recognize our ignorance and take steps to fill the gaps one little step at a time. What does the end result look like? Of course we have no idea! We’d have to be expert shepherds to know and we’re a long way from that. But if we diligently take steps one at a time, then, much like the stream that carves out the canyon, we’ll get there eventually. And we have to at least try because otherwise the “sheep” *will* die.

Responsible stewardship isn’t some binary achievement received when all the unknowns are gone; good stewardship exists in the presence of extraordinary uncertainty and risk too. What makes for good, responsible stewardship is recognizing the sheep are already here, doing the best one can with what one has, and taking care to become more knowledgeable, thoughtful, and competent with each passing day.

*Marcel Gietzmann-Sanders*

*August 1, 2024*

The Steward is in the Details

Open a textbook on fisheries science, and what you'll find feels more like a physics textbook than an agricultural guide. It attempts to build a "theory of fish management" with a suite of tools that are said to work across species—whether you're managing shrimp or cod. The logic behind this is straightforward: create a generalizable theory of fish populations, and you can manage any fishery, anywhere.

But if you applied this same approach to farming, at best, you’d be considered naive—at worst, completely out of touch. Imagine trying to grow cabbage, potatoes, strawberries, corn, and apples using one, single strategy. You’d be bound to fail! Each crop has its own quirks, its own needs, and its own life history that must be carefully and individually managed for any chance of success.

The same is true for fish. History has repeatedly shown that when we ignore these nuances, we do real harm to fisheries. Again and again, fisheries management has faltered because it tried to generalize, applying one-size-fits-all models to species with highly specific needs.

What’s more, life would be much easier if we took advantage of these differences. Once you stop trying to generalize the entire ocean, what once seemed like irritating exceptions or complications that disrupted your model suddenly become useful leverage points for devising more ingenious strategies. Take one of the most challenging aspects of fisheries management: counting fish. Many fish exhibit behaviors we could use to our advantage. Some species form spawning aggregations, others return to specific rivers or coves, some are sedentary and ideal for traditional sampling, while others form schools that can be tracked. Try to create a single method to count all these different species, and you’ll be at a loss. But if you lean into their quirks, you’ll feel downright clever.

And managing risk becomes a lot easier too. When management is tailored to a species' particular life history, we gain a clearer understanding of what constitutes true vulnerability. Instead of relying on broad models that struggle to predict outcomes accurately, we can assess risk based on the species' actual behaviors and ecological needs. And when we find that some of those needs aren’t being met, we can use all we know about the species to step in and give them a helping hand.

The point is this: management shouldn’t be about simplifying species to fit the model; it should be about building strategies that work with the biology, not against it. Just as good farmers care for each of their crops and herds in ways specific to their needs, so too must we manage each of our fish stocks according to their unique biology. When we do so all the nuances and caveats that seem to make fisheries so difficult and insurmountable just become practical issues to revel in for the species in question.

It seems that in the end, the steward is in the details.

*Marcel Gietzmann-Sanders*

*September 22, 2024*

The Power of a Name – Fisheries Development

If I had my way, I’d change “fisheries management” to “fisheries development.” Development comes with the connotation that you’re working to increase the intrinsic value of an environmental resource, and not just trying to ensure the ecological health of a stock. If all that mattered were the fish, fisheries management would just be fish management.

To me, however, this is far more than just a change in the name. Once you start thinking about things in terms of development a few key points become immediately clear. The first has to do with how we define success. While it’s true that the obvious definition – improve intrinsic value – is conceptionally sound, it doesn’t actually give you a way to measure success. Before you can do that, you have to first understand what the intrinsic value of the fishery is, and that requires getting into the specifics.

For instance, take Atlantic herring, which is mostly harvested as lobster bait. Compare that to oysters, which are not only a high-end seafood, eaten almost entirely raw, but also serve as filter feeders that improve water quality. Then look at salmon, which has a sporadic commercial presence but a huge recreational fishery. Or tarpon—people don’t eat them, but they’re highly prized in sport fishing. Each of these fisheries has distinct intrinsic values, and therefore you can’t measure success in each the same way. In sum, while there is an answer to “What does success look like in Atlantic herring development”, there is no answer to “What does success look like in fisheries development”.

