

GARY BELOVSKY

Salt Lake City, Utah

An Interview By

Becky Lloyd

March 25, 2015

GREAT SALT LAKE HISTORY

U-3296

American West Center

J. Willard Marriott Library

Special Collections Department

University of Utah

Salt Lake City, Utah

THIS IS AN INTERVIEW WITH GARY BELOVSKY ON MARCH 25, 2015. THE INTERVIEWER IS BECKY B. LLOYD. THIS IS THE GREAT SALT LAKE ORAL HISTORY PROJECT. TAPE No. U-3296.

BBL: This is an interview with Gary Belovsky at the Department of Natural Resources building in Salt Lake City, Utah. Today's date is March 25, 2015. My name is Becky Lloyd. This is part of the Great Salt Lake Oral History Project.

Let's start, Gary, with when and where you were born.

GB: I was born in 1950 in St. Charles, Illinois.

BBL: What was your family doing in Illinois?

GB: My dad was an auto dealer.

BBL: He owned a dealership?

GB: Yeah.

BBL: What kind of cars did he sell?

GB: Chevys.

BBL: Did he keep that dealership through his whole career?

GB: Pretty much so.

BBL: It didn't stay in the family?

GB: No. Times change. The auto business changed in the 1970s when we had that real spike in the interest rates and it was rough to stay in business at that time.

BBL: So that killed his business basically?

GB: Yeah.

BBL: What did he do after that?

GB: Retired.

BBL: He retired. That's interesting. Did you mother have a career outside of home?

GB: She worked with him in the business.

BBL: Did you grow up working there too?

GB: Yeah.

BBL: Did you sell automobiles?

GB: Yeah. I started working at thirteen in the parts department. Eventually in summers, when I was in college, sold automobiles.

BBL: How did you like that?

GB: I liked that.

BBL: Did you do pretty well?

GB: Yeah.

BBL: I imagine you would.

GB: Yeah, I did well. I was a good salesman there. But I also knew I didn't want to have to deal with the public in that way (laughs).

BBL: Right. Were your parents hopeful that someone in the family would take it over?

GB: Oh, yeah. They thought I was going to stay. My brother did go into it.

BBL: How many children did your parents have?

GB: Just two.

BBL: Two boys. Are you the oldest?

GB: Uh-huh.

BBL: Did you also have a nice fancy Chevy that you drove as a kid in high school?

GB: Yes, but I had to pay for it myself. I had to have monthly payments on it. At some point in college my father gave me back all my monthly payments. So I did not have a free ride in that sense; I had to buy my own car.

BBL: Good. So you grew up there. You attended public schools in the area?

GB: Public schools until high school. Went to a Catholic High School. Went to Notre Dame.

BBL: Okay, you graduated from high school. What did you do in high school? Sports? Any particular activities?

GB: Played some baseball. That was about it.

BBL: Did you have any academic interests at that point?

GB: Not particularly. I was going to go into the car business (laughs).

BBL: Right. So you went to Notre Dame.

GB: Right.

BBL: What were you majoring in?

GB: Business. My degree is in business, but my sophomore year I decided I wanted to be an ecologist and my parents said, no, you're going to get a business degree. And I said I'm going to do both. So I essentially did both. I was short two classes from a science degree; the one class was physics and the other was organic chemistry.

BBL: Otherwise you would have had a dual degree in business...

GB: Yeah, and biology.

BBL: Why the interest in ecology?

GB: Because I liked the outdoors.

BBL: So you thought that you would become, what?

GB: So I'd be outdoors all the time doing things (laughs). As you go on later in life you find you're behind the desk more and more and more.

BBL: Right. Did you think that you would be a ranger?

GB: Yeah, that's what I kind of figured my life was going to be. But then I started grad school at Yale and I realized that I really wanted to just do research. Then I finished my PhD at Harvard and I stayed as a post-doc at Harvard and the University of Washington and then got my first job at the University of Michigan. I was there, faculty, tenured and everything, for over twelve years, twelve-and-a-half years, and then I moved to Utah State. I was there for nearly ten years when Notre Dame offered me a job back. I guess you can't leave the womb, so to speak.

BBL: Let's back up. What were you studying at Yale?

GB: I was in the school of Forestry and Environmental Studies, environmental science.

BBL: That was a master's degree?

GB: It was a master's degree that I had there.

BBL: Then when you went to Harvard, what were you studying?

GB: Organismic biology.

BBL: Organismic?

GB: Yeah, it was whole organism biology, rather than cellular or molecular. It was split into those.

BBL: So forestry, you were still thinking maybe forest ranger, work outside?

GB: No, I was actually in wildlife at that time and I was doing research on moose. Then I did my PhD on moose at Harvard. As things went on, I started working, switched to elk and bison and that, and eventually to grasshoppers—and I still am working on grasshoppers—and added brine shrimp at the Great Salt Lake later on.

BBL: Was that, for you, kind of a natural progression to go from those big animals to brine shrimp?

GB: I think that there are a number of reasons. You can answer more important ecological questions by working with organisms you can manipulate. Working with big things, they're just logistically impossible to manipulate. Also, the regulations you have to go through now days, to do anything with them is just getting more and more prohibitive. So I realized that the questions, the scientific questions that I was interested in working on could be experimentally examined in the field by manipulating on numbers of these smaller organisms and I could get much better data that way.

BBL: What was it that led you more to the research when you decided you really wanted to do research, can you pinpoint that?

GB: I just found it to be fun.

BBL: In your undergraduate and graduate studies, you had to do research.

GB: Yeah. When I started my master's at Yale, I just came to the conclusion that it was a lot more fun...there were two reasons: we didn't know enough to really be able to do the management, save the world type decisions. It was just more fun, I found, collecting data and analyzing data and that's why I decided to focus on that.

