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A Fishy Future?

Interview with a Recirculating Aquaculturist

Red Herring

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“I work on what’s called a “recirculating” aquaculture farm. We’re still trying to maximize fish production, but we deal with the waste problem by closing the loop, doing our own water treatment on site and re-using as much of the water as we can. We have very high stocking densities — let’s say twenty to thirty thousand fish, in tanks the size of swimming pools. Dozens of these tanks can fit together within one warehouse building. The water they swim in is constantly flushed out, filtered or treated in several ways, and pumped back in clean. The solids that are removed in the treatment process are stored and sold for fertilizer. So the water in the tanks “recirculates,” in parallel, and the tanks share a number of supplementary systems that help maintain an optimal growing (“culture”) environment: heating, feed, chemical regulation, and so on. We grow them for about a year, with each fish ending up as about a pound of meat when fileted. The idea is that this basic design can be

scaled up to make really huge farms. Ours is a really huge farm.”

Red Herring, fish farmer interviewed by Flint Arthur

Flint: The United Nations recently reported that “Oceans’ fish could disappear within 40 years.” Is the situation really that desperate?

Herring: I don’t know! I know next to nothing about fish, or oceans. It does seem like many of the remaining commercial fisheries are under pressure, and the company I work for seems to think that a lot of the future demand for fish is going to be met by farming. They cite all sorts of dire statistics when they’re trying to convince investors to buy in to the way we’re doing things. There seems to be something to it — fish won’t necessarily go extinct, but fishing grounds reach the point where the cost of catching fish exceeds the price you can get for them. Human demand grew so quickly that not a lot of time passed between when we saw oceans as being almost infinitely bountiful and when we started scraping the bottom (sometimes literally, trawling the sea floors with massive nets).

Simple overfishing is one thing: as I understand it, populations can sometimes be restored through proper management. But in many cases we’re destroying habitat in a more significant way. Right now we’re watching a new dead zone develop in the Gulf of Mexico due to the Deepwater Horizon spill — when you wipe out the microorganisms that transform sunlight into food for everything else, it’s gonna take a long time for a wild “fishery” to grow back.

I suppose fish could drop out of the human diet, or become a real luxury, but first we’ll probably see more and more aquaculture.

Fish farms are sometimes criticized as “the feed lots of the sea.” Can you talk about some of the benefits and problems of open sea/pond aquaculture?

Raising a lot of fish, or a lot of anything, in a small space requires concentrated inputs, and produces concentrated outputs. If that small space is in a cage or net suspended in the ocean, or a river, or if it's a system of ponds outdoors, you're going to have an impact on the environment. If your number one priority is maximizing pounds of fish flesh—or maximizing profits—chances are good that you're making a mess with your waste streams. For example, fish piss out a lot of chemicals in forms that, as they break down, use up a lot of oxygen, so if you're concentrating them intensively in one place you're damaging habitat downstream, or under the cages, by oxygen depletion. There are other outputs that are damaging in that kind of concentration.

Also, if your farm is open to the elements, it's a real breeding ground for all sorts of opportunistic disease. Many farms rely on a constant regimen of antibiotics, which can be poisonous downstream as well as to the workers and consumers. Keeping disease bacteria and other microorganisms at bay for long enough to grow filets on fish is one thing, but living systems also depend on “beneficial” microorganisms doing their thing, and sustained exposure to antibiotics can damage those processes.

Aside from the risk of disease, fish also tend to gather and accumulate mercury, PCBs, dioxins and other industrial contaminants in their bodies. There's a lot of official disagreement over how some of these things affect consumer health, and I'm not an expert, or an alarmist, but if you're concerned for what you're eating, you might want to do a little research before shopping for fish.

How is the farm you work at different than open sea/pond aquaculture?