The second point a “development” perspective exposes immediately is that ecology is technically a subsidiary concern. If a stock is considered ecologically healthy only because we’ve shut everyone out of the fishery, while you might call that a win from a conservation perspective, you’ve failed as a developer. Likewise, there are fisheries where the stock is doing just fine ecologically, but the human side is suffering either because of things like brutal working conditions, uncertain job prospects, or very difficult economics. When we think about things from a development perspective these human-centered issues are just as much a part of the work as anything ecological.

Finally, development naturally encourages creative solutions. It’s not just about managing what already exists through catch limits, licenses, and stock assessments. It’s about innovation—building artificial reefs, running fishing derbies to tackle invasive species, promoting cooking methods to open new markets, or developing better fishing gear to increase efficiency and reduce bycatch. Where management implies corralling the chaos, development is about turning potential into value—making a fishery the best it can be.

A name can be a powerful thing when it brings the right mindset. That’s why I’d choose “Fisheries Development.” It’s not just a shift in terminology; it’s a shift in focus—from managing decline to fostering growth.

*Marcel Gietzmann-Sanders*

*October 3, 2024*

Solutions First: Biomimicry as Central to Environmental Development

Imagine for a moment that your goal is simple: provide fish protein to the market. Your options are pretty simple: either you manage wild fisheries or you turn to aquaculture. Let’s compare these solutions at a high level.

On the fisheries side, things get complicated quickly. First, fish exist in a web of predators and prey. Depending on their life stage, what they’re being preyed upon changes constantly and where that predation is happening changes too. Furthermore, they themselves are predators, feeding on different things as they grow. Then there’s the fact that they move and therefore aren’t all conveniently in one place, making them harder to find. Finally, you don’t control their size, health, or population. All in all, so many variables are beyond your influence.

Contrast this with aquaculture, where you control everything—the broodstock, the growth, even the genetics. There are no food web complexities to worry about, and assuming you can close the system, the environmental concerns start to shrink too. Life becomes far simpler, scalable even, making aquaculture seem like the obvious, responsible choice.

But let’s flip that thinking on its head. Instead of starting with a goal—like maximizing protein production—and finding a solution, what if we started with one of nature’s solutions and tried to understand the value it brings?

Take a mangrove estuary, for example. You’ll find these in Southeast Asia, the southeastern U.S., and many other parts of the world. They act as nurseries for hundreds of fish species, many of which are commercially important. These estuaries also host crabs, mollusks, and cephalopods, cetaceans, turtles, sharks, birds, and all sorts of other creatures supporting both tourism and food industries. Besides providing habitat, mangroves protect coastlines from storms, stabilize sediments, and improve water quality. Suddenly this solution feels like a slam dunk! By protecting or developing these estuaries we will be developing a vast array of different value propositions all at once.

And this is the key point. If we approach environmental development with a narrow, reductionist perspective, nothing will make sense. The complexity of nature will always seem too inefficient or messy, especially when compared to the clean lines of human-engineered solutions. But if instead we seek to understand the multifaceted solutions that nature has already provided for us, developing them will seem like an obvious win. The key to environmental development is to take on a biomimicry perspective. Seek to understand and the gifts nature gives us will become clear.

By embracing a biomimicry perspective, we start to see how nature’s solutions can inspire our own. For instance, if we want to protect coastlines, we can look to how mangroves, salt marshes, and coral reefs naturally buffer against storm surges and erosion while providing numerous additional benefits like habitat and water filtration. Instead of building single-use concrete barriers, we can work with these natural defenses to achieve more sustainable, multi-purpose outcomes. Or take predators—rather than trying to outsmart nature with our own tools, we can learn from how predators like sharks, wolves, and birds of prey have honed their strategies over millions of years. We can adapt their patience, efficiency, and adaptability into our own practices, whether it's for fishing, land management, or even agriculture. In essence, biomimicry teaches us that the most effective solutions are often the ones that work with nature, not against it.

