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Rhodes, Edwin ~ Oral History Interview

Fred Calabretta

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Voices from the Fisheries
166 Water Street
Woods Hole, MA 02543

Interview with Edwin Rhodes by Fred Calabretta

Summary Sheet and Transcript

Interviewee

Rhodes, Edwin

Interviewer

Calabretta, Fred

Date

August 18, 2016

Place

Mystic, Connecticut

ID Number

WFF_MF_ER_001

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Biographical Note

Edwin Rhodes was born in Milford, Connecticut on March 4, 1943. During high school, he visited the Milford Lab to ask about a science project. He met Victor Loosanoff, the Lab Director, who became a mentor. Ed began working at the lab in 1959 as a high school junior and continued to work there until about 1970. After a brief break, he returned to the lab from 1971 to 1989. He rejoined NOAA as the Aquaculture Coordinator from 1997 to 2001. He has spent his entire career, both in the public and private sectors, working on aquaculture and shellfish.

Scope and Content Note

Interview contains discussions of: laboratory work on oysters, shellfish aquaculture, global warming, collaboration with other scientists, changes in technology and advances in the lab components, physiology, DNA

Ed Rhodes provides a rich overview of the history of the Milford Lab from 1959 when it was part of the Bureau of Commercial Fisheries to its' transition under NOAA Fisheries and the National Marine Fisheries Service. He gives a description of his work in the lab as well as in the field. He discusses the aquaculture industry and how the Milford lab has supported the industry throughout the year. In addition, he describes his work in the private sector in Chile and with other organizations.

Indexed Names

Blogoslawski, Walter
Calabrese, Tony
Chanley, Paul
Carson, Rachel

Davis, Harry
Gagen, William
Glass, Herman "Mike"
Goldberg, Ron
Kromansky, Joe
Landers, Warren
Loosanoff, Victor
Lucash, Joe
MacKenzie, Clyde
Nelson, David
Norris, Russell
Riccio, Rita
Tubiash, Haskell
Toner, Dick
Ukeles, Dr. Ravenna
Wallace, David
Wallace, Libby
Widman, James

Transcript

Fred Calabretta: This is an oral history interview being conducted as part of the Voices from the Science Center's project funded by the Northeast Fisheries Science Center. It is also part of the Voices from the Fisheries Project that is supported by the NMFS Office of Science and Technology. The narrator is Ed Rhodes. The interviewer is Fred Calabretta, we're located at NOAA's Milford lab, Milford, Connecticut, and the date is August 18th, 2016. I think we should be all set, and just to start maybe with your full name and your date of birth.

Edwin Rhodes: I'm Edwin Rhodes, and I was born on the 4th of March, 1943.

FC: And where were you born?

ER: Here in Milford, up the street. Actually Milford Hospital, but my family home was only a couple blocks up the road.

FC: So you grew up in Milford then?

ER: I did.

FC: And how did you, what do you remember of your earliest interest in the marine science world.

ER: It started independently of the lab, but then there was a nexus shortly after that. As a sophomore in high school, we were doing biology projects and the previous summer, a friend and I, with a small boat, had built an oyster reef, what we called an oyster reed. We took small rocks from the shore and brought it out close to Charles Island which is nearby here. And so we built up a reef structure that started to get populated with stuff, not necessarily oysters but different kind of critters and stuff. And then we had to do a biology project in our sophomore year. We chose to do something with oysters and starfish, and our biology teacher said, "You know there's a lab in Milford nearby where you live." And we'd never really seen it. There were all kinds of trees here, and the small lab was behind the trees, down a dirt driveway and so on. So we actually came in and introduced ourselves, got through the front door, and Victor Loosanoff was the old Russian director was sitting in his chair with his green visor and we sat down, "Boys, what are you here for?", "We want to get some information on starfish and oysters." "What do you know?", "We don't know much", he said, "Well, there's a library at Yale, you should go there and learn about oysters and starfish." So we spent a number of weekends going to the Yale library, got help there, learned quite a bit, had the nerve to come back and talk to Victor again, and he quizzed us on what we knew about oysters and starfish. He basically embraced us. Took us to the back, introduced us to some of the biologists and basically said, "Take care of these boys." And so we came to the lab once or twice a week to get seawater, filtered seawater, so we could run our aquariums at home with our home project.

FC: So he really encouraged you then to learn more and...

ER: Yeah absolutely, other biologists I would say probably were more mentoring than Victor. He was at least a level or two levels above where we were during my whole stint with him, but Victor, I can only smile about my relationship with him, because it always had someone between me and him. I mean, he was very hard on the biologists directly below him. But, being one level below that, I had at least a level of protection. Although, when I started working at the lab, he would come by every day, put his hand on my shoulder and say, "My boy, what discoveries have you made today?" And my favorite story was there was a microbiologist here named Haskell Tobias who said, "Ed, if you ever have two breakthroughs in one day, save one for the next day, because Victor's going to ask you every day."

FC: So what year was that, that you first came here?

ER: That was 1959, or actually '58 when I first walked through the door as a student, and then fortunately or unfortunately, our high school was on double session, so I got out of school every day at 12.30. And in November of '59, Victor called me and said "high school is in double session would you like to work every day from one to five". So I started in November of '59. I started working those four hour shifts. And then in the summer, \$1.15 an hour became \$1.35, because we now could work as men [chuckles] 40 hours. So we worked full time in the summer for that 20 cent increase, and then in the fall, it went back to the one to five, and our pay went down as well. But Victor, I mean he was our mentor, so we had to show him our quarterly report cards. Make sure our grades were As basically or he wouldn't have kept us. So it was I and my biology partner, a guy named Bill Gagen started here. We didn't get paid through the government system, because we were 16 years old. We were actually hired, or, our pay came through the

Oyster Institute of North America, which I guy named Dave Wallace and his wife, Libby, ran in the Chesapeake, it was an industry group. They had some industry money, and so Victor persuaded them to through a couple bucks under the table, I mean I'm not sure, I mean I got a real check, a 1099, but it was not from the federal government. So those few years and summers didn't count as federal employment for me at all.

