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## Blogoslowski, Walter ~ Oral History Interview

Fred Calabretta

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

# **Interview with Walter Blogoslawski by Fred Calabretta**

## *Summary Sheet and Transcript*

### **Interviewee**

Walter Blogoslawski

### **Interviewer**

Fred Calabretta

### **Date**

August 9, 2016

### **Place**

Milford, Connecticut

### **ID Number**

VFF\_MF\_WB\_001

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### **Biographical Note**

Walter Blogoslawski was born in New Britain, Connecticut on February 8, 1943. He received his Bachelor's from Fairfield University, a Master's in Marine Science at Long Island University, and later a Ph.D. at Fordham University in 1971. He began working at Milford Laboratory in 1971 as a microbiologist and is retiring this year.

### **Scope and Content Note**

Interview contains discussions of: microbiology, Apollo space program, waste treatment system, degradation of crude oil by microbiology, Bureau of Commercial Fisheries, SCUBA diving, importance of habitat, oysters, clams, aquaculture, hatcheries and poor sanitation, Shellfish Biology Seminar, technology changes, Koch's Postulates, copper, impact of technology on knowledge, value of libraries and research, importance of collaboration between industry, researchers and government, toxic algal blooms, ozone gas, climate change,

Walter Blogoslawski discusses his upbringing, how he became involved in marine research, his work for the Apollo space program and at Monsanto at the beginning of his career, and how he came to work at Milford Laboratory. He discusses the importance of sanitation in the health of the aquaculture habitats. He talks about the effects of climate change and advances in technology on his research, and the ways in which he has collaborated with other scientists and students.

## **Indexed Names**

Cousteau, Jacques

Crick, Francis

Fleming, Alexander

Freudenthal, Dr. Hugo

Loosanoff, Victor

Ross, Dr. Donald J

Watson, James

Weicker, Senator Lowell

## **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 Walter Blogoslawski. The interviewer is Fred Calabretta. We're located at NOAA's Milford, Connecticut lab, and the date is August 9th, 2016. Okay. And just to start, and for the record, if you would just give your full name and your date of birth.

**Walter Blogoslawski:** Walter Joseph Blogoslawski, and I was born February 8th, 1943.

**FC:** And where were you born?

**WB:** In New Britain, Connecticut, about 40 miles north of here.

**FC:** And grew up in New Britain?

**WB:** For most of the grade school, I went away to prep school, to Gunnery, and then went on to Fairfield University where I got a B.S. degree, and then Long Island University, where I got a Master's in Marine Sciences, and at Fordham University where I received my Ph.D.

**FC:** And as you were growing up, if you could talk about your earliest interests in the water.

**WB:** My parents had a cottage in Clinton, Connecticut, and we would go down to the shore, and I had an opportunity to both swim and boat down there. I had a small sailboat and I used to race in the Duck Island Yacht Club back in the very early days, when Duck Island Yacht Club was a very small group. And for pleasure, I enjoyed snorkeling around the rocks in the Clinton area, and was introduced to scuba diving. In about 1961, I actually purchased scuba gear and began diving in and around Clinton, Connecticut enjoying the views of the underwater, and I got very interested in fish, fishery resources, and things you could see underwater.

**FC:** And did you, was science something you had an interest in, and an aptitude for early on?

**WB:** Very much so, my father was a medical doctor, and he had a general practice in New Britain for over 50 years, and we talked about science all the time, he wanted me to replace him basically. But, one of my problems was whenever he took me to an emergency room to have me watch an operation whenever I saw blood I passed out. So I was not a very good candidate for

cutting people or dealing with any kind of blood, human blood. I found, however, that the blood of oysters and clams was colorless to green, and it didn't bother me the same way that it bothered me to see the blood of humans. Either through surgery, or even when I get a venipuncture today for a blood test, I find it disturbing. So I have avoided anything related to medical work, even though that's what my father wanted. So we talked about science all the time in those early days, and that's what attracted me to science. He used scientific method. He even ran some labs because they didn't have, the closest lab was the hospital lab. So, he would do occasionally a sugar, a urine-sugar test with a test tube and an alcohol lamp, and that kind of interested me, doing science.

**FC:** And then you did mention, your education. But how did you enter this profession, when did you first start working for what is now NOAA?

**WB:** I was in college, and my major professor, Dr. Donald J. Ross, was a bio teacher, and I told him that I was in pre-med at the time, and that was all they had. They didn't have a bio major in Fairfield University, all they had was a pre-med course, and I indicated to him I was very interested in bacteria that grew in the ocean, and could he help me direct me. And so we prepared some bacterial plates, and I found his advice very, very helpful, because he had been to Woods Hole on summer sabbatical, and had worked with other microbiologists at Woods Hole, so he was able to advise me and encourage me in spite of the fact that all that was granted with Fairfield was a pre-med B.S. degree. So that's what I ended up getting, and when I left Fairfield, I decided I wanted to get into marine sciences and so I took a Master's at Long Island University, and found another major professor, Hugo Freudenthal, who encouraged me strongly in wanting to learn about the degradation of materials by bacteria, and how bacterial cycles worked in the marine environment.

**FC:** So even at that stage, that was a focus, or that was a research interest?

**WB:** Yes, it was. It really was, and from my master's degree I ended up working for a company on Long Island called Monsanto Biodize, and Monsanto company at this point was involved in the degradation of industrial wastes, and we had a laboratory in College Point Queens. So I would go there during the day, and in the evening I would do work on my academic affairs, because LIU [Long Island University] had night courses. So I was able to support myself by working in a lab during the day and attending night school at night, so that worked out.