BBL: So you got to the University of Washington, you said?

GB: Well, I did my PhD at Harvard, did a post-doc at Harvard as a Harvard junior fellow.

BBL: What was the focus of your study at Harvard?

GB: Moose. Foraging behavior of moose. So I did mathematical modeling of food choices by moose using business models that I had learned in business school, like linear programming, which determines how you allocate resources. So I reversed it and said how do you bring in the best set of resources if you're out feeding? So I built these models and that's what my PhD was.

Then I went to the University of Washington as a post-doc for a while. That's when I took the same sort of questions and started to adapt these to looking at bison, elk and big horn sheep and antelope and rabbits and all kinds of things in Montana. I'm still working in Montana. Our study has been going there for thirty-eight years, something like that.

Then I moved to Utah State from University of Michigan.

BBL: What brought you to Utah State?

GB: I'm a Westerner at heart, so I'd rather be in the mountains in the West than in the Midwest. That's why I came out to Utah. I loved all the time I spent in Utah; I miss Utah tremendously.

[brief interruption]

GB: I wanted to live in the West and I came out here to Utah State and I was here for nearly ten years. The state at one point, we were again, we had a National Science Foundation grant to look at brine shrimp, to use them as a surrogate to model extinction of threatened species, species threatened with going extinct, endangered species. We were testing the mathematical models by using jars of brine shrimp. The state came to me and said, you know, "You're working on brine shrimp. Can you help us with managing the shrimp on the Great Salt Lake?" And I started working with them. Then after a period of years, all of a sudden they came to me and said, "How would you like to take over the laboratory work and the modeling work that we need for the Great Salt Lake project?" I said sure and that started in '94, '95, somewhere in there, and I've been doing it continuously since then.

So not that I wanted to move back to the Midwest to live, but when Notre Dame got in touch with me, the alma mater and everything, I decided I'd go back and be director of their Environmental Research Center. I've been doing that now for going on fifteen years, it will be

fifteen summers this year running it and it will be fifteen years a year from June completely.

Yeah, it's been quite an experience because it was one of my favorite people's vision was to build the Environmental Research Center, Father Theodore Hesburgh, who just passed away at ninety-eight. He wrote the Civil Rights Bill and all this kind of stuff. His vision was to have an Environmental Research Center, so I got to work with him very closely over the last fifteen years.

BBL: That's great.

So when the state of Utah approached you about working with the brine shrimp, were they having problems? What did they need?

GB: Those were in the days when there were no, literally, there were very few regulations on the harvesting industry. There were threatened lawsuits at the time, I'm sure you're aware of this, that conservation groups were claiming that the industry was overharvesting the shrimp and that the state needed to impose stricter oversight of what was going on. So that's when they came to me and said can you help out with this. Those were, as we call them, the Wild West years of the project.

BBL: So how did you approach that problem?

GB: Well, the first thing we had to do was figure out what we knew about the lake. That was the most striking thing, I thought, because here's this lake, this phenomenal natural resource, fourth largest hyper saline lake in the world, and when it came down to it we knew absolutely nothing. There was a study here, a study there. The best data we had was Doyle Stevens' work from the 1970s. But we had published data—this gives you some idea of what we had to work with—we had, actually, I found one paper where the shrimp sample from the Great Salt Lake was to throw a bucket off of the pier at Saltair, pull the bucket up and count the number of

shrimp in the bucket. That's what we had. We had better studies with Doyle's work in the '70s, but there was no systematic collection of data, nothing on which we could start to build resource management type of perspective. That was the most shocking thing.

So I spent some time early on trying to assemble all this data and there wasn't much there. Then I tried to hypothesize some models on how the lake might be working, given that data, but, of course, there was no way you could have any certainty on what you were...you were shooting in the dark, essentially. Then we sat down and we had a whole bunch of brainstorm meetings, most of these took place out at Antelope Island at that time. Well, the first ones were in Ogden at the regional office up there, then we moved them out to Antelope Island. And we had these brainstorm meetings where we'd just sit there and we'd throw ideas around. Is this worth looking at? Could this be important? That's how we went through this.

BBL: What people were involved in those early meetings?

GB: Well, we had Don Archer from UDWR, we had Clay Perschon from DWR, we had a couple of the old-time shrimp industry people that were involved; Don Paul was involved. Paul Birdsey was involved a little later. I'm trying to think who else. Doyle was involved. I'm trying to remember who else was in that original set of groups. We had some other DWR people who have since retired as well that would occasionally sit in on these meetings.


BBL: Did this whole concept of trying to come up with a formula or something, did that concern the industry?

GB: Yeah. It wasn't necessarily a popular idea at that time.

BBL: But they were willing to sit down and participate?

GB: They were giving us insights into things and said, "Oh, no. That can't be the case." They basically argued that there was no way they could ever overharvest, etc.

So we got together and said we weren't going to be able to go forward without a good set of data. So we started putting together research questions and what needed to be collected to start to answer some of these questions. A lot of the questions we came up with, now you look back in retrospect and say, "Boy, how could we have been so silly to have said that?" But we had nothing to build upon. Like I said, we were shooting in the dark at that stage. So, simple questions like, if nutrients are limiting the growth of the phytoplankton in the lake, are the nutrients coming from cycling within the lake, so the lake is an internal self-contained system? Or are those nutrients coming in annually with the run-off? Now obviously the run-off is bringing stuff in, but the big question is are the overwhelming amount of nutrients already there and so it's just a progressive accumulation over time from the run-off, but in any one year, it's really what's already there? Or is it what's coming in every year? We had no idea. Had no idea.

