

A TALE OF THREE SEAS:

From Fishing through Aquaculture to Marine Biotechnology in the Life History Narrative of a Marine Biologist

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ABSTRACT In this article, I present the life history narrative of a scientist working in the field of marine biotechnology, the practice of investigating, modifying, and growing marine creatures to harvest natural materials and chemical compounds of potential interest for medical, pharmaceutical, and industrial application. Dominick Mendola has traveled in his life through three seas: a sea associated with fishing, with aquaculture, and now, with biotechnology. I argue that this man's story can be illuminated using ethnological insights about the properties of nature and the nature of property first developed in maritime anthropology. After presenting his narrative, I examine continuities in his visions of oceanic nature as a space of health and bounty alongside significant shifts in the modes of production he has employed to extract food and, most recently, pharmaceuticals, from the aquatic realm.

Introduction

The Oceans and freshwater resources of our Water Planet are now known to hold a veritable treasure-trove of new biochemical diversity. These vast marine and aquatic resources, which encompass nearly 80% of the trophosphere of our planet, represent the next frontier for discovery of new pharmaceuticals and industrial fine chemicals. For the past 30–40 years dedicated marine researchers at oceanographic institutions worldwide have discovered a large number of unique and biochemically diverse bioactive natural products from a wide variety of marine organisms, including microorganisms, invertebrates and plants. And only a tiny fraction of this unique biochemical diversity has been discovered so far, with lifetimes of new marine and aquatic environments yet to be searched. Discoveries to date encompass both new and uniquely marine biochemicals, with some new chemical structures previously unknown from terrestrial ecosystems. The findings to date are exciting, the opportunities for the future immense – the time is right to take advantage of this new opportunity for commercialization of new marine natural product chemicals!

CalBioMarine Business Plan, www.calbiomarine.com

Maritime anthropologists have historically anchored their researches in the lives of fisherfolk. In recent years, such scholars have also begun to reach into the works and lives of fisheries scientists, managers, and administrators, arguing that these people, too, are possessed of culturally particular views of the sea and work with parochial, tacit, and craft knowledge (Finlayson 1994; Pálsson 1998; Taylor 1999; Scarce 2000:

Poore 2001; Walley 1999; Kitner 2002). What has remained absent from much maritime anthropology, however, has been an explicit anthropology of marine biologists not involved in management or conservation regimes, an account of how people in, say, oceanography and marine biotechnology produce for themselves and others a nature for the sea. To be sure, much work on the culture of oceanography has been done in the history of science (Deacon 1971; Schlee 1973; Rehbock 1975; Rozwadowski 1996, 2002; Höhler 2001), though little follows scientists up to the contemporary moment. Meanwhile, in science and technology studies, there have been some notable studies of shipboard interaction, relations between scientists and their funding agencies, and the symbolic construction of the sea through scientific mapping practices, though none of these emanated from anthropology, per se (Bernard and Killworth 1973; Bernard 1976; Callon 1986; Mukerji 1989; Crawford 1997).

I would like in this article to offer an ethnographic glimpse at a genre of marine science known as marine biotechnology, the practice of investigating, modifying, and/or growing marine creatures in order to harvest materials and chemical compounds of potential commercial interest for medical, pharmaceutical, and industrial application (see National Academy of Sciences 2002). I argue that the activities of marine biotechnology are firmly located within the subject concern of maritime anthropology and, indeed, that tools developed in maritime anthropology can be employed to make sense of them. I will make this case in an experimental mode, presenting and analyzing the life history of one scientist, the founder of CalBioMarine, whose mission statement appears as the epigraph to this article. Dominick Mendola narrates his founding of this company as growing from earlier personal engagements with the sea. Indeed, his biography, as we shall see, has taken him through a variety of engagements with the ocean – from fishing, to aquaculture, and now, to biotechnology. For Mendola, these moments are linked not only through his biography, but also through a consistent imagining of the nature of the ocean as a place of bounty. After presenting the transcript of an extended interview with Mendola, I will also analyze some of the discontinuities that are in play here, arguing, using the work of Gísli Pálsson (1991), that Mendola's trajectory takes us through three rather distinct systems of maritime and aquatic economic production.

I first met Mendola at a marine biotechnology meeting in Hawaii in April 2002, where he was seeking new collaborators in the development of marine bioproducts aimed at diseases such as cancer. I conducted the interview I present here in California in August 2002, in the offices of CalBioMarine, which was in the process of moving to more modest quarters. After transcribing the interview, I worked with Mendola to clean up and correct the text; his real name appears here with his approval. Mendola's voyage to marine biotechnology is a tale of three seas: the romantic sea of immigrant fisherpeople, the countercultural sea of 1970s southern California aquaculture, and the highly capitalized, corporatized sea of biotechnology (there are two important eddies in the flow between these seas: Mendola worked in 1960s antisubmarine warfare and in a pre-biotech aquaculture enterprise most characteristic of start-up companies of the 1980s. More on these later). I take my cue here from the anthropological genre of oral history (Griaule 1948; Shostak 1981; Behar 1993; Herzfeld 1998), which seeks to tease out cultural meanings that unfold from and locate one individual's life history (see Fischer 1995 for a mission statement about examining scientific autobiography). I do the work of cultural analysis after presenting Mendola's story, uninterrupted, here:

Mendola's Narrative

Dominick Mendola: My connection with marine biotechnology started the first time I stuck my face underwater and saw that there was something in the ocean under there. I grew up on the ocean.

