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## Link, Jason ~ Oral History Interview

Joshua Wrigley

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Voices from the Fisheries  
166 Water Street  
Woods Hole, MA 02543

# **Interview with Jason Link by Joshua Wrigley**

## *Summary Sheet and Transcript*

### **Interviewee**

Link, Jason

### **Interviewer**

Wrigley, Joshua

### **Date**

September 19, 2016

### **Place**

Woods Hole, Massachusetts

### **ID Number**

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### **Biographical Note**

Jason Link is Senior Scientist for Ecosystem-based Management for the National Marine Fisheries Service, still sitting at the Northeast Fisheries Science Center in Woods Hole. Dr. Link earned his B.S. in Biology with a minor in Chemistry from Central Michigan University. He then received his Ph.D. from Michigan Technological University. He began his career with NOAA NMFS at the Pascagoula Lab before moving to the Woods Hole Lab.

### **Scope and Content Note**

Interview contains discussions of: ecosystem-based fisheries management, working with international fisheries scientists on ecosystem-based fisheries management and hopes for the next generation of fisheries scientists and managers.

### **Indexed Names**

Almeida, Frank

Beverton, Ray

Cousteau, Jacques

Hope, Ken

Keen, Bob

King, Bob

King, Donna

Merrick, Richard  
Schritter, Colonel [First Name]  
Selgeby Jim

## Transcript

**Joshua Wrigley (JW):** This interview is being conducted as part of the Voices from the Science Centers project funded by the Northeast Fisheries Science Center. It's also a part of the Voices from the Fisheries project that is supported by National Marine Fisheries Service Office of Science and Technology. I'm Josh Wrigley, Project Manager of Voices from the Fisheries, and today I'm speaking with Jason Link, who is the NOAA Fisheries senior scientist for ecosystem management, [sitting] here at the Northeast Fisheries Science Center, and we're doing the interview in his office at the main lab in Woods Hole. It's about 2:00 and it is September 19<sup>th</sup>, 2016. We'll sort of jump in here and I'll ask you the first question, which I guess would just be when and where were you born?

**Jason Link (JL):** Danville, Illinois, so I can't pick on you about the Kansas thing [Editor's Note: JW was discussing Midwest background prior to starting the recording]. Danville, Illinois.

**JW:** Danville, Illinois...is fairly landlocked.

**JL:** It is.

**JW:** [laughs] Now you're working here by the ocean. Did you have any formative experiences growing up that set you on a path toward working on ecosystem-based fisheries management?

**JL:** Not necessarily ecosystem-based fisheries management, per se, but certainly marine biology. I had several. My dad was in the military, so we would always go back to the family farm in Indiana, and we had tours of duty in Michigan, so it was [primarily in the] Midwest. I got really hooked into the Great Lakes and I can come back to that in a moment. We were overseas a lot and probably I was one of those really rare kids that knew what I wanted to do at an early age. I was always the kid flipping over logs and jumping in mud puddles and cutting fish open and looking at what they were eating. I was always curious about how critters worked, so I always knew I wanted to be a biology[ist]—the wetter, the better was kind of my thing. Then, my dad was stationed on Guam when I was a kid and he hooked me up with scuba diving lessons, so I would go scuba diving with him and all the guys from his office. They were serving a two- or three-star general for the entire Pacific and they were all on his staff, so I was out there with all these old guys. My dad and Mr. Hope--Major Hope and Colonel Schritter (Schritter had the "Schritter bucket") and here I am, a 12-year old kid arguing with this full bird colonel over the scientific name of these shells. My dad was like, "Relax. That's my boss, you know?" [laughs] So, I was scuba diving and they'd take me out of school or I got to stay up late [and] go with them [night diving]. That probably cemented my need or [interest in the topic]. That was the time period when Jacques Cousteau was doing his thing. I didn't really care for the Speedos or the rolled up stocking caps, but I enjoyed the guy --

**JW:** The old red watch cap?

**JL:** Yes. Exactly. But I enjoyed the ability to just understand how stuff worked and I loved being in the water. And then we were always hunting and fishing wherever else we were [living], so probably an inherent interest in this stuff and then that time on Guam scuba diving and then in Florida, at yet another station [of duty]. We had some grandparents down there fishing on the Gulf, and then fishing with my Granddad in the Gulf of Mexico and fishing with my dad in the Great Lakes probably [helped] to put me on this pathway.