I work on what's called a “recirculating” aquaculture farm. We're still trying to maximize fish production, but we deal with the waste problem by closing the loop, doing our own water treatment on site and re-using as much of the water as we

can. We have very high stocking densities — let's say twenty to thirty thousand fish, in tanks the size of swimming pools. Dozens of these tanks can fit together within one warehouse building. The water they swim in is constantly flushed out, filtered or treated in several ways, and pumped back in clean. The solids that are removed in the treatment process are stored and sold for fertilizer. So the water in the tanks “recirculates,” in parallel, and the tanks share a number of supplementary systems that help maintain an optimal growing (“culture”) environment: heating, feed, chemical regulation, and so on. We grow them for about a year, with each fish ending up as about a pound of meat when fileted. The idea is that this basic design can be scaled up to make really huge farms. Ours is a really huge farm.

Are you concerned about disease with the fish? Do you use antibiotics on your fish?

Disease is one of the main dangers of intensive production. If fish get a given bacterial infection or parasite, it spreads very quickly within a tank. By closely monitoring fish health, trying to prevent contamination from outside the building, and proactively culling any weak-swimming fish, disease can largely be kept at bay without the use of antibiotics.

Would you eat the fish you farm?

I do eat it. My company gives us a small fish ration on top of our wages.

Do they taste good?

I think so. But I ate fish growing up, and I'm not a picky eater. Some of my coworkers hate the product.

What is the nature of the work? Is it a skilled or unskilled occupation?

You certainly need some people who know exactly what they're doing, because so many things can go wrong and you have to be attuned to small early warning signs. Given the current spread and separation of specialized knowledge in our society, I'd say if you were starting up a big fish farm you'd

ing rather than deepening the metabolic rift. Fish production might be a useful component of such systems.

So I'm inspired by the experiments people are doing with smaller-scale, backyard aquaculture — which I guess is getting trendy in Australia and elsewhere — not because they're building directly toward the solution to our food needs, but because it might be a piece of a much more complicated patchwork of solutions. Current attempts to raise fish in intensive polyculture, and even according to permacultural design principles, are contributing to this knowledge base, even if they fail materially or are shut down for being a waste of money.

Whatever useful lessons we learn from any of these various approaches to fish farming, though, I think it's going to be important to combat the tendency to divide the engineering and design know-how from the day-to-day operational work of fish culture. The profit motive drives this division, since management saves money whenever it can replace a team of five well-rounded problem-solvers with one expert and four menial workers. If the people are going to confront and overcome the food crisis of the 21st century, it will be by developing our industrial, nutritional and ecological literacy, and resisting our stupefaction as workers and consumers.

What is the most inspiring thing about your job?

I raise meat in vats! I feel excited to be living in the future.

What is the most disappointing thing about your job?

This gnawing feeling that we're headed into the wrong future.

their diet. We need to find ways to meet the demand for fish that aren't depleting limited resources, be that wild fish populations or fossil fuels. If we discover new energy sources (or better ways to use and store solar and wind energy), then sure, let's build hundreds of big, inland, monostocked recirculating aquaculture facilities! If not, we probably need to continue to develop and propagate creative design solutions.

It's a little embarrassing to look at some of the 1970s utopian aquaculturists' ideas of what would be possible today. If you look through the New Alchemy Institute's journals, or any of the Soft Tech, Whole Earth, etc catalogues, they were pushing the idea that psychedelically painted passive solar greenhouses, supplemented by hand-built windmills, might supply the energy required to intensively farm tilapia and vegetables together in mild climates. I guess it could work for your separatist rural commune, but I don't think it would do much for a village, much less an urban neighborhood. They were just very optimistic about how easy it would be to raise fish and edible plants together in polyculture.

Since the least-bloody predictions for a free and voluntary population degrowth involve a peak of six to eight billion urbanites by midcentury, we need to focus on ideas that are relatively modular and can be incorporated directly into cities. Allowing people to move into cities, but finding a way to grow a large part of our food and reuse a portion of our waste there, will be crucial. I don't think we can permanently sustain a spatial separation of farming, residence, and the treatment of farm and residential waste streams. I think that figuring out how to grow fairly complex biological culture systems on the interior of city blocks will be part of the solution, if there is one.

