07-20-2016

Rhodes, Linda ~ Oral History Interview

Maggie Allan

Recommended Citation
Rhodes, Linda. Interview by Maggie Allan. *Voices from the Science Centers*. Voices from the Fisheries, NMFS, NOAA. 20 July 2016.

This oral history was produced in 2016 as part of the *Voices from the Science Centers Oral History Initiative* conducted by *Voices from the Fisheries* with funding by the NMFS Office of Science and Technology.

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

Interview with Linda Rhodes by Maggie Allan

Summary Sheet and Transcript

Interviewee

Rhodes, Linda

Interviewer

Maggie Allan

Date

July 20, 2016

Place

Northwest Fisheries Science Center
Seattle, Washington

ID Number

VFF_ST_LR_001

Use Restrictions

Biographical Note

Linda Rhodes was born in Fort Eustis, Virginia in 1952. Linda moved to the Seattle coast in 1974. She earned her Ph.D. in Molecular and Cell Biology from the University of Washington in 1993. Linda has done work as a histopathologist and zoologist. She began working for the Northwest Fisheries Science Center in 1976 and has been a microbiologist since 2007. She enjoys in her leisure time participating in citizen science projects in her county. As of this interview, Linda lives on Whidbey Island, Washington.

Scope and Content Note

Interview contains discussions of: molecular biology, histopathology, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Puget Sound, Whidbey Island, government scientists, multidisciplinary research, Pacific Northwest marine ecosystems, ecotoxicology, citizen science, bull kelp, infectious diseases in fish, bacteria, hyporheic zone, respiratory bacteria in killer whales, women in research science and environmental DNA.

Linda describes in this interview the challenges of government science with specific attention to issues surrounding the importance of microbiology. She describes the path of her education and career with the Northwest Fisheries Science Center in Seattle, Washington.

Indexed Names

Morely, Sarah
Tyson, Neil deGrasse
Hanson, Brad
Utter, Fred

Transcript- LR_001

Maggie Allan: Ok. This interview is being conducted as part of the Voices From The Science Centers project funded by the Northeast Fisheries Science Center. It is also part of the Voices From The Fisheries Project that is supported by the NMFS Office of Science and Technology. I am Maggie Allan and today I'm speaking with Linda Rhodes at the Northwest Fisheries Science Center in Seattle, Washington at 2pm. Linda Rhodes was born in 1952 in Fort Eustis, Virginia. She received her Ph.D. in Molecular and Cellular Biology from the University of Washington in 1993. As a member of the Environmental Conservation Division, she worked as a histopathologist and zoologist examining the relationship between anthropogenic contaminants in marine sediments and diseases of fishes like the English sole. Linda has worked at the Northwest Fisheries Science Center since 1996 and has been a research microbiologist since 2007. Welcome Linda, thank you for doing this interview today. Can you start by telling me about what inspired you to pursue a career in science and where you got started?

Linda Rhodes: Well, I think I was interested in science because I had a - like most people - I had a really great science teacher in 8th grade and we got to look at anatomy, physiology, and I thought 'oh, that's how stuff works in the body!' So I was interested in going to medical school at the time and then eventually realized that I was better suited, I probably was better suited in not working with people, especially sick people. I always wanted to know how things worked. My dad was an automotive mechanic and I helped him for many years. Take things apart, put things back together, and understand and diagnose problems. The basic tools and thinking about troubleshooting those kinds of issues and problems sort of got engrained in me early on. So, once I got out of college as an undergraduate, I realized I didn't really want to go to medical school but I had never done much in the way of camping or being out of doors but I moved to Seattle. I was living in Texas. I moved to Seattle in '74 and realized there was strong interest in natural resources and the outdoors in the Pacific Northwest and so it kind of got engrained in me - once I made it past my first winter here, that was a tough one, adjusting to the rain. I realized I didn't know very much in terms of really being able to do anything even though Ihad a Bachelors in biology. So, I actually went back to school to a community college and learned histopathology there and learned statistics. I learned a lot of really neat tools that made me realize that community colleges are terrific places to get an education and skills. Then just with one year, I started working here as a work study student with the community college and I wanted to work on my project here (NWFSC) because I was having to travel to complete the project. I saw a student - a graduate student - with a microtome and said "Hey, in exchange for letting me finish my school project, I'll cut these slides, cut the sections, and make slides for you for your project." So it was kind of a trade off and that just lead into being hired here. So, I actually started working here at the center in 1976. I was here for 11 years and that's when I did all the ecotoxicology work and histopathology. At the time, I realized that there was a whole revolution in molecular genetics because when I took genetics in college it was all Mendelian and classical genetics. But the molecular part wasn't there yet and here I'm looking at slides, looking at liver

