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Dickhoff, Walton ~ Oral History Interview

Maggie Allen

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Voices from the Fisheries
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Interview with Walton "Walt"Dickhoffby Maggie Allen

Summary Sheet and Transcript

Interviewee

Dickhoff, Walton "Walt"

Interviewer

Allen, Maggie

Date

August 23, 2016

Place

Northwest Fisheries Science Center
Seattle, Washington

ID Number

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Use Restrictions

Biographical Note

Dr. Walton "Walt"Dickhoff was born in Wisconsin in 1947. He received his Ph.D. in Physiology from the University of California Berkeley in 1976 and joined the Northwest Fisheries Science Center in 1986 working in the Coastal Zone and Estuarine Studies Division. Dr. Dickhoff is the Division Director of the Environmental and Fisheries Science division, and his research focuses on salmon growth and development.

Scope and Content Note

Interview contains discussions of:NOAA, National Marine Fisheries Service, Northwest Fisheries Science Center, physiology, salmon, parr, smolt, hatcheries, aquaculture, salmon development, salmon migration, genomics, DNA sequencing, big data, climate change, ocean acidification, shellfish, sablefish, Deepwater Horizon oil spill, Puget Sound Restoration Fund.

In this interview, WaltDickhoff discusses his work with the Northwest Fisheries Science Center over the course of his career. As an undergraduate, he did research on flatfish adaptations andhis professor encouraged him to go onto graduate school for physiology. When he finished his Ph.D., he received a National Institute of Health Fellowship to work in the Zoology Department at the University of Washington. There, one of his students connected him to the Northwest Fisheries Science Center, where the major focus was increasing the survival rate of salmon born in hatcheries by controlling the rate of the maturation from parr to smolt. This research prompted the formation of the Hatcheries Science Review Group, which reviews hatchery operations and genetic management plans.

Dr. Dickhoff believes that some of the challenges of working in government include the instability of funding and the necessity to prioritize only a few research areas. He describes how advancements in technology, particularly in genetics, genomics and big data, havefundamentally changed the nature of biology. He emphasizes how climate change and ocean acidification are affecting his work and how the drastic pH swings of the ocean negatively affect marine animals like shellfish, finfish and corals. For the Paul Allen Foundation's ocean acidification challenge, his lab collaborated on a proposal with Puget Sound Restoration Fund, Univ. Washington, and NOAA Pacific Marine Environmental Laboratory to develop areas of kelp to remove carbon dioxide from the ocean, which is currently being deployed in Hood Canal.

He also discusses his work with sablefish aquaculture and on Deepwater Horizon oil spill seafood safety. In addition, he discusses collaborations within NOAA and with other agencies, and how NMFS encourages collaboration between scientists across divisions. He advises young scientists to keep their eyes open for unexpected opportunities and develop good quantitative skills. He plans on retiring within the next five years.

Indexed Names
Allen, Paul
Hoberecht, Laura
Howell, Ruth
Incardona, John
Jewett, Libby
Mahnken, Conrad
Scholz, Nat

Transcript

MA: Thisinterview is being conducted as part of the Voices from the Science Centers 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. I am Maggie Allen and today I'm speaking with WaltDickhoff at the Northwest Fisheries Science Center in Seattle, Washington. It is August 23rd, 2016 at 11:00 a.m. Walt was born in Wisconsin in 1947. He received his PhD in Physiology from the University of California Berkeley in 1976 and joined the Northwest Fisheries Science Center in 1986 working in the Coastal Zone and Estuarine Studies division. Today Walt is the Division Director of the Environmental and Fisheries Science Division, and his research focuses on the growth and development of fish, especially salmon. Okay Walt, why don't you just start by talking about what inspired you to pursue a career in science and how you got to where you are today.

WD: What inspired me in science…actually, I was going to be an M.D. or something like that when I was an undergraduate, but as an undergraduate, I had an opportunity to do some research on how flatfish adapt to freshwater and seawater. That kind of introduced me to the excitement of doing science and discovering stuff people didn't know about before. And then the professor who had that undergraduate course asked me if I was interested in graduate school and if I was interested in being his graduate student, and I said yes [laughter]. So, that led me into science.

