David Noakes Oral History Interview, June 4, 2015

Title
“Repaying a Debt to the Fish”

Date
June 4, 2015

Location
Oregon Hatchery Research Center, Alsea, Oregon.

Summary
In the interview, Noakes provides a detailed overview of his upbringing in Ontario, Canada, remarking in particular on the social and cultural norms that informed his youth, and commenting on his educational experiences from primary school through his graduate studies at the University of Western Ontario. From there he discusses his doctoral studies at the University of California, Berkeley, noting the significant cultural changes that he encountered as a Canadian living in Berkeley during the late 1960s, and likewise reflecting on his research and mentors during that time.

Noakes then recounts his first academic appointment as a junior faculty member at the University of Edinburgh. In this, he focuses on the societal differences that he observed while in Scotland and describes the research that he conducted during this time.

A major topic of the session is the three decades that Noakes spent as a faculty member at the University of Guelph. He recalls the circumstances by which he relocated to Ontario, speaks of a sabbatical that he took at the University of Oxford, and then details several research projects that he led at Guelph. Specifically, he recounts his work with local, cold-water fish populations; discusses his study of the ecological impact of a nuclear plant in southern Ontario; comments on his collaborations with Canadian First Nations communities; traces his decades-long relationship with scholars based in Iceland; and notes his work on killfish, the only fish species known to reproduce by self-fertilization.

The interview then changes its focus to Noakes' association with Oregon State University. He shares his memories of the decision to leave Canada in favor of Oregon, his initial impressions of the university, the pre-history of the Oregon Hatchery Research Center (OHRC), and the crafting of a mission for the center. He then describes the duties of the board that oversees the OHRC, comments on the center's international reputation, lends his thoughts on specific features of the center that make it both adaptable and effective, and reflects on the sense of community shared by those who live and work at the center.

The session concludes with a discussion of OHRC's engagement with tribal communities in Oregon, and Noakes' expression of hope that the OHRC will continue to pursue its stated mission in the years to come.

Interviewee
David Noakes

Interviewer
Chris Petersen

Website
http://scarc.library.oregonstate.edu/oh150/noakes/

Transcript

Chris Petersen: Alright David, if you'd please introduce yourself with your name and today's date and our location.

David Noakes: My name's David Noakes, I'm a professor in Fisheries at the Oregon State University in the Department of Fisheries and Wildlife and I'm director of the Oregon Hatchery Research Center. Today is Thursday, 4th of June, 2015.

CP: And we are at the Hatchery Research Center.

DN: And we're at the Oregon Hatchery Research Center.

CP: Well, we'll talk a lot about the center as well as sort of the overall patterns of your research, but I want to get a little bit of biographical information first if we could. You were born in Canada, is that correct?

DN: I was born in Canada.

CP: Where specifically?

DN: I was born in a small village called Hensall, Ontario Canada in southwestern Ontario, not far from a city called London.

CP: Is that where you were raised?

DN: I was raised there until I went to university in London. I did my bachelors and masters degree at the University of Western Ontario in London and then I did my doctoral degree at the University of California, Berkeley.

CP: What was your family background?

DN: My family background, how far back do you want to go?

CP: Start with your parents.

DN: My parents were both born in that region of Canada, they both grew up there. They lived there all their lives. My mother's father had immigrated to Canada in the early part of the twentieth century from the Orkney Islands in the north of Scotland. Her mother's family had been living in Canada for about five generations before that. They had originally come from Ireland. My father's parents; both his mother and father had immigrated to Canada independently before they were married, they didn't—independently from England. My father's mother came from the north of England and my father's father came from the south of England.

CP: And what were your parents' occupations?

DN: My mother was a housewife, my father worked at a number of jobs at various times I knew him. In most of his career, in fact, he worked as a stationary engineer and then as an industrial engineer for Bendix Home Systems in Canada. He was production manager for North America.

CP: What was community life like growing up for you?

DN: It was a very small community; it was a small rural village in southwestern Ontario. At that time the total population probably about eight hundred people. The nearest city was London, which was thirty-five miles away. There was an elementary school in the village where I grew up but there was no high school, and so we had to travel by bus six miles to the nearest high school. So it was essentially a small, self-contained rural village centered on rural economics, grain farming, harvesting, livestock, the typical sort of mixed farming things in that part of the country.

CP: So I would gather that the outdoors were important to you from an early age?

DN: The outdoors were certainly significant. My father would take my next older brother and I fishing fairly frequently during the year, and then usually in summer vacation we would go either someplace locally or the family would go to

some place a little bit farther away camping, often camping out when we were younger, camping in tents, then later on camping out in mobile trailers. And so we spent a fair amount of time outdoors. Certainly growing up in a village like that we spent quite a lot of time doing things outdoors. As we got older we spent time working on farms, doing agricultural labor.

And even when I was in high school, the science courses I took in high school were not ordinary science courses. They were initially, in fact, they were mostly agricultural sciences, because we had to learn a lot of things about livestock. We were, again handling animals and doing things with crops and those sorts of things.

CP: Were there any other strong interests that you had growing up as a boy?

DN: Reading. I had an older sister, still have an older sister, she was very influential to me, especially early on, because she taught me to read before I started school, and so I could read before I went to school. And I remember when I was in first grade—there was no kindergarten when I started school—so by first grade I could read and we had, because we had no library in the school, we had a small collection of books on a shelf in the back of the room. Each student was allowed to take one or two books out and we could keep it at our desk until we finished reading it and then we'd take it back and exchange it for another book. And so the first morning there I took two books and I read them before recess and I asked the teacher if I could get new books to read between recess and noon hour, and she refused to believe that I could have read two books in the morning before recess, and so in fact she punished me by making me stay in and missing recess because she didn't believe the story that I could read books.

And so reading was important to me. And then I discovered, again through my older sister, there was a small local library in the village in the town hall. It was one room on the ground floor, and so I discovered through my sister that I could get a library card and I could then go and I could borrow books and I could take them home and read them. And so my intention when I went there was to read a lot of books, and I discovered they were books that were fiction, which I thought were not very interesting because there was people telling stories that might even not be true. I was interested in things that were nonfiction, so there was a relatively small section of the library that was nonfiction, so my intention was to start at the top left-hand corner and just go down the nonfiction, read all the books, and so I did that. Before I got to high school I read all the nonfiction books in the library.

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CP: Wow. Was there a book that made any particular impact on you?

DN: There were lots of books I went flying through. The ones that were the most boring were the government reports, because the government reported all sorts of statistics about grain harvest and timber harvest and economic things and population changes, and they were kind of tedious reading and so on. The ones I guess that were most interesting to me initially were books on history. I mean real history, not fabricated history. And books about science.

CP: Yeah, I know history's an interest that stuck with you for your whole life, it sounds like.

DN: Well, books have always been important, and I went to high school and there was a larger library there. We were not allowed to take books out of the library; we had library scheduled, library class, so we'd go to the library and we'd read things and be in the library. And mostly, it was pretty clear in retrospect, the library classes were class slots when they couldn't think of anything else for us to do, and so they'd simply send us to the library. It kind of was a holding pen. And most of the students would goof off and just talk to each other and do other kinds of things, but I thought it was great because there were a lot of books there, more books than I'd seen before.

And then when I went to university, of course there were bigger libraries. And I discovered about the time I was in second year of university that in fact because we were in an honors science program we can get a special card that would allow us then to go into the stacks behind the regular public part of the library, and we could then go in there and we could go through the stacks and look at things and so on, and I found that was one of the important things, because I could go in there and I could browse then through all the library collections and see all the books there and find things. And then at the university of course you discover that there's a whole different world of publication devoted to scientific literature; refereed journals and so on.

CP: You mentioned that you were interested in the scientific books as a boy; did your interest in science sort of flourish in high school?

DN: Science was certainly important to me in high school, and I did well in science classes in high school, in part because that was the emphasis. When I went to high school, it was a number of years ago and so, I mean I don't apologize for it, because I didn't control it, and I don't apologize for it because it's true; when I went to high school there was a quite strong separation of people so that people were separated by the perceived academic standards. And so in grade nine, for example, we had class 9A, 9B, 9C, down to 9F, and it was quite clear. It was quite explicit. Everyone knew that the people in 9A were the very bright students who were going to do well. The students in 9F were the people who were just hopeless and they were just there because they had to be there. And they knew that, every one knew that. There was no secret about it. These people were treated that way. And so when I started I was in 9A and then 10A and so on all the way through. By the time I got to grade 13 the numbers were reduced, so in fact there's only one class in grade 13. We had five years of high school then. And so I took quite a lot of science but also, fortunately, I took a fair amount of languages, and so in fact I took five years of French and four years of Latin language, as well of five years of English language when I was in high school.

So that was one of the things; the other thing was that there was very strong separation between male and female students, and that was also quite explicit, and there was no apology because that's simply the way it was. And so, we were called boys and girls, and so the boys had to take, in their first year, they just had to take mechanical hands-on kinds of stuff; agricultural sciences or mechanical shop classes. That's what they had to take. The girls had to take home economics class. That's how it was. And so they'd learn how to do laundry and how to do cooking and the kind of things that were clearly career-oriented for them. And there was no escape from that. I mean the idea that girls would be allowed to take something other than home economics was simply not a question. And the idea that boys would take something other than mechanical shop and agriculture was simply, I mean it wasn't a question.

Once we got past grade 9 there was a further separation. So there were people that went into a two-year program, maybe a three year program. A three year program, I guess it was, that basically was training people to go into business. And so they would learn typing and bookkeeping and those kinds of things and so on. And those people were, with rare exceptions, they were all female students. And so it was quite clear they learned how to do typing, they learned how to do bookkeeping and other kinds of things because they would get a job and they would do something useful until they got married and then they would stay home and raise children. That was simply understood that's how it worked.

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And so the idea that any of—and so the boys would then, if they were academically inclined, would go into science classes, because they'd go on to university. If they weren't academically inclined then they'd go into something sort of in the middle and they'd learn a little bit of everything and then maybe they'd become a school teacher or some other kind of acceptable job. Or maybe they'd just do agricultural kinds of things and then they'd become farmers, or they'd do manual laboring kind of things. The idea that any male students would go into classes and learn typing and bookkeeping was almost unheard of. In the time I was—in the five years that I was there I think there were probably three male students that were allowed to take typing and business, possibly because they wanted to go on and work in a bank or something. I know they had to get special dispensation to do that, because that's how it was. That's simply how the world was in those days.

CP: So sort of by nature being a good student, sciences were kind of pushed upon you, or you were prodded in that direction, it sounds like? On some level?

DN: It wasn't so much impressed upon me. In fact, if I'd have given a choice I certainly would have taken science classes, because if you didn't take science class you had to take English classes or you had to take other kind of things that were, they were clearly taught by people—and there was no secret, I mean you could tell, even the students could tell—they were taught by people, they were taught by teachers who were there because they couldn't get other kinds of jobs. I mean being a high school teacher was a sort of a safe kind of bet. You could do those kind of things, it was a sensible kind of thing, it was reasonably well-paid, it had reasonable status in the community and so on, but it wasn't a sign of success that if you were teaching English or teaching Geography in high school in those days, if you were a male person, a man, it was regarded the sort of a sensible kind of thing to do, but it wasn't something you would strive to do.