Fathers and Fishermen

My grandfather on my mother's side was a fisherman in the San Diego Bay. He emigrated from Sicily where he was a fisherman and in the Navy. My father's side were almond farmers on the slopes of Mount Etna. And the fishermen met the orchard keepers and they got married, spent a cold winter in Boston. And then they heard that there was an enclave of Silicians in San Diego fishing and – boom – out came the fishermen. The almond orchard descendents stayed in New York. But my father, their offspring, moved to Monterey when he was seventeen to go sardine fishing with John Steinbeck – you know, figuratively. While he was in Monterey, he traveled down to San Diego, in about 1941, to marry my mom, when she was seventeen, in what was sort of an arranged marriage between the two, since their families were related in Sicily (my two grandmothers were raised together; one was adopted by the other's parents). After my mom and dad married, they went back up to Monterey so my dad could continue working in the sardine fishery. And I was born in Carmel, California, in March 1943. So, my father was on Cannery Row and they fished-out the last of the sardines, and there were no more jobs for fisherman there. He said to my mom, 'Let's go down to San Diego, and I can fish with your dad and see how we do.'

So, my grandfather was fisherman. And as the first born in the United States, I was a proud little kid in San Diego's Wop Town, as they used to call it, Little Italy. My grandfather had a 30-foot Monterey double-ender named after his two oldest daughters, my mom and my aunt. *Stella Rosa* was the name of the boat. It was a gorgeous little boat. I can remember it very clearly, the first time, walking, holding my mother's hand, down to the dock from our house in Little Italy. It was only some blocks. I put aboard the boat and I could feel it: I was going to be the next fisherman on that boat. So that was my first connection with the ocean. Everyday my grandfather would go fishing at three in the morning, except for Sundays. You could hear him upstairs at Nana's house, getting ready to go. He would walk down to his boat with this bag and a few fishing net things or whatever. He would go out everyday and he would plan to be home for lunch.

And he would come home for lunch. He would bring lunch with him! He would have a gunny sack wiggling over his shoulder and he would pour this gunny sack of marine organisms – fish, shellfish, into the kitchen sink, and things would be flopping: lobster, octopus, fish of all colors and all phylogenetic origins. And I would rush over there and look in the sink and get flicked in the eye with scales. So, I was handling marine organisms from a very young age. And he would tell me what they all were and then the next thing he would do would be to pull out a knife and just cut it up – whatever we were gonna have for lunch, cut the head off and kill it, drop something else in a pot. But it hit you square: we're killing animals to eat, right now. And you don't like it as a little kid. You love pets, you want to keep the lobster alive in

the sink, but it ain't gonna happen! Nana would have a boiling big pot and *cioppino* (fish stew) would be on its way. So fish would get cut up fresh and thrown into that pot and within a half hour or less we'd have cioppino for lunch, and she'd spoon it out and Grandpa would sit down for his jug of homemade wine and I'd be over there with my little bib. I can remember it so clearly! I did this everyday from when I can first remember. That was when I was about three.

I had to move away from this house, which was when I was about five. For two years I had this memory. Plus going down to the boats and helping them do the nets in the yard. And I got to learn and to do all of that. I got to haul out on day trips on the boat to test the engine. All before I was five. So I was the son of a fisherman who was the son-in-law of a fisherman, and that was cool. All of my family were fisherman. My aunts married fishermen. We had Greek, Portuguese, and Italian in my family – all intermarried, all around fishing. At five years old, we moved out to Point Loma. My parents wanted a bigger house. We'd lived with my grandparents. They wanted a house of their own, they could afford it. They built their own house off of fishing. At that point I was disconnected from my grandfather's boat except for once and a while – the weekends. But my father went to work now for tuna fishing instead of for my grandfather. And so we started getting in with the Portuguese and Sicilian tuna boat owners, and my dad was one of the best fishermen – *is*, he's still alive – that ever fished out of San Diego. Everybody loved him. He worked his butt off, he was so good. His nickname was 'Sea Bass,' because his name was Sebastiano.

So, Sea Bass was a smart guy and I took my cues from him. He said to me 'Go to school. I don't want you to be a fisherman. It's too hard. I want you to go to college.' 'Sure, dad. Can I try fishing?' 'Yeah, you can try it.' Talk about hard work! It is amazingly hard work and it doesn't stop, except when you fall exhausted into your rack at night. Then you can be awakened in the middle of the night, for some reason, be it engine or weather. First thing in the morning at the crack of dawn, you're up and you have to stuff a giant breakfast down because there are the fish and oh my gosh it's so hard, but there they are. Look at those fish! There must be a million of them! I'm with the binoculars and I'm just oh my gosh we're gonna catch those! We see the little fins sticking out, but the water boils for miles, way out there and the boat steams around and everyone's yelling at each other and the net's peeling off the back or, in my father's day, they put the rails down and people jump in with their poles and the ocean is coming up to their necks and they're in there with their gear on and the poles and they start throwing bait. I threw bait on some bait-catching trips, that was my job, to chum, until my arms were falling off. All these sardines and you're throwing them. And you're a fisherman. And you could have a Ph.D. and it wouldn't matter. You've got to pace your energy to make it through a whole day and you get cut up, you get injured. I got so sunburned, so stupid.

Stefan Helmreich: So you decided to go to college?

DM: At San Diego State. I switched from medicine to oceanography. And I was nineteen years old and I went to the Scripps Institute of Oceanography to apply for a job and I got it. I was an engineering aide with the marine physical lab. My boss

was a co-designer of the research platform FLIP, which was a one-of-a-kind vessel [FLIP, which stands for Floating Instrument Platform, is a 355-foot-long vessel that can flip from horizontal to vertical and stay moored in an upright position. It has been used to do experiments in underwater acoustics, particularly for bearing accuracy research related to the Navy's submarine rocket program]. And we were the first scientific crew, in 1963. My first job was to work with this engineer and attach – to the FLIP – underwater strain gauges and acoustic monitoring instrumentation for anti-submarine warfare needs. And I went to sea every summer with the FLIP for ten years. The longest time I was at sea was ninety days without coming to shore, and that was hard to do. You can only read so many books. Each time I went to sea I got deathly seasick and I was determined to overcome it, but I realized that I have middle ear damage, from rheumatic fever when I was a baby so there's no way I can fix it. Fred would say we're putting out. I'd be so sick I just wanted to kill myself. But I wouldn't and I'd come out of it after two weeks or something and I'd be ok as long as it didn't get too rough. That was what oceanography means: going to sea. I loved it. But it was getting to me. And there were all kinds of remedies. I tried all the ones they had in the 60s. They all gave me a stomachache or made me vomit.