lesions from English sole in Puget Sound and wondering, 'I know what this lesion looks like, I know what the cell morphology is like, what's going on inside the cell to produce that appearance.' At that time, National Marine Fisheries Service was not tapped in to molecular genetics. So I quit. I quit my job and went back to school. I had a ten year break with graduate school and then doing post doc but my home was really here in the area. I really never intended to leave Seattle. [laughter] I did a post doc in Maine and then came back here and thought, 'Well, I could - with a background in molecular biology - I could work for industry, I could work for academia, or I could work for the government.' I had a lot of cohorts who went to biotechnology, it was a growing area in the early '90s and I got a pretty good idea what that was like and it didn't appeal to me a lot. I knew from the ten years of grad school and post doc work, I knew what academics was like but I really remembered my experience doing all the ecotoxicology work. We did a lot of team work, we worked together, and I felt like - in fact, many of the folks who I worked with at that time - we felt like we were really doing something useful for society and we were working together and we liked to feel like that the awareness, regional awareness, of the public in terms of water quality, how we humans impact the marine environment. We liked to believe that we actually helped elevate that awareness. So, every time I see a storm drain that has "Dump No Oil"on it,I feel like, "Yes!" our research made a contribution to that. So that was a big appeal for coming back and working within the government system. That's why you see that my service tenure starts back in '96 rather '95 or '96.[1]

MA: That's when you start working full time...?

LR: Again. Right. I resumed so I had ten or eleven years of full time and then I just picked up and continued my career as a government employee.

MA: So what happened between those ten years until you became the research microbiologist?

LR: Oh, so when I came back, I had all this molecular biology expertise.Salmon had been listed as an endangered species and the problem there were infectious diseases because there were efforts to culture salmon in a captive brood stock setting. That's one of the things about becoming an educated person is you have to learn how to teach yourself. So even though my background was not specifically in microbiology, I transitioned into learning more about infectious diseases in animals.

MA: How has the environment, that you noticed, changed over the time you've been here?

LR: You mean the culture within the center? The environment in the center?

MA: That too. You can answer that. But also how everything you've studied has changed as well.

LR: So, one of the things that I think is really hard for scientists... First of all ,there are disciplines. People get trained in different disciplines and you tend to stay in your discipline because you're comfortable with that and you know the lingo and you know the people. I think that that is changing. People realized that they have to talk to people outside of their discipline.

[1] Narrator Clarification: Linda Rhodes began working for the federal government in 1976. She quit the civil service in 1987 to attend graduate school, then resumed civil service again in 1997.

Because my interest had always been physiology and anatomy and biochemistry and those kinds of areas, those all deal with individual organisms, but if you look at what NOAA Fisheries does in terms of science contributing to policy, it's really about bigger things. It's about species, multiple species, habitats. How you take what you know looking at individual organisms and translating that or expanding that into,'Ok now take these findings and apply them to a population and what is that going to mean for that population.' I think just the fact that we can't sit around in our own little disciplines anymore and have to talk to other people and learn how to communicate with them in order for your work to have value in a different field, you have to be able to talk to the people, I think that's really changed a lot. It used to be harder to do and now people are realizing it has to be done. It still makes it hard. It's hard when you talk to somebody who doesn't necessarily understand all the vocabulary that you have just as much as you have to learn their vocabulary.

MA: On that note, I'm not very familiar with histopathology so I imagine a lot of people aren't. Can you explain a little about what that means and more into detail about what you do?

LR: Oh ok. Sure, sure. So that's (histopathology) a technique that's been around for quite a while and basically you collect a piece... if you're going to necropsy or dissect up an animal, you collect their tissue and you put it into a fixative so that the structure is preserved. You embed it some kind of a medium, usually a wax medium, and that allows you to cut very thin slices and put them onto a glass slide. Now you can stain that with different kinds of stains. This is technology that goes back to the 1800s which allows you to see different components of the cells in that tissue and you can put that under a regular light microscope and look at the structure. You're looking at really thin slices and looking at the structure of those tissues.