**FC:** And even though that wasn't specifically focused on marine science, it was probably a good laboratory experience?

**WB:** Yeah, I used a microscope and worked on custom tailoring bacteria to degrade industrial wastes, like oil wastes or plastic wastes. We basically adapted naturally occurring bacteria from sewage sludge to degrade these materials and then sold that concept to a customer. And I did that for a couple of years, and that was a good background for me in sciences.

**FC:** And then what was your next move, your next career move or step after that?

**WB:** I got involved because one of my professors was at Grumman, Fairchild and Hiller Corporation in the Apollo space program. They had an issue at Grumman about a waste

treatment system aboard a space craft. And the problem was, would the recycled water, because they were trying to vacuum, separate the fecal material and the urine and the water that was in it, so as not to carry any excess water on any long duration flight. They were looking for a microbiologist, and they also had told me that it would count toward credit toward graduate school if I participated in this plant. So I was like, hm this sounds like fun, the Apollo program is fascinating all of us, at the time we were fascinated with the thought of going to the moon, and I took the professor up on what he had asked and ended up working at the Dayton Air Force, Wright Patterson Air Force Base in Dayton, Ohio for about four months, in between going to school and so forth. And got to meet lots of fascinating people. We worked with a chamber in which astronauts were going to be placed for 30, 60, or 90 days, and the concern was the interaction of bacteria from skin and other places, would they cause toxic shock or other problems that couldn't be cured in a long duration space mission, something to Jupiter, for example, or Mars. Something beyond the 10 or 20 days it would take to go to the moon. Something long term. And the concern was surfaces, people who might have a staph or a strep that could be transmitted on control, and would those controls then cause carrier people to actually infect other astronauts, make them ill, and create an issue for a long term flight. No doctors on board these flights, so they would have to resolve the problem on their own. That was what I had done for this professor, and that was fascinating to me, because it was another aspect of microbiology.

**FC:** Was the work classified?

**WB:** Yes, at the time it was.

**FC:** So you had to have security clearance.

**WB:** Yup, and I basically worked for Fairchild Hiller Corporation at the time which is still on Long Island, so then I ended up going on to Fordham, and spent three years working on a Ph.D. and it involved strictly marine microbiology at the time. And fascinatingly enough, I was reading on ocean industry magazine in my graduate years, and in the magazine it was announced that the Milford Lab was looking for a microbiologist, a marine microbiologist, so I quickly applied and I got the job!

**FC:** And what year was that?

**WB:** 1971. So, I had graduated with a Ph.D. in June, and I started here in June, so I had just literally graduated and started work. That was 1971, and I've been here since then, roughly 45 years.

**FC:** And were you, you must have been pleased to get that position?

**WB:** Oh, I was overwhelmed, because I'd been looking for work. After assuming I was going to get a degree, I'd gone to Miami, I'd written letters to Australia, I'd written any marine sciences facilities, and one of the positive responses was, I got a letter from the government of Kuwait, who said they would be very happy for me to come over there and work on crude oil microbiology. Part of my thesis had to do with the degradation of crude oil by marine bacteria, so they had offered me a lot of money at the time, and the only thing that had turned me off

about that, was that there was a war going on between Iran and Iraq, and Kuwait was very close to that war. So even though I was excited about the position, I didn't want to take it, and I ended up working here.

**FC:** And where were you living at the time, before you made the move here?

**WB:** On Long Island in Sea Cliff, New York. When I first went to Long Island, I lived in Glenn Cove on the North Shore, and then moved to Sea Cliff on the North Shore, and I found a ship wreck near where I lived, and was able to SCUBA dive on weekends on that shipwreck, and I enjoyed the fish and the other marine animals I saw associated with that shipwreck, so I still manage to get down to Hempstead Harbor, and these are some of the artifacts that I have collected over the years, marine bottles, spikes from shipwrecks, animals and plants and so forth.

**FC:** And could you describe what things were like here when you first started. Maybe the research activity at that time, the key staff.

**WB:** The staff had been shook up. The reason I got the job here was in 1970 there was a proposal by the Washington office and the Gloucester office to close this facility for lack of funding, and a million dollars was required to keep this facility going. And people here had received RIF notices, which are reduction in force notices, and some had actually physically left. And because they left, there was a microbiology position open which I was able to get. And that person ended up going to Oxford, Maryland. And a few other people were very concerned about whether the lab would stay open because of that pretended closure, but that was reversed.

The shellfish industry said, "We're not going to allow the Milford Lab to close" because we've been working here at this lab for the shellfish industries problems for years! The former lab director, Victor Loosanoff, had developed methods for artificially rearing oysters and clams. Basically, he was the father of aquaculture, and that technology had been exchanged to the industry, and the industry appreciated the fact that there was a scientist and a laboratory that could do molluscan biology, and the industry wrote letters to Washington and Washington reversed itself and said, "Yeah, we'll keep the Milford Lab open." And so we received some funding in '72, and at just about this time, what was then the Bureau of Commercial Fisheries, which is what was the initial part of this lab, it was opened in 1933 as a Bureau of Commercial Fisheries laboratory, BCF we called it then, the Department of Interior was switched over to NOAA, the National Oceanic and Atmospheric Administration, and so I ended up working for NOAA, rather than Bureau of Commercial Fisheries-Interior, and NOAA's been who we've been working for ever since.