So the real scientific advances we're looking for aren't in aquaculture but in wastewater treatment. If we can find sanitary ways to decentralize water treatment, and to use the resulting bioavailable solids (such as growing algae and plants), which is easier said than done, we will be directly address-

better have an engineer, a fish biologist, and a professional chemist in house, as well as someone who can negotiate the markets for feed, chemicals, machinery and other materials. Once you get going, those people are only needed part-time. You will need some skilled, handy folks around for maintenance. But the bulk of the work we do requires between a day and a month of training.

I came in off the street with very little related background. Most of my time is spent slinging feed into tanks and removing dead or dying fish from the systems. Those are the two most labor-intensive parts of culturing fish. If the water temperature drops a degree or two overnight, it might mean pulling forty dead ones out of a tank instead of the normal ten. I've learned a lot more than that on the job — water chemistry, mechanical skills, and so on — but I'm not a skilled worker.

Recirculating aquaculture uses a lot of technology intensively. Is that hard to maintain and keep together? Do you have a lot of waste and dead fish when systems fail?

Sometimes. It's not pretty. It's a high stakes process — so many factors have to line up, and one little mistake can have pretty huge consequences. The culture tanks aren't self-regulating like natural fish habitats are.

In another conversation we had, you said you'd double the staff size to make the job more enjoyable. How would increased staff help, and what isn't enjoyable about the job now?

Well I'm sure the company that owns the farm couldn't double their labor budget, and they used to run the same farm with even fewer workers. In a different society... if more people were available to train in depth and then work part-time to do the boring repetitive tasks at their own pace, for example, you're producing a lot of food for the work you put in. I'm not saying people should be willing to work for food, but if we were to do away with money — the regulating substance

of poverty and social austerity — someone working for a few hours and taking home a few pounds of fish would be a win/win on a farm the size of ours.

Right now, it's like any other job under capitalism: shitty. Stressful. Boring when it's slow, and dangerous when it's fast. If you find a way to do a given task more efficiently, you don't have an incentive to share that knowledge with others — you either spend the resulting free time alone furtively, or else your method becomes standard procedure and everyone is expected to work more productively. It's dim and hot and it smells kinda bad, and there are thirty unemployed people out there who'd love to have your job.

What are some typical work-related injuries and illnesses in aquaculture?

According to government statistics, slips and falls, and cuts, with the outside chance of drowning. There's a lot of electricity and water, and spinning machinery. Some farmed species have sharp spines and other defenses. There are bacterial infections that can cross over from fish to mammals. Obviously if you're cutting or canning fish on site you have all the hazards of that job. It can be heavy work. I've seen older folks mess up their backs pulling nets or carrying feed around, working against the clock.

More to the point, with just about any job there's some level of investment in safety precautions that gets traded away in a competitive market environment. I like to recommend Kris Paap's book, "Working Construction," which talks about how sometimes employees in competitive industries choose to collude with their bosses against safety, to keep the jobs... this is why you see workers treating safety inspectors as their enemies, out to shut down a jobsite or cut into the bottom line. If recirculating aquaculture becomes profitable, or better yet, if the profit motive is removed, it will become easier to improve safety.

they were contained within our walls. We might be able to arrange our work better without managers, but would we really want to share in ownership of a company struggling in such a painful marketplace? I don't know if we could do a better job of courting investors and wholesale customers than our bosses do.

Where I see the most potential is in using our position to plug into a wave of struggle that's initiated elsewhere, especially if food security is an objective of that struggle. The actually existing food movement is about as remote from our world as the unions are, which is another whole discussion. If it advances to the point where it can welcome farmworkers as agents of change to the food system, and develops a critical perspective of the social position of small farm owners, I think aquaculture workers have a lot to contribute.

Given all the problems with aquaculture in general, and recirculating aquaculture in particular, do you see it as a positive development?

I don't think any productive technology will really help address coming natural resource shortages unless it meets two criteria. First, it needs to in some way overcome what Marx called the "metabolic rift" — the severing of material society from its soil. Matter and energy that we use need to be reincorporated into wild ecosystems afterward. Second, the technology needs to require that we change our social structures to adopt it, and be obviously worthwhile to us. Ecological destruction and austerity are driven above all by the wealthy, and by the poverty that sustains them. Taken alone, recirculating aquaculture meets neither of these criteria.