MA: Ok. And how has that technology changed since you've been working?

LR: There are new tools, for instance, antibodies which can recognize very specific molecules can be used to identify the presence of those molecules and tissues. That was somewhat used back in the '70s and '80s but now it's widely used as a technique to identify specific molecules. There is even one step beyond that and you can make really, really, thin slices and use electrons to look at it rather than light and that gives you a high, highmagnification. Again, that's a technique that actually has probably already peaked and maybe even is starting to disappear as other kinds of ways of visualizing tissue come about. But light microscopy is still a very useful tool.

MA: Where do you see that evolving into the future?

LR: I think it's a staple. It's reliable. The evolution of it maybe more in ... You still rely on the human brain to interpret what you see because it's just like looking at artwork. What you see and how you interpret it is pretty important. That probably will not be replaced by computers. I think you will always have people. I think the hard part is going to be training enough people to do that kind of work because we are losing people. Just as an interesting comparison - so as a molecular biologist, I completely understand how to extract molecules from tissues and analyze some particular nucleic acids for their content but having had the histopathology side, I also understand the value of that. So many people who are molecular biologists feel like you don't

need the histopathology. We've replaced it. I know both sides, I say that's not true. Those are complementary techniques not a replacement technique.

MA: You said you're having trouble getting new people into the field. Why is that?

LR: It's because histopathology takes time to learn what you're looking at and it's not a matter of being handed a kit and following the instructions like a set recipe. Being able to do things in the laboratory... A lot of molecular biology you can do things without understanding what it is that you're doing and you don't have to do much interpretation of it. With histopathology you have to be able to interpret things from the very beginning. So it's training, it's the amount of time invested in training someone to be able to make those interpretations. But, I will say, you go to the hospital and when they do biopsy samples, they're still using histopathology for that kind of work. They can't necessarily rely on just what's called a grind and bind technique which is what a lot of molecular biology is.

MA: Do you personally train people here? Or is that part of your description?

LR: I train people in the molecular aspects. The one histopathologist that we had here, I worked with him back in the '70s, he retired last year [laughter]. So we do have people now who are doing histopathology for very specific tissues. For instance, there's a group that does a lot of reproductive biology and they're interested in looking at the ovaries and testes of fish to look at the different developmental stages. So they're very focused on those specific tissues for research purposes but not for general health assessment purposes.

MA: So, where is your main study area currently?

LR: I spent about ten, fifteen years really looking at bacterial infections in fish. NOAA Fisheries ... the interest in fish health has declined in the sense that we don't have hatcheries. We're not like the Fish and Wildlife Service. We don't do that kind of work. Most of what we're doing is looking at animals, free ranging animals in the field, for instance. Unless there is an epidemic of something going on, there isn't a strong support for maintaining expertise in that area. So what I've been doing is transitioning over to expanding what we do in microbiology, particularly with bacterial cells, and trying to develop environmental microbiology components. People think of bacteria as being bad actors and causing disease, but turns out that's a tiny, tiny, fraction of all the bacteria that are out there. There's a lot of bacteria that you absolutely have to have that are part of you as an organism. You have a lot of bacteria that are on your skin, in your gut, everywhere, every part of you, and they're doing something beneficial for you. They're not harming you. Same thing in the environment.In marine waters, there are bacteria there doing biochemistry a lot of jobs, in addition to breaking down decaying material, making those nutrients available for phytoplankton or some other organism to use. There are bacteria everywhere[laughter]. And so trying to expand our vision of what bacteria are beyond the disease component is something that I've been taking on for the last four or five years. We've collaborated with fish biologists who were trying to do assessments in Puget Sound of the food web, for instance, and bacteria are part of that microbial food web that ultimately provides food to forage fish and the salmon and marine mammals. People are getting it, that's the cool part about it. At one time,people were looking at me like I was crazy when I would say, 'Look, there