**JW:** So, you saw quite a number of different species and environments then growing up?

**JL:** Oh yes. We would go to Australia [with my dad's work] and I remember you couldn't go swimming on the beach because the man-of-war, whatever these nasty jellyfish were there that would kill you really quick, so we were kind of bummed about that, but just we couldn't go swimming in the river [either] because there was a 21-foot crocodile and all these things. [laughs]

**JW:** More dangerous than up here.

**JL:** Yes. Exactly. But just being able to get in the water when we could or see these different places gave me an appreciation that life was diverse, both the human culture of it but also the critters out in the world, out in the water were pretty amazing. So, that's some it.

**JW:** Where did you wind up doing your undergraduate and graduate work?

**JL:** My dad was stationed in northern Michigan at the time. We had two tours there and I finished high school in Gwinn, Michigan, and I wanted to be a marine biologist but I needed to get in-state tuition. I was playing baseball. I was going to be a professional baseball player and I went to Central Michigan University for my undergrad. They don't have a whole lot of marine biology right in the middle of Michigan, but they did have the Great Lakes.

**JW:** Was that located in Ann Arbor?

**JL:** That's U of M. [and] Michigan State is East Lansing. Central Michigan is an hour up the road from East Lansing in Mount Pleasant. Right in the middle of the state, as the name would imply. I did undergrad there. I chose that largely because they had a really great baseball school at the time and I was trying to do that. [laughs] That's a whole other story. Anyways, I got involved with Bob and Donna King, who were some professors [while I was] an undergrad there. They were really great people and I was studying limnology, basically fresh water marine biology, fresh water oceanography and was really into lakes. Then, from there I had several opportunities and I remember agonizing over studying plankton or studying aquatic insects. Basically this was streams or lakes. It was this huge career choice.

**JW:** This was during your undergraduate?

**JL:** As I was getting ready to finish up to go to grad school, I had those opportunities. Anyway, I went with the lakes and the plankton and I went up to Michigan Tech and the Upper Peninsula

and I loved it there. Quality of life. Hunting, fishing, slow pace, everything. It allowed me to work on Lake Superior for five years.

**JW:** Does that make you a Yooper?

**JL:** Exactly or “you betcha.” [laughs] How do you know that?

**JW:** There were a number of people from Michigan in my grad program.

**JL:** Yes, so I went to Michigan Tech to get my Ph.D. and I was working on plankton. Largely there’s a big *Daphnia* there and there’s a *Ceriodaphnia*. My major professor, a great guy, Bob Keen, had done a lot of work for the EPA [Environmental Protection Agency] basically killing *Ceriodaphnia* with all these different levels of toxins and we were doing that. I was looking at the community in Lake Superior and I just started going out and sampling and sampling and sampling. I got my Master’s license to be able to drive the boat and I worked out a deal with the department chair and I drove the research vessel for everybody else in the classes and then I got to use it a couple times a month or whatever the situation was. But I had to go get a U.S. Coast Guard license, so that was my career backup if I got tired of being a geek. [laughs]

**JW:** Was that a six-pack license or a different type of certification?

**JL:** No. It was a Master’s, I forget, 500 or a thousand or 10,000 tons, whatever. It was big. It wasn’t just a six pack, but I could have done six pack [tours or trips]. I was scuba diving a lot there as well and would help recover snowmobiles that fell through the ice to augment my graduate school income and all these types of things. But I remember from there it was really competitive. The zooplankton ecology world was hyper, hyper competitive. It was very hard to get funding and they were arguing over some pretty arcane details. I got hooked up with a guy and I wrote him a letter that I had been sampling Lake Superior. So, I’m just a big believer in just getting out there and observe stuff because you never know what’s going to happen. You can form hypotheses from that.