Hippie Aquaculture

So it was 1970-71, and I had a life changing experience when my wife left and took the kids. I was fairly devastated and that was just about enough impetus to tell my boss 'I'm gonna quit.' And he said 'What, quit? We need you. Why are you gonna quit? You got this job for life!' Well, as an engineer by this time, I had graduated and they made me a full engineer. 'I'm gonna quit, this whole thing with my wife leaving and the seasickness. I'm gonna do something else.' 'What are you gonna do?' 'I'm gonna go back to school and join the graduate program at San Diego State in aquatic ecology.' And the aquatic ecology department at San Diego State had eighteen professors, maybe four or five were aquatic ecology professors, people from the best aquatic ecology programs in the nation at that time.

And we got a hell of an education. We got one of the best educations in aquatic ecology that you could get in the nation and I loved it. I majored in marine biology as an undergraduate – inveterate biology – but as a graduate I started switching to fresh water ecology, which gave me a really good basis for ecology. So I got the marine and the fresh water and got straight A's through grad school and did wonderful work and would have loved to go on for the Ph.D. but the three kids and the court order said otherwise. I was dragged into court. They said: 'What are you doing in school? You're supposed to be working!' It was before this judge, who was not very understanding, and I said to the judge – I was a little cocky – that I was a seeker, that I was seeking enlightenment, intellectually and otherwise and that this was the best thing I could do for my children at this time and that I would like him to bear with me because when I'm done with this journey I'm gonna be employed as a Ph.D. something or another. And he didn't buy it. He said 'No sir, you've got that all wrong. You're a father and you must support these children and you must do that immediately or else I'm gonna throw you in jail.' And he said 'You understand me sir?' I said 'Yes, sir I understand you. I don't like jail.' So I went and got a job. I quit my academic pursuits and I got a job. At a pharmaceutical company in Palo Alto. What is a marine biologist

doing at a pharmaceutical company in Palo Alto? Really strange. The vice president of research thought that aquaculture was something they should get into in 1972.

SH: Was your earlier decision to quit the Scripps job shaped by any countercultural politics of the 1960s about the military, the Vietnam War? Were people at UCSD protesting?

DM: I was one of them.

SH: How did that figure into your decision?

DM: It didn't figure in at all. I was one of the most active political people that you could imagine in the state of California. I helped start the Peace and Freedom party. I was one of the first people, in the first cadre, who fought for equality and peace and freedom and 'Out of the Vietnam War.' And I was working on anti-submarine warfare ... so, yes, thanks for cueing my mind. If there *was* any part of the work that had to do with it, it was the warfare part, taking ONR [Office of Naval Research] money in my salary. You're right. It *was* a little part of it, I remember now. It was a little part of me that said: I don't want to take any more Navy money. But that wasn't the *main* reason. The main reason was emotional. It was the family, that my whole life was in upheaval. My beautiful daughters were taken from me and that was extremely hard. So, I said I'm gonna do something else. Change is good. The Vietnam War was winding down and we were successful. We did shut it down and I felt very proud of that, you know in a small way. I met Herbert Marcuse. I used to go the homes of other grad students and have sessions where we all sat on the carpet and listened to him talk about philosophy, the military-industrial complex in America, Marxism, and other ramblings about the times we found ourselves in.

So I didn't have a job. So when the judge ordered me, I went to Syntex in Palo Alto. Luckily the guy calls me up at my lab at State and says, 'We're looking for an aquaculturist. Could you come up for an interview? We'll send you a plane ticket. Monday? Do you know what? Nobody was getting jobs back then in marine biology. People who were my classmates were becoming real estate agents. The fact that I could get a job at that time was amazing. So I cut my hair. I had a ponytail. Shaved my beard. My mother bought me a suit. This is what's neat about being Italian. You can always go back home no matter what age, no questions. But my divorce blasphemed the family. The first person to get divorced in my family was me, first person to graduate from college, first person to do some other things. Could always go back home, though, they love you. So I got the job. It took twenty minutes. I knew aquatic ecology and I knew applied aquatic ecology, which is aquaculture, and I'm an expert at it, I'm a world expert at it now. There's only three of us! I'm being a little facetious, but back then there were not too many aquaculturists and my roommate and I during graduate school were both aquaculturists and the third roommate was a researcher at Scripps. Our fourth roommate was a biology undergrad at San Diego State.

We had a household that was all aquatic oriented and in our backyard we built our first aquaculture unit. In our backyard it was a total living, aquatic ecosystem contained under a greenhouse roof, from solar panels to all levels of the trophic food

chain in one tank. Totally recycled and purring along in near perfect balance – real cool! No effluent, except to the garden, producing food at three to four trophic levels in our backyard because our professors had taught us well.

SH: What attracted you to aquaculture?

DM: It was primal. When you walk through the door of an aquaculture greenhouse, you take a deep whiff of negative ions, essentially. And you've got to put on your shades, you've got to take your shirt off and get into shorts. It's so warm and it's moist and it's gurgling away. And there's food coming out of those tanks and you don't have to go to sea, get seasick.

SH: So, a primal experience of the ocean but without the seasickness?

