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Interviewer: Tom Martin (TM)
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TM: Today is April 19th, 2017. We're at the home of Tom Martin and Hazel Clark. My name is Tom Martin. This is an interview with Joe Shannon, as part of the Grand Canyon Historical Society Oral Interview Program. What year were you born?

JS: 1957.

TM: Where were you born?

JS: Poughkeepsie, New York. It's Iroquois for "where the big creek meets the little creek." (laughs)

TM: Wow. Poughkeepsie. Who knew?

JS: It's actually shortened. It's half of what it's supposed to be.

TM: Is that right? What were your folks doing there?

JS: They were second-generation Irish immigrants. My father was a heavy-equipment operator, a mechanic and my mother an accountant. I'm the fourth child. Three siblings: two sisters and a brother.

TM: Did you go to high school in Poughkeepsie?

JS: Well, in the town north of it I grew up in. It's called Pleasant Valley, New York. It's on the Hudson River. That's the "big creek." I went to school in a system called Arlington school systems.

TM: Okay. In Pleasant Valley?

JS: Yeah, so it was like very rural. It's upstate New York, what we consider upstate. Twenty minutes it was to Connecticut, to give you an idea of the border. Where Massachusetts, Connecticut, and New York come together.

TM: And the Hudson River. Did you learn to swim when you were a kid?

JS: Yeah, we were very wet people as a kid. For us, it's a lot like Arizona. We didn't do anything without going in the water. So, family picnics, family vacations, somewhere there was a lake, the ocean, Connecticut Sound. Somewhere there was water involved, in reflection, yeah.

TM: Did you guys have a boat?

JS: No, we didn't have that kind of money. No, but we swam, and we went to, you know-there was, there's lakes there, so we had friends that had boats. We'd do the floating docks-went, swim out to the dock with a springboard on it, that kind of stuff.

TM: How did you get interested in biology, then?

JS: Well, one of the creeks…so, you know, its creeks...it was called the Wappingers Creek, well, it still is. We did a lot on the Wappingers Creek. All Indian names back there, tribal names. There was a big gap in time between my brother and me. And he's disabled, was disabled, just died a year ago.

TM: Is this your elder brother or younger brother?

JS: Older. I was a "Catholic mistake," so there's a six-years difference. So, pretty much, my upbringing was outside because I would make a mess. I was a boy and I was just messy. When the house was clean, I wasn't allowed in the house, just to sleep. When you're given those options, which I thought was a great deal on my part—could stay outside, go have fun. And, of course, there's water, so we would always go play in the creek. Probably my first recollection of doing anything scientific in this creek is painted turtles, which I don't know, really, what kind of turtles they were, but some aquatic turtle. We were told they were called painted turtles. So, what do we do? We go get some of our paint from model airplanes or something and numbered them every time we found one. We never wrote anything down, but we would just go, "Oh, there's 3. Holy cow. We marked 3 way over here by Brown's pond. I can't believe 3 is…" That was in grade school that we were doing stuff like that.

TM: So, 3 made it 100 yards? 3 made it a mile?

JS: Like, a quarter mile.

TM: Wow.

JS: So, what we learned is they would walk up and we'd see them floating. We'd see them traversing the river, whatever their territory was, or something like that. Yeah, walk up, float down—kind of like what we do when I'm floating in a raft, I guess.

TM: Oh, that's fun.

JS: And probably avoiding the snapping turtles, you know. So that was really the beginning. The other, probably, that got me going in science was, to teach me to read, my dad read *National Geographic*'s to me. That really got me going on the natural world in my upstate New York deal. Because can I vividly remember him sitting me down, trying to get me to read.

TM: How cool is that.

JS: What a great book to learn to teach a kid because its half pictures, right? So, it was perfect. Yeah, so those are really fond memories as a kid.

TM: Fun. Fun. After high school, then were you thinking, I'm going to go straight into college or…?

JS: No. I hated school until I went to college. I detested it. I thought it was a waste of my time. I did everything I could to get out of it. I raced motorcycles and I wanted to be a professional motorcycle racer, but I couldn't keep my balance. You gotta finish to win. It dawned on me after a while that I don't have the ability to go professional. At the same time my father died, and I didn't know what to do. They said, "Well, you can go to college on Social Security." So, I did.

TM: How old were you then when you went into college??

JS: 17. I was terrible because I needed remedial help. I couldn't read, I couldn't write very well. My first GPA was .6 because the classes I took didn't count. We call them now zero-hundred-level classes. I had to repeat algebra, college algebra. I retook it and took a photography class. Got my GPA up and now after many, many years… You can never be a 4 now but I'm 3.9.

TM: What was it about college that captured you? Because it sounds like you hated school. You were doing some other things. Your dad was a mechanic and wasn't necessarily a school-bound kind of guy. He was interested in, sounds like, you learning to read and write and be good at that. What was it that captured you in college?

JS: I think it was just the natural sciences. I just immediately liked the natural sciences. I joined a… You know, I was a Boy Scout, so that was probably part of it, come to think of it. The classes I took… That was when outdoor education was big for—it still is, I guess—rehabilitating people. I never took a class from this fellow, but you know how you make friends with an instructor. In retrospect, I was probably trying to replace my father at the time, you know, as a 19/20 year old. He was the Natural Conservation Resources department chair. We made friends. So, we would go climbing. We did all kinds of stuff together. I think that's what triggered it. I think that's what got me interested in the science part of just understanding what's going on around us.

TM: Do you remember his name?

JS: Dick Barnett. Richard Barnett. Yeah.

TM: What did you graduate in college in, then?

JS: That was community college. I transferred to Roger Williams University in Bristol, Rhode Island, and got a Bachelor of Science in marine biology. At that time, I was going to go back to get a master's at New Paltz, New York, on the Hudson River. I worked off and on with consulting firms, in outdoor education programs, in construction, so I was bouncing around in those days. Reagan got elected and took all of the money away. Sound familiar (laughs) with today's events? But I had that completely set up with this outdoor education program through the community college and a research station on the Hudson River. The professor was at New Paltz, which was across the river, maybe a 45-minute drive from my house. The study site was in the middle of the Hudson River. It was to figure out kind of what I've always been interested in at ecosystem level. In this case, the target species was sturgeon. That was an endangered species being impacted by the four power plants: two nuclear and two coal or gas fired.

TM: Impacted in what way?

JS: They're anadromous so they go up into the fresh water to spawn. They go up to spawn, however, as they're swimming…and then they spawn. And they're big. They can be up to 6 feet long.

TW: Wow.

JS: Yeah. Big fish. Their offspring, of course, are microscopic to begin with, but they get sucked up into the cooling towers. All power plants need water, right? So, you just boil water, spin something, and then what do you do? So, there's two impacts: it's impingement of pulling the water in and it smacks against their screens that kills the adults. The little ones get through and get boiled and then they're released. That was back in the late 70s/early 80s. In those days, I just wanted to be paid to be outside. So, I'd either go camping or day tripping. The power plant work was shift work but we did collect at night but we got to go home or we'd run the river and stay in taverns, which in those days was a just a bar that also was a hotel. Real common place to stay. That was fun. So, we'd go all the way down to New York

City, down to the Tappan Zee and George Washington bridges and collect and go up not quite to Albany, but almost. We used to span a huge area in these really cool boats that we drove around.

TM: Wow.

JS: Yeah, that was fun. Then I came out west in ’79 and took a National Outdoor Leadership School, a NOLS class, because those folks from the community college, Dick Barnett and the other instructors there said, “You should check this out.” I did and I worked off and on with them for 15 years.

TM: As a NOLS Instructor?

JS: As a NOLS instructor, did logistics as well. Did all kinds of things for them in those days. In between there, to get to the river, to get from that time point to NOLS, is when I met my wife. So, basically, I was living on the East Coast, New York or Pennsylvania, or I had some friends in the winter and I would come out and do seasonal work in Lander, Wyoming. I taught classes in the Wind Rivers, the Big Horns, the Absarokas, all throughout the northern Rocky Mountains. I met my wife and I had gotten injured and I couldn’t carry… In those days, we carried packs, like 100 pounds was normal. Was a climbing course, it might be 120 pounds. We carried books. In those days only big people backpacked and mountaineered. When people say they have a 40-pound pack now, I laugh. But, that’s how I met Emma at NOLS. I was beat up and she said, “Well, come down for a winter in Scottsdale.” So I did, and never left.

TM: Was that the first time you’d come to Arizona, then?

JS: Yeah.

TM: What year was that?

JS: ’86, I think. Fall of ’86.

TM: How do you spell Emma’s last name?

JS: Benenati. “Good life.”

TM: In what language?

JS: Italian.

TM: Cool. So 1986, you still just had an undergraduate degree?

JS: Yep, and I started teaching.

TM: Where?

JS: At Scottsdale school systems. I finally got a real job, a permanent job, but I substitute taught in the Scottsdale and Paradise Valley school systems. So I went back to school and got a teaching certificate in Chapman College in biology.

TM: In ’86?

JS. ’86. Took me ‘til ’88, I think, to finish it. So, from that, Emma was a—still is—backpacker in the Canyon. She had done… In those days, you had to… She made a big deal about this. You had to keep a resume on file, and you had to keep track of all of your trips. When you would apply for a permit, you had to explain to the rangers that you were capable of the route you’re picking. You had to negotiate if you were capable of the route or not.

TM: This was in the 1980s?

JS: Yeah. She was very proud that she had a resume in good standing. In those days, if you said… Let's say you're doing a Marble Canyon trip, off-route Marble Canyon trip, and you're going in on the 5th and you're coming out on the 10th. You're obligated to call them by close of business on the 10th. If not, they send a search party. One time we got out. It was wicked weather, and we ended up going to Cliff Dwellers. Just made it in…one of those things, we were just lucky to make it out...and forgot to call and we got in trouble. Emma thought, "Oh my God, they'll never let me hike in the Canyon again." So, it's really funny how things have changed where you actually had to call and let them know you're OK. Because there were so few people.

TM: What were you thinking the first time you came to Grand Canyon to do a backpack, having only been in Arizona, well, not very long? You'd been in the Wind Rivers, so you'd been in Wyoming. You'd seen some pretty impressive and inspiring country out there, a little north of the Southwest. Can you expand on that a little bit?

