Bruce Mate Oral History Interview, September 8, 2016

Title
“Tracking Marine Mammals Across the World's Oceans”

Date
September 8, 2016

Location
Hatfield Marine Science Center, Newport, Oregon.

Summary
In the interview, Mate describes his family background and upbringing in Illinois, his move to Oregon during his undergraduate years, his post-doctoral research on heavy metal metabolism in marine mammals, and his experience of working for OSU as a Marine Extension Agent. From there, he comments on the role that the Hatfield Marine Science Center has played in the community of Newport, and then retraces his doctoral research on the migration habits of sea lions.

As he recalls the early years of his faculty career at Oregon State, Mate shares his memories of a few important graduate students that he has mentored. He then narrates the history of his research program at OSU, which is the primary focus of the interview.

In reflecting on his research, Mate discusses some initial work that he led on pinniped and lamprey conflicts with salmon and other fish in a variety of Oregon rivers. He then recounts his use of radio tracking in his study of seals during this time; his initial idea that these same techniques might be applied to whales; and the financial risk that he and his wife assumed in self-funding Mate's very first whale tagging expedition in Baja California.

The success of this initial expedition and the subsequent growth of Mate's research program forms the heart of the interview. As he outlines the history of his groundbreaking work on the use of radio and satellite telemetry to study whale behavior, Mate discusses specific projects on right whale behavior in New England; gray whale behavior off the west coast of the United States and Central America; multiple whale populations off the west coast of Africa and near Antarctica; and blue whale behavior throughout the Pacific Ocean. Mate likewise shares his perspective on the awe inspired by coming into close contact with the world's largest animals, and also details recent research on the impact of climate change on the health of the world's blue whales.

As it nears its conclusion, the session changes its focus to the history of the OSU Marine Mammal Institute and its growth in recent decades. The interview is rounded out with notes on family, an aside on Mate's love of British cars, and words of wisdom for OSU students of today.

Interviewee
Bruce Mate

Interviewer
Mike Dicianna

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

Transcript

Mike Dicianna: Today is Thursday, September 8th, 2016 and the OSU Sesquicentennial Oral History Project has the honor to capture the story of Dr. Bruce Mate, Director of the OSU Marine Mammal Institute here in Newport. We're at the OSU Hatfield Marine Science Center, and my name is Mike Dicianna; I'm an oral historian for the OSU Special Collections and Archives Research Center. We always like to start with a short biographical sketch of our folks, like when and where you were born, some early childhood memories.

Bruce Mate: I was an early Baby Boomer, born in 1946 in Wheaton, Illinois, which is about thirty miles west of Chicago. Grew up there, did all of my schooling up until college there. Met my wife – started dating in the 7th grade which is an unusual thing, I think, these days. We'll have been married forty-nine years this year. So we were both in band, enjoyed the Midwest, the people, the sense of humor, the values, and the worth ethic. But we moved out here in 1967 after getting married – she after finishing a nursing degree – and we've never looked back; this is home. We've had two children and have grandkids, we're all Northwesterners now.

MD: What about your high school days? Were you interested in the natural sciences early on as a high schooler?

BM: I was very blessed to have a sophomore biology course from a fellow by the name of Ed Baker, and he was fabulous. Quite honestly, he made biology come alive for me. It was one of the first courses where I was really inspired to work harder that I might have otherwise. His dedication to the field – he actually would spend his own money to bring specimens from marine areas, from Carolina Biological Supply, so we had real things to look at. It was the turning point in my life in terms of career; I knew I wanted to do marine biology. I didn't know I would be doing future work with mammals or anything like that. As a matter of fact, I moved out here for my senior year of university so I could start looking at graduate schools specifically to be near the coast.

MD: What did your parents do for a living? Did they influence your decisions?

BM: My dad was a really great role model. He was actually my step-dad, married my mom when I was three. He had left high school as a sophomore because his dad died. He had to work to keep his mom in food and lodging. He entered the CCC, was out here in Oregon making trails in parks and that sort of thing, and then enlisted in the service when World War II broke out and did his GED afterwards.

When he entered my life, as a youngster, he was doing floor sanding and floor instillations; a very blue collar kind of situation. By the time I left high school, he was the editor of three industrial trade magazines; really made a success out of himself. He could do the *New York* crossword puzzle on Sunday, handily, so very self-taught. Again, a good work ethic; a good role model.

In high school, I hung out with some folks that were much geekier than I was. Three of my best friends were amateur radio operators and got me involved with that, and little did I know that would become an important part of my future in research. But I was an amateur radio operator from 1957 on. I actually had a contact with Yuri Gagarin, the first man in space, as a part of that history of amateur radio. And a lot of that stuff gave me an electrical engineering understanding. I actually started as a double major in electrical engineering and biology.

MD: So one of the things that I always really enjoy asking people, it's a generational thing: everybody has that significant memory that sticks with them for life – they're imprinted by it. Pearl Harbor or today the Challenger disaster. Did you remember when JFK was assassinated or when the first steps on the moon happened? Did that imprint on you?

BM: I remember both of those vividly. I think one of the things I remember that was associated with the JFK thing was when Lee Harvey Oswald was shot live on television, and I realized that that was a real human life being taken. You know, all the kids play cops and robbers, cowboy and Indians, all those things as a kid, but this was the first time I'd ever seen a human life taken. It struck me. I mean, I knew the significance of what that was, and I continue to be humbled by the horrific numbers of people who meet a demise in unfortunate social circumstances these days. It continues to be something that's going to plague humanity for a long time.

But I think one of the things that lifts people up out of those really desolate circumstances are finding some purpose or reason and having an opportunity. I do a lot of research in Third World countries where, no matter how hard you work, you really don't have very many opportunities. And every time I come back to the United States, I feel very blessed and know that we live in really an amazing place.

[0:06:00]

MD: Where were you when Neil Armstrong set foot on the moon in '69?

BM: In 1969 I was in Oregon already, and I was just starting a graduate program, a Ph.D. program. I got a National Science Foundation pre-doctoral fellowship. I had originally been accepted to UW to be doing invertebrate work, and the summer before that, I had gone to a marine station at University of Oregon's Charleston Marine Lab, and the first speaker was George Bartholomew from UCLA, he was a marine mammal specialist, and he said nobody knew the migration habits of sea lions. I said, "that's absurd; this guy can't know what he's talking about."

And you asked me a question about Armstrong, it felt as foreign a territory – I just couldn't believe that something wasn't known that basic. I got started that summer doing a project on it, and ultimately called UW and said "hey, can I do work on marine mammals?"

"No, no, you're going to be doing work on krill."

I go, "uh, I think you're going to be having an opening for somebody else to do krill work. I think I found something I really love." And in that same kind of time period, that shifted. "Wow, much bigger universe, so to speak, bigger world, and I may have found a part that I can put my own foot on." And I did that for a Ph.D.; figure out those migration habits. The sense of exploration though, has always been deeply engrained in my life.

MD: Well, we know less about the oceans than we do about space.

BM: In some areas that's for sure.

MD: Now when you graduated from high school, what influenced your decision to go to college? What schools did you look at and where did you actually end up?

BM: My family had very modest means. My dad was the first person in his family born in the United States. And even though he got a GED, he was the first person, I think, to have a high school education as an immigrant family. My mother's side of the family had some college experiences. My grandfather was one of the editors of the *Chicago Daily News*.