If you were to design a fish farming system in utopia, what would it look like?

I can't bring myself to imagine a utopia that rests on changing what people prefer to put in their mouths... but I do hope people who want to eat meat start eating more fish. If people make that switch more often it will reduce the resource base of

Would you say that your job is exploitative or that your labor is alienated?

Is that a multiple-choice question? Just kidding. My job is not fun, or lucrative. It's hard to say how much of that has to do with recirculating aquaculture, and how much has to do with being part of a more or less deskilled workforce in a rural part of the US during this global recession. It's hard to ask for raises on a farm that's operating at a loss. Everyone just keeps their head down and hopes the job lasts.

Something worth mentioning is that some colleges are offering aquaculture programs, and students are graduating from those programs much more quickly than the industry is expanding. So that training is being wasted as those graduates either take menial jobs in the industry, or work in other fields, or end up underemployed facing a fresh debt burden. I wonder how many workers out there have the basic principles of aquaculture system design in their heads, and if they will ever be able to put that knowledge to use.

Is there any potential for workplace organizing? Is there any manifestation of low intensity work resistance now?

Where I am there's some regular individualized resistance of the smoking dope and stealing tools variety, which is great unless you're the one trying to find a certain tool or annoyed that your coworker keeps staring at the fish. I don't think fish farmers are likely to become a vanguard of working class political recomposition in the next few years, unfortunately.

The actually existing labor movement has no economic reason to see these farms as strategic, since the profit margins are slim to negative, and since it's a capital-intensive (or rather really resource-intensive) form of food production, as opposed to a labor-intensive one. I would love in theory to have worker control of our farm, or even to get into a position where we can exert some counter-planning, but I don't think the improvements we could make for ourselves would be worth the fight, if

Are any of the labor laws about fishing or agriculture used by owners to exploit aquaculture workers?

I'm making above the prevailing (poverty) wage for farm work overall. And I've only worked at one facility. Without getting too specific, I have seen instances where falling under USDA jurisdiction as farmworkers (rather than the Department of Labor) is used to management's advantage. I'm sure that if we were trying to organize ourselves a little better, we would see the hammer fall.

I know shellfish such as oysters have almost completely shifted to aquaculture. Here in Maryland, prisoners make wire oyster cages that are used by volunteers to raise oysters in a dozen rivers. Any thoughts on that?

We must free the prisoners and burn every prison to the ground.

What sort of resources does recirculating aquaculture use? Can you give us some numbers on productivity in terms of the amount of the fish produced, relative to power, water, feed, and labor hours? How many people do you work with?

When done right, recirculating aquaculture can be an incredibly efficient use of land, water, and labor, per unit of food produced. And compared with all other meat production, it's an efficient use of biomass — many species can convert their feed to edible flesh at a ratio that approaches 1:1 when conditions are right.

The core of the work, i.e. fish culture, maintenance, processing and transportation, is done by a couple dozen people working full-time. We need quite a bit of water to fill up, but a lot less once we're up and running.

But, it's energy intensive, and drains resources in hidden ways — much of our "ecological footprint," so to speak, is offsite. This isn't quite the miracle industry portrayed by its capitalist backers and their media hype men. It's important to be skepti-

cal of some of any claims you hear about new (or old) forms of agriculture, as long as there's money involved. Anyone trying to turn new forms of scarcity into new sources of profits does not have the needs of the people at heart, and will in the end resort to smoke and mirrors when rational, informed collective decision-making threatens their profitability.

The most obvious resource we're using a lot of is electricity. We pump an awful lot of water around in circles, and filter and sort it, and heat it in the winter. Producing the right environment in the culture tanks also needs direct inputs, first and foremost aeration with oxygen, so we're dependent on outside companies that produce liquid oxygen, as well as salts, chemicals to raise or lower pH, and any number of more specialized tricks: biological supplements and so on. We're raising fish in an entirely synthetic environment, and the components of that environment break and need repair or replacement.