JS: I thought it was a big gravel pit because that's the only reference I had. When I was racing dirt bikes, we'd go up into Maine and they would put us in the old marble and granite quarries. That's the only reference I had to the whole thing. And I never really—still don't—understand it, the openness. I still can't comprehend it, to be honest with you. Every time I see it, I have to readjust my view, my viewpoint, because it's so big. You gotta remember, we were fit. We were young, we were fit. The canyoneering was easy. I thought it was easy compared to mountaineering. And of course, the change is from carrying a bunch of climbing gear to carrying water. So the packs were still heavy. But we looked at it as just, "This is great!" So, if we weren't coaching… You know, it's the same thing, if you're a young educator, you're asked to do everything. We were the coaches and there's afterschool stuff, always asked to do field trips and stuff. But pretty much every weekend, if we could, we were going up to the Canyon.

TM: Where were you teaching?

JS: My first job was Arcadia High School. I taught astronomy and geology at Arcadia High School, which, in those days, was one notch away from being a private school. It was a really… The cars in the parking lot were worth way more than what the teachers made in salary for a year. It was a really good school with high academic standards. Then I got riffed, which is short term for more money problems. Then I went to Supai Middle School and I taught seventh and eighth grade math: algebra and geometry.

TM: How did you get that job?

JS: Because of my science background, I got enough math that…

TM: How did you even know they were looking for teachers in Supai?

JS: Oh, no, not Supai. Sorry. Not Supai the canyon. Supai Middle School, which is in Scottsdale School District, which is a middle school in the southern part of Scottsdale.

TM: I apologize. I misunderstood completely. I'm thinking, "Supai? Wait a minute." Okay. So middle school, still in Phoenix.

JS: Yep, still in Phoenix. And then, along the way, probably '84 or '85, I'm going to say '84, Emma took a course with Phoenix Community College in the summer with a river trip with the Diamond boys. She really liked it. In fact, we still have a picture that she took and it was still… She didn't know any… You know, new passengers, new river people. Flow, to them, there's a river, there's a river. However, they

were still dumping from the ’83. The thing that she remembered the most when we got on the river is we got to Crystal and all the boatmen were hugging each other. It’s because it was 45,000 which is the cutoff from fun or not.

It turns out that from that, she got to learn about other things going on about education. She heard about a class at NAU called The Ecology and Geology of Grand Canyon, which Stan Beus started with Steve Carruthers. They were the two main movers and shakers. Stan Beus is the original geologist at NAU. And Steve Carruthers, in those days, was a faculty member, and he’s one of the original ecologists to go down through the Canyon. This is just after, a few years after, he left the museum. They were the two that ran the trip. I was still pretty beat up the first year that she did the class, which I guess now is ’87, but they let me tag along. It was pretty cool. It was two weeks in town learning about the Colorado Plateau. We even took a bus ride up to Zion. We spent two weeks traveling around learning geology, biology, just of the area. Two weeks on the river. And then two weeks in town, writing up the two-week river trip, the data we collected.

And you gotta remember this was just after they instituted all the regulations on camping in the river that Carruthers takes credit for getting the data. Like campfires on the beach. When we sit on the beach now we don’t get charcoal. But, in those days, you did because of open fires. So he was still collecting the bits of charcoal. We were doing ecology—birds, mammals, all the basic stuff. It turns out that these reports that the teachers made, the Grand Canyon…I don’t know what they call them, Natural Resources Department, used it. They didn’t have the people at the south rim to do the trips.

TM: So the National Park Service used this data?

JS: Yeah. It was not just the usual summer/teacher/have some fun. The funny thing is that, of course, the beaches were still redistributing from the ’83 super-high flows. And Stan Beus… In those days it was stadia rods and typical surveying. Old-fashioned what we would call today “without-satellite” surveying, all right there, analog, writing things down. He said that there’s no pattern. There’s too many variables here. There’s less sand in Glen Canyon, there’s little sand in Marble Canyon, and once you get into Grand Canyon, there’s more. It’s always moving around and the difference is the height of the debris fan determines the size of the beach downstream. And this is this guy doing this with this old equipment. So Glen Canyon is the stretch from the dam to Lees Ferry. Marble Canyon is Lees Ferry to Little Colorado River, and Grand Canyon is from the Little Colorado River confluence to Lake Mead, by the geographical terms in those days.

TM: So in 1984, Beus had figured out that Glen Canyon had been desanded, Marble Canyon was desanding, and below the Little Colorado River things were…I wouldn’t say putzing along, but not as bad as upstream. He had figured that out in the mid-1980s.

JS: Yeah. And what made the size of the beach was… Let’s say a debris flow came down Hermit and it stacked up the boulders and everything. Let’s give it three or four months and it settled out. It turns out, that where it hit the water and settled and stabilized is the same stage, or the height, as 30,000. So, in those days, it was 3[000] to 30,000 in those days, the discharge, cubic feet per second from Glen Canyon Dam. So it never quite would get… It wouldn’t top it but it would come close so it would make an eddy below it and it would deposit sand up to 30,000. So now if you release 45,000 and it goes over that 30,000, you have 15 extra thousand cfs, we’ll say, or 4 or 5 feet of stage, that scours out the beach below it. So the size of the beach is dependent on the debris fan that made it.

TM: So you’re saying, if I can think about that in my own brain, it’s almost as if the debris fan as a dam, if you will, a damming effect, protects the downstream just below the dam of boulders and that’s where

the sediment will build. And that building of sediment depends, of course, on how high the river's going to come in behind that protected pile of boulders.

JS: Yeah. My job on those trips was we wanted to know what was the water quality in the water as the water went down. So water's released out of it. Is it full of nutrients? Is devoid of… Is it like sand in a filter of a swimming pool? I would go through and carefully collect this vadose they call it, this water coming out, and took it back to NAU Chemistry Department.

TM: And what did you find?

JS: It depends. Typical science answer, huh? At some elevations it did, and some elevations it didn't. It was catching some organic material and it was processing it, and in others it was just exactly the same as the river. We were looking for simple nutrients like nitrates and phosphates, that kind of stuff.

TM: I'm assuming then by the mid-80s here, everybody had realized that Glen Canyon Dam 13 miles/14 miles up in Glen Canyon from Lees Ferry, had dramatically changed the ecology of the Colorado River. What was the thought at the time, then? This was before the whole Glen Canyon Environmental Impact Statement, all the studies that happened late 80s into early 90s. Can you kind of, in a synopsis, capture what the thinking was about the river at the time, in the mid-1980s? And maybe it's not very different from the way it is today.

JS: In those days it was more… The fundamentals haven't changed at all. But the basics were, it's still true, you can't go back. Once you plug a river, it's that concept of "hysteresis" where you're never going back to where you were. You might be able to fix, or change, or probably come up with a couple of things that might help, but it's game changer a hundred percent. There is no relationship. Even then they made that pretty clear that you can't go back. There is no going back. I use this in my classes when we talk about resource management. One of the most famous ones that, thankfully is quit now, but with terrestrial things in forests around here, we say we want pre-European settlement. Okay? The trouble is you can't maintain anything in the natural world. There is no way to keep… What's your favorite year of your life or time span in your life that you think if you could keep living it you would? And you probably tried. Some people, it's the 20s, some people it's their 70s. Who knows? But you can't maintain that. So why do we expect to be able to maintain anything in the natural world when everything else is changing constantly at some level? Pretty much that's what some of what the big picture stuff was. This is a major change and so some of the original boatmen, like Pete Resnick and Dierker, well, Carruthers, he used to - row a snout, 22-foot Rogue snouts, which I have a hard time even understanding. These were the people collecting the original biological data in the Canyon for money through the Museum of Northern Arizona. They figured out pretty quickly that there's no ecological restoration here. This is just telling the Bureau of Reclamation, "Here's what you got. Baseline data." They quickly found out that if you talk about trying to make changes, you're going to lose your contract. They told me this as a teacher in those days that, "Just shut up, sit down, collect the data, don't worry about it." So we always put these management implication parts in, but they're pretty rudimentary.

TM: Had anybody done any data collection, in any shape or form, before the dam? Before 1963 had anybody looked at the river as far as the biology of the river, fish species, aquatic insects, amount of sand, and back eddies? Had anybody done any of this kind of research pre-1963?

JS: Not to the level that was required. There was natural history people for fun. If you get a bunch of scientists together, there's always an entomologist and they're always going to be looking for bugs. However, that was all just notes. There was never really anything published. The only real science that ever occurred was for archaeology in Glen Canyon, they didn't even go below the dam site because… Is it 1914? The Antiquities Act forced the Bureau to send down archaeologists through Glen Canyon. But

they didn't go below because all they knew was that the reservoir was going to inundate everything. There was going to be water below.

TM: Right.

JS: However, like I say, every time you get scientists together… Two archaeologists, Polhemus and Polhemus, two brothers were archaeologists, they were into water bugs. They collected hemiptera.

JS: And that's it. One paper on…

TM: What year?

JS: This is '57. It's the only bugs collected prior to the inundation because they weren't required to. And then the next was {Steve] Carruthers. Carruthers' book, still today, that he published in '90, no '86, somewhere in there.

TM: Published with Brown?

JS: Yeah, Carruthers and Brown.

TM: In early 1990s, mid-ish, yeah.

JS: Those fundamentals haven't changed a bit. It's still the same. Our level of detail is better because our technology is better. Our statistical analyses are better, but the fundamentals are still the same. Haven't changed a bit. Those guys, in those days, they had those basics figured out. So, if you fast forward to now, and everybody knows about sand in Grand Canyon. Well, the reason we all know about sand in Grand Canyon is because the commercial river runners figured out pretty soon that there's less camping in Glen Canyon, less camping in… You know what I mean? They got the idea that we need sand for camping. It's really ironic that sand got such emphasis below Glen Canyon Dam because it was built as a sediment trap. Its number one purpose was a sediment trap. And then we spend all this time and money, and still today, to try to understand sediment that is purposely trapped. But yet we spend all this time and money, trying to say… But, it's really easy to convince people of sand because there's either enough or not enough. I think it helps the upside of that, even though from a purely scientific standpoint, it's silly, wasted money, it gets people to observe and pay attention. And that, probably, has far more value than anything else. So, when the boatmen go down and take pictures of beaches and, "Oh my gosh, look how big the beach is. Oh my gosh, the beach is gone," it's what Stan said would happen. It depends on the flow and the debris fan that made the eddy below. It's just as simple as that. And that's why the straight shot camps like Grapevine have a really hard time maintaining because that's a really low debris fan there. It comes and goes based on the input from the watershed. All those big streams—the Paria, the Little Colorado, Kanab, the three big ones—are all dammed. They all have diversions on them. They're all manipulated. The whole thing from a sediment standpoint, and all the time and energy put into it, is diminished. And Glen Canyon Dam just makes it even worse.