But when I graduated from high school, I didn't have any means; I actually applied to the Naval ROTC scholarship program. I did very well on the exam, but I'm color blind and it ruled me out. Now this was, of course, during the Vietnam era. So I took out student loans, which after we got married in 1967 felt like a burden but, oh my goodness, what a great investment. My wife continued to work while I was doing graduate work, but we basically put ourselves, education-wise, forward. I did get a NSF pre-doctoral fellowship which really helped for the research side of things. It was a good start.

MD: So your undergrad was all at the U of O?

BM: No, actually I started off at Illinois Institute of Technology in Chicago. Double E – electrical engineering – and biology mix. Then I came out to U of O for my senior year.

MD: So you transferred in. So you're not totally a Duck?

BM: Oh no. I'm a platypus! [laughs] Duck bill, Beaver tail.

I didn't move very far. When I finished at U of O, I got a post-doctorate at Oregon State in biochemistry and environmental health. I wrote a post-doctorate for the National Institutes of Health and looked at heavy metal metabolism in marine mammals. While I was doing my Ph.D., there was a die-off of sea lions and I had lots of collaborative

relationships develop with people. Don Buehler at OSU was one of those persons, and he was interested in heavy metals and polychlorinated biphenyls and other man-made contaminants – DDT and their residues.

[0:10:27]

What we found was there were really high levels of mercury in seals and sea lions, and we couldn't figure out "well, how come natives in the Pribilofs can eat fur seals that are really high in mercury and not get mercury poisoning?" The end result was that sea lions and seals have a way of taking the organic parts of the mercury, like methylmercury, and demethylating them, and making them non-toxic so you can eat them and they go straight through. So evolutionarily, those mammals have come to cope with something that has been in the ocean for millions and millions of years. Ninety-five-plus percent of the mercury in the ocean is naturally occurring, so they've had to deal with that.

That was a fascinating thing, but it brought me to OSU and my first job here was as a post-doc.

MD: Here at Hatfield?

BM: No, actually on campus. And then my first hiring at OSU was John Byrne, who was then Dean of Oceanography, hired me as a faculty member in Oceanography with a marine mammal emphasis.

Actually, I had a transition job there too; I worked for the Extension Service. I substituted for Paul Heikkila on the southern Oregon coast as a Marine Extension Agent in Coos, Curry and Douglas counties. And I would have to say that's the first job I ever had that made me feel any sense of wealthy. It was not the monetary wealth; it was the wealth of connections. People could come to me as an Extension agent and say "I have a problem," and they'd explain it to me, and I could go into the university and find a solution for them. And that kind of ability to give without need for compensation – because actually their tax dollars already paid for those kinds of things – that gave me an enormous sense of connectivity to the community, and it's affected my entire research career ever since. I've felt like most of my research is very applied, it's not ivory tower stuff, there's actually a reason for it. And I think I got that grounding from my Extension experience in working with commercial fishermen, people in tourist industries, and marine education.

MD: What year was that?

BM: That was 1974.

MD: So that was very early. So you worked alongside Bob Jacobson?

BM: Yes, absolutely.

MD: And now he has passed his job onto his daughter; second generation.

One of the things I always like to do is get a feel of campus life when a person is in their undergraduate years. A lot of them are Beavers, but you are unique because you were in college during the height of the turbulent 1960s – Vietnam, the counterculture – do you have any memories of what that was like? Both in Chicago and then when you ended up going to the capital of that at the U of O in '68?

BM: Illinois Institute of Technology, where I started undergraduate work, was on the south side of Chicago and in some very impoverished neighborhoods; a fair bit of violence in the community, not very far from where the Chicago White Sox played baseball. Just this wonderful mix of a big city that has lots to offer in the way of museums, theaters, things like that. Not being very well off, so I couldn't take advantage of things that were expensive, I got to understand public transportation systems, I got to understand communities that were in need and in pain.

When I came out to Oregon, Mary Lou and I probably would have gotten married earlier but she was in nurse's training and, believe it or not – my graduate students can't believe this, the women – if she'd gotten married, she'd have been kicked out of school. That's how much the times have changed. And that was true for a lot of teaching programs then too. So as soon as she got done with three years of nurse's training, we packed up in a six cylinder Valiant and drove out here. Came to Oregon with seventy dollars in our pocket. We didn't have enough money for our first and last months' rent and deposit, but nice people who would make things work for you.

Eugene was – still is – a very different community than much of the rest of Oregon, and because we were newly married, we spent more time together than we did searching out other social contacts. It might have been different had I been single coming.

When it came to the end of the senior year and I went into a marine station experience – as I said, just prior to leaving to go to U of W – that was very life changing. And that was part of why we moved out, so I could have that kind of experience and look at different schools. Those field experiences are profound even today. The students who come to the Hatfield Marine Science Center have an experience here – whether it's for a term, or a summer, or longer – they leave here and their outbound interview suggests that this has been their strongest experience through all university, coming in contact with not just the animals and the environments but also the stakeholders who use them. Because there are some different philosophies from different groups of people that live near the coast for a purpose. So fishermen may look at things differently from land use planners. Or, in our community here in Newport, if it weren't for retired people's income, we'd be a federally designated impoverished area. The average wage in Lincoln County, I think, is $33,000 a year, so we don't have a lot of diversity here. Microsoft isn't going to move a group here, and the Marine Science Center represents a big deal for our community.

As a for instance, Don Davis, who was the city manager for thirty-five years here, I know him well and he told me when they signed a ninety-nine-year lease for the Hatfield Marine Science Center in 1964, their hope was it might attract up to fifty family wage jobs. Well, today there is more like 400 people working in this campus area, including state and federal agency folks, and it has a huge impact on the community. Not just because there are people here with a family wage job, but they have a variety of interests – they support theater and orchestra and library and they are interested in how the school programs are going; they volunteer, they mentor.

So the impact of this institution here in our community is huge. And now that we have other programs that we are looking forward to, like the Marine Studies Initiative for undergraduates, it's going to be all the more significant a role. Not just for Newport or OSU or the state of Oregon, it's going to be impactful nationwide, if not internationally – there'll be nothing like this anywhere else.

[0:18:19]

MD: Now, when you were at U of O did you guys live in Amazon Housing?

BM: No, we did not.

MD: You couldn't get into it? It's a national landmark, those broken-down houses.

BM: Yeah, they were old World War II barracks. We had friends in that sort of housing so we experienced parts of that. But no, we lived off campus, 8th and Lawrence; I still remember that address. Very modest second floor apartment.

MD: So we talked a little bit about your graduate work. Fill us in a little bit more about the whole idea of studying the migration of sea lions. I would've assumed that they would have known that for a hundred of years, because they hunted them.

BM: Big animals near shore, what's to not know? Yeah, I was absolutely shocked when George said that they were unknown. And that summer I started a project and I basically was going out counting noses – harbor seals and sea lions – and there was a shift in which type of sea lion was dominant throughout just even that summer, and there was a huge influx of animals at the end of the summer. I was going "where are these coming from?" And it really inspired me, I guess. I thought, "this is fun, I'm outdoors, I'm feeling," I'll say, "useful," but that's not the right term. I'd have done this just for fun, I was having such enjoyment. And I still give the advice to graduate students: find something you really, really like to do, because if you don't like it, you will never work hard enough to be good at it. If you love something, you can give lots and lots of extra time to it because you like it, and that's a necessity for being good at something, is the devotion of time and energy.

