Oral History of

Robert Raymond Hessler

Interview conducted by Laura Harkewicz

27 February 2006

and

6 March 2006

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ABSTRACT:

Robert Raymond Hessler was interviewed over a two day period. The first day was February 27, 2006. The second date of the interview was the following week, March 6, 2006. Hessler was born in Chicago, Illinois on November 22, 1932. In 1960, he received his Ph.D. in invertebrate paleontology from the University of Chicago, from which he had also received his B.S. and M.S. degrees. He began his oceanographic career as an associate scientist at Woods Hole Oceanographic Institution (WHOI) in 1960. While at WHOI, he became interested in deep sea biology and worked with the Deep Sea Research Vehicle (DSRV) *Alvin*. He worked at WHOI until 1969 when he began work at Scripps Institution of Oceanography (SIO). At SIO, he worked as an associate professor and professor of zoology (1969 – 1980) as well as a professor of biological oceanography (1980 – 2001). In 2000, he was the only recipient of a prestigious honorary doctor of philosophy degree from the Faculty of Science and Mathematics at Lund University, Lund, Sweden where he has done, and continues to do, research work in carcinology, the scientific study of crustaceans. Our interview covered many topics related to Hessler's over forty year career in oceanography, including: his experiences at WHOI versus those at SIO; his work with *Alvin* and research into deep-sea hydrothermal vent biology; his undersea photography, including the way he used it to fund his final two graduate students; his experiences with personal and scientific burn-out; his teaching activities; his reflections on scientific competition; and his current passion with art. Throughout the interview, Hessler expressed a high level of introspection, which reflected the insights of a man who had carefully considered his life, the contributions he had made to his work and his family, and the motivations of a scientist who had made a career of exploring the deepest mysteries of the sea.

INTERVIEW HISTORY: The interview took place over two days, one week apart. The first day of the interview was recorded in the Helen Raitt Room at the Scripps Institution of Oceanography (SIO) Library. The second day of the interview took place in the second floor Archives storage office at the SIO Library. We talked for approximately three hours on the first day and continued our conversation for approximately thirty-five minutes the second day. The total interview time was approximately three and one-half hours. The recording was not paused except to turn the tape over or switch tapes. A portion of the interview has been restricted until a later date, due to the personal concerns of the interviewee.

Laura Harkewicz
Oral Historian, SIO/UCSD
June 29, 2006

Dr. Robert Hessler (left) and graduate student Michel Boudrias with laboratory equipment, 1991. Scripps Institution of Oceanography Archives, UC San Diego.

INTERVIEW WITH ROBERT HESSLER: 27 FEBRUARY 2006

Harkewicz: ##[1] This is Monday, February 27, 2006. I'm in the Helen Raitt Room in La Jolla, California, at the Scripps Archives Library, Archives, with Dr. Robert Hessler. Good morning, Dr. Hessler.

Hessler: Good morning.

Harkewicz: So, first of all, my first question for you, Dr. Hessler, is: how did you decide to make a career in oceanography, or in biology in general? What brought you to this field?

Hessler: The biology part is easy. Even as the littlest child, I showed an unusual interest in bugs, and when my parents were alive they recorded moments that made this obvious. And I went to a camp when I was in grammar school: Mr. Bo's[2] Family Farm Camp. Mr. Bo was an extremely charismatic person, a teacher, and, he simply increased my love of the field. For example, when you go to camp, sports is usually the center of it all. At this camp it was butterfly collecting, and I just loved all of that stuff. So, it's no surprise that this continued on. When I went to University of Chicago—initially I was going to go to college at Colorado A&M to study forestry, but then decided that that wasn't for me. Also, I was emotionally a little young to be away from home at that point. And so I fled back to Chicago after one quarter and enrolled at the University of Chicago, immediately with my interests biased towards the sciences, particularly arthropods. And then I continued on at the University of Chicago. I was always interested in evolution, so I finally went for graduate work in paleontology and did my work on trilobites. Well, what should have happened to me then, when I finally graduated, is that I should have gone to some kind of a school or job related to geology, but a couple of things happened that made that impossible. One was that at that time there was a glut in the market for exploration geologists and that affected the whole field. It was hard to get a job. The second is, and I'm sorry to say it, the University of Chicago was never big on filling people with facts, nor was I ever big on bothering to learn them. And I was totally unready to take a faculty job in geology, totally. That was brought out to me in a miserable interview I had with the University of Illinois at Urbana, very embarrassing. So, there I was. I was finally ready to go out into the big world, with no job prospects, and one of my professors said that he had a friend at Woods Hole Oceanographic Institution who needed someone to work with him because he'd just discovered a really unusual crustacean, which he'd named the *Cephalocarida*,[3] and he wanted somebody to

[1] The symbol ## indicates that the tape or a section of the tape has begun or ended. For a guide to tapes see the final page of this transcript.

[2] Hessler noted that Bo was short for Boubjerg.

[3] Cephalocarids, a type of crustacean, are benthic (sea floor) marine animals that are found in all kinds of sediments and feed on detritus. Cephalocarids are tiny (2–4 mm. long—about the size of a sesame seed) and consist of a head, a thorax with eight segments that contain paddle-like appendages, and an abdomen. They have no eyes and are considered primitive. For more information see: Robert R. Hessler, "Cephalocarida: Living fossil without a fossil

study its anatomy. And my professor thought that I would be a very good man for that. This man's name was Ralph Johnson.[4]

Harkewicz: Your professor or the man at Woods Hole?

Hessler: He wasn't actually my professor. He was a secondary professor of mine, but he had kind of taken me under his wing. And the man at Woods Hole was Howard Sanders.[5] He had only recently graduated himself and he had discovered this remarkable animal during his graduate career. His professor, G. Evelyn Hutchinson,[6] said, "You really ought to do something about this." It turned out this animal was extraordinary, absolutely extraordinary. And so Howard was passing through Chicago and on his way he stopped and interviewed me for an afternoon. And we just talked and at the end of the interview he said, "The job is yours." It's a little different from the way we operate these days. That was in what, 1959. And so I took this job at Woods Hole Oceanographic Institution, knowing very little about living organisms, and knowing very little about anything. I was one dumb graduate. And I took this job and started to learn from scratch. I learned how to do anatomical studies on this beast. And it was a slow learning. There was a lot that I had to do. I had to learn about the literature. I had to learn about what other animals were like. In those days it wasn't the most important thing to publish as soon as possible. You could get the job done. But I took a long time before I finished my first study of this animal, which was on the skeletal musculature. And finally, after maybe three years, I was ready to publish and I turned out a monograph[7] on the skeletal musculature of *Hutchinsoniella macracantha*.[8] I have to say it was a damn good piece of work, and I—to this day, it is cited as one of these landmark pieces of work that will never be copied again because no one has time to do work like that anymore. We're all busy writing proposals. It was a marvelous era, the sixties.

At any rate, while I was there Howard was studying coastal ecology, because that was his forte, and he was called in on the carpet by Buck Ketchum[9], who was kind of the senior biologist at Woods Hole. And Buck told Howard that unless he started to do blue-water oceanography he had to really be looking for a job elsewhere. They weren't interested in coastal oceanography. Howard took that seriously and came back somewhat shaken to our little lab which was a horrible

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record." In *Living Fossils*, eds. Niles Eldredge and Steven M. Stanley (New York: Springer Verlag, 1984), pp. 181-186.

[4] Ralph Gordon Johnson (1927 – 197?), professor of paleontology, University of Chicago.

[5] Howard L. Sanders (1921 – 2001), marine biologist, Woods Hole Institution of Oceanography.

[6] G. Evelyn Hutchinson (1903 – 1991). American zoologist and professor at Yale University; considered the "father of modern limnology."

[7] Robert R. Hessler, *The Cepahlocarida: Comparative Skeletomusculature* (New Haven, CT: Connecticut Academy of Arts and Sciences, 1964).

[8] *Hutchinsoniella macracantha* is the scientific name for cephalocarida.

[9] Bostwick "Buck" Ketchum (1912 – 1982), scientist, chairman of Biology Department, and associate director of WHOI, 1960 – 1977.

little place; they had not treated us well. And he said, after having thought about it, "How would you like to study the deep sea?" I thought, I had all these wild ideas about what the deep sea was like. When I was in grammar school I read Beebe's book, *Half Mile Down*,[10] or whatever its title was, and was fascinated with the topic. And I thought, "Sure." So I'd already taken one left turn by going to study modern biology, although it was on evolution and anatomy, which is my deep love. And then, I took a right turn from that which was to study biological oceanography, and that's how I got into it.

Harkewicz: I've found that a lot of people I've interviewed have sort of not taken a direct route. It's kind of, a lot have been sort of—I don't think there's a straight line, perhaps, to oceanography.

Hessler: I don't think there is, and I don't think there ought to be. Serendipity controls what you're going to do next. And that's as it should be.

Harkewicz: I agree. So, how did you end up here at Scripps?

Hessler: Howard and I, particularly Howard—I was always in his shadow—made a name for ourselves in the deep sea. Howard was perhaps the first real ecologist to ever study the deep sea. All the rest were explorers and taxonomists. At that time, Bill Fager[11] was trying to build up biological oceanography here at Scripps. And he thought a good thing to do would be to develop an interest in deep sea biology. He came to Woods Hole trying to pry Howard loose. At that time he would have been happy to take me as well. He wanted to have a deep team, but in the final analysis Howard didn't want to leave Woods Hole. It was his home. He loved it there. He was finally being well treated. And so that's how it all ended. But it didn't end that way. In late 1968 or 1969, I got an invitation to apply for a job here in biological oceanography. Dick Rosenblatt[12] was the chairman of Biology at that time. No, he was—what do we call it now? He was in charge of the academic branch.

Harkewicz: Right. The Graduate School. Yeah.

Hessler: The Graduate School, yes, which at that time was still a rotating position. And he invited me to apply for a job. Coincident with that I was getting very uncomfortable with my position at Woods Hole, because it was more and more dependent on being able to do deep sea biology and I never felt totally comfortable as a deep sea biologist. I had no training in ecology. I had no training in any of that. I was really, I always felt out of my league. And even when I was

[10] William Beebe (1877 – 1962), American ornithologist, explorer, and author. In 1934, Beebe made a record ocean descent, 3028 ft. (923 m.) in a bathysphere. His book, *Half-Mile Down* (NewYork: Harcourt, Brace, and Co.) about the descent was published in 1934.
[11] Edward William Fager (1917 – 1976), SIO marine ecologist.
[12] Richard Heinrich Rosenblatt (1930 -), professor of marine biology, research zoologist, and curator of marine vertebrates at Scripps.

here at SIO, I really felt out of my league. I was not an ecologist. And at that time Howard was showing an interest in inviting another man to join the team. Fred Grassle[13] was his name, and he got his degree from Duke University, having studied at least partially in conjunction with Bob Menzies,[14] who was another deep sea biologist. Fred was as superb scholar, still is a superb scholar, well trained in benthic ecology, and was happy to come to be with Howard. And I felt threatened. I felt that I was going to get shown up and pretty soon I was going to be in trouble. What I'm showing to you is not necessarily reality but showing you the insecurity of a young man, at that time. For better or for worse, I'm laying it on the line. And I should be hiding this, but I'm not hiding it because at some point I've got to be open about these things. And so, that and another reason: I was at heart a Westerner. I'd grown up in Chicago. I was fascinated with the West. I used to come out here for vacation, mountain climbing and doing all that good stuff. And I thought this was finally an opportunity. Not that California is the West. California is the West as about as much as Florida is the South. Florida is New York transformed. And California is the rest of the nation transformed, but it was near the West, and I wanted that. So, I applied for the job, did a really bad job in my interview, and you guys took me anyway.

Harkewicz: Sounds like you're too hard on yourself, though.

Hessler: Whatever. Maybe I am hard on myself, but maybe I know more than you guys do. I think that subsequently people thought very well of me. Whether I deserved that, I don't know. My students, for the most part, at least openly, loved me. They thought I was a fine advisor. Did I deserve that? I don't really know. I tend to think they were being very kind, but nevertheless they would still say, “Bob, you were a great advisor.” And I'm not going to dissuade them of it. I'm deeply grateful that they thought so. I did some darn good deep sea biology here. I think I served as a role model. I'm proud of a lot of the papers that I wrote. I'm not particularly proud of what kind of a laboratory leader I was. I didn't know how to do it. If I had a chance to do it again, I'd do a much better job. If I had the chance to write proposals again, I'd do a much better job. But this is how it all worked out, and I grew in the job over those thirty-some years that I was on the faculty here. So that's how I got to Scripps.

Harkewicz: How did the Woods Hole community compare to the Scripps community, especially when you first came here? And when I mean community, I mean actually at the institutions, but also the surrounding area.

Hessler: When I got to Woods Hole you could fit the entire research staff in one room not a heck of a lot larger than this, and once a week we would all sit down for lunch together, the climatologists, the geologists, the biologists, the physical

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[13] John Frederick Grassle (1939 -), Founder and current director of the Institute of Marine and Coastal Sciences, Rutgers University. Grassle worked at Woods Hole Institution of Oceanography (WHOI) from 1969 – 1989.
[14] Robert James Menzies (1923 – 1976), professor of oceanography, Florida State University. Menzies was at Duke University from 1962 – 1966.

oceanographers. We would all sit together and have a good chat. They gradually outgrew that room, and by the time that I left they were in departments so that by then you were primarily dealing with biologists, if you were a biologist. When I got here, that situation had already evolved. I dealt with biologists. So my impression of Woods Hole was always, because I started that way, always it was a family. And, when I got here, Scripps was no longer a family, if it had ever been. Scripps was famous for its infighting. Famous for its "people you love to hate." And, we won't go into names. And you know as well as I do. You will have, you have the misfortune of not being able to interview some of them because they're dead. So . . .