TM: Right. So, let's back up a little bit. This is 1986-ish, 1987. You're on the river as part of this summer teaching course, you tool around, you do a river trip, you write up what you saw. And then what happened?

JS: On my trip, anyway, the big thing that happened was we were at Tanner. Big beach, tied up in the side in shade, and Dave Wegner comes down. He's the sole full-time biologist for the Bureau of Reclamation. And he came down to tell us they just signed off on doing a full EIS. So this was under Environmental Impact Statement for Glen Canyon Dam.

TM: Do you remember what month was this? What year was this?

JS: This was end of July 1989.

TM: Dave Wegner wanted to come in to tell Carruthers and Beus that this had happened? Because my running assumption is he was going to need those people.

JS: Exactly. And, remember, we were these boatmen who were also scientists and these teachers were the biggest group of people currently working on the river. It was probably a full trip. What was that in those days? Twenty-seven, 37? It was a lot of people.

TM: Forty-two is the commercial…

JS: It was huge.

TM: It was large, yeah.

JS: I mean, it was a three-pooper setup in the morning. I mean, it was a big, big trip.TM: Hmm.

Yeah. He came in and told us and, you know, OK. We're looking at each other, well, they're going nuts, man. They, like, you know, that's just… So he just hiked in to tell us. You know, in those days, there's no phones. And we were there when he showed up. He just *showed up*. It was really pretty cool, in retrospect, that he just hikes in and there we are, to tell us all this cool stuff is going on. So that's really the big take-home that changed after that. But these reports… We would make a report, probably 150 pages of the little synthesis that the teachers ran. But the raw data. We would type up the data for them. Computers were just getting going in those days. They would have the numbers to show that we found these lizards here, we got these birds, what studies we were doing. Larry Stevens was involved, and he was always interested in tamarisk in those days. Any animal sightings. Carruthers loves the fish, so we would collect some guts for analysis. It was rigorous, but it was more of a natural history kind of surveying than anything else. No experiments or anything like that. But really good natural history science, I think. Really good for teachers, particularly grade-school teachers, that, even today, usually end up going into grade-school teaching because they're not that science literate. So it was a really good way for them to get immersed in science. Really helpful in that regard. So it helped both the educators in Arizona and the Park Service. The next step, though, for us, because money was coming… Larry Stevens was always looking for help. So was Carruthers. They still do.

He had a trip in January of that year-, that was '90. And'90, and the launch was with the Stanton rematch. For verification, if you ever look at the Stanton book that Webb put out from U of A [University of Arizona], as we're going through Hance, there's boats in it. So these guys matched, in their minds eye, anyway, to the minute, when Stanton took his pictures to prepare to put the train to take coal from Grand Junction along the Colorado to Southern California just for energy needs. It just turned out that 100 years later, we ran Hance at…it wasn't even 3,000 [cfs], it was wintertime. I vividly remember that. And those guys were pretty mad that we went through. The boatmen, a guy name Jeff Aronson and Larry, were pretty freaked out because it was low. It really was easy. It was slow, it took forever. I could have gotten out and walked as fast. It was only knee deep. It was really something. Just to let you know, Emma and I were in those boats. So I took a leave of absence from my job, they gave me the month off. Part of the fun stuff that we did… It was a five-week trip. It took us seven days to get to Navajo Bridge. We were coring hackberry trees. There's a lot of hackberry trees between Lees Ferry put-in and Navajo Bridge. I never realized that till you go and find them all. We didn't make it to Cathedral the first night. That's not even 3 miles. But it was cold. So we went to Phantom Ranch and everybody hiked out but Emma and I. We camped at the normal beach, in Cremation we call it, and rowed back and forth every day and hiked all over Phantom Ranch. About in the middle of it, we hiked up to Bright Angel Lodge and

got cleaned up and spent a night up there and ate real food. So we called it a "vacation within a vacation."

It was snowing. Ah, we had a great time. It was great. It was a great winter trip. Freezing, freezing cold winter trip. Ice, you know, the whole thing. But it was great. I think because we were both NOLS people, we were competent. And I thought desert backpacking was pretty fun and relatively easy. Boating was like a dream come true, compared to a mountaineer. Your equipment is carrying you. You eat the weirdest, greatest food on the face of the Earth. And there's nothing, really, to do. It seemed so easy compared to mountaineering, where everything… It's much more intense. And don't get me wrong, river running with big water and boats is intense. But the regular, day-to-day stuff was fun. So these guys recognized that in us. We got offered either a job or go back to school. I picked going back to school. Going back to school meant getting a master's at NAU in ecology. Emma was already in a program with Dr. Beus in geology. And they offered her if she wanted to quit teaching and go back to school full time or go to work for the park or the Bureau. She elected to finish her geology degree with Dr. Beus and teach. Kept her job in Paradise Valley school system teaching and coaching there. Meanwhile, I decided to go back to college, to the university to get a master's degree. Then for one year we had a commuter relationship. She also took time off, leave time.

Then she made the big decision to quit teaching, which was a big deal, to quit the security—low pay, but the security—of the retirement system and benefits and all that to be a graduate student. And in those days, graduate student in the 80s, you got nothing, man. You gotta make your own way. So we explained that to them and they came up with money so that, in the end run, we ended up with four degrees between the two of us and no debt. Because we just kept bugging them that, "Wait a minute, we can see there's money around here." In the long run, I think that the best part of all of the research that the Bureau does on the entire basin is that they are really free with money for education. I don't agree with how they manage things and do things ecologically or for the environment. I don't agree with their priorities, but they do help with education. Dozens and dozens of people have gotten educated through the Bureau in an indirect way.

TM: And the Park Service does that as well, don't they?

JS: The Park Service… I think it's the Bureau that set the bar and the rest of the Department of the Interior goes, "Huh. That's a great idea." Then you end up getting people... One of my buddies… Maybe you remember Kevin Wilson, who got a degree at Devils Hole. Studied the pupfish, the first endangered fish over there in Death Valley. Went to Toronto, University of Toronto, and studied streams and climate change and now he's chief of resources for Death Valley. But it all came because we hired him from Crystal Creek Sandwich Shop to work on the Colorado River. Full-time, full-paid position in Flagstaff to work on the river, those are pretty hard to come by. He parlayed that into a full… He's a career parkie now.

TM: What do you remember about Glen Canyon Environmental Studies? Sounds like you saw it form right there on the beach at Tanner when Wegner walked up to Beus and Carruthers and said, "Hey, we've got some money now. We've got money to really look at the river in a very microscopic way, if you will, while they're looking at rewinding the turbines in the dam and being able to release a higher flow through the turbines."

JS: It was frenetic. It was science on not just steroids, it was science on turbo-boost, nitro-fueled steroids. And it only lasted six years. It started with that day, that announcement of the money being allotted for the first full EIS to determine Glen Canyon Dam's impact on the Colorado River through Grand Canyon. It ended in 1996 at the first 45,000 high flow. Dave Wegner lost his job. Actually, he

didn't lose it, he got reassigned, if he wanted it, to the Bureau in California to monitor a canal or something. But in that six years a lot happened. In retrospect, it was a lot of wasted money because it was happening so fast. However, the people that were involved were highly, highly dedicated and highly, highly motivated. As Wegner would say, "Good science." Always saying, "Do good science." But, really, the gestalt was: Maybe we can counter the Bureau. I don't think it was hidden that people really didn't like the way the thing was being managed. Really, there's no book for this. Maybe there is now, but, in those days, there was no real book, "Here's how you operate a dam."

So the stories are… You always hear the stories. The dam operator, the main guy's name was Dick White. And he, they say, when they were just closing if off and the cofferdams were closed, how much do you let out? There were no rules for this. There was no we call "minimum flow criteria" now or "instream flow criteria." Really important EPA different germane things. That hadn't been established yet. Not even close. Well, he was on the phone they have to the operator and said, "Let out a little more." And the story goes…and I asked him this with another student tour, he goes, "Yeah, that's pretty much what we did. We wanted to let out enough water to make it look like a river." When you stood at the dam and you looked downstream past the runoff from Page it makes a righthand sweeping turn, it goes from bank to bank. The island is there, but it covers it from bank to bank. That's 3,000 cfs. That's how they got the minimum flow of 3,000, and that's how in the winter when they were really trying to save water, you would not always have 3,000, because there weren't that many gages to even tell if they were. So, in their mind, they would average 3,000. So if you're doing a winter trip and you just happen get Sunday water at Lava on a Tuesday, it might be 1,500. Just happened to be that run through Hance was less than 3,000. And that's like, "They can't do that." They laughed, everybody laughed, "They can do what they want. There's nobody to tell them no." The Grand Canyon Protection Act was just getting started. On that original winter trip in '90 was also a side trip that with Jack Schmidt and…I lost his name, the fellow that started Natural Channel Design that died in the plane crash with Frank Protiva.

TM: Oh, um… Tom…

JS: Tom Moody.

TM: Moody.

JS. Okay. Tom Moody and Jack Schmidt, on this trip is where they sat around with these Middlebury students, Middlebury, Vermont, Jack was a professor there, came up with the nuts and bolts of going to Washington and starting to fight for the Grand Canyon Protection Act. That was a class that those guys put together to come up with the nuts and bolts to outline the rough draft of the Grand Canyon Protection Act. That I'm aware of, anyway. I'm sure there was much more before that, but that was the focus of their river trip. We camped with them a couple times. I was really naïve, and I remember thinking you're really gonna tell the Bureau of Reclamation what to do? That's like telling the FAA, the Federal Aviation Administration, or DOD, the Department of Defense, "Here's what you should do for the environment." That's how I was… I still do look at the Bureau like that. The environment and the Bureau are like opposites. One's an extraction thing. But they did it. Now, is there teeth to it and all that? Who knows? But the funny thing is that's when it… So that was a pivotal time, the agency time to get things in order. Grand Canyon Protection Act, money for the first full EIS.

