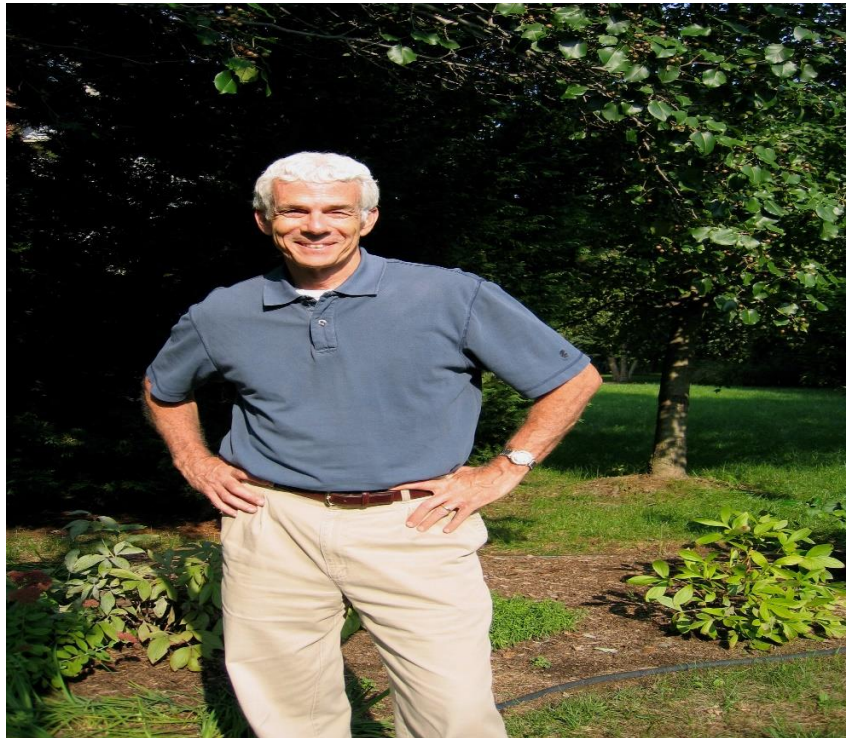


The Oral History of Jim Nichols

November 11, 2019

Interview conducted by John Cornely

Annapolis, Maryland



Oral History Cover Sheet

Name: Jim Nichols

Date of Interview: November 11, 2019

Location of Interview: Annapolis, MD

Interviewer: John Cornely

Approximate years worked for Fish and Wildlife Service (FWS); later U. S. Geological Survey (USGS):
35

Offices and Field Stations Worked, Positions Held: Wildlife Biologist (Research) at the following stations (agencies changed due to reorganization): FWS Migratory Bird and Habitat Research Laboratory (1976-1982); FWS Patuxent Wildlife Research Center 1982-1991; National Biological Survey Patuxent Wildlife Research Center 1993; National Biological Service Patuxent Wildlife Research Center 1994-1996; USGS Patuxent Wildlife Research Center 1996-2015

Most Important Projects: Integration of population research to adaptive management and smart decision making.

Colleagues and Mentors: Bob Chabreck (Louisiana State University); George Petrides (Michigan State University); Walt Conley (Michigan State University); Dave Anderson; Dan Anderson, Tim Robinson; Sam Martin; Jim Hines; Doug Johnson; Jim Burn; Galen Butterbaugh; Ullas Karanth; Russell Oates.

Brief Summary of Interview:

Nichols discusses growing up exploring nature before studying wildlife ecology in graduate school. He started trapping animals while working on his master's and PhD research focused on small mammal population dynamics. After finishing his PhD, Nichols joined the Migratory Bird and Habitat Research Lab at Patuxent. He planned on staying a few years but ended up remaining with the FWS (later USGS) for his whole career, valuing the collaborative dynamic with managers. Nichols talks about a revolution in statistical methods for estimating wildlife populations, moving from borrowing approaches used in human demography towards ones addressing key issues like detection probabilities. He discusses efforts to bring more scientific rigor into the waterfowl harvest regulations decision-making process. This led to the adaptive harvest management approach used for setting duck hunting regulations. Nichols criticizes the shift of the federal wildlife research program from the U.S. Fish and Wildlife Service into the U.S. Geological Survey, feeling it risks breaking important established connections between researchers and managers. In discussing his proudest contributions, Nichols emphasizes his collaborations and role in the revolutions around population estimation and adaptive decision-making for bringing more rigor into wildlife management.

THE INTERVIEW

JOHN CORNELLY: This is John Cornely with the US Fish and Wildlife Service Heritage Committee. It's the 11th of November 2019. We're at the DoubleTree Hotel at a Fish and Wildlife Service retirees reunion in Annapolis, Maryland. I have the pleasure today to be visiting with Jim Nichols. Known him for quite a while. He's done some great, great work for wildlife analysis and research. And with that, Jim, I'll let you get started. I'd like to start with your birthdate and where that was and just take a little stroll through your life and your career.

JIM NICHOLS: Thank you. Thank you so very much, John. It's a real pleasure to me, and I'll be counting on you to sort of help me along with this. Not sure exactly how to [do this]. Anyway, my birthday is May 24, 1949. By the way, Bob Dylan also happens to have that birthday. I love that! The place was Waynesboro, Virginia. It's in western Virginia, not West Virginia. It's the kind of place that [when] a friend of mine, for example, asked me to give a presentation at the University of Virginia, which is on the east side of the mountain from Waynesboro, and when he introduced me, he said, "Well, I want everybody to know Jim is from Waynesboro and look – he's wearing shoes!" That's the kind of place it was.

Anyway, there was a big DuPont plant there and my dad was a Naval Academy guy who was a chemical engineer and worked for DuPont, and that's why we found ourselves in Waynesboro. So, I grew up there. As far as wildlife stuff, I guess I'll just say briefly that my dad wasn't a hunter, so I didn't do any hunting actually until I was in graduate school. But I spent a lot of time wandering around the woods and mountains catching snakes, and things like that.

MR. CORNELLY: So, you're on the west side of the Blue Ridge.

MR. NICHOLS: Exactly, right.

MR. CORNELLY: Mike, my son, was the director of a television station in Charlottesville for a few years.

MR. NICHOLS: OK, so all you had to do was go over the mountain from Charlottesville a little bit west. Waynesboro was between Charlottesville and Staunton.

MR. CORNELLY: I've actually been though Waynesboro 'cause I've been to Staunton.

MR. NICHOLS: You've been to Staunton. It's a nice place to grow up where kids could leave early in the morning and run around like I said, catching snakes or things like that and come home in the evening and parents weren't worried about anything that had happened to me. So, it was a nice place to grow up. When I was in high school my dad ended up moving to Newark, Delaware, which was [near] Wilmington – the home base for DuPont. I ended up doing my last couple of years in high school in Delaware and graduated from Newark Senior High School.