Certainly it was quite clear that the more interesting classes, the hands-on kind of thing, the thing where you got to do things, were science. And certainly my interest in science was not just because of my interest in science; because it allowed me to continue to ask a question, because I was always interested in asking questions and understanding things and figuring out things, and so that's what science did. It allowed you to do those kinds of things. And so it wasn't science across the board, so that I didn't take biology classes in high school, for example, because the high school I went to, the only people that took biology classes were girls, because they were going to go to teacher's college and they were going to become teachers, and so they'd teach biology. I mean the idea of boys, male students taking biology in grade 12 or grade 13 would be regarded as kind of strange, because if you were a real guy and you're taking real science, you'd take chemistry and physics, because that was real science. Biology was you'd learn how to do a dissection of a frog or something and learn how to press leaves and identify veins in leaves and so on. It wasn't regarded as being real hardcore science.

CP: So was there sort of an expectation from pretty early on that you were going to go to college?

DN: There was sort of the expectation in an academic sense that people who were in the academic stream would likely go on to college. That at least they would continue on their education, or they'd expect to win some kind of career where they'd be expected to perform at some kind of managerial or supervisor kind of level, as opposed to a hands-on manual kind of stuff. I mean there were a number of patterns that were quite clear. The one pattern that was quite clear was that the boys who were there, it was quite clear their objective was to stay in school, because they had to until they turned fifteen or sixteen, depending upon their circumstances. They would quit school so they could—they'd get a job and the first thing they'd do is they would then buy a car, get a girlfriend, and then in a few months they'd be married. And so that was what their—that was what their life was. I'm not sure they would do that in the sense of planning out in terms of career aspirations, but I could tell you what would happen. That's how it happened.

And so by the time we got to—we started off in grade 9 and there was ABCDE and 9F, and all those classes were full. By the time you got to grade 13 there was one class, and so it's quite clear a lot of people didn't make it to grade 13 because they—in some cases they were regarded as being drop-outs, in another case they weren't drop-outs because that's just what they did, because why would you go on and get a lot of education if you're going to work in a factory or going to work on a farm and do those kind of things? For the female students, I can't speak from firsthand, obviously, except I had a sister that went through, and so they were treated differently and the expectation for them was that they were going to become women and get married and stay at home and raise kids and have a family.

If they wanted a professional career then they'd get a job working at an office for a bank or a life insurance company or something like that, and so if they did typing or if they did bookkeeping that would be a reasonable thing for them to do. I guess the only thing that would be regarded for them as being sort of a professional kind of thing was they'd become a school teacher. And it's probably still true throughout much of North America at the elementary level; the teaching profession is dominated by women, in part because that's their expectation, in part because that's what society expects of them, in part because it's regarded as being a good thing to do, because you're taking care of young kids and that's what women are supposed to do, and mothering and all that kind of stuff and so on.

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And the idea that men—and I suppose this is probably still prevalent—the idea that men would aspire to become an elementary school teacher would be regarded as being kind of odd. If you wanted to become a teacher, why wouldn't you become a secondary teacher and teach real science and teach real kids and grown-up kind of stuff? Because teaching elementary kids was basically babysitting kind of stuff and so on. And certainly, I mean my wife was an elementary teacher, that was her profession for her career, and it certainly was very common when we grew up and where we grew up that almost all the teachers in elementary school would be women. There would often be one male teacher in the school, and despite his age, his competence, anything else and so on, inevitably he would be the principal. He'd be in charge of things no matter how incompetent he was, no matter it was experienced or inexperienced or anything else it's on; he was a principle because he was a guy and they were in charge and that's how they did it. And that's how life ran. And it would be very uncommon to have male teachers who didn't become principles pretty quickly.

And so that was the—and for women that was, the idea that they would go on to university and so on—and I can't speak from personal experience, obviously—my guess is that they probably weren't strongly encouraged to do that. There wasn't

much of an expectation, there was not a lot in the way of role models. I mean so that the aspiration there probably was to maybe become a high school teacher, more likely to get a job working in a bank or doing other kinds of things, or get a chance to go to the city and do something in the city and live in the city. I mean my mother's sisters, only two of them went away from home, and one of them went to a town not far away and took a one year business course and worked in a bank; the other one went to a bigger city and took a six or eight month course and became a hairdresser, and they were regarded as being unusual for women from a small village.

CP: How did you decide on Western Ontario as your university?

DN: It was the closest community with a university. It was a reputable university that had a variety of kind of programs and things available to it, and I had relatives, an aunt and uncle who lived there, and so I lived with them in their house when I was a student, and so it made it financially feasible for me. The only other option would have been a college—at that time it was a college—it was affiliated with a bigger university. It was an agricultural college. And certainly because I grew up in that cultural area, for most students that were encouraged at high school, the guidance counselors actively encouraged us. They were either, many of the boys were encouraged to go to the agricultural college; the idea was you'd get a two or three year diploma and you could then be kind of a sensible kind of farmer and you could manage and you could be more successful. Or you might work for a feed company or you might get a job working for some industry kind of applications and so on.

For the women that went to that agricultural college, they had what they called the diamond ring course. The diamond ring course was basically a home economics course, and the idea that women—it was explicit, the idea that the women would go there. There was—the agricultural college had a veterinary college, agricultural college and a home ec college. And so the home ec college was women, agricultural was men and the vet college was men. And so the expectation was that women would go there, and it was called the diamond ring course; if they were lucky they'd get engaged to a vet before they graduated. If they weren't lucky, in the last year they got desperate and they would settle for some guy who was in the agricultural things. So it sounds terrible to say it, but it was true. And I'm not saying that's right or wrong or anything, but it was certainly true.

And so the encouragement we had in university—had in the high school, secondary school, was that if you were going to go on to university, if that was a perception of what you would do, then you'd be encouraged to go to an agricultural college. The best-known graduate from that college, in fact, was John Kenneth Galbraith. You may have heard of him. He was a remarkable individual. He was one of the tallest economists I've ever seen. He described the education there, if not necessarily the best, it was certainly the most economical education in the British commonwealth. He then left the agricultural college and he went, in fact, to University of California, Berkeley and did his graduate work, his doctoral degree at Berkeley, the same as I did.

And so he came from a farm, not from a village. I came from a village, he came from a farm, and so for him, bright kids from the farm, you go to the agricultural college and you'd learn agricultural kind of stuff and you'd then go back home, do things and so on. He clearly was more exceptional than that and so he went on to university and did a degree in economics and did okay.

And so that was one thing that people think about. The other one was that you'd go to an academic university, and there were two academic universities. The one that some people were encouraged to go to was, again, a branch, at that time a branch college of a bigger university, and it was known for engineering. It had a co-op program in engineering. And the students would go there because they could learn engineering and engineering was, at that time, was kind of a big thing. It was a career option, clearly. And it was a co-op program which was very good, because you'd go to school for half the year and then you'd work for a company for half a year, and so in fact you could afford to go there and you'd basically subsidize your own education. That became the University of Waterloo, which is quite well-known for engineering because, I don't know if it's still true, but for many years Microsoft hired more graduates from the University of Waterloo and IBM hired more people from there than any other university in North America. So it become extremely well-known for engineering, and rightly so.

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And so for people who were clearly seen to be in engineering, that would be encouraging. And for other students like me who were interested in academics in a broader sense, I suppose, the University of London was about equal distance away and it was regarded as a kind of multi-university. It had a medical school, a dental school and it had all the kinds of things you'd expect a university to have in it. So it was an older, well-established school. But the primary reason I went there was because I had relatives living in the city, and so I could live with them, pay reduced rent, and I could afford to be in a university. Otherwise I could not have afforded to go to the university.

CP: Well you mentioned you didn't take any biology classes in high school, but that was your major in college. How did you arrive at that?

DN: Right. I started university and I had a bunch of entrance scholarships that I got because of my academic performance in high school, and so in fact I went to university and enrolled in an honors program in physics and chemistry, because that's what I'd taken as science in high school, and that was my perception of science. That was everyone's perception of science. That was everyone's perception of science; that's what it was. And so I arrived on university the first day. In those days you'd walk around with a piece of paper and register for classes and get things signed and so on. And so they asked me for the paperwork that they had sent to me where I preregistered, and the paperwork had not arrived and I didn't have it, so they had to run around like crazy and fill out the forms and do things, which they did. They were very helpful. And so they said "okay, in first year you have to take chemistry, you have to take physics, you have to take English, you have to take calculus and then you have to take two other options. You had to take—you had a choice of two out of three, and so the three courses were botany, zoology and geology and you had to take two of those to round out your program.

And they said "which of those two do you want to take?" and I said "I don't know." I certainly wouldn't have thought about taking botany because botany was, why would a guy interested in science take botany? Zoology maybe, geology was rocks, and so maybe you'd get a job with a drilling company or something. And I said I wasn't sure and so they said "well what do you want to do when you graduate?" and I said "I'm not sure" and they said "well, is there any possibility you might teach high school?" and I said "maybe," and they said "well then you should probably take botany and zoology because then you could teach biology in high school, because you've taken those two courses," and I said "okay." So they signed me up for botany and zoology plus the other ones.

Well I discovered during first year that the way it was taught then was that chemistry and physics were the most boring classes in the world. I mean they were taught by guys, old guys, they were big classes, they were taught by old guys who basically couldn't teach and they were just were hanging on, and so they were given these big introductory classes to teach because they hadn't kept up with science, they hadn't done experiments, they hadn't published papers, they hadn't done things. And so they were just extremely boring and tedious and they were doing stuff that even to us it was quite clear was twenty-five or thirty years out of date. I mean they're teaching from old books and just teaching simplistic kind of things that were boring, totally boring.

Fortunately for me, the person who taught first year zoology was a parasitologist. Ken Bourns was his name. Parasitology is one of the most interesting areas of science because parasitologists have to understand all kinds of things. They have to understand—have to learn physiology and health and disease and behavior and ecology and everything you can imagine; they have to understand it to understand the life cycle of parasites. And he was a wonderful lecturer, very dynamic, very enthusiastic, taught a wonderful course and gave lots of examples of stuff that I knew about and plus stuff I had not heard about, and I said "this is incredible, this is the kind of stuff I want to do." And so at the end of first year I switched from being physics and chemistry and I switched in the biology option. So I did my last three years and graduated in the program in zoology. I did a masters degree in zoology and a PhD in zoology.

CP: So you had, by the end of your bachelors experience, I suppose, had arrived at this idea of becoming an academic?

DN: I don't know that I'd arrived at the idea of becoming an academic as a career option. It certainly was a potential career option. And those days, I suppose by some measures, was more attractive than it would be nowadays, because there was certainly, there was certainly some indications that there might be job openings, because universities were expanding. Especially in Canada, because there'd been roughly small universities with affiliated colleges, and because of changing demographics and population, then the government started making those colleges into independent universities until it was quite clear that if those things were going to grow there'd be a need to have people hired there. But it was also quite clear that going into a career in academics would require a lot of investment time and effort and so on. You couldn't just

go with a bachelors degree or a master, you'd have to get a PhD, and so it was a big deal. A very big deal. And it was largely unforeseen.

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I was the first person on either side of my family to go to university, and so there was no clear example for me and no clear role models. And I was, of the class I graduated from in high school, there were three or four of us went to university. Maybe four or five, because a couple went to the agricultural college. So there was not a large number went to university. And so there's not, there's not kind of a critical mass of people to—or people to follow. There were a few people but not very many. And so I was undergraduate when I got into biology, especially zoology. I took up all the courses I was interested in doing kind of things and did very well and enjoyed it, and I decided I wanted to do a masters degree. And I got a scholarship to be a master student, and so in fact it paid me enough money so I could live as a graduate student and pay tuition, do those kind of things. And so the only real choice for me then was what did I want to do as a graduate student, and so I chose I would go into behavior kind of studies.