Harkewicz: Are you sure you don't want to name names? You have the opportunity to clear the deck, so to speak.

Hessler: Well, one of them was Craig. God, his last name? Not Harmon Craig, come on.

Harkewicz: Oh, Harmon Craig?

Hessler: Harmon Craig.[15]

Harkewicz: Yeah. Okay.

Hessler: Gosh. I'm seventy-three years old, for the record.

Harkewicz: You're doing great.

Hessler: And Ed Goldberg.[16] I think he's still alive, but I doubt that you'd want to interview him. And there were others as well. Just really abrasive people.

Harkewicz: Uhm-hmm. Did you ever have any problems with them yourself?

Hessler: Only once. On the first cruise that I took to sea, knowing nothing about Scripps tradition, I was taking the ship from Hawaii to Adak in the Aleutians, and we were doing certain spots and deadheading for other areas. And during that deadheading they wanted to know whether I should leave the depth sounder on. And I—having that, doing that means that there had to be a biologist on watch. And I wanted these guys to get their rest and I couldn't think of any reason for it, so I said, "No, turn it off." And when I got back and they'd discovered that I'd done that, oh, they were all up in arms over this biologist who had broken Scripps tradition. And I was called onto the carpet in an open meeting, and I was deeply criticized for it. Never having been asked to do it, never having been told, I was deeply criticized. And I thought "What in the hell is going on here?" As the meeting went on I still didn't understand what was going on. As I recall there was someone, not a biologist, who defended me and that was nice, and it all ended and

[15] Harmon Craig (1926 – 2003), Scripps geochemist.
[16] Edward D. Goldberg (1921 -), professor of chemistry, SIO.

went away. Did I feel badly about that? No. I always felt puzzled, but I also felt alerted for future situations to make sure that didn't happen again—

Harkewicz: Right.

Hessler: —because it was strictly ignorance, which I was very good at. *[Laugh]*

Harkewicz: Well, I don't know if it's your ignorance or ignorance on their part, though. It sounds like, you know, there were all these unwritten things that people were just supposed to know.

Hessler: Indeed, there were, there were at Scripps. This society had its rules. So, I gradually grew into the situation. I suddenly discovered that I had to find money just to set up my lab, because in those days they didn't have a lot of setup money. Setup money wasn't one of those things. And also, I had this naïve Depression attitude that when you do a job, you do it yourself. You don't ask somebody else to do it for you. If I was going to come here, I was going to set up a lab. I was going to find the money to do that. I hadn't expected anybody to do it. They gave me more than I had even really thought of asking for, and so they primarily set up a lab for me, but I needed a lot more. And I was willing to find the money, and initially—this was the end of the sixties—money was still there to be had. And so I was able to set up a lab. Students came to me. I had never taught before. I set up a course in deep sea biology, and it turned out to be a good course. It evolved over the years. I was learning how to teach as I taught, and learning how to do research as I did research. I had to decide what I wanted to do that was not simply Woods Hole all over again, and I decided on a program. I had one close friend here, Bill Newman.[17] We had known each other before as carcinologists, carcinology being the study of crustaceans. And he was one of the people who were urging me to come here. He wanted to have a colleague. And we made good colleagues right from the very start. And having him here, someone to talk to, was really very nice. And Bill Fager was also very nice to me, although not in a position to be able to help me very much.

That's how the first year went. I decided since I had been invited here as a deep sea biologist, and I decided that a good deep sea program was to investigate that portion of the ocean that everybody was ignoring, and that was the part of the ocean where there was so little life that most people didn't want to spend a lot of time on it. I thought, I would go to the center of the ocean and at its most sterile part, where the primary productivity at the surface was worse, and see what life was like at the bottom, and I would do it in a quantitative way. And so I had to design a quantitative tool that would do the job. In discussions with people like, oh, I think Fred Spiess,[18] and Peter Lonsdale,[19] I decided on a box corer,

[17] William Anderson Newman (1927 -), professor of oceanography, Marine Biological Research Division (MBRD), SIO.
[18] Fred Noel Spiess (1919 - 2006), research geophysicist, former director of Institute of Marine Resources, SIO.
[19] Peter Frank Lonsdale (1948 -), professor of oceanography, SIO.

modifying a box corer that Rupert Riedl,[20] I think, had designed in Germany and had been modified here by Peter for taking geological surface cores. But I knew I needed a big sample and so I decided to build one that was a half meter by a half meter. It would take a quarter meter squared sample, and I designed it myself in utter ignorance. But I loved doing stuff like that. I really loved it. And I collaborated with John McGowan,[21] who was kind enough to take me on a cruise to the very kind of spot that I wanted to study. The cruise was Climax II,[22] and we went to sea together. I came here in late '69, around Christmas. Is that right? Have you looked? Or did I come here late '68, at Christmas, and started in early '69?

Harkewicz: I have you in '69.

Hessler: Okay. So, January of '69?

Harkewicz: I don't have the exact date. I just have '69 to '80 you went from associate professor to professor at SIO.

Hessler: Okay. I've got a feeling I was here all of '69, which means that this had to be the spring, summer, winter, or spring summer, autumn that I went on that first cruise. I had started to accumulate some graduate students. Bill Newman had one, who he felt would do better under my tutelage, by the name of Frank Rokop.[23] And, for some reason I was put into contact with some other students, one by the name of Peter Jumars.[24] Peter was thinking of coming here and studying some group of animals. He wanted to be a benthic ecologist, and was interested in the deep sea, and I suggested to him that he would do better studying polychaetes, gave him a whole bunch of reasons, and that made sense to him. And he decided to study with me. And I'm getting chronologies mixed up here. But another one of my early students was David Thistle,[25] who I met at the MCZ[26] in Harvard. And he wanted to come to Scripps and he wanted to do systematics, although he ended up doing ecology. He talked to me and I sounded like a pretty good prospect to him, and he sounded like a good prospect to me. And so he came here and he became one of my early students. And then finally there was a fellow named George

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[20] Rupert Riedl (1925 – 2005), Austrian zoologist and evolutionary biologist known for his system theory of evolution and evolutionary theory of knowledge.
[21] John Arthur McGowan (1924 -), Scripps biological oceanographer.
[22] The Climax II cruise was aboard the R/V *Argo* and took place from August 13 to October 14, 1969. Leg I (August 13 to September 12) was from San Diego, California to Honolulu, Hawaii. Leg II (September 20 to October 14) was from Honolulu, Hawaii to Papeete, Tahiti.
[23] Francis Joseph Rokop (1945 -), formerly of the department of biology, UCSD. Rokop co-authored (with Jeffrey L. Brandon) the book, *Life Between the Tides: The Natural History of the Common Seashore Life of Southern California* (San Diego, CA: American Southwest Publishing Co. of San Diego, 1985).
[24] Peter Alfred Jumars (1948 -), professor of oceanography and marine sciences, Darling Marine Center at the University of Maine.
[25] David Everett Thistle (1949 -), professor of biological oceanography, Florida State University.
[26] Museum of Comparative Zoology

Wilson who came here from Kentucky, Indiana.[27] I've forgotten. And he came to work with me. Pete was one of my earliest. Frank was the earliest, and I don't know who was with me on that early cruise. Maybe none of them were.[28] Maybe I was just pirating some of the technicians who were there, and they were all very kind to me. And on that first cruise we collected ten replicate samples from this one spot. It was laborious. My box corer worked, after a certain amount of fiddling, but I had forgotten to take some things into account, and that was something that we all learned in our various kinds of business, in that there's a scaling issue. You just don't scale things up linearly and expect them to work the way they did in their small model. Things operate exponentially. Things get exponentially harder, and I discovered that I could get a sample but I couldn't figure out a way to get them out of the box, because it was so cumbersome, there was so much friction, they were so heavy. Somehow, I worked that out, and this was the story of my life, modifying pieces of gear gradually to make them work. So, what else is new? Everybody does that. And I got pretty good at it—to the extent that I designed a piece of gear which up until the last few years of my stay in oceanography was the way to go in deep sea oceanography. I had established the route one wanted to if one wanted to study quantitative oceanography. And then toward the end, the field really exploded and other people were putting their minds to it and developing better techniques than I had, which is great. There were flaws in my technique and they were figuring out ways to solve those problems. We've gotten a long distance away from your initial question.

Harkewicz: That's fine.

Hessler: Which was, how did I find it here at Scripps?

Harkewicz: Right.

Hessler: I'll go back to it briefly. I was, for many years, really afraid here because I didn't know that I had the stuff. But it's obvious that I survived. So, here I was surviving, doing a good job, but constantly looking over my shoulder. Is that insecure or what?

Harkewicz: It sounded like you had a lot of things that were thrust upon you when you, you know, you said you had to set up your whole deep sea class by yourself, and things like that. And yet, you achieved them. How did you go about that then? I mean, how did—you say you were so insecure but you went ahead and did it. Just ploughed through your insecurity somehow or other?

Hessler: Yeah. Ploughed through my insecurities. It's as simple as that. I knew that only I was going to be able to save myself. Nobody else could do it. I had to do it, and

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[27] George David Fries (Buz) Wilson (1947 -), principal research scientist marine invertebrates, Australian Museum. Wilson was born in Cincinnati, Ohio and lived in Ohio, Minnesota and Kentucky before going to Indiana University (Bloomington) for undergraduate study.

[28] Hessler later noted, “That was correct, I went alone.”

somehow I did it. I'll never know how badly I did it in the beginning. I'll never know what other people thought at the time. And I'll tell you a story in that regard.

Once, way toward the end, when I knew I had made it and everything was fine, one of my graduate students, Craig Smith,[29] who dearly loved me and I dearly loved him, we were having a chat and he said—we were talking about nicknames for various people around Scripps—and he said to me, "Bob, would you like to know what students called you?" And I said, "No. There are some things that people never need to know." And so I have no idea.

Harkewicz: Are you still curious about that at all?

Hessler: No.

Harkewicz: No?

Hessler: No.

Harkewicz: Well, good for you, I guess.

Hessler: I know that it's undoubtedly there in the record someplace, and I would never prowl to find out. It's undoubtedly going to come into the record, as time goes on, with all of these people, and that's fine by me. I don't want to know what my wife thinks. I don't want to know what you think. This is what makes society function at all, the fact that we're willing to accept that we're living with all of these unknowns and doing what we can, and hiding from these other people all the things the things you think that they don't need to know. And they're doing the same to us, and somehow it works. It makes for a happy society.

Harkewicz: I see. Okay. I like that. It's an interesting way of looking at things. So, as long as you—you mentioned, you know, you mentioned society—well, we talked about the Woods Hole community versus the Scripps community, and maybe you already answered this but I'll ask you anyways. Did you feel like the scientific philosophy was different here at Scripps than at Woods Hole, or the way things were done was different here? Or if it has changed over time?

Hessler: Certainly the way things were done. There were a whole bunch of things that at Woods Hole you could just expect. You didn't have to find money to mail your letters. You didn't have to find paper. There were all of those things. You had your telephone. You didn't have to pay for it yourself. A lot of things, secretarial help, everything, was just given to you. When I came here you had to pay for those things. But what I was also seeing, in retrospect, was nothing more than a transition in the way science operated. In the beginning, when I started all of this,

[29] Craig Randall Smith (1954 -), professor, Department of Oceanography, University of Hawaii at Manoa.

they were happy to have you doing your own science and they tried to help you as much as possible.

Harkewicz: "They" being?

Hessler: The institutions you worked with.

Harkewicz: Okay.

Hessler: By the time I left here, the situation was absolutely opposite. The institution, the University of California and Scripps Institution of Oceanography, wanted money. They wanted people who would bring in money. And so the people that they hired here were not being hired for the glory of Scripps. They were hired to find money for Scripps to operate, to find money for the University of California to operate. They may think that this is a terrible thing to think about them, because they don't think of themselves that way, and I'm going to say they tried to find themselves the best people they could, but if you look at the record, more and more it goes toward those fields that will provide money. And so there was a long evolution between when I went to Woods Hole in 1960 and now, in 2006, just a constant evolution in this direction where money drives science just as it drives everything else, including democracy.

Harkewicz: Well, that brings up a very important or very interesting area of discussion that hopefully we can talk about. You mentioned a few times about the sixties and we've talked about money, but in the sixties there was a lot of, or post-World War II, a lot of funding came from the military and from the Navy specifically. So, first of all, do you think that the sixties were the "golden age of oceanography?"

Hessler: Absolutely. The sixties were the "golden age of oceanography." Prior to the sixties there were wonderful people, but they had to fight really hard to find money, because there was no real process by which they could assume there were places in the government waiting to give them money if they were good enough. And, after World War II, after GI Bill, after the discovery of how important science can be when you need it, I've often thought of basic research as being like money in the bank. It's there for when you really need it, and god knows we discovered that during World War II. So they were looking for ways, and the economy was flush. They had the money to sponsor science. The National Science Foundation really took off. There weren't that many of us in oceanography yet. The chances of us being funded were very high. And so you didn't have to fight very hard. Your working day was spent doing research. In those early days; only a small portion of it was spent being an administrator for the Institution. Only a small portion of it was spent writing proposals. By the time I left, only a small portion was spent doing research. Lots of time was spent doing administration. Lots of time was spent doing proposals. In the early times, I would say, "Somebody's giving a talk on such and so, wants to walk over with me?" And, my colleague would say, "I was planning on it." Toward the end I would

say, “Hey, there's a good talk being given over at Sumner, let's go over and see it.” “No, I don't have time. I'm writing a proposal.” That was standard response by the time I left here.

