

NOAA Beaufort Lab Oral Histories
Carolyn Currin Oral History
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Joseph Smith: Joe Smith here at the NOAA Lab in Beaufort with an interview with Dr. Carolyn Currin today. Also present and a few of the interviewers are Dr. Don Hoss and Dr. Bud Cross – both former directors at the lab – Dr. Doug Vaughan, Dr. Jeff Govoni, and myself. We will begin the interview with Don.

Don Hoss: Well, I think this is going to be a fun interview. Carolyn brought a lot to the lab. But I think we will start as we normally do, with kind of a little bit of background and how did you get here, type of thing. It is not an easy place to get to. [laughter] It is always interesting to see the route that different people took to get here. So, with that, take off.

Carolyn Currin: My journey here probably started in Laramie, Wyoming, when I decided I wanted to do fisheries, and I also wanted to get out of where I was living. So, I went to the University of Wyoming in Laramie and really liked science. It was the first time I'd really been a science major and loved it. But I realized I did not want to do trout fisheries. I wanted to get back down to the coast. I had a work study. There was a fellow in the lab, and I asked him – a graduate student. I said, "Samuel, I need to transfer to the East Coast for Fisheries, where should I go?" He says, "Go to NC State." That's where he was from. So, I did. I applied to one school, went to NC State, and finished, got my bachelor's degree at NC State.

Jeff Govoni: Excuse me, Carolyn. You are originally from Baltimore.

CC: I'm originally – I grew up in Baltimore, Maryland. Well, I ended up in Laramie in one way or another.

JG: That was Jeff Govoni asking. [laughter]

CC: So, Diane Lawrence, and I don't know if many of you remember her, but she was my TA for a limnology class at NC State. She was doing her master's degree work in Gordon's lab. Back in those days, there was a lot of NC State students who were given lab space here. They could come down, and it was kind of the NC State lab, really. So, Diane Lawrence said to me – I graduated that December. She said, "Carolyn, I'm working at this lab down in Beaufort, and they're looking for a technician. Why don't you ride down with me, if you want to interview for it?" I said, "Oh, yeah. Great." I had never thought about working in the coast. I had always been a river person. Came down to the coast, I can remember standing out on that dock and looking down Taylor's Creek and thinking, "Oh, my gosh, this is just beautiful. This is where I want to be." So, it was working with Jud Kenworthy on decomposition of seagrass. I had taken some microbiology. I had taken a lot of chemistry, which was good. I interviewed with Gordon. They hired me. I started in March of 1983 for 700 hours. So, I came here for a 700-hour position in March of 1983. I just managed to stay one way or another after that.

DH: So, your first work here was with Gordon?

CC: With Jud.

DH: Jud.

CC: In Gordon's group but Jud was my direct supervisor.

DH: You got lucky.

CC: You know what? You are exactly right. [laughter] No, I could not have – I mean, I know [laughter] you're kidding in some ways.

JG: We told you it was going to be funny. [laughter]

CC: Yes. To me, I mean, Jud is like the best field person, one of the greatest – I mean, I learned so much from Jud. I really did. It was great. I learned how to run a boat. I learned how to do an experiment. I learned how to record data. I learned how to operate the CHN. I mean, I learned how to do science from Jud. He was a great person to learn that from.

Douglas Vaughan: What happened after your 700 hours employment expired?

CC: Well, for a little while, I worked over at the Duke Lab, well, for one of their things where they had that fish bait. They were grinding up fish and freeze-drying it and then coating fishing worms with it to make better lures. [laughter]

JS: Patty Hay, I think Patty Hay –

CC: Patty Hay and Mike and Kathy Cheek's husband also, we all worked over there.

JS: I think it was the start of gulp baits.

CC: It was. It was.

JWS: Patty would say they were putting spots in blenders and pouring off the supernatant and then spinning that.

CC: Exactly.

JG: Making bubble gum.

CC: Then (Gap Kreiner?) was the plastic chemist. He was figuring out how to put this stuff on the worms. I actually ended up going out with bass fishermen. I had control [laughter] and treated worms and to see if we could prove that they– so, I did that in the inner time. Then I got hired to work with Pete Hanson. I also ran the CHN, probably under the table. This is on the record, I guess. I kept running the CHN, and for like Duke or other people back in those days, we had an instrument nobody else in the county had. So, I could come in and would do that. So, I just kind of managed to stay here one way or another. Then Pete Hanson hired me to work on the Status and Trends Program.