FC: So, you've talked about it a little bit, but could you describe the lab a little bit more at that time. So this is the Bureau of Commercial Fisheries at that time.

ER: Right it was the Bureau of Commercial Fisheries at that time.

FC: And if you could describe the lab, and maybe a couple more of the key staff.

ER: Yeah, I mean the main players at that point certainly were Victor and his secretary Rita Riccio, she was the schoolmarm, manuscript typist, the stick by the books personal secretary basically, back when people actually had that kind of staff. And there was always a Junior Secretary in that pool as well. And then the other key person was Joe Lucash, who was the maintenance guy. He and Victor basically built, I guess, when there was one, wooden building at first before the brick lab was built in the '50s, I guess. And Joe Lukash and Victor were peas in a pod, in one sense. Joe was 6' 5", Victor was 6' 3", both imposing men who liked to work, and back then sexism be damned, the men took off their shirts in the summer and strutted around the property. Showed their muscles and moved oyster shell, and dug dirt or whatever had to happen, and the boat captain was Mike Glass, Hermann Glass was, our boat then was the *Shang Wheeler*, named for a famous duck decoy carver. And so they were the integral part.

The biologists at that time. I worked first with Clyde MacKenzie who amazingly is still kicking and works at our Sandy Hook Lab. He was my very first boss when I was hired in 1959. He was doing our chemical studies to try to figure out what could deter starfish from eating oysters. Whether NOAA wants to hear it or not, we were putting some very nasty stuff in the water to try to create barriers that starfish wouldn't cross. For example, you could put a ring of this chemical around an oyster bed, and the starfish wouldn't. A lot of that worked pretty well in the lab, didn't work very well in the field. So Clyde MacKenzie was a key scientist then. I believe that Rene Ukeles, our algologist, started really around the same time. I believe it was probably in '60 or '61 that she began. And I worked mostly with Warren Landers and Paul Chanley when I moved from Clyde's department into the aquaculture division ,if you would, or the culture department where we were growing clams and oysters and scallops and stuff that was with Warren Landers and Paul Chanley. And I spent a lot of time as a 16-year-old, Paul Chanley went on to publish a paper called something like the size and shape of bivalve larvae. So he had grown, or I had helped him grow, 40 or 60 species of bivalves from all over the country, all over the world. And we had photographed the shells and it was my job to basically do all the counting and measuring of these things. As a 16-year-old working with a microscope, I ended up wearing glasses very quickly, and now as 73 year old with cataract surgery, I don't have glasses anymore. So I went a lot of years in the middle thanks to Bureau of Commercial Fisheries and Paul Chanley, I started wearing glasses, and now I'm free of them.

FC: So was the focus always shellfish here as far as you know?

ER: Yeah, it really was. I don't know what the mandate was exactly. But certainly all of Victor Loosanoff's early work, and I should surely mention Harry Davis. All the key papers that came and really started shellfish aquaculture in the United States are authored by Loosanoff and Davis. Harry Davis was a really bright guy, but was always second to Victor in that sense. And he was kind of the technician, so he did a lot of the experiments along with the work that was published as Loosanoff and Davis. Harry was just meticulous and notebooks, took meticulous notes and very good in terms of interpreting data and so on. So, Harry was key to the lab becoming so formidable in those years in terms of just starting what became a very productive shellfish aquaculture sector in the United States.

FC: And what was the relationship of those two, in particular, with the private sector, and you know the industry people?

ER: You know, it was, as Bureau of Commercial Fisheries, the overall goal it seemed of the whole organization, the word "commercial" was pretty important. I mean, the people doing stock work at that time were basically out there to try to find new stocks of fish and to come up with new kinds of gear types that would help fishermen fish. Pretty obviously, 10 or 20 years later, when it became NOAA's Fisheries, their main job was to try to prevent fishermen from fishing. So that was quite a change.

But in terms of shellfish, we had a very open relationship with industry. I mean it wasn't too many years into my career when Warren Landers and I, my boss at that time, would go to all the hatcheries, all along the East Coast of the U.S., usually two or three times a year, tell them what we had learned in terms of perhaps new techniques. Oftentimes we were there later on with Walter Blogoslawski, if they had a disease problem in their hatchery then we were there to try to help them figure those kind of things out. So in one sense, we acted almost like an extension service, I think, in terms of trying to help the industry get started. Clyde MacKenzie was one of our divers. He did a lot of work on Long Island Sound, especially with the oyster industry. He would go out on their boats, and he'd be their eyes and ears in one sense. They didn't dive, they sampled their beds using dredges, so you bring something up to the surface, but it doesn't show the true picture. But, Clyde would dive on their beds, tell them what was happening in terms of oyster drill predation or starfish, or silting, or other things that a dredge couldn't reflect as accurately.

FC: And have you found that the people in the industry have always been receptive to input from the scientists, because we worked on a project documenting the Stonington fishing fleet about 25 years ago, and at that time regulations were getting tougher and tougher, I mean they're talking about fin fish, and mostly bottom fish, but what I heard so often was, all those scientists, they're not out here every day, they don't know what they're talking about.