MA: Okay. And then you decided to get your Ph.D. in Physiology after that?

WD: Yes, that was for my Ph.D. in Physiology.

MA: Okay. And then how did you end up in Seattle working here?

WD: So, after I finished my Ph.D., I had an opportunity—I got a National Institute of Health Fellowship to work at University of Washington in the Zoology department and my plan at that time was to do two or three years of post-doc and then find an academic job where I could do biomedical research after that.

But what had happened during that time when I was at UW in that post-doc, I was giving a lecture on the thyroid gland in a comparative endocrinology course and a student came up afterward and asked me if I know anything about thyroid hormones and salmon. And I said "well, I just developed a thyroid hormone assay that could be used in fish", and so that started a conversation on potential research on development of salmon parr-smolt transformation, when they transition from freshwater to seawater and looking at mechanisms of that, was a graduate student who was here at the Northwest Fisheries Science Center, and so he got me involved in some projects that were going on here at that time.

In fact, the major project that they were looking at was how the quality of smolts produced in public hatcheries, salmon hatcheries in the Northwest. The smolts are the form—they grow the fish up for a year and a half typically, and then they release at the smolt stage and those are the fish that migrate downriver and into the ocean. And they knew at the time that most of the mortality after the fish were released from the hatchery occurred within that first year after they were released. And so, what we're doing is taking fish from the hatchery and taking them to net pens, floating net pens in seawater at the Manchester Research Station, part of the Center. And in that protected environment where there was plenty of food available, they would follow the survival of those fish and they were surprised to find that sometimes 80 to 90 percent of the fish would die within six months. So, it wasn't predation or disease or things like that—the fish just didn't thrive.

So, that led to a lot of research just on the basics of the parr-smolt transformation, how it's controlled, how it's influenced. The parr-smolt transformation is kind of a biochemical, physiological, behavioral change in the fish that allows them to migrate rapidly downstream and survive in the ocean. It was an exciting time because at that time there was a lot of interest in this parr-smolt transformation in California, Oregon, Washington, British Columbia, a large group that formed to study this. So, it was an exciting time.

MA: So you started working for NMFS [National Marine Fisheries Service] through that collaboration?

WD: Yeah. I started working with NMFS—I had actually, after the NIH Fellowship, I had written research proposals to SeaGrant, to National Science Foundation, to U.S. Department of Agriculture and got those funded to continue those studies, and a lot of that was collaboration with NOAA Fisheries and the people at the Center.

MA: And then how did you make your way up throughthe organization and end up in your position you have today?

WD: I had an opportunity to be a permanent faculty member at UW, but I was interested in working with the Center, the Northwest Center, mostly because it was more of an opportunity to do more applied research, research that could influence policy and regulations. So, that was exciting, although as a professor at the university, I really enjoyed working with students and teaching. I found that at the Center I could still work with students at UW, so that was a good opportunity.

Anyway, so 1986 Conrad Mahnken hired me to do more of this research on salmon and that's how I became a NOAA researcher. I still maintain a lot of connection to the University of Washington as an affiliate faculty, as I do now. I'm still on student committees and things like that. So, while I was at the Northwest Center, I became a Program Manager for the Physiology Program and we had a lot of other researchers doing different work—mostly again on salmon and salmon hatcheries and trying to improve salmon hatcheries. So, that went well and we found a lot of interesting things about how to improve smolt quality at hatcheries and probably the major thing was to increase the growth rate of the fish in the spring when they were going through this parr-smolt transformation because increasing the growth rate improved all the physiological changes in smolts and also made them migrate down river faster. Then, when they got into the ocean, they would grow faster.

MA: So, how did you find that out? Or how did you do that?

WD: We did that through a series of experiments and a lot of these experiments were also supported by the Bonneville Power Administration. Experiments…we'd go into hatcheries and look at the differences in how the fish were growing, kind of just a lot of comparative studies at different hatcheries with some hatcheries that were very successful with the smolt to adult return, and some that were not. We also did experiments where we would take fish, the juvenile parr, and put them on different growth trajectories. We'd take small parr and big parr and make each of those two groups grow either slow or fast. We'd end up with fish that were the same size that had been growing fast or had been growing slowly. We could see all these physiological differences and migrational differences, migration rate differences.