**JW:** Why was the field so contentious at that time?

**JL:** It still is, I think. It’s just the nature of the people, the nature of the critters. I don’t know. I’m not a psychologist, but my observation [is this]: if you have a graph on the y-axis is one axis and then x-axis is the size of the organism. I think it’s a decline and the y-axis is the anal retentiveness of the people studying the organism. The bigger you get, I think people get more relaxed maybe because you [don’t] have to work so hard to actually see the critters.

**JW:** [laughs] Less territorial?

**JL:** Yes. And to make it [correct], I think it actually curves back up when you get into the marine mammal world, but anyways, that’ll alienate everybody I work with now. [laughs] I don’t know. But what I did notice was it was very academic, very arcane, and I always kind of had this applied bent. I noticed the zooplankton community was entirely different than what had been published two, three decades earlier. So, I wrote the guy, [and]said "am I missing something?"

What's going on?" He said "You need to come over here." He ran, it was at the time a U.S. Fish and Wildlife lab, turned into a National Biological Service, now USGS [United States Geological Survey] Biological Resources [Division]. That was Jim Selgeby. He said, "Hey, we have had this huge recovery in lake herring," which is a whitefish related to salmon.

**JW:** Is that lake whitefish?

**JL:** It's related to lake whitefish. *Coregonus*, but it's lake herring, which is a little smaller than lake whitefish. They're planktivores and [he said] I think we've had this huge shift in the zooplankton community. So, come over here and talk to me. So I did. We set something up and I ended up co-oping with him in Ashland, Wisconsin, and then I ended up doing experiments down in Ann Arbor, Michigan at their main lab on Green Road. It dawned on me people are less anal retentive, there's a lot more funding, people are a little more relaxed, and the outcome of what I do actually has relevance in the fishery sector, so I kind of made that other shift from then. That kind of gives you my history and background of getting through college and graduate school and so on.

**JW:** Then you wound up working at the Pascagoula lab?

**JL:** Yes.

**JW:** For a couple of years after that, right?

**JL:** Did your homework. Yes. Yes.

**JW:** What was the focus of what the biological sampling that you were doing down there?

**JL:** It was an interesting job. I ended up, [I think] I had five offers. I was really fortunate and I didn't want to go into consulting right away. I felt like I needed to have some experience before I went back to academia. So, I took this job at [it was] a NMFS lab. On Friday afternoon, you have these 30 people from the South who are contract workers for the government or term workers for the government, and on Monday morning they're working for a damn Yankee carpetbagger, me, who's fresh out of grad school.

**JW:** How'd they feel about that?

**JL:** They were not happy campers and it took me several months to smooth over and calm the feelings down, but I tell you, I learned several things. I was basically the project manager for 30-plus people fresh out of grad school. I learned a ton of science in the Gulf, but I learned more about the business of science, which has helped me out and it's also kept me from choosing to take perhaps more administrative-type positions in my career, because I had a taste of it pretty early. [laughs] I worked on... we were sampling and we were basically like the survey unit for the Gulf. We were sampling ever kind of critter out there. The shrimp survey, the red drum, their groundfish, their video survey on the reefs; the whole bit. We had a great team of people. They even had a plankton group, but I was particularly working an un-trawlable bottom habitats because they have these little things called oil rigs. You can't really trawl there.

**JW:** I think I've heard of them.

**JL:** Yes, you've heard of these? But there was this amazing artificial habitat, so kind of put some of that [information together] and basically mapped it out. Then the other thing was, I looked at their small pelagics, because they're fish that are 20 centimeters big or whatever that are silverish that eat plankton and are eaten by everything else in every marine --

**JW:** Forage fish.

**JL:** Yes, exactly, in every system. So, I always had an interest in those kind of critters in particular, so worked on that, did a little [related] work there.

**JW:** How was the transition moving from Pascagoula up to Woods Hole here?

**JL:** It was fine.

**JW:** What were some of the challenges there?

**JL:** Some of the challenges were I remember going to dinner with Frank Almeida, who hired me, and I wore this fleece. I came up here to do house-hunting or whatever [it was] and I had this fleece jacket. I had given away all my hockey equipment, all my cold weather stuff. I'm down there [in the Gulf of Mexico and] my blood had thinned out. I remember freezing to death coming out of Liam Maguire's in Falmouth with this wicked November wind cutting right through my fleece. It took me a season or two to get re-acclimated. [But] it's fine. Then the pace of life was very different. It's just go, go, go, and the concentration and density of people, even Falmouth on the Cape, is huge. Then, when the population doubles or triples in the summer, that was an adjustment, too, but the science was always there. I was having fun with that and came up to run this Food Web program and I was tickled pinker than a spawning salmon because I just love that stuff. I mean it just excited me. Still does.