And I was very fortunate the person I worked with was, at that time, a relatively new faculty member, very active. He'd done his—he was Canadian but he had done his graduate work in Europe, one of the people in that field to come back from Europe and bring those ideas back to North America. And he was extremely generous in terms of introducing people and making the contacts and so on. And so I did a master degree with him and then it became obvious that I wanted to do, I continued to do academic research. And so I contacted a number of people, made some applications, did the Graduate Record Exams and so on and then went to Berkeley and did my graduate work there.

CP: So as a masters student at Western Ontario, were you focusing on fisheries at this point?

DN: I would not focus on fisheries in the sense of fisheries the way we think about nowadays. I was interested primarily in animal behavior. Studies of animal behavior or evolution ecology, those kind of things, and so I worked on behavior of fishes because the person I worked with worked on fishes, and so I mean he—that was not the only thing I was interested in. He had some students work on other kinds of animals but he himself worked on fishes. But his primary interest and his primary teaching and research and so on were in behavior, and so I took animal behavior. It had to be on fishes. And then when I applied to do PhD work the person I applied to and the person I was accepted by was also a person who most of his work was done on fishes, and so I was doing work that was primarily behavior, ecology, evolution on fishes. And so the fish thing sort of was a, if you will, an ancillary or secondary aspect to what I was doing.

CP: Well you'd spent your entire life essentially in this one section of Canada and then you went to Berkeley for your PhD. I'm interested in the adjustment there, changes that you encountered culturally, I'm sure, being in Berkeley in the late sixties, and just what it was like to be a doctoral candidate in a different part of North America.

DN: There were certainly a lot of changes, social, cultural, political, all sorts of things. At that time I had the option—so I was offered a teaching assistantship by the department at Berkeley, and so I accepted it. And so I could have gone either on an immigrant visa or I could have gone on a student visa. It was made quite clear to me by the immigration people that if I went on an immigrant visa I would be drafted within six months. They told me quite honestly and quite openly. I decided, not necessarily because I was opposed to being drafted or opposed to the war, but I didn't see much point, if I was going to go and be a graduate student, not to be a graduate student. So I went on a student visa. And so on a student visa I was not allowed to work outside the university, so that in some sense was, I wouldn't say it was a restriction; it was a constraint.

So yeah, it was enormous changes. I started graduate studies in the fall of 1966 at Berkeley, and so I was a graduate there from 1966 until December of 1970, so there were a lot of things happening at Berkeley that were different from the way I'd grown up, different from the way most people grew up and different than most people experienced it. So yeah, there were social and political, cultural, all kinds of differences. Climatic differences. It was enormously different. It was a very large university, larger than universities I'd been at before. I mean I grew up in a community of eight hundred people, and so it was not unusual for some of the introductory classes at Berkeley that it had that many students in one class. And living in Berkeley in the San Francisco Bay Area was enormously different.

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And there were a lot of things happening in the 1960s. Especially at Berkeley. So I got to see all kinds of people up close, personally. So I saw Martin Luther King Jr. in person, speak. I mean for many years of course it was the place for anybody who wanted to be seen. They would troop up to Sproul Hall steps at noon hour and stand there and make a speech, because that was how you got on the six o'clock news. And so you could walk across the campus and go to Sproul Hall and you knew that whoever was in the news would be there and they'd speak on the Sproul Hall steps and you'd see them at night on national news—on international news, not just national, on international news. There were clearly a lot of protest movements that took place. The city was occupied a couple times by National Guard; it was under martial law. We were attacked and tear gassed by helicopters. Yeah, there were all kinds of things that happened.

I got to do part of my graduate work in Central America, and so I happened to be in Central American and got stopped in the Soccer War between El Salvador and Honduras. I arrived at the border the night the war broke out and spent some time trapped in El Salvador and then tried to get to Nicaragua and spent some time trapped in Honduras watching their aircraft, air force take off to attack the air force in El Salvador. The last time that Piston Engine Aircraft fought in a war against each other. We arrived at the airport in San Salvador about half an hour after it was bombed by the Honduran air force. So we got pretty close to it.

CP: It sounds like. Wow, that's something else.

DN: It was, yeah. So yeah, it was an extraordinary place to be because of course there were extraordinary people there in all sorts of ways that you could imagine. My wife and I had married before we went to Berkeley, and so we were not allowed to work, so we managed an apartment building. So we didn't get paid money for it. But you discover often that getting paid money is not necessarily the same as having money. And so we managed the apartment building and so we got the apartment rent-free and laundry rent-free and parking rent-free. So we didn't pay for those things, and so—in fact we mostly missed a lot of time and effort taking care of the apartment that had seventy-five tenants in it. It was privately owned but almost all the people that lived there were students, and so we got to manage seventy-five students, which was an interesting experience in all kinds of ways.

And so that part of was interesting, but the university of course had, as it does now, a lot of extraordinary people there, both in terms of faculty and also visiting people coming through, and you got to take classes from people who were Nobel Prize winners. For example, there was a colleague of mine, he and I were graduate students together. He was working up at Lawrence Radiation Lab and Luis Alvarez was his supervisor. When it came time for him to graduate in theoretical physics he couldn't get any good job interviews because nobody wanted to work with physics people, and then Luis Alvarez won the Nobel Prize, and so he got job interviews the next week. They had a party at the lab to celebrate Luis getting the Nobel Prize and his wife said no, she wasn't going, because the last time they had a party for a Nobel Prize winner it was really boring. And she wasn't being facetious. So yeah, you got to meet people who were doing extraordinary kinds of research, extraordinary teaching in all kinds of ways.

CP: Well what shape did your research take as a PhD candidate?

DN: Pardon?

CP: What was your topic?

DN: I studied development, early development behavior in a particular group of fish that have a very complicated kind of social behavior, and so I studied cichlid fishes, and so they were native to Nicaragua and Central America, so that's why I did my field work in Central America. So I did lab work and field work. Lab work; looking at fish in tanks and doing kind of things and then field work; spending my time with my head stuck underwater watching fish underwater and doing things. But looking primarily at—and I was working on fish, ichthyology, those kind of things, fishery kind of things, but the primary interest was looking at behavior and understanding behavior. One of the members of my supervisory committee for my PhD work was Richard Dawkins. So I've known him very well ever since then. You may know the name.

CP: I don't, no.

DN: You're probably the only person in the English-speaking world that has not heard the name Richard Dawkins. *The God Delusion*, *The Selfish Gene*, all those kind of books? You can't be serious.

CP: Sorry.

DN: Okay.

CP: Was he your mentor, or did you have another person who was sort of leading your...

[0:35:04]

DN: He was a very important mentor in many ways. He had done his PhD work with Niko Tinbergen who won a Nobel Prize in 1973. So that was kind of the peak of his career. Another member of my graduate committee was Howard Bern who was certainly the preeminent environmental physiologist, endocrinology, that kind of stuff, and so I mean when I tell students who recognize the names and so on, I mean the five people who were my advisory committee, my examining committee, they would terrify most students at times, because they were all world leaders in what they did; psychology, endocrinology, physiology, behavior evolution, that kind of stuff. So those were enormously influential people.

CP: Yeah, it sounds like an amazing environment to have been in.

DN: It was. And I got paid to be there.

CP: So you did some teaching during this time as well.

DN: I was a graduate teaching assistant, because that's what I got paid to do. I was hired by the University of California to be a graduate teaching assistant, so that paid me money. My starting salary was two thousand, four hundred dollars a year. But in those days people who were residents of California didn't pay tuition. They paid what were called incidental fees; it was a couple hundred dollars a year or something. And so part of the deal was that they gave me a tuition waiver, and so I paid the same fees as an instate student. So I got health insurance and all the kind of benefits and so on and I paid incidental fees but didn't pay tuition. So I got paid twenty-four hundred dollars, that was my income. Yeah, so I got lots of benefits from the University of California system.

CP: When you finished up in Berkeley and you returned to Canada, began a long affiliation with the University of Guelph.

DN: No, I finished up at Berkeley, then my first job, which was for almost three years, was at University Edinburgh, Scotland.

CP: Okay, I didn't know about that.

DN: I was a junior faculty member there.

CP: How did that come about?

DN: That came about for a couple reasons, primarily because of Aubrey Manning who was there. Aubrey Manning was a professor of animal behavior. Aubrey had also been a student of Niko Tinbergen's. Aubrey retired a few years ago. In fact Aubrey's coming to visit this summer. Next month he'll be here. July he'll be here. So I stayed in touch with him. And so one of the people I consider—I'd only consider a small number of people and places to go and do PhD degrees and I was lucky enough that I could pick and choose. And so I had been accepted to go to Edinburgh to do a doctoral degree by Aubrey and he offered me seven hundred and fifty dollars a year. That's what they had offered. And apparently students were living on that in Scotland. And I decided not to go there because I just thought it was too far away and all those kind of things, but I was always very impressed with Aubrey, his ideas. And so, in fact, when I finished my doctoral degree I was hired. They had a junior rank called the university demonstrator at the university, and the idea was it was a five-year, non-tenure track position. So they'd hire you and it was a way of bringing new people in. And so I was hired and so I was there for almost three years. And so I spent three years living in Edinburgh Scotland teaching courses, doing research, meeting people.

CP: What was your experience of Edinburgh?

DN: It was a remarkable place to be, very different from California in some ways. Much more traditional, but a bunch of older, established universities have a very different kind of tradition. I mean Edinburgh has the reputation, quite deservedly, of being, first of all, the intellectual capital of Scotland. But also in many ways, but in many respects they have one of the intellectual capitals of Britain, and therefore Europe. I mean they had intellectual influence on people from Edinburgh, including particularly the university has been enormous over the last several hundred years. I mean philosophy, science, all the kinds of things and so on, enormously important. And so the medical school, for example, used to be the premiere place where people in Britain who wanted to go to medical school, they'd go to Edinburgh. Charles Darwin was a medical student at Edinburgh. He survived for a year and couldn't tolerate it and so he dropped out of—he and his brother went there. His brother graduated. His father and grandfather had been—got their medical degrees at Edinburgh. It was the place that people went to, to get a medical degree.

And in fact when I was there one of the courses I taught was first year biology to medical students and to dental and veterinary students. So in a very different kind of historical sort of tradition, it had a different structure and operation in terms of the people and how they did things and the way they were just operating in contrast to Berkeley, for example. And so the university structure of Edinburgh was you had each department had one professor and that was it, and then there would be a reader, a senior lecturer, a lecturer and a university demonstrator, and that was the way it was. And so the person who was a professor was in charge of everything, and so there were no faculty meetings. We had one faculty meeting a year and the professor would tell us what happened last year and what's going to happen next year. And so if you wanted to find out about things you'd go and you just sit down and talk to him in person, or talk to her in person, and they would give you an answer, yes or no, right away. That's how things worked.

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And so it was wonderful in terms of organization and meetings and all that kind of stuff and so on, because it was an incredibly civilized kind of place. And it had many aspects of the UK system where once you're inside the system you get treated as being an equal, which is different than being outside the system. And so when I was there, we moved from California so of course one of the first things was we opened a bank account, which seemed remarkable to the local people because in those days, maybe it's changed now, but in those days people didn't have bank accounts. People got paid money; on Friday you got a paper envelope with money in it. That's how you got paid. And it was a cash economy and so if you had a bank account it meant that you were a person of some substance, because you have a bank account. And so we opened a bank account, and people, they were quite happy we had a bank account because they found out I was at the university, and in fact when we walked into the bank they just sort of ignored us. They eventually came and talked to us and I said "I want a bank account" and they said "yeah sure, okay. Whatever." And they asked where I worked, I said "the university." Well immediately the manager personally apologized and invited us into his office, made tea for us and people ran around and did all the paperwork and such for us and they apologized all the time that they had made us wait.