As long as we take a reductionist perspective, nature will not only seem too messy and complicated, but we’ll also miss the point entirely. Biomimicry allows us to see ecosystems not as chaotic webs to be controlled, but as collections of brilliant, multifaceted solutions waiting to be enhanced. Instead of starting with a predefined value and working down, we need to learn to listen to what nature has to teach us and build from the ground up.

*Marcel Gietzmann-Sanders*

*October 13, 2024*

The Keystone Question: How to Be a Predator

Environmental development is about understanding how to take advantage of the solutions that nature has already provided, rather than trying to reinvent the wheel. One of the most significant areas where we can learn from nature is in understanding what it tells us about how to be a predator. Let me explain.

When people talk about the environmental crises tied to modern society, they often point to greed, ignorance, carelessness, or a lack of holistic thinking. And while these criticisms have merit, I’m not sure they’re the right ones. That’s because, in many respects, we’re not so different from any other creature out there.

Take walleye, for instance. They aren’t exactly models of restraint—they’ll eat their own young without hesitation. They’re not thoughtful or wise in any human sense, nor are they concerned with maintaining balance in the ecosystem. They exist to eat, grow, and reproduce. And yet, here we are, living in a world that has thrived for billions of years, filled with selfish actors, all striving to survive in a system of apparent chaos.

Life has already solved the problem of predation in the face of selfishness and imbalance. And that’s a relief because it means we don’t have to create the solution from scratch. Instead, we can focus on understanding how nature manages to function this way—what makes it tick. And here as with all environmental development, biomimicry is key. By mimicking nature’s systems, we can start to understand how they maintain stability even in the face of perverse motives.

So, what does this look like in practice? Simple. Start with the most basic model you can think of for why predation works without causing collapse. Try it out. If it works, great—we’re on the right track. If not, we don’t need to reinvent the wheel, it’s just time to go back and observe what actually happens in nature. Where the model fails, what is nature doing instead? By updating our model step by step, eventually, we’ll understand the solution ecosystems have already crafted.

Once we have that understanding, the next step is to compare. What is it about human interaction with the environment that has led to such destabilization? If it’s not greed—since all living creatures act selfishly—and if it’s not ignorance—since other species aren’t exactly enlightened—then what is it? Sure, technological advancement plays a role, but does it inherently cause destabilization? If so, what about it does? What’s great here is that there’s no need to guess. We have a system that works (nature) and a system that doesn’t (human activity). Put them next to each other and find the distinctions. The answer should become clear. And from there, we can learn how to be good predators, just like the rest of the natural world.

So this is our question - why do predators work in nature? The answer will come when we can build a toy model of it and the first step toward that toy model is the simple question posed in “Serengeti Rules” – why are trees green?

*Marcel Gietzmann-Sanders*

*October 18, 2024*

It

Coexistence hinges on the principle that as one creature exerts pressure on another, the changing conditions eventually favor the victim, making it the fitter and ensuring its survival.

*Marcel Gietzmann-Sanders*

*November 15, 2024*

A Personal Note

When I started my master’s degree program, I did so with the belief that the only way I could help modernize ecological stewardship was by becoming the customer of that modernization.

I had tried working with various people—folks who were either too busy, too distracted, too threatened, or simply too distant from what modernization could even mean. I realized I would have to become the customer I wanted to serve.

This was grounded in the idea that my ultimate goal was to build some kind of business or technology that would push ecological stewardship forward. For years, that has been my modus operandi. When I worked with EwA, I was building apps. When I collaborated with Glenn, I developed infrastructure. At the NMLC, it was the same—I wanted to contribute something tangible. Even back at Harvard, when I asked my professor for advice, they suggested I use the tools I have to build things for others.