TM: Can you tell me a little bit more about the Protection Act? What it was attempting to do and did it… Today, in 2017, is it still doing what it was intended to do?

JS: Well, it's another one of those things. It depends on who you ask. The EIS is the data. This my version, anyway. An environmental impact statement is supposed to be a scientific document to

describe, through data, the environment that you're looking at that has some sort of environmental aspect that you got to quantify. The Grand Canyon Protection Act is more of just what it says, is that we know that there are threats and risks to the Grand Canyon. We need to define the policy to prevent these threats and risks to diminish the quality of the environment. So they're parallel, really. You really can't have one without the other. You can have all the data you want, but there's no policy with it there's no teeth to it. And a lot of this is fake. A lot of this was 100 percent politics because if you've ever seen the hydrograph for 1991…they called them beach building flows or beach something flows; it's always got to do with the sand. It was crazy discharges, followed by steady 5,000 to study the sand, basically. And we, Emma and I, both got involved in those, she more than me, and that's when I started doing more aquatic ecology trips. One right after the other. We were supposed to have this done/the reports out for the EIS in 1992.

The problem was they already wrote the EIS. They just did it without data (laughs) because we didn't have the data done and they already had the alternatives and preferred alternatives, and we were still working up the data. We all were. Most of the sand data that drove the boatmen nuts at that time, everybody nuts, because you never knew really what was going on…these were really radical flows, to try to figure out what it meant to the sand. That was the impetus because the commercial river runners wanted sand to camp on. Well, everybody did but they were the pushers. There was really no organization for private river runners in those days. I'm thinking, wait, we haven't submitted reports yet and you guys are already coming up with the alternatives and everything. Right then and there it's like okay, those guys told us that just sit down and hang on, it's got nothing to do with your data. So, sure enough, the preferred alternative that they came up with matched exactly the flows that they had before the dam was rewound.

To back up a little bit, in 1990 they were rewinding the turbines. They were upgrading them. They had better technology, better magnets, I guess. I don't know. They rewound them, redid the bearings. Maybe they had ceramic bearings. But, anyway, they could make the same amount of electricity with less water. So they could raise the bottom and lower the top. Which is really all that EIS did was raise the bottom, lower the top. So instead of 3 to 33, it was 5 to 20. And in that 5,000 to 20,000 cubic feet per second, they altered the ramping rates a bit because we knew that as the water came out of the beaches it would calve off the sand. We all think that the beaches get washed out when water comes up. They don't, really. At least equal and on some beaches, more is lost as the water goes down, because as the water drains out, it pulls the face of the beach with it. So, as river runners, we see the beaches being cut if the wind is against the eddy. So if the eddy is going upstream and the wind's going downstream, that'll really eat into the bank quick because there's too much friction. But if it's not windy, it's smooth, as the water comes out, it makes these rivulets and then it calves off the sand. The balance was don't raise it as fast and don't lower it as fast. So the ramping rates were moderated a bit.

TM: And they were able to do that. As you mentioned, you measure water in cubic feet a second and before the rewinding of the turbines, they were going from 3,000 cubic feet a second to 33,000 cubic feet a second. After the rewinding, to produce the same amount of electricity, they were able to keep more water in the river at a minimum flow of 5,000 cubic feet a second and then they would go up to 20,000. So what this meant is they could store more water in the reservoir. So therefore they could produce this electricity longer with the amount of water they had in the reservoir.

JS: Right. And one of the things you asked me about doing this little interview, is whether there are some take-home messages. One of them is that the dam was built to be a sediment trap. It's the original reason. Lake Mead was filling in too quick. The second reason was recreation because they knew they could make money off of the lake because they knew they made a ton of money off of Lake Mead from

recreation. The third was water storage to help keep the water level up in Lake Mead, the 8.32 million acre-feet average every 10 years. That's all part of the plan devised in the 40s. The fourth was hydropower to pay the bills.

The number one use of that water was the rural electrification of the Colorado Plateau. It's not the major cities like they market. They sell it to them, but the first cut at the electricity is, basically, Mormon towns throughout the Plateau, which no one in their right minds has a reason to live there. There's no reason for these towns to exist without government subsidies. And there is *absolutely* to reason for them to exist and grow winter rye and soybeans and alfalfa without abundantly cheap electricity to pump the water through their irrigation system. As far up as Carbondale, Colorado, that I'm aware of, anyway, because I know people that live there, Page, Monticello, Blanding, Bluff, all those towns are co-ops. They're Bureau, they're Colorado River Storage Project, CREDA, Colorado River Economic Development groups, Western Area Power Association, clusters of towns that have no utility. There's no Arizona Public Service or Salt River Project. It's directly from the Bureau to them. So, on the high-flow years where they're making extra, the people in Page, they got rebates. In 1997, they actually got money back from the Bureau because it's a co-op. They made so much money in the high-flow years. So it's exactly the opposite of what everybody thinks, that it's all for the big cities. So it was really… Mormons control the West and natural resources, and this is a really key part of the population of the West.

TM: So in the last 10 years, there's been a fairly substantial drought in the West and on most years the dam would peak out at 17,000 cubic feet a second and many months when it was running 7,000 to 11,000 cubic feet a second. So, clearly, they were not producing the electricity they thought they would. How did they meet their long-term electrical demand? Did they go back to Blanding and Page citizens and say, "Well, this is a co-op and on our side we now need…or we can't give you electricity." Or, "We need you to help pay us for the loss that we have?"

JS: Right, the rates went up.

TM: They did.

JS: And probably this year because we're going back to equalization. In fact, the past two years, they've released a little more than the minimum they have to, and therefore they're making some of that money back. So I think they spread out… For some reason, they use 10 years for everything. I don't know why. But it's over 10 years. So their co-op agreement is based on cost over a 10-year period, I think with the idea that within 10 years we're gonna get a wet year to balance it out.

TM: Okay.

JS: So they had to purchase electricity from other places throughout the grid.

TM: And when they have to purchase electricity from other places, my running assumption is they probably buy that electricity retail.

JS: Yep.

TM: And they sell it wholesale.

JS: Yep.

TM: So who pays the difference? Meaning, if I'm an electrical supplier and I sell electricity as a contract and I make wholesale contracts I'm going to sell to a town somewhere on a wholesale rate and I can't

meet that commitment. In order to meet that commitment, I have to turn around and buy on the spot market at retail, and then sell through at wholesale. I'm losing money. And who pays for that?

JS: The consumers of APS and SRP and the other utilities throughout the West. The for-profit people bail them out.

TM: Okay.

JS: Yeah.

TM: You mean their rate payers bail them out?

JS: Correct. So we subsidize… When you go through Monticello next time on your way up to do a Moab trip or Cat trip and you see them irrigating, we all pay those farmers to do that.

TM: It's interesting now because Monticello has a large wind-generating facility right in town now, and I wonder how that electricity pays into the…

JS: That is a great question. I don't know.

TM: Is that a Bureau of Reclamation project or is that an independent project that feeds into some grid somewhere and wheels off to Vegas or…? I don't know.

JS: Without looking, I would say, without a doubt, it's the Bureau.

TM: Huh. Interesting.

JS: Because they control, you know… It's the Bureau of Reclamation, Western Area Power Authority, Colorado River Economic Development Association—so WAPA, CREDA, the Bureau. There's a fourth one, Colorado River Storage Project. That act worked, that work together with those three entities for all water and electrical management on the Plateau. Starting as far north by Evanston on the Green River, that power plant way up there. Then Flaming Gorge, actually East Bell, gosh, I used to be able to rattle them all off. But all the way down, there's power plants and reservoirs, power plants, throughout the whole basin. They are the ones that shuffle all that around on the western slope.

TM: Let's move back then into, it sounds like 1991, where the data is coming in on these flows. It sounded like there were, if I can get this right, it was a five-day flow that could be very variable. It could be a solid high flow, it could be a solid low flow; it could be some sort of ramp up, some sort of ramp down; a fast ramp up with a slow ramp down, or a slow ramp up with a fast ramp down. Different heights, different cfs's, meaning different heights. And then there would be a fixed three days of low water, a constant 5,000, and there were four river trips doing four different sections of the river. They would survey a specific number of beaches to look at the sand after the prior week's flows. And that happened all through that year.

JS: Yep.

TM: What you're saying is, the environmental impact study alternatives and preferred alternative were already written and decided upon while those studies of the flows were ongoing.

JS: Right. So they backtracked. They knew enough on what flow makes what for electricity. They backtracked so they made sure they were not going to lose their ability to make the equal amount of electricity. Weren't going to let environmentalists determine electrical production.

TM: Got it.

JS: So all of the alternatives were basically slight adjustments of what they already knew. If it turned out that it matched something that might benefit the beaches, well, then it's a win-win for everybody. That's essentially what happened. The documents convinced everyone that the slower ramping rates up and down were the way to go. And then we still are dealing with that today to the point where the extreme now is this nonsense of steady flows on the weekend are supposed to help the bugs and not diminish the beach size. We've been advocating… Even in those days, I said we should match the natural flow of the river based on the past. If it's a 10-million-acre-foot year, then find a past 10-million-acre-foot and just make that hydrograph match seasonal flow. We've never had a steady-flow experiment. It's never happened. All of them have been disrupted somehow, some way. We've never had one long enough for a biological response. We've had them long enough for an abiotic response, but not biological.

TM: How long would that need to be?

JS: The minimum… The data shows that an amnesiac—so amesic—I don't know about the desert because it's so hard to study—but a normal river in, say, the Mississippi Basin, if it's a flood in a tributary, enough to move the bedload, move the sediment, the boulders, a minimum of 30 days to get the bottom of the food web back to some operating standard. Your chlorophylls being produced, the bugs are coming back, the fish are going back to where they belong, the trees are starting to adjust. Adjustments are being made. At the minimum, under optimum conditions—there's others that say it never does—but the minimum is 30 days. We have never had a steady flow of anything for 30 days. However, it's the sediment because you can get abiotic data instantaneously with an overflight. So the whole thing's been skewed toward physical data. A remnant of that is this need for beaches for camping. The biologists have bought off on, "Well, at least give us three days/two days of steady flow." So for us, we laugh and go, "So, yeah, so the fish and the bugs, the aquatic insects are gonna have a weekend off."