We had no idea as to, we had questions at that time, we had shrimp fishermen saying the reason why the shrimp numbers were going down on the lake was because the [sounds like Crick-sons]  were eating everything. We had other people on the lake saying, oh, the shrimp numbers were not going down or the cyst numbers were not going down per se, but they weren't floating anymore so they were all sinking to the bottom. So these were all of the things that had to answered.

One harvester might tell us that he could prove that you could overharvest shrimp because they had done it in some pond in Brazil, let's say. Somebody else would say, no you can't do it. I'd have to be talking to the shrimp fishermen, so the shrimp fishermen who said that you couldn't overharvest, I would say, "Well, that's possible, but I don't have any proof of that." Then his response would be, "So you're calling me a liar." And I would say, "No, I'm not calling you a liar, but your buddy over there says they can be." And I was in meetings where a shrimp

fisherman would then come running at me, threatening to beat me up and two game wardens would come out of the side.

BBL: Seriously? You were physically threatened?

GB: Oh, yeah. One night early-on when we were doing this and discussing things with the shrimp fishermen in an open forum like this, it was supposed to come up during the day—I drove down from Utah State—and we got to about four or five in the afternoon and Don Archer said to me, “Oh, we’re not going to get to it. Go on home and have dinner.” Well, I got home back to Logan, the phone rang at eight o’clock, and he said, “We’re on the agenda for eleven o’clock tonight.” I jumped back in my car, drove back down here, gave this talk about what we know and what we don’t know, what we’re thinking and what we’re not thinking about. This one shrimp fisherman comes barreling towards the podium that I’m standing at ready to pound me. Two game wardens come out on either side of me. Then when we got done at the end of the night, Don Archer made sure that one of the game wardens escorted me out to my car to make sure I got on the road okay, that somebody wasn’t out there to beat me up. I didn’t call anybody anything, but this was the sort of tension that was going on at this time. So those were the Wild West days that we refer to.

I was offered a bribe by one fisherman in those early days, saying, “What do you need? Would you need a new pickup truck? This is what we’d like to see,” or something like this. These aren’t the guys we’re working with now. Those were the individual family-run businesses and half those guys are all gone now. The people around now are industry-type people. I said to him, I remember it was Easter Sunday night he called me and he said this to me and my comment was, “You know, if I were to do this, it would have to be for a whole lot more than a pickup truck because my career would be over with,” I said (laughs). I said, “Like enough money

for me to retire in Rio de Janeiro,” something like this. And he couldn’t understand this. The next morning I called UDWR immediately, I called Don Archer up and I said, “Don, I think I was offered a bribe last night. This is what went on.” And he said, “Yes, you were offered a bribe.” I said, “I just wanted to let you know because I don’t want anyone to think that I’m involved in any way.” Well, it was a good thing because within three days, all of a sudden somebody at the Audubon Society called up here and said that I had taken the bribe, because it was a way of trying to do in everything. Don could then say immediately, “No. He turned in the person that talked to him” (laughs). So those were the Wild West days.

So they had the moratorium on the harvest and that moratorium was set up so that we had a period of time to collect data before the state would develop regulatory strategies.

BBL: So the moratorium was absolutely no harvesting?

GB: Except on the beach, I believe, and the north arm. I think they could harvest on the north arm, too.

BBL: How long was that?

GB: Two years, I think. It’s a long time ago to remember, but I think it was two years.

So we collected data at that time and we had a start on some of these things. What transpired at that stage was the season came in and I was elk hunting in Montana at 8,000 feet, camping, and my cell phone rang. I sat in a pickup truck for two or three hours with everybody down here and we’re doing back-of-the-envelope calculations on what the limits should be for the harvest, and we came up with twenty-one cysts per liter, the magic number. And now after all the years of research, we were really lucky because it turns out the best harvest level we have done with all the data we have now is about twenty-four cysts per liter. But it was just dumb luck.

BBL: Was it really?

GB: Yeah, it really was. I mean, to tell you the sort of data we had, what is overwinter survival of cysts. Well, literature from other brine shrimp in other places in the world said it was somewhere between ten and ninety percent survival. So ten plus ninety gives you a hundred, divide by two, fifty percent is the average, let's go with that. Well, what did it turn out, I think now after measuring overwinter survival in the Great Salt Lake since '98, our studies give us something like an average of forty-eight percent survival, but that can vary from somewhere near seventy percent down to nineteen percent, or twelve percent, so there's this huge variation there. So that's why I said it was serendipity that we got to where we ended up. I say this time and again, I don't ever want to take credit for that we did the right thing and we knew what we were doing; it was really luck. I mean, it was luck, but we had the right idea down on what needed to be done, it's just that we didn't have the numbers at that stage. Over the years, we've gotten those numbers and fine-tuned them and that's what I reported today when I said this is what we projected the harvest was going to be, or the amount of cysts out there for the harvest and, what was it, we projected 120.6 or something, and we saw 127.1, so we're doing pretty well. But we couldn't have said that back then.

But then when the State imposed this, two things happened. First of all, the shrimp industry, the fishermen at the time, immediately blamed me for everything because they said I was the one making the decisions and I kept trying to tell them no, I just feed information to the State and the State makes the decision, I don't have any authority. The other thing that the guys like Clay and Don would do at that time is they would impose the closure of the season. This is again the Wild West days. They'd call me up at my home some evening and say, "You going out of town this weekend?" And I'd say, "Why?" They'd say, "We're going to be closing the season

over the weekend. We recommend that you don't answer your phone over the weekend or you're not around." I go, "Oh, thanks!" (laughs).

So, yeah, we refer to what we go through now as these are the Love Fest years now, because after those early years when there was a lot of mistrust, the industry thought we were out to close them down and that the scientists and the State were going out gunning for them. That never was the case, but they were frightened by what could happen. On the same hand, to a certain extent, when we didn't come up with regulations and data that would have shut down the industry even more, then some of the conservation groups felt that we were in the pocket of the industry. All that, I think, is over with now.