DV: Oh, I know. I had forgotten that.

DH: I forgot it completely.

CC: Yes. So, I worked for him for a while, went out in the field, and that was really kind of fun, catching fish, starting down at Laguna Madre and working my way up around the gulf. That was fun. Then catching fish and then doing a bunch of particle size analysis and stuff like that.

JG: Catching fish?

CC: Yes. The fieldwork was the fun part and then came back to the lab. Then I think from there, I did come back and worked for Jud again for a little while. But then I eventually decided to go get a graduate degree. So, I left the lab and went to UNC in probably [19]86 maybe, somewhere in there. I came here in [19]83. I think in [19]83, I started my talk ladder. I think in [19]86, I'd started at Chapel Hill.

DH: How was that funded?

CC: I just left. I left.

DV: Oh, you did not maintain a relationship with a lab at that time?

CC: No. I mean, I was a temporary. I didn't really have any kind of a standing. So, I left and was in Chapel Hill for a year, taking classes, and then came down here for a year and was working at IMS. Then after those two years, I came back to the lab. I think it was like a part-time seven or something like that. I got an office here. I was looking at nitrogen fixation at that point. I'd done a bunch of immunology when I was in Hans Lab. At that point, we started looking at nitrogen fixation. I remember Gordon telling me, "Carolyn, they tell us this is not the National Marine Plant Service. This is the National Marine Fisheries Service. So, you had to make a link." He talked about making a link between nitrogen and plant production and fisheries. So, a lot of my Ph.D. work was done on the Port marsh over there, that big habitat marsh restoration project in the Newport River. Lisa Levin was involved with that – looking at the recovery of the benthic infauna – and Steve Broome and had graduate students working there. Then Hans had both myself and Suzanne Thompson and (Mandy Joy?) all looking at nitrogen chemistry. Hans.

JG: Hans Paerl was your major professor?

CC: Hans Paerl was my major professor. Yes. Correct. So, that was where I did really almost all my Ph.D. work, other than the initial stuff I did in the lab. So, we looked at the recovery of both the spartina community. That was about the time when stable isotope research started coming out as a way to trace plant production into the food web. It was a way to look at a fish's stable isotope chemistry, and you could draw conclusions on where, what sources of primary production were fueling that fish production. So, I went to Gordon and said, "Hey, Gordon, I think this would be a good thing to do at the Port marsh." Gordon said, "Yes." I think I want to say he found \$2,500. I mean, you look back on it, it was not much money, but it was enough. So, that's what I did and figured out a way to get the stable isotope composition of benthic microalgae, which hadn't been done very much.

JG: Was this carbon and nitrogen and sulfur?

CC: Carbon, nitrogen, and sulfur. We didn't get sulfur on the benthic microalgae, but the sulfur was crucial for distinguishing spartina from phytoplankton, for example.

JG: Vascular plants from phytoplankton.

CC: Right. Because they're getting their sulfide versus sulfate in the water column. So, it had a very different sulfur signature. So, published a paper in *Marine Ecology Progress Series* on – and that paper still gets cited. But that was just an idea. That was the freedom to me, the freedom of being able to go into your branch chief's office and saying, "Hey, I've got an idea." Having them be receptive to it, it was great. So, that was my dissertation work, was ran through, I think it was three or four papers came out.

DV: Your major professor.

CC: Hans was. Yeah, Hans.

DV: Both degrees.

CC: I never got my masters. I published a paper in L&O on the nitrogen fixing, trying to trace nitrogen fixing cyanobacteria. So, if I hadn't come back to the lab, I probably would have continued more in a microbiology vein. But when I came back to the lab, it was like I have to do something because a lot you were paying my salary. So, we worked it out. I don't remember how it all got worked out, but it all got worked out. Hans was fine with it. The lab was fine with it. So, the rest of my dissertation was on the recovery of this salt marsh restoration and how things changed in that. Then how both restored and natural marsh supported fishery production is kind of how we couched it. That's what we did. So, that work continued through – I didn't actually get my Ph.D. until [19]94. So, the next thing that happened was the lab closed for a year basically because they had to replace the steel, the underpinning. Remember, everybody got farmed out. Well, that was the year. So, by now I'm married to Mark Fonseca. So, that was the year that people got farmed out. Mark went to Berkeley to do his Ph.D. We went to California for a year. So, I finished writing my dissertation out there. He started his Ph.D. out there. So, we were out there for a year. That was a good experience, too. I mean, I became very familiar with California salt marshes. One of the things that was so great, I look back at my career, was the opportunity to go to so many different places. I learned salt marshes are so different. It was endlessly fascinating to me, no matter where I went. New Jersey or Alaska or California or Florida, Southern California, wherever you went, they're just different.