[0:20:16]

So yeah, I was very blessed that summer to latch onto something that worked very, very well for me. And I'd have to say that, as an advisor to students, I'd even do the other flipside too: when I got done with my Ph.D. and I was looking at this post-doc opportunity with Don Buehler, I sort of thought "you know, maybe because I did a natural history kind of Ph.D.," I mean, it still had statistical elements to it and time-based issues, "maybe I haven't been tested as thoroughly as other Ph.Ds might," that have the rigor of a sophisticated hypothesis and a test that you can repeat over and over again instead of documenting the reality of what a circumstance is.

So I went into this post-doc almost sort of – it was academically interesting, but it had also a personal challenge for me of the organization and rigor of a more traditional experimental approach. And I found I could rise to the challenge pretty easily, I liked it, but the parts I liked were the creative elements: what's the issue and how do you get towards it? The mechanical parts of actually turning the crank were sometimes really painful; it just felt like I could teach a fifth grader to do the mechanics.

The three-year post-doctoral program I got done – we did an experiment with sea lions, we fed them some radioactively labelled methylmercury and watched it demethylate. I basically had that whole thing in hand in little over a year and I thought, "you know, I think there are probably other people who will probably have the patience to follow through after the first major publication of what's going on, who like it, and I'm robbing them of that opportunity, [laughs] because what I want to do is to go back and do what I really like." So that is when I switched over to Oceanography and the Extension work, and both of those was just right. Just right.

MD: Well, one of the things I read in your bio is it says that you've been involved with marine research since 1967, so that's during your undergraduate studies. So basically for your whole life?

BM: Yeah, I was not finished with my undergraduate degree until late '68; so that experience at the marine station, and then I stayed and did a little bit more work in preparation while I prepared the NSF pre-doctoral fellowship. So I found it was really helpful to actually gain some more coursework in something that would be helpful in my graduate career while I was in that undergraduate situation.

MD: So you became an official part of Oregon State University in what year?

BM: 1973.

MD: So we're talking basically a career of a lifetime with Oregon State?

BM: Yeah, I've been here forty-three years already and am obviously eligible to retire, but if you are doing something you like, again, that's a hard thing to beat. I think most people are not so blessed. Many of the folks I know work a job that pays the bills and they become involved in them certainly, but when you talk about passion, they kind of shrug their shoulders and go "well, it's a wage," or something like that. So I know I'm very blessed. Quite frankly, even the development of a broader program than just my own – we're developing the Marine Mammal Institute and so forth – has been an expansion of that initial passion where I was the only one doing something, and where I could see there were much greater needs in my field, and academically, than what I could satisfy on my own.

[0:24:18]

MD: What kind of courses did you teach when you were actually over there on campus? Just basic oceanography? Or did you teach in your specialty?

BM: Actually, when I was hired by John Byrne in 1975, he directed me right here to the Marine Science Center then, so I really never had teaching experiences on campus living in Corvallis. I've lived here in Newport since 1975; so now forty-one years here at this location. But I did teach, and I would commute from here over to campus and teach a course at night. So a very different kind of scenario than a traditional – in fact, I think actually the way that worked favored the learning situation for me and also for some of those students.

By the way, some of those students I still have professional relationships with from 1976 and '77. Rick Spinrad is right now the chief scientist for NOAA, he was in one of those early classes as a student. Richard Merrick is the chief scientist for the National Marine Fisheries Service, he was one of my early master's students here at OSU in Oceanography.

MD: That's one of the questions I always like to ask is when you've mentored and taught so many generations of oceanographers, who's the famous ones?

BM: Actually, it's been amazing. All the students I've had are working in their chosen career, which I think is a rare thing all in itself, but it probably speaks more to their rigor and persona; if there's anything for me here, it's that I'm able to choose well. Now marine mammals are popular animals, so you do get a number of people applying, but you want to pick people, again, who are inspired and are willing work hard.

Jim Harvey is another one that stands out in mind, he's the director of Moss Landing Marine Labs in California. If you want a master's degree from a California state institution, you go to Moss Landing. Just a great guy, did a good job. Robin Brown, who heads marine mammals for Oregon Department of Fisheries and Wildlife for the last thirty-plus years. A number of the students I've had have had careers and have retired already. Jim Sumich was a professor at Grossmont Community College and is now retired.

But it's just really wonderful to keep up with people like that. In fact, I heard this week from Jonathan Temte who's a medical doctor in Wisconsin, and he did his work here looking at the reproductive attributes of harbor seals and Dall's porpoise. He figured out it was light-generated. Photo-period had a lot to do with when the females came into estrus and how it synchronized their reproductive periods. Anyhow, he's still doing work in human medicine, but as a result of his work with marine mammals.

There are many, many other examples, some of whom are working still with me because once you mentor people and they good at skills that you still need, you're going to keep them here. So there is a number of people that are working with me that have been with me for over twenty years now.

[0:27:43]

MD: Well, let's talk a little bit about your lifetime of research, especially in – what people are going to be interested in is whales, because they're a happy animal, everyone wants to know. But you've been groundbreaking in electronic tracking and things like that, so let's go a little bit through your research career.

BM: So I didn't start off in whales. As a matter a fact – I mentioned sea lions – early on I got some Sea Grant funding – the Marine Mammal Protection Act started in 1973, so people were forbidden to harass and kill animals. And we had a history here in Oregon, we had a bounty on seals and sea lions earlier in the 20th century, and then we had Bill Puustinen, a seal hunter on the Columbia River, to kill and harass seals that were in competition with salmon for the gill net fisheries. I got to know those people when I was in the Extension position and because I had Coos, Curry and Douglas counties on the south coast, I got to know the Rogue River and the Umpqua and the Coos Rivers very intimately.

Sea Grant funded a project looking at marine mammals and fishery competition in the Rogue River, so I spent three years doing that and it was really challenging from a variety of standpoints. The research was very interesting – there were three ways we figured stomach contents: we could look at what animals brought to the surface and we could see, and that included a lot of large fish like salmon where they'd tear out the belly and the fishermen would be pulling their hair on the shoreline. And sometimes when they'd catch a fish, they had to work hard or they couldn't get it landed before a seal or a sea lion would take it.

Another way of doing it was to go and collect the scats, the feces, off the hauling areas and look for the little ear bones of the fish, the otoliths, and we could identify not only the species of the fish but the size. And there, none of the large fish that they brought to the surface visually ever showed up, because they didn't eat the heads. And the fishermen always swore they just took the bellies, but we knew that they ate the whole rest of it because we also, at that time, killed animals and looked at the stomach contents.

The three methods came out with three different answers of what the animals eat. And so that was a really big lesson for myself and other people in the field. Tom Roaf was the graduate student on that and later went on to get additional degrees and became a forensic pathologist for the Fish and Wildlife Service.

But I guess the reason I brought up these methodological things was that there were so many polarized groups – reminds me a little bit of political times now – that it was hard for them to take in any information that wasn't along the path they

were already on. So, it turned out that the vast majority of what the sea lions fed on in the Rogue River were lamprey. Now, they're called lamprey eels, but they're a fish. But lamprey are a parasite and they attach with their jaws onto fish and they suck the blood juice right out of them. And there are some places on the Fraser River where runs of salmon have 65% of the returning fish with lamprey scars on them, but we have no idea what percentage of the fish they have attacked in their lifespan that succumbed to the parasitism. And we know that for salmon that if 1% of them return from the number of smolts that go out, that that's a decent return. If you get 2% and you're in a commercial business, then "woohoo! We're really successful." So that 98 to 99% of mortality that occurs in the ocean, we know some of it is consumption by predators, some of it is parasitism.