**FC:** And that seems like an interesting time, because you mentioned the transition here, and there was a lot of change at that time here, but it seems to me it's also the environmental movement is gaining momentum, and people are paying more attention to the marine environment.

**WB:** And waste products going into it. The causative agent of algal blooms, phosphorus, nitrogen, and how the ocean itself was changing for the negative. Fisheries were declining and, you know, people thought there was never an end to fisheries, that we could keep fishing for

ever, and that turned out to not be the case. With modern technology areas were fished out, and our lab that was in charge of determining the success or failure of marine fisheries at Woods Hole were doing surveys to try and prove that the fishery resources were still viable. But the reality was they were declining. Habitat was being destroyed by the fishermen. They would drag nets over the bottom and basically ruin that habitat for good. And the species that needed those bottom resources weren't able to re-colonize even if there were moratoria on the particular fishery species. So, once the habitat, the home let's say, of the fish had been ruined. That fishery resource was no longer able to reproduce and live in that environment.

**FC:** And did that activity impact fin fish and shellfish?

**WB:** It definitely impacted fin fish. Shellfish had been overharvested for years. When the first colonists arrived in the Northeast, there were middens of oysters piled high to the roof that Indians had taken and utilized, and colonists started to utilize the same resources, and as the white civilization increased, oyster harvests increased and increased. The American Indians had used ecology. They never overharvested a resource. They always managed to control the harvest so that there would be future fisheries. Not so with the Europeans. They were just determined to take every last seal, every last fur otter, or every last animal that they could harvest. The whale fishery is a very good example. And Mystic Seaport is a classic place to observe the last of the whalers, the Morgan. So that was, the whole history of mankind is one of the depleting of resources to the point where I was reading this morning, that we now are in a debt to our resources that is significant to the point where, in '71 the debt was on borrowing resources was somewhere in November, and now it's in August. That we are depleting them so fast including just water. That the future of Western civilization and the rest of the world is going to be dependent upon our wise management of the few resources we have left, and the recycling of those resources.

**FC:** And we don't have the greatest track record in a lot of areas.

**WB:** Apparently not. Unfortunately, not. And it's quite unfortunate that there isn't strong political will to recycle and manage things better than we have. A good example is the drought in California right now. Waters being utilized at a rate greater than is being replaced.

**FC:** Yeah. Could you talk a little bit about some of your early work and projects when you started here, your early years here?

**WB:** Yeah, I worked on bacteria that affect the survival of juvenile oysters and clams, and these bacteria can cause mass mortality in a very quick time in a hatchery situation. So, oyster farmers who are growing oysters and clams would contact me and say, "I've got this problem, everything is dying, could you come over and take a look." And I would go to Long Island or go to Maryland or go to California or go somewhere to work with shellfish farmers on their bacteria problems, and I found a common thread, that when you take a large number of animals and throw them into a small situation that you're going to get transfer of disease very rapidly, and bacteria were really related to not good sanitation, not proper cleaning of the water, the salt water.

I tried to encourage farmers at that point to think of sea water as milk, and if you think of warming up milk, you know it spoils quickly. The same thing can be said of sea water, it carries bacteria in it that can cause either depletion of oxygen or outright disease, if allowed to get warmed or sitting in pipes for long periods of time. So we encourage farmers to flush out the pipes and to keep some sort of a disinfectant available. Be it either UV light, or ozone gas, or chlorine, or something to maintain a high level of cleanliness in one of these shellfish hatcheries. Much like you see in the various hatcheries for chickens and hogs today, that if you don't maintain a critical level of cleanliness, disease can and indeed does happen regularly. There are flu outbreaks in birds and in hogs and in oysters too, so I worked with farmers to develop methods to prevent these diseases from occurring, and I learned early on that many of these farmers had the same problem. So I decided, rather than me going to all these shellfish hatcheries, why don't they come to our lab and learn a little bit about what we do and how we can prevent their problems. So in '75, I instituted the Shellfish Biology Seminar. And we had seven, or actually nine shellfish farmers attend the very first one. And they thought it was fascinating and said, "Please, hold another." And basically it was just to describe methods of keeping bacteria out of culture and preventing issues from arising as a result of poor sanitation. So we followed that meeting every year for the next thirty-six years, and the last one I had in Portland, Maine, we had 600 attendees. Aquaculturists who are now growing shellfish, clams, lobsters, fin fish, and were fascinated by the methods that the Milford Lab had come up with all those years.

**FC:** And that seems like a model project in terms of connecting industry and science.

**WB:** Technology transfer, it evolved, and it was so encouraged by the industry, that in spite of the fact that there were years when we had no funding to do this meeting, the industry said they would pay or would help in any way possible to see that this meeting continued on. So I started charging a registration fee to cover the cost of printing the abstracts from the meetings so that they would have a copy, a permanent record of what had been said. And everyone was encouraged with that, and so we did that and we've held those meetings. As a matter of fact, there's one in January in Providence, Rhode Island, it'll be the thirty-seventh meeting. So, it's been a fun run with this meeting. Some of the farmers that have attended have attended all of the meetings. So I have a good friendship built up over the years with some of these individuals.

**FC:** It's interesting because with some commercial fishermen, especially maybe ground fishermen. I've done some interviews with them in the past, and they seemed skeptical about science and scientists, "they're not out here every day, they don't know what they're talking about, I do, it's cycles", and yet in the shellfish industry and with aquaculture in particular, it seems just the opposite, where there is respect, and that information is valued.