MR. CORNELLY: What year did you graduate from high school?

MR. NICHOLS: I should know that, shouldn't I? 1966. I was one of 49 graduates in my high school in 1966. So, I went to Wake Forest University in North Carolina with the idea - wasn't sure what I wanted to do when I grew up - so I was a biology major there. They didn't have courses that were specifically what I wanted. Anyway, I took an ecology course and really, really liked it. I decided that was the kind of thing I wanted to do with my life. My parents thought the medical way of doing things would have been

much better. But I didn't have the grades for that. I had a guy who taught me ecology - I won't say his name. I liked him OK, but when it came time for me to figure out what to do with my life after this, he said, "Well, you really need to go to graduate school." He said that "I don't think you're cut out for the zoology or ecology department, but maybe one of these wildlife places will take you." I should say also this this guy was a bit of a snob. His degree was from Duke. He said, "Any of these wildlife places will be okay." Anyway, I applied to a couple of places. LSU (Louisiana State University) happened to be one of them, and I was lucky enough for them to take me. It must have been a bad year for applicants – my grades weren't very good. In fact, not that this is interesting, but I ended up getting married in my senior year of undergraduate, and I got 4.0 that year, and that raised my GPA to 2.7. That was what kind of student I was. I was much more interested in playing and doing other things, as you might understand.

MR. CORNELLY: You're not the Lone Ranger there. There's a lot of people in that category.

MR. NICHOLS: I got lucky enough with my GRE's and went down there. LSU is very much a traditional wildlife management and game management department. We had spittoons in the graduate room with all the desks there. It was very, very traditional. I really enjoyed the experience and learned an awful lot about management and management values. They did their job. My thesis had to do with - the only way I could get any money as I wasn't smart enough to have gotten a regular graduate assistantship – so I had a job with U.S. Army Corps of Engineers on something called the Atchafalaya Basin Usage Survey. I would drive all around to these check points and ask people questions as they emerge from the swamp, find out what they'd been doing back there and that kind of [thing]. So, I had my thesis project. It had to do with fur trapping in the Atchafalaya Swamp, following around trappers and things of that nature and trying to get statistics on the different species that were taken there, and things of that nature. My thesis was on furbearer resources of the Atchafalaya Basin. Again, it was funded by the Army Corps of Engineers.

MR. CORNELLY: Who was your major professor?

MR. NICHOLS: My major professor was Bob Chabreck, a guy I have an awful lot of respect for and liked an awful lot. He's passed away but he was a real good guy. He instilled general values about wildlife management and the history of wildlife management. He was just a really good fellow that way. He was also a good ecologist. His primary interest was marsh ecology, so he knew a lot about vegetation and stuff, but he also studied alligators. That's what actually got me pretty interested in alligators. So, I got a master's degree from LSU in a couple of years.

MR. CORNELLY: That would be 1968?

MR. NICHOLS: No. I ended up taking an extra year [at Wake Forest]. My wife was an undergraduate. I had to wait a year for my wife so I took some extra courses.

MR. CORNELLY: I don't think we covered the graduation year at Wake Forest.

MR. NICHOLS: That would be 1971. I started there in '66 but because I was waiting for my wife to graduate from High Point University, which was near Winston-Salem, I finished up at Wake in 1971 and went straight to LSU. Not that interesting a story, just real quick - I remember my 18-hour drive from Winston-Salem to LSU. I'm driving this big U-Haul and my wife's driving our Chevy Nova. We saw a snake on the road somewhere in eastern Louisiana. We hadn't gotten to Baton Rouge yet. We stopped – it was

a copperhead. So, I caught it and put it in a cooler. My wife to this day gives me grief about having a poisonous snake stuffed in the cooler!

We got to LSU. It doesn't matter very much but I didn't get an assistantship – I got just a job with the Corps. Before that, I needed to make money somewhere and I didn't care, so basically, I dug ditches on Interstate 4. It goes across the Atchafalaya swamp. I was digging ditches at one end of that interstate.

I got out of LSU. 1973 is when I got my [M.S.] degree there. Michigan State accepted me [for a PhD]. I was interested in alligators because of Bob Chabreck and the [alligator] night counts and the stuff I did [for my thesis]. It's weird. You buy a book called "Furbearers of Louisiana." And alligators are in there because of their hides.

MR. CORNELLY: Oh, okay. That's very interesting.

MR. NICHOLS: In my Atchafalaya Swamp [work], that's one of the things I did. I'd run around at night and go do [alligator] night counts in all these places. Of course, the hardest thing is figuring out where you were and how to get back.

Anyway, so the reason for mentioning that is that at Michigan State, George Petrides was a longtime professor there, and he had a project in the Okavango Swamp in Botswana with Nile crocodiles. It sounded like he had the money for the project, and he said he did. He thought he did – at the time. I said, "It sounds great. I'll go to Michigan State." But it turned out, through no fault of George's - he wasn't being a bad guy at all -it's just the money fell through for whatever reasons. And so, I was scrambling. I had no project at Michigan State. I had to find something real cheap, because all I had was a teaching assistantship. Basically, a fellow there who worked on population dynamics was a guy named Walt Conley. He was a new assistant professor. He wasn't so well known up there but he did stuff with small mammals. It was a time when Charley Krebs was doing a lot of stuff on population ecology [microtine population cycles]. I'd heard of this and so I said, "OK, that sounds great." George Petrides was fine with it because his money had fallen through, and I had the option to stay in there and write proposals for two years, but I was married and kind of wanted to get my union card and get right out of there. So, I switched major professors and everybody was fine. But I happened to pick a time when unbeknownst to me or Walt, the microtines (meadow voles) happened to be in one of the downtimes in their [population] cycle. You think about a PhD project as a four-year cycle. I'd catch two or three animals out of several hundred traps and that kind of stinks. I trapped for a couple of years and [their populations] just started to come up at the end of the time. But as I said, I wanted to get my union card.

So, I'd been working with Bob Chabreck at LSU doing some population modeling for alligator harvest in Louisiana, and I'd been kind of doing that on the side. And I approached Conley, my major professor, and said, "Hey, just for expedience sake, would you have a lot of heartburn if I switched over and allowed this to be my PhD project?" He was really, really good about it. He said, "That's absolutely fine. I'm a population guy and population modeling is what I do. That's absolutely fine." I remember one of the guys on my previous committee, my small mammal committee, made a statement when I told him about it. He wasn't nearly so supportive as my major professor. I'll never forget. He told me, he said, "Well, Jim, you've got to remember that your PhD thesis is what you'll be known for your entire career and if you shift to something like this," he said, "there's no way I'd do it."