**JW:** In terms of ecosystem-based fisheries management, which is your specialty, how has that developed over the past several decades to bring us up to the point where we are now in terms of science and public support for, I guess, a paradigm shift toward that?

**JL:** We've known about it for a long time, at least two or three decades, and you look at all these U.N. reports, the Brundtland Report, all these calls [in the] late '70s, early '80s; it's been around. Everybody's been spending a ton of time arguing about what it means, why you do it, what the benefits are, and we still have to give attention to that. But once we kind of got past that and, five to 10 years ago, convinced everybody in general, not everyone, but a lot of folks, [that] this is a good idea, the objective really wasn't why we want to do this, what is it? As I say, we still get that. The objections were more along OK, fine, how do you do it? We had been working hard, that's where the modeling stuff that I used to do a lot of, still do some, came into play. We have been working really hard to say all right, you're right. What does it look like to do ecosystem-based fisheries management? What are your performance measures? How do you get a metric that say, OK, we're now doing it or whatever, and not be trivial in that, but just instead

of renaming every program with an ecosystem thrown into it, actually do the right thing. So, that's where I think the how and what it looks like in practice, implementation, is where the discipline is now. That, to me, is the exciting thing and where we're moving the needle. But, we've finally gotten buy-in here in the past year [or so] of the agency to the point where we have a roadmap that's coming out that says here's how the National Marine Fisheries Service is going to do ecosystem-based fisheries management and that roadmap is something we developed over a year working with a team of people all around the country. But before we did that, we had to do a policy statement. I remember sitting right at this table with my boss, Richard Merrick, and he said "I want you to develop an EBFM [ecosystems based fisheries management] roadmap." I said, "Okay, yes sir." And he said, "Make sure it's consistent with the EBFM policy statement." I said "That's a good idea. Yes, sir." And we both looked at each other and we then said, "What policy statement?"

So, we actually had to write that up to codify what we think EBFM looks like and how you would go about doing that. What are the main principles? What does that look like? I'm not sure, Josh, if I'm answering your question entirely, but I've seen the needle move the past five years in ways I never thought we would because we're getting this buy-in both in terms of the policy side, the regulatory side of NMFS sees the need for it, they see the potential efficiencies. Our administrators, senior level leadership within NMFS and NOAA sees the value of this. The fact that I have a job and that's my gig is to push this stuff forward is a huge thing. I mean at some level you could have a monkey in my job [doing the basic duties], but [in some ways] always there's [always gonna be a need for] a job for this, but the point is that we're moving forward on this [topic] and we've got now constituents and shareholders way into it because they're saying, see, "I told you so. Climate is impacting these critters. I told you so, there's too many seagulls eating my favorite critter."

**JW:** This is on the industry side?

**JL:** Industry and the NGOs as well, right? And the buy-in from all the stakeholders has been amazing. There's concerns, make sure you don't lose your bread and butter. Make sure you don't lose capacity or erode what we've done so far, and we get that. But, with climate change, and I could tell you story after story if you went around the country, but with climate change it is really driving this. We're seeing critters grow in different rates or grow slower, grow faster. We're seeing the distribution shifts [of fish], probably the most obvious one. But in some parts of the country, we're trying to prepare the industry to say hey, folks, this critter might not be here anymore. You need to plan for that, transition from that, but there's something else coming in. You want to take advantage of that. How do we get set up to do that? That's really driving a lot of the thinking and by the way, we have this EBFM approach that we think can help us do that.

**JW:** How has the language regarding EBFM evolved since the early '80s, when you said people started thinking about more holistic approaches to environments...ecosystems?