DV: I went to Harkers Island for that year.

CC: Oh, did you? Yes. People got farmed out all over, everywhere. But somehow –

DH: I went to Harkers Island too.

CC: Well, we went to Berkeley. So, I was out there for a year. Yes. That was when I finished writing, because I was working. Of course, Ellen was born in – so, that must have been [19]94, must have been that. Ellen was born in [19]89.

DV: Well, what kind of position did you have here when you went out there? Were you a part-time, permanent, or –

CC: I don't think I was permanent then. I don't think I became permanent until I came back. I really don't remember. I was part-time for a long time. Here's another, we talk about the experience of maybe women scientists at the lab. I've told Don, I said, "I feel so fortunate." I had nothing but support. I don't have any tragic stories to tell. [laughter] Maybe some funny ones, people who you would expect to say stupid things said stupid things. [laughter]

JG: I can imagine who that would be.

CC: But other than that, I mean, you could just blow it off because it didn't matter. But the people that mattered, and the way I was treated professionally was wonderful. But one of the things that I did was because I had – Ellen was born in 1989. I did not want to work. I wanted to work, but I wanted to be able to leave at 3:00 p.m.

JG: Ellen, your daughter?

CC: My daughter, Ellen, was born in 1989. I wanted to have the freedom to leave when I had to leave. I didn't want her to be there till 5:00 p.m. So, I worked thirty-two to thirty-four hours a week for years. I was a part-time employee. A lot of times I worked more than that. But to me, I didn't have to feel bad about leaving at 3:00 p.m., if I wanted to leave at 3:00 p.m. Sherry Chester came to me at some point, and she said, "Carolyn, you're still –" Somehow, she said, "You're still a part-time employee." Because she had a son the same age as my daughter. I said, "Yes. I just like the flexibility." She said, "Do you know that when you retire, you're only going to get half time credit for those years? Even if you're working thirty-two or thirty-four, you're only going to get half time credit for those year." I said, "No, I didn't know that." I mean, you're not thinking about retirement when you're in your thirties. [laughter] But thank heavens, Sherry flagged that for me because I was almost working full-time, really. So, I thought I was going to be getting 80 or 90 percent credit. Of course, I wasn't even thinking about retirement.

DV: Yes.

CC: So, anyway – so, I didn't switch to full-time until probably [19]94. I was a permanent employee before that, but I became full-time, I think, in [19]94. Then we came back here.

DH: If you can think of it this way, what do you think your favorite line of work was when you were here? Or was it all favorite?

CC: It really was. I felt like I had a lot of freedom really and could pursue opportunities and things that I wanted, I liked. So, I was able to write, get funding to go work in New Jersey with (Ken Abel?) and (Sam Wainwright?). That was another stable isotope. I did that funding. That

was a very fundable, scientific approach for a long time. So, I went and worked with Ken Abel in New Jersey, looking again at sources of primary production that fueled food web up there. I got funding to go work with Lisa Levin at Scripps. There was a salt marsh, there was a restored and natural salt marsh in Mission Bay in southern California. So, went there for, I don't know, three or four years. We published several papers. Of course, those marshes there are so different than our marshes.

DH: You were up there that long?

CC: I went back and forth. Yes. No, I wasn't out there, but I flew back and forth a couple times a year for several years and worked with Lisa on that.

DH: I am glad to hear that. I have forgotten a lot of what you are saying. But the whole basis of the lab as I know it, since we weren't funded completely by National Marine Fishery Service, we had this big AEC money. When that ran out, we had to be like a university really. We had to get money. We had to do things. I think it kept us sharp. Because without it, we would have been out of business and –

JG: Diverse, kept us sharp and diverse, I mean, scientifically diverse.