are a lot bacteria out here, you need to understand better what it is they're doing. Who are they and what are they doing.' We're kind of in the "who are they" phase right now. We have great techniques, the high throughput sequencing capabilities that we have here at the Center. We're using those to look at what kind of bacteria are present in a variety of samples from marine water. We're actually trying to expand it to killer whales, and it's hard to get samples from killer whales, especially southern resident killer whales. We actually have been successful working with Brad Hanson's group to collect breath, exhaled breath, and look at what kind of bacteria are present there. Incidentally, your respiratory system is not sterile. You have a lot of microbes, bacteria sitting in there that are doing good things for you and we're hoping that's a similar situation with the killer whale. So that might be a non-invasive method of collecting a sample that gives us a way of at least assessing what are the changes, what changes do you see over time maybe with an individual whale or is there a difference between a mom and the offspring since there are people here who can identify every single whale on sight. So water, killer whale breath, working with folks in the fish ecology and the watershed group who are looking at stream restorations and streams...there's alot of focus on what's in the stream and on the surface of the stream, right? It is a habitat for fish but it also turns out there's water that goes from the surface into the stream bed and there's ground water from the surrounding terrestrial area that come together. And so we were working with Sarah Morely who is interested in the macro-invertebrates that are in that stream bed or in the hyporheic zone and we're looking at the bacteria that are in the hyporheic zone because water comes from the surface dives into the hyporheic zone and comes back out again. There's actually a diagram of it. The water that you see running in a stream spent some time in the stream bed and comes back out and when it's passing through that subterranean or that hyporheic zone, bacteria that are there actually involved in converting contaminants, for instance, breaking contaminants down or breaking down nutrients. We're trying to look at all the different kinds of things that bacteria can do in aquatic systems or in aquatic animals as opposed to just…what are the ones causing disease.

MA: Right, so not just the bad ones.

LR: Exactly, exactly.

MA: So with the changing population in Seattle and the Seattle area, a lot of people have heard about environmental studies from the Puget Sound recently, especially with salmon. Is that part of your research and how has it changed especially with these changing conditions of the area?

LR: Well, I think the center, (and again I'm going to just talk about the center because that's what I'm most familiar) At one time, doing Puget Sound work was done by a relatively small group of people at the center, I think now it's much more broad and much, again, multidisciplinary. I mean, you have a whole watershed group focused on what's going on above in the freshwater and the watershed areas and I think that we're seeing more pressures on the system and we're getting pretty much better at quantifying what those pressures are. I think the part that's going to be difficult is can you do anything about it. It's one thing to identify a problem, it is another to try to come up with a solution or mitigation for those problems. The biggest thing that I see is a shift in what we, it's called a shifting baseline where what you think was unacceptable 30 years ago now has become acceptable. Sometimes it's good and sometimes it's not so good. Because now you can say, 'Well, maybe the water is up to my neck and it's not

too bad because my heads still above water.' Whereas before, if it was up to your knees, you would start freaking out. So, I think that those are all necessary human adjustments to a situation that we may not be in control of anymore.

MA: So, you don't know what you and this center will do? Do you have any plans to help mitigate it or....?

LR: I feel like making the public aware of what we do and what those threats are and why those threats exist, if it does come from what we as human beings or how we live our lives, then that's our only real hope of changing people's behaviors. We can't mandate people to stop moving here or stop driving. Well, we could mandate stop driving your car but that isn't going to happen. I think it's just being better aware of how we fit or don't fit into the larger ecosystem and what our effects are. Just educating the population, just educating the public. People who are not scientists but who are good people. The better we can communicate what we find, the better chance we have of them coming to that realization on their own of, 'Oh maybe I should take the bus instead of driving my car.'

MA: Now getting back to your career specifically, what has been your biggest challenge in your career and what has been something you're most proud of?

LR: I think the biggest challenge has been - particularly with being in the field of microbiology and being in Fisheries - is figuring out how to make microbiology relevant to NOAA Fisheries. I mean, if I were in EPA, it probably would not be a problem. If I were in a different branch of NOAA, like NOS, it probably would not be a problem. But because Fisheries is very strongly oriented toward fishing and fishing communities and sort of the products that people derive from aquatic resources, I think understanding how to fit our work into Fisheries has been the biggest challenge. The thing that I'm most proud of is up until recently, I pretty regularly had student interns and they were a blast and being able to have them around for maybe a year or so as opposed to the ten week kind of flash mob that appears now in this summer of interns [laughter]. I would have long term interns so there would be opportunity for them to really understand what it takes to make a project go and how much work it is and I think it contributed to their decisions about whether to stay in science or not stay in science. I'm happy to say most of them decided to stay in science in spite of the boredom because a lot of what we do is very boring and tedious. They've all just been, every single one of them gave back to me and it was great because I got the benefit of them learning new stuff and they were happy to share with me and visa versa. To me all of the interns have been just really the big reward for me. Regardless of whether my work dies in the library somewhere so nobody ever knows anything that I've done [laughter] I feel like those are the people that took away part of something that I was willing to share with them and they were happy to take it.