Harkewicz: So, if money became the driving force, or actually probably always was the driving force—you know, a lot of historians have talked about the fact that with Navy patronage, it was what the Navy saw as being worthwhile that was funded, as opposed to just basic science.

Hessler: Not in biology.

Harkewicz: You don't think so?

Hessler: In biology it was ONR.[30] As a person rather ignorant of the whole thing,[31] yes, I'm sure that the Navy did have their interests and they wanted to make sure that scientists somehow supplied answers to their questions. But the people around here are really good and they all knew how to turn basic science, interesting science, into a vehicle for answering the Navy's needs at the same time. So sure, the Navy was manipulating it, but also we were manipulating them.

Harkewicz: Okay. So, you didn't see that as being any kind of conflict at all, as far as you could see between the science that was done, and the science that the . . .

Hessler: I don't think so.

Harkewicz: Okay.

Hessler: I don't think so.

Harkewicz: Did you have any experience working with *Alvin*, the deep sea vehicle?

[30] Office of Naval Research

[31] Hessler later clarified that he was “ignorant of the whole thing” because he “never asked for ONR money” and therefore, was unfamiliar with the process.

Hessler: When *Alvin*[32] was first proposed, I remember one morning somebody walked into our lab, someone I didn't know, and Charlie Hollister[33]—. Charlie Hollister was at Woods Hole. He had come from Lamont and he had worked with Bruce Heezen[34] on bottom photographs, and he was still interested in that sort of thing. He was in geology. At that time, a number of firms had been seduced into building deep diving submarines because the Navy wanted a prototype deep submersible to be able to act as a rescue vehicle for submarines that got stuck. And so, I think three different places got into the game and were designing deep-water submarines. One of them—why do I think it was Westinghouse? I think it was, but who knows—wanted to build an *Alvin*-like creature. One built the *Aluminaut*[35] and one built something else. And so, they came in and they asked, "If we built something like this, can you think of a use for it?" They went away, and I proposed to Howard that we could, just as we had did a deep sea sampling transect, we could do a deep-sea photographic transect and see how the creatures changed as depth changed, going in the same area where we had done the other project. Howard seemed interested, I told these people this. I kind of became our representative for moving this project forward. I recall I designed our camera, designed how we were going to do it, and when *Alvin* first became available they were saying, "Oh, anybody want to take a dive?" And amongst us biologists, I said, "Yes." I've always operated under the philosophy that if people want you to

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[32] *Alvin* was a Deep Sea Research Vehicle (DSRV) that was developed at WHOI by Allyn Vine (1915 – 1994)—the vehicle's name was a contraction of Vine's first and last names. *Alvin* was operated by WHOI but was owned by the U. S. Navy. *Alvin* was built by the General Mills Electronics Group in the same factory used to build cereal-producing machinery. *Alvin* was commissioned on June 5, 1964. The manned (three-person: two scientists and one pilot) vehicle was designed to replace less maneuverable deep-ocean research devices such as bathyspheres. *Alvin* is launched from the R/V *Atlantis*, a deep submergence support vessel, and features two robotic arms that can be fitted with experimental instruments specific to a scientific mission. The submersible's original goal, as designated by the Navy, was to serve as an all-weather rescue vehicle for disabled submarine personnel. In its scientific research capacity, *Alvin* has been used in a number of important scientific developments including the 1977 discovery of deep-sea hydrothermal vents and "black smokers" (smoky superheated water with the pH of household vinegar). Perhaps the most famous use of *Alvin* was the 1986 diving exploration of the RMS *Titanic* lead by WHOI scientist Dr. Robert Ballard (the *Titanic* had been located a year earlier by Ballard using other research vehicles with photographic capabilities). In 2004, the National Science Foundation (NSF) announced plans to replace *Alvin* with a new Human Occupied Vehicle (HOV), which can dive deeper than *Alvin* (6500 meters to *Alvin's* 4500 meters) and use new scientific equipment. For a history of *Alvin's* development and use in the context of Cold War military science see: Naomi Oreskes, "A Context of Motivation: US Navy Oceanographic Research and the Discovery of Sea-Floor Hydrothermal Vents," *Social Studies of Science* 33/5 (October 2003): 697 – 742. For general information about *Alvin* and her history see: Victoria A. Kaharl, *Water Baby: The Story of Alvin* (New York: Oxford University Press, 1990) and the WHOI web pages at: http://www.whoi.edu/home/index_about.html .

[33] Charles Davis Hollister (1936 – 1999), WHOI oceanographer and seismologist.

[34] Bruce C. Heezen (1924 – 1977), geologist from Lamont Geological Observatory, now known at Lamont-Doherty Earth Observatory—the Earth Institute of Columbia University. Heezen was the leader of a team that discovered the mid-Atlantic Ridge during the 1950s. This discovery supported the theory of plate tectonics and continental drift.

[35] *Aluminaut* was a deep-diving aluminum submarine built as a joint venture between ONR, WHOI, and Reynolds Metal Corporation. Construction of the vessel was subcontracted to the Electric Boat Company. *Aluminaut* was commissioned on September 2, 1964.

do a dangerous thing with them [*laugh*] it was probably all right to say, "Yes," because they don't want to die any more than you do.

Harkewicz: Good thinking.

Hessler: So I said, "Yes." And they paid for my way out to Bermuda where they were doing deep diving tests. A lot of shallow water dives had been done. Some deep engineering dives had been done. Some deep dives on the SOFAR[36] station, which was a Navy installation for transmitting communications over long distances. But no one had ever done a science dive before. I went out there with the idea I would take bottom photographs, and designed a little rig for taking a bottom sample off Bermuda. I said that I wanted to go to the same spot where William Beebe had dived, off Nonsuch Island.[37] And, they said, "Okay. Let's do that." And so on Dive 152 *Alvin* did its first science dive, and we did it off Nonsuch, to a depth of 1,800—. No, no, no, no, no. One mile off Nonsuch, in the same area where Beebe had gone a half mile. But we got down to the bottom and I took some terrible pictures, worthless, and took a couple of samples and processed them, and brought them back to the lab. That was *Alvin's* first science dive. That was my first dive. And, on the basis of that we designed a science program to work on the Continental Slope on what we called the "Gay Head-Bermuda Transect." That's a transect we were working between Gay Head on Martha's Vineyard, and Bermuda. And we took a number of samples at a variety of stations, and photographic samples. We got the pictures back. I figured out a way, using Alvin's aerial photogrammetry[38] to then quantify them, and we started to identify the animals in a laborious way and gradually quantified this study. All of us put together a paper on the quantification of these photographs.[39]

Harkewicz: Do you remember what year that was, the first year that *Alvin* took its science dive?

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[36] SOFAR (Sound Fixing And Ranging) is the "channeling" of sound in relation to temperature and pressure differences at various depths in the ocean. The ocean is divided into horizontal layers based on speed of sound in relation to temperature and pressure. On one hand, as the temperature decreases, the speed of sound decreases. On the other hand, while pressure (depth) increases, the speed of sound increases. Sound waves bend, or refract, towards the area of minimum speed of sound. A sound wave traveling through a region of rapid change in temperature with depth (a thermocline) bends downward as the speed of sound decreases with temperature decrease but is then refracted upward as the speed of sound increases with increasing pressure and depth. This up-down-up-down "channeling" of low frequency sound waves causes sound to travel over great distances without significant loss of signal energy. The SOFAR channel axis is deepest in the subtropics and at the surface in high latitudes where the sound propagates in the surface layer. In middle and low latitudes the SOFAR channel axis lies between 600 and 1200 m. below the surface of the ocean. Scientists have used this channeling of sound, along with hydrophones placed at the right depth, to monitor and record whale calls, earthquakes, and man-made noise (such as submarine activity) that occurs many kilometers from the hydrophone detectors.

[37] Nonsuch Island is a tiny island located off the coast of Bermuda.

[38] Photogrammetry is a measurement technique whereby three-dimensional coordinates of points of an object are determined by measurements made in two or more photographic images taken from different positions. This technique creates the illusion of depth.

[39] J.F. Grassle, H.L. Sanders, R.R. Hessler, et al, "Pattern and Zonation: A Study of the Bathyal Mega Fauna Using the Research Submersible *Alvin*." *Deep-Sea Research and Oceanographic Abstracts* 22 (7): 457-482 (1975).

Hessler: Well, it had to be at least in 1968 because I was still there. I have a feeling that we took several science dives in 1968, and it was all very primitive. I don't know that you want to go into the early life of *Alvin*. It's been well documented several times before because Woods Hole has made so much of its eminence on the basis of *Alvin.* But we wrote our paper when I had gotten out here. And there were many techniques that I didn't know. One of my many inadequacies I didn't know about—I'd never taken a class in statistics, and we needed to take, have statistics. And Fred Grassle, who was very good at that stuff, had done some statistics on it and I said, "Let's let him be senior author." And so he took over on that and he did his part, and we all did our parts, and there was this multi-authored paper, but there was not a person on that paper who hadn't worked on the study.[40] In those days you still had to work on a study before you got to be an author. And this very good paper came out of it. And so, yes, I've always had a lot to do with *Alvin*. Then when the next phase came, when geologists in 1979 discovered the hydrothermal vent faunas, I was in the first group of people to write a proposal to do deep-sea biology there. In the first deep sea biology cruise I was there. In many of the subsequent dives I was there. And so, yes, I was involved in the early, early days and maturation of *Alvin.*

Harkewicz: When you went on this first hydrothermal scientific cruise, did you use Alvin then, for that, too? Or something like *Alvin*?

Hessler: No. We used *Alvin*. That's all we used. *Alvin. Alvin* has been the—up until the Japanese got involved in the game, and the French, because France came shortly thereafter. But Alvin has always been the principal tool for Americans to actually visit the bottom.

Harkewicz: So, okay, I'm not . . . ##

Harkewicz: ## We were talking about using *Alvin* to explore the hydrothermal vents, and I was curious as to how that was actually done. My picture of it is that you would go diving in *Alvin*, and then you said something about using photographs to take the organisms—could you describe that a little bit?

Hessler: My specific task was to document what kinds of animals lived at hydrothermal vents. And so photography, once again, became very important. And I would compare different vents to each other. I would do transects from the heart of the vent way to the side to see how the fauna changed as distance from the venting water increased. And so, for me, photography was very important. I thought I would be able to do quantitative photography, quantify the photography, by using stereo. As it turns out, I never succeeded in doing that. And we can get into that later on. It's a complicated issue. So, my job was to make sure that the camera studies were up to snuff. Other people wanted to study other things and it was

[40] J. F. Grassle, C. J. Berg, J. J. Childress, J. P. Grassle, R.R. Hessler, D.M. Karl Jannasch, R. A. Lutz, T. J. Mickel, D. C. Rhoads, H. L. Sanders, K. L. Smith, G. N. Somero, R. D. Turner, J. H. Tuttle, P. J. Walsh, and A. J. Williams. "Galapagos '79: Initial findings of a Deep-sea Biological Quest," *Oceanus*, Woods Hole, MA 22(2) (1979): 2 – 10.

their job to make sure that there were tools on board *Alvin* for doing their job. Each person designed that. There would be a basket on *Alvin* for holding tools, for holding the samples once they had been taken. There was only, in the early days, one mechanical arm. And so it might have even been used for holding the camera, which we put in the basket for the corers and everything. It was extremely cumbersome. It was totally inadequate. We wasted more time than we used well. With *Alvin*, as with everything else, it was a slow learn. But, we learned. The only difference about learning with *Alvin* is that it was very expensive to go to the next phases because very often it meant you had to modify *Alvin,* and that's costly, like putting on another mechanical arm, and improving navigation. I can't tell you how much time we spent in the early pioneering days at navigating, just hunting for the same spot over again. We were using three sonar sounders and somehow we had to triangulate—not us triangulate, the ship, the mother ship had to triangulate—and then we triangulated on the ship to somehow find our way there. And we could waste half a dive, or the whole dive, and we would never find the same spot again. So time was used very inefficiently. It took a long time before decent papers were being written. But, after a while the navigation improved. The tools improved, and we got much, much better about doing the job. The reason why, in those days, it was always better to do it with the submarine, with the scientist in situ is, there was no remote way of really assessing the general situation and then focusing on one particular spot. It took a human being being right there in order to do it. As far as I'm concerned, in many ways, in most ways, it still takes a living human being being right there to make the kind of on-spot decisions that result in the best science. But now there are tools, ROVs, that have gotten much cleverer, that are able to navigate superbly, and work with other devices so that probably you could do it using an ROV today.

Harkewicz: That's a Remote Ocean Vehicle?[41]

Hessler: Yeah.

Harkewicz: Okay.

Hessler: Remote Ocean Vehicle. Although, I would still say keep your submarine because your submarine is going to get you there faster.

Harkewicz: So, when you say that you think the best science is done with the scientist in situ, do you mean actually in the submersible or do you mean somewhere nearby?

Hessler: In the submersible.

Harkewicz: Okay.

[41] A Remote Ocean Vehicle (ROV) is operated remotely by a person, or equipment, aboard ship or some other support vehicle.