And lamprey are incredibly abundant. In fact, lamprey are anadromous, like salmon, so they come up fresh water rivers and lay their eggs upstream, just like salmon do, and every female that gets upstream successfully to the spawning beds lays 100,000 eggs. So they're incredibly productive. And these seals and sea lions were predominantly, I mean over 80% of their diet, were lamprey. So from, I'll say, a biologist's perspective, their presence in the river consuming lamprey probably has an off-setting benefit to salmon that far surpasses their consumption of salmon. The studies that show salmon consumption in the ocean are almost all 3% or less of the diet. And in the rivers, while it may be higher, the biggest impact we found were the downriver kelts – the steelhead that go up, spawn, and go back to the ocean – and in the Rogue, only 15% of those returned for a second spawning. So when we found a 6% impact on downriver kelts: trivial.

But so here I have this fabulous study that shows differences in the way you study, and what the outcomes might be. The fisherman really didn't care, many of them, that they ate lamprey. They just wanted to get their salmon landed, and they wanted the seals and sea lions, the competitors, the heck out of there. In fact, the earliest, I'll say, control of seals and sea lions was in the Rogue River when Hume, H.D. Hume, had harvesting operations and aquacultural operations – hatcheries – for salmon in the 1800s. So this business of getting seals and sea lions, the competitors, out of the river systems has got a long-standing history here in Oregon.

But now we're forty-plus years into the Marine Mammal Protection Act, and all of a sudden what's being considered for listing under the Endangered Species Act? Lamprey. And it's probably because of seals and sea lions coming back in and preying on these parasites of salmon.

[0:34:12]

MD: Well, they're an easier catch than salmon.

BM: They're easy, they're highly nutritious – very fatty – so it's a great food stock for seals and sea lions. But it is interesting that when white settlers first arrived here, abundant populations of seals and sea lions, huge abundance of salmonids, and that was nature in its natural balance. So I use that example to say that as humans go into ecosystems, nature's got all the gears meshing and things are kind of in balance, and you can mess around with the size of the gears, but if you remove gears you're changing things that could be to your ultimate detriment.

That process was exciting academically, but from an Extension standpoint it was pretty depressing, because everybody had an axe to grind and they didn't like everybody else's view of it. And at that same time, I started to develop ways of tracking whales and I got to a point where the whale stuff was working well, everybody was excited and happy with the results to find out things we didn't know.

In this other area of my life, which was pinniped-fishery conflicts, where everything was just really butting heads – the only way to put it – and pretty much [laughs] "I just want my way," I made a career path choice which was, for me, dealing with more with people who were excited about what I did, there wasn't any negative aspect to it at all, and I could see I could make big gains. But it came out of the pinniped stuff. Robin Brown and Jim Harvey and I tagged seals in Netarts Bay around the chum salmon fishery there, figuring out where things were going, and Robin did a master's thesis on that. We gained tools on how to do things – how to capture, how to attach, how to track – and I had some ideas of what I might be able to do with whales.

Now, quite honestly, I went to agencies and nobody would fund it. They would say "well that all sounds very interesting academically. If you had a system that worked we might fund you to do some work, but we aren't going to fund you to go out and try something."

MD: Yeah, to develop it.

BM: Yeah. That could be lame-brain, "how would we know that's a good investment?"

And I tried for a couple of years actually, agency after agency. And in the end, it was my wife Mary Lou who said "look, you really believe it's going to work don't you?" I said, "yeah I do."

"How much is it going to cost?"

"Well, it's going to be about $25,000, and I can't find it." And she said, "well, why don't we just go do it? You never take vacations anyhow, let's just take a vacation and go do it?" I said, "well, how about the money?" She sold her car, second mortgaged the house, and she said "now what's the problem?"

So I often tell students that the biggest and most important decision you'll ever make is who your partner is going to be. I mean, more than your career almost, you want someone who is going to pull with you. You can grow together or you can grow apart; if you have the right partner, they'll be happy to make concessions back and forth. Mary Lou has made a huge difference.

So we did that. Jim Harvey and his girlfriend Mary Yoklavich at the time – they're now married – and Mary Lou and I took a month's vacation time, we went to Baja, and we tagged three gray whales in San Ignacio Lagoon – this was 1979 – without any formal funding whatsoever. And it worked. But they were only radio tags that could be heard like a kid's walkie talkie, line of sight, maybe 3 to 5 miles.

So after we tagged them in Baja, we came back and we left the receiver – the only one we had – with folks in San Diego at the National Marine Fishery Service. And we figured the chances of one of those three whales going by between 8:00 and 5:00 on Monday through Friday was one in three, and we had three whales tagged, so ok, we might get a chance. And we were lucky, it did.

And then we sent it down to people – we had it here at the Coast Guard station – and when it didn't come after a period of time I got anxious, got in an airplane, flew south, and found it at Coos Bay. The next day it passed here, and the next day it passed Tillamook. And then we sent it up to friends that were doing bear work in Alaska. They were delayed getting out – weather, plane issues – they finally got out and they said "well, it's getting kind of late, should we set up Bruce's experiment or shall we put it up tomorrow?" And this one friend said "let's do it today." And the next morning: "beep, beep, beep."

So I use that as a life lesson too. I'd rather be lucky than good, but usually if you work hard you get more luck. Luck happens when opportunity and preparedness meet, an old Chinese proverb. So if you work hard you get more opportunities to get lucky.

So from that, then I had something to show an agency: "well look, it was ninety-four days after tagging it went through Unimak Pass, we can track whales." And immediately we got funding to do more of that sort of work.

[0:39:56]

MD: So the technology back then was relatively crude.

BM: Very crude.

MD: And today you can track them from satellites?

BM: Yeah. So as a result of my success in tracking animals and having the tags stay attached for fairly long periods of time, the Office of Naval Research started to fund the development side for the satellite work. First the bureau – well, at that time it was the Minerals Management Service, it had originally been the BLM – for oil and gas areas were interested in what whales did. So they started funding the work, with just VHF radios, on gray whales.

Office of Naval Research started funding the development. There was a big conference where 400 veterinarians and academics got together on the East Coast in Airlie House, Virginia. And they said "you know, the potential for major impacts to animals is so small, but the need for understanding this information is so huge, we don't want you to start this with common species. We want you to go directly to the highest and most endangered species, because that's what we need to know right now." And at the time, right whales in the North Atlantic were estimated at about 350 animals total, and half the animals that were found dead each year were as a result of vessel collisions. So we knew that ships were possibly, just by themselves, doubling natural mortality and keeping the population in check from growing.

And so once we got some satellite technology going – and of course, like everything, the first time is large, expensive, crude by comparison to today, just worlds apart. So I pioneered the development of satellite monitored radio tracking with large whales. We found a place – people who had been doing the work on this species, principally from the New England Aquarium, Scott Kraus and his colleagues, had thought that because they would get photographs from the same animal in the Bay of Fundy three times during the course of the summer, that the animals just lived there all summer long. But as soon as we got tracking done, we saw that they would leave the Bay of Fundy, go out into the North Atlantic, and come back in. And so being sited multiple times throughout the season wasn't a surprise, but that isn't where they lived.