And the funny part of it is, the whole thing is nonsense because it isn't gonna be steady. It takes three or four days for the river to equilibrate. A weekend steady flow - at least vary as Lees Ferry is a mid-week steady flow downstream, and it really will never become steady. It'll just be slower because it'll just be draining. And just by the time it reaches the bottom, it'll start coming up again. They are deathly afraid of getting the data because everybody knows if you take a variable out—in this case, flow—you're gonna have a biological response. And if you want more bugs and you want to recover native fish, you've got to have a biological response. You've got to remember, in those days, the Park Service was the grantor. USGS was a contractor to the Park Service. And that in itself was… And it didn't work out. The Park Service could not handle millions of dollars a year administratively. They couldn't do it. They didn't have the ability. In the Park Service, they didn't have the expertise to run environmental studies of the river. The Bureau struggled. Dave Wegner's crew probably was the best you could throw together at the time, in such a short space of time. There were reviews done even from, what we call a GCES Phase 1, which is basically Dave Wegner in the office and Mike Yard on a boat, and volunteers and a few seasonal people. And they got reviewed for that. National Academy of Sciences and National Research Council reviewed them. That was in Santa Fe in the late 80s. So we were starting to understand, you. You gotta remember, the journal that regulated rivers had just come out in the early 80s, and it was European-based. They've regulated rivers long before we did. The Romans did it. I mean, they've known about channelization and impoundment and all that, long before. But there was really no information. The two key people in North America were Jack Stanford and R.V. Ward. Those were the original people and they were involved in it. And they were still just trying to figure out what was going on. We didn't really know what the implications of a dam were at those times.

TM: Okay, so we're talking about a natural flow, with bugs and native fish and temperature modifications and sediment, driftwood. Let's back up a minute because I kind of want to get back to you and Emma in 1991. We've gone off on a little side track, if you will…

JS: Little details, yeah.

TM: …about dams and dam management. I want to get back into this, but before I get there, we've got just about 27 years to fill up, maybe 25. Because you're working on your master's at this point or your Ph.D.?

JS: My master's.

TM: Okay. So 1994 would have been the first habitat flow. I don't want to say "flood flow" because when I think of the Colorado River pre-dam, I think of the lowest high water in any summer. So if we have a spring runoff, the lowest high spring runoff is about what the dam can do wide open. With the jet tubes and turbines all running is about the lowest high flow. So I kind of want to keep that in mind, but then say, okay, 1994, they're trying to mimic the floods with the first habitat flow up to 45,000 cubic feet a second, only for a couple days, and then we're gonna drop that down. I want to get there yet. So are you still going back and forth to Phoenix at this time?

JS: No. I was done in '92, graduated in '92, got my diploma.

TM: Your master's was in…

JS: My title was aquatic… I don't even remember now. It was probably way too long. But it was aquatic ecology. "Benthic Ecology of the Colorado River below Glen Canyon Dam through Grand Canyon National Park" or something like that.

TM: That was your thesis project.

JS: Yeah.

TM: Yeah, yeah. But this was a master's in biology, then?

JS: Yep, mmm-hmm. In the Biology Department at NAU, yep. With Dean Blinn. Peter Price and I think Larry Stevens was also on my committee. All-star committee. Man, it was great. I learned so much in those two years. And then Emma finished, also. She got her geology degree. Then she came up, was working with us, and Dean said, "Well, why don't you get a Ph.D.?" to Emma. Emma, at that time, wanted to study coyotes or wolves. She couldn't find anybody to help her. A fellow named Gary Bateman was the wildlife biologist on campus, the only one. He wouldn't touch it because he said it was too difficult. Grand Canyon was too hard to work in. We still don't know anything about coyotes in Grand Canyon. But, anyway, Dean studies diatoms which are the unicellular algae. Emma finished her degree in '96 and she was the first one to study the linkages between Lake Powell and the river and how it affects the algae. We know the dam does things for temperature and flow, but Lake Powell is not static. Lake Powell only holds two years of water and it goes up and down like crazy. It changes dramatically over the course of a year, between years, and over decades. And the water chemistry changes. And what does that have to do with the primary producers, or diatoms, downstream? So that's what she studied. The nutrients, the minerals, and its effect on the bottom. And she taught herself German. Like I say, most of aquatic ecology came from Europe. That's the original aquatic ecologists. The keys for diatom's in German. So she taught herself. She's pretty smart. She's way smarter than me. She taught herself German to read these. We still have them. Richard Quartaroli in the NAU book prison has got one that in the 90s cost $10,000. It's *the* German treatise on diatom identification at that time.

Now it's all genetics. But you can't take it out. And our microscopes that we use to do that kind of analysis, you can't carry around. So we would go over with cameras and take pictures of the pages. Yeah. It was just those silly things. But, anyway, so that was '92 to '96. Then I went back to school in '96. So we didn't overlap, going to school. I graduated in 2000 with my Ph.D. That included the tributaries this time of the Grand Canyon. So it was still more of the same of what I did before and included tributaries.

TM: Okay.

JS: And at that time, to make it even more fun, Allen Haden, who's over at Natural Channel Designs now, he studied the upper basin. So, basically, what we got paid to do was prove that aquatic organisms need to be wet. Because the Bureau thought that the intertidal zone… They'd used the marine analogy that if you keep fluctuating it enough, we'll come up with a whole new bunch of organisms here that'll live in the intertidal, therefore, we need the intertidal. So Wegner convinced them that we need to go up to the inner basin. The assumption is that when you go from the Green River above the confluence of the Colorado, and they meet in Cataract, that that has some similarities to the pre-dam condition because they're far enough below dams that they've recovered in some way. It's probably true because the beaches come and go like crazy, the flows are dynamic, and it's covered with bugs—the kind of bugs that everybody likes, mayflies, dragonflies, you name it, they're up there. And there's a ton of native fish and a ton of non-native fish, and they all live in huge numbers up there. So, why? And they didn't like it because it turned out that it's completely different. So we got a window, we said, into the past. Not perfect, but remnant. Freezes in the winter, gets up into the 80s and 90s, you don't need a boat all the time, you can just float. There're bugs galore, there's wood galore. We think that change is bad, but aquatic ecosystems need a variable temperature. You need a range of temperature for the bugs to go through their life cycle. The cold is just as important as the warm. It triggers them.

Most organisms, earthly, it's about 10 degrees C—50, 52 degrees Fahrenheit—triggers reproduction. That's the spring. Soon as the atmosphere hits 50, spring happens, everywhere on the globe. That's the big key. So when you mess with that temperature range, and you don't get that, or don't achieve it enough, you're never gonna get what you need for more natural or normal type of biota. You're gonna get weedy species that grow like crazy and invasives will come in. And that's what you get below a river, a dammed river. Weedy species, invasives explode below. He figured that out. The and it's the fun part of science. So we went up there July 4th weekend, pretty sure it was the weekend, 1995, I want to say. Anyway, it's 45,000, and we didn't know; it came up pretty quick. We just thought, oh, no big deal. So we had one rowboat and a boat called the Splash Master, which was a 13-foot pontoon boat—metal frame, 40-horse Mercury two-stroke engine—and a rowboat. I had a rowboat, me and Kevin, and Allen's in this sport boat. We're at the put-in, and a guy named John Weisheit, he's an environmental advocate out of Moab, and he was at the ramp. He turned to Allen and goes, "You're going to die." That's really not something you say to somebody when you're putting in and the water's up, but that's what he said. You couldn't pull in, there was no eddies. It was at 45,000, and I didn't know. I was just learning.

TM: Where were you putting in?

JS: At Mineral Bottom on the Colorado side.

TM: On the Green side, at Mineral Bottom.

JS: No, I got it wrong. Potash.

TM: On Potash, okay.

JS: Putting in at Potash.

TM: So below Moab, on the Colorado River, above Meander Canyon and above the confluence with the Green River that drops into Cataract Canyon. It's 45,000 cubic feet a second on the Colorado, and you haven't even picked up the Green flow yet?

JS: Right.

TM: Hence, John Weisheit says, "You are going to die."

JS: So we were looking at each other and… You know, we're just flying down through there and…

TM: Wait. You're in a rowboat and Allen's driving the Splash Master 40-horse. Okay.

JS: Yeah. They got ahead of me. They were doing something, looking for fuel, I don't know. They were doing something. I was just floating along. We said, "Well, let's meet at the confluence before we go in, to check it out, see what we're doing." It's hot but I was cold. Cause I started a fire and they never forgot. All they ever talk about is Joe had to start a fire. Well, you could, for one thing. Anyway, I was cold. But I couldn't pull in. The boat's there, they're standing on the shore waving to me to make sure they see me, and there's no eddies. And I'm flying. I'm going, like, 10 miles an hour. I am cookin'. I could see this isn't gonna go good. I had to kind of break through the eddy fence to get into where a little slack water was, where the little Splash Master was just bouncing up and down. I remember pulling, pulling, pulling, and then jumping up, running on the front of the boat, untying the bowline and throwing it. Just as I was about ready to go around something—probably bushes—they grabbed it, and I got back on the oars. So we're looking at each other, "So, what? What do you think, you know?" So we went for a swim; this is probably how I got cold. While we're swimming, we're getting hit with driftwood. We picked the driftwood up, and we're looking at it, and it's covered in freakin' bugs. I don't mean, like, two; I don't mean 200; I don't mean 2,000. I mean like 2 million.

TM: What kind of bugs?

JS: Everything! Covered in bugs, larvae. Yeah! So this was probably our fifth or sixth collection up there. We had these exact spots where we go and it's a certain level to get to the bottom. We wanted to... The full scientists that we were in those days, we wanted to be perfect in every freakin' way. We can't get down to there, you know?

TM: So hang on a second. So you had a little clam shell device or something that you would drop down to the bottom or…

JS: No. We had that, too, yeah, but we were supposed to go down into the cobbles and collect, scrape with this…

TM: You mean, just walk out and wade in up to your knees or so, and scrape up the bugs on the rocks.

JS: Right. It was way, way too much water for that. But we're gettin' hit with these, these… We're gettin' hit! There's wood everywhere! Another reason I started a fire. We're just getting pounded and covered with bugs. So, let's collect this stuff. It's bugs. We came here for bugs. Let's collect some bugs. So it turned out that the bugs were even on the rocks all the way up.