And so then we had a bank account and so I carried a checkbook with me and I carried a regular fountain pen, and all the time I lived there I could go anywhere I wanted to and I could pay for something, I could just pull out a checkbook and start writing it. I was never asked for identification, I was never asked for any kind of proof, so the idea that if I had a bank account and a check and a pen to write with and so I was clearly a man of substance. And so I was treated accordingly. So I was a university person, so when our son was born there, my wife's in the hospital and she first went in and she was treated like an ordinary person, although they were kind of resentful because she was clearly a North American, but then they found out I was a faculty at the university; they apologized profusely and then the sister, the woman in charge of the hospital would personally come and talk to me and tell me things and answer questions and so on. So you got treated very differently. I mean you had rank there, even though you didn't necessarily have it in economic terms. I mean I took a fifty percent cut in salary from being a grad student at Berkeley to being a faculty member in Edinburgh. And so we didn't do it for the money.

But many of the people, not all, many people at universities in Britain, England and Scotland, come from families that has that kind of tradition of being there, and so they're established and so they have houses, they have all that kind of stuff and so on, and/or they may have family fortunes in some cases. But they are recognized as being a person of stature, and so you're treated quite differently. I mean the only other country I've been that was like that was Germany. I was a visiting

professor in Germany once and the same thing; I walked in, I was going to open a bank account and we were fumbling with the German trying to get them to understand us and eventually they did. When they found out I was at the university immediately a guy just waived his hand and people just ran around and did things for us. And so we'd just show up at the bank and then people would come running over and take care of us. And so people got treated, they got treated differently.

And so certainly being at the university in Edinburgh was quite different. There was very different kind of pressures and expectation in terms of—I mean in North America that was productivity and getting research money and doing research and publishing and so on. There's certainly some of that in England and Scotland but it was not necessarily the same, and so people were, it was, I don't want to say more civilized but it was a totally different kind of structure, different kinds of expectations and so on. Not necessarily in a good way or a bad way, but just very different. I mean there's certainly very well-known people there, many of them doing very productive kinds of things. But the idea was that they were--you'd gone through this whole kind of thing and you'd proven yourself, you were in the system and you're treated accordingly.

CP: So were you given freedom to sort of develop your own research agenda at this point?

DN: Yeah.

CP: And what did you study?

DN: I studied behavior, because Aubrey Manning did behavior. I went there primarily because of behavior genetics. I wanted to learn about behavior genetics and Aubrey had done all this stuff on drosophila, on fruit flies, and he was doing stuff on mice and that kind of thing, but there were people in the research group studying all kinds of things: cockroaches, mice, slime molds. I started doing stuff on fish and so I was the first doing research on the fish, but people were interested in the questions rather than the particular ordinance that they were setting, in most cases. Some people were just doing pretty theoretical kinds of considerations.

CP: And that would be the case for you as well? You're interested in the questions rather than the organisms? Or were you--

DN: Right, yeah.

CP: Okay, so the fish is still just sort of a vehicle for you at this point.

DN: Right, but it was more than a vehicle, it was more than a vehicle of convenience, because I knew quite a lot about fish because I'd taught fish courses and I'd learned about fish and how to do things, and so the more you do certain kinds of things, the more you learn about, and so it becomes kind of self-reinforcing. So then I moved back to North America, moved back to Canada. I did a lot of teaching in ecology, behavior and evolution, but I also did a lot of courses, teaching in fish kind of courses, because I knew a lot about fish.

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CP: What was the decision to move back to Canada and move to Guelph from Edinburgh?

DN: I mean the immediate reason was because I was offered a job. And so the expectation when I went to Edinburgh was I'd be there for two or three, maybe four years maximum, but to come back to North America. There was never any intention at that time, and probably subsequently, to live there, because it's a different country in all sorts of ways, many of which are not convenient. And so it'd be very expensive to live there, it's miserable over there because there's no central heating and just on and on and on, and all those things were true. It's a different kind of culture in many ways and so on. And so the expectation obviously was, our expectation was we'd come back to North America. And so I had applied for jobs, applied at various places, had some job interviews and the University of Guelph offered me a position doing animal ecology, which included the expectation I would teach ecology, teach behavior and teach fish kind of courses and so on, which was the kind of stuff I wanted to do. It was not all that far away from where I'd grown up and where my wife had grown up, and so it was a reasonable place to go, it was a reasonable university. It was the university, in fact, where I might have gone as an agricultural student, the university where John Kenneth Galbraith had graduated from, which was irrelevant because by then it was an independent university.

It had become an independent university around the 1960s; up until then it had been an affiliated college with Toronto. It had become—so it was a new university, it was rapidly growing, all kind of things happening and so on, new people coming in, lots of students coming in. So it was a productive place to be in that sense. In many ways typical of lots of Can—well North American universities in general. And its major advantage is, when I first went there, inasmuch as a sort of middle and upper level administration, it was relatively enlightened, relatively forward-looking and progressive in doing things, compared to other situations. So it was a good place to me. There were lots of good people were hired around the same time. I had a couple of senior colleagues that I still maintain contact with who were very good people, who were very influential people, who were very strong in mentoring. So it was a good place to be.

CP: Well I want to spend some time talking about your research at Guelph but I kind of want to jump forward a moment to ask about your sabbatical at Oxford University. Can you tell me what it was like to be at Oxford?

DN: It was a wonderful place to be. The situation in most universities of North America, other places you go to sabbatical, and the origin of the word is "seven," so every seven years you're entitled to apply for sabbatical. You don't get it automatically and you have to support yourself and pay money and so on. And so in fact I delayed my first sabbatical. In fact I delayed most of my sabbaticals for the convenience of a colleague who was doing other kind of things, and so I took over his teaching. And so in fact I didn't take as many, I didn't take them as frequently as I could have otherwise. My plan always was to go to Oxford to spend time there, because one of the few places that I considered going as a doctoral student was to go to Oxford. I'd applied to work with Tinbergen at the time and he was simply overwhelmed. He had a waiting list of five years or something, and so that wasn't realistic, so I went to California. Tinbergen, in fact, by that time had retired at Oxford.

He was still around and so I wanted to go to Oxford because it was one of the key play—there were two or three key places where people were doing behavior studies at the department of my interest. Oxford was one, Cambridge was one, Berkeley was another one, and there were two or three other places but certainly Oxford was, by most majors, Oxford and Cambridge were the premiere, premiere places to go, certainly in Britain and Europe. Undoubtedly that's where all the strong theory was, all the best people were and so on. It was an extraordinary place to be. We've still maintained friends with people and we still go and visit. We were there last year, we go and visit people there. It's extraordinary, first of all because they're old places, they're well-established. They're fabulous places to be because they're wonderful, and if you're on the inside then it's wonderful because you're accepted, and if you're on the outside then you walk around like a tourist and you get to see the place and you say "well that's a cool-looking building, what a wonderful-looking place." Yeah, so it's great to be at Oxford and be on the inside. You get treated quite differently and you get to meet all kinds of remarkably interesting, intellectual people. And you get, by most measures, an enormous—especially if you're there as a visitor—you get enormous amounts of freedom to go to seminars and meet people and talk to people, and you get incredibly bright students.

CP: I'm sure.

DN: The important things about universities are the library, and the library at Oxford is incredible. I mean I had to get a special reader's card, of course. You can't just go to Oxford and walk in the libraries. There were a lot of libraries, I mean the main library is the Bodleian library. And the Radcliffe Camera is what people think the library is. It's this wonderful, fantastic building you see in all the videos. You can walk in there and you'll look at it but you can't use it. You have to get a special card and you have to go—the Bodleian library there's a special room with a special guy and you have to go and you swear an oath. You got the form, it's—you have to be recommended by a full professor, a real professor, and you go there and you swear an oath. You put your hand on the book and you put your hand up and you swear that you'll not kindle fire, that you'll not bring in tobacco, you'll do all kinds of da da, do all kinds of things. Then you sign a piece of paper and they then give you a reader's card, and so then you're allowed to be a reader or perhaps even you can do things.

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Yeah, so it's a great privileged place to be. And is it nice to be privileged? Yeah, it's nice to be privileged. You're not privileged necessarily in an economic sense, and not necessarily everyone there is privileged economically, although lots of people are, but you get a lot of very bright people there, especially among the students. I mean I did tutoring with students from there and you get extraordinary students, I mean just incredibly talented individuals. And of course the

faculty, not everyone but many of the best people around want to be faculty members of Oxford and members of the college and so on. It's a wonderful life.

CP: Well back to Guelph and talking about research, I have some snapshots of your research that I've been able to dig up through my own preparation, but I'm sure that my understanding of your thirty-three years there is pretty incomplete, so I guess I'd be interested in just hearing you talk about some of the themes of your research at Guelph as it evolved over the course of time, and maybe we can touch on some specifics in the midst of that conversation.

DN: Sure. When I went to Guelph I had worked on various kinds of fish things. For my masters degree I'd worked on native fish in Canada; in California I worked on tropical fish, cichlid fish. At Edinburgh I'd worked mostly on tropical fish and other kinds of things, just because they were convenient. And so when I went back to Canada it was quite clear to me very quickly that two things were important: one is that you had to get research money and you had to do research in order to get research grants, and the Canadian granting agencies are much more restricted than they are in the United States. I mean at that time if you were lucky you'd get a research grant and you might get ten thousand dollars a year, maybe. In fact, you'd probably get five or six thousand dollars a year. And so they weren't going to give you much money, so it had to be something practical, realistic. And they were not going to give you money so you could fly off to the Caribbean and do stuff on exotic, tropical fish. It had to be something that was clearly local and of interest and importance locally. That was pretty clear.

And so I was looking for systems where I could do that kind of stuff on fish that were local; they were readily available and there was expertise on them and so on. And so there was, and still is, a fair amount of expertise and interest at that university and many universities in Canada, working on local cold-water fish like salmonids, rainbow trout, steelhead, brook trout, lake trout, sturgeon, those kinds of things. And so most of the research I did there was on those kinds of fish because they were available, because they were local, because I could have people do field work, bring it to the lab, do kinds of things and so on, and it was the kind of thing I could get research money to support students through it. And so I started off working in those kinds of systems but asking the kinds of questions that were of interest because the questions were of interest. And so I was interested in behavior, social behavior, the evolution of behavior, how behavior develops, behavior genetics, a bunch of different aspects about behavior, because of my experience as a master student, as a PhD student, as a faculty member in Edinburgh, and looking to address some of those questions using the animals that were local interest, local importance.

CP: And one of those particular projects, from what I gather, had to do with a nuclear plant and its impact on a specific fishery?

DN: Nuclear generating station. There's a project we all taught called WINGS, which is Whitefish Interaction at Nuclear Generating Stations. Very large nuclear—an enormous nuclear generating station on Lake Huron in southern Ontario on the shore of Lake Huron. It was a big nuclear generating station that was created to generate electrical power. That's what nuclear stations do in most cases, but they do it legally and if they're not legal then they're making weapons-grade plutonium and uranium. But this was generating power and so it was situated on a lake because they used cooling water, so they take in huge amounts of water from the lake, cool the reactor and put the heated water back in the lake. And so that's what—it was a situation essentially a private company was doing this but the government was involved because the government agency regulates them and monitors what they're doing and that. Because it's radioactive there's all kinds of rules and regulations and so on. So it was a, it's a typical complicated kind of situation.