MA: And so how do you think your work and like that, for example, has that influenced policy? You said that's why one of the things you like working for NOAA.

WD: Yeah, well, the bulk of that work, not just mine but with other researchers too, had influenced how hatcheries are operated. In fact, a few decades ago there was kind of an external group that was formed, the Hatcheries Science Review Group, that went about reviewing all the hatchery programs and how they were operating and each hatchery had to develop these hatchery genetic management plans which would describe how they would operate. So that continues today. It's a scientific overview on how hatcheries are operated. So, that was a major accomplishment, I think, and result of that research.

MA: Okay. Would you say that maybe it's a project that you're the most proud of?

WD: Yes [laughter].

MA: What have been some challenges working for the government or in science?

WD: Challenges working for the government…some of it—well, let me step back and say since that research with the Physiology Program, about 13 years ago the Division Director at that time moved to another division and I had an opportunity to become the Division Director and not only oversee that research, but oversee research on what is now seven other programs dealing with food safety, toxicology, again, a lot of Pacific salmon research, harmful algal blooms, microbiology, aquaculture, fish nutrition—a wide range of science. So, that's been interesting and fun.

Some of the challenges have been kind of the instability of funding. There were a lot of increases in funding in the 1990s, early 2000s, but then recently the funding has changed quite a bit. It's kind of stabilized but costs have gone up, so we've had to prioritize which research areas we're going to emphasize. So, that's been difficult managing through that.

MA: Has technology made any of your tasks easier as it's evolved over time?

WD: It's made them—I wouldn't necessarily…yeah. A lot of things are easier than they used to be. You can make a lot more progress a lot more quickly, but there is challenges in that, too. I'd say the major things that have changed technically is just the ability to look at animals and their physiology and the ability to get a lot of detailed information on genetics and genomics. The whole Human Genome Project advanced a lot of technologies, DNA sequencing, and generation of massive amounts of data and then how you make sense of that data, kind of the bioinformatics end of things. So, that's really changed. In the old days, we used to look at—like I said, we looked at thyroid hormones and what parts of physiology thyroid hormones affect. Now, you can look at essentially all the functional genes at once and it's overwhelming. How do you make sense out of all this information? So, that has really changed. It's just changed the nature of how you do biology.

MA: And how do you see that evolving in the future? What kind of changes do you see?

WD: I see a lot more of that going on. I think we'll be able to—as we get more information on the fish or other aquatic organism genomes, we'll have the tools to look more at how they adapt to change in environments. So, I see that changing, just the amount of information we have and making sense of that massive amount of data.

MA: And how—what about climate change and changing ocean conditions? How will that affect your field?

WD: Yeah. Those are affecting them now [laughter]. They're huge effects.

MA: How are they being affected now?

WD: For example…let's say one example is—well, one area that we've gotten into that's a bit new is the ocean acidification effects. The ocean acidification is kind of the evil twin of global climate change. We're seeing pH swings, huge pH swings over just a few hours in some areas of the ocean and in some shellfish hatcheries, for example. So, that low pH is affecting survival of larval shellfish and it's also affecting a lot of other animals. It can affect larval finfish, it can affect corals. It affects primary productivities. Those ocean acidification effects, I think, are major. I think the animals can have different abilities to adapt to those changes. For example, there is evidence that the Olympia oyster, which is the native West Coast oyster, is much able to handle changes in acidity compared to the Pacific oysters from Japan. So, there's a question of how much adaptability is there in the future. There's somewhat of a limit in that ocean chemistry and the calcium saturation level is set, so you can't really—it's difficult to adjust to some of those low pH levels. It's the physics and the chemistry issues. But the pH is fluctuating, so even on one spot, it can see quite a range of pHs, so how can animals adapt to those kind of conditions, the fluctuating pH?

MA: So are you guys just trying to answer those questions? Is there anything else you're trying to do?