**WB:** It's very negative. This lab has always worked toward that end, to assist the industry in coming up with a product that's safe and wholesome -excuse me a second I'm going to get a water - We were offered, twice when I was here, we were offered up for closure. The industry went to bat for us both times. One time, the people in D.C. neglected to check on who was the person in charge of the budget for NOAA, it turned out it was Senator Lowell Weicker, from the State of Connecticut, and when he found out that they were offering to close this laboratory in



his home state, he went wild. He actually had the two people who were responsible for offering this lab up fired, which I found pretty powerful, that a senator can do that. He then offered to add \$600,000 to this budget for this laboratory, and it went right through. So, bio-politics is powerful stuff.

**FC:** Have there been ups and downs in funding over the years?

**WB:** Oh, yeah. Aquaculture has never been what I would call a winning word in the United States. Overseas, China, Japan, they believe firmly in aquaculture and growing food from the marine environment. For some reason, fishermen don't seem to get the fact that once you kill the last bison or the last passenger pigeon, then there's none left. And I guess it's because the ocean is so vast you think it can never be depleted, but it's not a matter of depleting, it's a matter of changing the environment to the point where the animals can't survive in that environment.

**FC:** Do you think it's partly because it's an invisible resource?

**WB:** Yes, that is the key. You can't see it. You can go in a forest and count the number of trees as any kind of forest ranger or forest biologist would tell you. Count the number of pines, the number of oaks, the number of hemlocks, and have an accurate analysis. Here, it's an indirect study. We take a boat out of Woods Hole, we drag a net around, and hopefully we catch with that net eggs or small fry of that species, which we can then extrapolate to hopefully a sustained yield population. But it's indirect, and it's guesstimation. It's like dragging a net across the surface of the earth from a flying saucer. How are you going to hopefully catch what you want? Most people, if they saw a net coming, they'd get out of the way just like the fish would probably if they felt the pressure of a net.

**FC:** That's interesting because that's a major challenge that you face, access to the resources that you're interested in. It's not easy.

**WB:** No, it's not. Granted that we now have more and more equipment that allows us to view the underwater world. But Jacques Cousteau, I mean, without his intervention with the development of the SCUBA gear, I think this field would have not advanced very much, and now optical equipment. And of course, the interest by the oil companies in developing technology to move and collect oil off shore caused development of submersibles, and equipment that could be used by biologists to further our study of what's in the environment.

**FC:** So the technology has had a major impact.

**WC:** It has. But it required a lot of money to go to develop, and a lot of that development cost was born by the large oil companies because they're trying to move off shore, and collect resources from the deep now, because on land, apparently we've exhausted many of those resources. We continue to move further and further away, and that has impacts when, of course, there are oil spills.

**FC:** And, looking back again on your, the earlier phase of your career, were there specific scientific theories that sort of guided your research at that time?

**WC:** Well, there's something called Koch's Postulates which basically say you have to recover the disease, or you have to prove that there's an organism involved in causing a disease, and then recover that organism, cause it to cause disease again, and then that's pretty well proof of the fact that you have a causative agent involved in the disease problem. So I kind of relied on that, and over the years, I've found that by being very, very careful in documenting everything and keeping accurate records, sometimes you see something that you don't expect in science, that something doesn't come out the way it's supposed to, and if you can get that to repeat a few times, then that's kind of interesting.

I've got about sixty publications in the scientific literature and a couple of books, and some of those were based upon unusual observations, that not everything happens the way it's supposed to. So, serendipity, good luck, if you will, in science is often even more important than good science. I think Fleming, the microbiologist who discovered penicillin, discovered it quite accidentally, that fungus was invading his Petri dishes, and was causing the bacteria he was trying to grow to die. And he put two and two together and said, "this might have some value." And it turned out, penicillin was discovered as a consequence, and that of course has really revolutionized human medicine.

**FC:** Are there days that you've had where you just leave here with a big smile on your face because of the results of your work that day where you're just, you've just come up with some good information and it's just very satisfying?

**WC:** Well, yeah. Those days aren't often, but when they do happen, they're wonderful and they give you a terrific high. You had a eureka moment, if you will, and you discovered something that you never thought you could imagine, and then hopefully you can reproduce it the next day. That's the key in science, being able to reproduce the cause, the whatever relevant experiment you did to the point where you get the same result. Not always do you get the same result after two or three tries, and that's what makes the work so challenging when working with salt water, because the water that you had one day is not the same water you have the next day. The ocean is changing. Each tidal event brings either low or high tide water, and we pump salt water from a river out here, and if it rains one day, that means there's silt in the river. If someone is dredging or digging in the harbor, that means we get dredge spoils into the laboratory. And all these effects the outcome of each experiment. So that makes variability very strong, but it also makes the data realistic to the shellfish farmers, because they're dealing with the same thing. They're pumping water from day to day, and the water changes from winter to summer to fall to spring.

**FC:** Do storms, especially rain storms tend to disrupt your studies?

**WC:** Very much so. It changes the salinity, so we literally can't pump if it's a really severe storm like a hurricane. And just the winds can stir up sediment, and the sediment can carry pollutants. Most of the boats that are out here use copper as an anti-foulant to prevent the formation of barnacles on their boats. This copper washes off the boats, usually in the fall or spring when they haul their boats out, and that copper ends up in the sediment. And if the sediment is re-suspended, we pumped some copper into the building. Copper is deadly to invertebrates. It kills everything, and it can have a profound effect on trying to grow oysters or clams.