DH: It also, though, made us a little bit more like a university in the sense we had to put in grants. That was not quite the same for the fisheries division, but we had to – I do not know what our percentage. I can't remember now. But it was about half was grant money, was it not?

CC: Yes.

JG: Reimbursable, so we could not call them grants because federal government cannot grant.

DH: Commit as grants. But anyway, we could get money from anybody except NSF. We could not get money from the National Science Foundation.

JG: That is because it is government money. Government cannot give money back to the government. [laughter]

CC: I think now we can't get Sea Grant money. But it was California Sea Grant that funded the work out in California. At some point, it became – I remember I got a phone call one day, "Oh, we cannot pay for your travel," or something like that. So, they can pay, but they couldn't pay for my travel. So, we had to work things out.

DH: I think it made a good place to work. All that caused us to hustle. But I think that is good.

CC: For me, it meant that you were collaborating with the academic community, which was great. I don't know where we are now. After that, so the next things, the other things, big things that happened, I guess, that are worth mentioning, at some point, we took on the Kasitsna Bay Lab. Gordon asked me or somebody here suggested that I go up to Kasitsna Bay and do some work. So, I did, and that was wonderful. Again, we did some stable isotope work. That's one of

the projects I regret that we didn't get published the way it should have. There was just so much going on. But what a fantastic experience that was to go up there with those. They're like 40-, 50-foot tides. Did you guys all manage to get up there? I mean, what an extraordinary place? Just extraordinary. We'd go up there in the summer. We would work almost – well, 18-hour days. We could catch two tides a day. We'd go out and those long, long flats. We were catching microalgae. We were still very interested in micro-algal support for clams. We went up there and made presentations and gave the data people and wrote reports and things like that. We would go out. Then it would be 11:00 p.m., and the day was over. We would just get in that little dinghy, the inflatable. We'd run out at 10:00 p.m. and watch the humpbacks and the sea otters and come back and go to bed and get up at 6:00 a.m. or 7:00 a.m. I mean, they were great, great trips. We finally went one September. It got dark about 9:00 p.m. We're like, "Where are the light switches?" We had never used a light switch [laughter] until that time.

DV: That is funny.

CC: Yes, it was. The freezers were stocked with halibut. They said, "Help yourself." I mean, there were so many people up there all the time. You just went in, and we ate halibut all the time. I had so many great technicians. John Campbell – I can't remember his name now – we would have halibut for breakfast, lunch, and dinner. It was really good with a can of tomato soup. You had to go shopping and bring all your food over for a week over there. That was really a great little time period then when we were doing that, along with all the other things we were doing. But that was great. Then I guess the next big thing that happened, so somewhere in there, we started working. I started working on living shorelines. This became a topic locally. They were putting rock in front of marshes and calling them living shoreline. It was a sea level rise issue. Coastal Federation was doing this, and they did the one out there at Duke. So, I got really interested in that. That ended up being a large part of the rest of my – that was in the early two thousands now we are. So, Kasitsna Bay was the late [19]90s to early 2000s. I guess somewhere in there, it might have gone there in [19]99 to 2002 or 2003 or somewhere in there. Then I think we started on living shorelines in 2003, before I even knew what a living shoreline was, before I even heard that term. One of the things I'm happiest about is that marsh that I planted out there – which we didn't even know the term living shoreline right then. But we had had a hurricane. We had had a whole bunch of roses on the shore. David Johnson was the lab director at that time. There was a proposal to extend the seawall that exists from Duke to the seawall that's in front of Gray's shop. They were going to put a seawall across that, that would have been almost the rest – well, it would have been the rest of the shoreline. I suggested to David Johnson that we try planting marsh on the beach, so we can lose the beach. It was eroding. So, we went out and hand-harvested spartina from a couple of spots and looked at the impacts of that and planted, as I recall, three rows of spartina, the extent of that beach in 2000, we have pictures of it. It did well. Steve Broome helped me. Steve Broome and Coastal Fed helped me. Coastal Fed gave me a bunch of fertilizer. Steve Broome showed me how to do this. Within a couple years after we got the marsh established, we got Division of Marine Fisheries to deposit oyster culture. So, they came over with their barge. I've got great videos. They had oyster shells on the barge. They had a water cannon. They blew the oyster shells off the barge in front of the marsh. They did that a couple of years in a row. So, protected that marsh by establishing an oyster reef. That has been great. We're going to have to think about how it's going to persist now because sea level rise is affecting it. I mean, it's still there, but the whole