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We became involved in part because we're interested in the fish and things about the fish and life history and reproduction and migration and all those sorts of things, but we also became involved because the people of particular concern were the First Nations people, what you would here call tribal bands. In Canada they're called First Nations people. They're called First Nations people because they have treaties, they have treaties that their ancestors signed with "the Great White Mother," Queen Victoria in England, who said "we'll take all your land and all the valuable stuff and we'll let you live over there. Just sign here and you can live over there and you can hunt and fish and do all the kinds of things you've always done, because hunting and fishing is okay for you people, I guess." That was more or less the attitude, and so they were given a bunch of land that was not much of interest and not judged to be valuable, and just sort of go away. Over the years what happened, what has happened is that the people that signed it, the First Nations people who signed these

treaties said "just a minute, this said that we can hunt and fish the way we want to hunt and fish, and so we could collect, we could do things, we could use it for ceremonial purposes, all the sorts of things, that we've got a piece of paper that said we could do that." And the government said "yeah, yeah, okay. Well here we are, alright, alright."

And in this particular case, I mean I'm being facetious here, in this particular case they had treaty rights, historical and treaty rights, to fish whitefish and other fish, but especially whitefish, in and around that area that was affected by the nuclear station. Not surprising, if you and I are catching fish and really we see this gigantic thing there that's sucking up water at unbelievable rates and putting it through and putting huge amounts of heat back into the lake, you'd say just a minute, this may not—this may have some impact on the fish, just by itself. And then you see it's a nuclear place, and so you can't get in there. I mean if you go in there it's like going to a military thing that you can't get in there. You get all kinds of inspection; they look inside your car, they look underneath your car, they do all kinds of—and you get the paperwork. And so you can't get in there. I mean we got in but only to a certain one level, because it's dangerous because all the stuff is radioactive. And you say "just a minute, you're taking all this stuff and you're trying to tell me that none of the radioactivity is getting out and getting in the fish, poisoning me and my people?"

And so they were quite rightly concerned that they're catching these fish, they're eating these fish, they're clearly suffering all kinds of social problems, economic problems, health problems, nutritional problems, all sorts of things, and they say "just a minute, we think it may have something to do with that gigantic factory over there sucking up all the water and putting all the nuclear stuff in here, in the lake." And so there had been an ongoing controversy between the people operating the station and the First Nations people to say "yes you are," "no we aren't, " "yes you are," "no we aren't, " and so on. And so it was finally decided more or less that the university would be the kind of honest broker and we'd be called and we'd do the research, because we had no vested interest here.

And so it was a very complicated arrangement where there had to be money to pay for all this, there had to be permission to allow to do this back and forth. It was a very complicated kind of situation to then do the assessment to find out what's happening in terms of the, either the real, the potential or the actual ecological impacts of the operation of that station on the biology life history, the contaminate burden, all sorts of things, of the fish that were involved there. And so it started off just with us but then it very quickly involved some people who were epidemiologists and human health and fish health people, and so it developed into a big project, ran for several years. A lot of people, a huge amount of effort, a lot of complex kind of negotiations and so on. And so in the end it's probably fair to say that there were not likely health issues in terms of radioactivity getting into the fish, and you can say that with a reasonably good certainty because you can actually measure radioactivity.

But there clearly were very significant ecological impacts, because you're adding a huge amount of heat. I mean nuclear generating stations are allowed, in that situation, are allowed to operate on what's called Delta T; you're allowed to heat up the water, and so you can heat up the water by fifteen degrees Celsius, which doesn't sound like much, but it's a lot. And so I mean you can see it from outer space, and so in the wintertime there's no ice there because you're putting a lot of water through. And so there's, you're clearly changing the whole local environment. So very complex situation, a large amount of [unintelligible] and so on, big reports, lots of discussions, all sort of things. It was a very complicated situation that most people would never experience, because it would not be—it's not conventional research but it involves—I mean it's based upon conventional research but it involves a lot of human interactions dealing with people, dealing with management issues, dealing with regulatory issues, dealing with political issues, all sorts of things. Law enforcement.

I mean the First Nations people, for example, quite rightly and justifiably say "we have a treaty with the federal government. We are First Nations, that's why it's called First Nation, we are one of the first nations. And so our dealings are with the federal government. And so if there are regulations on the provincial level, provincial people say, in Ontario, "we regulate fisheries. You must deal with us." And they said "no, we must not. Our treaty's with the federal government." And you can't imagine the kind of complication that leads to, because the enforcement people say "we're here and we've got helicopters, we've got guns, we've got boats, and so we're going to enforce this," and they say "I don't think so." That's only part of the story, process that we see here. Now that was not—that was certainly a major project that we did, but it was not typical of much of the research that I did there.

[1:00:42]

CP: Yeah. Did you have a larger collaboration with the First Nations communities?

DN: We had a lot of collaborations with First Nations people, for a variety of reasons. Some of those are personal, because we had students who are First Nation students, we had people that worked for the First Nations people, people who got degrees with us and then worked with them as consultants, people who came to us for advice. So we had a lot of interactions with them in various ways, studying basic biology, looking at age and growth and capture efficiency and fisheries kinds of things and so on. So eventually there was a faculty position established at the university that was sort of jointly supported by the First Nations people and by the university, to deal with traditional knowledge, providing information that's of particular relevance to First Nations people and so on. So that's a—it developed into a much bigger and broader kind of collaboration by the time I had left.

CP: I want to ask you as well about your connection with universities in Iceland, and you set up an exchange program, is that correct?

DN: I did. I had published papers, a lot of papers on developmental behavior, ecologic, life history, genetics and that kind of things on particular kinds of freshwater fishes, on lake char and brook char, what people usually call lake trout and brook trout, in North America. And some of those papers were published in a big book—I've got a copy here I can show you—on chars of the world, on fishes of that particular group of fish, and on animals. And I was then—the first contact was actually a student, a graduate student who came from Iceland, applied to the university and was accepted because he was an exceptional student. The situation then was as a grad student you had to have someone who would be your adviser and support your research and so on. And so he came to the university and he interviewed with two or three of us and he decided he wanted to work with me. And so that's how it started. So that started around 1980, that started. And so he came to me, did a masters degree, then did a PhD, and then I went to Iceland and started doing things; I had people coming back and forth, send student to Iceland. I had a series of students from Iceland, had people on sabbatical.

So I've been going to Iceland since the early 1980s, I guess. On average probably once a year, once every couple of years, spending time there. I spent a couple of sabbaticals there, had people come to my lab in Canada. I've had people come to Oregon State University from Oregon. In fact, there's two Icelanders right here now, visiting in the university. So I spent a lot of time there doing things there; teaching, research, mostly went to my interests and research interests, but also we had an academic exchange program that was set up that supported people in all sorts of areas, and then established a multi-disciplinary environment field course that was taught for a number of years in Iceland. I had students that studied everything and went there as undergraduates and they did projects there as undergraduates on everything from witchcraft to language, to history, to geothermal energy, to marine fishing, the design of boats, immigration, genetics, horses, on whaling. I mean anything you can name, plus lots of things you can't think about. And so it's been a very rich and very rewarding association.

CP: Well one more thing I want to ask you about from the Guelph years is your work on killifish, which are fascinating-sounding animals, hermaphrodites that produce and fertilize they're own eggs.

DN: Internally so far they look like for—like hermaphrodites. The only fish species that's known to regularly reproduce by self-fertilization. So they don't produce clones: they're sexual animals. And they're remarkable, first of all because they contain both female and male reproductive organs in the body at the same time, which is generally judged to be a difficult thing to do, because of the endocrinology involved and so on and so on. In animals, vertebral animals, including fishes, it's always been a supposition that an animal can either be a male or it can be a female but it can't support those functions physiologically and endocrinogically, can't support them at the same time, but these fish do. The story's not quite that simple, but I mean it's more complicated in the sense that some of them are males, and they're males their entire life. The other ones start out being females and then they develop male functions, so they become hermaphrodites, and then later in life they drop the female function and become only male functioned. And so it's a somewhat complicated situation.

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But yeah, it started because of contact with a friend of mine who worked with the EPA in the United States, and he used them as experimental animals because they produce animals by themselves. They're not clones, but each individual animal then produces offspring by itself, and so you can simply hold them and so then you can get animals that are almost genetically, they're really very similar to each other and so he was using them for testing various kinds of chemicals and other kinds of things. I was, and I still am, interested in those animals, because of what you'd expect that their behavior should be like and what—in ordinary kinds of animals you can talk about how males might behave and

females might behave and make a choice and courtship behavior and all sorts of things, but if you've got animals that are hermaphrodites, that's an interesting question. And there are some other species of animals that are hermaphrodites, but they're either male or female, and at a particular time they routinely change sex. The colleague of mine from Hawaii who was just here—in fact that's the kind of fish he normally studies—things like some of the groupers and gobies and so on, they routinely change sex.

And so for them they're either behaving as a male or female, but for an animal that's a simultaneous hermaphrodite, the question then is how do you behave when you encounter somebody else? And so that was one of the questions. The other question was in terms of how do they survive by being internally self-fertilizing, because in principle they should become extinct pretty quickly, just because they're inbreeding. It's the ultimate form of inbreeding, and so you'd think it's not a good thing to do. But in fact, as far as we can tell, they've persisted for a long time. And so I've had a whole bunch of people work for me, including a very good friend of mine from the University of Minnesota who's a theoretical biologist. He and I published a paper which we got away with, I think, one of the great titles of all time. The title of the paper—well the paper was published in a journal of theoretical biology, so it's okay; the title of the paper was "Is a Little Bit of Sex as Good a Lot?"

And the question there had to do with not so much with sexual reproduction, but with outcrossing, because the supposition is that if you keep inbreeding and inbreeding and inbreeding, eventually I'm going to get inbred and have all kinds of genetic problems. And so we were able then to calculate how frequently you would expect those animals to have to outcross with somebody from a different lineage in order to maintain some degree of genetic heterozygosity. So that was, it still is, a very interesting situation. When I left Guelph I gave all my colony to a colleague of mine who studies physiology, and she's now made enormous advances studying physiology, because those animals are not just remarkable in terms of their reproduction; they also spend a great deal of time living out of water. They spend much of their lives living out of water, almost like amphibians. They had been in extremely demanding physical circumstances, and so she's interested in how animals do that physiologically. So they're turning out to be really interesting animals in all sorts of ways. And so I did a bunch of research on them, because they're easy to keep. We had little plastics cups, we put a little bit of saltwater in there, the little fish lived by itself, you feed the fish and it produces fertilized eggs. It's, in many ways, they're the ideal experimental animal.

CP: Well, I'm sure we're giving short shrift to your Guelph years, but I'd like to move on to talk about OSU a bit. You were at Guelph for thirty-three years and you had a whole career there, and a very successful one. You made a decision to come to Oregon State in 2005. What prompted that?

DN: Because I owed it to the fish. The Oregon Department of Fish and Wildlife and Oregon State University had come up with the idea of inventing the Oregon Natural Resource Center, the place where we're sitting right now, and it was designed from the start to be a research center to address questions related to hatchery and wild fish, interactions with hatchery and wild fish; looking at the mechanisms that might produce a big difference between the fish, how you manage those differences, then how you also have important education outreach functions. That was established quite clearly, and so I was aware of that. I mean I knew a number of colleagues here before I came here. I found out through them about the opportunity because the search was on then to hire someone. So I always had some contact with them, got some information, was encouraged to apply, and so I applied here. But I came here in part because the opportunity—large part because I wanted to do things to pay back a lot of what I owe to the fish, because I'd taken a lot from fish over the years, from a lot of fish over the years, and I owe it to the fish to repay that favor, to repay the debt. So I've learned a lot from the fish and so it's part of my responsibility then to provide that information to help the fish. And this was an ideal place to do it.