One of the things we did find in the Bay of Fundy is where they were feeding: right in the midst of the shipping lane. The animals would come up with mud all over them and, because it was the deepest part, the shipping channels were right through that area. So after collecting this data, we took it to the shipping industry and said "look, here's the data; this is where the whales are, we can't do anything about moving them. But if you moved your shipping lanes just three or four miles to the east, you'll change the chances of hitting a whale by 80%. What would you like to do?" And that was my Extension experience coming through. It wasn't, "we're going to picket you, we're going to boycott you," it was, "here's the data, what would you like to do?" And in the back of our minds, "and what do you think other people will think when they see the data when we publish it?"

And Moyer Brown, who was very active with right whale work and still is, on the East Coast, was the person who really took that to the shipping industries. They went to the International Maritime Organization and the shipping industry itself changed the lanes; got the Coast Guards of Canada and America to change them formally on charts. And I asked a shipping guy, I said, "boy, that seemed like an easy sell. How neat." He said, "well truthfully, it costs us two million dollars every time we hit a whale." And I said, "how can it be that expensive? Are there fines? It can't be damage to the boat."

He says, "no, but our insurance carrier won't let us take the ship back to Europe until we've been into dry dock and inspected it and made sure that we didn't damage the rudder post or the prop." And he says, "there's only one dry dock large enough for these sized vessels, and it's scheduled for routine maintenance, and we have to sit there twiddling our thumbs, losing business, until we can get onto it. So you've just solved a big deal for us."

I went "perfect!"

MD: [laughs] It's a win-win!

BM: Yeah. And that's the way most conservation work should wind up, is with an adequate understanding of the importance of the animal you're focusing on or its interactions with other things that are important – whether its salmon or lamprey – that you come up with things that make sense and that you could show and talk about to a middle-schooler and they would understand. And they can talk to their parents about it, and everybody nods their heads and says, "yeah, that's a good decision; that's a good way to go."

So we've been doing work now with endangered species all over the world; fifteen populations of animals in every ocean throughout the world and have been in fifty-five countries. And the results have been phenomenal, because when you bring a new technology to animals that are so poorly understood – you don't even know whether the one that surfaced over there today is the same one you saw last week over there – you can really make dramatic changes. For right whales, we thought they were slow moving, near shore, surface skim feeders, and in fact, we found that they were fast moving, went offshore, and dove deep routinely.

MD: Game changing as far as knowledge of it.

BM: A 180-degree course changing. They are not what we thought, because all we could do is evaluate with what we saw visually during daylight hours on occasional trips out in good weather.

[0:45:54]

MD: Well, I saw the list of species of whales. Is that in the middle of the ocean and then in coastal waters, or just globally? Basically you're everywhere.

BM: We're everywhere. There are probably another eighty populations of endangered whales that could benefit from this kind of work, but it's all limited by money. So what we need to do is find customers – the way I would call it – who are in agencies that have a need to know. For bowhead whales in the high Arctic, it was another right whale species harvested by Alaska Aleuts and Eskimos, and they needed to know for oil and gas purposes and because of this harvest, what's going on.

Well the first whales we tagged – and Greg Krutzikowski was a big part of that – we tracked animals all the way over to Siberia. And that very first route, everybody was just "oh my gosh!" We tagged it in Canada, it went across Alaska, and they move just as fast through ice covered waters as they do through open water. It was one of these "a-ha" moments.

So three countries that share that species, and if we're interested in conservation we have to know what's going on in all of them and have to have them understand that they have some responsibilities for that; their activities in association with those animals. So your, I'll say, perspective on some issues change as a result of new information, of course. And that work is still being done, and its being carried out by Lori Quakenbush at the University of Alaska through funding still associated with oil and gas. And they are finding the same thing and much more, of course, because the technology has improved and they've been doing it longer now. But that was in the early '90s.

Now we track blue whales here on the west coast of the United States. We found the very first breeding and calving area for blue whales of anywhere in the world, and it was 500 miles off Costa Rica in a place that has upwelling during the winter. Most whales go from places where they feed, to places to breed and calf where there are no feeding opportunities. So they fast for the migration from feeding to breeding, all the way there and all the way back. So they have to make a good enough living during the feeding portion of the year to sustain all the other important activities. That in itself is an amazing evolutionary solution, I'll say. But to give birth to calves in the productive areas, which are usually cold, doesn't make as much sense as mammals being born in warmer water. But those warm waters aren't productive, typically.

But where these blue whales went, there was a convergence of a couple currents in the gulf, of Tehuantepec winds, and the result was the reproductive area changes every year depending upon the currents and winds. And that's why whalers never polished them off, is they can go back to the same place they were last year and found a few, and they wouldn't find them there, and that saved their bacon. Unlike, say, gray whales that go into breeding and calving lagoons and are very regular – they were discovered and they were decimated, and now, with protection, those animals are off the endangered species list.

So again, knowledge is power. By us being able to empower others about where these animals have important seasonal places helps that. So gray whales we're very familiar with, we've done a lot of work, our first starting work was with gray whales. But we tagged some gray whales in Russia that were considered the most endangered large whale in the world; they number less than 150. And to our huge surprise – we thought they would go up and down the Asian coast the way they go up and down our coast, from high latitudes to summer and feed down in Mexico. Instead of going to the South China Sea like we thought, those animals in Russia, in the southern Sea of Okhotsk, crossed the Bering Sea, crossed the Gulf of Alaska, and went right down to breed and calve with the animals that we've been studying for a long time.

[0:50:35]

MD: Down in Baja, basically.

BM: Down in Baja, yeah. And none of our professional folks really predicted that. But with that in mind, it changes the whole thought structure about intermixing between possibly two stocks, or maybe that they aren't two stocks, maybe they are really one, and this is just the most westerly extension of what we have thought of as an eastern Pacific stock. So yeah, there's just been a lot of interesting challenges, a lot of changes in concept.

Ari Friedlaender, one of our faculty members now, is tagging minke whales and humpbacks in Antarctica where we had tagged some humpbacks early on. They migrate all the way up past the equator, from the southern hemisphere, into places sometimes as far north as Costa Rica. So the two hemispheres, if you're feeding in the northern hemisphere and go near the equator for the winter to breed and calve, the winter for our populations is summer for the southern hemisphere, so they're down here feeding. So the populations are doing this, and they don't have a lot of combination possibilities in the middle. But we're working these things out and understanding this now better than ever before.

When we tagged animals on the equator of western Africa in Gabon, they went all the way down to the Antarctic to feed. Same with right whales off the southern tip of South Africa, down to the Antarctic ice edge, because it's an incredibly productive area – really the motherlode of whales, so to speak, worldwide. And that's why the whaling industry is concentrated down there. And they just decimated the whales. For blue whales, we killed 336,000 blue whales in the Antarctic regions, and today the whole population is 2,000 animals. So it isn't even 1% of what we killed. Now I think by anybody's measure you'd say, "yeah that's probably worth talking about endangered. Less than 1% of what we killed."

But it's that kind of impact of numbers, that I think, people generally say, "yeah, we should conserve whales," but they don't really have a sense of how much impact there was, or what kind of a change it makes if we understand where they go to feed or where they go to breed – in this case, in the Antarctic – that might need seasonal measures of protection in order to facilitate their recovery.