**FC:** So, has the science itself sort of remained constant over the years?

**WC:** No, it's changed. When I first went to graduate school, the computer I used was an IBM 360 model 40. It encompassed most of this building. And I could go in there in the winter and warm my hands on the vacuum tubes because they were huge. And we used punch cards to enter data which included commas, dashes, and you had to spell a word right or the card is rejected. Now, I just hit a button and I have a program in front of me, that's all manufactured, all set. I can do a statistical analysis by hitting another button, all the work is done for me, and the power that I have now on this desk is more than the Apollo moon rocket had, so it's phenomenal how science has evolved. That's the mechanical side. The biological side, when I went to school, we talked about DNA, because Watson and Crick had discovered the tangle of DNA, but nobody thought much about it at the time, but now we have the human genome described, and many bacteria described, because of their DNA and RNA sub-basis. So we are down to the fact of being able to identify something absolutely. When I first started, we had to do fifty to seventy tube tests using sugars and various components, to identify a bacteria to species. Now, they do a DNA analysis and boom, they have its' species. This all took me weeks. Now it takes days to hours. Science is evolving very, very fast, and human medicine is evolving fast too as a consequence.

**FC:** Is it also a challenge too because, I'm thinking, even with digital photography, we can take a hundred photos in a few minutes, and those photos pile up and in your research do you find that there can be an information overload?

**WC:** There's a data overload. And the older you are, the more the overload, because it's hard to select, and it's hard to run a good program that will help you select the right data because there is so much of it now. Younger people are also getting an education that kind of restricts them. When I talked to graduate students today, and I've had master's and doctoral candidates work with me, they'll take a hand held device, and I'll say, "we'll do a literature survey on this particular specie." And they'll punch a couple numbers up, and they'll say, "well, we have everything from 1975 forward." And I said, "Well, what about 1950? What about 1940?", "Oh, the machine doesn't have that." "Have you ever gone to a library?" "We don't know about libraries, I've never gone to a card catalogue, I don't know how to use a card catalogue, I don't know how to use the library." And I say, "Oh my God, you don't know what's in the books do you?", "No, I have no idea." And that's scary, because their whole world is what they can hold in their hand on a small device. They don't know how to go to Yale Sterling, or into one of the major libraries in New York, and go down into the stacks and wander around, smell the dust, and see the old books, and actually find a reference to 1885, or 1904, or in the '30s or '40s. Scientists have been working for years. Many of the ideas that are just recycled over and over. But the technology changes, which allows those ideas to come to fruition. You have a new tool, the tool allows you to determine the right answer to a question that was brought up 50 years ago.

**FC:** Well, and you have a situation to, if somebody is going to come along and could benefit from your hand written research notes or lab notes, I can't read them because they didn't learn cursive.

**WC:** [laughter] Well, that's another story, I didn't even think of that. That's quite true. No one hand prints everything in a notebook. Yeah, that's very true. They're not teaching cursive anymore in school, are they? So, how do you sign a check now? That's a good question.

**FC:** You don't use a check, you use a debit card! [laughter]

**WC:** My son, he lives exclusively off the debit card. And I ask him, "Do you ever balance?", "No, the statement comes once a month, and I think it's all right." And I said, "You don't know where your money is?" And he said, "No, I trust the bank." I said, "that's a lot of trust!"

**FC:** Well, we think about it at our place. We have these wonderful manuscript resources, and 19th century journals and letters, and all these things that grad students theoretically are not going to be able to read.

**WC:** Or want to read. Because they're in a hurry to finish something. That's the scary part.

**FC:** It's interesting. Well, we've talked about it a little bit, and you've mentioned the shellfish seminar, but I wanted to ask you a little bit about, more about that, why is it important to bring together industry and researchers?

**WC:** And government, it's very important that the researchers and the government understands that the tax payer is responsible for funding these projects. And it's important that the tax payer realizes that there's value that we have, that should be exchanged with the users. And in this case, it's the farmers. And the farmers are pleased to know that there's someone who's interested in their problems, and how to resolve those problems. So, there are fisheries, laboratories up and down the coast that work on different things, and we just happen to work on molluscan studies. Shellfish.

**FC:** You've been, you mentioned it a little bit earlier, but you've been involved in some international projects and research projects.

**WC:** Yeah, I've worked on trying to ameliorate or reduce the effects of toxic algal blooms, and I used a gas, ozone gas to reduce the effect of red tide blooms on either shellfish hatcheries or aquaria. And some of that technology has actually exchanged itself. The Disney World resort in Orlando, Florida has a very large aquarium called The Living Seas. And I worked with one of the biologists in the mid '80s on developing a way to treat that water so that that aquarium would be able to have both fin fish and whales and dolphins. And that was using ozone gas, and it ended up being a wonderful exhibit. It's 6 million gallons of lake water that has been turned into an ocean, and it supports marine life in the sense of both fin fish and dolphins and that was a fun project to work with.

That was like an unusual part of this work, and I've worked with biologists in Alaska on trying to reduce spoilage bacteria, and I learned a lot about ice. Ordinary ice contains bacteria that can cause fish spoilage. I never knew that. And I found out only indirectly by having used ice for studies in bacterial growth and degradation of fish proteins. And son of a gun, you take an ordinary ice and put it against a fin flesh, and within days you get spoilage. If you sanitize that ice, if you disinfect that ice, you decrease the spoilage, so that the fish shelf life increases almost

twice. So you get more bang for your buck if your ice is clean which is something I never anticipated, but turns out to be so. And that was one of the benefits of some of the work I had done here.