Anyway, I was too much of a wise guy. Yeah, I said, “Geez. I always thought my thesis should probably be the second worst thing I ever did in my career,” thinking, I hope I get better at it! I ended up doing basically a computer modeling project. I kept on tracking birds and stuff about other species.

MR. CORNELLY: Recently, I saw some citations of yours that had to do with some small mammals, which I didn't know that you had done. And I can't even tell you. It's been in the last month or so that I saw these. Wow, you know, because that's how I kind of started out with. Well, I did all my graduate work on mammals and then spent my entire career working on migratory birds.

MR. NICHOLS: That's why I always think of you! (laughter) Again, many bumps in the road but I went ahead and finished the alligator dissertation. Lucky enough to have it pass, so I got my degree from Michigan State in 1976. I applied for, as everybody does, I was applying for jobs – that was back in the day when you almost didn't have to have a post doc to get a university position. So, there was one that I applied for. I was told that I came in second because the other guy studied bears and was going to teach about large mammals. I didn't get that one. I had an interview at the University of Windsor, just across the bridge from Detroit in Canada. I didn't get a position there.

The other thing I applied for then was with the Fish and Wildlife Service, an organization called the Migratory Bird and Habitat Research Lab. It was kind of weird because everybody thinks about Patuxent and knows the name Patuxent. But this Migratory Bird and Habitat Research Lab sort of grew out of the old Migratory Bird Populations Station which was at Patuxent. Anyway, they wanted a [waterfowl] population person – a duckhead – which I was not. I ended up coming to find out later that was basically David R. Anderson's position. He had just left Patuxent, and it was his position that they were trying to fill. If I had known at the time, I probably wouldn't even dare to go for an interview.

MR. CORNELLY: I interviewed Dave. I've known him for a long time and worked with him a little bit.

MR. NICHOLS: Those were shoes you never, ever tried to fill. I didn't know about that until I got the position.

MR. CORNELLY: Sometimes it's better not to know.

MR. NICHOLS: It was in that case. Anyway, I interviewed and it went okay, and they offered me the position, so I went ahead and took it. I had the idea that I was going to sort of treat it as a decent paying postdoc in the sense that I expected to spend between three and five years there, and then get a job at a university. I started in and I ended up really liking the group of people that I worked with. It turned out, and only once in my life, I guess, was around the mid- '80s that I applied for a job at the university, and I was lucky enough to have been offered it. But it was one where my wife was in a PhD program. It was real hard decision no matter what, because I really liked the people and the work I was doing at Patuxent, but I always thought I would be at a university because I do like working with students. Anyway, my wife was in a PhD program at the time at the University of Maryland, and basically her major professor just couldn't imagine how she could possibly survive and finish writing her dissertation without her wisdom. That was a deal breaker and so made my decision easier, I guess, and I stayed at Patuxent.

MR. CORNELLY: Who were some of the colleagues, the people that you were working with, when you started there?

MR. NICHOLS: I remember the names. I'm not sure if other people would remember. There was a guy named Chuck Kimball, a fellow named Bob Munro, and Tom Dwyer who later ended up being the head of the Office of Migratory Bird Management for a while. There was a woodcock guy (Dick Coon and Dave Dolton who was the mourning dove guy. A lot of people like that. Franklin Percival. He was a guy that later became the co-op unit leader down at the University of Florida. He was my first boss.

MR. CORNELLY: I've been told that I should interview Franklin. I interviewed the co-op unit fisheries person, Mike Bannon, and he said, "Why don't you come down and go fishing and interview Frank?" I may actually do that this winter, but I'm not sure. I think I've met him. I think I met him one time a long time ago, but I'm not sure. I've certainly heard about him a lot.

MR. NICHOLS: Frank was one these guys who reminds me of the old Andy Griffith show. He's from South Carolina, has the real southern South Carolina drawl, which might make a Yankee tend to think he wasn't real smart. But all you got to do is listen to him for a while, and you learn he's real smart. I enjoyed his really interesting stories. Franklin is just super for interesting stories. That would be real interesting one.

MR. CORNELLY: That's one of the things that we like to do is get good stories.

MR. NICHOLS: I'm sorry - a slight diversion: There's a local radio show down in Gainesville that was interested in oral history. They've had him on at least once to talk about his childhood in South Carolina. Nothing to do with gators or wildlife. It was he was just such a good storyteller

MR. CORNELLY: Better make sure I have lots of electrons [for an interview.]

MR. NICHOLS: Yeah, that's true. So anyway, then later on there's some other folks; Barry Noon, whose now a guy out of Colorado State, a big guy in the conservation biology world. He came in as another so-called non-game folk because that was all partitioned into game – Franklin Percival was the head of the game section. Non-game - Stan Anderson, who was a co-op guy out of Wyoming. He was head of the non-game section. And Chandler Robbins, whose been at Patuxent for such a long time, was in the non-game section. All kinds of good people. Later on, they ended up hiring Ken Williams who along with a lot of other things was with the Migratory Bird Management Office and the North American plan [North American Waterfowl Management Plan] and then eventually of course was the CEO of the Wildlife Society – he was there. Great co-workers. I really appreciated the chance to work there. I guess what I'm saying is, if this is about me and it's early on, I was doing my own computer coding in Fortran. I wasn't very good at it but I could do it. The lab director at the time – the guy who hired me – was named Fant Martin. He spent time at LSU himself, and he had done a lot of things. But anyway, he was director of the Migratory Bird and Habitat Research Lab, and he said: "Look, I've got some extra money, and maybe if you wanted to hire somebody for ten hours a week to help you with programming, then you can do that." So, I called over to the University of Maryland's math department and asked if anybody might be interested in a part-time job as an undergraduate. Two people applied. A lady – I can't remember her name and a guy named Jim Hines. The first interview was Hines. And he's a very quiet guy. He doesn't get excited about hardly anything. And so when I got done with the interview with him, I said to him, "Thanks a lot for coming" but I said to myself without even seeing this other person, "I'm going to hire the other person" because this guy didn't show the least bit of interest in what I was talking about. Then the other student, the girl, never ever showed [up], so I went ahead and hired Jim. It wasn't smart because I might not have done that if other people had applied, but it was the luckiest thing I ever did

except marrying my wife. He knew the programs and started working with me part-time as an undergraduate. After he graduated, he decided he liked it, and we had funds, and so we worked with him full-time. My entire career he's been hugely helpful to me. Maybe every once in a while, I was smart enough to be able to figure out how estimation protocol and problem might work, but being able to translate into code is a whole other thing. I could give the guy my equations, and off he'd go off and develop code. We worked synergistically, and as I say, without him, my career would have been entirely different and not nearly as productive. So, Jim Hines – I also love this – I'm babbling on here – I love this because Jim has a bachelor's degree. He never had any other degree. Now he serves on - well publications are only one thing that people pay attention to. He's got somewhere over 30,000, which, as you know, is a big number for a scientist. Also, the other thing I really loved is - I dislike this whole idea about having prejudice about degrees, and Jim now sits on committees for PhD students at the University of Minnesota and the University of Florida, for example. I think it's entirely appropriate.