**JL:** I think it's gone from this catch all [term] - holistic - people hear terms like that and they think of naturopathy, homeopathy, natural medicine. They think granola and tree huggers and all that. Then there's the really science that does we're going to manage fisheries. I think there's some of that that we've gotten past; [but] they're still out there. [laughs]



**JW:** So [it was?] known as ecosystem-based --

**JL:** Management.

**JW:** Management, even in those early years?

**JL:** Or ecosystem management. In Europe, it's ecosystem approaches; ecosystem approaches to management. What we've been trying to do is to clarify what we think it means. We have this blue diagram that kind of lays that out. But EBM, to some people, means you're going to recognize that temperature could affect recruitment of silver hake or Pacific whiting. Okay? That's a step. To other people, EBM means we're going to manage wind farms, the navigation shipping lanes, and protected species and birds and fishing, and habitat, all at the same time. Well, that's comprehensive, okay. And then there's kind of this --

**JW:** Then you're really getting into the human dimensions of things as well.

**JL:** With the multiple sector bit, right? All the different ocean uses.

**JW:** Conflicts and --

**JL:** Exactly. Whereas what we're trying to say is ecosystem approaches to fisheries bring in things of the ecosystem into a fisheries context and ecosystem-based fisheries management is managing the whole system of fisheries as a system. That's where you gain some efficiencies, you don't miss things, you don't overlook certain things, you're accounting for this [or that]. You actually set what your objectives and priorities are within that region for the fisheries, et cetera, et cetera. That's where we're getting some clarity. And when we're talking with people on Congressional Hill, when we're talking with shareholders, it's still a nebulous term and what we try to do is say at what level are you referring to, to make sure we're talking at the same level of multi-sector versus adding temperature and very different expectations, different math, different everything.

**JW:** Is that a big conceptual challenge to advance the conversation with policymakers?

**JL:** Once you clarify where you're talking and you have an infographic, I think it falls into place. The other challenge then is, okay, fine, but this is a little arcane and it's a nice concept, but give me an example, tell me a story. What does this mean to me? What does this mean to my fishery? What does this mean to my shareholders?

**JW:** How to contextualize it?

**JL:** Yes. So, we're working on that. Stonington, Maine, is a great example in this region.

**JW:** Oh, in the Penobscot East Resource Center?

**JL:** There's that. There's good stuff going on there and they're trying basically to do an integrated ecosystem system assessment of Penobscot, but they've shut down the shrimp fishery. We saw it coming, we knew there were predators, we tried to get that in the assessment. We knew the temperature was going to impact those critters and tried to get that in the assessment. Had to close the fishery down. What are those guys doing now? There's a community resilience [concern] of the human community there that we need to think through and I'm very concerned about that. Nationally or outside of the region or even perhaps outside of Maine people are saying all right, it's a small fishery, it's just this small shrimp [fishery], maybe worth \$5 million dollars, okay? And what I'm saying is one, it's important to those people there in Stonington, but more so, this is a harbinger of things to come because there's a \$500 million-dollar fishery in lobsters that probably are going to see something similar. How are we going to handle that? When you put it in those kind of terms, the human angle, the dollar bill angle, people start [saying] yeah, well we've got to do something about this and quit ignoring that or quit ignoring the fact that when you catch herring, mackerel, squid, butterfish in this region, forage anywhere, that it does have an impact on those stocks that's almost double [of just fishing mortality] because there's a predation set and conversely, a couple fishery management councils have said we recognize that and we're going to have a minimum threshold for forage so that you [can] have your protected critters or commercially valuable critters have some kind of food out there. So, we're wrestling with that. That's a tangible example.

**JW:** Is that related to the forage fish omnibus amendment that the MAFMC [Mid-Atlantic Fishery Management Council] is considering?

**JL:** It's related but I'm [also] thinking of Pacific Fishery Management Council that already has this in place, all right? And the one in the Mid-Atlantic is looking at that. There's a couple other places around the country [that] are looking at it through different regulatory vehicles and mechanisms. But, that's a great example of the need to do EBFM. Just accounting for the fact other stuff's going on than we typically think about.

**JW:** Have there been examples of the success of EBFM in freshwater environments that have been useful at all in sort of explaining to people how the conceptual breadth of this?