This is sort of abstract, but it might help to think about it in terms of the laws of thermodynamics: we can't just produce an ever-higher level of order within our walls without it being offset by a greater amount of disorder somewhere else. The more usefully arranged matter/energy (edible fish meat) streams forth from our loading docks, the more disorganization we're pushing elsewhere. You can't just turn dirty water into clean water. I don't think people should be discouraged by this, but I do think we need to have an understanding that all human endeavor has unintended consequences, and if some green capitalist is describing ideas to you that sound a little too tidy to be true, your bullshit detector should be going off.

Wild evolved living systems are more materially ordered than anything we can design. We can choose to prioritize other forms of order (like human pleasure, freedom, justice, intelligence, and longevity), but in doing so we need to have a realistic understanding that there will be some material sacrifices, imperfections, and surprises.

equation — it isn't a case of technological "advancement" being spurred by capital's desire to break down worker control, as was the case with longshoremen and containerization, the initial mechanization of coal mining, the introduction of numerically controlled lathes, or the development of the moving assembly line.

My guess is that even in the more established, traditional fish farming industry, where multiple farms are competing directly to make profits, there's a somewhat more established division of labor within the farms, since more profit can be re-invested into improving labor control and minimizing labor costs. Recirculation aquaculture is a fledgling industry where employment is a little more ad-hoc and wages are kept down by the fear of plant closures. These farms only exist at all because private investors or institutions think they're a good idea in the long term, and some consumers are willing and able to pay a premium to support their methods.

Maybe that's more of a question for people who work on fishing boats, though — in their view, are we scabbing? Our jobs are a lot less dangerous than theirs, and it could be argued that we benefit from the same environmental regulations and population declines that put them out of jobs.

It also sounds like there won't be so much room for small producers, but rather large aquaculture corporations would come to dominate the market?

If the technology becomes profitable, larger companies would certainly have an advantage. I don't see this as a good or bad thing necessarily.

Do recirculating aquaculture farms ever cut corners and compromise environmental ethics to maximize profit?

Yes. I could be wrong, but from what I can tell, if anyone is currently making money on recirculating aquaculture in this country, they are probably lying to their customers or misleading them in some way.

less, breaded, and may contain traces of mercury, hormones, or antibiotics. It's pretty grim.

The current capitalist perspective is that since the seas are going to be commercially unfishable, and traditional aquaculture is eventually going to face more scrutiny and regulation, we might as well get in on the ground floor of recirculating aquaculture now! But that's the thinking of the enemies of food security.

If money were to completely lose its value overnight, would recirculating aquaculture be a sensible use of the available resources to meet our food needs? If so, then it's a valuable technology, and if money is getting in the way of developing it, then it shouldn't be commodified in the first place. On the other hand, business plans not panning out due to per-unit production costs might indicate that it's a waste of real resources. Either way it merits careful investigation and thought. If energy costs go up, fish grown on recirculating farms are unlikely to get more affordable.

Is capital transforming the way labor works in regards to fishing? Seems that if aquaculture dominates the market then many current fishers will be unemployed? It also seems that a lot of working conditions will be more subject to time management, manager surveillance, etc...

The shift toward aquaculture isn't because fishermen have become too powerful and well-paid. If wild fish remained as abundant as they once were, fish farming wouldn't be competitive. Instead it's relative scarcity putting upward pressure on prices. Small, often family-based fishing crews are competing in tighter markets against larger scale operations which use more extreme techniques (various sorts of trawls, tangle nets, purse seines, and so on).

Market entry already favors larger capital, and from that perspective building an onshore farm might look more attractive than buying a bunch of boats, nets, navigational equipment and moorings. I don't think labor costs factor heavily in the

Can you explain the difference between farming vegetarian and carnivorous fish?

As with all meat farming, you have to picture the end product as the peak of a matter/energy pyramid. The more levels there are on the pyramid, the broader a base of resources are ultimately being used to produce it. Fish are no exception. If you're catching menhaden at sea to feed to bass on land, you aren't doing anything to address the current problem of human hunger.

There are some grey areas; some farms use feed made from bycatch or other industrial byproducts. "Feathermeal," for example, is secondary material collected in poultry processing, and a lot of it ends up as fish feed. In the same way, a lot of fish processing waste ends up as pet food. I'd say there's a benefit to turning byproducts from other industries into food, as long as it doesn't provide opportunities for diseases to emerge. In the short run, if you tolerate the existence of these massive poultry operations, then it's hard to argue against using feathermeal to produce fish.