MD: That's one of the things that I've seen in images that are related to you, I've just got ask, what's the experience of being like from me to you to a giant blue whale? You used to float around boats a lot.

BM: Oh yeah.

MD: I know you don't do it as much now.

BM: Yeah, I've tagged over 800 whales being within ten feet of them.

MD: And a blue whale that's a hundred and some feet long.

BM: Yeah, largest animal that's ever lived on Earth. I never have gotten tired of the awe experience of that. I mean, when an animal like that's coming up through the water, you start to see an iridescent blue and it just gets bigger and bigger and bigger, and you're out on a boat that's a fourth of the size of the whale. "Whoa! Look at that!" Very, very fortunately, we've had great experience with folks helping us design things that were surgical quality, stainless steel indelerend [?], and we go through quite a process to make sure we put long-term dispersed antibiotic on it and its clean, so we don't feel like we're impacting whales. And we do a lot of work to follow up on that.

But the actual field experience with whales is certainly the highlight of the job. I haven't done that in five years and I probably never will again, because I've mentored, well, younger people who've got stronger bodies for it. I have to say, I've also paid some price for that, physically. But like any pioneering thing, you're going to have an improvement in the technology – smaller, better, cheaper, more capable – and I've gotten to participate in that in my field very significantly over the last, well, twenty-five years for the whale work.

[0:55:21]

MD: It's awe-inspiring to think that you're that close to whales on a regular basis, but what's it like being on a research vessel, floating around in the Pacific or the Indian Ocean? Is that part of being an oceanographer?

BM: Sometimes frustrated in not finding what you're looking for. You're in a large vessel, you're cruising around at eight, nine miles an hour, pathetically slow. In the case of sperm whales, we've done a very good job in the Gulf of Mexico, of possibly going right through the area and never seeing them even though they're there, because sperm whales dive for over an hour on one breath. So if you're limited range of visibility is maybe three miles and you're looking three miles ahead and you go through an area in an hour, you could have passed animals that have been down for a long period of time that surfaced behind you. So sometimes being on the large ship, you're waiting for the opportunity when you see animals and you can launch the smaller vessel that you can go out and tag in, and literally one or one-and-a-half human body lengths away from you. So you're very, very close to very big animals.

We've never ever had any antagonistic responses from whales and so that's a blessing. But the kind of information that comes back is developed to the point where now we can tell – the tags have three axis accelerometers on them like you have with some smart phones, so we can see when sperm whales, at a mile depth, are lunging to grab a squid in total darkness. Light doesn't penetrate that far; they're in a world where the sounds they make and the way they perceive their environment – they're using sonar to identify where the bottom is, where food is. They'll be coming along [makes clicking noise] and then when they are about ready to lunge to catch something [makes screeching noise] and that [screeching noise] is the fine-scale information they need to know how they're going to exactly – when they're in close enough range to be able to grab something.

So we sort of have our eyes and ears and sensors on these tags now to where we have a better sense of how animals forage in these very, very difficult circumstances, and it makes a difference. So right now we're funded to do some work with the Navy looking at how much time these animals spend in Navy training areas, where they're using sonars of both medium and low frequency, and trying to determine whether that's an influence on the baleen whales. And I have to admit, right now I still don't know how a blue whale goes from foraging out all the krill here to coming over to this krill spot, and how it knows that this spot that's a mile away has got krill, because this animal doesn't have sonar of high frequency that can discern the small things it eats. And the aggregate group of them doesn't have a strong enough reflectivity for lower frequencies. It might be that they just mask background noise and form an acoustic shadow and that's why the animal goes there. I really don't know.

But the kinds of possibilities are exciting to think about. You have to stretch your imagination to think about all the modalities these animals use and we've got tags now that last up to a couple years, and we're starting to learn a little bit about whether the same whale does the same thing year after year. We want more samples of that to find out how rigidly they are, I'll say, engrained to a pattern, or how much more likely it is that they're responding to the environmental cues and they're more flexible in what they do year to year, depending upon where the food is and what they experience.

[0:59:40]

MD: Well, like the different species of whale have different feeding requirements, like the killer whale, do you guys tag killer whales and track how they eat?

BM: We've been permitted to do that but we've never tagged killer whales. I'll say that there's a strong following for that species, and particularly because some of them are endangered, up in the Puget Sound area, we know that those animals come out here on the coast from time to time. It wouldn't be time effective for us. Brad Hanson of the National Marine Fisheries Service is doing some of that tagging now. But we stick mostly with the larger endangered whales.

MD: That migrate more.

BM: Yeah, blues, fins, humpbacks, right whales, sperm whales, gray whales. So we have that whole suite of animals. And the populations are different between the two hemispheres, as I was saying, but it's also different within an ocean basin. So you can have humpback whales, several reproductive populations of humpback whales, in different parts of a hemisphere, and what's good for one may not be an answer for the other at all, so you really have to have a discovery process.

And you started that question out about, "what's it like to be around whales?" It's wonderful. And I want my great-great-great grandchildren that I'll never meet to have that opportunity to experience. And I want everyone to realize that we're working hard to keep those animals being a functional element of their ecosystems. Even when we don't fully understand and appreciate how complicated it is in this watch of things that are keeping good ecological time, as a metaphor, that we know everything that has been here has a role. Some of them will go ecologically out of favor, shall we say, and go extinct through natural causes. But humans themselves shouldn't be the thing pushing these things out of business in their ecological roles, or we're going to make some mistakes. And we won't even know what we regret, because we didn't understand it in the first place.

MD: I interviewed Charlie Miller, who works with zooplankton, whale food, and I asked him, through his long history – about as long as yours – of studying the oceans and also being involved with how climate change and the whole global warming argument, have you seen that effect your research and your findings in whales? As he does in plankton?

BM: So there are some whale species, like humpbacks and fin whales, that I would call switch hitters. They can either eat zooplankton like krill, or they can eat fish. So that diversification of diet gives them more options. But for instance, blue whales are obligate feeders on krill. They don't eat things over an inch-and-a-half long and they are very species-specific. I mean, there are several species within that group called krill but, in the last three years, this work we've been doing in the eastern North Pacific has occurred during two seasons of what's been called a "warm water blob," off southern California, and then a very severe El Niño. Now the result has been that these animals have not been able to find food. Without upwelling – the cold waters bringing nutrients toward the surface, where krill and other things will bloom as a result of the whole food chain being energized by these nutrients coming up into the photic zone – 80% of the blue whales we encountered this year were emaciated.

Now here's the largest animal in the world, ever, and you can see their vertebrae, you can see their scapulas; a neck that normally is imperceptible. And we won't tag those, we aren't going to put something on an animal that's already got some issues going. So it was very difficult to find healthy enough animals to tag.

Now is that – El Niños are certainly a natural phenomenon, we think that it might be modulated by some of these climate issues, but the warm water blob had never been seen before. The lack of, I'll say, intense storms up here in the Northwest is part of that, but we think that is part of – maybe what we're seeing gives us some insight into what climate change, particularly warming, may result in, and there will be winners and losers. And blue whales and krill may be one of those losers in that situation.