I think that things have worked out well and we probably have, I would argue, and I've said this to NPR for some interviews, probably have the best managed fishery that's out there, commercial fishery, and that's because the State's doing a great job in terms of we figured out what had to be left in the lake. We didn't figure out what you could take; what had to be left in the lake. Too many fisheries now say, "Oh, you can take this amount out." Well, that varies. The amount that's out there varies from year to year. So if you just say you can take a constant amount out for a year across all years, and you've got a low year, you're not going to leave enough behind. But because we did the calculations on what you need to leave behind, there's still going to be some variability there, but it's a lot safer than going the other way. Then the State, by sampling as frequently as they do during the harvest season, is keeping track of what's out there. So when we hit that endpoint or get close to it, they start backing things off. So that's why I can assuredly say that without things changing, climate change and that going on, but if things stay relatively constant for us, we've got a fairly solid handle on managing this resource.

BBL: Is that model, that algorithm that you use is called the Belovsky model, isn't it?

GB: I don't know if it's called the Belovsky model. I don't call it that. It's called our harvest model.

BBL: So I have heard it with your name.

GB: Okay, that's somebody else, not me (laughs).

BBL: I guess you don't know for sure, but was that concern about you being in town when they were going to close the harvest, was that warranted, do you think?

GB: Oh, I think I just would have been harassed on the phone. I wouldn't answer the phone, so the answering machine filled up with things like, "How could you do this?" (laughs).

BBL: Oh, so you really did get calls then?

GB: Oh, yeah.

[brief interruption]

GB: So, yeah, I would get phone calls from these guys and the answering machine would fill up with this kind of stuff, "You're stupid." "How could you be doing this?" But it all worked out.

BBL: Was that something that you envisioned when you were thinking about doing research (laughs)?

GB: No, no. That was not on my list of things that I wanted to encounter. No. Not in the least bit.

So, it's progressed pretty well, and the project, the Great Salt Lake Ecosystem Project, in those days was focused on the harvest of the shrimp. Now the project has moved—it's still a major thing because the biggest part of the funding for everything that the project does is coming from the license fees and that from the shrimp fishing, so it owes the shrimp fishermen a certain degree of monitoring and keeping track of things, but it's broadened considerably. Now we've

gone on. Obviously the key at one point was we had to get into the phytoplankton, the algae, because that's what the brine shrimp live on. We had to get into, we're now starting to look at the brine flies. We're looking at the bioherms. We're looking at nutrient cycling in the lake. So it is an ecosystem project now, whereas in those early years, even though we knew that we had to understand the whole ecosystem, we had a focus at that time on the shrimp because of the harvesting aspect of it. Now the project is looking at the whole ecosystem.

BBL: It was a natural progression to expand and include...

GB: Well, it had to be done. It was just that at first there was an immediate problem that needed to be addressed and that problem had to deal with the shrimp directly and it didn't matter so much why the shrimp did what they were doing, we just had to be sure that there were going to be shrimp there.

BBL: Right. Was there overharvesting going on back then? Or was that not the focus?

GB: That's still debatable. We've come up with some calculations that indicate that there were some years of very, very high harvesting, okay, that I would feel uncomfortable with. But then, other people say, no the harvesting wasn't as great as what you're projecting it to be. Quantifying the amount of the harvest is not easy. You think it would be; I thought it was when we got started. But that's why we finally came to the conclusion that monitoring the harvest was not as good a management strategy as monitoring what was still left in the lake because as the industry will tell you, when you throw all those eggs into a big giant essentially burlap bag, you've got wood, you've got dead birds, you've got an empty shell that's not active, all this. And for years we talked about, well, can you core in and get a measurement in the middle of the thing and just not what's at the top of the sack and things like that. It's always been very difficult. So what the State operates on is the raw harvest and the industry would come back. So for this year, the guys

here in DWR told me that this was the third biggest harvest on record. Talking with the shrimp industry guys today, they said, well, it was just a mediocre harvest. I said, "So what's the difference here?" They said, "Well, Gary, you know what the difference is." They said, "The State's counting raw harvest and we're taking out all the garbage and we're taking out all the cysts that aren't really good cysts, and we're only looking at those that hatch." So they're making their comparisons on sort of a different set of numbers. So looking at what's in the lake is the safest thing.

BBL: That's interesting. And you say that's pretty unique.

GB: Yeah, if you look at fisheries, like salmon fisheries, they give out licenses and things for how much can be harvested in total. They don't keep track of what's actually out there after the harvest because that's a very hard thing to do. It's easier to measure what's been taken than what's in the ocean. So by this management strategy, measuring what's actually out there in the lake, it's a far more conservative and biologically realistic way of looking at things than can oftentimes be done elsewhere.

BBL: Right. So the twenty-one or twenty-four cysts per liter that you came up with, is the number that's needed in order for it to replenish itself the next season.

GB: To the maximum level.

BBL: Is there a problem if it's thirty-five or forty?

GB: Yeah.

BBL: If we cut it off there, what's the problem?

GB: Then you have too many hatching in the spring. They deplete the phytoplankton down, then there's not enough food, so you've got low survivorship. It takes a long time for the population then to build up over the summer and you may not get a population that builds up

high enough to either produce enough cysts or switch over to cyst production, because remember, the brine shrimp reproduce in two different ways: Live young and cysts. If they have plenty of food, each female has plenty of food, she keeps putting out live young. It's when she finally goes through a starvation period then she will then switch over to the cysts.

BBL: Okay. So you really have to have a fine balance between too much nutrient and enough to keep the industry going.

GB: Correct.