I work with shellfish farmers in France, in Baja, Mexico, and in the Keys, all on disease problems. We had a hatchery in the Turks and Caicos that grew conch, queen conch, and they were experiencing difficulties, and it turns out, it was a sanitation issue, their intake pipes were loaded with a bacteria that, a vibrio bacteria that caused mortality. And once they instituted a regular cleansing of those pipes, those problems disappeared.

**FC:** Are the problems affecting shellfish pretty much uniform around the globe, I mean is it the same issues, is it pollution and water temperature?

**WC:** Yes, climate change is having a profound effect too. By the warming of the seas. Everything is accelerating faster, disease issues come on faster, species are more subject to maximum temperature sustained that they can tolerate. The very limits of their tolerance is being stressed now, species are moving is a consequence. Lobsters, which used to be in Long Island Sound are moving north, because the water is getting too warm, so that effects the fishery here. But it increases the fishery somewhere north, like Maine. They had a record lobster harvest the last two years, as a consequence of our lobsters leaving. Cod fish is another thing. They're moving north too. And what was left of the population has moved more north, and so the Canadians have a wonderful resource now, whereas it used to be our resource. So what do you do? You going to put a fence up? [laughter] You know that's the one thing about land farming, you can put a fence up and keep your cattle in one spot. In the oceans, there are no fences.

**FC:** How would you describe the state of the marine environment in Long Island Sound today?

**WC:** It's getting better, only from the perspective that there are more and more people who believe in ecology now. When I was young. When you went out on a boat, you drank a beer, you threw it over board, you threw the empty, the can, the bottle. Nowadays, people bring their empties back, because there's a five cent penalty if you don't, so people are encouraged from a financial standpoint to not throw their empty overboard. I find empties from the 1800s right up to the Coca Cola bottles of the present day underwater. Because glass doesn't degrade, and plastic itself doesn't degrade too much either, but it's fascinating to see how attitudes have changed, but it took a laws to make that happen. It took people actually thinking about it, and reducing nitrogen in sewage plants, that's absolutely critical because that's what causes algal blooms. When the algae die, they take oxygen out of the water, and they make the water unsuitable for any marine life. Attitudes have changed really dramatically.

**FC:** Have you, has your diving supported your work and the ability to take a firsthand look at a shellfish bed?

**WC:** Yeah, and I have done that. I've actually gone on the shellfish bed, took a dive to look down and to see what the growth of the animals were on the bottom. And sure enough, some years you see very healthy bottom, and other years there may be a fungus mat growing on the bottom as a consequence of one of these mortality events on algal bloom which cause a mass

mortality, which cause animals to die back, and really affects the farmers, because they literally can't change their bottoms. They have designated bottoms from the states. They're allowed certain acreage, which they pay a fee to own or lease from the states, either Massachusetts, Connecticut, Rhode Island, New York. And that bottom has to remain pristine. If it doesn't, they don't have anything to work with. So, all the shellfish farmers maintain their beds, either by harvesting them with dredges, or cleaning off the starfish, or removing the predators like drills, or other animals, crabs. Literally if they don't, they lose their product. Just like a cattle farmer would lose its product if wolves were allowed to roam wild or mountain lions were allowed to harvest his crop. So there has to be a balance between predators in the environment and man's control of that environment.

**FC:** It's interesting because you've mentioned it several times, you see parallels between land farmers and people who are doing aquaculture.

**WC:** Yes, absolutely. And if we don't start thinking in those terms, we aren't going to have a marine species to deal with. It's critical that we put eggs back and not just take every last resource, every last specie out of the environment without replacing it. Because we well know that if you have a garden at home, if you don't plant tomato seeds, you aren't going to get tomatoes next year. So, unfortunately that still has not rung true with the fishermen yet. And they are starting to get it, but it's going to take another generation. Younger people are going to have to replace the older people who still think that there's plenty of fish out there to catch wild, and not ever put anything back, that somehow nature will make it all work, and it doesn't.

**FC:** In terms of the future of your field, and looking at bacteria pathogens and disease affecting shellfish. What work remains to be done, or what do you anticipate in terms of future work?

**WC:** Viruses. I have never had the ability to work with virus that affect the survival of oysters, clams, lobsters, fin fish, because we just don't have the equipment or the money to be able to do that. And quite honestly, there must be millions of unusual viruses that are out there that can cause one thing or another, including cancer, or who knows what else, abnormalities, genetic things. Anyway, that's one thing I wish I had been able to do, but my career is over, so I won't get to do that this career.

**FC:**Is there a link between the health of shellfish and human health?

**WC:** Obviously, yeah. If you put shellfish near a polluted area, that is polluted with human sewage, then if those shellfish are eaten raw, the chance of picking up a human virus, like polio, or norovirus, is very high, and that has a big impact. So there are state regulations and rules that prevent shellfish farmers from utilizing areas that are near sewage treatment plants or even after heavy rain falls, when sewage treatment plants bypass their waste into the marine environment, so that those farmers don't harvest that until the water cleanses itself. So, there's a time period there.

**FC:** But do you think, you were talking about viruses, do you think that there are viruses that are potentially a human threat, that we don't understand or haven't identified yet?