The questions are big questions, they're important questions, they're significant questions, so that was also secondary to why it was important. There are very good people here at the university, and that's where I associate with this. I liked the concept of the research center, the idea it was designed to be a research center and not just a place that was going to do some research incidentally. The idea that it was supposed to be international, all those kinds of things appealed to me, that I could do something useful, I could contribute to a bigger exercise, I could do something important for the fish for conservation and for management, restoration, all the kind of things for Pacific—for native fishes, not just for salmon, but primarily for salmon here, and get to do it in an environment that was productive in terms of the faculty colleagues and the other sorts of situations here. It was not an easy or simple decision to do.

[1:10:31]

CP: I'm sure, yeah. Setting the research center aside for a minute, what was sort of your sense or your impression of OSU when you got here, in kind of a broader sense?

DN: In many ways, I mean generalizing very broadly, in many ways it's fairly typical of this kind of university in the American system. It's a multi-university with some limitations. I mean it has a vet college but does not have a medical school, does not have a dental school. It has some professional schools, it had quite a strong reputation in life sciences, especially in things related to Fisheries and Wildlife, which is more or less a North American, especially a U.S. American emphasis. It's a land grant university and so it's similar to the university I'd been at in Canada. It represented many of the kind of values and many of the kinds of people similar to the university and situation I'd been, and kind of the university here obviously was and still is somewhat bigger than that, more international in many ways, although much less so in other ways. More international in the sense that it's operated under a different scale, and so in terms of the research, research opportunities, collaborations and so on, much broader than typical Canadian universities. But in some ways, in some peculiar ways, much more restrictive in terms of international opportunities. Surprisingly so.

CP: The research center had a history before it was a research center. Where was it at in its sort of evolution by the time you got here? Had the facility been fully constructed, or was it still in the process of being retrofitted from what it had been before? Maybe you can give us a sense of the history of this facility.

DN: There had been a production hatchery here for fifty years or something like that. I mean for a long time. It was essentially derelict, and so by the time I got here it had been deconstructed, it was all gone. I mean there were a few buildings that remained; the houses where people lived were still here and being reconstructed, but there was nothing significant here when I came here. It had all been planned, the construction on it. When I first came here it was probably halfway through in terms of construction, so there was nothing here except stories and paper records and so on of what had been here before. It had not been a production facility for a number of years.

CP: Were you charged with sort of establishing an agenda for this facility as its director, or did you have a mandate that had been given to you by someone else?

DN: The place was established certainly in the physical sense; it was planned quite appropriately and quite well by ODF&W and OSU. They did workshops and they brought in professional people, and so in fact it was very well designed conceptually from the start. It was quite well designed physically and it was reasonably well constructed, given all the constraints and uncertainties that you have designing and operating a place like this that never had been built before. And so all that was predetermined. The mission of the place was predetermined, the mandate was essentially predetermined. That was part of the job description, the position description, so all those kinds of things were, in that sense, predetermined. Certainly what was to be done and how it was to be done were largely the expectation that the people had for me and what I was expected to demonstrate and do, and set up the tone once I came here.

CP: What is the mission of the research center?

DN: The mission here?

CP: Yeah.

DN: There's three parts of the mission statement, and you'll see them described in various ways, and first is, in the simplest form, without a lot of preamble and so on, is to understand the mechanisms that might produce differences between hatchery and wild fish. And that's important because it emphasizes understanding the mechanism. It's not set up to just compare hatchery and wild fish. There's a lot of people still that are sort of beating a dead fish to demonstrate that the hatchery fish are different than wild fish, which is, it's not interesting. I mean I find it boring. In the same way it's like measuring; take any two samples of something and you measure them, they're not the same and you say okay, and so what? And you measure this, you measure that, you measure size, you measure shape, you measure color, you measure all kinds of things. So you can find all sorts of things. And then the standard thing that people do is they take, quote, "hatchery fish," they take, quote, "wild fish," they raise them in some circumstance and they then measure the difference and they say "ah, this proves that hatchery fish are inferior because they've got smaller heads, because they're

stupid, because they can't swim fast enough, because they got too much fat in their body, because they've got too much buoyancy. Whatever it is, it always turns out to be wrong.

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It's like being—well I went to a small school in a small village, it's like being—you were the kid at the bottom of the class; it didn't matter what you did, it was wrong. Okay, you're the stupid kid in class, everybody knows that, and so we'll measure how tall you are. If you're tall then that's bad because you're tall and stupid. If you're short then you're short and stupid. If you run fast, well of course you can run fast, because you're stupid, or if you run slow—so I mean I grew up with kids like that and I grew up in that system, and so that's what it amounts to and so you can say alright fine, I understand that. Okay, I got the message, yeah, alright, okay. And so that's not what we're doing. We're understanding the mechanism, so the question is what causes the differences? Because you can measure differences forever and you say okay, but the point is to try and intimate causes of those differences, that's the first thing. And so a lot of what we do is not measure differences; it's to try and find out what causes differences between hatchery fish and wild fish. There are differences, everybody knows that.

The second statement of the mission, again cutting it down the essence, is then to help managers and the people who are responsible for it, to use that knowledge, use that information to then either, to manage those differences to meet conservation and fishery goals. Now in some cases that may be to maximize the difference; in other cases it might to be minimize the differences, for example, or to do whatever. It doesn't say that hatcheries are good, hatcheries are bad, whatever, it just says that here's the information, these fish are different, that's what causes those differences, and so it's up to you then, if you decide that the priority is to reduce this, minimize that, maximize that, whatever, that's your decision. Those are policy kinds of things, and so that's the second part of our mission.

The third part of our mission, and these are not necessarily in order of priority, is to provide education, outreach, information to people in Oregon and elsewhere so they understand the relationships among wild fish, hatchery fish and the environment, so people understand a lot of different kinds of things. And so again, it's not saying that these are good, these are bad; we're able to understand what goes on, how it goes on, how things are being managed, why they're being managed. And so it's a big mission, in many ways, but they're simple statements, they've very clear statements and we constantly come back to them, and every time someone comes to us and says "I'd like to do this, I want to do this, I want to do that," first question we ask is "how does it fit our mission? How does it fit our priorities?" Because we have priorities on time, we've got priorities because of space, because of funding, because of need, because there's a question that comes up because whatever.

And so when people come to us, either internally or externally, and say "I'd like to come here and I'd like to use those wonderful stream channels up there, and I think it'd be cool to measure swimming velocity of fish in different waters," and we'd say "I'm sure it would be. How does that relate to our mission and how does that fit in with our priorities?" So that's what we have to say. And so it's really important, it's absolutely critically important to have that, because if you don't then you suffer from what people describe as "mission creep," and so you start doing kinds of stuff and say "wow, now we've turned out to be the greatest place in the world for studying swimming velocity and fish that are jumping in our waterfalls. Well, that might be a useful thing to do but it's not what the place was set up to do. And so in fact we keep coming back to that all the time.

And so there's lots of people, I don't know if you'd say a majority, but certainly a very large number of people that come here and want to do things, and we sit and talk and we're very helpful and we appreciate them coming here and so on, but we'll say "yeah that's wonderful and I can understand why you want to come from your country to come here, or your state or your province or your university and come here, because you don't have this kind of stuff, you want to come and use it and so on, but it doesn't suit our mission, it doesn't fit our mission, it doesn't suit our priorities and so on, so either we are going to discuss that and you're going to adjust those things and prioritize things and so on and keep coming back to us, or we're going to shake hands and agree that that's not going to happen here." And so we do that. And so that's what the mission is and so we pay very close attention to that.

So we have a fifteen member advisory board now, twelve of those are voting members, three are advisory members, and so they view and vet everything that goes through here. And so they set up a research plan, and so they represent every kind of interest you can imagine from stakeholder groups across the state. And so they get to comment on those things,

they get to see the importance of it, they get to understand those things, they ask questions, they provide information and they provide parties, all that kind of stuff and so on and so on. That's a primary part of how we operate.

CP: So this board weighs in on proposals to do essentially everything here, or?

DN: [Nods affirmatively]

CP: Okay.

DN: Everything. Now in some cases they'll bring stuff to us, and in some cases we may say "yeah, that's a wonderful question, but it's just a question because you want to know whether you can put a tree in your river, or someone wants to know whether you should put a bridge there or a cover, and well that's okay for you, it's an important question and so on, but is it appropriate for us to spend two hundred thousand dollar—you know, we have to set priorities." So first of all we'd say "interesting question for you, I can see the law is all over you, people are going to say you have to do this kind of stuff and so on, but is it appropriate for us to the research on that here?" And maybe it is, maybe it isn't. And so what I constantly do for many people is I have to tell them—and it sounds slightly odd, but it's not—is to say that we have to do big research here, we have to choose research that's important, and we have to choose research that's going to make a difference.

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And so it's fine to say okay, we're looking at this particular kind of stuff and say well that, it's okay, but how's that going to help the salmonid as a species, or how's it going to help the state of Oregon, or how's it going to help the people who live here or doing labor or doing something? It has to be big enough and general enough it's answering a real question, because we're going to do a lot of time and a lot of attention and we don't have unlimited attention, we don't have unlimited funds, we don't have unlimited facilities and people, and so we have to make sure that whatever we're doing is a really important question, it's a big enough question, we'll get the answer to it, we can say yeah, that's significant and we've answered a question. And so another way of looking at it is to say—there's different ways of saying it and different people have a different way—but one way of putting it is to say "simplicity is the ultimate sophistication."

It's easy to make things complicated, especially in science. It's really easy to make things really complicated so that not even you can understand it. You say well, I guess it's important because someone's got a lot of flashing lights and they're titrating stuff and they're going to—if you ask them the question "when's it going to be important for people?" and the answer they will say, "it'll be five to ten years." They always say it's five to ten years. Why? Because they're required by law to say it's five to ten years. They never say "it's going to happen tomorrow, we've got the answer now." It's easy to make things very complicated, to say we need more money, we need more of this, we need more of that, so it kind of gets very complicated to measure all these kind of things; then we have sequence the genome, we have to count this, blah blah blah blah blah." It's easy to make things really complicated, it's very difficult to make things simple. If you make things complicated then it's almost impossible to understand it, because they'll say "oh, it's not that simple, it's very complicated. It's not just that there's a gene for this; it depends on where you went to school and the kind of water you drank and the kind of car you drive, and it's really complicated." And you say "oh, I guess so, you're wearing a white coat, I guess you must know what you're talking about."

It's really difficult to make things simple, and so what we try to do here is we try to make things reasonable so that we can understand it and so anybody else can understand it. You can say okay, we try to set it up so that—we try to get a big question, an important question, a question of high priority, a question that suits the mission, and we say okay, the answer can either be yes or the answer can be no. If the answer is yes then we can pursue those questions; if the answer is no we'll say might be of interest, but it's not important. And that's a challenge, of course. And so to give you an example of the kind of stuff we're doing here, a couple of examples; we're looking at olfactory imprinting. I mean no one doubts, seriously, that the way that returning salmon and steelhead come back is they recognize their home river based upon some set of chemical things in the water. There's some debate as to whether those are chemicals from other fish, whether they're chemicals from the leaves, the trees, the rocks, whatever and so on. But they certainly, you can demonstrate pretty clearly that the chemicals are quite important, and so then you say okay, that's a very complicated kind of situation, what are they responding to? And so what we try and do is narrow it down and say okay, here's a question; we say if it's these sorts of things then the answer is yes, if it's those sorts of things then answer is no, and so we can just sort of get a head for that,

so you don't—but to get to that point there's also a lot of understanding, a lot of discussion, a lot of reading and planning things so you can get a simple answer.