MR. CORNELLY: Maybe some of the reasons I'm glad I went as far as I did but it was not really on purpose. So, I finished my master's degree and there was a federal hiring freeze. And my advisor had been trying to talk me into going on for a PhD. I said, "Well, I guess I'll have to." But I always wanted to be a management biologist. I'd done some research and worked with research guys my whole career and kind of set that boundary between the two and said, "If you're doing applied research that doesn't get applied, what good is it?" We need to work with the managers and so on. But there are times, a lot of times actually in refuges, that it's probably better if they don't know that you have a graduate degree of any kind. And there are other times where it's very useful. I've served on graduate committees, and so on. And so, it's kind of a fine line you waltz. It sounds like you're probably the same way. You don't think that just because somebody got an extra degree, that they should be snobby about it, because some of the smartest people I've ever known don't even have a bachelor's degree.

MR. NICHOLS: Exactly. One of my favorite examples from our world as you mentioned is Aldo Leopold-winner Doug Johnson. I interacted with him a lot, because he had been in the Service just a couple of years more than I. I interacted with folks at Northern Prairie [Research Center] like Doug Johnson. Doug was one of the smartest guys I ever met. No matter what metric you use, if you look at publications or whatever, in my view, he almost transformed Northern Prairie! You can look at what was coming out of there before Doug Johnson and after. The integration and how everything fit together was so much better. He was a guy that had perspective. He had a master's degree, and I never forget – there was one time, sort of in mid-career when he decided he might want to be a research manager when he grew up. There was a hard-and-fast rule that "thou shall not have any position like that without a PhD." That motivated him to go back and get a PhD. After, he wised up and realized "Ah, I don't want be a research manager after all." He was real happy being a scientist.

MR. CORNELLY: Well, I interviewed Doug too, and I liked you guys to remember that you're part of the family and you're part of our history. He was very honest, talking about some of the real innovations that he made that nobody else was really thinking about or doing. I've worked with him for many, many years, but that's what some of the stuff is. I didn't know that. I didn't know this, and so on. But on the other side of the coin, I've had some discussions with him because his attitude was that the refuge manager doesn't understand the research I do. That's his premise. No, Doug. Both of you need to come together in the middle someplace, and you need to help educate him, and he needs to let you know what his issues are. You need to figure out how you can use these breakthroughs that you make for

better wildlife management. I think we got closer and closer to agreement on that. We maybe never quite got there.

MR. NICHOLS: I very much agree with you on that one. Basically, I've been extremely fortunate to have been in the wildlife profession since 1975 or 1976 to now. During the period I've been here, there have been two major revolutions, and maybe a whole lot more than that. Two that I have been a part of and felt especially lucky in that. One of those doesn't have as much to do with management and the other very much does.

The first one is one has to do basically with how we estimate stuff. No matter what kind of stuff we end up doing in wildlife management, at one time or another it usually gets down to numbers – to having to think about populations. So, I get it – worrying about [body] conditioning and physiological ecology and things of that nature – all of that is important. But, sooner or later, it's got to be relevant to what populations do to be relevant to a lot of what we do in wildlife management. I had that attitude. And thanks to folks who were at Patuxent, just the guys right here like David Anderson, Ken Burnham and folks like that – they initiated what I think is a complete revolution in the way we do business.

Just briefly what we used to do was try to borrow methods from other biological fields like human demography, for example. Things of that nature. For some things, for population modelling where it says, OK, you give me survival rates; give me reproductive rates, and I can tell you some stuff about how fast populations ought to grow – things like that. For that kind of borrowing, I think that borrowing from demography works just fine. But for other things, like how do you estimate a survival rate? Well, if I'm a human demographer, I've got a pretty good count and interest in individuals of a particular age. I've got a pretty good count – whether it's in a local area or countrywide or whatever – I've got a number and I've got that same number one year later, and I say how many of them are left? Estimating [animal] survival isn't as straightforward as you would think. Basically, the message is that they [human demographers] don't have to deal with this fact. Anytime you or I want to know how many animals are out in a place, no matter what survey method we use, hardly ever can we count everything that's out there. We're always missing data. And so, we've got this detection issue that's not faced by a lot of disciplines.

Wildlife ecologists recognized this pretty quickly, that just straight borrowing methods from folks who could rely on direct counts wasn't really doing the job. So, we had a series of real statisticians and certain biologists who were able to talk to those statisticians, who at the end basically created a revolution in how we actually count things. I was very fortunate to have been a part of that.

The other revolution, I think, is basically how you do integrate with managers and make smart decisions. There was something that always bothered me throughout my career, throughout the early stages of my career. I did pay attention to this estimation stuff and so realized that we were applying an awful lot of rigor and careful thought to how it was you estimate stuff like survival rates or how many animals there are and things of this nature. Stuff like that.

We were also applying a fair amount of rigor to the population modeling. Give me some survival rates, give me some reproductive rates, and I'll tell you how fast the population grows. Right? So, in those two areas there were very rigorous models, (unintelligible), what you would call scientific. We were doing a good job. But then the sort of last methodological piece for a manager involves “How do I make a decision?” And what always bothered me is you had somebody looking at these estimates, looking at

projections from these models. People spent an awful lot of time and [effort on the estimation and modeling.] And then, the final decision, for example, the harvest regulations meeting, will be a bunch of smart knowledgeable folks. No knock on them at all, but with cigars and bourbon in hotel rooms, saying “Nah.” They’ll look very carefully at these estimates, scratch and turn their heads, and then at the last step, would be, “I think we’ll shoot these many birds.” There was asymmetry that all this attention and effort was being devoted to one piece of the decision process and the final piece of the decision process was completely seat of the pants. That doesn’t mean that bad decisions were always made, right? And I think lots of times they probably were okay. It’s just there was asymmetry in the process. So that’s when people began talking about structured decision making and how do we go ahead and put the same rigor into making that final decision as we did into getting the information that we claim to be using to make the decision.