ER: I think our relationship on the shellfish side is quite different, just as is the relationship between environmental NGOs [non-governmental organizations], and shellfish versus fish, I mean it's pretty easy, not completely easy, but it's easier to get permission if you would, to grow shellfish, because of some of their positive benefits and very few of any negative benefits, versus

fishing which is taking a common stock and ecosystem changes, and all that kind of stuff. So yeah, I think, I'm sure if someone new came into it, trusting the government right away wasn't probably, you know, and a lot of the shellfish guys are pretty libertarian. I mean they're pretty non-government in one sense, but they certainly accepted that help. And we get, I don't know what the current status of the lab here is, in terms of its' position in NOAA and funding and everything else, but I know now that I work pretty intimately with a shellfish group that represents quite a few hundred shellfish farms along the East Coast, that we do quite a bit of support for the lab. We visit Congress twice a year with our issues, and one of them is always funding for aquaculture through the Milford lab or through USDA's [United States Department of Agriculture] program, so it's kind of a blanket thing, but when we talked to the Connecticut congressmen, or whatever were certainly supportive of Milford. And it just seems universally in our board for example, the look at the Milford lab as the only federal lab that's really doing shellfish work, and so they remain supportive after even 50 years.

FC: So it's always been pretty much a solid relationship.

ER: Yeah, it has. One of the programs that I was involved with quite intimately too, the lab, starting before my time, did sampling for oyster settling in Long Island Sound. So, every year they established at least 10 stations up and down really just the Connecticut side of Long Island Sound. And twice a week, the boat, the *Shang Wheeler* would go out and put in shell bags, new shell bags, and retrieve the shell bags that had been out for three or four days, and then those shell bags came back and we hired a couple summer people who counted the oysters that attached to those shells, and the industry would hold back the shell they were going to put in the water for their collection that year until the lab said, "Now is the time." So, we did not only setting of oysters on shell to help the industry, we also did plankton samples and counted oyster larvae and watched them as they staged up towards metamorphosis in the plankton as well. So we were actually the weather service for oyster setting. Truthfully, the oyster industry, if it got to be late July or whatever, and we hadn't yet seen what we thought was the right conditions, they often would deploy their shell anyway, because they have them ready. They weren't going to get that dirty before winter anyway. And of course their strategy was to try to keep the shell clean until the last minute, so if we could help them by saying, June 15th you ought to go in the water or July 15th you got to go in the water, that was quite helpful to them. So that was a free service, we got calls at 4 o'clock in the afternoon on the shell bag days, you know, what are you finding. That kind of thing. So I'm sure, I can't remember, I don't think we did it back then obviously, because we didn't have computers and internet. We must've probably called individual companies or they called in or something. There was no electronic network that would have advised everyone simultaneously.

FC: But still good communication then. And you know the other thing I wanted to ask you about going back to 1959, that the profile of the lab at that time. I mean publicly, were people in Milford aware of what was going on here?

ER: Really not very much, and I think that's even why, even though I was only 16, why I hardly knew it existed. It didn't seem like it made any kind of local news. It was a research facility, quiet, it wasn't, although Victor I would say was certainly flamboyant, and he was flamboyant

within the shellfish industry, and not, it wasn't a time when you needed to make local or state news to secure your funding, for example. I think it was, he was a very forceful person, I think, I don't know exactly the politics back then that he might have been dealing with, but he was so forceful that I think within the Bureau of Commercial Fisheries system, he probably got what he thought was his fair share of funding each year, and it seemed to me that the lab continued to grow. Eventually there was a point where we needed a larger facility and so on. And then of course, once we took down the trees, and this facility was built really right on the road, we became much more visible.

FC: Do you think outreach activity helped with that over the years, whether it would be school programs or any sort of community outreach that would...

ER: Yeah, I think it does, I certainly think it does now. I mean what we were trying to do with the oyster festival, back 40 years ago when the oyster festival first started, was really to highlight what the lab does, and show people what we do. And it became a high enough profile, so we ended up with quite a few students. I know I mentored a number of high school, or early university students with their science projects in terms of high school or thesis problems in terms of university. So it seems to me we got more, the lab was more visible in the sense of just having that kind of interaction, too. And of course, having students around is always positive I think, it's great to have young people, inquisitive, running around, as well as the older staff. And of course, there hasn't, amazingly, the turnover here would, except for a few notable exceptions, probably me, people stayed. There wasn't, I smile all the time, we have some people on the staff who started about the same time I did and still here Clyde MacKenzie still working in Sandy Hook, but the staff basically stuck it out and I was here when the new building was built and the staff was increased, and a lot of those people that started, like Ron Goldberg, Jim Widman, and Joe Kromansky and others had been Northeastern students that came here as co-op programs, and then were hired and stuck it out, and I guess you probably know better than I how long say Ron was here. But they all started basically around the same time when the lab was new.

FC: And why do you think such a substantial number of people have stayed for so long. What's the general appeal of the work or the facility?

ER: I mean there is that inertia of rest. There is the positive attribute that if you have a federal, your job is pretty secure, although I never looked at it exactly that way, you have to, as a federal employee, you have to roll a little bit with the priorities that are set. In my own case, I really wanted to do aquaculture for aquaculture's sake, and when it became an enhancement program or contributing to a stock assessment program or a natural recruitment study, I was less, I liked it, but it wasn't exactly what I wanted to do. I think other people have, they get paid pretty well, they're in disciplines that they enjoy doing and generally I think they've been productive and helpful. I sometimes wish they'd be a little more aggressive than they are sometimes. I don't want to talk about personalities really, but I mean there are some top notch people and some middle of the road people like you'd find in any institution.

FC: So you first came here in 1959 and then if I understand correctly from that time until 1990 you spent a lot of time here, you were in college and you left for a short stint, but you spent a lot of time here in that 30 year period, is that right?