DM: Exactly. And the food! I could produce food for human beings in my back yard. I'm gonna carry on the tradition! I'm gonna *be* the fisherman's son, *without* the boat, *back in that sink!* The big sink! It was primal. I was right there! It was so cool, I can't tell you! For me, it was my life. So, I became an aquaculturist through the graduate program and then I was hired at Syntex to get *paid* to be an aquaculturist and grow shrimp in the basement of the animal sciences building at Syntex pharmaceuticals. With a white lab coat on. The kid's made it! I'm getting paid to do aquaculture and talking on the phone to my friends who are waiters! I scored! In the early 70s! And we *did* grow shrimp in the basement and I immediately flowered and started inventing things. And they were just blown away. I had three inventions in the first year. New fundamental things that were needed for aquaculture and my boss loved me and he said, 'Now I want you to come with me to Mexico. We got an aquaculture project down there.' We flew from Palo Alto to Mazatlan. A couple Mexicans picked us up and drove us out to the country where they had a river where the fresh water shrimp spawned, and we were raising fresh water shrimp in Palo Alto and *these* were the freshwater shrimp that we were raising.

[Dominick shows a photograph of shrimp and then arrives on a page in the photo album showing him with friends on an aquaculture farm he had during graduate school]

This was me, the graduate student, before I got the job. This was my partner, my roommate and these are all the other aquahippies that we lived and loved and – you know what his name is? – Sundancer.

SH: So, from the military industrial complex to the hippie industrial complex?

DM: You got it baby!

[Dominick shows pictures of some other fish he grew]

These are hippie fish. The reason why they're hippie fish? Vegetarians. As adults in the Amazon Basin where they are native, they eat mostly fruits and nuts that drop

into the water from the trees. Our job here was to grow vegetarian fish for those California vegetarians that also ate a bit of fish once in awhile – you know, ‘fishatar-ians’! So now they’ve never eaten any red meat and keep the purity of their chakras or whatever. We fed the fish a totally organic vegetarian diet, so that made them ‘organic’ fish – hippie fish!

So, I’m in Palo Alto. I fly to Mexico, we’re doing freshwater fish with Syntex. Two years later they closed the division. And they wanted me to stay there and design new aquarium pet products because they were gonna acquire an aquarium pet company, and I said ‘No sir, I’m a food man. I don’t do pets.’ I said ‘See ya!’ My ex-roommate was in the graduate program in Davis, getting his Ph.D. in aquaculture. ‘Steve! what’s going on at Davis? I’m just quitting my job at Palo Alto.’ He says ‘Cool, I’m quitting my doctoral program.’ ‘See you back in San Diego.’ So we regrouped in San Diego and we started up in our backyard, again.

We put together a business plan in one night. We stayed up till three in the morning and we put down on paper a business plan for *Solar Aquafarms*. Food from solar and aqua. And the plan was superb, I tell you. When we woke up in the morning, the proposal was sitting on our dining room table. We both had the same immediate waking thought: get back there and see if it’s still there and read what you actually wrote down! And we sat there with our jammies on and said ‘This is hot!’ Because we had gone to the next level, the next intellectual level of engineering on the system. We had figured out how to totally integrate everything into one tank. And we got it all conceptualized in one night. And it only took two joints!

First time I’ve mentioned that. But it is not the first time it has had an effect on a business plan or the evolution of our anthropological roots or whatever else we’re doing. We connected right in with our most inner being and were able to channel that into our engineering. It was so cool, my hand was shaking when I wrote down these things. I was the scribe. Two of us, with Joan Baez or somebody on the radio. You know what I mean. And our house overlooked Mission Bay, the twinkling lights of the city. Could see out to the ocean, the sunset everyday, our little aquaculture greenhouse in the back yard. We were just totally connected and we could get ourselves just totally channeled in on aquatic ecology and we would just go yeah, baby! And we did it all in one night and that proposal is the basis for all my career. It still encompasses everything I do, in ecology, in aquatic ecology, in marine pharmaceuticals. It’s all in that proposal.

I’ll tell you what happened at that time that was a little sad. Steve’s girlfriend was a practitioner and believer in psychic phenomena and psychic human powers. They invited a psychic woman to come in to ‘consult’ on a problem we were having breeding this one species of fish. She brought in this mysterious – I mean psychically tuned-in – hollow aluminum vessel that they dangled over the brood-tank by a monofilament string in a psychic experiment to entice the fish to breed, telepathically. It didn’t work worth beans, and they had to pay her \$40 a session to ouiji-board the fish to boot! I just said, ‘You guys are blowing my mind, you’ve crossed over.’ I said look I believe in psychic stuff, in fact I’m pretty tuned-in myself, but I will not

have one more dollar of *Solar Aquafarms*’ investor’s money paying psychics to get the fish to breed – that’s what we’re supposed to do! They agreed, and stopped using the company checkbook to pay for any psychic readings. They used their own money from then on and did it on Saturday or Sunday, after work hours, so it became an obsession of theirs, not a business function of the company. But that was a big schism in the hippie-fish family.

So I took the license to the technology and I went to Mexico, back to where Dr. Bennett had introduced me and I got Mexican partners and Canadian partners and U.S. partners and we went to the Mexican government and said ‘We’re gonna build you the best little ol’ fish and shrimp farm in all of Mexico.’ And we got a project with the Mexican government for eleven million dollars to build a five thousand acre integrated shrimp farm. But after the Mexican debt crisis of 1982-3, they owed our Mexican consulting aquaculture company, Aquasin, S.A., of Mazatlan, Sinaloa about \$93,500 when the country went bankrupt. And they couldn’t pay us. I stayed around Mexico for six months trying to get paid and it wasn’t going to happen, so I left Mexico and limped back to the U.S. with only \$200 left for gas and food on the road. I got into the U.S., called my mom: ‘I got enough money to come home. I think. If I don’t put my foot on the gas too hard.’ ‘Oh baby, where are you?’ So I show up at my mom’s in Point Loma for a good pasta lunch. One buck left in my wallet minus about \$12,000 on my American Express card. I’ve got to do it again now!