Another part of that was very often in the sort of management problems that I’ve been associated with, we’ve been so stupid in a way that we’re not even positive how our systems respond to the actions that we take. We don’t know how. We could set this pattern this year and we’re not, say, a lot different from what we did last year, we’re not exactly sure how much the population size ought to change. That’s sort of a bothersome thing. We have these different stories about how they [population sizes] might change [if we took one action versus another.] Sometimes they were motivated by things that might not necessarily be scientific. For example, if you’re a state biologist and you saw your job is trying to make sure your hunters had as many birds to shoot as they possibly could, then maybe you would lean toward a hypothesis that said, “Ah, go ahead and shoot a bunch. Things like density-dependent mortality are going to make it so it doesn’t really translate into much of an effect on the population.” Other folks would be cautious and say, “I’m really worried about this.” Different stakeholders, in this case different states even in a flyway, have very different ideas about what regulations ought to be, and they translate into different models of how the system responded to the actions that we can take. And so not only trying to be smart about the way we made a decision, but properly accounting for that uncertainty, not just saying, “Well, it looks like the evidence is on this one side. So, I’m going to go with these guys even though I’m not really sure.” Trying to get away from that. This notion of so-called adaptive management was a way that formally incorporates that uncertainty about how the system responds to the stuff that you can do to it, in a way that is objective. It’s transparent, it’s scientific, it’s defensible. That’s something that’s always made sense to me. Again, it’s been a part of that management revolution. Trying to do better at that [decision making.] In the “duckology” world, that was basically the first time that any agency worldwide had really officially adopted an adaptive management program. It was [developed] at Patuxent in 1995. And basically, you may remember the issue. I think it was the State of Mississippi that was able to somehow wrangle - after everybody had agreed to the regulations – they managed to wrangle an extra week or so at the end of the season. The idea of having birds just sitting there and not being able to get at them was bothersome to some people. There was an end-run done.

MR. CORNELLY: It was a political end-run that was done that didn't really fit into the process.

MR. NICHOLS: Well, to the framework that everyone agreed to and had been going by for a long time. Basically, what happened is that senators from 49 states, the ones that didn’t get included, were writing to the Secretary of the Interior and the Director of the Fish and Wildlife Service. "It’s foul here. Hey, we don't do business this way. This is really a bad thing." This is in 1995. I'll back up a tiny bit. A Fish and Wildlife Service biologist named Fred Johnson – he used to be a state guy from the State of Florida who

later came up to the Office of Migratory Bird Management at Patuxent in their group that worked on surveys. I worry about going off on a tangent.

I'll still never forget this. In 1989, Fred walked into my office at Patuxent after his first [hunting]regulations meeting - because he was one of the guys that was supposed to be working on those. He shook his head and said, "Jim, if regulations are still being set this way when I retire, I'm going to view my whole career as having just been a complete failure." And so, we talked, and he listened to some ideas. You know, I'd been proposing some things about adaptive management for a long time, but it's a whole lot easier to talk about them than it is to actually write them. It was easy for someone like me to tell them what was logical and ought to be done. And he walked out of there saying, "We're really going to have to make this happen." Right then, I remember thinking to myself, "Geez, it's kind of a shame, because I agree with him 100 percent, but it's probably a very, very slim chance of this ever being able actually to come to fruition.

Fred, to his credit, I believe it was around '92, he developed a working group associated with adaptive harvest management. We started meeting. I'd go to him and explain things about how I thought it all would work and about optimization. Ken Williams was the guy who really knew optimization. Various of us were associated with that group, and there were some key state folks who were hand-picked to at least be open minded; not hand-picked because we thought they were going to be "yes" people at all. People who would at least not say "Oh, you're crazy. Dale Humburg was one of them. Jim Ringelman from Colorado. You can imagine the types of people we got. So, for a period of three years, this ad hoc working group got together at least a couple of times a year to talk about how you develop a framework for adaptive harvest management. We made a bit of progress, but we weren't quite ready to step forward and do it. Then in 1995 this end-run had caused the political crisis that caused the director of the Fish and Wildlife Service to say, "Man, we've got to have some other approach. We've got to have something we can claim is objective in principle." We were right there. It was a little bit before we wanted to, but ...

MR. CORNELLY: I remember that. We thought we had another year or two or three before we pulled the trigger on it. That forced the issue. Knowing Humburg, they rambled on for a long time. It seems to me that they were really good biologists, smart people and good guys. But one of the most important things is they were state guys and not feds. They were trusted. Not that the state guys didn't trust some of us, but they trusted those guys more. We needed that liaison because obviously not everybody was going to just jump on the bandwagon. Once some of them – especially if they've been around for a long time - were used to this seat of the pants [approach] and they could see no reason why not to keep doing it the way they were [used to].

MR. NICHOLS: Exactly. We're all resistant to change, and so it's important that people at least listen. That doesn't mean everybody always agrees, but the working group needs to. We had folks who were engaged and very interested.

MR. CORNELLY: It generated a lot of really important questions from people who didn't quite understand what was going on.

MR. NICHOLS: Yeah, well, that's another good point. In '95, what happened? Ken Williams, Fred Johnson and I ended up making presentations to the Director of the Service. Afterwards, I'm convinced we could have talked in another language, could have said things that were completely incomprehensible and the

answer would be “Yes, we want to do that” just because it was such a political screwup. Luckily, we were there and something that I think actually was good, is good. But you're right. The state folks were just piling on. Folks like Ringelman and Humburg, for example, the state folks who were involved, were just ideal for being at the flyway meetings. We went to the flyway meetings afterward as well, to present our point of view. Having guys like that who were engaged and integrated into the group was just hugely important, to the point that I think things would not have happened nearly so smoothly if it had not been for them.

MR. CORNELLY: Well, when I first started going to Service Regulations committee meetings and being more actively involved in the regulation setting process, there just wasn't a lot of trust between a lot of the state guys and the migratory bird or flyway [reps.] Some of the flyway [biologists] like Jim Bartonek - the Pacific Flyway didn't really know how they were being manipulated by Dr. Bartonek, who made them always feel it was their idea. He was in charge. There was no question he was in charge. But you know, it was a tough time especially to make major changes in the business.

MR. NICHOLS: Once again, you had these two extreme factions of approaches. Some really wanted things more liberal versus those who really wanted things more conservative. And you're right. There are a couple of cases where there may have been flyway reps who view themselves more as pals of State guys as opposed to representatives of the Service.