ER: The only time, the lab was going to close in 1968 I guess. Regional director Ozzie Norris showed up in basically this room, all of us assembled, and I guess we'd had an inkling from the morning paper that the lab was going to close, 30 day notice, everybody out. We asked questions like, "What do we do with our data?" "Burn it. Throw it out, useless." So, I had a young family and had applied to graduate school, I couldn't wait. I basically shaved my beard off, went for an interview in New York and got a job in Marathon, Florida growing shrimp and spiny lobsters. That company, which was an offshoot of Monsanto, closed that lab after a year, and moved me to run the oyster hatchery on Long Island for Long Island Oyster Farms. And I guess, a year and a half later, 1970 or early '71, NOAA Fisheries was created, the lab in the meantime had a sequence of 30 and 60 day notices for the whole year and a half or two years I was gone, they mostly sat around and read newspapers, because they didn't have any money for anything. But the lab never closed, when it became NOAA Fisheries, I guess speaking from the outside I can be as apolitical, whatever NOAA fisheries then embraced aquaculture. So the Bureau of Commercial Fisheries and the people there were gone, whatever, so suddenly the lab is an aquaculture lab again, and I was invited to come back. And so I did back in '71 or something like that, and then I stayed until 1989, late '89 or maybe the first month on '90, before I went and started a private scallop farm in Chile in South America.

FC: And the early '70s is an interesting time, because the environmental movement's gaining traction, and people are paying a lot more attention to the environment, including the marine environment, and I mean did that have an influence on what was happening here?

ER: It did, I mean I think it was mostly positive, and of course we were growing with shellfish industry at that time, and for me that was all positive. We had a lot more hatcheries and hatchery based production, but I think one of my favorite parts of that, I got my first, I had a folder in my desk here that was called hate mail, and the first letter in there came from, basically a local Audubon or state Audubon group that basically just said, aquaculture is terrible. We shouldn't be doing this kind of thing at all. I mean I never thought I wore anything but the green hat, and suddenly I was being labeled with a black hat, and it took me a while to figure out how to maneuver in that environment. To realize that there are people who think the shore or the oceans should only be preserved for whatever God created and not be used for fishing or not be used for private aquaculture.

And of course, especially in shellfish aquaculture, you're taking whether it's a lease or whether in some places you can now get an outright purchase of underwater lands, if you will, to do it. It is taking what is a common resource, and privatizing it, and we have still some of the major conflicts today are still with adjacent land owners that would think that a shellfish farm, for example, will spoil their view or not be what they bought the property for and so on, so that remains a major hurdle.

On the other hand, some of the things I did which weren't quite exactly aquaculture for producing food, we did quite a bit of work on the environmental side with basically developing bioassay kind of animals and stuff. So back, I know I spent a number of years actually with Tony Calabrese on a little clam called *mulina*, which we ended up calling the molluscan fruit fly, because its' life history was something in neighborhood of 45 days. It could go through a whole life cycle in 45 days, and we looked at that as a bivalve that could be exposed at that time to heavy metals or other kinds of environmental things that people were interested in and then look at those effects on reproduction or survival and those kind of things. I actually was growing quite a few things. I grew a lot of typical crustaceans, typical gastropods, typical fish and other things. So that was a little bit of a diversion from my aquaculture bed, I guess, but it was fun to try to grow things and develop new systems to grow them.

FC: But for a moment there, when you got that hate mail, you thought maybe you were on the wrong side?

ER: No. [laughter] I thought they were on the wrong side. No, but it did, probably for the first time, I started to realize that there are two sides. And even though I think it was a pretty positive argument for what we were doing, I think we're on the right side. But we had to build, we had to know what to say to the other side as well for the first time. And going back to those chemical studies with starfish and everything else, that was the '50s, '60s, anyone could put anything in the water, I mean, and we, in the total sum of things we didn't put that many tons in there. I don't think we screwed up anything permanently, but the kinds of things we were doing, both personal exposure to those chemicals and putting them in the water, would be just something that would be unthinkable now. But as you said, that whole picture changed from the '50s to the '70s, whether it's Rachel Carson or other kinds of things that suddenly we had to pay attention to those things.

FC: And in that period, from about 1960 to about 1989, what were some of the changes you saw. I mean you've talked about some, but sort of in the evolution of what was going on here at the lab, and the science and some of the focus, or whatever?

ER: Oh, yeah certainly, I mean electronics and materials and everything all became very important. And in the old lab, the sea water system, the hot sea water system at least, was all lead, lead pipes, lead heat exchange. This was the virtual, once lead had a little oxide coating on it, it was virtually nontoxic, at least to the creatures we were trying to grow. We had lead sinks, I mean this was all before fiberglass was even invented, or PVC. So the advent of PVC pipes, and fiberglass, plastic buckets instead of glass cylinders or whatever. Our breakage rate went down substantially. I used to wash, used to do a lot of experiments in one-liter glass beakers. And I had a stone sink in which to wash them, and that was kind of a lethal combo. I mean I was pretty dextrose and careful, but you certainly, we had to put them down very gently in a stone sink. I was just thinking of one memory. I loved building little models, and I'm sorry it disappeared someplace. But I actually did a model of the room that I worked in, in the old lab, with the stone sink in the corner, and these similar to some of the things I think that are probably still down here, but back then wooden frames, basically photographic trays where the things that you slid in and out have animals, and then a whole heat table in the middle, and some incubators over on the

side, but I had actually, every day when I worked here, I'd spend ten minutes taking measurements of the stone sink or the incubator, and I'd go home and craft it and put it in place. So I ended up with a perfect little model of the room.

FC: What became of that, didn't it survive the moves?