WD: Yeah, we're trying to look at that, but also there's issues about can you do anything about ocean acidification and can you mitigate it in any way? One interesting project we're somewhat involved in is Paul Allen's Ocean Acidification Challenge which he issued a few years ago with the Paul Allen Family Foundation. They solicited proposals from various groups and we partnered with the Puget Sound Restoration Fund and the University of Washington and other parts of NOAA, the Pacific Marine Environmental Lab and others to put together this proposal to the Paul Allen foundation, and there were about 32 proposals from around the world. We didn't win that competition [laughter] but we came in second. So, Paul Allen came back, their group came back and said "we're still interested in doing some things, what could you do?" And we developed some parts of that initial proposal.

Basically what the proposal was is to develop kelp, macro algae, develop arrays, Kind of like floating pens that were somewhat submerged that would grow bulk kelp or sugar kelp, and this is sort of like planting a forest to remove CO_2, this is planting a forest of kelp in certain bays to remove CO_2. So, the initial site for that is in Hood Canal in Washington where these kelp arrays are being deployed and the idea is to create this area of high pH, less acidic conditions and then look at what things like pteropods that are sensitive to pH and see what kind of refuge from acidic ocean conditions could be created. Beside Paul Allen Foundation, there was additional

funding from the U.S. Navy to support that research. So, can we plant underwater forests and counteract CO_2 and ocean acidification? So, that's kind of an exciting project.
MA: And have you started that?

WD: Yes. Puget Sound Restoration Fund is just deploying the kelp at that site in Hood Canal this year.

MA: So, you're going to wait to see what the results will be?

WD: Yes. The next few years.

MA: Yeah, that's pretty exciting to see what will happen. Do you think there's anything else NOAA or the public can do to help mitigate ocean acidification effects?

WD: Reduce CO_2emissions [laughter].

MA: Just general…yeah.

WD: Whatever we can do.

MA: Right. And how is that affecting your other, any other—I know you're involved a lot in aquaculture, in sablefish aquaculture. How is your work being affected by those environmental changes? Can you talk a little bit more about sablefish aquaculture?

WD: Yeah. The sablefish aquaculture is actually not that related to the ocean acidification, but it's a new opportunity I think. One of the—the capture fisheries are now pretty much completely exploited, a lot of them are well-managed. But there's an additional demand for seafood globally, including in the United States, and that can only come from aquaculture. So, there's a way to do—and aquaculture has been criticized a lot for not being sustainable or environmentally sensitive on a global scale. So, I think there's ways of doing that, that there are problems with aquaculture, environmental impacts, but they're all manageable if it's done the right way. So, we're doing a lot of those kind of developing this aquaculture science and trying to inform policy about the appropriate ways to do aquaculture to reduce any kind of environmental impacts. Reduce reliance on forage fish for fish feed, reduce impacts of any escapes or even assess what impacts those escapes might have. Disease issues, pollution issues. Like I said, a lot of those I think are manageable.

The sablefish project was something we initiated about 8 years ago. Sablefish is a unique fish. It's a cold water fish, very high growth rate, has a unique flavor. It's very oily, has a lot of omega-3s so it's very nutritious. Chefs in restaurants love it because you can't overcook it—you can't dry it out. Sablefish is also known as black cod. But the capture fishery is about 35% of its historic high and it's not expanding, so we think there's very good potential new markets for sablefish there and demand is increasing too, especially in Asia. So, the sablefish project we started out a number of years ago and it's been pretty successful. Very little is known about sablefish reproduction and how you grow the larvae and the juveniles, and so we've been pretty

successful producing a large number of juveniles—I think this year 2016 we produced about 70,000 juveniles. So, it's beginning to see this could be large enough to develop an industry.
MA: Do you think the public has become more okay with aquaculture, since you're addressing those things that they're concerned about?

WD: Slowly, yes. Yeah, there have been problems in the past, but I think it's getting addressed. Still a bit of an uphill battle. There's still quite a few myths out there about aquaculture, but I think we're in a good position to address a lot of those.

MA: Is that part of your job, too? Is to kind of…?

WD: Yes.

MA: Do you do outreach, or do you talk to the public at all?

WD: Yes, in fact we have an aquaculture coordinator, Laura Hoberecht, in the regional office here and she's organized a lot of these outreach alongwith Ruth Howell in our communications. We've met with county commissioners who are reviewing their Shoreline Management Act and considering issues about aquaculture. We've held these kind of public information/outreach events with some of the State Departments—sponsored by the State Department of Ecology to talk with other country commissioners and local governments and tribes, to address these issues about what are the real risk of escapes or what are the disease issues, what are the environmental impacts. So, that's I think been very productive and a very important thing to do. I've even gone to Sierra Club meetings [laughter] to try to get our message across.