**JL:** Good question. The automatic place you go to when you hear a question like that is the Great Lakes, right?

**JW:** Yes, because I remember you had said you worked on Lake Superior.

**JL:** There's been a lot of lake trout restoration in the Upper Lakes, the colder lakes, anyways. But those lakes are so artificial because of the invasives, pick your list, right?

**JW:** Lampreys.

**JL:** Zebra mussels, sea lampreys, the spiny-water fleet changed things so everybody's all worried about that, but the bulk of their recreational fisheries are also invasive species. [laughs] They're just stocked, right? The Pacific salmon that are stocked in there. So, in some regards, those are good examples because you have the eutrophication [issues] in dealing with the

nutrient loading. You have the coastal zone management issue coming into play. You have the fisheries coming into play. It's managed more so as a system. I would say it's probably fair [to say that] most limnological situations are managed more from a systems perspective, but it's also a scale thing. You're able to do that typically, so those are the cases where I'd look at that. Some of the other inland seas in Russia, [like Lake] Baikal or even getting into the Caspian, sure could have benefitted from it but I don't think there's a lot of management to that end. The African rift lakes, same thing. I'm not sure how much management's there but it's certainly an interesting story and case study.

**JW:** As sort of an international issue, a number of different scientists and organizations, I guess, are working on parallel approaches here?

**JL:** Yes. Should I elaborate?

**JW:** Sure to the extent you want.

**JL:** [laughs] I'm working all around the world with people who are trying to implement EBFM. We just had a symposium in May in France looking at how do you bring in the human dimension to integrated ecosystem assessments and we had a great time. One of the key things from that is that it has to be interdisciplinary and you have to address the multiple objectives. It can't just be not only one fish or a bunch of fisheries, but you have to look at jobs, you have to look at well-being of resources and communities and human aspects. The economics are part of it, but the sociology is a part of it. It was really intriguing to see that interdisciplinary approach. We're working very closely with ICES [International Council for the Exploration of the Sea] and their implementation of their marine strategies framework directive, which is kind of their big mandate pushing things towards good environmental status in Europe. We're working with the Aussies to implement this. They've actually been leading the world in terms of their legislation and some of their scientific approaches to do ecosystem management in a data-limited situation. We work with the Canadians a fair bit. We work with the Norwegians. We're working with some Asian nations to try to look at this, so it's a global effort. And I'm pretty good colleagues with the head now of the fisheries portion of FAO [Food and Agriculture Organization of the United Nations]. We're talking about this all the time. Pick your organization; this is a big, big thing and it's not something that is going away. What it really is, is that wrestling with how do we make this operational so that you can use it to make decisions. That's where I think there's going to be some interesting research; that interface between science and management for the next five to 10 years, [and will] be a lot of fun.

**JW:** When you mentioned before the prominence of computer modeling, what role does uncertainty play in sort of moving ahead here, since..?

**JL:** What kind of uncertainty? We wrote a paper that characterizes [that] there are six major kinds of uncertainty. Most scientists when they hear that are thinking statistical precision uncertainty. I'm also thinking accuracy. I'm also thinking implementation of management and communication. There's all kinds of uncertainty. I think the point is you have to address all that and what we use these models for and try to bracket them is: here's the range of what's impossible, can't ecologically get there. Here's the range of scenarios or alternatives that would

be really bad, would make you violate the law. And here's a range of scenarios that are okay, pick amongst those. That's kind of it's not as precise as we might be used to, but that kind of broader level bounding the problem, scoping it out, is where we're headed with this. Management strategy evaluations are a lot of what we're aiming to do with these other models to kind of scope out the issue and look at different options of how you can do it. To me, it's not only characterizing uncertainty. We're always going to need to do that and measure that with not only the bias aspect, but the precision aspect, but also just step back looking strategically - have we got it right? Are we in the right ballpark? Have we got it accurate, close enough? So that, to me, is almost more important, to make sure we're not being very precise but inaccurate and missing a major driver just because we're not thinking about, modeling it.