So after a couple of plates of pasta, I got up to use mom’s phone to call a friend of mine in Hawaii who was building a shrimp farm on the island of Molokai, to ask for a job. We had been selling them brood shrimp for their farm from our project in Mazatlan, so I was pretty familiar with their operation. ‘Hey Nolan’ ‘Connection sounds pretty good – usually not this good from Mexico’ ‘Yeah, I’m in San Diego.’ ‘OK, what do you need?’ ‘I need a job.’ ‘What happened?’ ‘They’re not paying me anymore in Mexico. I’m home.’ He said ‘What kind of job?’ I said ‘What kind of job do you have?’ ‘I need somebody to run the hatchery.’ ‘I’ll do it.’ ‘Good. Can you get over here next week?’ ‘Yep.’ Next week I had a job in Hawaii. Not too shabby! Nolan got his Ph.D. at Scripps. I helped him design his farm in Hawaii. At *Solar Aquafarms*, he came to us first when he wanted to do aquaculture, and we designed his farm for him. I go over there and design the hatchery. On Molokai. Gorgeous. I was one of only a handful of whites over there. The local boys give you the stink eye; they don’t like you, got keep your head down, respectfully. Then we hire the local boys – twenty-three of them and give them the best job they’ve ever had or could ever want to have. Fishing. On land!

Hawaii was wonderful. I was really into shrimp farming. And I wanted to be a shrimp farmer the rest of my life. I became vice president in charge of Hawaii operations for *Orca Seafarms*! We had five million dollars in our farm from investors, and we’re doing fine, we’re producing ‘The Finest Tasting Shrimp in the World.’ That was our motto. We won second prize in a world shrimp tasting conference on the island of Molokai. First place were *estero* shrimp that had been imported to the shrimp marketing conference from Mazatlan, Mexico – right where our brood shrimp for the Molokai farm originally came from! So, we were number two in the world next

to Mexican estero shrimp, and we're producing 200,000 pounds per year of this beautiful shrimp on the beautiful island of Molokai, Hawaii. Now that was cool, we were clicking!

The way I marketed these shrimp was brilliant. I showed up looking like this [points to his casual clothing, a Hawaiian shirt] with a cooler. In that cooler were shrimp that we had harvested that morning. And I'd go to the hotel and I'd say 'I need to talk to the chef.' 'Do you have an appointment?' 'No.' I gave them my business card. It has shrimp on it. Chef comes out in a white hat: 'What do you have for me?' And I say 'I have the finest tasting shrimp in the world.' 'Where did you get them?' 'Molokai. You can see our farm from here.' 'Molokai? You? Farmed shrimp?' 'Yes sir. Would you like to see them?' We're in the lobby. I'm opening the cooler. I'm pulling out bags, ziplocks, with two-and-a-half pounds in each of the finest tasking shrimp in the world. He opens a bag and sticks it to his face. 'Good,' he says. 'It has no odor, a little marine, a little iodine. Come with me son.' We go to the kitchen of the Hyatt Maui. I'm impressed. And he says: 'How many of these can I have?' 'All yours.' So he asks these guys to cook them up five ways, and he says, 'Would you mind waiting for me out in the restaurant?' And he comes out and he sits next to me and we have a white wine poured for us, a full white tablecloth at about 10AM. There's no one else around. Out come the shrimp, all arranged, all totally gorgeous. And there's five different meals and they set them down. I just didn't know what to do! He said 'Mangel let's eat.' So he starts eating and he's immediately impressed. He says, 'These are delicious, you farmed these yourself?' 'Yes, sir.' And then I'm eating them and I'm thinking these are really good! And I'm just seeing dollar signs! So here I am, an aquatic ecologist, marine biologist aquaculturist, who is now also a marketing specialist – add that to my resume! I could market shrimp around the world. It's primal again. Let's eat! My farm-raised food and your nutrition. So, I market to all the Sheratons, all the Hyatts. I get to stay in the best hotels in Hawaii, doing marketing sojourns on the weekends. I get to satisfy all of the chefs. Guess what? It all came crashing down – for a combination of reasons, not the least of which was our inability to raise our stated impound level for a limited partnership, tax-advantaged private-placement stock offering that we had out. When the Congress of the U.S. stalled in passing the budget that year, 1985, our broker-dealers were unable to convince enough of our interested client-investors to hold-on and wait until the budget was passed. So, we had to return the money we had committed from the investors we did get, and as a result we were instantly bankrupt in January of 1986.

Drugs from the Sea

SH: So how did you start CalBioMarine?

DM: So, it's 1986 and I returned to San Diego from Molokai. I went down to La Jolla to visit with one of my mentors, Jack Savidge, a sage businessman who had been our outside director at *Solar Aquafarms*. I say, 'This time I'm gonna be in charge. I'm not gonna be vice president any longer. I've been vice president too much.' 'Great, glad to hear that,' Jack says, 'What do you want to do?' 'I want to grow the finest shrimp in the world in a greenhouse in Encinitas. Just like we used to do with Steve

at *Solar Aquafarms*. And I want to sell them right out of the tanks every Friday out of a little shrimp stand on the highway, you know, 'The Little Shrimp Farmer from North County. I'll be happy as can be, if I could just get back to where we were. But I'll probably have to get at least one investor since I'm flat broke... again!' He says, 'I support you in doing that, but let me ask you a question. You're a marine biologist. You used to be at Scripps and everything. I was just out at New York at Kodak, talking to one of their vice presidents in their pharmaceutical subsidiary. He asked me this question. I'm going to ask it directly to you: 'Do you think it's possible to grow drugs from the sea?' I said, 'You mean apply aquacultural premises to growing organisms for their drugs? Do I think it's possible? I don't know. I think those organisms are mostly weird ones. Yeah, it's probably possible. Boy that's a neat idea.' 'Well, if you can figure out how to do it, I'm pretty sure that Sterling Pharmaceuticals would like to hear about that.' And I said, 'Really? Tell you what Jack – I'm gonna go down to Scripps and talk to my old buddies and I'll ask.' So I went into John Faulkner's office, and I said: 'John, do you think it's possible to grow drugs from the sea?' And he said, 'Mendola, what are you into now? Possible to grow drugs from the sea? You mean grow the invertebrates that produce the drugs, yeah that's probably possible, but why would you ever want to do that? Stick to your shrimp – you'll make more money.' And I said thanks and I walked around the hall to Bill Fenical's office and said 'Bill, do you think it's possible to grow drugs from the sea?' Bill says the same thing: probably possible and if anyone could do it, it's you.