MA: How does that go? Are they receptive?

WD: Yes. I mean, they're polite and they listen. They like to see peer-reviewed, scientific documentation, which is what we do.

MA: So, a large range of people and organizations that you talk to. Cool. Where else does your work or has your work taken you throughout the region, country, world?

WD: Yeah. So, a lot of the salmon work has taken me all over the world. We had a lot of collaboration with university and government researchers in Japan and Scandinavia, Norway in particular. So, a lot of different—throughout the U.S., too. And then some of the…most recently, five years ago, six years ago now, the Deepwater Horizon oil spill brought us down to the Gulf of Mexico for most of that summer, the oil spill. Our chemistry group and toxicology groups have a long history of responding to oil spills going back to the Exxon Valdez in Alaska in 1989. NOAA's oil spill response has two elements. One is kind of a seafood safety initial response where fisheries are closed where the oil is present, and then we do—as the oil is spreading, we sample fish in federal waters around the area before the oil gets there to verify that those fish are not contaminated, and then after the oil spill ended and the oil well was capped, then there was still a huge area in the Gulf that was still closed, and so as the oil receded, we went systematically through all of those areas over the next year to take samples, send those samples

for chemical analysis back to Seattle and clear those areas one by one. So, it took us about a year to reopen the half a billion dollar Gulf fishery. So, that was interesting.
MA: I was going to ask what was that experience like for you to be down there?

WD: Yeah, that was really eye-opening in a lot of aspects—just the immensity of that oil spill and then the effect it had on the people in the industry. That industry was totally shut down, the environmental impacts were huge. It was another challenge convincing the public that we were—that the government was doing the job to ensure that the seafood was safe. That was a real challenge. Not only safe from the oil, but safe from the dispersants that were being used, the millions of gallons of dispersants that were released to reduce the impacts of the oil spill. No one had ever done measurements of dispersants in fish foods, so we worked a lot with the FDA [Food and Drug Administration] and very quickly developed assays for the dispersant and started screening the seafood.

MA: And through that you were able to find that it was safe to eat and the public was eventually reassured, yeah.

WD: Yes, right. We had analyzed tens of thousands of seafood samples.

MA: I remember it took a while to feel like it was okay to eat again. So that was part of your job, was to—

WD: Convince them that this was the most tested seafood in history, I was completely confident that it was safe to eat—I would even bring it home to my family.

MA: And so have you been back there since then to see any changes?

WD: No, I have not been back there. There are still some lingering aspects of the impacts. For example, the increased freshwater flow from the rivers around the Gulf to keep the oil offshore, keep it from the more sensitive nearshore estuarine parts, which was probably a good idea. But it wiped out a lot of the oyster reefs. So, there's a lot of efforts to rebuild those. In fact, we're interested in being involved in that—rebuilding oyster and shellfish habitat. In fact, that's one of the new things we've started just about three years ago is more work on shellfish. We built a shellfish hatchery in our Manchester Research Station, partnering again with Puget Sound Restoration Fund. A lot of assistance from NOAA's Office of Aquaculture and the State of Washington to do that as part of the Washington State Shellfish Initiative. The initial goal of that was to rebuild the Olympia oyster in Puget Sound, which is the only native oyster on the West Coast. So, oyster rebuilding, we're getting more involved in oyster genetics and pathology and recovery, and so we can see opportunities to work in the Gulf at some point, too.

MA: And how do you collaborate—how do you personally collaborate through different NOAA offices and universities? How does that work?

WD: That works well. We collaborate with a lot of other offices within NOAA. The oil spill, the Office of Response and Restoration, out Ecotoxicology Group, Nat Scholz and John Incardonaon those people, they work a lot with OR and R in response and natural resource damage assessments after an oil spill. That's after the seafood stuff, you have to look at the—you have to assess the damage from the oil spill. So, we work a lot with them.