ER: It didn't survive the moves or whatever else, but it was fun to do. So I probably diverted away from the question. So the materials, I mean, that changed a lot, and then of course the technology. At age 16, I had blown out my eyes trying to count Paul Chanley's larvae on slides where you had a chamber with material in it, and you had to go across the back, and across the back. So you needed one hand to move the stage, basically move the stage, and one hand for the counter, counting whatever I was counting. And so no hands to actually do the focus of the microscope. So what you do is, you are basically using your eyes up to point where you couldn't hold the focus anymore and then you'd have to focus a little bit. So, my eye doctor said at 16, "You know, you've been reading books under the covers, or have you been looking through a microscope?" So, for example, very shortly, we got the company called Coulter Counters. We could run and put a sample of bivalve larvae through this automatic counter, and it would not only count them, but it would size them by volume and so on. I mean that kind of technology, that was early technology.

Then of course the whole genetics explosion, suddenly we can do DNA, we can count chromosomes. We went basically from the very rudimentary biology things you do, how do you determine what temperature to grow an oyster larvae while you try a whole bunch of temperatures, you'd do it a bunch of times, but we never could or even thought about investigating the physiology, what's underlying here. When we started having physiologists here, like Fred Thurber and others, suddenly we're looking at an animal from the inside out, not necessarily from the outside in.

So all those technologies. I think our field is probably slightly, it's not medicine, probably we don't get the bells and whistles, and tools quite as soon, but basically those things become available and so. I'm so impressed now when I go to a shellfish research kind of meeting, the level of sophistication in terms of the talks is no longer, we ran this experiment to figure out what temperature this clam dies at. It's a whole genetic description of the genes that control all of the physiological processes, and which ones fail first at certain temperatures. It's a totally different kind of picture. And I'm very, I admire the people that have those specialties, and that they've decided in many cases to apply them to shellfish. That's pretty cool that we're not lacking to far behind the most advanced science.

FC: During this same period up to about 1989, are there some key projects or favorite projects that you we involved with?

ER: You know, always. When I was trying to grow things, there's a little snail called *Crepidula*, that I became pretty enamored with. No one had really ever tried to grow it before, and we were growing it more for bioassay purposes. That became something that I really enjoyed doing. At the same time, this is kind of almost a funny vignette, I was trying to grow blue crabs, commercial species, but we're basically dabbling with it a bit to see if we could grow them far

enough at least to do bioassay kind of work. And so I had a whole array of adult crabs in the downstairs lab of this building and every day, I had to clean the trays, see if the crab molted, feed it, look at its' food consumption, that kind of thing. And I had one crab in the lower shelf that every time I would pull out the tray and walk away to do something, it would always get out of the tray and jump into the water, the sink that held the tray basically, and I would run back there and grab it, throw it in the tray and yell at it, and one day someone was giving a tour of the lab, and I was over washing a tray at the sink, and thing is 20 feet away, same thing, starts to crawl over the side and I turned around and yelled, "Get back in there!" And the crab completely reversed and went back in the tray. And the tour leader, David Nelson, I think at the time, he said, "Oh, it's Ed, he talks to his crabs. He's got them trained." I'm sure it was just the timbre of the voice, or the vibration in the room, but the crab reversed itself.

Yeah, and I guess the work that I found most interesting, and it's been applied at most hatcheries in the world, and it's certainly why I was successful in growing scallops. I did a lot of work on trying to determine optimal feeding rates, and densities of food in the water for bivalve larvae, and that was really fun, and in some ways it was anti-Milford. Because, the Milford method for growing shellfish came from basically having more or less a Monday to Friday week. And because we told hatcheries basically how to grow them, they were doing the same thing we were doing, which was that you change the water and re-fed your systems Monday, Wednesday, and Friday. From Friday to Monday, you might have gone in and added a little food, but you didn't. So you weren't a two-day scale, you were on two days, two days, three days. So I said, "Well, why don't we try to figure out what the larvae like, rather than what the human schedule is like?" So, let's put one larvae in a large volume of water and see what food density works. Because the Milford method was feed once a day, so the food concentration is very high, and as they graze it down, it drops down precipitously low, if you've got active feeding larvae. It just didn't seem right to me, so it turned out, very low levels of feed constantly, in other words, you were basically feeding constantly, and just keeping up with the consumption rate is a much more efficient way to grow, and most hatcheries now have all kinds of sophisticated electronics. They sample the larval tank for algal concentration and then have a metering pump that puts that food back and so on, and the water change is based on changes in the water quality rather than just Monday, Wednesday, Friday, or some other schedule. So we did that manually in Chile because we had less expensive labor, we could have night technicians that sampled the water every couple hours and re-fed based on those things, but in the United States now, many hatcheries now have electronics that do that. That I think was perhaps in the long run my most important contribution to the way things work.

FC: Do you, during that period and your time here, are there, sort of along those lines, are there certain moments that stand out where you had a really good day with what happened in the lab or surprises, or you know, you just went home thinking, boy you know..?

ER: I mean in that work, it was surprising right away when in order to do that work, we put larvae at very low density, for example, at different food concentrations. And the rate at which they grew was just astronomical. I mean it was 50% better than anything we'd ever seen before. Another thing I did, and I think there's a hatchery on the West Coast that may be using it and I

don't think they want to tell me, because I gave them the idea and I think they might owe me something. And that was, once you have this food concentration worked out, and your water quality parameters, you can grow bivalve larvae at astronomical densities. Typically, you're growing, I mean the real number, 10 per milliliter, or 5 per milliliter, you can grow hundreds per milliliter if you run them, if you have a continuous flow system instead. So like the water is constantly renewed, and the food is always at a constant level. And that's still something even in my advanced age, I occasionally - I now live in Florida, and I'm next to a very good friend's lab director at the Mote Marine Lab there, and he and I have discussed having some space to try this out in a different kind of way. So I still remain a little interested in that concept.