Bingo. I walked out of there and I went to the library. And I sat on the floor of the third floor stacks and I went through monographs of drugs from the sea. There was a symposium in 1985 in Hawaii. The first marine natural products symposium and I went through it and took notes like crazy and I went to a Xerox machine and I was onto it, and I went back to Jack's office with my notes all scribbled down and I said, 'Jack, it's possible!' 'Do you want to do it?' he says. 'Well, you know I'm a little shy, I really want to do shrimp.' He said 'Let's do both, let's do both shrimp and drugs from the sea.' Our first business plan said marine shrimp and pharmaceutical aquaculture business and we showed that to Sterling Pharmaceuticals and asked if they'd fund it. On that Friday, Jack wrote me check for \$3500 and said 'Take this check home and polish up your proposal.' He was the first investor in CalBioMarine, and at the time it was California BioMarine products. And Jack wrote the check and I took the check home and sat in my trailer with my little MacIntosh in Encinitas, because my daughter and her husband and my granddaughter were living in the house paying off the payments and I lived in a little thirteen-foot trailer. I wish Steve was there because we could have done the proposal in one night!

SH: With drugs from the land!

DM: Yes, drugs from the land [laughs]. I did the first CalBioMarine Technologies, Inc. proposal: 'drugs from the sea by aquaculture' – or, more precisely, 'Large Scale Production of *Bugula neritina* in a Controlled Culture System to Produce Chemically Consistent Bryostatin 1' – and we submitted it to the National Cancer Institute and we got funded in 1990. Two iterations and we were a company. We had \$50,000. I hired Kathy Rudie as marine tech and she and I were charged to grow *Bugula neri-*

tina, to yield an anticancer drug, bryostatin. And, by golly, we were successful. With all my expertise, I just stuck my face in the water.

The reason I've been successful with organisms is, I told you earlier, I can go underwater and I can connect with them. I know where they fit in the food chain. I know what they need, I know how they breathe. I know how water affects them. I know what turns them on and turns them off. So I go underwater and I look at the organism in its natural environment and that tells me what the system needs to culture them. That's what I did at *Solar Aquafarms*. I would get into the tank with the fish or shrimp we were trying to culture, and I could sit there for hours, on a hooka air supply. I'd be asking 'what do you guys need to breed, baby? Music? Brazilian music? We got it!'

These guys, the *Bugula*, they were weird, weird looking guys. But I pretty much knew who they were and what their game plan was. Kathy and I were successful the first time out of the chute. I was able to settle larvae from *Bugula* onto an artificial substrate on a tank in a lab, feed them algae, and grow them up and have the biomass produce bryostatin. First time! Feebly and meagerly but yes, the chemistry was cool.

We got two phase-two grants from the National Cancer Institute, and a two-year grant from the DOC/NOAA (Department of Commerce/National Oceanographic and Atmospheric Administration). We used the money to design, build, test and optimize a next-generation, in-the-sea aquaculture system to grow *Bugula neritina* on a large-scale, and it worked fantastically! The system was designed around these super-cool, underwater 'box-kite'-like structures from which we harvested plastic panels lush with aquacultured *Bugula*. The bryostatin content was equal to that in nature – so we were winners! Now all we needed was a contract from a pharmaceutical company that wanted to market bryostatin as an anticancer drug. Hopefully that would come, in due-time, since bryostatin 1 should win approval from the FDA sometime in 2003. CalBioMarine has the only system in the world that can produce the biomass. We have a patent on this and we have done it in the ocean and produced huge quantities of biomass that has chemical potency equal to natural. We've also done similar with *Ecteinascidia turbinata*, tunicates on a Florida key, underwater, with an in-the-sea growing system that is extremely successful producing biomass and chemistry equal to the ocean [see U. S. Department of Agriculture; Phase II SBIR grant, 'In-the-Sea Culture of Tunicates to Supply a New Marine Anticancer Drug.']. So, we are the first people in the world to ever grow a marine invertebrate for its natural product content and I'm quite proud of that! They both produce anticancer drugs and both of these drugs are in clinic with humans. They're both going become drugs next year. And we have systems to produce them.

So why aren't we rich? Well, mainly because our technology was developed a bit ahead of the curve, meaning that clinical development for the drugs we targeted for our in-sea aquaculture systems has lagged way beyond what was predicted when we first started developing the systems. Bryostatin 1 has been in the clinic now for some twelve years, and it's been almost that long for ET-743 (the *Ecteinascidia turbinata*-

based drug) as well. So we have technologies and no real market at this time. Hopefully we will get a call as bryostatin 1 becomes a drug, and the pharmaceutical companies find out that you just can't go to the ocean and get that much of it by natural collections in a reliable, reproducible manner, year after year. Aquaculture is the only viable technology for bryostatin 1 supply at this time. We are also supporting the development of a microbial/genomic source through our on-going collaboration with UCSD / Scripps Institution of Oceanography, but that's another whole story.

Because it is aquaculture, pharmaceutical companies really avoid it. They want chemical *synthesis*, in labs, son! Not the animals. They don't want to deal with the mucky ocean and Mother Nature. They want control. The pharmaceutical companies don't want this; this scares them to death. It's not controllable; it's in the ocean. But I said 'Look, I can build this redundantly. I'll put thirty percent more units out there than we need. I'll divide it geographically between Southern California and Northern California.' But they think they can synthesize it more cheaply.