thing is moving shoreward. There's a slope down there that we're going to have to deal with. I've tried to talk to Greg about it. Greg, can we talk about this? Of course, when they did the big bulkhead, new bulkhead thing, there were some impacts. Anyway, so that really started the next phase of my research. I kind of went from food webs and bigger marsh restoration projects to living shorelines and impacts of sea level rise on salt marshes. That really was what I did for the kind of primary focus for the last, I guess, almost twenty years I was here.

DV: Were you having experience with the project that we did down in Swansboro on the intracoastal waterway?

CC: Yes.

DV: That was supposed to be to stabilize the intracoastal shoreline.

CC: I'm glad you mentioned that. Right. So, I was Jud's technician on that project. So, yes, there were three dredge islands that were graded out and marsh was planted. So, Steve Broome was involved in that as well, and Gordon. Mark and Jud planted seagrass in front of all of those. Then Steve Broome planted marsh. They looked at fish use, and those are actually really important. Unfortunately, most of it only got published as a technical for the agency. Dave Meyer published a paper. He put oyster in front of some of that salt marsh at three locations, and those are all still there. I show them to people. In fact, not too long ago, I was on a living shoreline. The coastal federation organized this big thing and took a bunch of people out to talk about living shorelines. We went down, and we looked at the one at Swansboro, which is still there. I was able to talk about, yeah, this was done in 1990. I don't know that the seagrass is still there. The marsh has been peeled way back but it is still there.

DV: The purpose of that was experimental study to see if, in fact, they could use that technique to stabilize erosion all along the whole waterway intracoastal. But they never did pick up on that, did they, and expand from the success that you guys had?

CC: No, they really didn't, and it's a little frustrating. I mean, some of them, like the one down at Harkers Island, that's such a high-energy system that was tough. Although I went there after one of the hurricanes and took pictures, and there's like four little patches of marsh, like the size of this table there. The only patches of marsh that were still there were the ones that had the oyster that Dave Meyer put there. That made a big difference. He did publish that paper. It did make a difference. This is where we are now, is talking about, once again, using dredge material, keep the sediment in the system. We're losing our salt marshes. They're drowning. This is the work that I'm doing now really is experimental use of using dredge sediment to provide the elevation and provide the substrate that marshes can survive through sea level rise.

DV: Is this not pretty much what the coastal federation has picked up? Is there a technique of living coastlines similar to what you guys did?

CC: They don't typically add sediment to it. What they typically do is add stone or stabilize an existing shoreline. Then if it's an unvegetated shoreline and low energy, they'll plant salt marsh. That's what they did in front of sea mass, for example. They planted salt marsh. They might

have added some sediment to that, actually. They might have put some. I think they did. They definitely did. Somebody put sediment in front of sea mass, and they built those great big giant bulkheads.

DV: But is an oyster shell a big part of it?

CC: Yes. It has become so. I mean, they have now diversified. I mean, there's a thousand different ways to stabilize a shoreline from granite, but yes. So, that was what I started doing next was looking at – well, we looked at fish use. We set fyke nets, and we published some of that. Then the next thing that really happened was I went to a surf meeting in Oregon – in Seattle, during Hurricane Isabel, and heard a conference, a session that Don Cahoon of USGS had on Surface Elevation Tables or SETs, which are these benchmarks that he worked for USGS was setting out in marshes to look at how marshes were keeping up with sea level rise, how marsh elevation was changing. Now, I thought, "Oh, that's really cool. That would be cool to do in these fringing salt marshes." So, I came back. I'm trying to think who funded that. It might have been – no, I think I got internal funding through – well, we were NCCOS by then, right? When did we become NCCOS? What year?

DV: 2000.