**JW:** I came across a quote a while back by Ray Beverton where he was commenting on the move in fisheries science away from science toward mathematics. I was wondering if you, I can't remember the quote exactly. If you don't want to comment on it, that's fine, but I just wanted to get your thoughts on that trajectory and whether you see it as an issue or what perspective do you bring to that?

**JL:** If it's the quote I'm remembering, I remember reading [it] and I remember agreeing with it. A lot of what we do - am I allowed to use analogies in this?

**JW:**[laughs] You're not straitjacketed by anything.

**JL:** All right. A lot of what we do is very, very mathematical. When I think about all the kids that we hire for all the positions [we have], what sets them apart are their quantitative skillsets, so we need that. We need to continue to do that. But what sets those [excellent] people apart are the ability to step back and integrate and actually think hypothetically, think as a scientist, but think as a biologist as well and to pull this [all]together. The analogy I think of that I try to wrestle with a lot is [in]the ecosystem community, the ecologists are Doc Brown from *Back to the Future*, right? Wild hair, "Great Scott!", and they're crazy and they're doing all this and - you can't see it, but my hands are all over the place, right? Then, we've got [others of]them to the point where it's so operational in some parts of fisheries, what's the status, what's the ACL, what's the catch limit, what's the reference point? Thank you, that's all we need. We're so operational that that part of the discipline, that part of the organization has become like Agent Smith in *The Matrix*, right? They're buttoned down, they're tight, almost like an accountant. You get outside of the code, you get whacked to get back into it.

I think that's a healthy tension to be operational and to think more broadly and innovatively, but we get so focused on feeding the machine that sometimes I think we forget to step back and integrate it, or to look at more broadly [at]what actually might be going on biologically. Is there something hypothetically that we're missing that we just haven't thought about? Is there something new that the biology is driving that we've never seen before? I don't know. The short answer is we have to always do the actuarial science part of this business but we can't only do just that. A great quote I saw, I forget which CEO [it]was, his Chief Operating Officer asked him, "What happens if we train our staff particularly to innovate and they leave?" You know, broadly? And the CEO's response was, "What happens if we don't and they stay?" It really struck me as we get so focused... and then[stay] on a path and people have these 10...15-year career

trajectories that we need to be able to provide new tools and opportunities and ways of thinking. I'm beating this answer to death, but yes, I agree with it. [laughs]

**JW:** Well, I think that's pretty much everything. Are there any parting thoughts or words that you'd like to add in, in the end?

**JL:** This [entire series] has/]is kind of been for old farts or getting to be old farts is what I can understand, not entirely, but you're --

**JW:** Mostly.

**JL:** But you're hitting [up]old guys and old things.

**JW:** Career trajectories, how...the evolution of one's research interests, how the facility itself has changed, community memories from early on in careers. Change over time is really the essential theme.

**JL:** Yes, so with that and that emphasis of who you're targeting, I think I would want to speak to the next generation or the generation even behind them that's coming up and just [say to] mind your Ps and Qs, get the three Rs, reading, writing, arithmetic, have that solid base, but you never know the trajectory of what your career's going to look like. I've had, I think I mentioned--

**JW:** True.

**JL:** The decision points between insects and plankton, the decision point between fresh water and marine and so as long as you keep your toolbox, your professional toolbox, stocked with recent tools and update those, you can work wherever on different issues. You need to maintain that for flexibility and I would also say in addition to that flexibility and having that skillset is there's a lot of serendipity in this business that you never know. [laughs] And just being able to take advantage of that with respect to your core interests is --

**JW:** To seize an opportunity?

**JL:** Yes, exactly. I'm looking forward to what in 10 or 20 years what fisheries science looks like, fisheries management looks like. Hopefully, we can help shape it moving towards EBFM, but I'm just curious when I'm a lot older and much more grey, I'm curious to hear what some of these are going to sound like from other people.

**JW:** They go back a ways. We can do a follow-up interview then too.

**JL:** Well, I mean from the people we're just now hiring, I'm curious to hear what their trajectory is going to look like, like what the state of the discipline will be then. So, I just want to give a nod to those folks who haven't walked the path as long yet to be encouraged.

**JW:** Great. Thanks very much for sharing your thoughts today.

**JL:** Sure.