MA: Do you know if any of them are working here now?

LR: Yeah, there is one. A couple of them that are still here working as contractors unfortunately but I keep in touch periodically with other ones and Facebook is a good way to stay in touch. It's interesting to see how divergent, how they've gone in very different directions and they knew... they told me when they were here,"These are the kinds of things I'm interested in,"even though

they were doing the work that maybe was not necessarily what they were interested in, I think it gave them appreciation for what it takes to do that. Kind of the fundamental tools that you need to develop to be a researcher or scientists I think they developed. Some of them were actually so good that they first authored papers. It was good for them to be able to go through that experience and it was a joy for me to be able to help them do it. I think it was beneficial when they were trying to build their own CV and getinto graduate schools or get jobs.

MA: So, in regards to people, like the interns who would be just starting out, what is an average day for you like now working here? What was it like in the beginning kind of compared to how it is now?

LR: Well, I'm a program manager now so I spend a lot more time at the keyboard and I spend a lot of time talking to people. It's pretty interesting. Sometimes it's not necessarily science but it's still important because you're family. At that point you're talking about a lot of different things that effect how well someone can do their job. So now my office, where it's located, the hallway is right there, people see me all the time but I leave my door open and people take advantage of. So I do spend alot of time just being at the keyboard answering emails and I do have to spend time doing science. A lot of time that's in my commute, where I can just plug in and read papers or work on things, or I do telework at home now. In the past, I did a lot more lab work. It was definitely much more lab oriented and I like that. It was a sense of doing something and having a product at the end. But it's ok. I'm ok with the transition.

MA: Did you ever go out into the field?

LR: Oh yeah, oh yeah. Lots of field work, and I still do field work. I went out on the ocean acidification cruise back in May and June. [For] one of the[m], the hyporheic zone project, we'd put on the waders and go out to the Cedar River and Knickerbocker or Thorton Creek here in Seattle and get out there and collect stuff. So I love going out in the field and I would never take a job that wouldn't let me do that.

MA: What's your favorite place you've gone out into the field?

LR: It would probably be the first trip I ever took. I had never been on a boat. I'd been working here about a year and a half, two years, and I got sent to Kodiak Island to go on a charter boat and the crew had been on this boat for four or five months, they were all sick of each other but I was lucky enough to go on the last leg, the last three weeks. So they all decided to put their arguments aside and just enjoy the last three weeks and that's what kind of got me hooked on staying inmarine sciences and realizing --of course this is 1978 I think -- that, 'Wow you can go places where there is nobody there!' I'd never seen anything like that before and we were running like six different kinds of gear, small boat deployment as well as stuff on this larger vessel. I'd never seen phosphorescence at night. It was hard, hard work, and I had to adjust to things. I think that was kind of the hook got set of like, 'Oh this is a pretty cool area if I can do science in this area, I'll stay with it.'

MA: What about your collaboration with other people in the field and other scientists, things like that, what has that been like? Especially in the office, your relationships with your coworkers.

LR: The science collaborations are usually great. Again, most of the time the collaborations are across somebody else's discipline so it's a lot of me learning their stuff and them learning my stuff and figuring out how we want to put that together. I have no quibbles about that. It's always a learning experience and I think that's the thing you're going to find about scientists is that everything is an opportunity to learn something. Just by nature, you're always pushing edges to figure out how far you can go with things. You're always going to learn that, especially in the government science arena, it's very impressive. I think people who are government scientists are here not because you're making a killing off the salary [laughter] but they're also not doing it for ego reasons. I know academic sciences can often be very self centered and they have to be that way.The funding structure sort of drives that, so it's not a criticism of the academic scientists but maybe more a criticism of how they keep their careers going. Here, I mean in government science, it's much more collegial. We are all working toward - I know this sounds corny but - we all are working toward what's good for our society or good for our country or good for the environment that our society and country rely on. I think the goals are beyond our own personal goals and I think that that really is a very different mentality and that's why I've never really seriously thought about leaving government work, even when administrative rules are, or whatever constraints you might have as a government scientist can feel, oppressive. I think it's that bigger objective that keeps me going and think it's true for most of my coworkers. My coworkers are respectful. I very rarely run into a situation where people don't acknowledge other peoples expertise or…what's the term…try to horn in or discredit someone else. I don't think that's a thing that's being mandated by all that training we have to take for HR [laughter]. I think that people come to this inherently with that respect for other people. I don't fraternize necessarily with people outside of work. That is actually something that has changed a little bit. I know that at one time there was a lot of value in having your private life and your professional life and trying to keep those somewhat separated because if something went horribly wrong in one, you sort of had the other one you could escape to [laughter]. Sometimes I've seen situations where that was valuable for someone to be able to come to work and not deal with the private parts of their lives and not have their coworkers involved in that as well. I see now there's a lot more interaction people have - younger than me - have a lot more interactions with their coworkers outside of work. That works, it's fine for them. It's just a different mindset and that's good. I live a long ways from here and I take public transit so when I go home, I go home. When it's time for me to catch my last bus, I'm gone. So I maybe don't go to the tavern with coworkers and celebrate happy hour, for instance.