MR. CORNELLY: No, it's true. Right, I know one example in particular that was very true. The Service finally did something about it. But the other thing, on the Service side - where this happened - Galen Butterbaugh was our regional director when I first got to Denver. And we were in the mode of “bring us a rock and we'll tell you if it's the right rock or not” instead of sitting down and saying well, “if you would modify that recommendation a little bit this way, we can live with that”. Galen started the idea and Dave Sharp and I were involved. After we have our closed meetings, let's sit down with some of the Central Flyway guys and see if there's some wiggle room that scientifically we can make room for. Let's sit down and talk to them instead of just waiting until they bring another rock and say "no" again and waste all this time. I said, by all means, we're partners in this, and we don't always have all the right ideas. So, let's work with them instead of just saying, well we can't tell you what's going on behind closed doors. You've got to figure it out for yourselves. That was one of these sea change kinds of things that you were talking about - looking at harvest management. Our whole relationship, the personal approaches to things, started to change before we got into adaptive harvest management. You don't really think about these things at the time, but when you look back you say, "Well, that was an important piece of this stuff too." We were getting along better and talking more about things and then this new concept comes along. It's hard to understand, but we're doing it for the right reasons.

MR. NICHOLS: Part of the concept was trying to do exactly as you say and get along. For example, the idea of the compensatory and additive mortality hypothesis that dealt with these two extremes. If you went backwards with people - liberal versus conservative regulations - the whole idea of this adaptive management was saying, OK, we're going to go ahead and actually incorporate both models. There's a real attempt by the Service to do exactly as you say. Look, you fellows that think that hunting doesn't matter at all - we're not going to brush you off to the side and say that your ideas don't matter. We're going to take it so seriously; we're going to incorporate that model of how things work ...

MR. CORNELLY: We're going to try to learn how things really work and see if you're right or they're right or some place in between.

MR. NICHOLS: Then we said we'll do the same things with the folks who want real restricted things. We'll add this additive mortality. We will incorporate both of these into the way we make decisions. And then from now on in time, the idea is that we'll put more and more weight on the model (or models) that does the best job of predicting. So now we're not going to put more influence on the model that has somebody who's louder or more politically connected. We're going to be subject them to the scientific fair game and the models that predict the best, those are the ones that are going to be the most influential. We're still going to toss models away but you just get more and more influence the more and more it's clear that the model ends up being a better predictor. So, there is a real effort to take stakeholder opinions into account. My claim is that it [adaptive management] really reduced the contentiousness at flyway meetings and not long after that I started going to flyway meetings less and less [as I was not needed]. At least early on, it really did reduce a lot of the fighting.

MR. CORNELLY: I still go occasionally, mainly to represent the Trumpeter Swan Society. I think it's still less contentious. The Pacific Flyway was very different from the Central [Flyway]. I think Jim Bartonek had a lot to do with that. They had university professors that were doing waterfowl research show up at flyway meetings and they had some managers show up – some refuge people. I had been a refuge biologist for four or five years before I went to my first flyway meeting. I had no idea how this process worked at all. We were asked to send people to band ducks and do May surveys. We had no idea how the data were used or how important it was.

And I got to the Central Flyway, and they didn't invite any of those kinds of people. And I said, based on my experience, it was a whole new world for me, and I said, "We all need to know how this works because this is really important to everybody." I started saying we need to invite some of these people to these meetings. We need to invite them to make presentations - from Valentine Refuge or wherever it is. Of course, the North American Waterfowl Management Plan - the joint venture started up just right at the time I moved to Denver. And we found out that most of our state counterparts - outside the regs arguments - most of the time we spent with them, we were arguing about hunting regulations. Now when we are talking about habitat and populations, and all this stuff, we find out that the vast majority of the time we're on the same page. And so, our relationships- we became pretty good friends with some of these people that we were pretty well fighting tooth and nail with before. A lot of this stuff just kind of came together, similar to what we're talking about. This was a little bit before '95, and adaptive harvest management, but when you stop back and think about it, they really helped set the stage. Because by 1995, in my personal experience, the state guys and the Fish and Wildlife Service guys knew each other a lot better because we were working on joint venture technical committees together and doing a lot of a lot of other things, and that had to have been helpful to get this new process up and running. I didn't even think about that until you started talking about this.

MR. NICHOLS: Yeah. Your comment about the flyways – I always thought of the Pacific and the Atlantic Flyways - they hardly ever sent me to those flyways [meetings.] It was always to the Central and Mississippi 'cause that's where the fighting occurred. (laughter)

MR. CORNELLY: Well, they fought with the feds or they fought with each other. The Mississippi and Central [Flyways] were always fighting over mallards.

MR. NICHOLS: You had fights in the northern and southern parts of the Mississippi [Flyway] – oh yeah. You mentioned the idea of talking with managers. The mallard adaptive harvest management is something that really, again, at the time I envisioned and think of these two revolutions. One how you

estimate stuff and one how you make the entire decision. The decision process stuff on the mallards is the first sort of example that I know of where an agency really followed something that I thought was really neat. Back at the time we were hoping this was going to be sort of a “Field of Dreams” thing. We would build it and they would come and everybody would see how this works, and that any other management decisions would begin to be made that way. We were just very naive and dismayed – very disappointed – that this didn't happen. In retrospect, maybe the ducks weren't a great example to start with, in the sense that you mentioned doing something like adaptive management with another kind of problem we faced. And I'd say, “Well, wait a minute. We don't have hundreds of people hanging out of airplanes, counting ducks. We don't have thousands of banded ducks.”

MR. CORNELLY: And that's the thing. I ran into this a lot. I was trained as an ecologist and did a lot of habitat-related thinking and so on. One of the reasons that it could work is it's the biggest data set in the world, basically. Some of these people didn't really understand that. They wanted to follow that model because it made so much sense, but they didn't have the data. And then they would start doing some stuff and say they were doing adaptive management, but they weren't. It became a buzzword. They said, “We'll try something. If that doesn't work, we'll try something else.” I said, “Well, we've been through trial and error since the Stone Age. That's something a little bit different.”

MR. NICHOLS: Yes, there's two things about that. One thing, conceptually, I don't think the amount of data matters a bit. In other words, in terms of the decision process itself ...

MR. CORNELLY: I agree with that.

MR. NICHOLS: I go through it exactly the same way. But on the other hand, you're absolutely right that people perceive that [adaptive management] as being something that is a big deal. After that, we purposefully or I purposely, got involved in a few other smaller ones just because I thought it was important to have examples of things where here you did it on a smaller scale and you wouldn't know nearly as much. Whenever I get involved in one of these, often you don't have the well-organized flyway systems and documentation, and that's okay. You find that the first parts of these decision processes have to be taken seriously. They're coming up with objectives and coming up with what management actions you're willing to consider. And those are two things that require stakeholders. You can't do it without them. You've absolutely got to be working with the manager all the way, and you've got to be working with constituents and the people who claim to have an interest in whatever issue you're managing. In those meetings where you get together in workshops and try to talk with two different groups who just hate each other and try to come up with a compromise, a set of objectives, that's enough of a compromise that each will agree to. I hate that. A hundred times I'd prefer to be doing estimation stuff but I thought it was important enough to our profession that I ended up doing way more of that [decision process work] than I was comfortable with.