BBL: Interesting. So by that way, just thinking out loud, the survival of the lake really is dependent on the brine shrimp industry as well. If nobody harvested, do you think it would self-regulate?

GB: That's an interesting question, and I've played that scenario out with mathematical models and I've tried to go back and look at historical records, which are terrible. If you go back to Fremont and Stansbury and people like that, and some of the 1880 newspaper articles here in Salt Lake City, you see people coming out and say, "Oh, the shrimp are so thick, you can walk across the surface of the lake," or something like that, on the shrimp. Then you see somebody else's journal or newspaper article saying, "Oh, there's nothing in the lake; it's dead." So I have, the mathematics tells us that in the past, it's possible that the shrimp numbers cycled quite a bit between peak years and low years and it varies considerably. Of course, we don't have that data, and now, of course, we have an industry that's harvesting down to a set number every year, so we're getting more and more consistency. It's not allowed to cycle. And I went back and historically looked at this. The data's not there, but people talk about years with nothing in the water and years when it's just totally alive. Were these up and down years? I don't know. But we don't know any of this because no data, substantial amounts of data were not taken on this lake

until all this became a management issue. So biologically it's interesting, it's a possibility, but as a scientist, I can say that we can't prove or disprove it.

BBL: You stayed at USU for ten years and continued your involvement, I guess, they had this committee or group or whatever continue with the management?

GB: Yeah, and we're continuing to do research. I never was involved in the active, on-the-lake research. Basically that data was sent to me. We analyze it; use it for modeling. I have been doing the laboratory work on how well shrimp can do at different temperatures, salinities, food levels, types of food, things like that. Brine flies. We're doing bioherm growth, phytoplankton growth. We've been doing all that in the laboratory to get sort of the background data that eventually we're going to be able to build, we're very near a stage where we can build an ecosystem model for the whole lake and then use that to try to project how different things will affect the lake in the future. So we're very close to that level. And I could probably get started on it if I could have a few fewer other things on my plate to do right now (laughs). But, anyway, that's the ultimate goal that we're working for. And the only field work that I'm involved with on the lake itself is we do this experiment where we put out cysts in the fall that are counted in a sleeve in the lake on floats and we measure how well they survive over the winter. As I said, that's a key variable and the literature had said that it was somewhere between ten and ninety percent. Well, it is between ten and seventy, or something like that on the lake, but on the same hand, we want to know why it varies from year to year, and that's what those coolers are full of right now [referring to coolers he has with him]. Those are the results of this winter's experiment that I'll take back. We know how many cysts we put into each of these sleeves that have been bouncing around in the lake since December, we're going to hatch them now and see what

proportion, we know what proportion of the eggs could hatch originally and we'll now see what proportion can hatch. So that's the main piece of fieldwork that I'm doing on the lake right now.

BBL: When was the first time you saw Great Salt Lake?

GB: The first time I would have seen it would have probably been when I was like twelve or thirteen years old on a family vacation, like going to Yellowstone or something.

BBL: Did you stop at the lake or did you just drive past?

GB: I remember my dad wanted to see the Bonneville Salt Flats because that's where the fast cars go, right.

BBL: Did you go out there?

GB: Yeah, oh, yeah. Well, we went all the way to California and then came back around.

BBL: That was on your way. I thought this was just a side trip.

GB: No, no. We went straight out through. But I think that was the first time I saw Great Salt Lake.

BBL: When was the first time you went out there, to the lake?

GB: Well, probably two years before I was hired at Utah State, I went out to the lake because I was here...no, 1985 I went out to Antelope Island because I was giving a series, a week's worth of lectures at University of Utah. So I was in the field in Montana doing research and I drove down from Montana here to Salt Lake and I spent an afternoon out on Antelope Island at that time. That would have been '85 I think, or thereabout. Never thought that I would be doing this now, at that stage. Then next time I would have been out there would have been about '89 or '90, probably 1990. I came to Utah State to give a series of lectures, so we went out to the Great Salt Lake at that time.

BBL: For sightseeing?

GB: Yeah, just sightseeing.

BBL: Do you, or while you were living here, did you recreate out there? Hunting or boating?

GB: Oh, I used to go pheasant hunting on the north end of the Great Salt Lake at a wheat farm that was out there that was owned by a couple of old Japanese guys who'd been interred here in the Second World War and stayed after the war and became farmers here. So they had a pheasant hunting club and I used to go out there on the north arm, on the north side there and go pheasant hunting. But that was the only recreation that I think I did on the Great Salt Lake.

BBL: But you say you've gone out a couple of times to collect samples? Do you do that or you have other people?

GB: Both. Yeah, so in December I'm here while we're doing that study. Now the State picks up everything after we put it out in December, but I also have two or three other people with me in December when we're doing this.

BBL: Those are students of yours?

GB: Students and technicians of mine. Because during that December trip I'm also doing the advisory TAG meeting, usually a meeting with the shrimp fishermen, and some other things, so I'm going in and out.

BBL: So after you were at USU for ten years, then you got the offer to go to Notre Dame, but you kept your ties here, obviously, with the Great Salt Lake.

GB: Yes.

BBL: When was the TAG group, the Technical Advisory Group for the ecosystem of the Great Salt Lake...have you been with that from its inception?

GB: I am the only person left from the original group. That's why I'm probably gray (laughs). Yeah, as John Luft says, I'm the institutional memory now. Now Paul Birdsey's coming back,

but I was involved probably four years before Paul was, so he was involved in those early years as well, but I was there earlier yet. So I think everybody that was there in the early years is retired, except for me. I think the TAG started in about, I want to say our first TAG meeting was '96, something like that.

BBL: Was that something that you were trying to develop, that you were pushing to get done?

GB: No. Basically I'm ex officio.

BBL: Now? Still?