CC: Okay. So, it would have been NCCOS for me. So, I wrote in NCCOS Internal and got money and put in the first of what eventually became over 50 SETs that I established in Carteret and Onslow County. The ones in Carteret County were all established in fringing salt marshes. Some of them were behind living shorelines. Some of them were just on regular, natural fringing salt marshes. We're going a really long time. I mean, we could be here for a long time. So, I'll try to keep it short. But that's great because that was 20 years ago. So, now we have this striking record of the loss of salt marshes because of some of those sets that I put in at the lower end. I talked with Don Cahoon, "How should I do this? How should I put them out?" We came up with a scheme. I put one within the lower edge of the salt marsh and one of the spartina and one at the upper end of the spartina distribution and many of the natural marshes where we initially, in the early two thousands, established an elevation benchmark. Those benchmarks are out in the mudflat, I mean, way out in the mud flat. The marsh is tens of feet away from it. There's just this stainless steel-encased thing and concrete out there. So, it's a really visually striking indication of a loss of marsh that's been presented, and I think has helped make the case. So, that kind of became, from then on – so, I had SETs. Then the next big thing, just to – so, I did that in – then in 2007, DOD initiated the Defense Coastal Estuary Research Program on Camp Lejeune. Pat Tester said, "Carolyn, why don't you go to this meeting?" So, I went to that meeting. My very good friend, Iris Anderson, was there, who was a – she died a couple years ago. But she was at VIMs. She was just a great salt marsh. She was from Boston. So, she worked in salt marshes. She did nitrogen cycling and gas flux and all this stuff. Hans Paerl was doing the estuary. But Iris and I and Jim Morris, who I'm sure you all know from South Carolina, we went in together. That was just a great thing. I had ended up getting ten years of funding, really good funding. So, I could have postdocs and technicians and work with these really great people. That all took place down at Camp Lejeune. We put in SETs. We did a lot. It was all sea level rise and blue carbon. That also got us early on into this, which is now a very hot topic of the ability of salt marshes to sequester carbon and become an important part of fighting climate

change. So, I had a great postdoc named Nathan McTigue, and I worked with Iris and her graduate students. We published a lot of papers on blue carbon and marsh's ability to sequester carbon. But that DCERP project, that DCERP funding, it was very good funding. I don't know how much we got over the years, but it was on the order of 800,000 or something like that.

DV: Ten years.

CC: Yeah, it was ten years, five years and then another five years. I mean, what a gift, right?

DV: Oh, man. Yes.

CC: So, that was a great – that was the last, whatever, ten years kind of was doing that kind of work.

DV: So, you retired when? Recently?

CC: Recently, two or three years ago. It was during the pandemic. So, nobody knows.

DV: Oh, that recent. Okay.

CC: Yeah. I had to come in here when the whole place was closed down and empty out. That was kind of tough because I didn't really get everything and didn't really get to say goodbye to people. But it was time. It was time. It was time to go. Then I just want to say – well, I'll stop talking if you have questions.

DV: Go ahead, Don.

DH: Jeff, if you have any questions.

JG: No. I've been interrupting her enough, and that is just trying to provide clarification for the recording and the notes, like you are originally from Baltimore, things like that.

CC: Oh, sorry.

JG: Hans Paerl was your major professor. You kept saying Hans. Well, people listening to the recording will –

CC: Yeah. Hans Paerl at IMS, he was – and just, again, I feel like I've been fortunate in so many ways. Hans gave me free reign and lots of support and was very open to me coming. I just feel like I've been really lucky in my career.

DV: Of all the stuff work you have done since you have been here, what have you done that has given you the greatest personal satisfaction and accomplishment?

CC: I think I'd have to say two things. I really thought the work we did with looking at fishery food webs, estuarine food webs, and in particular, I think, the work I did with my colleagues to