Hessler: The submersible is a, essentially, a mobile sphere which is, I don't remember exactly, maybe seven feet in diameter, the upper part of which is mostly filled with electronics. The bottom part of which is substantially filled with various life-sustaining gear, has three portholes. One of the portholes faces forward for the pilot. Two portholes face obliquely forward and downward for the two uncomfortable observers. There's not enough room. It's a really uncomfortable eight or nine hours that you spend down there. From every point of view it's uncomfortable. In the beginning it is exhilarating because you're seeing a world that only the privileged see. The people who go into space, I doubt, see anything as wonderful as they see when they go onto the deep sea bottom. It is an extraordinary experience. But nothing is extraordinary forever. After a while, you know what you're going to see, and more and more, for those who have done it over and over again, it becomes a job, and you try and do it well. And every once in a while you see something wonderful again and you love that, like going into the forest and seeing a bird you've never seen.

Harkewicz: Well, it sounds to me like it would be rather a frightening experience . . .

Hessler: They didn't want to die anymore than I did.

Harkewicz: Exactly. You said that earlier. I can understand that. So, tell me a little bit about your work with the hydrothermal vents, then.

Hessler: My job was to document the fauna at different vents and at the same vent in various places. And I did that, and I did it pretty well. I did describe the kinds of animals that lived at one vent and in one general geographic area. In this case, we called it the Galapagos Rift, was the first place we went to. And then we would go to another hydrothermal vent not very far away and document its fauna. And a third place, I don't think we ever did more than three places particularly well. And then we had the opportunity to go to other geographic places. One was also on the East Pacific Rise at twenty-one degrees north. That was the second spot. And that spot was different in that it had black smokers[42] and other kinds of chimneys, and so there was a new circumstance in order to, that allowed us to document a different kind of environment. Black smokers, of course, are those places where undiluted hot water is coming to the surface at incredibly hot temperatures. And so hot that the water was precipitating solids as it came out and touched the diluted cold water. But that's for someone else to tell you about.

Harkewicz: Are these kind of things only learned from using those kind of vehicles like *Alvin*, or would you have been able to do this kind of work other ways, do you think?

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[42] Black smokers are a type of hydrothermal vent found in the ocean floor. Hydrothermal vent fields are usually hundred of meters wide. They are formed when superheated water from below the Earth's crust come through the ocean floor. Black smokers, where sunlight is sparse or nonexistent, are the center of entire ecosystems that contain organisms that use chemosynthesis to transform methane and sulfur compounds into energy and upon which more complex organisms such as clams and tubeworms feed.

Hessler: I think Peter Lonsdale knew that there was especially warm water coming out of the bottom. I don't know exactly that history, the history of the chemical and geological oceanography. But they detected temperature anomalies by being very close. They saw signs of biota down there and suspected that there might be something special going on without ever, to my knowledge, ever having accidentally gone over a vent, because you couldn't navigate that well. So they may have suspected something, I've forgotten the details of the literature, and do not want to take anything away from any one of them. But I don't think anyone ever saw that fauna until the geologist went over it and hit it in 1979. And so I would say, with the primitive navigation we had in those days, no, you had to be right on site in order to be able to see extraordinary things like that.

Harkewicz: Okay.

Hessler: So now I was studying the composition of faunas at different geographic localities and this gradually multiplied. Other people started doing this at other places. My last opportunity to hit new sites was to go to the Marianna Back-Arc Basin, where the geologists were going and where they knew there were hydrothermal vents, on the other side of the Pacific, and to study hydrothermal vents there at a depth of almost 4,000 meters. At the Mid-Pacific Rise we were working at about 2,500 meters. People were discovering them on the Mid-Atlantic Ridge, finally. So there was all of this geographic work being done, and I was doing my share. I was saying, I would say I was doing a good job holding up my end in terms of publications and informing the general public, the scientific public, and also the general public. One of the things that I was doing was writing papers in semi-popular journals like *The New Scientist*, sharing this information in a semi-popular way, partially because I liked talking to the general public but also because it was a damn good way of getting first-rate science out quickly, and I wanted to do that.

Harkewicz: Did you ever get any criticism for doing that?

Hessler: No. No. Never. I never heard of anyone saying, “Well, if you had put it in a scientific paper you could have said so much more.” I never even heard anybody say that. It fulfilled my needs and I think it fulfilled everybody else's needs.

Harkewicz: Do you think it helped you get anymore funding?

Hessler: Yes. Of course it did. Because the more you can say you have been using the money that you got well the more you could ask for more money. And, I never was embarrassed about citing these papers. I didn't do it very often, but I did do it.

Harkewicz: Before you were talking about going out on cruises where geologists were going. And, I was wondering how that was all worked out between, you know, the physical oceanographers and biologists. How you worked out working together and also how different institutions used these kinds of vehicles? Was there tension

involved in that or conflict with people wanting to do something and not getting access to the equipment?

Hessler: Absolutely. The vessels that we use are part of a consortium of American oceanographic vessels of all the institutions combined, whose purpose is supposedly to supply the country's—the scientists of this country's—needs. And therefore, no one institution could claim to dominate any one particular cruise. They might succeed in doing so. They might want to do so. But, as time went on it became harder and harder for them to do it. In the beginning, they succeeded fairly well, but toward the end it got harder and harder. And, in the beginning a cruise could be dominated by one particular discipline, but toward the end that got harder and harder. And so by the end, particularly in these hydrothermal vent studies where time was so precious, a chemical oceanographer never could dominate a vent cruise because all the biologists would argue, "It is so hard to get to this site, we don't know when we'll ever get to that site again, are you trying to tell us that there's so little time no one can do biology there?" And there was, nobody was ever willing to answer that question in the affirmative. Somehow there was always time for biology. There was always time for geology. There was always time for chemical geology. And so when we got to sea we kind of knew how much each study deserved, but as time was lost because of disappointments and so on, the amount of remaining available time got shorter and shorter and people would fight. And sometimes the result of the fight would be fair. Sometimes the result of the fight would be unfair. I think at no time did anybody's study get totally washed out because of an unfair loss of ship time, although it came mighty close at times. There were things done at sea that in retrospect were really ugly, where the winners should have been ashamed.

Harkewicz: But, you didn't feel like one discipline seemed to carry more weight than others?

Hessler: In the beginning, I think the geologists had more clout but that gradually disappeared.

Harkewicz: So, how was funding arranged, though, for these kind of things? There's all these different people. I mean, I know there's usually a chief scientist on a cruise, isn't there?

Hessler: Uh huh.

Harkewicz: So, how did that work out?

Hessler: To do your science, you each apply, generally, to the National Science Foundation. The biologists apply to "Biological Oceanography." The geologists apply to "Geological Oceanography," and so on down the line. And those, the applications have to include a—if they wanted field work—what field work has been proposed. And so long before that a cruise is proposed where people got together and said, "Oh, I want to do biology," and that geologist would say, "Oh, I

want to do geology on that." If you get your funds the assumption is made that you're going out on that cruise. This is one of the arguing points for why no one discipline can dominate entirely because other disciplines got funds under the expectation that they were going to be able to dive on that cruise.

Harkewicz: And that's also between institutions?

Hessler: Between institutions. Yes, there's a lot of hard bargaining, but yes it ended up being a successful procedure.

Harkewicz: So, you try not to duplicate other people's work somehow or other?

Hessler: I'm sure some people try. Some people try to ace other people out. This is science, after all. But, in general, the process works well.

Harkewicz: "This is science after all." That sounds funny for you to say it that way, as if it's like a sports or something.

Hessler: Science is political. Science, unfortunately, is competitive. And therefore sometimes it's disappointing where you are competing with somebody else to get something out, to enhance your competitive position, unfortunately increasing, excuse me, decreasing someone else's competitive position. You don't really want to do that. All you want to do is succeed, knowing full well that you're succeeding at someone else's expense. That's the name of the game. And it causes you to rush papers into print. And so you are printing papers which really haven't matured as much as they should. It results in your playing, maybe playing unfairly when you are reviewing someone else's proposals, when you are reviewing someone else's papers. It puts everybody to the test to be sportsmanlike, and we all succeed to varying degrees. In general, I would say the process worked. In general, we showed our better side, and sometimes we didn't. Maybe we were even unconscious of the extent to which we did not show our better side. And I'm not trying to emphasize the badness of science. I had a great time. I respect virtually all of my colleagues. But you asked the question, and it would be ridiculous for me to launder the thing that we did.

Harkewicz: So you're, from what you're saying it sounds like mostly internal scientific politics that you're talking about? But what about external politics?

Hessler: I have no idea what happened between the directors of Woods Hole Oceanographic Institution and the director of Scripps Institution of Oceanography. I have no idea what happened between the various funding agencies.

Harkewicz: Just something you don't know about?

Hessler: Well beyond me. And really that's the only external part other than our applying for grants and reviewing, yes, applying for grants and reviewing proposals, reviewing publications. We all did the best we could. We all knew what was right, and we all knew the ethics. Every one of us always knew the ethics and we knew what we weren't supposed to do. And the lion's share of the time we did the right thing.

Harkewicz: When you say ethics, do you mean ethics and values from a personal basis or do you mean more scientific ethics, like what was right for science?

Hessler: I would say that what's right for science is the same, those things are the same thing, is what makes you an upstanding moral member of society, that they're really not different. You've got a little special parts to them, like "Thou shalt not steal. Thou shalt not lie," and so on.

Harkewicz: So, but when we talk about external society, outside of science, how do you think over the period of time that you have worked in the scientific field, how do you think that has affected science? Things like the Women's Movement or the Civil Rights Movement, how did changes in society affect science?

Hessler: In terms of our moral qualities and our willingness to adhere to them as we do science. I think we've done just fine. I don't think we're any worse than in the beginning, although in those days there was less competition. We may become less pleasant people when we get together in meetings. We may become more strident when we're arguing our own point of view. We may fight harder. But, when we go back to our own labs we behave well. How do we behave toward women? Our attitudes toward women, in general, have changed. And I think this is a particularly interesting issue with respect to oceanography because of that overriding tradition that a woman's place was not at sea. Women had to fight very hard to gain that right. I personally never took that point of view. I knew that there were technical problems to having a woman at sea, simply providing her with convenient bathroom rights. That's a really tough problem. And gradually it was solved and women became more and more accommodated. But, I think that was the only thing that I could think of. And, indeed, I think there were women on the first cruise that I ever went on. Some brave and stalwart women had already fought that far. I, and none of the colleagues that I ever interacted with when we were deciding on who should be accepted to graduate school here, I never remember our leaning against, away from a woman because she was a woman. I never remember us doing that. I never remember us treating a woman more harshly when she was our graduate student. I don't remember ever being biased against a woman who was applying for a job here, nor have I ever heard anyone speak up in a judgmental way. Whether other people were feeling biased I have no idea. But I think Scripps has always behaved well in the Women's Movement. I really do.

Harkewicz: Did you ever hear any bias toward hiring women, to get more women involved?

Hessler: Yeah. And, I've even felt the bias. Given two people being equally appropriate, I would vote for women, a woman, simply because I'm now about to kill two birds with one stone, and not unfairly hurting anyone. With regard to race, I would say that I started life as bigoted as any white man. I'm not a religious person at all, at least not in terms of established religions. I have my own religion which I suspect I believe in more deeply than most established religious people do, and how I feel about that is in some of those other tapes that I told you about[43]. But I lived in a white community, initially rarely exposed to blacks. I was afraid of blacks. I thought that the average black American was inferior, not necessarily because he was inherently inferior but because he was poor, because his education was poor, because he lived in the South where everything was inferior, for all of those reasons. And, as I say, I was afraid of him because he was also more criminal. And, as life went on, going to University of Chicago, I was directly exposed to them. We were, the University of Chicago was in a black neighborhood. I was even more afraid of them. As the Civil Rights Movement gained force with Truman, with the Kennedys, I knew more and more what I should be thinking. I knew that it wasn't right. I was still afraid of them. I still thought that, on average, they weren't as smart. I knew that they were poorer. I learned to appreciate the principle of generational reinforcement of attitudes by the environment one lived in. I tried not to be prejudiced. And it's been a fight the whole time. But today I can say, I can look at a black American and not necessarily think that, "Oh, he's black," as my first thought. I was in the bank the other day waiting for another guy to see a teller, and we fell into a conversation, had a good time together. He happened to be black. I assumed he was in that bank and he was as good a man as I was. And I left the bank thinking to myself, "Wow, Bob. You're coming along." And so, in terms of Scripps, if we had a qualified applicant I would bend over backwards to get that person into Scripps. I felt badly that so few minority Americans tried to get into Scripps, but they didn't. I don't remember anyone ever trying to join our faculty. I would have bent over backwards to get them onto our faculty, but not to the point that I would have accepted a person who would have had a hard time just staying afloat. By accepting that person I would have done him no good, because ultimately we will only be patient with people who are up to snuff. So, that answers that whole prejudice issue, I think.

Harkewicz: Have you had much of an opportunity to interact with oceanographers from different nationalities that might be different races?

Hessler: Japanese. Yeah, we, I have no sense of inferiority, unless it was in the early days when I felt that they still hadn't gotten up to speed in deep sea biology. And, you know, at least there used to be standards for what a publication should look like, and those standards used to differ from one country to another. I always felt that Americans and Brits had equally high standards, and that the French would publish a paper that was softer than they should be publishing, and that it was harder to judge German papers because they tended to publish in German, as the

[43] Hessler had mentioned some personal tapes that he had recorded for his own use.

French did, and it was a little harder to judge them. I knew that Russians would publish a paper that were distinctly softer than what we published. Those situations have changed with time. And so I feel no sense of discrimination of other nationalities, unless they're just getting into the business and I know very well that they're still scrambling to get up to snuff. Then I would judge their papers not harshly but knowing that they weren't there yet.

Harkewicz: Okay.

Hessler: And, the same with my colleagues. I don't know of any highly, or even partially, biased colleague. I am happy with them all.