The ocean acidification is a lot with Libby Jewett's group. Other parts of the agency. Some work with the Weather Service in terms of predicting harmful algal blooms and certain weather conditions promote toxic algal blooms. So, lots of work with other parts of NOAA than other government, USDA [United States Department of Agriculture] as I mentioned is a strong partner, Fish and Wildlife Service, worked a lot with them. And then with university and private groups. So, a lot of collaboration with University of Washington and a lot of other universities nationwide and internationally. In fact, we have visitors now from…one from Korea and one from Japan and one from Spain right now.

MA: And they're working with you?

WD: Yeah. In our division, groups in our division. So, that's important too. We worked a lot with—like I said, some non-governmental organizations like Puget Sound Restoration Fund, it's a private nonprofit group. We've developed a cooperative research development agreement with them so they can actually have staff running our shellfish hatchery, which works out great, and doing collaborative research. We're also working with some private industry on the aquaculture side of things, Trout Lodge, Point Whitney, LLC is one of those, Jamestown S'Klallam Tribe is in that. Trout Lodge is the world's largest producers of salmonid eggs, so they've been our partner with the sablefish. One of the goals of that project is Trout Lodge Group—we're working very closely with them so we transfer the science and technology to them so they can pursue this as a commercial effort, and the idea is that they would produce sablefish seed and then they would—their partner, Jamestown S'Klallam Tribe would grow those out and harvest them and try to get that going. The tribes are interested in diversifying. Aquaculture is one of those, especially with native species like sablefish.

MA: That's interesting, all the different partnerships and ways to use your different skills and abilities to work together. How has your—since you've been here in 1986, how have you seen the office itself evolve and change?

WD: You mean the agency NOAA, or Fisheries, or just the Center?

MA: Well, usually yeah, the Center itself. This office and the people in it.

WD: Okay. I think there was a cumulative risk initiative a number of years back, like in the 1990s, and that was good because we hired a whole group of young researchers and it was like a shot in the arm. These exciting young people that came in at that time greatly diversified what we were doing, expanded a lot of the ecological work, expanded a lot of the modeling that needs to be done now because datasets are so huge and complicated. So, that's changed.

Along with that time, we've been able to maintain a certain academic atmosphere that I think is unusual for NOAA Fisheries Science Centers. We operate—although we have clear mandates and things that we need to do for the agency, the basic science is very collaborative and very interactive. Almost like what you see in universities. In fact, we promote that kind of collaboration among different kinds of scientists and across divisions through the internal grants program, which is something we started 15 years ago, 16 years, something like that. That's where there's a bunch of money set aside for researchers to compete for. They have to write proposals and compete for it and there's an emphasis on cross-divisional, cross-disciplinary collaboration. So, that works really well. There's a lot of, I think, improvements. Get people excited about doing new things and challenging the quality of their science, if there are competitive programs.

MA: And that's evolved kind of through time? More things like that happening?

WD: Yes.

MA: And what are your personal plans for the future, in the next five to ten years?

WD: Next five to ten years…I'll be retired within five years [laughter]. I'll be traveling, taking more time with family. Not sure how much fisheries will be involved in there other than maybe catching salmon [laughter].

MA: Going to stay involved as a hobby or something?

WD: Yeah. I think I might. But it's been good to see, like I said, we've created a lot of new directions so it's going to be very satisfying to see how those things carry on.

MA: So what advice would you give to someone just entering your career?

WD: I'd say keep your eyes open for opportunities. You can't predict where they're going to come from. When I came up to Seattle, I never thought I'd be involved in fisheries. Make sure you have good quantitative skills. As I said, the amount of data that's generated is now massive. Big data, how you analyze is really important, understanding how these complex ecosystems work, it really requires modeling. So, a good quantitative background is something that you need.

MA: Yeah, knowing software like R or—

WD: Yes, exactly.

MA: So definitely take those classes. Okay, great.

WD: And keep your eyes open.

MA: Yeah, be open to change.

WD: Be open-minded.

MA: So, are you glad you ended up at fisheries then, overall?

WD: Yes, it's been very satisfying.

MA: Cool. Well, if you have anything else to mention about your life or your time here, but that's pretty much most of the questions.

WD: It's been a great career.

MA: Cool. Great, thank you.