And so, I don't care – I know there are some people who are adamantly opposed to even thinking about that as a concept or humans having some impact in that, but the vast majority of scientists have bought into climate change, and I think a growing number of people. But when a middle-schooler says, "what can I do?" there are all kinds of things. And I'm very easy in that, "well, if you want to help marine mammals, don't release helium balloons at a wedding or a party. Tell your folks to do something else to celebrate." Those things go out into the ocean, turtles eat them and they starve to death. We find gray whales with up to fourteen trash bags in their stomachs. We've had elephant seals who have choked to death on Styrofoam cups. When you go out to the beach, pick up your litter and take it home. "If your folks are going to change their oil and they're just going to let it drain on the ground, tell them that's really bad for the ground water and for the animals out in the bay." We're all in one nest and we can't crap in our own nest.

[1:05:46]

So climate change is a little bit of that kind of an issue, but it has such far-reaching implications for species mixes, changes in ecosystems, and for people. As we're recording this, we're having the warmest year in history, which surpasses last year as the warmest year, which surpasses 2014 as the warmest year. And the more extreme weather that we see – hurricanes, tornadoes – part of the climate issues is that it's like the weather on steroids. There's going to be more of what there was. So if you're in a place with wet weather, you may get a lot more wet weather. If you're in a place that's dry, it can get a lot drier. And some of that's going to mean a difference where humans can live, probably, and real estate values, but more importantly the quality of life for our future generations of family we haven't met and never will.

So it's that sense of responsibility. When I got started in biology, I wanted to make the planet equally good for my kids. And then when I had grandkids I went, "oh, it's a lot bigger mission than just your most intimate relatives." And for biologists, that really is our species and perhaps more importantly our interrelationship with the other species. We need to be looking at and taking ownership of the impacts we have that affect all of that. And many of them we don't know, but it's one of the reasons it's important to have scientists and academics, and why that isn't a waste of time. Even though the vast majority of us aren't educated to do that and we tend to favor the things we know and are most comfortable with, we need specialists in a variety of areas.

I like the Aristotle quote. He said, "a society that values its philosophers more than its plumbers won't have either philosophy or plumbing that holds water." Very insightful. We need quality at every level of endeavor. All of us have ownership, some responsibility and some impact on how the future will play out, and doing what we can to make it the right world, a world that we would like to live in and we would like our children to live in, even though it might be generations forward. It's that kind of care and responsibility, and I think it's really hardest for people who are in large cities and don't see nature in operation. And I think it's also very hard when you don't have economic capability to

have alternate choices; you have to do things that are, I'll say, expedient. And that usually also means that there's some additional price that the future will pay.

MD: Well let's switch gears just a little bit. You are the director and the endowed chair of the Oregon State University Marine Mammal Institute. Now I've found that in 2006 it was granted full institute status, but actually the origins of this organization that you're shepherding go clear back into the 1980s. How about a nutshell of what this place is all about?

BM: Yeah, so I came to OSU in '73 and I guess by the mid-'80s, I had visions that we could be much more for my area of interest – the animals I care about, the habitats and what not. And by 2006, particularly with the help of Stella Coakley, who was the associate dean then in the College of Agricultural Sciences, she really helped us get that instituted through the university and blessed. And that's when we could start to add faculty.

[1:09:59]

And actually, it's interesting, John Byrne was the first dean that hired me and during the Reagan years, he went off and became the head of NOAA, just as Jane Lubchenco has recently. And while he was the head of NOAA, he was also the U.S. representative to the International Whaling Commission. Now John's an oceanographer in his own right and a great guy, not just compassionate but understanding of these ecological relationships. When he came back to become president of Oregon State University, I had been doing work already with whales and, in 1989, I told John that I had an opportunity to take over a charter going to Baja that was used by the Smithsonian Institution to show people the natural history of gray whales. I said, "I really want to do this. It's first available in 1989, I want to seek your blessing." He says, "I love the idea. In fact, I want to do it with you." And for the first three years of that annual trip that continues to be going to Baja annually, President Byrne, his wife Shirley, and Mary Lou and I led that group of thirty folks each year down to Baja, and we started, I'll say, a constituency of people that were interested in marine mammals in general and started to contribute to funds.

And the discussion on those trips – I remember a very important one. An elderly woman from Grants Pass who asked me about my funding and I said, "well, the university pays me but I have to put money in the bank in order to get it back. We live on grants and contracts." And she went up to John Byrne and took this arthritic old finger and pushed it into his chest and said, "John, you mean to tell me you aren't paying this young man?" [laughs] John spent time telling her that, "actually, you know, soft money research is not uncommon at Oregon State University. It's some of the way we..." I think this year we were $330 million of outside resources coming to the university through people that applied for grants and contracts. And he explained to her that yeah, this was true. And she said, "well, I think we ought to change that," and out of those early trips came an endowment that was fundraising that Mary Lou and I did, largely. Early on, certainly President Byrne and John Evey and John Irving were people that stand out in my mind from the Foundation that helped.

And the monies that were raised from those trips and the contributions that came afterwards from very generous friends, have made it possible for the Marine Mammal Institute to have a substantive endowment. I would certainly like to see it bigger, but it's the only funding we have. We get interest, 4.5% interest per year, off that. That's the stability that allows us to hire faculty and say, "you know what, between ourselves and perhaps some commitment from another dean or department head, we're going to give you half of your salary that you can count on every year. The other half, we expect you to go out and earn with grants and contracts." But that endowment was absolutely critical in creating the mass, the tipping point, to be able to move forward with inviting more people to have a working relationship with marine mammals like I have. And so now we have – between students, staff and faculty – we have forty-two people doing outstanding work all over the world. And it makes OSU, I think second only to the folks in England in terms of the size of our program and its global impact.

MD: And that's all based on the research that you started and it's filtered out through your people.

BM: I think maybe the influence I've had might be philosophical. And again, picking good people, like in students. But I think the credit really goes to those who saw that vision and invested in that endowment. And right now we are embarking on the development of an endowment that's specific for graduate student fellowships. I've been here for over forty years; we still don't have a single Foundation-based fellowship that we can offer students. Because they spend their first year on campus doing coursework before they can come over here and be involved in grants and contracts that we can pay them from, this is an attempt for an endowment that will pay for their first year on campus and increase the flow of students that

get the research opportunities here. So that's our next thrust. But again, the idea is an endowment, because that gives the program stability, and that's really important.

[1:15:23]

So now I don't go out and work with whales anymore. My gratification has to come, and does come, from making opportunities available for other people as new faculty members, staff, and certainly new students who will, again, be the future of the field.

MD: The next generation of people coming from this institute, they may make even more groundbreaking-

BM: Oh, undoubtedly. They will build on the shoulders of the people who have come before them, but what they will do will be really significant in so many different sorts of ways.

Let me give you an example of how important the funding is. Jim Harvey – the fellow I mentioned who got his Ph.D. here and is director of Moss Landing Marine Labs – I was at an international meeting and he said, "let me introduce you to a great grandstudent." I said, "a what?" He said, "a great grandstudent." I said, "I don't quite get it." He said, "well, you mentored me, and I mentored his mentor."

MD: [laughs] It's a family, yeah.

BM: "So this student is part of your tree." And I realized that a lot of people I know and who have helped us with programs here as donors, they understand financial leveraging, where you put 10% down and you control an asset and you make it grow, whether it's a business or a piece of property. But I think most of us don't understand that academics have the rare ability to have that kind of leveraging of ideas and opportunities. And so I know that whatever efforts I've made to date, I can see that, and I can see a couple generations out ahead, but the impact we can make I think is even bigger and will improve with time. And it will be from the generosity of folks that care about the oceans, care about the animals we work with, but also recognize that some of what we do is going to be not only applied and help immediately but also fill in our understanding so that we understand more of these relationships and how those might be influenced beyond the specific work we're doing, in a collaborative sense with others.