Harkewicz: So, on something, a little bit more specific to Scripps history, I know that there was a, at least in the past, there was a stress on physical oceanography with biological oceanography sort of coming on the short end of the stick, so to speak. Do you feel, did you ever experience that here or do you feel like things have balanced out as time has gone on?

Hessler: I think that things have balanced out a good deal. I know what you're talking about and I believe that it existed. If we wanted to get something done, not in the world but here at Scripps, we as biologists had a harder time because the physical oceanographers had greater access to the throne. I would say that even to this day physical sciences have a leg up on the biological sciences, and I think the reason why is not conscious prejudice but because all of our directors have at one time or other been in the past physical scientists. They don't know what biology is. They don't know what their questions are. They don't know anything. They're all really stupid when it comes to biology. I thought Charlie Kennel[44] was commendable at wanting to take short courses in biology. And I'm sure he learned a lot, but I'm sure he's also forgotten most of it. These guys are too busy, become too busy, they come into that office with the best of intentions of mixing it up with the troops and ultimately they realize that the only troops they really have time to mix it up with are the ones on the Beltway, D.C., and gradually lose their commitment to mixing it up with us. They all start so well, and I would say usually with us being part of it, they lose their intensity of their motivation to keep in contact with this. So Charlie, to the best of my knowledge, has only a limited view of what's going on here in biology, although it's probably better than it used to be. And I don't know whether biologists are suffering as much as they used to suffer. I suspect they are not, but still to some small extent it's a little harder for biology. That would be my belief.

Harkewicz: And earlier you said something about bringing people in because they can bring more money in. So, how do you think that affects the science that is done?

Hessler: Oh, I am convinced that in biology—I'll step back a little. Anyone knows that molecular biology and genomics have become the in-thing in the world of

[44] Charles Frederick Kennel (1939 -), director of SIO, 1997 - 2006 .

biological science. The in-thing in the world of science in general. It is the most important kind of biology. I mean the most important kind of science that's being done right now because it's going to save people's lives. I'm firmly convinced of that. And even though it hasn't happened quite yet, boy, it's getting closer and it's so exciting. So, NIH, Institutes of National Health, is that right?

Harkewicz: National Institutes of Health, yes.

Hessler: Have a lot of money. We wanted there to be more molecular biology here at Scripps. We in Biology wanted there to be more. And it was moving, in part, in the direction of incorporating more of it. Charlie Kennel has led that fight because he has asked, more than once, the question, "Where's the money in the granting agencies?" And one of the obvious answers is NIH. Charlie and everyone else over in the director's office wants to tap NIH. Am I saying this as a whistleblower? No. I am not being accusatory as well. I'm simply stating the facts. They know where the money is. Why not have people at Scripps who are tapping this source that would make life easier here? And so when a proposal came to have a faculty member in genomics, Charlie was four square behind it, and did everything he could to see that this would happen. I question whether we necessarily got the best person. I would have preferred that we got a person who was just coming through the ranks because there aren't any established people who are already really studying marine biology. I wanted somebody who was committed to marine biology, but would have had to start a little lower and develop his reputation, his or her. I automatically use "he" to represent the human race.

Harkewicz: I understand.

Hessler: Man to represent the human race, in the sense of mankind.

Harkewicz: Yes.

Hessler: He wanted somebody who was eminent, and therefore went for somebody who would already be off to a good start. And Scripps Institution chose a woman who was really there, and to the best of my knowledge is doing a great job of supporting genomics of marine biology here at Scripps.[45] I have no complaints. But the reason why this senior person got here was because of the likelihood that she was going to—one of the reasons—she was going to ease the path toward this new set of funds. Now I wasn't here. I was already mostly retired by the time any of this happened so I wasn't involved in any of the discussions. This comes from, in my belief, talking to people and my witnessing what was going on. And I may be entirely wrong.

Harkewicz: Okay. One of my other interviewees suggested that he felt that genomics wasn't the way for Scripps to be looking for funds, that they should just be spending their

[45]Theresa (Terry) Gaasterland (1963 -), professor of computational genomics and leader of Scripps Genome Center.

time doing what they do best, which is oceanography. And in his case, particularly, ecological oceanography. But others have said that marine genomics is the way to go. So, from what you're saying, I'm getting the impression that you think that there's nothing wrong with this whole idea. This other person thought it was too fashionable or just jumping on the bandwagon with everybody else and that Scripps should stick to its more traditional type of work. Do you have any thoughts on that?

Hessler: I know who you're talking about? And he has always had this attitude. And I think, at least in part, he knows where he's coming from. He's not all wrong. My response is more moderate in that I believe that genomics should not dominate life at Scripps. It should be part of the biological partnership. What he is worried about is that more traditional forms of biology, ocean biology, are going to suffer because of the ascendancy of genomics. And I think it very much, it very much behooves the director of Scripps Institute of Oceanography to never let that happen. And now we come to a larger issue and that is the issue of research universities in general.

There's no question but that science flourishes at research universities, and other universities, who didn't even intend to be a research university, tend to go toward greater strength in science because it can happen so much more easily to let science become more and more powerful. But a place like UCSD also has humanities. We have a history of science. We have literature. We have dance. We have language, and on, and on, and on. And none of these disciplines have an easy time getting money. They all have a very hard time. And the temptation up in the president's office—is that what he calls himself, the president—the president's office, is to spend a little less time thinking about them because they're not commanding the big bucks. And I know that they consciously fight against having that thought. Do they participate in making UCSD great any less than the scientific disciplines? Absolutely not. They are equal partners in what makes us a great university. Would this university be even better if we spent more time on our sciences to make them have even more Nobel Prize winners in science? No. We need just as many Nobel Prize winners in the Humanities. Would we be even better by spending more time in genomics, which is the big money winner, than in biological oceanography which has a little, has a harder time finding money? Absolutely not. We are only a great university, a great Scripps Institution of Oceanography by being well balanced in all of these necessary disciplines. Indeed, I'm not sure that genomics would do very well because it's the question that biological oceanographers ask that feed the ideas that in genomics would be so exciting.

Harkewicz: So, you don't think that Scripps suffers in any way from being affiliated with UCSD?

Hessler: No. Absolutely not at all. We are strengthened by it. And, I think the recent direction of going more toward undergraduate training was both inevitable and wonderful. I think it will save Scripps's life. We're doing just fine. ##

[Three pages of text have been closed for a period of thirty-five years by the interviewee. This portion of the interview will become open on August 29, 2041 under donor agreement.]

Hessler: ## Now we can talk openly. Cecelia[46] and I have had a good marriage together. I loved having met her here at Scripps. I think that worked very well. I'm not sure that it's a great idea for two scientists to be married here at Scripps. It places too much burden on them. If they want to get another job someplace they have to get two jobs. It's just too hard. I would say it would be much better if you're in our business and are mobile, or even if you're not mobile, be married to some other kind of professional person. Be married to somebody who's a nurse. Or, if you're a man, find a secretary, find a librarian, and find some other solidly employed person to marry. It's going to be easier for you. And that's my statement on it.

Harkewicz: Two scientists are just too difficult, you think?

Hessler: I think it imposes an additional burden. You should, if you're interviewing couples, ask that question. “How is it to be married to another scientist at Scripps?” For me it was really hard.

I wanted to say something else to you. Oh, the reason why I wanted to marry Cecelia so immediately was not just because I wanted to. We'd gone through twenty years of this. My wife and I had been separated a long time, since the eighties, early eighties. But I could not retire from Scripps. I was already past retirement age, and I was getting burned out. I could not retire until my spouse was my spouse of record for one year and one day. And so I wanted that first day to start as early as possible.

Harkewicz: I see.

Hessler: The day I married Cecelia I went into Charlie and said, “Charlie I'm going to be retired in one year. You can start thinking about that.” So that's that little part. I was burned out. I'm going to talk about that.

Harkewicz: Please do.

Hessler: After all, this is not just about Scripps.

[46] Robert Hessler and Cecelia Ross were married in 2000.

Harkewicz: No.

Hessler: In the final years the problem of finding money was getting more and more onerous. The competition was greater and greater. And finally, I was being pretty thoroughly outcompeted in the world of deep sea biology. I decided, "I don't want this anymore." So I decided to stop being a deep sea biologist. This was many years before I retired.

Harkewicz: When you, I'm sorry, when you say "outcompeted," did you mean scientifically speaking or did you mean as far as getting money and stuff to do what you wanted to do?

Hessler: None of my proposals were being funded.

Harkewicz: Let me ask you this, though, and I'm sorry if I'm interrupting you again, but do you think that means you weren't asking the right questions?

Hessler: In part I wasn't writing, asking the right questions. Maybe I wasn't doing it in the right way. Maybe it's because the field was getting so competitive that there were now a lot better people than me. I'm not shy about that particular issue. Life goes on. And now the people who had their experience in ecology and in statistics were finally right there and able to say things that I wasn't able to say. Maybe my questions now were getting a little old fashioned. Whatever it was, I blamed nobody, although at the time I blamed them and was very angry. But today I blame nobody. The fact remains the handwriting was on the wall and I decided to get out of deep sea biology. I still had a couple of students who were in one way or another involved in deep sea biological questions, and I still had a way of putting them still through school, through the cooperation of Scripps's Graduate Department, but also because through all of my photography lots and lots of people wanted to use my photographs in various kinds of popular publications. And they would say to me, "May we use this photograph?" And I'd say, "How much are you willing to pay?" And they'd say, "We're willing to pay so and so." And I'd say, "Okay, you can use the photograph." And then when the money came in I would put it into an account that would support these two graduate students, and it succeeded in supporting these two graduate students to the extent that they needed research support. These were Scott France and Michel Boudrias[47]. And so, that's how I gradually left the field of deep sea biology.

What was I going to do? I still had years ahead of me. I was going back to my first love, bugs. I had done it for a while, a lot in my early years here at Scripps, and quite a bit at Woods Hole. But, it gradually got displaced by deep sea biology because that's what paid. Hard to get money in carcinology. And, indeed even at Woods Hole, by the time I left, I was doing mostly deep sea biology. That's what got me my job here, deep sea biology. And I felt obligated to be a good deep sea

[47] Scott Charles France (1961 -), assistant professor of biology, University of Louisiana at Lafayette; Michel André Boudrias (1961 -), assistant professor Marine and Environmental Studies Department, University of San Diego.

biologist because that's what I got hired for. I understood that. But when I came to SIO, I had also started giving a darn good course in arthropods. Bill Newman and I gave it together. And it was a great course. We taught people something about living organisms, something which is seriously threatened here at Scripps right now. So I was certainly earning my keep—I also had a wonderful course in deep sea biology. It was becoming nationally known and perhaps even world known. People who would leave here would take my notes, and when they had to teach someplace else, my notes formed an important base for their course in deep sea biology, or part of a course that needed deep sea biology. They had profited from what I had done. So I paid my keep here. Nevertheless, I knew I could do good work in carcinology. I decided to pay for it out of pocket. That's how I was going to pay for it. I could afford to pay for it. It isn't very expensive. And so I did and it worked very well.

During my first sabbatical in Sweden, I learned what it was like to live in Sweden for a year. I loved living in Sweden. It was the best and worst year of my life. The worst because it destroyed my family. The best because I absolutely loved Sweden. I love Swedes. That was in 1977-78. In the late eighties, no the late seventies—I'm getting things all mixed up. No, late eighties, late eighties that this, this is solid. Late eighties I went back there for a six month sabbatical. I was already separated from my wife, already having a wonderful time with Cecelia. I spent another six months in Sweden and then thereafter I would be going back to Sweden for three months, two months, one month every year. To this day I go back to Sweden, go back to Lund where I have a colleague who is equally retired, equally enamored, a perfectly marvelous man, one of my very best friends, at the University of Lund. And we do carcinology together. Have a great time. So, I was doing that and I was doing carcinology at Scripps. I didn't take any more students because I couldn't support them. And that's how I finished my last years at Scripps. I'm down to one room, one laboratory, which is my home base here and it's more than adequate, and I'm having a fine time there. This is kind of a summing up of what finally happened to me at the very end, and I'm sure there's some questions and issues in the middle that you might want to ask me, and I probably want to tell you. I think I want to tell you who I am.

Harkewicz: Okay.

Hessler: In the beginning I told you how insecure I was. And do I wish I had not been an insecure person? Sure I do. I was an insecure person. I've been an insecure person since practically the day I was born. That was the name of the game. Did I let it get in my way? Yes, I certainly let it get in my way. There were opportunities that I could have taken that I didn't take because I was afraid, so I didn't. Did I let it destroy me? No, I didn't. I knew that for what those things were that I had to do, I knew to take the responsibility and to do them the best way I could. Did I succeed? Yes. Did I become one of the best deep sea biologists in the world? Yes, I did. Did I become one of the best carcinologists? I mean, worldwide, in the world? Yes, I did. A lot of people know who I am and they respect me. Do all of

my students respect me and are they glad that I was their professor? Yes. Do they love me? To my knowledge, most of them do. Do most of my colleagues love me? Yes. Do I love them, all of them? Yes. Have I had a great life? Yes. Do I wish that I had taken more opportunities? Yes. What's left? Have I written papers that will be read for decades and even centuries? Yes. I'm very proud of some papers that I wrote. The ones that I'm proudest of are in carcinology.

Harkewicz: Really?

Hessler: Really. I did some good stuff.

Harkewicz: Do you think you would answer these questions the same way if I asked them of you twenty years [ago]?

Hessler: No. No. I didn't know anything then. I think today I'm a pretty good human being. I think, when I think back to then I was a very flawed human being who meant well, who didn't know that he was flawed. I don't think I was ever an evil person, even though I did evil things.