GB: Still. And always have been, because I'm funded to do research for the State and it would be a conflict of interest for me to be a member of the TAG if the TAG is also determining where they're going to do, topics of research they're going to do.

BBL: So you moved to Notre Dame and took over the position of Director of the Environmental Research Center. What was that like? What was it like when you got there?

GB: Well, the Environmental Research Center, Notre Dame owns 8,000 acres in the Upper Peninsula of Michigan and that's basically their Environmental Research Center. That land's been closed to the general public since 1913. Notre Dame acquired the land; it was donated to Notre Dame in the 1940s at some point. It's been used for environmental research. The land was used going back into the '20s and '30s, before Notre Dame even had it, some famous studies were done there by early lake ecologists and some early forest ecology work was done there in the 1940s and '50s. So they had this 8,000 acres there and it got started in 1976. Notre Dame finally in 1976 decided that they were going to start having summer classes there and have it open for research on a regular basis.

So in 2001, I took over and we've built all kinds of buildings up there and housing and a number of researchers now, we have over a hundred people doing research probably in a

summer, coming in and out. When I took over there were probably fifteen or twenty. The class now has gone to thirty-two and it was thirteen when I took over. We also added a research center in Montana and one in Puerto Rico. They're not as big as the one up there—that's the biggest. The one up there, since I took over, we became designated in the National Ecological Observatory Network; it's called NEON. It's this National Science Foundation funded program, twenty sites across the United States for thirty years, and they're doing the same studies at all of the twenty sites across the country looking for changes. You have one right here in Salt Lake City with the U of U that's up in, part of it is up in the canyon, the gardens that the U of U has up there. Red Butte. So you have one here. We have the one at Notre Dame that's up at our land in the UP of Michigan. So that's just been in operation now for two years. So there's a lot of activity.

But we started one in Montana. That just came out happenstance. Somebody at the University in the administration said, "You know, we're trying to work with Native American tribes in Montana and we're looking at this, that and the other thing. We hear you do some research in Montana." Well, I'd been doing research since the '70s in Montana. Turned out it was my research, same tribe. I work on their reservation and everything was just totally coincidence. So they had this program that they were starting and it was going downhill and they were having trouble working with the Native Americans because one of the people at Notre Dame was not simpatico with some of the things that the tribe wanted. So the university said, "Well, you're in charge now. Figure it out." So we've got that program going. Tenth year of that program; this summer will be the tenth year.

Then we have one with University of Puerto Rico where we had a Notre Dame donor who was interested in our site up in UP of Michigan and said, "I'm going to give you money to

take Puerto Rican students up there.” I said, “Okay, University of Puerto Rico has to reciprocate. Take some of our students into their summer program.” So we’ve got sort of an exchange program going that way. Anyway, that’s what my job pretty much is.

BBL: So your center still has the Montana connection, Michigan, Puerto Rico, and Great Salt Lake?

GB: Well, Great Salt Lake isn’t part of it.

BBL: It’s not?

GB: No. That’s just me.

BBL: Okay.

GB: Yeah, we’re not bringing classes and students and things out here. That’s just my research.

BBL: So you have grants, I guess, to work at all of these places? Or is it just part of that NEON...

GB: No, I have grants at all these places.

BBL: But the Montana, you’ve been going for thirty...

GB: I think this is the thirty-eighth summer. And we’ve been continually funded either by the National—all but one year—we’ve been funded either by the National Science Foundation or the US Department of Agriculture.

BBL: Then I guess you have to work a lot with donors, you mentioned a donor. I’m guessing to do that Michigan expansion and build all those buildings...

GB: Well, on top of that, all these students, no cost to the student. Notre Dame is tuition free. They get \$500 in research. They get their travel expenses paid for, and a \$3,500-a-summer stipend for taking the class. They get paid to take the class.

BBL: I did not know that.

GB: Well, it's unusual. There's very few programs like this that have the kind of funding that we can provide the students.

BBL: So what percentage of your time is spent fundraising, would you say?

GB: I would say probably twenty percent—fifteen, twenty percent is about the right amount.

BBL: That keeps you busy. That's incredible.

Tell me if there are things that I've missed about your Great Salt Lake research that I haven't asked you that should be included.

GB: Well, you should probably talk to a couple of the old-timers from UDWR that were involved. One would be Clay Perschon and another would be Don Archer, probably. They were involved in those days when there were lawsuits threatened and everything else.

BBL: The Wild West days.

GB: Yeah.

I think one of the biggest things that people don't realize is what a unique resource this lake is. We had a hard time, we still have a hard time, convincing politicians within the State of Utah and Utah's politicians in Washington, D.C., how important this lake is as a biological resource. Too much, part of it is that, this is a utilitarian perspective; you can't drink the water; can't irrigate with the water. But it's a tremendous biological resource. Probably, as you heard from the speaker on the Salton Sea, probably the one hyper saline lake left in the world that, I don't want to say is not threatened, but is not on the verge of utter destruction. You look at the Aral Sea, the Caspian Sea, the other lake in Iraq that he talked about today, those are the top three that are bigger. Then the Great Salt Lake. They don't exist anymore. There's no water being put in anymore into those lakes. They're drying up. All the water that's flowing is being

diverted before it can get to those lakes. This is the only one left right now that we have a reasonable chance of maintaining. It's a unique resource. And it's a valuable resource. What is it? \$1.3 billion a year it generates for the State? So it's not as if it's just not economically important, it's just that it doesn't have those characteristics of potable water and that, that we tend to look at things. So it's really important that we protect that resource out there.

BBL: Have you been called upon to work with some of our politicians?

GB: No, not with the politicians. I've been on several panels and that for the State, where we've assembled information, but no, not with the politicians per se.

BBL: Not directly.

GB: Yeah.