Or the stuff on geomagnetic orientation and homing; you'll say how do salmon find their way around the ocean? Well you can spend a lot of time, a lot of money, a lot of people and you can try and track ocean—fish out in the ocean. And people try to do that, and it's never going to work. The Pacific ocean is a very large place and you can't track the fish, and you put tags in them and track them, so you can put a hundred fish or a thousand fish and you get information back from two or three or four or five fish and you'll say that's information between the four or five, what's that tell you? It doesn't tell you anything useful, as opposed to setting it up like we have outside here where we have the testing towers, where we put the fish inside there and say okay, if the fishes respond to geomagnetic information then in this circumstance they'll face the left, in that circumstance they'll face the right. And so we tested and they faced the left and faced the right. So that's it, they're paying attention to geomagnetic information, that's all you need to know.

And then you'll say what's the next question? The next question is okay, suppose there's the north to the south, which way are they going to go? And so we spent a lot of time and effort, and some of the results we get usually are the kind of result that people are impressed with, because they can see right away and they can understand yeah, it's important. As opposed to saying to someone "we measured all kinds of things, we measured this and blah blah blah and we think there's a five percent chance or a twelve percent chance or whatever," and you'd say "whatever. Get over it." Looking at salmon smolts going to the ocean; people have done it for years and years and years, and so we take the fish, we put ultrasonic telemetry tags in it, we put Hydro Foams in the river, people assumed you catch the fish out here, fish going downstream in the spring, but those are the fish that are going to go to the ocean.

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We did the studies in terms of only thirty percent of those fish made it to the ocean, and so it's a very simple, it seems like a very simple kind of thing to do, and people would say—well one way, I got another thing which I say: "why didn't I think of that?" I mean $E=mc^2$ seems pretty simple. One of my favorite cartoons is a guy in front of a blackboard and he's writing, it's written $E=ma^2$, and he's crossed it out; $E=mb^2$ and he's thinking and thinking and thinking, and you could see what the next thing's going to be. It's not quite that easy. The story is told about Huxley, Huxley who was Darwin's "bulldog," when he read Darwin's manuscript on the origin of species, he said "how stupid of me not to have thought of that, because it's just so obvious," like I'd say, "it clearly must be true. Why didn't I figure it out?" And so the great talent to many people is to figure out things; you see it and just, and it's like Newton and having the apple fall on his head, which is not true, but it was saying well how could someone not figure this out?

Because it just seemed so obvious someone—I use the example sometimes here in Oregon, you're driving down the road, you drove here this morning from Corvallis, you drive past a Christmas tree farm and you believe it's a Christmas tree farm because the trees look like Christmas trees, but they might not be and it just looks like a lot of trees, and you suddenly get to the point in the road and you'll see all these trees are planted in straight rows, and you'll say it must be a Christmas tree farm, because trees don't grow that way. And you'll go a bit father down the road, it makes no sense, because it's just like a jumble of trees, and if you look farther down you'll see the trees are in rows again. And so it's partly that perspective you sort of, if you get the right perspective, you can look at it and say it's obvious. And so you don't need to know and I don't need to know that someone planted the trees; we just drive and we get to the right place and we take a picture and say there it is, somebody planted those trees. How do you know? Because trees don't grow that way normally.

And so the challenge then is to figure out how you ask the question so you get a simple answer that everyone can understand the question, everyone can understand the answer and everyone will agree with it. And so the most difficult part, of course, is to ask a question, because we're asking questions of the fish, and so the really challenging thing is to ask a question the fish can understand the question and they can provide an answer that we can understand. And that's difficult in most cases, because the fish can't understand English, as far as we can tell; we can't understand what it is they're saying to us. And so we set out, for example, and say "okay, if you can feel this field around you, then turn left," and if they turn, obviously well I guess they could feel the field around, because they turned left. If they turned right that means that okay, I guess they didn't feel that field around them. We can understand that. So me and the fish can agree what the question was, what the answer was, and then move on and do something else. And so much of what I do is working with people, first of all so that I can understand what they're getting at, and then figuring out how we can set it up so that everybody can understand it.

CP: You referenced people from other countries wanting to come here, and we've talked off camera about the many visitors you've had from around the world. It sounds to me like the center has developed an international reputation.

DN: Yeah it is. I mean a lot of people want to come here for several reasons; one is because it's nice, second reason is because it's convenient, the third reason is because somebody else does most of the work for you, and the fourth reason is because the only thing you want to do is here. I mean why would you not want to do this kind of stuff? So it's a nice place to be. It's far enough away from the city it's kind of rural but not so far away that you can't drive in the city and do stuff, and so I'd say okay, that's pretty—got paved roads most of the way, so it's convenient there. It's in a nice part of the country, it's in, it's more or less central Oregon, more or less in the central coast range, which is a pleasant place to be, all those kinds of things. You look outside the window here, there's a stream there where there's wild fish. Come back here in November when we have our fall festival and you'll see wild Chinook salmon spawning out there.

And so if someone wants to study wild salmon, there's wild Chinook salmon, wild Coho salmon, wild cutthroat, wild steelhead; every species of fish that's here. There's wild lamprey, they're all wild, they're out there. So if you want to study real fish, they're out there. It's a real watershed. I mean there are people doing stuff here, there's a few houses, maybe, there's a few places above where they cut some trees occasionally, yeah; there's a few places where people have vacation homes, yeah, but it's sort of real. It's not destroyed, not turned into a golf course, and all that kind of stuff and so on, so it's real. And so that part of it's great. It's convenient because people come here and they'd say "okay, I come here and I want to raise fish." I mean Neil Thompson, the guy you met this morning, he wants to raise fish from different families in different tanks, and you'd say "okay, we've got fifty, a hundred tanks and we'll divide those things up." There's the tanks for him. He says "great, this is wonderful." He says "I want these fish fed twice a day this kind of food and so on" and we say "yeah, the people here can do that kind of stuff, they're professional people who can do that kind of stuff," and so he says "this is pretty cool."

I come here, I talk to them, I arrange things and then I go away, and the people who are here routinely, the students, the volunteers, the interns, the rest of the people and so on, well that's what they do. They know what they're doing and so they feed the fish, they make sure the water's running, make sure the tanks are clean, they make sure that the temperature's right, so they take care of all kinds of stuff for you. And they're nice people, they're reliable and dependable people, and you say "okay, then I'm going to come back here on June the 15th and we're going to collect all the data from the fish." And it works. Why would you not want to come here? I mean all those kind of things work really well, and the people here are very cooperative, they're very friendly, very knowledgeable.

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And the place here is almost infinitely adaptable, so we've not yet found anyone who's been able to describe some kind of experiment that we couldn't run here. We just say okay we can do that, we can modify and so on, but it has to suit our mission and it has to meet our priorities. It has to be possible, has to feasible, has to suit all the kind of things and so on. And so there's a very long line of people who want to come here and want to do stuff, and want to take over and say "well, I'd like to come in, I'd like to run stream trans [?] for six months," and we'd say "okay, you can do that, but someone's going to have to pay for the time, someone's going—because if you're taking water, you're going to pay for the water, you're going to do all kinds of stuff and so and so, the cost." But the cost to people to come here and do it are trivial, because if I want or you wanted to set up a place like this and run an experiment, it would cost us several million dollars to build a place so we could then run an experiment for six months or something. Or you could come here and you could spend a few thousand dollars and you get to use the space and get to do it for almost nothing. And you get to live in a nice place with nice people, and you get real data; it would work. Because it works.

CP: What are some of the key features of this facility that make it so adaptable?

DN: Because it was designed by people who knew what they were doing. There was a workshop that was held when this place was being planned. It was the brainchild of Lindsay Ball, who was the director of ODF&W at the time, who said quite rightly that these discussions are going on forever with hatchery and wild and managing the fisheries problems and so on, and it needs science. There's no place for people to do science, and so there's this hit and miss bits and pieces; someone says "well, somebody in Idaho measured this, and if that's true then this might be true, and if someone else in Michigan did something and then someone in Washington state did something else and if I take little bits and pieces and put them together and multiply it by a thousand, then maybe that's all we can really do. But there aren't any—there wasn't

any place here where people could then actually set up an experiment and test those things specifically. And so that was the intention.

Before the place was designed then there was a workshop, a couple workshops that brought together people who were research scientists, who were fisheries managers, who were engineers, who were hatchery people; all the kinds of people who should be involved were brought together and say okay, what are the research questions that need to be addressed? What kind of space and facility and resources would you need to address those questions, and how would you then incorporate them into the design of a place that you could do that? They did. The big mistake that people make, almost invariably, is—they're very proud of this, especially administrators—is they will say "we've got this place now and this is the state-of-the-art place for studying molecular genetics and left-handed red tree frogs," or whatever, and you'll say "that's incredible." This is absolutely state-of-the-art in this kind of stuff. Then you come back six months or two years later and they say "well that problem was solved and now we're doing something else," or "that person left and so now we have to hire somebody who's going to look at," let me think, "they're going to look at the grammar in literature from the Far East from two thousand years ago, and they need a lab that's set up for that kind of stuff" and you say "well, you get to do this lab," and they say "well that's wonderful, we don't actually need all the taps, we don't need the floor drains and so on"; "too bad, you get to work in it."

So you often visit university labs, especially at other kinds of places and you'll say "this is a pretty cruddy facility. Why have you got all these wires hanging from the ceiling?" and they'll say "well, because it was designed to be a state-of-the-art room for people to study mouse genetics," or horses, or whatever it was. And so the downside of having something state-of-the-art is—in your hand you presumably have a cellphone or a computer, and you fell victim to the old state-of-the-art thing; you bought it because it's state-of-the-art, and then in six months—or well, actually it's eighteen months—about eighteen months it's obsolete. And then you're stuck with something and you say "this is a really cool machine." I can take you downstairs and I can show you old computers, for example, and you look at these and you'd laugh and you'd say "why would anybody be so cool about buying something that a green dot was going to cross?" You know, there were, it was four columns, it was four rows high and it had forty columns across. Why would somebody pay money for that? Well, because that was state-of-the-art. Wasn't that cool? Yeah, it was real cool.

And so if you build something to be state-of-the-art it almost doubles—you're building something to become obsolete right away. It's not going to work. And if you build something to be state-of-the-art that's hard-wired and hard-build and so on, then you're just putting yourself up for a tragedy, because in six month's time or a year's time you have to tear it all apart and rebuild it and say "ah, we need to have a bunch of cold water in here. I guess we'll have to put in some water lines, or I guess take the water lines out, or I have to drains, I have to rip up the floor, do all kinds of stuff. And so you spend much of your time, much of your money ripping things apart and making it constantly state-of-the-art. This place is state-of-the-art for nothing, but it can be state-of-the-art for anything, and so as I said, I don't think anyone's come here that's actually proposed a research project to us that we couldn't do, we couldn't—and then, so okay, if you go down to the wet lab and say "what do you want to do in the wet lab?" "Well I want to have water coming from below." "Okay, we can do that, water from below, yep." "I want cold water." "Yep." "We need hot water, I need that space over there." And so the space doesn't belong to me or anybody else; the space belongs to someone who gets assigned that space and that water for a length of time to do something. And so okay, that's your space over there, you get those tanks, you set up, you do your kind of stuff; when you're finished it goes away.