Harkewicz: You were, not to break the mood, but you were talking about teaching and I wondered how important you felt teaching was to your career or to your life?

Hessler: I always felt that it was half of my career, because teaching always gets short shrift at Scripps. Not as bad as it used to be. And I felt that it deserved to be better. And so, I wanted to be a good teacher. I think I have always taken strongly the opinion of others. That goes way back. I did not want to have my students have a poor opinion of me, and I mean my classroom students as well. And so I was forced to do as good a job as I could so that I would earn their approbation. So, whatever the reason, I tried hard to please them. Would you believe that I got the first teaching award that a person from Scripps has ever been awarded?[48] Did you know that?

Harkewicz: Yeah. I believe it, I didn't know it, but I believe it.

Hessler: I did.

Harkewicz: It sounds like you cared a lot about what you were trying to tell your students. So that's what it takes to be a good teacher, I guess. That's great. When was that?

Hessler: Oh, I don't know, a few years before I retired. There were days when I would leave the lecture hall having given a lecture that I knew had been so good that I was as pumped up as any Olympic winner possibly could be. It's the same kind of sport when you get right down to it. When you know that you have done a gold medal job, it's a great feeling. But I also feel that way about when I've written a

[48] Hessler received the Distinguished Teaching Award from the San Diego Division of the Academic Senate of the University of California in 1999.

damn good scientific paper. I really feel pumped up about that, although there's never the rush in science. I have had ideas where I have suddenly, something has finally occurred to me where I have been just as pumped up. I've given scientific lectures and meetings where I have done such a good time, did such a good job that I was in awe of what a good job I did. And I have had times when I feel I really blew it, although that's rare. I have times, lots of times when I feel that I've done a mediocre job. And other people said it was okay, but I am a hard taskmaster on myself.

Harkewicz: How important is it to you to get feedback from other people? I mean, is it enough for you to know that you did a great job for yourself or do you want other people to tell you that they appreciate it?

Hessler: Oh, I like it when they tell me that, but if I know I did a bad job there's nothing that they can say to make me feel any better. I am *the* judge.

Harkewicz: Uhm-hmm. Yeah. I can understand that.

Hessler: Good.

Harkewicz: What do you think Scripps meant to you?

Hessler: In the final analysis I loved being here. I loved all my colleagues. They gave me, at Scripps, a lot of opportunities to do science. I don't know whether I would have done better at Woods Hole. I suspect since both institutions were rapidly changing at the time, as a sign of the times. I could not have been treated any better anywhere than I was here at Scripps. University of California betrayed me only once, and I never forgave them for it. Want to know what it was?

Harkewicz: Sure.

Hessler: I got a raise but because there was a budget problem in the University of California in general, they postponed my raise. And then there came time for the next group of people to get a raise and then the University of California said, “Well, we're never going to do that again,” and gave them raises, never even mentioning how they were going to make amends for having postponed my raise and all those people like me. And it went on years that way where I and my group was the only group that got penalized for that shortfall in funding, until finally a group of us, not including me, put forth a class action suit against the University of California. And the University of California said, “Oh well, we really meant to pay all of this back. Just be patient and we'll do it our way.” And, those guys said, “Sorry, Charlie, that's too late.” And the class action suit, of course, was won. And I didn't get all of what was owed me but I got some. It's the only time I felt my university had betrayed me. Otherwise, I loved being here. I forgot to notice what a wonderful place this was as time went on. I became jaded, burned out by the, all the administration I had to do, guilty for not being able to help out students

because I didn't have any money, tired of it all. And really wanted to retire, which was why I was so sorry I had to wait until my wife died. But, I, for the most part, I respected Scripps. I loved having an office where—my office was right there at the edge of the ocean. I could see San Clemente Island on a clear day, and felt I could almost see Japan at times. It was a great spot to be. I loved living in the West. I forgot to see the way La Jolla looks to everybody else. This is paradise. It really is. And I got so used to it, it wasn't until recently that I began to realize, "My god, this is paradise where I'm retired." The University of California is the best employer to be retired from in the whole world and I have been grateful to them for that, for standing by me.

Harkewicz: Do you think this burnout affects other people and do you think it affects science, then?

Hessler: Yeah. Here at Scripps I have the most wonderful way of checking out whether the people at Scripps are excited by what they do, and it's a bioassay. I think bioassays are very telling. When I came into the parking lot today to park my car, at eight-thirty there was only one car there. In the mid-seventies, going into the mid-eighties, if you weren't here before eight o'clock there was no parking. People here don't like coming to work anymore, and I have proof they don't like coming to work. And, that tells me something about what life at Scripps has become.

Harkewicz: What do you think made Scripps successful?

Hessler: Well, even all the badmouthing that I've done, take that aside, what makes it successful is a damn, having a damn good set of colleagues; having an absolutely superb library, although Woods Hole has a better one; having an administration that is accessible to you right up to the very top and never think twice. If you need to see Charlie, why by god you just go and see Charlie and he's happy to give you the time. This is a marvelous thing. Having the best graduate students in the world. Those kids are so wonderful. I don't deserve them. I couldn't get into Scripps, those kids are so good. There's, in a competition they are just naturally so good. Having great ships. At least in the old days, willing to back me up when I was in trouble, financially or something like that. Paying good salaries, having a hard—I got a hard-money salary, a hundred percent hard-money salary until the day I retired. Those don't even exist at Scripps anymore, but I had that, a hard-money salary and that was wonderful. They paid well. That was wonderful. Good health plan. That was wonderful. Name something else. Can you think of anything else that I forgot to mention?

Harkewicz: I guess just treating their employees like people, maybe, more or less.

Hessler: Yeah. They did. Oh, I forgot. Great winters.

Harkewicz: That's true. You can't beat that.

Hessler: So, it was a good move. I don't think I would have ended so well at Woods Hole.

Harkewicz: Then I have to ask the other side of the coin, though, is, "What has threatened its success?

Hessler: Loss of easier money. Being forced to denigrate the real goal. They've lost their eye on the prize. They think it's money. They're first to think that it's money. Getting too large so that we, in biology, lose track of what's going on in physical oceanography, and vice versa. They've lost something, too. Having to spend too much time on administration, both in teaching and in just staying alive. I don't mean spending too much time in teaching, I mean in administration of teaching. Having to live a life here which forces you to put aside the thing that you're most passionate about to get here in the first place. You, too, the scientist loses his sight of the prize. You don't wake up in the morning saying, "God, I can hardly wait to get started on this thing" anymore.

Harkewicz: Do you think that's a problem in science in general, or is it just here at Scripps?

Hessler: I don't know. I think the thing that's wonderful about scientists who do research in basic science, not applied science, is that they get to wake up in the morning and say to themselves, "What am I going to do today?" And I don't know of any other discipline, profession, whatever, any way of earning money where you have the privilege. And even we are losing that.

Harkewicz: Do you think that Scripps has gone too far towards applied science, then?

Hessler: No. I think that Scripps is probably still one of the best places in the world to work. It's gone down hill but so has everyplace else. All the things that I said about Scripps does not take away from the fact that it's still one of the best places on earth to be.

Harkewicz: Even though people are not here at eight-thirty in the morning to work?

Hessler: Well, I feel so badly because everybody—to me it's a sign that they're being ground down. I want them to fell better about being here.

Harkewicz: I agree. Anything else you'd like to add?

Hessler: Not right now. Anything you want to ask?

Harkewicz: I'm sure there are plenty of other things that I could ask but I can't think of anything right off hand.

Hessler: But, we didn't talk much about my science here, but I guess it speaks for itself, and I have spoken about my science in other oral histories which I intend to turn over to you.

Harkewicz: Okay. I wouldn't mind talking with you about your science if you'd like to, if you're not too burned out with this?

Hessler: We could spend some more time just talking about me in science. I'd like to talk about me personally.

Harkewicz: Okay.

Hessler: You know, there are things that I'd like to get off my shoulders.

Harkewicz: Please do. Yeah. I have no place to go.

Hessler: And it may all be privileged for a while, but so what?

Harkewicz: Okay.

Hessler: Well then, let's make an appointment.

Harkewicz: Okay. All right. We'll do that then. ##

INTERVIEW WITH ROBERT HESSLER: 6 MARCH 2006

Harkewicz: ## This is March 6, 2006. I'm in my office at the Scripps Library with Dr. Robert Hessler. Good morning, Dr. Hessler.

Hessler: Good morning.

Harkewicz: So, we were going to continue our conversation that we started last week. You had said that you wanted to talk a little bit about your work, I believe, your research, or your work in general. So, is there anything off hand that you thought you would like to say, that you have thought about since last week or anything?

Hessler: There is one thing that occurred to me. I described to you how in my later years I felt burned out. There was one factor that we didn't even discuss at all and that is the death of my son. You knew about that?

Harkewicz: I knew something of it, yes. But, I didn't want to broach the subject in any manner that might upset you or anything like that.

Hessler: Well, I wouldn't have, I wouldn't even mention it if it didn't have something to do with what we're doing here.

Harkewicz: Okay.

Hessler: It just occurred to me, and I've never been able to evaluate this, that his death in 1995 cast a pall over my entire life.[49] In retrospect, I'm thinking it could be that as much as anything that burned me out, without my even recognizing it. I think there was a general malaise, a general low-level constant background noise of depression that started that day and has been with me ever since. And, without my recognizing it, it could be that as much as anything that really blighted the end of my career here. So I just thought I'd put that on the record.

Harkewicz: Okay. Well, that's perfectly understandable.

Hessler: Yeah, it is understandable. I only wish I knew the validity of the possibility, and there's no way of knowing this.

Harkewicz: Well, you can't separate your personal life from your career.

Hessler: By no means.

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[49] David Francis Hessler, a computer programmer with the UCSD School of Medicine, was shot to death outside his home in University City in November 1995. He was thirty years old. Police suspected his death was related to a car-theft ring that was operating in the neighborhood at the time.

Harkewicz: So, I guess, I don't know if I asked you this at all, but I wondered who or what might have influenced your research or your interests in the research that you did do? Or maybe you could just give me a general idea of how you might define your work? I know that it changed over the years, but . . .

Hessler: Okay. I have always liked to portray what I'm studying as well as I could in the sense that I wanted to be able to describe what I saw. If I was in the deep sea, I wanted to really be sure that I understood what I was looking at that particular moment, and presumably if I'd come back two days later it would have been pretty much the same. That is, what does the deep sea really look like? This is not necessarily with any particular theory in mind. I wasn't necessarily interested in why it looked like that. I wanted to make sure I really knew what it looked like. And, while I was involved many times in the "Whys?" of what something like that looked like, it wasn't always what drove me in the beginning. What drove me in the beginning was, "What's going on down there? What does it look like?" And I think this has influenced all of my research. Certainly, if you look at my papers on the deep sea bottom before we started on hydrothermal vents you would see that I was strongly motivated by that. When we got to hydrothermal vents the part of the pie that I picked was, "What does it look like?" Other people could do other things, but that's the part that I picked. When I went to vents in various other parts of the world, first and foremost "What did it look like?" And then secondarily, "What does all this mean?" In my proposals to the National Science Foundation, frequently it was this higher level of interpretation that seemed to dominate, but it didn't dominate in my own mind. Everybody who makes proposals to the National Science Foundation does so with the idea of making sure that they got the money, whether their proposals of what they wanted to do was what they were really after or not. I think we talked about that last time.

Harkewicz: Okay.

Hessler: And this of course, has also affected my study of arthropods, crustaceans. I really wanted to know, well, when I studied them in the deep sea, what crustaceans were down there, and what they looked like. Since I left the deep sea and started to study anatomy it was largely because I wanted to be sure that I could describe what an animal looked like inside and out. That's always seemed important to me. I think less important to the world, but we'll maybe get back to that. And what's interesting about all of that, in retrospect, is that when I finally retired and turned more and more toward art, sculpture, drawing, painting, I've always been driven by the need to portray a person as accurately as possible. This isn't always the best line in art. Art always loves a certain quirk, the interpretation of what one sees. But I really have been driven by, "What does this person look like?" In my art classes, where we're doing portraits of a model, other students are perfectly happy to not necessarily make what they're drawing look like that model but to make sure that they portrayed that model in an interesting way. I'd like to portray that model in an interesting way, also, but it's always been my desire to also be able to portray that particular person, so that someone looking would say, "Oh, I know

that model, it's Tara, and you've really gotten a good likeness there." If I'm able to do that I feel very happy. And I mention this because obviously this is a thread that runs through my entire life, science as well as non-science. So in my studies of crustaceans I've had such a good time looking at an animal and seeing something clearly. And then, later on considering what did that mean, what kind of a purpose did that structure serve for? What does this mean in terms of the evolution of that particular organism, and those things followed and I've had a good time studying anatomical purpose, phylogenetics. I've had a good time studying those things, once I've figured out what it was that I was actually looking at.

Go ahead, ask me something.

Harkewicz: So, is that why—you mentioned before, photography, as in relation to the hydrothermal vents, and I didn't ask you really anything about it, so is that why photography was so important to you?

Hessler: I think so. When you leave the vents it's not long before you've really forgotten what it was that you saw. Photography is the best way of taking notes, and it was a long time in the vent stuff before the photography was good enough to really serve that function. Now I think it really is, but I have to confess that even toward the end of the period, when I was doing it, we still didn't have it really right. I think subsequently people have gotten it right, particularly when they were able to couple their photography with navigation. That is, taking two pictures and showing where they were with relation to each other, starting to be able to plot what something looks like on a map. That's when it all took full flower.