TM: Wow.

JS: What we learned is—we got a paper out of this—what we learned is that the driftwood is a habitat unto itself.

TM: As it's floating in the water?

JS: As it's floating because it catches these eddies and stays there for a long time. Like hours or days in one eddy.

TM: Is this wood that's not necessarily floating on the surface, but is actually in the hydrologic stack of water from the bottom of the river to the surface?

JS: Yup. And then we think that when it hits shore, they might vacate and then try the rocks.

TM: So bugs might vacate?

JS: Right. They jump off the wood and get to the shore because we were finding them on land. If it was rocky, we were finding them. this is rare. Stuart Fisher out of ASU and his wife, Nancy Grimm, at that time, were studying the spates on Sycamore Creek, one of the Sycamore Creeks coming off the Mazatzal's. They were the only ones that we knew of that were studying floods in a desert environment. Turns out they were in Australia, but we didn't know it at that time. That's it. You don't go there when it's flooding, right? You're gonna die. Stay away.

TM: That's right.

JS: So here we are, three guys out camping, trying to collect, and all of a sudden, we figure out, "Huh, we can collect driftwood." So we got to our sites and we collected driftwood.

TM: But you're above Cataract at… I'm assuming the Green was… If the Colorado's running 45, I'm assuming the Green was running 30, so you're probably looking at Cat at 70,000/75,000?

JS: There was a lot of water, yeah. The gages went. There was a gage problem. So we never really knew. How we ran it was you couldn't pull in. So it was a big deal to pull into our collection sites, which, luckily, we had guessed would be available. The best river-running story is… So Allen would go up and motor scout, you know, and then point to which side you go down. So it's Kevin and I, and this is bail-bucket days. So it was Kevin and I, and Kevin would say, "Why don't you go the right?" "OK, I'll go to the right." And, oh, now he's pointing us… So he would adjust me on where to enter. Then he would wait until just as I was going in, and he'd be to the side, and then he would keep pointing, and that meant: If I'm going in on the right and he pointed to the right, keep going to the right. Or I'm going in on the right and now he's pointing to the left slowly, that means I've got to go to the left after I go down a ways. That's how we scouted it. The worst one was… There're three drops, right?

TM: Big Drop 1, 2, 3.

JS: Mmm-hmm. We pulled it above 1, and we ran all three at the same time.

TM: Oh, wow. Because you can scout 2 from 1, but to scout 3 from 1, you gotta walk down that far.

JS: But we didn't know. None of us had been there at high water before. We had probably done five or six trips, but they were in the fall. And they'd been at 5,000 or something.

TM: Nice. It's a nice run at 5,000.

JS: Yeah. So we get down there, and there's the Park Service in the…

TM: (laughing) Waiting to catch you.

JS: …one of those high speed…

TM: The catch and release boat.

JS: …cool engine…

TM: The jet boat. Yeah.

JS: The biggest thing I remember is I guess we call it "haystacking"? Where you don't really know… Having a plan is worthless. All I did was oppose the waves. Whatever came, I opposed it and pushed as hard as I could.

TM: So, wave came from the right, you turned the boat to the right and faced it. Waved came from the left, you turned to the left.

JS: And they were so steep that… Poor Kevin is just bailing and bailing and bailing. He goes like this [gesture], and a wave broke on his arms and took the bucket out of his hands, but didn't get his face wet. That's how harsh and steep they were. It was just those weird hydraulics. But we ran down through, the Park caught me and pushed me to shore. And I knew those guys in those days. They said, "Joe, come on, let's go look up in the Gut." I said, "Okay, let's go." So I got in with them. They caught me above Imperial, which was washed out. I got in and I asked those guys, and they're into the whiskey by then, I said, "Can I go?" "Yeah, go ahead. I dunno. Sure." They ran up right into Satan's Gut and eddied out right at it, and they said, "Go up and take a look." You could look right down… It was like China.

TM: Wow.

JS: It was incredible.

TM: You mean, looking down into a big hole off the front of the boat.

JS: With them just sitting there holding, waiting to see if anybody else was coming or not.

TM: Wow.

JS: Yeah. That was a blast. So that was a combination…

TM: Who was running the boat at the time? Who was running the Park boat?

JS: A parkie. And I can't recall his name.

TM: Steve Berry, "Teaberry?"?

JS: Yeah! Yeah, that sounds about right. The guy's been there for a long time. It's easy for him. It was nothin'. Smooth as silk.

TM: He's getting ready to retire soon.

JS: Ohhh. Yeah. What a blast that was. That was one of those really, really memorable trips because we come up with new science, come up with a new way of collecting, we came up with a whole new concept. Just the way science goes. Just at that point in time and we had this just outrageously lucky run through Cataract that we probably didn't deserve. (laughs)

TM: But you did good.

JS: Oh, yeah, god. (laughs) Yeah. It was… Oh my gosh, yeah, it was really something.

TM: Cool.

JS: That was… We liked it because it showed that there *was* life in a muddy river. See the concept was, back East, if the river's muddy, there's nothing in it, right? That's a fundamental paradigm that's just not accurate. There's muddy rivers all over the world.

TM: Is that in the literature, in the scientific literature, that muddy rivers are sterile wastelands?

JS: Yeah. Because…

TM: Really.

JS: Because the light is diminished. Evidence for that is looking at a tailwater fisheries. So the bottom of the release from a dam is always highly productive. So the Bureau's dogma was: We are making a better river because we're taking the mud out. And we had data saying no. And, in fact, I just was asked two years ago/three years ago, they wanted all that data. I think they were gonna refute it because we're the only ones that have published on this type of stuff. There's more now. But the driftwood thing just started on that trip, really. And the value of it. We knew about it but didn't have numbers to match it. I said, "Go ahead. Go. Don't go backwards to the old guy. Go do it again." We've got a paper…

TM: Reproduce the data.

JS: Go ahead. And I haven't heard from him. You know why? Because it's full of bugs. We all know, when we go up there, it's the buggiest place in the world. And they all don't bite.

TM: Why do you think that is? Because the prior hundreds of years of scientific knowledge was light, the sun, life, aquatic life, clear water, there it happens. How do you think it happens in a turbid system where the water turbidity is very high? You put your finger in the water, you can't see your finger.

JS: Time. Evolutionary time. You gotta have the time for the organisms to adapt to the muddy water, the turbid water. And that's why below the dam there's a lot of the same bugs. There's not enough time. There's no such thing as a suite of insects that can live in the stenothermic cold water. So if you run northern Alaska rivers, the Alsek, any of those that come off of glacial, they're basically tail waters. They're clear. They have a little maybe…

TM: They have some loess in them.

JS: Flour? The really fine stuff?

TM: The kind of bluish, kind of a chalky…

JS: Yeah. But there's no bugs because the temperature's cold. There's not enough variability in temperature, and they're too ephemeral. There's not enough time to be colonized by enough bugs to adapt to that cold stenothermic. So the midges, chironomid, which are black flies, winged insects, that are in the Grand Canyon are in the Arctic. The exact species are found up in Alberta in the Canadian Shield streams, coming off of the glaciers up there. When we started collecting, we were still getting a few pre-dam black flies. And, luckily, Carruthers had collected some from the 70s and had them right here, up the street, at the museum. We had a guy named Jim Sublette identify those Carruthers samples, which were pre-dam we call them, from the 70s, and then the Arctic the current crop of black flies.

TM: What do you mean, pre-dam from the 70s? Because the dam came in in '63.

JS: Because it takes a while… Biology doesn't give up. Biotic things do not give up. It's really hard to kill stuff. I mean, look at what it takes to have a pool. You cannot keep a pool clean. It is a lifetime

achievement award to own a pool and keep it clean. You use all the nasty chemicals ever devised, and still…

TM: And a filter and a pump and little brushes and…

JS: …water is life. So there always is gonna be something. It's just how much, and what kind. And the diversity comes over time. The Colorado River is the… We know the fish, at least, have been around since the Miocene, 2.3 million years; therefore, the food has to have come with it, which is probably even older. That's enough time. Decades from impounding the Colorado River is not enough time to get. So you end up getting a few species that grow like crazy. Like the trout is a big example of the consumers. You get a lot of little trout. A lot of trout. But that's it. You're not going to get even a variety of trout. You get rainbow trout. Believe me, the fishermen up there, the guides, have put in everything, and probably still continue to put in everything imaginable. Hoping something will take. Because they really want mayflies.

TM: But how are they going to get mayflies? They're going to need warmer water and turbid water, aren't they?

JS: Yeah, yeah. You're not going to get it without a whole litany of changes that just aren't even on the drawing board anymore. Those are gone.

TM: So what changes would we need? How are you doing for time?

JS: I need to leave in a little bit, like 15 minutes.

TM: Okay. Did we capture what you wanted to talk about?

JS: Yeah. Through the 90s. Yeah. We've made over 10 years of progress here. (laugh)

TM: Yeah? I sort of left you in 1995/1994. Emma graduated in '94, is that right? No, that was the flood.

JS: Yeah.

TM: And then Emma went out and got her Ph.D. as you mentioned. That's right, you got your master's in '92. Then when did you get a job for NAU?

JS: Basically, I ended up getting paychecks from them when I started working there in '91 as a graduate student.

TM: And you're teaching there now?

JS: I'm an adjunct professor there now, yeah. I was an assistant research professor for 12 years. I've been sick lately. I haven't been bringing in the money, so I've been demoted. Then, in between, I taught at Eastern Arizona College in Payson. They started a community college there. So I went there to teach, and I did research at NAU.

TM: It seems as though there is a trend, maybe, if you will. When people think of the Colorado River in Grand Canyon, they like to think that the 45,000 cubic feet a second habitat flows have been the answer to sediment, and everything's good again. But those of us that are down there, especially if we compare pre-dam photos to post-dam photos, we see the sand disappearing, we see a new high-water riparian line, which was never there historically. Oftentimes, for miles, there was no vegetation at all. I like to think about the people that hike the length of Grand Canyon from Lees Ferry to Pearce Ferry. Before the dam, that would have been way easy. You just hike along the river at low water and you could go miles and miles, a much easier journey back then. It seems as though, now, there's an argument for a steady

state from the dam, or some people are making that argument, but recently, there have been some people coming out of the USGS saying, “Hey, we need turbidity, we need mayflies, we need temperature.”