In the long run, if we're talking about food security, it's preferable to farm vegetarian fish. They're like little naive swimming machines that convert plant matter into fatty acids.

What about the difference between monoculture and polyculture?

Polyculture means raising multiple species together. Some farms try what's called "aquaponics" — raising fish in conjunction with hydroponically grown plants (herbs, seaweed, leafy greens, tomatoes, etc). The idea is that stuff in the fish waste can serve as nutrients for these plants, which can also convert carbon dioxide back to oxygen. So it conserves resources in water treatment, reduces some air pollution, and yields a secondary crop of food. The idea of growing algae is also becoming popular — algae capture sunlight, and their oil can be extracted to use in making biodiesel.

But it's difficult to design a factory system that mimics a wild ecosystem in a regular, beneficial way, especially at larger scales. I can see the appeal of wanting to further reduce the number of factors you're trying to manage, and just sell the manure on the side so farmers somewhere else can use it as fertilizer.

What do you think of more organic, permaculture farms like Veta la Palma in the south of Spain — low-density, open pond aquaculture?

Veta la Palma looks beautiful, and it's inspiring to see human intention engaging with the ecosystem so actively. I don't know if they describe what they're doing in terms of permaculture, but it's definitely on the same page: design that seeks to echo nature by reintegrating as many components as possible, making every output an input. This approach makes the total system the priority, and "production" (of harvested fish) less central. They're also restoring the wetlands, providing food and habitat for migratory birds, and growing the shrimp that their bass eat. I think it's great in and of itself. That said, it isn't going to be a very helpful tool in solving the food/energy crisis humans might be facing. They say they harvest 1,200 tons of fish a year on something like 8,000 acres of their land... with recirculating aquaculture, it's not unheard of to hit that kind of yield on 2 or 3 acres, though I'm sure our hidden land use is much higher.

Your farm is located in a rural area. Is there any reason that it couldn't be in a city, closer to where the market for fish consumption is?

I don't think so. There's quite a bit of empty industrial space, especially in inner-ring suburbs, that can be rebuilt or converted for aquaculture. I've heard that abutters complain about manure storage at fish farms, but I imagine there are ways to avoid that problem — storing it better, getting rid of it faster, or getting better neighbors. Farms smell! If the neighbors complain about the compost pile at your urban community garden,

they'll probably complain about a nearby fish farm, too. Besides that, so long as it remains possible to transport resources in and fish out, we should be able to site these in urban areas with no problem.

It would be preferable to site them in population centers — if all the product were prepared and eaten locally, the energy savings in "food miles" would help make up in part for the high energy cost of production. I would even go so far as to say the greatest benefit of recirculating aquaculture is that we can site it in cities.

How affordable are recirculating aquaculture grown fish compared to other kinds of fish harvest? Can recirculating aquaculture compete in today's market?

They're expensive. We're competing with wild overfishing, and with more environmentally destructive types of fish farms. There's a niche for what we do in the current markets, but my guess is that most of those customers are intentionally paying a premium, either because they want to help sponsor this kind of production, or because they're buying an uncommon or hyped species for status or novelty.

Let's say you're looking to feed two or three people on the income of one full-time working person in the USA. The median hourly wage here is about \$16, or \$640 a week, and on average people are spending 10 to 15% of our income on food, so let's say between \$60 and \$100. (The Department of Labor says that the "average consumer unit," which has 1.3 incomes and 2.5 eaters, spends \$118 a week on food, but that's \$67 at home and \$51 out.)

Buying a couple pounds of fish at \$8 to \$12 a pound retail, which is what a lot of the "green," "safe," farmed fish are going for, is going to look prohibitively expensive — it's a luxury purchase. If you're lucky enough to live near a fishing port, you can probably find fresh fish at market for \$4 or \$5 a pound. But if you live inland you're buying farmed, processed, frozen, and trucked product for that price. And that's probably flavor-