MA: Where do you live then?

LR: I live on Whidbey Island. Fortunately, I can do it all by public transit but I've been doing it since the '80s so I'm used to it but it is a part time job, commuting.

MA: How long does that take?

LR: It's easily five hours.

MA: Oh my goodness. Both ways?

LR: Both ways, yeah. A day. This is why I telework one day a week. Technology has really allowed me to make that time productive, too, with iPad and all those great tools that are now available, I can get a jump on work. But when I'm home, I like to feel like I'm in separate place.

MA: With the office environment, there's been some talk about women in science... Have you noticed since you've been here more women entering the field?

LR: Oh yeah, oh yeah. Well, I'll tell you early days, back in the early '80s, when I was going out on boats, there weren't that many women going out on boats and in fact - probably somebodydoesn't want to hear me say this - but you did have to be careful about people who didn't want to see women on boats.And that would be whether it was NOAA vessels or charter vessels, particularly if there were people who came from a commercial background. They just felt like women were bad luck. You were a little bit on point to make sure that you were not doing breaches of protocol and you had to be, you know, look out for yourself.And now it's totally different [laughter]. It's so totally different. I think women today really don't realize how different it is, and I think it's for the better. Everybody is just accepting that and again laws maybe had something to do with it, but I think it is very healthy to have the mixture of men and women. I mean, most of the women that were here when I started were office workers and technicians, there were a number of women who were technicians. To see women who were actually in a position of authority was not that common. I marvel when I go out in the field now and I see, 'Gee, more than half the crew are women, hauling all this heavy gear around! That is super cool!'

MA: Would you say there are even more women than men now maybe?

LR: That's possible. It's entirely possible. Yeah

MA: What are the biggest changes you see in the future of your field?

LR: I don't know about changes. I think the biggest challenges are going to be our ability to generate data [that]vastly outstrips our ability to understand or analyze or interpret all of that information. Technology has allowed us to produce a lot of information, but the human brain I don't think is quite caught up to being able to know how to manage it. First, you have to know how to manage it, and then you need to develop the capabilities of managing it, which is usually some sort of software or computer technology. I'm just seeing that now.For instance, sequencing is a great example, high frequency sequencing. You can generate 5 million reads. What do you do with 5 million reads for one experiment? That's a lot of information. Do you reduce it down? There are so many different ways and especially if you're collecting data for different kinds of variables.Like say you go out and you do a study and you've got temperature and you've got wind and maybe you've got how many people live nearby. You know, you have a number of different sources. How do you look all of those different sources of information and make a pattern from it?That's one thing I'll have to say, scientists are really in the business of looking for patterns. Sometimes it's to our detriment because we'll see patterns where there aren't patterns. That's something to be very careful about, that you aren't working hard to generate something that really isn't there. We're supposed to be looking for the truth, really. Being able to get the human mind around how to manage that amount, all the data that we're generating is problematic.

I think the other big challenge is going to be how do we preserve the information that we're collecting in a way that ok, maybe we don't know how to fully…we can do a little bit of analysis and get some sort of conclusion or inference from a data set.But the value of it may actually be 10 or 20 years from now where somebody is looking. Now the tools have been developed and somebody wants to go back and say,'ok, let's take a long term look at what's there.' How do you preserve that information and the context of that information so that somebody looking back, first of all, can find it and second of all, can understand how it was collected. So if they're going to an analysis it's a valid approach. I think we're awash in data points but whether we optimally use that remains to be seen.