BBL: Referring to that presentation that we both heard on Salton Sea, I have to say that was very gloomy for me.

GB: It is.

BBL: But you were just saying you don't think it's that threatened?

GB: Well, you know where he said the Great Salt Lake was? He was talking about the north arm. He said no brine shrimp. There's plenty of brine shrimp in the south arm of the Great Salt Lake. Not in Farmington Bay because we've messed Farmington Bay up, but the north arm, there's none there because of the railroad causeway and there's no fresh water comes into the north arm, so the salinity's built way up there. So his comparison there is not where we're at right now. We have brine flies, to the consternation of a lot of people (laughs), who don't want them buzzing around in the summertime. But we're not at that stage.

But I made the comment yesterday, we had a water quality meeting yesterday and we were discussing, very first thing in the morning they were going, well, what are we going to do

about water quality? How do we set up the standards for the Great Salt Lake? I said, “Well, I think before we worry about the quality of the water, we have to have water there to worry about its quality” (laughs), because, I said, “if you divert it all, it doesn’t matter, it’s just going to dry up on you out there.” So that is the issue that we’re facing right now, is protecting that resource.

BBL: What is your prognosis?

GB: I want to think we’re going to be able to do it, but the demands for water in the West are so great. Climate change I think is taking place; it’s going to get dryer. We’re going to evaporate more as it gets warmer. There is going to be a lot more pressure to try to maintain what we have. Salt Lake City can’t keep growing the way it’s growing and provide water to people if you’re going to maintain that resource. So it’s a challenge. We can do it, but we have to put our minds to realizing that we can’t have unlimited growth and maintain the lake, or any of the other resources around us. So I’m pessimistic, but I also have some optimism in all this. I believe we have the ability to make the right decisions and I think we can make the right decisions as people. If we do it correctly, it wouldn’t cost us that much or inconvenience us that much. If we go way too far, we lose the resource and we will be inconvenienced and it will cost us a lot.

But the Salton Sea is on the verge of collapse already. He didn’t talk about this today, but the Salton Sea, there’s documentaries out there written that were produced by, I think it’s the guy who did *Home Alone*, he did a documentary on the Salton Sea and the fact that this was going to be the world’s resort place. You could go there and get this great fishing. People were buying these homes there, these beautiful homes. Beautiful restaurants were being built and everything. Now, they’re across a big flat of dust from the water now. The docks don’t go down to the lake anymore. The Salton Sea is in a situation where it’s immediate; we’re not that bad, yet. But that gives us time to be able to fix things and prevent us from getting to that stage.

BBL: Do you think that the community of people interested in preserving Great Salt Lake and really appreciate the value of it, do you think that they are doing the rights things, as much as they can?

GB: Oh, yeah. I think they're very dedicated, very committed to doing this. I think they know what needs to be done. I think the problem you're facing right now is, again, the economic demands—there always are going to be economic demands. I mean, people have to live, and the demands of maintaining the resource, we can have the economy, but on the same hand, can you continue to grow that economy? At some point we need stability rather than constant growth and that's where the pressure is, from the growth. The city can't grow, the state can't grow number-wise, but you certainly could maintain the economic quality of living here, or even improve it, but not necessarily if you keep increasing the number of people in the state. Especially if you look at the State of Utah, it's the only, the main land that's useable is this little strip between the mountains and the lake: The Wasatch Front. So you're packing more and more people into a limited area.

BBL: Interesting. I want to ask you a couple of questions, but first of all, is there anything I missed about your Great Salt Lake research that you want to say?

GB: I've been interviewed enough in newspapers, and *High Country News*, and NPR, that if anything I forgot to say is probably in one of those interviews (laughs).

BBL: This is kind of a really goofy thought, but I wonder if there's ever been discussion with the brine shrimpers about can we make the shrimp harvest bigger by feeding the...you know what I'm saying? Make a super harvest. You would do that with your cows or if you wanted to increase your yield or the size of your chicken flock, or whatever. Can we do that with brine shrimp? Has that come up ever?

GB: Yeah. It's a sore subject with me because one of the things we found in the research is that nitrogen is the limiting resource to the algae out there. You get more algae, you get more brine shrimp. You get more brine shrimp, you tend to get more cyst production. Well, the obvious simple solution to this is if you want to have more cysts to harvest, let's just put more nitrogen into the lake, stimulate the algae, more food for the brine shrimp, more cysts are going to be produced. That is a simple line of reasoning that doesn't look at the details of what goes on. You put more nitrogen in there, one of the things that happens is as you change the amount of nitrogen, you get different species of algae growing. Some species of algae are more nutritionally better for brine shrimp than others. So it's not just a matter of getting more grass to grow in your yard; it's also a matter of getting better grasses to be growing, or types of grasses. That's what that argument fails to take into account. So, yes, you might be able to do that. You certainly could do it on a much smaller scale in ponds or something, but to do that in a lake in total, I think would be playing with fire. I think we could be changing things we don't understand.

One of the things that happened in the mid-'90s when we got started on this project is that the shrimp population crashed in the lake. Concurrent with that decline in the shrimp population, we saw just a bloom of a type of algae diatoms that we had never or ever had been reported in the lake. The shrimp can't eat the diatoms, they don't do well on them, especially the young juvenile and the nauplii, the hatchling shrimp. To this day, we don't know why that bloom occurred. At the time, everybody said, "Oh, it's the salinity," because we were going through a period of declining salinity in the lake. They said, "Oh, it's getting more freshwater-like and that's what the diatoms like." I said, "Okay, we can test that hypothesis if it's salinity. If the lake starts rising in salinity again, we're going to go through that window again of that same salinity and let's see if we get diatoms." Well, we went through that window again and we never saw the

diatom bloom. We don't know to this day why we saw that diatom bloom. I have some ideas, but I can't prove them. I have some ideas.