For me, this is an evolution of the primal connection with the ocean – to produce anticancer compounds to help save your mom and mine from breast cancer. It's primal again, and a great service to mankind. That's why I'm doing this stuff, to serve mankind. The money is nice if you can get it, but it's not the prime driving force that gets me up in the morning, year-after-year to make another day's progress towards that greater goal.

Where is CalBioMarine now? It's in an answering machine in my house, waiting for a rebirth. We've run out of money. We didn't get grants this year. We need to raise private money. CalBioMarine I hope can live till bryostatin becomes a drug. I know synthesis won't work. I do believe they will call me, and they will need some more, as an interim measure. Because I happen to know that synthesis is not gonna cut it for them and I know *that* because this paper [Dominick pulls out a scientific journal] came out on Tuesday of this week and this paper is 'The Chemistry and Biology of Bryostatin Antitumor Macrolides,' and it's by a prestigious group of chemists from Imperial College London (see Hale et al. 2002), and they say, through well-researched and documented – 117 references – that, on this page – this made me just laugh – 'Mendola's aquaculture solution to the bryostatin1 supply problem' – the last page of the article, when they want to make their closing chutzpah remark, they said Mendola is the answer! 'It only remains for the world pharmaceutical industry to embrace this powerful new technology he has developed to provide us with the next generation of nature's exciting miracle drugs.' A journal of the Royal Society of Chemistry! I just gotta last!

CalBioMarine biotechnologies is different than other companies because we were founded on the premise that you can grow drugs from the sea. And from the beginning, Drs. Faulkner and Fenical said that the biggest problem in exploiting the ocean's creatures for their natural products as drugs is the supply problem. You can't just keep going out there and raping the ocean and taking all that stuff. If you find some exotic thing down in Bora Bora, you bring it back, you gotta get more of it – you got to go back to Bora Bora. You got to get permission from the government.

So CalBioMarine has centered on the discovery, development and *supply* of marine product natural product drugs. We grow them ourselves. When you discover something, you can publish a paper on how neat it is chemically and what its bioassay characteristics are, but *can you get more of it?* That's where *we* come in. 'We are the marine bioproducts *supply* company, thank you. We'll take your order. Can you do sponges? Yes, sir, I can. I got an NSF grant to culture sponges. Can you do tunicates? Yes, I can. Bryozoans? Yes, I can. What you can't you do? Well there's some pretty weird stuff out there! But I'd be happy to try. If you can pay me to culture them, I'll try.'

But I didn't discover this stuff, the Indians did, right? The Chemehuevi Indians on the Colorado river, who worshiped Mother Ocean as the great mother of all creation, knew all about aquatic ecology and man's interconnectedness with the sea. We worked for the Chemehuevis out at Lake Havasu designing for them a totally integrated aquacultural wastewater treatment and water reclamation plant. So, man is interconnected with the aquatic marine ecology. And biotechnology has become the brains behind the engine that supposedly keeps the thing from going belly up, but we're pretty stupid. We're killing the oceans and we're making it go backwards. I want be on the positive side.'

The Nature and Properties of Seas and the Ocean in Mendola's Narrative

What can we glean from Mendola's narrative? I promised three seas, with a couple of eddies connecting flows from one to the next. Let me spell out these seas, with particular attention to the continuities and discontinuities that sequence them in Mendola's story. I find my motive here in Marilyn Strathern's *After Nature*, in which she writes of continuity and change, 'Instead of thinking what they measure, we might think how each depends on the other to demonstrate its effect' (1992:3). What, then, are the personal, cultural, and epistemological *effects* of Mendola marking his moves through specific seas as exhibiting continuity at some moments and change at others?

The Old Man and the Sea

Mendola's first sea is that of his grandfather and father, the sea of immigrant fishermen in the United States. It is a sea of abundance, symbolized by Mendola's image of himself as a child at the kitchen sink, which overflows with the fishy bounty his grandfather has brought home. It is a family ocean, with the men, the fathers, doing the work of hunting and the women, wives, doing the work of cooking the catch into food, transforming the wild nature of the sea into ethnically specific culture, symbolized by the cioppino Mendola's grandmother used to make. It is a sea of childhood, fondly remembered, even nostalgically imagined, a sea that is on the verge of vanishing, as indexed by Mendola's story about his father seeing the decline of the sardine fishery in Monterey (see Hamilton-Patterson 1992 on fishing and loss and Rogelja 2002 on how fishing in the age of declining stocks is increasingly rendered as a melancholy tourist attraction).

Mendola carries this sea with him as he begins his story. He switches from medicine to oceanography and uses his sea skills to become an engineer on the *FLIP*.

The sea he inhabits during this period represents a significant eddy in his story; this is the secret sea of the Cold War, condensed in the project of antisubmarine warfare, to which Mendola's work is connected (see Mukerji 1989). Mendola does not dwell on this tale for much more than its lesson about seasickness. And it produces the motive force for his move to aquaculture.

Counter Aquaculture

This transition was not explicitly political or countercultural, even as Mendola does acknowledge some uneasiness about getting money from the Navy during a period of antiwar activism on campuses in the United States like UCSB, with which Mendola's employer, Scripps, was associated. Mendola resists a full countercultural conversion narrative, phrasing his decision as less about politics – in which he was pretty secure as a founder of the Peace and Freedom party – than about personal change. Nevertheless, his aquaculture period remains suffused with imageries and practices characteristic of United States counterculture. Mendola's *Solar Aquafarms* stories well exemplify this tradition. For Mendola, connection with the sea is 'primal,' about being tuned in to what the fish on his farm need to breed. And being tuned in at times means being 'turned on,' that is, under the influence of mind-expanding substance. Mendola's story of writing the business plan for this company after two joints – 'We connected right in with our most inner being and were able to channel that into our engineering' – well condenses this countercultural back-to-the-sea imaginary – as does Mendola's romantic move, toward the end of his story, to speak about the Chemehuevi Indians on the Colorado river as being at one with the sea.