MA: So, how do you think that will help evolve our brains so that we can understand it as quickly as it comes out?

LR: I think there has to be a group of scientists or I think maybe each scientist needs to have thinking time. We spend so much time sort of dealing with a series of tasks. You know, you start your day out, you got a punch list of things, then you get pinged with a bunch of things that you have to respond to, and then you've got to worry about funding, get the funding here, figure out how to do the study, get the study done…Now we got data analysis. It's a little bit of a treadmill, in some respects, and we don't have the time to just sit down and think about things.And I think that's one thing the human brain is very good at making connections, if you can stop the ambient noise. Stop all the stuff we're being bombarded with and think about it. I listen to Star Talk Radio with Neil deGrasse Tyson and he had a couple people on who were talking about creativity and how everybody thought 1905 was Einstein's big year because he wrote 4 or 5 papers that came out.But it turned out that he thought for ten years as a postal clerk and then came up with these things. Figuring out how to carve out -- and I think it's good for everybody not just scientists--how to carve out a part of our existence so that we can contemplate, because contemplating, it's not all about just bringing in information. You have to have some synthesis time and understanding. What was I answering there?

MA: Yeah. How we can...

LR: ...how we can evolve our brains. Yeah, yeah. I think we need to let it work the paths that it's evolved over the last, however many thousands of years, it's been evolving.

MA: Now going back a little bit to before you started working here. Why did you come out to Seattle originally? What made you move out here?

LR: I'd never lived here before in this part of the country. My dad was in the service so I had moved around a lot and had lived in Alaska and Texas, Germany, East Coast. It was a place that I had never been before and I'd never lived here. Well, I'd lived on coastal areas but never really right on the coast. I knew one person here so I said 'well, I'm going to come out and visit' and then I didn't go away. So it was just mostly curiosity about a very different part of the country.

MA: How did you find this place at first? That was through the community college, is that correct?

LR: You mean this center?

MA: The center. Yes.

LR: Oh, yes. It was a work study job through the community college, exactly, yep.

MA: When you eventually got your fulltime position here, did you just apply and get it or did the work study position help you kind of transition?

LR: Those were the good old days. It turned out that histopathology was sort of a new area of research here and this one graduate student that I was making the deal with, was here on a temporary appointment.And because I knew how to do this work, the guy who was running the project that the graduate student was working in could see that there was potential for more histopathology to be done, and asked me if I wanted a temporary position. In those days, they had temps and so I got hired as a temp and I was on several continuing temporary appointments and then it turned into a full time position because I said 'I can do this stuff and you guys need someone to do this stuff' and they said 'yeah, you're right.'

MA: That's really nice! You talked a little bit in the beginning about how the Mendelian starting out and you said its changed a bit so you said that was the main scientific theory at the time around the ...

LR: ... the genetics, right.

MA: But you said that's changed?

LR: Well, the whole discovery of DNA and the DNA sequence and the fact that now you could actually manipulate DNA. So,in Mendelian genetics you're just looking at the expression of that DNA and the traits. People were able to figure out, we know that there are genes that drive that, but the actual physical manipulation of genetic material and understanding, it really wasn't around at the time that I was in college. So, in that 10 to 11 year period, a little bit longer, it became…it went from like a Nobel Prize, you know ground breaking technology or understanding, to, "Oh, this is something we can do research with," and that had changed greatly.But the Northwest Fisheries Science Center, (well at that time it was the Alaska…Northwest and Alaska Fisheries Science Center)that was not something that they could see that fit into their repertoire of technologies that they were using at the time. I mean Fred Utter was here, and he did some enzyme work, but the genetic part had not really caught on and that's when I thought,"Well if I really do want to understand better what's going on in these tissues that I'm looking at, I need to go someplace else."

MA: But now there are more... ?

LR: Oh definitely, oh yeah. They've got whole laboratories. In fact now there's another division that has a total group of people who spend time doing genetics.

MA: Right. And do you work with the eDNA at all?

LR: Well, that's the funny part. I always joke that microbial people have been doing environmental DNA for a long time because that's what we do. We grab stuff, we filter out the bacteria, we extract the DNA. But now the realization that macro organisms are shedding DNA or putting DNA out into the environment a lot,now the macro biologists are catching onto the fact that they can look at this stuff and maybe look for our organism of interest or whatever. E-DNA has been around for a long time, it's just that microbiologists didn't call it eDNA. But now it's becoming quite a buzz phrase.