And I should tell you one botched experiment. So I was doing these experiments, and because I was doing manually, I had to go in, I had to be there every hour to take my measurements and re-feed, things like that. I lived in the family house just three blocks from here. It was like 2 o'clock in the morning, I had to, I got out of the house and into my car, and a black glove came up, I was half asleep, and this black glove comes up next to my window, and then a black face, covered with cloth. It turned out that the Milford SWAT team was there, because someone in the neighborhood had a gun. But everyone was asleep except me, and they saw me coming out of the house, and they basically, "Roll down your window. Go back in the house." I said, "But my experiment! My experiment!" So anyway, that was an experiment that didn't get completed, because of the SWAT team, and no one was killed in the neighborhood, and it was a domestic quarrel that ended.

FC: Talk about unusual circumstances!

ER: Yeah, and the other thing. Growing things, just like farms or farmers are the same way, and oyster researchers are the same way. It wasn't until I circled back after Chile and Mexico and everything, and worked in NOAA Headquarters in Silver Spring for four years or five years. I didn't know what TGIF was, I didn't know what "Thank God, it's Friday" meant. The whole time I worked here, I think the numbers of Saturdays and Sundays I didn't at least come in to do something were miniscule. So, I just didn't understand the concept of working Monday to Friday. And when I worked for NOAA Headquarters, because it was almost illegal to be in the building on weekends. They had security, "Why are you here?" Thank kind of thing. So that's another thing that goes with the territory.

FC: You mentioned that sort of parallel to farming, it's the same kind of thing. If you have livestock you can't pretend they don't exist for two days.

ER: Right, somebody has got to feed them or milk them or whatever else, and same thing with what we did. I mean, you could stop your work for a period of time and take a short vacation or something like that, but once you have things going, weekend were not something that you could take off.

FC: And you retired from NOAA in 1989, 1990?

ER: Did I retire? I guess I might have. I mean, I didn't start to get a pension or anything like that.

FC: But you left here?

ER: Right, and I guess I just would have left that stuff intact from what I remember, and then I went back to NOAA Headquarters in '97. So, between '89 and '96/7, 6 and a half or 7 years in Chile, and then a year in Mexico. The same company that eventually formed around our scallop operation in Chile wanted to do some work in Mexico as well, so I moved up there and spent a year, a year and a half growing clam mussel thing called a pen shell. Kind of a very long curly outsidied shellfish that's called hachas in Mexico. It actually has a muscle that's just delectable in Mexico. It's probably the most expensive seafood.

Then my wife actually stayed in Mexico teaching, and I was back in Milford painting the house, having a pretty good time, and NOAA advertised that for the first time, they were looking for an Aquaculture Coordinator in Headquarters. And we got wind of the announcement, and I phoned my wife in Mexico, I said, "They're looking for an aquaculture coordinator in NOAA Headquarter, what do you think? Stop this pretend retirement I'm in." And she said, "Well, of course."

So I applied and got that position. So it was pretty well routed. I was pretty familiar with NOAA Aquaculture, I'd been in the private sector, which they really liked. But NOAA Headquarters and aquaculture funding was, I would have stayed longer if it had been more productive, but it's the typical bureaucratic. I wrote the Commerce, the Department of Commerce policy on aquaculture with this vision of spending quite a bit of money, and making aquaculture instead of a one and a half or two-billion-dollar annual industry making it a \$10 billion annual industry. But that was all going to require NOAA investment, you know, we looked at a billion dollars spread out over ten years, and I got dribs and drabs.

One notable moment when I had 30 minutes along with the three or four other people to explain the whole NOAA budget, including Weather Service, and National Ocean Service, the whole thing. And during that time, we had an aquaculture initiative on the table, and so I got my chance to have my one sentence to the Office of Management and Budget of person, one person in the room. And I started to start about the aquaculture program in two sentences, and she said, "Oh aquaculture! I was just in Norway, and my brother says that salmon aquaculture sucks." So, the initiative we had planned with different labs, the Galveston lab, the Seattle lab, the Milford lab had all had little aquaculture programs there. All their work to create a new initiative went down the toilet in one sentence. And that was pretty typical, we got a little extra between us and Sea Grant, we got some extra funding for aquaculture, but not very much, and so it just didn't seem like a rewarding thing to do, so I left Headquarters as well.

FC: And so when did you leave?

ER: That would have been in 2001.

FC:2001. And we've been speaking about aquaculture, but what's the state of it on the East Coast now if you had to describe it?

ER:I mean the oyster stuff is really hot. I mean, new oyster bars, lots of places to market them, more people seem to be enjoying them. I don't think that the per capita consumption is anywhere near it was at the turn of the other century, in the early 1900s or something that people talk about

huge numbers of oysters, and not so many people. But certainly now, our shellfish guys, they can virtually sell all that they produce, and the price is good, and they're making money.

The restrictions as we kind of alluded to are trying to find places to do it that don't have conflicts with other uses, and that's stands to reason sometimes shellfish guys I don't think are given a fair hearing, but tax payers, expensive homes have lots of lawyer friends as well, so it's a little bit hard, and it's certainly why I went to... I would say it's thriving at this point. The hatcheries are producing in most cases all the seed that's needed, people know how to grow them, they're getting market prices. You know, when I went to Chile, it really was because the way I had wanted to grow scallops was going to be pretty incompatible with almost any U.S. system. We used the three dimensional long-line system. I helped someone try to get a couple long-lines in Long Island Sound for some other reason, for a couple years back, and we went to a public hearing and he and I and his lawyer spoke in favor, and we had 150 people lined up on the other side. "Well, my son is learning to sail, and won't the keel of the boat get caught on the line." And we knew all these things wouldn't happen, but there was just the idea that something untoward might happen. As we often say in aquaculture in general, not shellfish on the East Coast, but it's not a matter or idea where Americans are going to do aquaculture, it's just a matter whether they can do it in their own country. So many people with fish farms or three dimensional shellfish culture or something have to go someplace where food production and jobs and other things are more important than landowner views of the landscape.