JS: Yeah. Over 20 years of saying that.

TM: Yeah, yeah, but it’s coming up again. It’s kind of in cycles and it got quiet for a while, and now we’re hearing it again because people are looking up, they continue to look up-basin, as you did that time when you were at the confluence getting hit by the driftwood full of bugs. Is there a way, do you think, to manage Glen Canyon Dam for hydropower and yet… You started in to talk about this run-of-the-river type operation, where if the river is going up at the confluence, the dam’s going up; if the river’s going down at the confluence, the dam’s going down. And the reservoir is a pool in the middle, with variability coming in and variability going out.JS: Yep.

The hydropower can turn, as you say, from 5,000 to 20,000 cubic feet a second to make electricity. It seems like you would need to do sediment modification below the dam and temperature modification somehow. And then drop in some wood.

JS: Yep.

TM: It doesn’t seem like such a lift too far. Do you think it could be done?

JS: Well, it depends on your event horizon or your view of sustainability or how far out are we planning? Because you could do all that, probably within 10 years, all of it. However, how long is the dam going to last? The number one biggest problem we have, as far as I’m concerned, is the two largest reservoirs in the West are future Superfund sites. What do we do with the sediment? All reservoirs have a lifespan. Already, the sediment that comes down from Cataract Canyon, the main tributary, into the northern end of Lake Powell, that sediment falls out as soon as it hits still water. However, a reservoir still has current. It never goes to 00.0. It’s 0.1 cubic meters per second, or something like that. That sediment has gotten to the cofferdam, which is the little dam you build to build the big dam to shoot the river during construction to one side or the other. It’s hit that and it’s piling up behind it now. That is when I stopped working for those guys in 2000 or so. That means it’s a rounded cofferdam. It’s hitting to the base of the dam.

TM: Be over the top of the cofferdam.

JS: Right. And how many years has that been?

TM: Well, what is the life of the dam itself?

JS: That’s what I’m gettin’ at. What’s the capacity now? They know. They know exactly the capacity of the lake. Exactly. In 50 years, you’ve lost a third, 30%, 40%. Double? Triple? So let’s say triple. In 150 years, it’s full. You’re gonna lose capacity/usefulness before 150. Maybe at 120.

TM: *Way* before that.

JS: We’re already at 50. Let’s just say we’re going to double it. We got 50 years to go. So, by 2080, let’s say, at the outside, it’s done, it’s over. So to me, I don’t think you should do anything. I think just live with what you got, it not worth it. Because the big thing we need to plan is what do you do when Glen Canyon Dam is no longer useful. It’s no longer a sediment trap. It no longer can make electricity. I can’t even get them... I haven’t done it in a while. I couldn’t even get them to… “What’s your plan?”

When it goes to deadpool, are you gonna do what Dick White [did] and just go, "Well, looks good. That's our minimum flow criteria," because it's gonna be a deadpool and you can't release the water out. And this was at Katrina. So, when was Katrina? The last Bureau meeting I went to, I said, "What are you gonna do?" "Joe, you got a question?" "Yeah, what are you guys gonna do when there's a deadpool? What's the plan?" "Oh…" They blew me off. But some of the lawyers, those guys, you don't go to meetings…they show... Sierra Club, you talk to a lawyer who's probably their first case, on the phone, about something, maybe. Bureau, you go to a meeting, there's five or six of them at every meeting.

TM: Listening. Waiting.

JS: They came up to me afterwards and said at Katrina, they got these giant pumps. Not the Bureau, the Army Corps. They figured they can do 5,000 cfs with these pumps through the outlet works. Where you see the 45[,000] coming out. The tubes, the jet tubes.

TM: Yes, but that's crazy because behind the dam is a wall of sediment that goes 190 miles or something like that. Wouldn't now be the time to start a decommission?

JS: Yeah. It's a failed experiment and the trouble is, eventually, we're gonna get what you're describing because it has to go to the ocean.

TM: Right.

JS: Over time, it all… You just can't walk away from this. I think that all of the… So we don't build dams anymore in these United States with the BOR. However the BOR goes, that technology is all over the world. Brazil has built the most dams you can imagine, everywhere. South America. Europe's pretty much done because there's none left. China's still doing it. So the technology's out there, and I think that that choking—this temporary slowdown—is a contributing factor to the fisheries failures in the ocean. Because we're stopping this input.

TM: Of sediment that the ocean fish need for food production.

JS: Yeah. It's a contributing factor to throwing off those ecosystems.

TM: Right.

So if you take the big, long-term picture, this is just a hiccup. The trouble is, in our lifetimes, it's a major deal. And they will not discuss how to deal with this. The only thing you can do is move it down through the system. Which is to decommission. And there's no…

TM: It's either that, or some massive dredging…

JS: Two or three…

TM: …that has to get going *now*.

JS: Right. And if you can't make electricity… Which the whole premise of building the dam and hydropower was to pay the bills, which they paid off. They paid it off, it no longer is a debt to the Department of the Interior. And if you can't do that, who's gonna pay to truck or ship or build the pipe? So the problem of sediment in the Canyon is temporary. It's just on what scale are you looking at here?

TM: Right. Right. Well, certainly temporary, until the next Frankenstorm comes along (JS laughs) and knocks out the really untested spillways around the dam. And then we can de-sediment Glen Canyon and take all that sediment that we were supposed to hold up there and send it down to Lake Mead, impounded behind Hoover Dam.

JS: Yeah. And no one wants to talk about this. The temporariness. Regulated rivers are a temporary technological fix. There's no… There's nothing… They don't last.

TM: So, we're starting to slowly wrap this up. I just want to double check, then. It sounds like you're suggesting—please correct me if I'm wrong—that we keep bringing this up to the radar screen of Bureau of Reclamation. They know this already. And there's no need for temperature modification, turbidity modification, steady run-of-the-river flows because the life of the dam is so short now that we basically just run the dam through its engineered lifespan. But then what do we do?

JS: I can't believe they don't have a plan. But there is not a plan for the public. They're not a transparent organization. They never have been. It's not their charter. Their culture is they don't need to do that stuff. And you gotta remember, this is Mormon. The Church of the Latter Day Saints run all natural resources in the West. Nothing is without their purview. Not the day-to-day, friendly LDS neighborhood-type people. I'm talking about the hierarchy of why do these towns… Ask yourself, why does Thatcher, Arizona, exist? That's a strange, little, weird part of Arizona. Small community, but they got a hospital, they got—what's their hotel? The hotel that is in every Mormon town. Gosh. We're building one. The one right down the street here. Anyway…

TM: Oh, the Marriott.

JS: There's 1,500 people there, and there's a giant Marriott conference center! So there's your dead giveaway. They're the first. They don't like Bluff because they couldn't make it because the river overran them there, right? They couldn't maintain status quo because it flooded. That's basically, to me, that's the hard part. [phone rings]

TM: It doesn't sound like Reclamation is going to address this situation until they're forced to.

JS: Yeah. You go up to Hite now and you can see just how much sediment. It's just unbelievable. Unbelievable. What's growing is all exotic stuff on the sand. It's just like the tamarisk, it's coming back. The put-in at the San Juan is covered with little, bitty tamarisk everywhere. We've burned that stuff, we've poisoned that stuff, we've bulldozed that stuff.

TM: Bugged it.

JS: Bugged it. Still coming back. So all these things, like I say, it'll never go back to what it was. It'll be something different. Whatever it is, it'll be different. Whether there's any native fish left, the big species, that's a whole 'nother … I don't know if they're gonna…because they're too dependent. The push is the native fish, that's the leverage to make change. However, they've convinced themselves that the Little Colorado is enough. And by translocating a couple places, is enough. But it makes it really tedious because you don't have a refuge. We're already using the refuge. There's no place, when they fail, to go. We know that there is little to no reproduction in the river. We know that. The sad thing is, and this is a mistrustful statement on my part, and then I gotta go. When I was heavily involved, they kept having the data go down that we're losing chub. The numbers are terrible. In 1999 and 2000, it got to be bad. It was less than 10,000. Anything less than 10,000, in wildlife terms, is really, really hard to count.

TM: Yeah. Well, it means extinction.

JS: Yeah. Eventually. But what did they do? They changed how they collect the data. So the fundamental problem with the whole thing, and I'm not the only one that says this, is they keep changing their methods. What they claim is that they…

TM: "They" being Reclamation.

JS: Yeah. …want the real numbers. But, really, what you want is the pattern. They think, from a legal standpoint, we need to know an exact amount. But isn't it interesting that after they changed their methods and analysis it's done nothing but go up. You cannot find anything that happened in that time period anything super-substantial. They weren't doing the trout eradication, which they've stopped, and the trout numbers… For me, this gestalt question you asked me is the fundamental thing that Wegner tried to set up, that isn't there now, is that the… There's only four or five people on a board that are operating the dam—heavy hitters: a water buffalo, a Bureau person, a state's person, an environmental group, and a tribe. So five people. No scientists, no managers, no lawyers. Five people. They vote. Had to be an odd number, right? And all the science is competitive. The fundamental problem is it's not competitive. So whenever you have government science, human nature makes it biased because these guys want their jobs. So Bob Hall, who basically took over from me, is okaying weekend steady flows for bugs. That's a joke. That's like saying, live in Arizona but yet we use snow to make Snowbowl snow. That's a punchline. That is embarrassing that I get a lot of laughs about. And now, we get… They've ben usurped now by this weekend low flow, steady flows. Oh my gosh! But it's his job. If he were to fight that, they would get rid of him. You wouldn't get that, though, if you had competitive science, where the science completely eliminates… I have good friends that are government scientists and they, after they're retired, say that they were pushed. They all will admit, after retirement, that their data was skewed to push agendas by the management. And let me tell you, the Bureau is the pusher of the pusher of the pusher.

TM: We see that at Grand Canyon National Park as well, or at least with think we do.

JS: Anytime you see government science, you really gotta wonder. What they're really good at is the abiotic stuff: satellite imagery, gaging rivers. Go do that stuff that probably no university wants. But put it out there for competitive, long-term contracts. And they *don't* go to meetings. They want the scientists to go to meetings. No, no, no. Scientists write reports, scientists give you a PowerPoint, scientists give you the data. You guys make the management decisions. It's too close together. And therefore you always get these political tail chases. Because nobody… And it's always the people mid to long career that cave because they can see the end and they're too invested and they know they're not going to be hired by anybody else because they're tainted goods. That is a cultural problem that no one wants to address.