MD: Is there any one accomplishment in this lifetime of research and work that you've done that stands out to you, where you say, "I'll take this to the grave; this is my accomplishment." Do you have one that you can attach yourself to?

BM: I made a good choice with Mary Lou. [laughs] Yeah, some things are fundamental like that where you also can't account for luck. But again, luck is when opportunity and preparedness meet.

I think tenacity. I'm real pleased and proud with some of the graduate students I've had, that we've been tenacious. A problem was there and we worked it, and when impasses occurred we changed the route, got around the impasse, and kept driving towards the issue. And that life lesson, I guess, is one of the things that I think Oregon State University has done a really, really good job of training these people. And I think their success in getting jobs and accomplishing major things in their career is perhaps the thing I feel most blessed about, that you can be a functionally significant role in changing lives. I think most people, even though we're soft money-funded doing research, most people probably don't realize that Oregon State's major product is successful people.

Hard not to get choked up about, because it's the kind of thing you want to have happen to your own family. And when you see that happen in other lives and how they can go and affect other lives, the life lessons that were here, they were fundamental to their training. So instead of it being a single accomplishment with a species or a grant or a contract, I think it's that. It's the training. The people.

[1:20:15]

MD: And this is something that runs through many of the emeritus professors, they all have this same feeling; that's what it's all about.

BM: Sure. It's like extended family, very realistically it is.

MD: Well, one of the things we always like to do is fill in our Beavers' history – tell us about the family, we've heard about the wonderful wife, but just kind of fill in with your personal life a little bit.

BM: Yeah. So I have two children, my daughter Michelle is married in Seattle. She's executive assistant to the provost in a university up in the Puget Sound area, so she's in sort of an academic environment. My son Rob is in the banking business and has been in Bend for a number of years, and is just moving to Seattle where his bank is taking over some other assets up there. And each of them has family with children. Michelle's family is two daughters and a son, spread from seniors in high school to middle school. And my son's family, his daughter is out of school now and in a career. And both spouses are gainfully employed in things they're enjoying. So I think, again, we've been very blessed. We happen to be people of faith and they're all people who enjoy that as well, so that's helpful.

What you want for your family, I think, is to know that they are, one, self-sustaining and contributing members to society, and I think I can say that, without a doubt, that all my family is in that mode. I certainly look forward to grandchildren being in that mode if we live long enough, but their parents are good role models for them, so it should turn out that way. But you know, a lot of life is luck. It includes a mixture of storms and it's how you address those, I think, is the character of any one individual or any family.

MD: Now where did your kids go to school?

BM: My son Rob actually went to the University of Oregon, and Michelle, she went to Pacific Lutheran University for undergraduate work and did some graduate work at Portland State University. She taught English as a Second Language for a while in Chile and has spent some time in Japan and Mexico and elsewhere. She's more the traveler and Rob is more the businessperson.

MD: So you live here in Newport?

BM: I do. I've lived here in Newport since 1975. My daughter would be the one that was more inclined to stand endless hours trying to get a steelhead and loves outdoor camping more than Rob would. He appreciates the beauty and what not, but he's more business-focused and more real estate kind of focus. We all enjoy getting together and feel very blessed about that. We do that several times a year.

MD: Well, as a British car aficionado – I saw that in your listing – what brand of British car is your passion?

BM: So, when I was a graduate student, I had a business rebuilding engines and transmissions on British cars. All of them – Triumphs, MGs, Austin Healeys, Jaguars. My later years here, I don't so much do rebuilding situations, but I've sort of narrowed it down to MG TDs and factory supercharged Jaguar V-8s. They're wonderful automobiles. The TD has a bumper sticker on it that says, "The parts falling off of this car are of the highest British standard." It's just like a Model-T Ford in terms of it's sort of both ends of the spectrum now, the old and the new.

The supercharged car I race every year at the All-British Field Meet if I'm here for it, on Labor Day weekend, and drive competitively, shall we say. The very brightest spot on my gearhead hat, the last several years, I've owned a Mini Cooper that's been converted to all electric. It's never been offered by the company that way and it precedes the Nissan Leaf and other things that are more commercially available now – Fiat and BMW and Mercedes for that matter. And this little front wheel drive car has a huge amount of power which is available as soon as you touch the pedal, because it doesn't need to get the RPMs up to get horsepower. So it'll do zero to sixty in four seconds.

[1:25:25]

MD: Better than a Ferrari.

BM: Oh yeah. In a demonstration drag race up at Portland International Raceway against a ten-cylinder Dodge Viper, it beat the Dodge Viper by five car lengths. [laughs] So I still enjoy. And I enjoy things that are not so much open racing, wheel-to-wheel, but more things against the stopwatch. So autocrosses and giant slaloms and things like that where you don't risk damaging yourself or somebody else's car but you can still have good fun.

MD: Well, you're a man after my own heart. One of the things that I always like to do is allow my folks to impart some final words of wisdom to the Beaver Nation, because this is a permanent part of the archives at OSU and part of our 150th anniversary celebration. I'd like to give you a chance to give the Nation your message.

BM: I guess if I had one message, I spent some time in the south of the valley getting education and I spent my career here at Oregon State, and I have found, without exception, that OSU alumni and friends are generous, they are open-minded, they are very excited and interested in propelling Oregon State University into the next century. They recognize the importance of education, they value, I'll say, friendships and reward with loyalty the development of those relationships, unlike any group I've ever been around. I mentioned that I came from modest means and went to school on loans; as we go out into the world with this new education and become successful, we all have assets that – family perhaps, or a church – that are going to be important to us and have resources beyond that. I've just seen Beavers step up and be generous about how the future is going to look at their impact. So it doesn't matter what they did – I mean, people come to me and say, "oh, if I had it to do all over again, I'd be a marine biologist." And I'd say, "you know what, you were so good at what you did, you could afford to come be a marine biologist part time with us as a donor. Or you could make it possible for somebody else to have that dream come true." And people step up to the plate and I am just in awe of that generosity and that commitment to education and to the natural world.

I end talks, public talks, to people I don't even know out in the audience, by saying that I think every single one of us ought to include ten percent of our estate to Mother Nature. Just as a thank you for the air that we breathe, the shoes that we wear, the animals that we eat, the fruits and vegetables. A ten percent commitment from everybody would change the world; literally change the world. And even in as small a group as Beaver Nation, huge impact, and indelible mark of a single university making that kind of a thrust. And I don't care whether it's to Forestry or Botany or Zoology, Fisheries and Wildlife, Oceanography, they're all really important to our future, and I would encourage all of Beaver Nation to continue to step up to the plate and do ten percent or more if you can, and make even a bigger difference.

MD: Well, on behalf of the Sesquicentennial Oral History Project, you have been truly one of our holy grail interviews.

BM: Well, I'm glad.

MD: And we want to thank you for your participation and good luck in your upcoming, if possible, retirement.

BM: Yeah, well, thank you for choosing me and thank you for spreading the message that, I think, so many of your emeritus faculty are sharing about the importance of this institution.

[1:30:04]