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The dry lab here, most people walk in and they say "there's nothing happening in the dry lab," and that's true because most of the time there isn't. If you walk into most research labs it looks wonderful because it's just full of crap. There's bottles and there's test tubes and there's everything, you'd say "wow, it must be incredible, there's just everything going on here." It's a jungle, it makes no sense to anybody. If you walk in there and say "do you have any 1.5 microliter pipette tubes?" and they'll say "oh, I don't know. I think Julie worked on them last year. Julie—oh she's not here, she moved on." So you can't find stuff. And stuff's not put away; the stuff just sort of sits there. You go down the stairs down through the lab, if people are working there the stuff is out and it's being done. When they finish working all the stuff goes away. If it belongs to us it's got a place and there's names and numbers on all the drawers and all the boxes and it's in a computer database that says it belongs in there. If you want to find it you go on the computer and look it up, says "yeah, we got two-hundred and twenty-five and we bought them six months ago, they were paid from this index, this is how you order them,

this is what they do," all the information is there. And they stay there; they don't sit out here, they stay there. If someone else comes in, they bring in their stuff, they set up and do their stuff, when they finish their crap gets cleaned up and it goes away and somebody else comes in.

And so it's a turnover and there's not stuff that sits around. It's either being used or it's someplace else. And the same with the wet lab; the wet lab is set up, and so okay, in two week's time your experiment is over, your tanks are going to go away because someone else is going to move in and do something else, and so the people who run this place have to be incredibly organized, because they have to be able to set things up and say yeah, it's going to work. You need water, you need this, you need heat, you need whatever, and so on, and so it's an incredible amount of coordination. It's like watching—the old joke is it's like watching swans on pond. If you're seeing it from above it looks like they're sort of serene and drifting around, but if you look underwater all hell is breaking loose, because the people here are incredibly organized, they're professional people and you get the impression that they just kind of walk around and they kind of do things, but they're incredibly organized, the place is incredibly organized, so there's probably—there certainly are a thousand fish here and probably a dozen different experiments right now, but it's not chaos because everything's organized.

And so everything, people know where things are, where it belongs, they know what their jobs are, people are trained here so anybody can take care of anything here if something happens and they break something that needs to be fixed, repaired, rebuilt. People who come here, the students, interns come here, learn everything from molecular genetics to how to back up a pick-up truck, because they need to know how to do it. If they want to have a job, they know those kind of things. And someone here will say "I need someone to do some welding." "Well okay, be good if you did some welding, wouldn't it?" "I don't know how to weld." "Well, you're going to learn," because people need to know how to do things, because you have to do things, and everyone has to be competent to do things here, and so you have to be able to do all this kind of stuff. And so it's incredibly organized and it goes through all the screening procedures, so we know that things that happen here, it's not just sort of chaos, it's not just sort of "I'm not sure who belongs there, I'm not sure who that belongs to, I'm not sure where the chemical is, I'm not sure where this fish"--you know. And so everything's organized here and it's run effectively and nutritionally, because there's very good people here.

CP: It feels to me like there's a strong sense of community as well, for those who live and work here.

DN: There is, and they want to see a strong sense of community, because people need to live here and get along with each other and you need to be able to trust somebody. People that live here know everybody else and they know people and they know where they are, what they're doing, all that kind of stuff. And they trust people. The people that are setting up to do research here need to know that the people here are doing their job and doing it properly. People that come here and do the research, people that let them come here need to know I can trust someone. I mean I've got a triaxial fluxgate magnetometer that we let people use to measure magnetic fields and so on. That instrument alone costs ten thousand dollars, and so if you want to use it, use it. You break it, you bought it. Okay? You back up a truck, use a boat and all that kind of stuff and so on, you better know how to do it properly. And so you get trained for human health, safety and all kinds of stuff and so on, and so that's why you have to trust people. And so you need to know people and get to know what they're like.

And so you sort of saw the coffee, we sit there and people joke and talk to each other and so on. It's all very serious, okay? They know each other, they know each other very well, and so—and it sounds kind of lighthearted and they're joking with things and so on, but it's all very serious, because in ten minutes they disperse and they go out and they do their job and so on, and everybody knows what they're doing and you don't need to check up on him, because he knows what he's doing because he went through the training, did this kind of stuff. You get to screw up once maybe, but you don't get to screw up twice. You make—John Wooden, you don't know who John Wooden was, do you?

CP: I do, yeah.

DN: Do you?

CP: Mhmm.

DN: He was a pretty good basketball coach. You get a lot of wise sayings, and one of his wise sayings was "the team that makes more mistakes will win; the secret is to make mistakes as fast as possible and don't repeat mistakes." And that's

true, and so you learn things and you figure things out and you say "why do we do it this way?" because we did it other ways and this is the best way to do it," or because "we have to do it this way," and so you know that's why you do it, you understand how you do it and you know that someone is going to do this and someone else is going to do that, someone has done that. So you need to know people, understand people, you can trust people, what they can do. You can't figure things out, you know who to go and do things. And so when things are set up here and running here and so on, people know that.

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And so there's a huge amount of communication goes on here all the time. And so the people who live here know each other very well, understand each other very well, know what they're doing. And the people that are here, stop and think about it: these people living here and doing things and running this stuff need to understand molecular genetics, and they need to understand how to operate a chainsaw and how to do aluminum welding, all kinds of stuff and so on. So they're extraordinarily talented people. That's why people want to come here, because if you get to come here, life is good.

CP: A couple more questions as we sort of wind up; I'm interested in knowing more about the connection between the center and Oregon's tribal communities, just the same as in Canada with the First Nations people. So obviously the fisheries are very important to Oregon's tribal communities.

DN: It's very important here. It's always a challenge, first of all, trying to provide opportunities so tribal people, First Nations people, first people, indigenous people, they have various names in different places, so they have the opportunity to be heard and to be seen, and that's not always true. And in some cases that's economic, in some places cultural, in some places social. There's all sorts of barriers and hurdles and so on that exist that we create, and it's our responsibility to deal with them. That's one of the issues. It's also true that we need to spend a lot of time and effort and intention to pay attention to people; to understand what they're saying. And you saw the sign we had downstairs, for example, for the free fishing this weekend. It sounds simple and some people think it's interesting and maybe even amusing to put the different languages on the sign. But it's also important to understand that people have different languages. Now, in some cases it may be a different language in the sense that you could understand the words they're saying, but they have a different message. In some cases the language is totally different, you can't understand a word they're saying. And so it's important to understand that and to listen to people and figure out how you can communicate and understand what they're asking you, what they're telling you, what you can learn from them, what they can learn from you. And so that's a challenge.

A lot of it of course has to do with things like what's important in terms of priority, what's important in terms of history, what's important in terms of what it is people are trying to do, and so different people have different priorities, for example. And so some people will say "my priority is I need to earn money because I have to support my family," or "my priority is I need to make sure that there's going to be fish coming back here for the next five generations," or "my priority's to make sure that that water's safe for my animals to drink" or whatever. There's lots of differences in people and different priorities. And so there's those kind of issues as well. And certainly for tribal people here it's important to understand that different kinds of things in the world have different priorities for them, that they may have priorities that may be different than we're used to. And so lamprey, for example. Most people here just ignore lamprey and say "whatever, they're a strange animal, they look weird, they don't look like real fish, they might be a parasite, so they might be hurting our fish. Why would you care about them?" Tribal people, for example, in most places in Oregon regard lampreys as very important. It's for food, because in fact traditionally for generations, countless generations, there are people that have depended on lampreys and harvesting lampreys and eating lampreys, and so it has enormous value to them that we need to understand.

We had a workshop here about a year ago on lampreys and trying to understand the lamprey biology, and a good deal of that was simply trying to listen to each other and hear those messages. So there's also the issue in some cases, it leads to them trying to understand how we can help people in terms of either providing information to them or helping them to understand how they can go about getting information themselves. And so with lamprey, for example, there's a couple of important issues. One issue is conservation, another big issue is restoration. There used to be lamprey here, there aren't lamprey here now, what can we do to bring back lamprey? Well the answer to that may range all the way from building better fish lighters to having some kind of hatchery for a lamprey, or a whole bunch of other things in between. And so that comes back to the question of listening to people, trying to understand what they're saying, what they're answering, and trying then how we can provide information to answer them. And it may in some cases be providing opportunities so

people can learn hands-on. You know, maybe come here and do a workshop, or we go out and do a workshop with them and if they learn how you do this, how you sample things and whatever.

So there's a whole range of things that are not unique, because we do it all the time for a variety of people. But they're notable because they are a responsibility we have in the same way we're responsible to all kinds other sorts of people, but there are responsibilities that are different than most other people can deal with. I mean their ancestors were here long before –there were people who lived here before European settlers came here, and they lived here in particular ways and there were particular things of value to them and so on, and some of those things persist. Some of those things have changed because they're not allowed to do it or they've not been encouraged to do it or they know about it or things have changed. So it's a responsibility we have that's in some ways the same as other responsibilities, and in some ways it's different.

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We also have responsibilities, of course; we have people from China that come here and they're impressed. These Chinese students come here and they're very impressed and impressive. They come here because they're impressive because they have the latest technology, and the first question they ask is "can I get Wi-Fi here? Does my cellphone work here?" and you say "just a minute, you're from China, how come you got better technology than we have?" "Because we built it." They've got sharper clothing than we have because they made it, and so you say "just a minute." But they come here and they're impressed by several things. They're impressed, first of all, because they can see the sun. You don't get to see the sun in China. Why? Because of air pollution. They're impressed because the water's clean here. There's no clean water in China. Why? Because they struck a deal in China. They said "we're going to make a lot of stuff cheap and there's no regulations, and so we can just put stuff in the air, we'll put stuff in the water and we'll make stuff cheap," and they did. And so you get a lot of money but it turns out you got no air, you got no fresh water. And the students will come here, the Chinese students come here and they'll spend hours standing and watching insects in the water. Why? Because they've never seen it, because they live in a city like Beijing or Shanghai that's got millions of people, and so they can never see anything natural. And so they're clearly impressed to come and see those kinds of things.

They are also impressed to come here and then discover that we can ask questions that may be relevant to them, about if you want clear air, if you want clean water, if you want fish, I mean how do you raise fish, what do you need to know? So again, it's a very different kind of group of people we're talking to. In some cases it's similar kinds of questions, or like I said, very different kinds of questions. In some cases we can understand their language, in some cases we can't understand their language. In some cases we can understand their questions and in some cases we can't. And so yeah, we deal with people from all sorts of places who will come here, who bring information, who bring ideas, they bring all sorts of things to us, and it's our responsibility to provide things for them.

Our primary responsibility, of course, is to the people of Oregon. People of Oregon pay for this place, it's a public facility, open to the public three hundred and sixty-five and a quarter days a year. And the people of Oregon pay for this and so this is their place. And so they have a right and a responsibility to come here, ask questions, provide information, learn things for themselves and so on, see for themselves.

CP: Well the last question I have for you is just a bit about the future. I mean the center's ten years into its history now. What do you hope to see over the years to come?

DN: That we will answer questions related to the mechanisms that produce differences between hatchery and wild fish, to help managers and other people who are tasked with that responsibility to manage those differences between fishery and conservation goals, and to provide information to Oregonians and others to help understand the relationships between hatchery fish, wild fish and the natural environment.

CP: To continue to pursue the mission of the Hatchery Research Center.

DN: That's what we're supposed to do.

CP: Well Dr. Noakes, thank you very much. This is has been very interesting for me and I appreciate you welcoming me to this very special facility and I wish you the best of luck.

DN: You're welcome.

[1:48:57]