FC: So, it's interesting, because I think generally, I mean we talked about it at work a lot, is that there's been such a drastic shift on the coast where it was a place where people worked, and now it's a place where mostly people go for fun and recreation, and so you have this big shift, and now that the guys that are trying to make a living there are an inconvenience.

ER: Yeah, this whole concept of working waterfronts and maintaining that, because the pressure to sell a dock or something where fishermen do their work and have that requirement are superseded by someone saying, "I want to build an office building with a great view, because I can attract better employees, so I'll build this office building on the water." We just came back from a couple days in coastal Maine where fortunately there's, at least so far, a pretty good mix, I think, of housing, upscale kind of things in working water front as well, and that's always a fight that we're in. I was the first Executive Director of this group called the East Coast Shellfish Growers Association. That's what I did after 2001, and now I still remain as the secretary or something so I have a seat on the board anyway and help their direction. And they're the people that come to Milford with all the oysters for this festival that's coming up in the next few days. So that, I remain active in that community. That's trying to save working water fronts and water quality, make sure water quality isn't degraded so that the shellfish can't get harvested or eaten. All those things. I mean, those are our main issues, so the permitting issue, land use, multiuse of water and so on are the issues.

FC: Is that more of a threat or an obstruction than some of the natural concerns? So more so than water temperature?

ER: Yeah, I mean, talk about frustration and government. I don't know, probably now seven years ago, maybe we weren't right at the forefront, but, you know, we looked at ocean acidification as a very real ocean effect of additional carbon in the atmosphere and climate change. But ocean acidification and the pH signal from the ocean is so stable that the fact that it's changed, and the fact that it's changed a couple tenths in the acidic direction is frightening, hatcheries on the West Coast claim, at least, that some of their small shellfish larvae dissolve in water at that pH, and they have to either buffer the water or wait for a different season when the water changes slightly.

But we went to Congress, many Congressmen, with the ask back then, naively, to do something with carbon. We were looking at the big issue, we got ocean acidification, let's stop it. What you get out of Congress is, can we help you buy four stroke engines that will emit less? Genetics, will you be able to grow an oyster at a different temperature with different acidity? At first, we just, like everybody, were really frustrated with that reaction. Look, we're here for the big picture, not the little picture. And eventually, like everybody else, we maintained that posture on the big picture, but we accept some of the funding for monitoring ocean acidification now, and for some studies, genetics and others that would look at these mitigation kind of things. Can we grow another strain of oysters that would, could be grown then in the same area for some more years while the water goes to hell in a handbasket?

FC: So, that's something you worry about?

ER: Yeah, I mean I'm old enough so I probably shouldn't, but yeah I've got kids and grandkids, and I mean I think, so the other job I've had, started with Philip's Foods. They hired me as their Vice President for Aquaculture and Sustainability. And I thought I was going to be doing mostly aquaculture. We actually started a farm for barramundi, a fish in Bali in Indonesia. That was the only aquaculture project I got involved with. But my fisheries sustainability role just blossomed and blossomed and today I'm now the Executive Director of a group of 26 importing crab companies that are putting their money together to try to improve the fisheries in seven Asian countries, and I guess from that standpoint, I have a worry about changes in the environment and global warming, and especially sea temperature rise, and sea level rise.

FC: What about closer to home? I mean right here on Long Island Sound and some of the changes you've seen?

ER: I haven't monitored it as closely. I know my wife at times has had positions as the public participation coordinator of the Long Island Sound group and so on. The water quality generally has improved since sewage treatment plants were upgraded and so on. But holding that line is always there. Depending on the ... of all the tax payers and so on. Sometimes it's easier to come up with a strategy with your sewage treatment plan that isn't quite as good as spending some more money to make it a little better. But the shellfish industry in the Sound seems to be still pretty healthy. It's not based as much on hatcheries as other places. There are some, especially in the eastern end of the state. There's more shellfish farming as we would call it, the vertically integrated, starting with hatchery seed and going through the market. Much of the industry here

still relies on natural recruitment of oysters and moving around. But that's been fairly stable as far as I know, but I'm not currently perfectly up to date expert on it.

FC: And it seems as though, I guess related to climate change is the storm. I mean we seem to be in a cycle where maybe there are more storms and worst storms, and impact on oyster beds and shellfish beds must be pretty substantial at times.

ER: I don't hear people in our circle talking about it as much as probably they should. Interestingly, now that I live in the Keys it seems like, at least for the four years that we've owned a home there, the pattern has been, more of the threats come into the Carolinas or up the coast. But that is also where our shellfish farms are and so that is a real threat. And I certainly know from putting together business plans and so on, an investor is going to want to know how often do these things occur and how bad will they be. It's one thing to say, "Yeah, I start with this many oysters and I end up with this many oysters, and I sell them at this price." But the investor is going to want to know how many years are you completely blown away and have to start again. So, I think that increasing storm threat that everybody seems to be predicting certainly will effect that industry. So, we really would like to see, at that top level, we really would like to see the world come to grips.

FC: What are the, and again you've talked about this a little bit I think, but some of the greatest challenges you've faced personally in your career?