That approach shaped my thesis, which focuses more on technology as a means than on learning any specific management practice. This lens, this bias, has guided everything I’ve done.

Recently, I was talking with a friend about where all of this might lead—what the development plan would be. I had arguments, ideas, and branching possibilities to discuss. But something felt off. The more I tried to articulate it, the more unsettled I became, as if the logic made sense but didn’t feel right.

It wasn’t until I found myself in a Taco Bell, waiting for a burrito, that a question hit me, almost out of nowhere: *Do you just want to be a steward?*

Not a steward to build something. Not a steward to be the customer of your own company. Just… a steward.

That question carried weight. I grabbed my burrito, got in the car, and started thinking.

I realized that my reaction to things I’m passionate about often follows the same pattern. When I see an aircraft in a museum, I don’t just admire it—I want to dive into a book about that plane. I want to learn every detail, marvel at the engineering, and respect the people who brought it to life.

When I went to Bletchley Park, I felt this deep desire to be part of something like that—a community of people working together on meaningful problems. But reflecting on it, I didn’t want to *run* Bletchley Park. I wanted to *belong* there, to contribute, to work alongside others. Setting things up is fine if it’s necessary, but ultimately, I just want to be part of something meaningful.

This pattern shows up elsewhere, too. I’ve become a technical lead on many projects but have never wanted to climb beyond that. I value the intimate, hands-on work with a team of engineers, collaborating and solving problems together. Middle management holds no appeal because it takes me away from the things I love.

Even with Network Earth, I’ve never envisioned myself as its CEO. I’ve thought about its design and organization, but in my mind, once it’s stable, I’d hire someone else to run it. My role would still be close to the ground, engaged in the work that excites me.

As a kid, when I collected frogs, snakes, or insects, I loved observing them—understanding their quirks and habits. That attention to detail and intimacy is something I’ve always admired in others, whether in the arts or engineering. People who truly know their craft inspire me.

I’ve always respected those who are in the trenches—the engineers, the developers, the creators. They’re the ones driving real innovation. My admiration lies with those on the ground, not with the people at the top of some hierarchy.

My book, *Moonshot*, reflects this perspective. It’s not about becoming a CEO; it’s about being a coactive developer, valuing and respecting those who do the work.

When people ask why I do what I do, I’ve given long, thoughtful explanations—about scientific revolutions, ecological modernization, and being customer-centric. But those explanations cast me as little more than a project manager for an organization.

What I’ve come to realize is this: I want to be a steward because I *want* to be a steward. It’s what I love. It’s where I thrive—getting my hands dirty, solving problems, working within a community of like-minded (and not-so-like-minded) people who share stakes in something meaningful.

It’s real. It’s gritty. It’s everything I’ve been searching for. I don’t need to be a technological powerhouse, removed from the problem. I want to be in it. And the best part? I can. There’s no reason why not.

As I explored in *Moonshot*, the impact we have isn’t about where we sit in a hierarchy—it’s about how well we do our work and whether we go the extra mile to mentor and inspire others. I don’t need to be a CEO to make a difference. I can contribute to saving the planet from wherever I stand, so why not choose a place I love?

I want to be a steward. To belong to a place and be responsible for it. To wade into its challenges—both literally and figuratively. To understand it deeply and operate masterfully. To surround myself with others who feel the same and to support and mentor them in turn.

That is my ideal.

*Marcel Gietzmann-Sanders*

*November 21, 2024*

To Coexist

**Niches:** One group can’t outcompete another if they’re technically not competing at all. Separation into niches allows species to coexist.

**Backstops:** If a species’ fitness skyrockets when it’s back against the wall it becomes very hard to drive it to extinction.

**Damping:** Apply friction to anything that oscillates, and you’ll damp it down to stability.

*Marcel Gietzmann-Sanders*

*December 5, 2024*

Moving Past Prediction

Ecological management is fundamentally a question of coexistence. How do we, while harvesting and using common resources, coexist with our ecosystems rather than damaging them?