Harkewicz: So, how did you learn about photography in relation to deep sea organisms?

Hessler: I don't really remember. I think some of it was stimulated when I was back at Woods Hole, because that's when I got started doing it. There was a deep sea photographer there by the name of Dave Owens,[50] who had designed some cameras for doing some of the first photography that had been done on the deep sea bottom. And I was mightily impressed by what he was able to do, and impressed by the clarity of what he saw. You could really investigate those pictures and see things that he didn't even know that he was photographing. And so I was influenced by that, and then the next step was how to quantify this. Howard Sanders was always interested in quantification as a first step toward ecological understanding. So naturally, it's one thing to take a picture, but unless you know the area that you're taking that picture of, it doesn't mean a lot. If your pictures are not taken straight down, then you have to start to get into the world of aerial photogrammetry, which is what lots of surveyors have done on land. That naturally turned me toward the techniques of aerial photogrammetry, and I read some of those papers with the hopes that they would help me do it on the deep sea

[50] David W. Owens (1946 -), director, graduate program, Grice Marine Laboratory, University of Charleston.

bottom. And, that's what got that started. Later on, when Ken Smith's[51] lab got involved, it was on this base that got them started as well.

Harkewicz: So, do any of the techniques that you use in underwater photography translate to just regular photography at all? I know you were talking about aerial photograph—or maybe you could just . . .

Hessler: Photogrammetry?

Harkewicz: Photogrammetry. Maybe you could just describe that a little bit because I'm not familiar with that. Does it involve some sort of graphing?

Hessler: It involves the principle of perspective.

Harkewicz: Okay.

Hessler: You occupy a large part of my field of view right now. If you stood fifty feet away you would occupy much less of my field of view. You would, in effect, look smaller if that wonderful computer, which is my brain, hadn't already translated that and told me, "No, you're not any smaller you're simply further away." That is, in essence, the purpose of photogrammetry, to figure out the size of something whether it's further away or closer up. It's as simple as that. All of the lines of perspective finally converge on a point, which is on the horizon at infinity. You want to know where everything you look at, everything you photograph is, between you, where all these lines are all still very far apart, and that point. Where are they located within that? And, once you've figured out how to do that, it automatically gives you a key as to how big all those objects are.

Harkewicz: So, when you're taking these photographs, how close are you actually to the object?

Hessler: Oh, it might not be more than a meter or so. But even then you have to know the field of view of your camera, and various other things, such as the focal length of your lens. You have to know the angle the camera is tilted on compared to the bottom, which you assume to be horizontal. And then finally, you have to know how far your camera is above the bottom. And if you know all of those things, you can calculate and put a grid on your field of view, a grid where every square in that grid, say, is a square meter. And if you look at that grid on a photograph what you will see is that the sides of those square meters are on lines which approach each other toward that focal point at infinity, and that the lines that portray the edges nearest to you, that are parallel to your range of vision, and on the other side also parallel, how they get closer and closer to each other the further you are away. And so that's how the aerial photogrammetry made all of this possible.

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[51] Kenneth L. Smith (1943 -), research biologist, senior lecturer at SIO.

Harkewicz: So, is this kind of analysis something that you would do after you had taken the photographs, or would you try to do these kind of calculations while you were photographing?

Hessler: No, afterward.

Harkewicz: Afterwards?

Hessler: Another way you can do it of course is to use stereo photography, with the two stereo photographs you have much of this information in another way. And another way you can do this, which is very popular because it's so easy to do, is to have parallel laser beams shooting out toward the center of the photographic field. If you know how far at the origin of those beams they are away from each other, when you simply look at them in your photographic image and you see them next to each other, you automatically know those two spots are a quarter of a square meter away from each other. So, they give you an enormous amount of information.

Harkewicz: So this was all so that you could quantify the photographs?

Hessler: Exactly. Why did I want to quantify the photographs? For my sake it was important to now how many animals per square meter and their relationship to each other in terms of distance from each other. But for other people it was a basic tool in working out the ecology of that particular environment, and of course I was interested in this as well. The number of animals per square meter tells you something about the amount of food that's being introduced into that community. The denser the amount of life, obviously, the more food that area's getting.

Harkewicz: Well, that brings up an interesting point and I don't want to get off the track of your photography totally, but I recently saw the video that we have. I think it was in commemoration of Richard Atkinson's appointment as chancellor and it was about the hydrothermal vents and there were several people that spoke, and you spoke about your work on the vents.[52] And, the general consensus, of course, about these vents is that it's a poisonous environment because of the sulfur that's released? So, how is it that this is like an oasis in the ocean and yet it's a poisonous environment. How is that possible?

Hessler: It's both things at the same time. The easiest way to explain what seems to be a paradox, is to point out that the ocean in shallow water is a really rich place—so why aren't we all underwater taking advantage of it? And the obvious answer is

[52] *The Deep Sea Hydrothermal Vents: The Hottest Thing in Oceanography, October 21, 1981* is a two tape video recording of a colloquium held at Mandeville Auditorium at UCSD as part of a program of events in honor of the inauguration of UCSD Chancellor, Richard C. Atkinson (1929 -). The colloquium featured scientists from SIO who presented illustrated lectures documenting unusual marine life and unique geological formations associated with hydrothermal vents found in the deep ocean. AC 86- 9, Scripps Institution of Oceanography Archives, UC San Diego.

that it's dangerous; you'll drown. It is a source of opportunity, but one that is protected at the same time. Vents are poisonous because they bring heavy metals to the surface which you know very well are poisonous to lots of organisms, and also brings hydrogen sulfide. The sulfide ion is very poisonous to fundamental physiological pathways in the human body and in most other organisms. If you cannot detoxify both of those problems, then you don't have a ticket to visit those environments. There are two ways to do it. One way is to detoxify it in such a fundamental way that you can spend as much time as you want there. The other is to do the equivalent of holding your breath and diving to the bottom: that is, go into those environments for sufficiently brief periods of time that you can escape from it again and recover from having been there. The organisms that you see in those environments are doing both.

There's a third way and that is that these environments have, of course, the most food right at the source, while the amount of food only gradually diminishes as you go away from that spot. What's very interesting is that the poisonousness of that environment decreases very rapidly. For example, the heat of that environment can be really dangerous, can be high if you are actually in the plume as it comes out of the bottom. You can go a quarter of a meter away and the temperature is almost ambient, which is usually just a degree or so above freezing, just a short distance away. And this is largely because there's a convection cell. That is, that hot water is going up because it's hot and therefore weighs less. This draws in the cold ambient water from the side. So there's a large convection cell that allows organisms to go practically right up to the edge of that and yet be in an environment where there's lots of oxygen, the temperature is cold enough, there's no sulfide, virtually no sulfide, virtually no heavy metals because all of that's shooting straight up in the plume so that as long as you don't get too close you're not near it. A lot of food is being created right there at that plume, and in various ways, portions of that food are dropping back down to the bottom in an aura which surrounds the center of that vent. So five meters away, there's still more food there because of the vent, than would be the case in the ordinary deep sea bottom where there isn't much food. And so animals can come into this neighborhood without getting right into the source and partake of an increase in the amount of food that they wouldn't find in their normal environment, and yet be relatively safe from the poisonousness of the environment.

Harkewicz: But most of these animals, aren't they anchored somehow to the area? I mean, they don't just come and go?

Hessler: Some are. Some are not anchored. Some fish come into the environment and take advantage of it. A few go right into the core of it and they have had to adapt to that environment in various physiological ways, some of which we don't understand yet. There are some crabs that go right in and can tolerate it day and night, so to speak. They have worked out ways of detoxifying the environment in their body. There are animals that are attached to the bottom: the tube worms, anemones, mussels. Those that live right there at the vent opening have learned

how to detoxify the environment physiologically. There are things like anemones that live further off to the side, attached to the bottom, or what they call “dandelions” attached to the bottom. These have not been so concerned with detoxification because they're far enough out that they're not living in a toxic environment, and yet are being exposed to more food than if they were a kilometer away.

Harkewicz: So, are there things we can learn from this environment to take to other environments?

Hessler: I'm not as good at that as physiologists are. Having a little sip of coffee here. And, I would encourage you, by the way, to talk to Ken Smith before he leaves this institution on the sixth. He's been involved in this game for a long, long time, and you would do well to partake of it before it's too late.

Harkewicz: All right.

Hessler There was one very simple thing. We discovered animals at the vents, the tube worms, that have no mouths, no anus, no digestive tract, and yet they are growing lavishly. We discovered that the way that they do that is to absorb sulfide in their system, take that sulfide to organisms, to bacteria that live within their body. Those bacteria proliferate and create a source of food for the tube worm. A wonderful symbiosis. There are clams there that take in some food, but for the most part are once again feeding bacteria inside their body by taking in the sulfide. This reminded people of some kinds of clams that live in shallow water environments, usually environments that are reducing environments because there's so much food there, there isn't enough oxygen to cause the destruction of all that food. And so the food piles up and it eventually results in a reducing environment. As I said, there are clams that live there that have no mouths and people always wondered how they live there. All of a sudden, because of this deep sea discovery, they looked inside them and they saw the bacteria, they realized, “Aha. This is the solution to this problem.” And it told them something about the biological environment around sewer outfalls as well as other kinds of environments, and potential practical applications. Something I know virtually nothing about is all of the various kinds of bacteria and archea that live at these hydrothermal vents. One of the things that has been learned I initially thought wasn't likely to be the case, but it's really very, very possible that vents or vent-like environments might have been part of the origin of life on this planet. That's kind of exciting. And so while that's not the only possibility it is one of the cards that's always been on the table ever since that thought first occurred. So yes, the study of hydrothermal vents has been important in terms of the study of other environments, but that's not why we do it. We do it because it's—a lot of people do it because it's so wonderfully fascinating.

Harkewicz: How would you learn something about these, like the bacteria in the tube worms? I mean, how did you learn that? Did you take tube worms out of the area and dissect them?

Hessler: Right. From the very start physiologists were onboard bringing these animals up to the surface, learning how they could study them before they died. So, they learned how to keep them alive longer, and then they learned how to study them. The bacteriologists, in the same way, gradually learned what these bacteria were doing and how to keep them alive so they could experiment with them. And that's how it's been done. And Horst Felbeck[53] has been involved in that. You would be well served, if you're interested in this question, to ask him about that. And as far as all of the deep sea creatures which can't be kept alive at the surface, we have marvelous microbiologists. You should talk to Art Yayanos[54] who is now retired. Catch him before he stops coming in. Doug Bartlett[55] also has done marvelous things down there. These fellows, in addition to telling you about the field, can tell you how Scripps has participated in these fascinating studies of the global oceans.

Harkewicz: You were at Scripps when hydrothermal vents were discovered, correct? Is that accurate?

Hessler: I came to Scripps, I think, just afterward, because I was here in '79 and they were discovered in '77. And the real biological work didn't get started until after '77. So I was still at Woods Hole working with others there putting a project together. Yes.

Harkewicz: And how did you get involved in this type of research, then?

Hessler: It was easy. I was one of the few American scientists studying the deep sea. It was logical that I study this aspect of it. I and Howard Sanders, and Fred Grassle, and others.

Harkewicz: And was your primary modus of study the photography, then?

Hessler: Yeah. In this particular case it was the photography. Fred Grassle was going to sample the bottom and do the kinds of things that you can do by sampling the substrate.

Harkewicz: And in our last conversation you talked about how, when you wanted to get out of deep sea research that you were able to sell your photographs in order to subsidize your graduate students?

Hessler: Yes.

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[53] Horst Felbeck, professor of marine biology, SIO.
[54] A. Aristides (Art) Yayanos (1940 -), biological oceanographer at SIO.
[55] Douglas H. Bartlett (1957 -), professor of marine microbial genetics, SIO.

Harkewicz: So, who did you sell these photographs to? What kind of people wanted to buy them?

Hessler: Oh, all kinds of people. I never sold photographs to my colleagues. I always, if they wanted photographs so that they could give slide shows and so on, I told them I prefer they don't use them in their research because that's why I took them, but if they needed them for their classes, for their studies, I just gave them photographs. But if someone was writing a science book for profit, I charged them whatever the publication, whatever their publisher was paying for photographs for these textbooks. If it were magazines, same thing. For any for-profit organization I took my small share of the profit. That's still happening today, although I don't encourage it anymore because I'm not really interested in going to all the effort. So even until today they're doing it, although there are people out here who by now have taken much better photographs than the ones that I took.

Harkewicz: Did you ever run into any problems with Scripps administration because you were selling these photographs that you had taken while you were working here?

Hessler: No. And I don't know why. Largely I never raised the issue, and maybe I was invisible to them. It didn't seem important because I always declared it on my income tax returns, and ultimately I was using it for students. Why should Scripps care?

Harkewicz: That still amazes me that you actually had to physically subsidize them. I mean, was there no other way that they could remain your graduate students or was that just something you felt responsible for?

Hessler: There was a time when Scripps was able to help students, but as time went on and money became tighter and tighter Scripps and the state gradually foisted more and more of the financial responsibility on funding agencies until today they foist everything on the funding agencies, even as much as paying for the buildings, in the form of overhead. They try to raise the overhead to a higher percentage, higher, and higher, and higher. They do it because they are in a bind. The state is no longer rich as it once was. But they also do it because of the current climate of gravitation toward the cash cow. It is both wonderful that they have the opportunity to support science in this way, and I think a little despicable that they have succeeded in forgetting what their responsibilities are.

Do you ask everyone that question? Interesting, you'll get interesting answers.