**WC:** There could be! That could affect human health, and I mean, we know that there are viruses that are water born that effect the cruise ships. People come down with huge problems on board cruise ships from drinking water that's not properly treated, and so the marine environment must have other viruses that can affect people in adverse ways. Because we eat these products. These are food for us. And you want to always eat food that has nutritional value and is safe. And these are very critical things. Marine environment, oysters and clams can accumulate things. They can accumulate metals and metals can have profound effects. Especially mercury or lead, cadmium, chrome, all of these have bad effects on people especially younger people or pregnant women. So, there's been an issue with predator fish such as tuna and the accumulation of mercury in these predator, top of the food chain fish, because animals are able to move small amounts of mercury and/or lead, or any of the other toxic, up through the food chain, to the point where the top predator fish, either shark or tuna, ends up with a burden, a concentration, and this would include swordfish, where we are finding mercury in both swordfish and tuna, and that has impacts on us when we consume them.

**FC:** Have there been, or what have been some challenges or frustrations that you've had to deal with in your career?

**WC:** Politics has been one of the big issues. Our agency was operated by fishery biologists, who's whole education and background dealt with fishery resources, maximum sustainable yield, wild harvest fisheries. And we have a mandate from Congress, to keep track of the fishery resources, the number of fish out there, and how many should be captured, and what yields, and what levels should be captured. So the word aquaculture was a four letter word to these people, and for, I'm guessing, a good 35 years of my career, I went against people who were suggesting that wild resource was the way to go, wild harvest, wild capture, aquaculture was something we did in the Agriculture Department, the U.S. Department of Agriculture. Quite honestly, this agency, the Agriculture Department would have been a better agency to have run this facility, but I was working for NOAA, so I had to convince people, and it's just now starting to come home to roost. We're now believing it, and the agency is using the word, and is actually, has an Office of Aquaculture in D.C. Never had it before. Last three years, they hired a guy, he hired staff. Now we have an Office of Aquaculture in the D.C. office. He encourages aquaculture, he has funding to do aquaculture. So, that's been a positive outcome. But, it wasn't so in the beginning, not so at all. Many, many years, I would put in for funds to try to have this meeting cover the cost of registration. "No, we have no money for that, sorry, you have to find it somewhere else." And sometimes, I actually went to the Department of Agriculture, and got funding for the publications. They found the value and the meaning so important to their farmers, that they funded the cost from that perspective, they paid the cost of printing the books, and the reprints that we produced. And I acknowledged it on the front of the book, so, it was crystal clear to my agency, that you guys didn't fund it, the Department of Agriculture through the North Seas Aquaculture Consortium paid for this booklet. Didn't embarrass them. [laughter] You know, to me that would embarrassing if I was an agency manager, and another agency was paying for the information, I would think I would be a little embarrassed, but it never bothered them.

**FC:** What do you see as your most important contribution in your field?

**WC:** Trying to convince farmers that sanitation and cleanliness in the shellfish and/or fin fish hatchery is critical to the outcome of their facility. And not to use antibiotics, because while antibiotics will have an immediate impact, it will increase your yield initially, antibiotics develop resistance. The bacteria develop resistance to those antibiotics and you end up with a bacteria that is a superbug, that resists all antibiotics and destroys the hatchery, and basically closes the facility. I've actually watched that happen in four different places, where veterinarians were consulted by the owners. Veterinarians saw that there was a bacteria problem and their solution was to add antibiotics to the water, and sure enough, it worked great for maybe one cycle, maybe two cycles, but then, nothing ever grew again. So, that was of great value to learn that we couldn't use antibiotics in the marine environment to control diseases as we could in the human environment. But of course, there are issues in the human environment with resistance, too. Now that many, many antibiotics have been overused for many years, there are problems with superbugs in hospitals where people might develop a disease in a hospital that couldn't be controlled by antibiotics. When you can't control it, the result is usually death. So that's a pretty severe outcome, or the loss of flesh or arms. Scary business.

**FC:** What have you enjoyed most about the work?

**WC:** Working with people. I try to help people with their problems, trying to resolve something like, you get a phone call, "Everything smells bad this morning! Can you tell me why?", I say, "What do you mean by smell bad?", "Well, it has an odor I never smelled before." "Well, can you describe the odor." And you go on and on and on, and finally, "Can you come and look at it?", and I said, "Sure." So you get in a car if it's local, or you get on a plane if it isn't, and you go down and you sit with the people and you say, "Well, what happened here?", "Well, about two weeks ago we hired a young man who just got out of college and he has a cell phone and he has a girlfriend." And I said, "Oh, that's interesting. And when you drain the water out, what happens?" "Well, he sometimes gets calls on his cell phone." And I said, "Oh, so that means that the water sits a little longer in the screens that it would normally." "Yeah, that's true." "And so when the animals are re-suspended back in the water after they've been filtered, they may have sat on that screen for the duration of a cell call." And the new employee syndrome, not used to handling animals, living things, that's a real disease issue. [laughter] Just sanitation, not respecting cleanliness, looking at the place as a kitchen, where you want to keep the counters clean all the time. And you know, it's a matter of questioning people, because many times they have no idea what caused their problem, because they have caused the problem and don't see it, and you have to stand back and put a mirror to them and say, "Look at yourself, look at what you're doing. This is what the issue.." "Oh, but I never thought of that." "That's why I'm here, to show you that you never thought of it, because it is an issue."

**FC:** I mean you have to have interviewing skills, just because you need to ask the right questions to get the information you need.

**WC:** Yeah, and there's a certain series of questions I ask everybody when we get to a situation like that. And I'm hoping that gets passed on to other people who will replace me at some point



so that they have those people skills. That's critical, being able to interact with people. Otherwise you get nowhere.

**FC:** Have you enjoyed that part of it, the collaborative work, or working with new employees or students or young people?