One of the foremost concerns is the risk of putting so much pressure on a species that we eliminate it entirely. How can we ensure that doesn’t happen? Importantly, we shouldn’t need to strike an overly precise balance to prevent the extinction of a species we depend on.

To explore this, we can turn to theoretical ecology and examine how ecosystems themselves prevent such outcomes. Despite the inherent noise and variability in these systems, they often maintain coexistence. This form of coexistence, which we’ll call "weak coexistence," prevents extinction but doesn’t necessarily do more. Time and again, the answer appears to involve **backstops**.

A backstop is a mechanism that dramatically increases a species’ fitness when its density drops to very low levels. For example, imagine a prey species that hides in crevices within rocks. When their numbers are high, many individuals are forced out of the crevices, exposing them to predators. But as their population declines, the ratio of prey to available crevices also decreases. At low densities, most individuals can remain hidden, leading to a significant increase in survival rates. This uptick in fitness can make the species effectively invulnerable to predation at very low densities. With this protection, the population can recover and begin to repopulate, creating a cycle.

This is what we mean by a backstop—a mechanism that ensures the fitness of the prey increases enough at low densities to outcompete the predator, even when the predator population is large.

We can apply a similar concept to fisheries. For instance, marine protected areas (MPAs) or "no-fish zones" can act as backstops. These zones provide refuges where fish populations can persist and recover even if fishing pressure or other factors, like disease, become overwhelming. However, while these protected areas can help, they may lead to oscillations. If fishing pressure is too high outside the protected zones, populations may collapse. The resulting reseeding from the protected areas will allow recovery, but this could lead to a repeating boom-and-bust cycle.

To move beyond weak coexistence, we need **strong coexistence**—a state that not only prevents extinction but also reduces variability in population dynamics. Here, we can borrow from control theory and the physics of oscillations, where the key to stability is **damping**. Adding friction to an oscillating system, like a spring, reduces its amplitude and helps it settle into equilibrium. Similarly, in fisheries management, damping involves being patient and incremental when adjusting policies, such as allowable catch limits. By doing so, we can stabilize the system and avoid large, destabilizing oscillations.

In addition to backstops and damping, another challenge arises: **outcompeting the species we harvest**. For example, when fishing for tuna, we often also fish their prey, like herring. By removing both the tuna and their food source, we apply pressure from two directions, increasing mortality and reducing fitness.

The solution, again informed by theoretical ecology, lies in **niche differentiation**. If we reduce the overlap in resource use, we reduce competition. For example, if different species—or different groups within a species—rely on different resources, time periods, or life stages, they don’t directly compete. By studying the needs and behaviors of target species, we can ensure their niches remain intact, providing the resources they need to thrive.

These three principles—backstops, damping, and niche differentiation—offer a framework for fisheries management that doesn’t rely heavily on prediction. Instead, it acknowledges the complexity of ecosystems and focuses on building systems that are inherently stable.

However, context is crucial. Backstops, like MPAs, work well for species with relatively sedentary behaviors, but they’re less effective for migratory species. Niche differentiation requires a deep understanding of a species’ needs and resource use. Damping requires patience and restraint when implementing policy changes.

This approach embraces the limits of our predictive capabilities. Ecology is far too complex to predict quantitatively at present. Any management strategy based on precise predictions risks failure due to overlooked variables. In contrast, this control-loop method doesn’t require us to know everything in advance. With built-in damping and safeguards, it naturally guides the system toward coexistence.

This way of applying control theory to ecological management provides a practical, resilient approach to ensuring coexistence. It’s a strategy that acknowledges uncertainty while maintaining the guardrails necessary to avoid catastrophic failure. As a result, it makes me much more optimistic about what ecological management can achieve.

At this point I have the theory and the tools. Time to fill out the context.

*Marcel Gietzmann-Sanders*

*December 5, 2024*