TM: That's not true for Reclamation. It's true for Interior. If you're a superintendent and you go up against the business community for manipulating your resource to maximize concessions returns, you're gonna be at Shenandoah polishing cannonballs.

JS: Yeah. I call it "polite manipulation." Very kind, very generous. We're doing each other a favor here. Besides the sexual harassment and workplace violence, that's a cultural problem throughout natural resources and science. It's really, really… And I'm not the only one. I just talk about it.

TM: Which is a great topic for maybe another day (JS laugh) because I would definitely like to know about that as well, and your take on that. Because we're sort of waiting now for the superintendent. They took their plan and went to regional. All the plans got stopped to be reviewed by new people coming in with the new administration. And where are we at on that? We don't know.

JS: And Alicyn [Gitlin] said yesterday that they have no plans to... What are we up to? Is it the back country? No, we just did the backcountry. What's the next plan that's in the usual mill? Is it river?

TM: The river plan is going to be kicked down the road for another 10 years. The backcountry management plan, they are sent back on their noses because of the concessionaire issue. They were going to take all of the guided tour companies and make them into three or four concessionaires. There would be winners and losers, and those guys all went crazy.

JS: I remember that now. Yeah, yeah.

TM: Linda Jalbert's retired…

JS: Okay, well, because she's retired, there's no opening, and guess what? Time out. Nothing. So it takes them so long to do anything now, and now they have an excuse to keep… There is nothing happening. This cultural shift in public land management is… They gotta get that straightened out. But it would be nice if, in the meantime, we got the science out, and made it… Run it through the National Science Foundation. Make it a completely competitive, high stakes, win-or-lose, and you're not involved in the management. That's a fundamental flaw with the USGS. They cozy up to the universities for legitimacy. They used to not. They published their own data because they couldn't get it into journals. They got 100 percent rejection. They didn't have the ability to publish in journals. That's why there's the USGS—I think they still have it—Water Resources Bulletin.

TM: Right. Right.

JS: It was their own publishing amongst themselves, because what they studied wasn't of value to the…

TM: So the peer reviewers kicked it out, you mean?

JS: Who cares what the water did going up and down?

TM: Got it.

JS: But you gotta add the biology to it. So part of this was that Wegner was, and Babbitt during that time, Secretary Babbitt, tried to condense all of the scientists into the USGS. The only holdouts were Fish and Wildlife because of the regulatory need of endangered species. The USGS originally was all physical scientists. And that's why, back to the sediment, they studied and they got all over it because it was their chance to study sediment movement in a clear river. That's why they bought off on the concessionaires with wanting their beaches, and they go, "Well yeah, this is perfect. We've always wanted to study sediment transport." That's why those guys go on and on and on about it. I tease Kaplinski and Joe Hazel and those guys…

TM: You bet. Mercilessly.

JS: Do you know what name? What family of sand is this? You've got to know this pile of sand by heart now. This is all you guys have done for 25 years.

TM: And they keep telling me that (JS laughs) the beaches are improving. And I'm like, "No." I look at the photographs from pre-dam and there's no sand in Grand Canyon anymore. There's just nothing there.

JS: This reminds me of Christa's paper. That's how she wrote it, that everything's rosy. We're doing the best we can, so it has to be good. Sometimes the best you do isn't good. In this case, it's tense. In my old-man memory, I try to use common numbers. There's 10 percent of the original dam sediment load, typically. A high flow takes that 10 percent and redistributes it to 5. Five goes down, 5 gets put up. So you're trying to manage, spending tens of millions of dollars for decades, managing a resource that you cut in half, you've cut by 90 percent, and then you cut what's remaining 10 percent in half to redistribute it across. Those numbers are the entire line. Because you still gotta get through Marble

Canyon to get to the sand in lower Grand Canyon. So it doesn't really matter. And you're losing all of the archaeological terraces in Glen Canyon. So moving 10 percent of the sand and only having half of that left is not a sound management plan. However, it gives the scientists a really good forum to study. And there's part of the trouble. Ask a scientist to study something is a different reason and a different outcome than asking a scientist to study something for the overall human-and-ecosystem-driven question, or management. We've divided that up. We're studying things for science sake and then trying to apply it for management, but the original science wasn't collected in those terms. We pretended they were, but they're not. The best, *the best*, studies were Lisa Kearsley's, Dennis Silva's, campsite study, Quartaroli was doing it, and it was really, really basic. It was low-tech. However, it included perception. And that, to me, is how that data should be collected—*not* overflights and trip after trip after trip. Where do you want the beaches for camping? That's the number one thing, not ecology. It's camping. That's the driver for sand. Therefore, the science should be based on that, not based on sediment loads and triggers and percent of this and that. They're miss… See what I mean? The scientists went down their avenue that they know and love so much. And now you can't just pick that data set up and apply it to what you're talking about.

TM: And the fascinating thing about perception is the people who've never run Grand Canyon, who show up today, they're going to see things new, and go, "Oh, this is what it is. This is the way it's always been."

JS: That's the… God, there's a philosophical term for that.

TM: Perception is a sliding scale.

JS: Yeah, that baseline. Your first exposure is your baseline...

TM: That's right.

JS: …without a good education and training to otherwise…

TM: That's right. That's right.

JS: Same thing's happening right here in the Peaks. Elden is trashed. I talk to kids riding their bike and they think it's a fantastic wilderness.

TM: That's right.

JS: I said, this place is ruined. There're too many people.

TM: Correct. That's the vision of longevity that we certainly have lost because nobody seems to be looking before '63. Nobody seems to be comparing, "Hey, what was the place before the dam, after the dam"? And nobody seems to have the foresight to look in the future.

JS: Yeah. I try to tell—*suggest*—you don't tell John anything, John Weisheit and Owen Lamar, those guys. Robin Silver. When I meet with those guys, that's the push. We need an exit plan. We can't fix what we've got. I think we've pretty much done that. Financially, the cheap fixes are done. But what's the exit plan? What's gonna happen with your kids' grandchildren? What are they gonna do for water and power? Because Mead is also going away.

TM: Exactly. And if we wait for a Frankenstorm to completely flush out the basin and dewater 40 million people, that's really not an option.

JS: Well, you had it. You had the Frankenstorm this year. It just didn't make it this far. The series of storms that hit Northern California, if they had maintained their energy…

TM: They didn't.

JS: …long enough to make it through the Mojave, past the Mojave Desert. It didn't make it past the Mojave.

TM: Well, look what it did to Oroville. It almost took that dam out. So we'll see how that sorts out. But, clearly, our engineered structures are fallible.

JS: Yeah!

TM: They are weak at extremes. And we're in a land time of extremes now.

JS: Oh, yeah. Yeah.

TM: I don't see the agencies looking at it, so…

JS: No. Well, it's back to religion. They don't want to. They don't wanna act like they can be defeated. No religion wants to say, "We blew it." I think to show that the Colorado River basin design has failure in it is a major, major ego blow to the most dominant religion on the Plateau. They're gonna fight it. Why not just say that when it goes to deadpool, here are here's the 5five things that we're going to try. Why not say that? That's It's a reasonable request. What do we do when deadpool occurs.? Which is going to happen. It could happen a few times before sedimentation occurs. That

TM: Sedimentation really kicks in.

JS: It could easily happen in five years. Because we had above average snowpack up until February. And in one month, we got below average. Because of this aridity, we all know, high- pressure builds. I was just telling a woman about that today. I took meteorology in 1978. And from an oceanographer, and. I can remember him, it's funny how things in your mind come back-and he's standing there with his chalk, an old Navy guy. Beating, beating on the chalk, talking about high- pressure over the Colorado Plateau. You know, we're in New England, and he's saying that that sets up. And this is in the '70s, this is when satellite stuff was only military. I don't know how the hell he figured this stuff out. But he knew that that high- pressure dome can push the Jetstream around and alter our storms. In New England. In the '70s! And he said that's why the Sahara Desert is the Sahara Desert. It's because it's a high- pressure dome. And the reason Australia is dry is because it's a high- pressure dome. And what have we got? Look at the foreseeable weather right now, this is it. We're living the life here of a beautiful spring, as we become crispy critters.

TM: Yeah, the tulips are out here, blooming in the backyard, and the winter snows have stopped.

JS: Yeah, and the trouble is it's the variability. So now we know that it's never like this. So if you go like that, you're going to go like that. We know that, that is just the way all weather patterns work like that. You never get like this. You're always going to get – so we… So we're going to get super dry, we're going to get super wet. It's the span in between. I don't know, Tom... I wanted to stay alive long enough to see it go to deadpool, but when it snowed this winter, I was thinking ah, I'm not going to make it. But now… now I don't know, because it's – you know, when it… When they don't dump, they're going to lower it. It's in the papers, they're going up to 35 feet. But how many feet are you going down now in Powell?

TM: Well they said they were going to move 11 million acre -feet, with the 8 million they're supposed to annually release. Now they've dropped that down to nine. They've clearly seen, okay what's going to

come in if we drop – if we pass through 11 million acre -feet out at the reservoir behind Glen Canyon Dam. To get down into the reservoir behind Hoover, move that water. We're going to cause some serious dilemmas to the reservoir capacity in Glen Canyon. They're not going to do that now.

JS: Man, isn't that something? And it all changed, because of the high- pressure, the aridity, and their models do not take that into consideration. Their models are still the 30-year historical and they haven't come in… If they ran the models just on the last 5 years of data, or 10, they would probably be more accurate. But the policy is 30 run years.

TM: That's right. Which kind of goes back to the fish again, you. You can see the fish population going down. That's changed how we count the numbers to how…hey, things are recovering. So you can play with these numbers just to make things look good. The reality is if you go drive across the bridge there, by Glen Canyon Dam, you know, you're seeing the real deal. You can't miss that. Joe Shannon, thank you very much for a wonderful interview. This interview is part of the Grand Canyon Historical Society oral history series. Today is April 19, 2017, and my name is Tom Martin. Joe Shannon thank you very much.

JS: Thanks Tom! That was fun!