**WC:** Students especially, yeah. I taught part time at Fairfield University from 1972 to 1986. I taught marine ecology, the biology of marine pollution, invertebrate zoology, and coral reef ecology all during that period, and I have an adjunct at the University of Delaware, at Bridgeport University, at Long Island University where I taught various courses including aquaculture and microbiology, marine microbiology. So, I've enjoyed working with students. I was just cleaning up my desk as a matter of fact, and came across, where is that picture.... One of my students who came here.

**FC:** Well, it seems like an interesting mix with the teaching, and the research, and the lab work.

**WC:** It is, it's fascinating, and working with young people. They're always questioning, and as a consequence. Anyway, there's a picture of one of the students that came in here as a Central Connecticut State student, and she worked with me for a couple of years. And a young man from Seattle who got a degree at the College of Fisheries came here. He worked with me, they got engaged, they got married, they had a child, and that was the picture that I was looking for, of both of them with the child, it's around here somewhere, I just don't know where. They met here, and now they're both involved. She's a microbiologist at New York Department of Shellfish Conservation, and he's teaching at LIU. So, that was a valuable background, and it's fun.

**FC:** You mentioned when we first started speaking, that you were about to retire, or retiring fairly soon, and are you looking forward to that?

**WC:** Well, I'm not exactly looking forward to not having a regular job. Something to go to every day, to work 8, 10, 12 hours. I am looking forward to SCUBA diving and sailing, and doing the fun things that I did afterhours. But I'm trying to figure out how to fill out a whole day doing that, and I haven't been able to come up with that yet. I love to swim, I love to sail, but I don't know if I can do that for 8 hours 24/7, So I've got to come up with something else to do.

**FC:** Do you want to stay connected to the science?

**WC:** I would, but I don't know how, and I don't know whether teaching would do that, because I certainly have offers to do that if I want to. I'm 73, I don't know how many more field trips I would want to make with a class. But that's certainly something that I have to come up with a solution to that problem. I haven't put in my paperwork for retiring yet because I'm waiting for a letter. So it could be as early as the end of August or the end of September, when I actually physically leave, and I've got to get all this mess cleaned up in the process. Forty-five years of paperwork. We used to keep everything. We wrote letters. And those letters were printed on paper, and we had to keep a copy of every one of those correspondences. So I have correspondence from 1971 until the present. Now I have e-mails, which is a lot easier, but still they have to be recorded someplace. And so, I, when I started to clean out my office, I thought, holy smokes, what do I throw away, I couldn't come up with that. You look back and you think,

well, this was an important letter I wrote, should I save this for posterity or should I just grind it up. I don't know the answer to that problem. I haven't come up with a solution, but I've got to, because I have maybe two weeks to a month to get rid of everything.

**FC:** It's a huge project.

**WC:** It is, and you don't realize it until you come to the end of a career, where you've been a government civil servant, and have worked with people, and have generated correspondence and information, and the time has gone by.

**FC:** And if you pitch a file, there could be something in there that a researcher would benefit from.

**WC:** That has value, yeah, in the future. Exactly, and you don't know what to keep and what not to keep. The research notebooks I'm going to keep and pass on, but the correspondence?

**FC:** Do you have a personal slide collection?

**WC:** Yeah, 35mm slides. I was going through that Kodak carrousel, piles. I showed them to students, "What's that doctor? What's that for? That circular thing." "Well, we used to put 35mm." "What are slides?" "Here, they're pictures." "Oh, we do that on the computer now." [laughter] Like I'm talking foreign stuff like it's outer space stuff.

**FC:** Dinosaur technology.

**WC:** Yeah, I even have some 4 by 5 glass slides. Big, big pictures. And kids have no idea. I mean when we used to project stuff, that was all Kodak. And if it wasn't a carrousel, there wasn't an easy way to do a talk. Technology changed.

**FC:** Well, is there anything else you'd like to add or anything that we didn't cover that we should have?

**WC:** I appreciate the opportunity to speak with you, and you know if I haven't covered any areas, hopefully you'll get back to me, and ask me what those questions might be. This is a picture of my sailboat, which I use, it's fortunately next door at the Milford Yacht Club, so I'm able to go out sailing every night that it's around.

**FC:** So it sounds like, in addition to being connected to the water professionally, it sounds as though you've always enjoyed it as a place for recreation.

**WC:** Yeah I've always enjoyed it as a hobby, and recreation too. I really do. As a matter of fact, Sunday, I was SCUBA diving for a lost rudder for one of the members of the Yacht Club, and it was 25 feet down and off shore, and it was dark, and I was thinking to myself, what am I doing down here, all alone on the bottom, looking for this guy's rudder on a Sunday morning when I should be in church? [laughter] And then Saturday night, I was having dinner at the Yacht Club, and a fellow who runs the tender, which boats people back and forth, had wrapped a rope around its' propeller. They said, "Oh, we need to have somebody..." I said, "Ok, I'll cut it." And I went

under the boat with SCUBA gear and cut the rope. So, I still have value, but the kind of value I have, I'm not sure I want to have. [laughter]

**FC:** You'll be getting calls.

**WC:** Yeah, exactly. Now he's retired, he can come out any time and look for stuff. And people drop cell phones overboard all the time, and glasses. I find glasses regularly for people. You have them in your pocket, they lean over, and into the water goes the glasses. Fortunately, it's usually right below the boat, so it's not hunting, you find them right away. Same thing with cell phones, but cell phones don't work too good. They don't like salt water at all. [laughter]