illuminate the important role of benthic microalgae. This kind of surface thing that wasn't really noticed, it was all marsh. But really, benthic microalgae are really important in fishery food webs. We did that work in a lot of different places, and that work has continued to be utilized. So, that, and then the work we did with sea level rise and carbon sequestration. So, I think, because of the work I did with sea level rise, since I've retired – I mean, I've continued to work with people. I worked with a couple of modelers at Duke. We published a paper after I retired, 2022, which used – they're modelers. I was a salt marsh person. I'm not a modeler. But it was a great collaboration and basically showed in very stark terms that North Carolina salt marshes are not going to keep up with sea level rise in their current position. You go ahead 50 years and really, except for the northern parts where you've got some low-lying land where marshes can migrate, the Newport River marshes are going to be gone. The marshes behind Shackleford are going to be gone. When they first took the data that I gave them, here's the suspended sediment, here's the tide range, here's the erosion rates, here's – and we went in, and I got all this and gave it to them. They put it together, and they give me this result. I'm like, "Oh, my God, that can't be right." We went back through every little bit of it in the literature and pulled it, and it is right. It's been substantiated. There's multiple papers out there now. But that paper, of all the things I've published, that's the first time I went to a meeting. So, Coastal Federation pulled in all these people and had a meeting. They took the model results that we had done. The only thing they did was – I think Katie had put – Katie Warnell from Duke had done this. She's a modeler. She's not a salt marsh person, but she's a very good modeler. She had put the marshes and went away in blue. The smart thing that Coastal Fed did is they redid them, but they put them in red. [laughter] Excuse me. They pulled in all these resource agency people and lots of people involved in nonprofits and everybody and put these maps up, great, big, gigantic versions of these maps that showed these marshes in red. I didn't know they were going to do that. I mean, this was the model that we had published. These were our results, and they're up there. They've got them on the wall saying, "Okay. We've got a problem. What are we going to do?" It was really satisfying to feel like, "Yes, we did something that has led to real changes, I think." I mean, there's still talk. I mean, I went to a habitat tradeoff meeting just this past week here in the auditorium that the North Carolina Regulatory Agency, state and federal – so, Army Corps was there. Our guys were there. The NMBs people were there. It was all about because they don't – soft bottom is protected, too. So, when people want to restore salt marshes now, when they want to use sediment to replace the marshes that have been lost, it's a regulatory problem because you're filling the bottom. You're adding sediment. That's a no-no dating to the seventies when marshes weren't disappearing with sea level rise. So, we've really got a disconnect between our regulatory protections now and the actuality of the marshes are drowning. It was great. Again, these models go up. I feel very comfortable saying to people, "These are going to go away if you don't – you are going to lose this habitat."

DV: If that is the case, then that is going to have some real impact on – if it is on a grand scale, on the coast, a grand impact on fisheries.

CC: Oh, absolutely.

DV: Yes, really big.

CC: Absolutely. I don't know about SAV, but the marshes are going to be gone in 50 years, and

development hasn't helped, right? If you put in a bulkhead, basically you're eliminating any marsh from ever being there in twenty or thirty years, wherever there's a bulkhead. So, that work, I felt, has been good. It started with going to that meeting in 2003. It's funny how things happen. It was IRF then. It wasn't even SERF yet. It was IRF. Seeing Don Cahoon and thinking these SETs would be a really good thing and then having NCCOS support it over the years. So, we have a 20-year monitoring record. Over the years, I've been able to patch together money. Jenny Davis, another gift to my career, was the day Jenny Davis walked into my office looking for a job. I had DCERP money. I was like, "Oh, yeah, I can hire you. [laughter] Please." Like I said, I just feel like I've been so lucky.

DV: Wow.

DH: Doug?

DV: Nope.

DH: Yes. Joe?

JS: Carolyn, I was involved with a couple of things you did, but they were an outreach. I know you had a lot of interest in outreach to elementary and secondary schools. I remember you involved me in a few presentations about Menhaden, but that was a facet you didn't touch on. But I know you were really active in that area.

CC: I was for a while. There were people at Beaufort Middle School, and we would take them out. One of the magic things I like to do was take a scoop of brown mud – you couldn't do this now – and I would add acetone to it. I would take the acetone out. Well, I had it in a little centrifuge tube, is I'd take a scoop of brown mud and put an acetone and shake it up. Of course, the chlorophyll was extracted. So, you've got this beautiful green layer, and you show the kids, "Look, there's plants. This mud turns green. Oh, don't touch that acetone though." [laughter]

JG: Do not breathe it. [laughter]

CC: Don't breathe it. But yes. So, I did that with Beaufort Middle School and worked with the high schools. Yes. I enjoyed that. I did enjoy that. We did some citizen science work as well. When we first started monitoring these fringing shorelines, I think we put Citizen Science in the title of that paper where we worked with community college and the junior league, the Moorhead City Junior League. We would get these kids out and count plants in a quadrat and help fish fyke nets. That was really great.

[end of transcript]