MR. CORNELLY: It is very important. Nothing is all one way or another, but most biologists, in my experience, tend to be pretty introverted. I, as a refuge biologist, couldn't do environmental education and things like that – that's somebody else's job. But nobody was doing it. So, after a while I would say, “We've got to have these voters, these are people - we need their support.” So even if you're not comfortable doing this, you need to educate these people why it's important to do what you're doing, whether it's with waterfowl or deer or whatever it is. I ended up doing just like you said. I ended up doing a lot more of that than I ever figured I would. Part of it was because nobody else was doing it. We

didn't have funding to hire the outgoing educators to do it. And if you didn't do it, you weren't going to be successful at a lot of things that you thought were really important.

MR. NICHOLS: I couldn't agree more. You end up finding yourself doing things that, I did anyway, I was not at all comfortable with. Again, you have to have somebody who can be that honest broker and simultaneously has the whole process in his or her head, so that they can actually shepherd people through this. The parts of the decision process that involve the modeling – how do you model responses and how does your system respond to the actions that you can take. Monitoring then informs you and says, “How am I doing right now? What am I learning?” That stuff I was real comfortable with. The stakeholder stuff, I wasn't but just exactly as you said, nobody else is going to do it and it's an extremely important part of the process. It's interesting. Most of us think there are basically two groups of folks who think real seriously about decision processes. One of them is folks from the USGS and Fish and Wildlife Service, even from the States, and the other one is a group in Australia – a guy named Hugh Possingham. They're extremely smart folks and have done just an incredible amount of neat work. But the one distinction between us is that often their neat papers were written as academic things where they take a problem and they end up making a sort of a toy problem. They catch all of the essence of the issue, and come out with some suggestions for management, but they're very seldom followed by the management agencies who were in charge of the problems to deal with. I think my claim, I don't know if I'm right about this, is the fact that we actually immerse ourselves in these processes and deal with the managers and stakeholders, especially on the front end of things – trying to get their mind engaged in the process. I believe that makes you much more likely to actually have things implemented. There's a few I've been involved with. In Delaware Bay - horseshoe crabs and red knots. It was the first time the Atlantic States Marine Fisheries Commission has ever endorsed a management program that deals with some species other than the horseshoe crab and the other marine species that are harvested. So, red knots are provided for in the management plan. I've been involved in that. Florida scrub jays, golden eagles at Denali, and different things. Just a few I've been involved in. In each case, the stakeholder stuff has made me uncomfortable but I'm happy to have been involved with it. That's basically the future of wildlife management and conservation biology - that sort of thing. I'm disappointed that it hasn't come along as quickly. The revolution in decision making hasn't come across as quickly as the revolution in how we estimate.

I have a bunch more to say. I could comment on a couple of really neat collaborations.

MR. CORNELLY: I'd like you to talk about some of those. One example or two.

MR. NICHOLS: There was a guy at the University of Florida, a long time ago in the early nineties, started asking me about how to estimate things about tigers. He was the first guy to ever think about using camera traps for something other than to get neat pictures of critters or to document presence in the area. In his case with tigers, he came to me and said, “You know about capture and recapture. We could use the individual stripe patterns on the tigers to estimate how many there are.” His name was Ullas Karanth. He was an Indian who worked for the Wildlife Conservation Society. I've met with him many, many times since we initially met. That's been a collaboration I've been extremely proud of. When you hook up with somebody who's interested in doing really useful things and follows some of your advice if he thinks it makes sense, that's always pleasing. He just won the Wildlife Conservation Society's very first lifetime achievement award. It was named after George Shaller. It was just presented to Ullas this last year. I had never known anything about tigers before I met him.

MR. CORNELLY: One of the things that, and I don't ask this with any particular expectation one way or the other, but all of my colleagues and acquaintances that ended up in the USGS after a couple of different [reorganizations] - I always ask how the contrast, if there are any differences from when you worked directly for the Fish and Wildlife Service after the changes were made – if that affected your specific position that much, or not. Because as you know, it was a really controversial thing. Well, it's still controversial to a lot of people. I understand that sometime in the last few years, that Bruce Babbitt who basically implemented this change said that maybe it wasn't the best thing to do. But I'm personally interested in - did it affect your job and how you did business in any significant way or just kept on keeping on?

MR. NICHOLS: I'll be totally honest, I always tell folks, I still always think of myself as a Fish and Wildlife Service guy as opposed to a USGS guy. It bothered me when switched organizations. I didn't like it at all. I didn't see any advantages, really. The main thing about being at Patuxent, it didn't affect my life that much. I've always been lucky to have supervisors who weren't micromanagers. Obviously, there were things I had to do, but I always had a chunk of time to do the things that I thought were most important. Because of my background in the Fish and Wildlife Service, I had a real good relationship with a lot of their people. For example, the folks who dealt with monitoring migratory birds at Patuxent. I just always had what I hope was a good relationship with the folks in the Office of Migratory Bird Management. Because no one was micromanaging me, I was able to maintain that kind of relationship through the years. I always say that it is the relationship with MBMO was basically in spite of rather than because of the organizational structure. That's the part that bothered me the most. If you didn't have the background in the Fish and Wildlife Service, you didn't have that built-in predisposition to work with folks who were involved in those important management issues that we're supposed to be servicing. It bothered me that a lot of new folks didn't feel that and were happy doing random work in the places that were interesting to them but weren't necessarily as useful to the land management agency. I've always been bothered by that. Personally, it hasn't hampered me because I've had access to those folks. I've been able to collaborate with them. But it's something about this organization that really bothered me.

MR. CORNELLY: Part of the thing that bothered me about it was the idea, because I've worked from almost day one with science centers and cooperative agreements when I worked for the Fish and Wildlife Service. My PhD was facilitated by a Park Service coop unit at UNLV (University of Las Vegas.) That's not where I was going to school. I went to Northern Arizona, but UNLV didn't have a PhD program. And of course, the Park Service lost their research people too. Somebody seemed to believe – I don't know exactly where it came from – that our scientists were biased because they were in the same agency, with the managers and stuff and, I've never seen that. I've never experienced that. We had some of the best people in the world. And so that bothered the heck out of me. Like I said, somebody has invented a problem that doesn't exist.

MR. NICHOLS: I'll pile on to that one. I've had people with extreme views – I won't mention names here – but I've been accused multiple times when I was working with the Fish and Wildlife Service of slanting things to fit some sort of Service idea of what research results have come out. Basically, the notion was somebody telling me what things ought to look like and I made it so that would happen. Never once in my career with the Fish and Wildlife Service or any other agency did any management person kind of duck his head into my office, and say, "Hey, Jim, you know it would be nice if your results came out this or that way." Nobody EVER did that. That was the biggest red herring and falsehood I ever heard.