MA: Yeah, ok. Well that's pretty much everything I have unless there's anything else you want to talk about yourself or your work or anything like that.

LR: Well, I do think there is one thing I enjoy…So, I spend my time, professional time, doing science and I also like to spend my leisure time doing science so I've been trying to get more involved in citizen science work. On Whidbey Island, I belong to the Marine Resources Committee which is an advisory group to the Island County Commissioners. That's a group of citizens with some with background in science, some with background in outreach and education, but everybody is joined together with the common interest in marine resources. My county, my home county, has 200 miles of shoreline- more than 200 miles of shoreline so there's a lot of marine resources around. I've been really having fun learning about my own home environment, which is a lot of fun because a lot of times here if you're in a national agency, you're dealing with bigger areas, even though Puget Sound is still kind of regional,but you still are affected by the California Current, [and]West Coast of the U.S.But it's really fun to learn about your own home. So I've been working on a kelp project, bull kelp monitoring project, which is just a lot of fun because I know nothing about bull kelp but I'm learning more about it. For me, it's very satisfying to at least take the skills that I think I have and developed over the last 35-40 years and to go do citizen science and try to transmit that to other people who are involved. I see citizen science as a rising commodity in doing scientific research and it has a dual purpose. People learn more and care more about whatever they're working on, and it also provides an opportunity to collect material where you could never pay enough people over a long period of time to do work. So it's a two way street. I'm going to retire at some point and this has really been a great chance for me to take my scientific mind and eye and look at my own home. You know, sometimes you feel like you don't make much of a difference but when you look at your own home, you can because now your voice is not drowned in the millions of voices.Your voice is actually…[it] maybe in the thousands of voices. Not everybody wants to do that. I know a lot of people go,'Oh, I'm done with science I'm going home. I don't want to think about that.' I feel like a lot of people who are researchers it's really a lifestyle. It's not a job, it's a lifestyle and you don't ever just turn it off, it's always there. For me, I enjoy it, it's a great excuse to kayak, you know, you get out there and do that kind of stuff and again be able to start thinking and going to the literature and going,'Oh, ok!' Now I'm realizing that bull kelp is an extremely valuable plant and habitat. We were just up looking at a bed a couple weeks ago and we realized the plants don't look as healthy as a bed that we were surveying that was on the Admiralty Inlet side. This one bed is on the inside that has a lot more fresh water influence. We realized the water temperatures are quite a bit higher on the inside than the outside and then going into the literature, I'm realizing that temperature is a big limiting factor for bull kelp. This might be a good example of a temperature influence. It's a great opportunity to learn about your own home environment and maybe make a

difference in how people perceive the natural resources that you have around. I think it's a great time in terms of awareness by the public, as well as our elected officials that if you've got something good…and that's true in the northern part around Whidbey…If the environment is in good condition, it's a lot easier to preserve what you have than to try to mitigate or restore something that you've messed up.

MA: So you work mainly all around Whidbey? This group is the whole island?

LR: Yeah, right, right. There are different projects that go on so you get to learn if there's an eelgrass group, if there's a forage fish group, if there's a pigeon guillemot- which is kind of a fish eating bird- group. So we all get to share information. Now we're actually starting to say we, because we're looking at different facets of the environment, we're going to try and focus on areas where we're all doing our monitoring in particular locations. Now we'll get a very rounded perspective instead of looking at pigeon guillemots over here and looking at kelp over here and looking at eel grass here. We're going to start focusing on certain locations where we'll understand how all of these organisms fit together in an ecosystem. Much of what is happening actually with the professional scientists, we're taking that same approach. We can do that on a citizen science level and you don't have to write… well, you can right grants but it isn't life and death. You can always go out and just collect data on your own or make observations on your own and so it's very liberating in some respects.

MA: And a lot of the people you said were involved in this are not scientists?

LR: Some of them are not. Some of them are retired scientists. We have a real cross section of people. We have one who is a professional videographer and photographer and he can take some really awesome images which can be important in outreach and education. But ultimately, we're going to turn to our elected officials and make suggestions or recommendations to them about issues if they're trying to make a decision about something. A shoreline management plan update. Things that they don't know about, that's our responsibility to inform them.

MA: Thank you!

LR: All right, thank you!