That's the problem. We could change the nitrogen in the lake and the net result would be maybe you'd have more algae out there, you should have more algae, but it might be something that's totally inedible to the shrimp; it would do more damage. That's the problem with that way of thinking. So I hear shrimp fishermen one time saying, "Oh, we don't want to clean up the water that's coming into the lake because it's bringing in more nitrogen from the farm fields where they're fertilizing" and things like that. You go, how much more nitrogen can you put in there? We don't need to clean up sewage coming into the Great Salt Lake because that's nitrogen, that's fertilizer for the algae. Well, it may not be. We might be better off with less nitrogen there.

The other problem is we've got that deep brine layer they talked about today, and he talked about with the Salton Sea today in the talk, everything settles out there. Then one of those days when that deep brine layer disappears, like it is currently, pretty much disappeared in the Great Salt Lake, all that stuff that's been accumulated and locked in below that layer, now is circulated throughout the lake.

BBL: And you don't know what effect that has.

GB: We know that at least more algae, but we don't know what the effect is on the composition of that algae.

BBL: So you mentioned today that there is a new type of algae that you've seen.

GB: Euglena. Well, it's a protozoan actually.

BBL: And you don't know where they came from?

GB: Well, it's always been there, but you would pick it up one cell here, one cell there. You'd see it in your samples, but not to the levels that we have been seeing in the last three years.

BBL: Do we know if the brine shrimp can eat that?

GB: We don't know.

BBL: Because you were saying today that you thought they were so big that they couldn't be eaten by the smaller ones.

GB: By the smallest ones. We don't know if the adults can eat them.

BBL: So I'm assuming that's research that you're working on now?

GB: Trying to. The first thing is you have to get a culture of these things going. So that means you take water from the lake and you sit there with a pipette and you look through a microscope and spot one cell, right, and try to pick it up and put it in a vial. Then you do this a bunch of them, then let that grow for a period of time, let them reproduce, then go back in because you don't get a pure culture. Then you go pick another cell and another one out of there, grow it again, and each time, you get a purer and purer culture until at some point you say, oh, it's ninety-nine percent pure, now we're going there.

BBL: That will be interesting to see where that goes.

GB: Yeah. Don't hold your breath. It won't be next week.

BBL: What does it take, a couple of years?

GB: No, it will take a few months to be able to do it, till we get a culture going. Then hope some undergraduate doesn't come in the lab and contaminate it. We've had that where we go away for two months because we're up in the north woods running the field station, and you hired an undergraduate to come in and give fertilizer in there and he takes the pipette and puts it

in a pure culture and then goes and picks it up and puts it into another culture and the next thing you know you have a mix again.

BBL: So that happened?

GB: Yeah, it happens. You want to shoot them (laughs).

BBL: He didn't get a good letter of recommendation, I guess.

GB: No. We didn't rehire him either (laughs). So that's the counter to that argument.

BBL: You do hear that so it wasn't so outlandish for me to ask that question.

GB: No, no. Not at all. I hear it.

BBL: Tell me what you've got planned for your future? What other projects you'd like to do, whether here or at Notre Dame.

GB: Well, we just got renewed for five years to continue our work in Montana. I've got a toxicology project going for water quality in the Great Salt Lake. What are the toxic metals on brine shrimp and brine flies? I hope to continue working with the State on the Great Salt Lake here. As everybody in the GSLIP project says, "The day you retire, give us a warning so we can retire and step down because we don't want to be here when you're not here to answer the questions" (laughs). So I've warned them, the day I retire, I'll give them some heads-up warning.

But, yeah, I want to keep my research going. I think at some point in the not too distant future, I'm going to step down from being the director and just get back into doing research again so I don't have all the administrative headaches that I have to deal with anymore. And someday I'll retire in Montana.

BBL: That's your plan?

GB: Oh, yeah. I'm a Montana resident, have been for some thirty-some years now.

BBL: When you were living there you got residency and kept it?

GB: Yeah, when we started working there I got residency and I kept it. So I'm working with the governor of Montana and the former governor of Montana and state senators and things like that all the time on conservation issues in Montana. We've just put aside 16,000 acres of native prairie. It took twelve years to get this project through. It's almost done—knock on wood (laughs). We've got the land saved, but we still need \$2 million we have to raise to protect the paleontological and archaeological rights, resources, of the land. The land literally is covered in places with dinosaur bones and Native American campsites everywhere. Every tribe has burial sites on there and you can tell who's buried...they can go out and tell you so-and-so was killed there in 1760 and this is his burial site and you can tell which tribe's burial site, because some bury, some make rock cairns and things like that, so we want to get that set aside. That's one of the things I'm working with the former governor of Montana on his fundraising to get those rights put aside.

BBL: So you've got a couple of things to keep you busy for a while.

GB: Oh, yeah.

BBL: Not short of projects.

GB: Not at all. But my plans are to continue working, helping the State out here with this important resource.

BBL: That's great. I think you're a huge asset to our State and one that's probably not known too well.

GB: Well, I really love this place. Every time I come back I go, why did I move away to the Midwest? I'm happy at Notre Dame. That's not the point. But I mean, every day, my office up at Utah State had this huge picture window and about three or four in the afternoon, I'd lean back

in my chair and put my feet up on the desk and just look at the mountains and, you know, I don't have that anymore and I miss that tremendously.

BBL: It is beautiful up there at Utah State.

Well, this has been terrific. This has been so interesting to hear your story, your connection to Great Salt Lake. I appreciate your time.

GB: If there's anything else I can answer for you, just give me call or send me an email.

BBL: Okay. Is there anything else you want to add before I turn this off?

GB: No.

BBL: Okay. Thanks again.

END OF INTERVIEW