MR. CORNELLY: Yeah, I agree. And like I said, my work not only depended on those guys but I cooperated on some other projects and stuff. I had somebody one time say, "I'd like you to do a research project to prove this." And I said that's not the way it works. That may be right, or it may be wrong, so you go out and make some assumptions.

MR. NICHOLS: If you have a question, I'll address it.

MR. CORNELLY: That's right. I've been retired now twelve, almost thirteen years, which is amazing. I had a similar thing happen to me. It wasn't this situation, but Migratory Birds was part of Refuges and Wildlife, and then we got split away. I thought that was really dumb and I still do. I wasn't concerned for myself. Just like you, I had a network, and I had connections with all the refuge people. And so, I said, as long as I'm here that's going to work, but when I'm gone and you've got new people... Like the young people coming into the USGS, I've talked to a few of them, and said, "Boy, do we wish your organization was back in the Fish and Wildlife Service." And they go, "Oh my god, that would be terrible" because they don't have that history, and they don't know. I was concerned that when you retired and I retired, those relationships – we still have those personal relationships, but they're not necessarily working relationships anymore. I think I've seen some of that. We still have really good people that we're bringing in, but things don't work the same.

MR. NICHOLS: Yeah, that's what bothers me. It's funny. It might seem like a bit of a tangent but it reminds me of this Jim Hines guy, the programmer who works with me - every five or six years we'd have what managers do – they develop new organizational charts. They always say, "Now wait a minute. You've got a computer programmer sitting here in the research group, and that's not right. We ought to have efficiency in all the computer programs."

MR. CORNELLY: All together.

MR. NICHOLS: And think how much more efficient that was? I was lucky enough [to win those battles and keep Jim Hines in our research group], but in my mind it's almost the same way. The idea of being in a research group, and it's similar to being, for example, a Park Service scientist working with a bunch of Park Service folks.

MR. CORNELLY: A number of parks too have specific areas to work with. Northern Prairie was probably the best science center that way because they were working with the wetland districts and the refuges in the prairie pothole area. They're doing some very different stuff, I think. I'm not that closely connected anymore to some of those people but it makes all the sense in the world to me to do things that way, and to have different specialties working together. You wanted that statistician sitting there, and you want that computer programmer sitting there because you're all trying to solve the same problem in different ways.

MR. NICHOLS: You're moving your hands and it isn't going to come on the sound bite. But that integration, it's my claim that it's hugely important - as opposed to the case where "What would the USGS person in Reston say?" Well, if the Park Service person has a problem, they just tell somebody in USGS, and you try to come up with the solution. That doesn't work. It's been my experience that doesn't work nearly as well as somebody whose part of the team.

MR. CORNELLY: No, it can work, but it's not as efficient. I think you've got much more opportunity for it *not* to work.

MR. NICHOLS: I agree about efficiency, and that's what's ironic, because efficiency is the usual reason people give for doing it, [for grouping people by technical speciality.] Let's get these guys together, these science guys.

MR. CORNELLY: Every time I've seen that and I've been one of those clients that had to get computer help or something, it's been more difficult.

MR. NICHOLS: It's much easier to have somebody integrated into your program. It always bothered me.

MR. CORNELLY: So, what are you proudest about, some of the work you've done through the years? Is it working on adaptive management? Is it other things?

MR. NICHOLS: In general, it's just having made, hopefully having made nontrivial contributions to those two revolutions. The one estimating "things" and the other in making smart decisions. There's a bunch of things I could say within those, but it's basically, to sum it up, it has to do with hopefully having contributed to those two areas that basically make the discipline look, I think, quite a bit different now than it would have 30 years ago. There's no way I take credit for, but just having been a part of that is fulfilling.

MR. CORNELLY: Well, another observation. Listening to you just reminds me, that with me and so many people I've talked to, you ended up doing something pretty different than what you set out to do originally, and I think a lot of us have looked back and said, "How did that happen? Why did that happen? But boy, I'm sure glad that it did." I don't know how to explain this. I was pre-med for three years, and one day I said, "I don't like sick people in the hospital. What am I doing?" I wanted to be a field biologist.

MR. NICHOLS: You're right. For my career, hopefully part of it was trying to make smart decisions, and doing what I think is best for myself and my profession. Another part of it is you get lucky.

MR. CORNELLY: The voles were at the low part of their cycle so you've got to do something else. It's so interesting that this kind of thing happens. It's different - it's just some kind of serendipity or something that happens and people end up where [they do.] I really loved the people I worked with and loved what I did, but that's not what I set out to do, but I'm glad it happened.

MR. NICHOLS: And it's funny - every once in a while, I feel - you may feel the same way - you know that a fair part of the accomplishments/contributions/whatever you made end up having been the result of serendipity or luck or whatever. Anyways, you just feel really fortunate that some of the decisions and some of the things that happened did turn out okay, 'cause it easily could not have happened. Maybe I'd be a grumpier old man. Anyway, I feel very fortunate.

MR. CORNELLY: Well, you know, this has been very interesting and very good and we've got plenty of time if you want to say anything more.

MR. NICHOLS: No, I'm way over. I don't want to break any rules!

MR. CORNELLY: There are no rules. Well, I really appreciate you taking this time and coming over and doing this. I think it's important. So, thanks again, and we'll turn the machine off here. I'll tell you what will happen from here on out with this interview, and then we'll go find a beer someplace.

MR. NICHOLS: Well, again, thank you so much for doing this, John. I couldn't agree with you more. I'm honored you chose me to be a part of this.

MR. CORNELLY: As I said, part of my emphasis, although I'll interview anybody, any program or whatever, but I want to make sure that you guys who spent so much your career in the Fish and Wildlife Service are included in this project. I also try to concentrate on Migratory Bird folks. I interviewed Russ Oates the other night. When he retired, he was a migratory bird chief up in Anchorage. And then I've got a special project that's oral histories around the history of the North American Waterfowl Management Plan where we actually interview State people and CWS (Conservation Wildlife Society) and provincial and DU (Ducks Unlimited) people on how the plan started and all that kind of stuff. I've always been interested in history and natural history – it's really part of the same thing. I'm sure you can tell I enjoy interviewing people like you and getting your stories down.

MR. NICHOLS: I'm so glad you're doing it.

MR. CORNELLY: All right, Thanks!

KEY WORDS: Adaptive management, migratory birds, monitoring, resource management, scientific personnel (USFWS), structured decision making