Mendola is not alone in deploying an immersive, spiritualized, even hallucinogenic imagery when discussing scientific breakthroughs. These have been a feature of scientific discovery stories since Friedrich August Kekulé's nineteenth-century dream about a snake eating its tail, which led to his discovery of the structure of the benzene ring. A kindred story within the late twentieth-century context in which Mendola is operating is the story of Kary Mullis, the Nobel Prize-winning inventor of the polymerase chain reaction. Mullis also connected his insight to drugs – in this case LSD, which allowed him to envision the copying of DNA (see Mullis 1998; Doyle 2001; see also Helmreich 2000). Some of Mendola's colleagues took this hallucinatory imagination too far for Mendola, trying to speak to the fish telepathically. Mendola has a keen sense of this cultural context, joking about hippie fish. The idea of being immersed in the ocean as a way of floating in some universal truth serum has a history that goes back at least to the romantic poets and their vision of the oceanic sublime (Raban 1993). But it is with such 1960s figures as John Lilly, who championed isolation tanks and communication with dolphins (Lilly 1961), that this acquires the kind of countercultural association that can have Mendola's colleagues attempting to speak to the fish.

For Mendola, this tradition interweaves with his own earlier narrative. He sees his aquacultural pursuits carrying his grandfather's and father's fishing tradition forward. The aquaculture pond is a bigger version of the kitchen sink he knew as a child. And the sink, as exchange point between male catches and female cooking, reappears, too, in the fertile, womblike imagery Mendola uses to describe his aquaculture greenhouse: 'It's so warm and it's moist and it's gurgling away.'

Where Mendola emphasizes continuity in viewing the ocean as a productive

ences between genetic information in a database and fish in the ocean, not least of which is that actually existing fish populations offer limits to their exploitation. Most marine biotechnology is predicated on the possibility of cloning, of reinventing the bountiful sea through technologies of replication and reproduction. But it remains the case that property is imagined as abstract potentiality, flowing from either the roving practice of fishing in ocean space or the activity of searching for useful genes and compounds in notional space.

Mendola's biotechnology is slightly different from the mainstream biotechnological enterprise of in-the-lab synthesis and its associated patent claims. In line with his aquacultural skills, Mendola hopes not only to make new bioproducts available to pharmaceutical companies, but more importantly, to *supply* the biomass required to harvest drugs of interest. Properties are held in patented *methods* for production and not so much in laboratory genetic or chemical recipes or in a located farm. Bryostatin is held as a 'fast fish' through licensing agreements to the biomass supply *system* rather than to a synthetic lab procedure — and rather than through tacit practices like those of fisherpeople or the explicit private property relations that characterize landed aquaculture.

Even as this radical shift from substance to system has taken place, however, Mendola still sees continuity. The sea itself turns into the kitchen sink of Mendola's childhood, reactivating the abundance of those waters. This abundance is still reproductively, even femininely imagined. As Mendola puts it, 'pharmaceutical companies ... don't want to deal with the mucky ocean and Mother Nature.'

Even if Mendola's project focuses on systems rather than on owned substances, one interesting side effect of it is that it obviates the need to get permission from other nations to bioprospect in their exclusive economic zones, something on which marine biotechnological enterprises that require harvested biomass have foundered (see Moran, King and Carlson 2001; Qanungo 2002). The 'backyard' of Mendola's aquaculture has transformed into the backyard of the California coast. The solution to the question of property in marine biomass is solved in Mendola's system: keep the creatures inside the United States — off, for example, the coast of San Diego, where Mendola's grandfather and father once fished. This generating of biomass close to home also partakes of a 1960s ethos of working in tune with nature; Mendola points out that his method of growing drugs from the sea avoids 'raping' the seas. Maritime anthropologists have written extensively on the gendering of the sea as a female force from which masculine fishers must wrest their wealth (see Pálsson 1991). Mendola seeks to transform this image somewhat, positioning his work as about stewardship of the fragile — though still feminine — ocean.

In this tale, the ocean is at once familiar and alien. Mendola's familiarity with this realm is grounded in his sense that he can tune into the creatures that live in the watery medium. But the alien character of the creatures that are denizens of the deep is present too; Mendola's sense of *Bugula* as 'weird looking guys' is consistent with his new enterprise of breeding creatures not for themselves, but for the drugs they produce.

By the end of his story, Mendola's means and ends have changed radically, even as he narrates his biography as animated by a consistent love of the ocean and its creatures. We might say that while his is a tale of three seas, it is also told as a story of *one* ocean. The Oxford English Dictionary defines 'seas' (under definition 1. d. of

'sea') as 'Different parts or tracts of the ocean,' while the 'ocean' (under definition 1. a.) is defined as 'The vast body of water on the surface of the globe, which surrounds the land; the main or great sea.' The temporal 'tracts of the ocean' — the seas (and the OED reminds us that 'seas' are 'Often merely *poet.* or *rhetorical*, like *waters*') — of which Mendola tells are historically and personally located, tied to particular technological and biographical moments. But the *ocean* for Mendola stands as a transhistorical surround — an entity that indigenous people such as the Chemehuevi Indians worshiped as 'Mother Ocean,' a place of 'primal' connection, a wild nature not fully under human control. A romantic, countercultural oceanic sublime supersaturates Mendola's cultural account, to some extent blurring the boundaries between the diverse coastal economies, seas, in which Mendola has labored. In this narrative, the sea change represented by marine biotechnology is rendered continuous with earlier modes of engaging the ocean. Returning to Strathern, we can say that this is the *effect* of subsuming different productive regimes under one continuous imaging of the ocean; marine biotechnology is rendered a natural extension of cultural practices of garnering food from the ocean. Understanding Mendola's tale of three seas requires us to attend to the historically specific properties of nature and natures of property in these seas that Mendola has navigated.

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