ER: Well, I guess I would have to say first I've been extremely lucky and fortunate. You know, I basically got part of a Masters degree, and basically went into the private sector before I finished school. And despite that, I've been employed if you would in aquaculture the whole time. Virtually from '59 until now in one sense. Or something very related. Certainly when the lab was going to close in 1970 that changed my life. I mean, I would have been more educated, been more local probably. But instead, I guess fortunately in some ways, it threw me into the private sector which I also relish. So, I mean the news that your job is ending and your plans for your family and so on are being changed in this way, and it certainly caused some sad and sleepless days, I'm sure, before I landed on my feet.

But just, I mean the challenges of being in headquarters, and trying to work to advance at a national level aquaculture in the U.S. was I would call that kind of a frustrating challenge. What we can do now from the private industry side now, I am still part of this East Coast Shellfish Growers group, we can work better with Congress to try to get those kind of things at least for the shellfish industry. So that's positive, that takes some work and some time a well, but it's almost more effective than being within the government yourself unless I suppose you're the Secretary of Commerce or something. And even then I'm not sure you have this much latitude as you think. Just as we know our President doesn't have a lot of latitude to get everything done that he would like either.

FC: What do you consider your most important contributions in the field, and you've commented on a couple of things, but...

ER: I think taking what I knew and going to Chile, and starting, that farm grew to having 900 employees. It's still there growing half the time, or 50% of its' production now is scallops, the other is abalone. They've actually , because of natural production of scallop in Peru, the price is a little bit different. But going there, basically turning over the first shovel full of dirt, designing it, starting with three employees. there were three Americans, my wife and I and one other American were the only English speakers in town, and we built that into a business where we were exporting 20 tons of scallops every three days. As I said, 900 employees, two processing plants. That was pretty heady. And because it's a renewable industry, it's not using up anything, it can be there forever. I still go back to Chile, try to get there at least once a year, renew acquaintances and so on. But that was very rewarding.

Some of the work on looking at improving hatchery production through different techniques and feeding or contributions as well that I'm pleased with. And I guess just generally, the fact that I've had those experiences on the research end and on the practical, commercial production end, or so on. I remain, for a lot of people in this country or even the world, a resource of trying to, how it all came together, where it's going. So I enjoy that.

FC: Do you enjoy the, do you have a preference in terms of, say a day in the lab, versus a day in the field, do you like a mix?

ER: No, I really like a mix. I always said if I ever won the lottery, I think I'd build a lab. Private marine lab. Have a couple people get to dabble with my flow through system, see if you can change the...I mean the reason I smile about that, hatcheries right now, if you go to a hatchery there are huge tanks for larvae, and I think we could make the footprint 10% of what a hatchery is now, and have the same production. So that's my smile. But we didn't touch on it, but Ron Goldberg and Jim Widman and I all got NOAA certified to dive, and that period time, those almost 10 years we spent doing shellfish work, quite a bit of it with scallops actually. Diving was pretty, that was really fun too, so talk about a day in the field. Those were really enjoyable days to lug the weight belts and the SCUBA tanks to the boat and jump in the water. I mean, it's hard to beat getting paid for that kind of stuff.

FC: Plus you can really see what's going on down there.

ER: Yeah, and that goes back to the early history. My very first summer here in 1960, I guess, if I started in '59 in November, was tending divers. So Clyde MacKenzie, Paul Chanley, and Dick Toner were the three original divers at Milford, and of course, Loosanoff is still there, and he had just imagined what was happening on the bottom, and suddenly we had three guys. I think they actually had some film, or they were able to document some of the things, and I know Victor was incredulous one time when Clyde said something about the starfish were forming balls, and rolling in the water in the tide, they were moving that way. And of course that was something that no one had ever seen before. And of course, he at first didn't believe Clyde, but then there were pictures and so on.

So those kind of things were, and that was, when you talk about changes. I mean, that's so long ago, I mean you could forget it, but adding SCUBA, or the ability to be underwater, how we can do it remotely even is really helpful, and it was really helpful for me. When I went to Chile,

while we were building hatchery and everything, we had about a year and a quarter before we actually had all our building built and production started. And I spent that whole year diving, on our, we basically had 4,000 hectares, 10,000 acres of this culture. And we had to put down anchors and stuff, and we surveyed the bottom, we did quite a few experiments with wild scallops before we had our own production to see.

So being underwater has been part of my nature too. Now in the Keys, snorkeling and diving is interesting. Of course, diving in Long Island Sound, you basically stick your face in the bottom before you see it. I used to say to Ron and Jim, we might as well have blind divers because you never see anything anyway, and they have a better sense of touch than we do. I remember one time we wanted to put in an array of scallop nets anchored from the bottom. So there wasn't any surface presence, and nobody knew we were there, but we wanted to do something like 2 meters on center and a large grid. We were trying to figure out how the heck, given that we can't see it, how do we do that. And we ended up in the fields on the other side of the lab here, with ropes, so we had the border ropes, and it turned out if you have two equal diagonals, you have a square, so we had the diagonals cut, so we would swim to the corner and place one, and eventually when we got the two diagonals even, we knew we had something similar to a square, and then along those border lines we had knots every two meters, and then we could run lines across two meters, two meters, and place our gear and so on. So we did that, and we worked on it for months with scallops, and took our samples, and then one day the water cleared, and we could see this thing for the first time, and it was relatively square, and we were pretty pleased, but that's the difference. When I went to Chile, 100 foot visibility was the first time I'd ever been to the bottom at 100 foot and looked up and saw the little boat that I'd come out of. So very different.

FC: Well, is there anything else that you'd like to add here? Or anything?

ER: No, I appreciate the opportunity, there's probably a bunch, I didn't sit home and take notes to make sure, if I was a good politician I'd make sure I had all my talking points covered.

FC: This is really helpful.

ER: Thanks for doing it.

FC: Sure.