Harkewicz: Yes. Probably not in quite the same way but I've tried to ask people that question in a variety of ways. You said just a few minutes ago that you wouldn't, you didn't want fellow researchers to use your photographs for their own research? Is that correct?

Hessler: Yeah. Unless they asked me.

Harkewicz: Okay.

Hessler: "There's something in this picture that I would really like to use in a publication. May I, please?"

Harkewicz: Okay.

Hessler: Or, sometimes they'll say, "Can I use one of these pictures to illustrate the environment that I was looking at?" And I would usually agree to that. I don't remember all the details in this. I'm sure the variety of our interactions was large, and there might have been some situations where I said, "No, I'd really prefer that you didn't do that." But this is part of the way we do science. It is an honor system. People know a lot about what I learned, and they are on their honor to not use it themselves if they know that I'm aiming to publish it, and vice versa. And, most people are rigid in their determination to avoid this accident. Occasionally, somebody slips up and it's all very embarrassing.

Harkewicz: The accident of publishing something that somebody else was going to publish.

Hessler: Exactly.

Harkewicz: I see.

Hessler: And sometimes, there are situations where there's actually conflicting scientific groups who are rushing to publication. I don't think that these people would steal someone else's data and I don't even know of a situation where that has happened, but it does—where they're in fierce competition it can become ugly. And one of the ways it can become ugly is by their competition for common resources. They're both going to NSF[56] for money. Of course, that's fairly easy. But, what if one of them is given the proposal of another to review? I think today NSF asks them, "Do you have any conflict of interest?" And they're allowed to declare it. In the old days, like during most of my career, they were not asked that question and they had to decide whether they could honestly review this proposal, or whether they had to declare themselves conflicted, and just return the proposal to NSF. Most people, though, even under those circumstances would read the proposal to find out what the competition was doing. Some, the most honorable of us, would return it unread.

Harkewicz: Well, it would be difficult, I would think, once you read it to not consider what somebody else was doing.

[56] National Science Foundation

Hessler: Sure would. Sure would. I don't know that anyone has ever taken a survey. I have not had this problem because I haven't really had any competition. Other people were looking at other sites. And I think I usually read other deep sea people's proposals. They weren't my competitors. I would also, in some areas where people took opposing points of view, I would always read their stuff to find out what they were doing with it. I did not regard this as a conflict of interest. And I, nevertheless, took it upon myself to make sure that this prior knowledge didn't affect my publications.

Harkewicz: How did you manage that?

Hessler: That I would not point out that I knew what these people were thinking.

Harkewicz: But, how did you filter your own, your own advice?

Hessler: I don't remember. I don't remember. I don't believe I ever went to bed with a guilty conscience, and so I have to assume that somehow I was really rationalizing, or doing a good job, and I don't know the answer to that. It could be that I was being despicable.

Harkewicz: I wouldn't say that.

Hessler: No, but . . .

Harkewicz: No, I suppose you were probably were really more aware of, you know, or being particularly cautious because you didn't want to have things you had read affect what you were thinking or something along those lines?

Hessler: I tried. All I can say is, I tried.

Harkewicz: That's the best anybody could do, I guess. How common was this technique, this photographic technique that you used? Did you use it a lot or was that sort of unusual? Did you have the market on this at the time?

Hessler: No. I think the French were using it quite a bit. They were competitors. They were working different areas, and they were both competitors and colleagues. It was rare for one's competition or disagreement with another person in my field to become so intense that you could not deal with these people in open forums. Most of them were friends, friendly colleagues. Some were no more than acquaintances and you kept it that way. And there were a few, I can remember, who were enemies. And, I can only remember that from early in the game when Howard Sanders and I got started. We had a person that I think we had to realistically regard as a competitive enemy, and his name was Bob Menzies. He was a deep sea researcher from Lamont before we were and we kind of came into the field and started stepping on his toes, and indeed out competing him. He did not love us. We did not love him.

Harkewicz: So, when you say “enemy,” does that mean you feel like he, that you had to watch your back, so to speak?

Hessler: A little bit. Not very much, because most of us, just on a day-to-day basis wouldn’t do anything that we had to protect ourselves for. We were doing our science. There was a basis for the work. Other than the discomfort of thinking that someone else could torpedo one's NSF proposal there wasn't a lot they could do to you. So you didn't have to worry that much. It's just that there were people that you knew were downright unfriendly toward you.

Harkewicz: And how would somebody go about torpedoing your NSF?

Hessler: By saying bad things about it. And if the program manager didn't know that there was this source of bias he couldn't guard against it. But that's why, these days, NSF has various techniques of making sure that this won't happen.

Harkewicz: So this would be during the review process, then?

Hessler: During the review process.

Harkewicz: When you first started out, when there was still military backing, Navy backing—was there similar kind of issues at that time?

Hessler: I never used the Navy, so I didn't have to worry about it. I was always with NSF. And I don't know what other people would say about that.

Harkewicz: Okay.

Hessler: Have you talked to Fred Spiess[57] yet?

Harkewicz: No, I haven't.

Hessler: Better hurry.

Harkewicz: Okay.

Hessler: I mean, really, you better hurry.

Harkewicz: Okay.

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[57] [57] Fred Noel Spiess (1919 - 2006), professor of oceanography at SIO. Spiess served as associate director of Scripps and director of the Marine Physical Laboratory. He also served as acting director of SIO from 1961 – 1963 while then director Roger Revelle was in Washington, D.C. acting as the first science advisor to John F. Kennedy’s Secretary of the Interior, Stuart Udall.

Hessler: My relationship to the Navy was peripheral and only occasionally annoying. For instance, I was doing some work in the San Diego Trough in the seventies and I discovered I had to check with the Navy to make sure I could go onsite and do my work, that there weren't submarine channels going through.

Harkewicz: I see.

Hessler: And, they made life difficult for me and my graduate students from time to time. Once a graduate student of mine discovered that he couldn't get back to a place where he was doing a time series. And I had to go to the Navy and find the person who was in charge of that, point out that this young man's entire career was at stake, and I actually got the Navy to back off. That was pretty good.

Harkewicz: Wow.

Hessler: And I give them credit for that. Unlike the Navy that most of us know, the Navy is capable of occasionally backing off. It was very good. In the early days of my business, life was easier in just being able to get money. You proposed to go to sea, and go to a foreign port and take samples on the way to the port, you didn't worry about it. You didn't worry about getting permission to take samples, because there was only a two or three mile zone surrounding those areas and I wasn't going to sample that anyway. And . . . ##

Harkewicz: ## You were saying, with the 200 mile economic zone it's more difficult to collect things?

Hessler: Worse than that. It's hell getting permission to do it. And, now the friendliness of the various nations is important. It didn't help us when the *Pueblo* in the Sea of China called itself a research vessel and put a smear over the entire field of oceanography.[58] Most of us, all of us, we're just research vessels. We are not trying to do anything subversive whatsoever. And the *Pueblo* made us look all subversive. Nowadays that the United States is held in such ill repute over the entire globe I can hardly imagine how difficult it is to get permission just going into foreign ports, much less working in foreign waters. So that was one thing. In the old days, when I was at Woods Hole, people would come in off the Atlantic,

[58] The USS *Pueblo* was boarded and captured by soldiers of the Democratic People's Republic of Korea (DPRK, North Korea) in 1968. The ship had strayed into the North Korean territorial limit, although the crew maintained they were operating in international waters. The ship had been designated by the U.S. Navy as an *intelligence gathering ship* and was on a mission to conduct and intercept surveillance of Soviet naval activity in the Tsushima Straits. The 82-member crew (one member was shot and killed during the conflict in which the ship was seized) was held prisoner for eleven months amidst accusations of torture and forced propaganda. The *Pueblo* remains in the possession of the North Koreans and is a primary tourist attraction of Pyangyang, North Korea. Hessler's reference to the *Pueblo* "calling itself a research vessel" is probably in regards to the U.S. Navy designation of *technical research ships*, which were used in the 1960s to gather intelligence information by monitoring electronic communications of other nations. The true mission of these ships was considered classified. Publicly, the ships were identified as conducting research into atmospheric and communication phenomena. However, their true mission was readily known and the ships were often referred to as "spy ships."

would always stop in Bermuda and load the vessel up with a duty-free alcohol and then come in and really enjoy it. And then somebody in Bermuda blew the whistle and the, what did we call them, the IRS? Who is it that controls . . . [59]

Harkewicz: Oh . . . .

Hessler: I remind the audience I'm seventy-three. I forget all these names. Whatever it is. The feds.

Harkewicz: I don't have that excuse.

Hessler: The feds were waiting at the dock for the *Chain*[60] to come in. The *Chain* came in. Some guy was loading a case of alcohol into his car. The alcohol was condemned. His car was taken away from him for resale. The whole ship was condemned. Woods Hole almost lost all of its federal grants, and this was the beginning of the end for ships coming back into the United States and going through customs. Now, you have to be so careful about what it is that you're sending out and what it is that you're bringing in. The amount of paperwork is absolutely enormous where once there was almost none. If for no other reason than these reasons that I've been giving you. I wouldn't go to sea again. It's just more trouble than it's worth.

Harkewicz: When would you say this kind of stuff started happening?

Hessler: Mid-seventies. Mid-seventies. The alcohol thing started earlier than that. The alcohol thing shut down alcohol onboard U.S. vessels. Nobody wanted that to happen again. Scripps, always having been influenced by the Navy, always had a no-alcohol policy on its ships. Woods Hole did not, then, although I think it does now. This did not stop people from, when they were going on a cruise, bringing their own personal supply and just being very *sub rosa* about it. I don't know what it's like today in terms of people doing that. I can see why Scripps was doing it. I personally felt that they were a little overboard about it.

Harkewicz: So, do you think you could do deep sea work without going out on ship, or did that, all this paperwork and this kind of trouble affect your desire to get out of that area?

Hessler: You cannot do deep sea work without going on a cruise unless you're in one of those few fortunate areas where you could conceivably go out for the day. But even the San Diego Trough is far enough out that it usually takes more than a day, and then there's a lot of hullabaloo, but at least you're staying in your own waters. I had a site once. In 1971 or '72 I had an elaborate program. We took the—it

[59] Hessler was speaking in reference to U.S. Customs.
[60] R/V *Chain*, a former WWII Navy salvage ship, sailed in the WHOI fleet as an oceanographic vessel from 1958 – 1975 when it was retired from service.

wasn't a vessel. It was called *ORB*.[61] It was a huge sea-going platform that got anchored out there and allowed you to lower an ROV through a well in the middle and do work on the bottom, day on end, while we took *ORB* out to sea for about a month. We called it the Quagmire Project and sampled the bottom. All kinds of people doing it in different ways. And then, later on, we wanted to go back. And would you believe that in the intervening time a treaty with Mexico had turned that area—this is when the development of the 200-mile limit was taking place—and it had now been given to the Mexican government, and it's never been sampled again since.

Harkewicz: Hmm.

Hessler: Yes. Very irritating.

Harkewicz: So, this is where politics really puts a damper on science?

Hessler: Yeah. We are, most of us, innocent in what we're doing, and yet the real world had made it more difficult to do it.

Harkewicz: Do you think there should be some sort of exemption for scientific research that you can go into different waters?

Hessler: No, I think that I would have liked people to view us as being less suspicious than they do. And we are less suspect than they think we are. But after what the U.S. government did, I can see why. There would be no point in arguing with people that we are innocent. How could they trust us? Because they can't trust whether we are we or we are U.S. government behaving in its usual way.

Harkewicz: Okay. Now if you can recall just a few minutes ago, you were talking about competition and cooperation between scientists, and you said something about things in an open forum. Now, when you talk about an open forum, do you mean discussions like at conferences? Or do you mean actually within publications?

Hessler: No. Well, once it's in a publication it belongs to everybody. But I mean scientific meetings, seminars. If you were invited to give a talk someplace you would give data that you hadn't yet published. All of those who are, heard those data, would be on scout's honor never to use what they heard.

Harkewicz: But is that the way that discrepancy, maybe differences of opinion would be hashed out?

Hessler: Partially. I have to say, we're spending a lot of time on this particular issue. I have to emphasize that it contributed almost no time when I was doing business. We're talking about it because it happens, and we all think that one's ordinary life we all

[61] The R/P *ORB*, Ocean Research Buoy, is a research platform used for a variety of scientific studies. It is operated by Scripps Institution of Oceanography but owned by the U.S. Navy.

know about so we don't have to elucidate that so much. But this is the sort of thing that you don't often get to hear about so, that's why we're spending so much time on it. In actual fact, we spent almost no time thinking about it because the system works the way it ought to almost all the time.

Harkewicz: So there usually isn't circumstances where people are arguing about something or using other people's data?

Hessler: If they argue about it, it's part of the game. You know what you know, they know what they know. You try to put your case forward. They try to put their case forward. Occasionally, you've got to back down because they were right, and vice versa. It's, that is not one of the things to worry about. The thing to worry about, if one is going to worry at all, is theft of one's ideas and one's data, and that's hardly done at all.

Harkewicz: Because it's sort of a gentleman's agreement, between scientists?

Hessler: And we are virtually all gentlemen.

Harkewicz: Okay. I was wondering, before we get totally off track of your research, I know that you had mentioned last time we talked about your bioassay technique about the parking lot, and people, and I believe you also mentioned this technique on the video that I saw about the hydrothermal vents and I wondered if you could explain a little bit about your ideas about bioassay, your idea of it and how that applies to the work that you did?

Hessler: Well, first of all, we all do it. Others don't apply that particular word to it. I think it's a very good word for it. All it means is trying to find out Fact A or Situation A, but not being able to attack it directly because it's unassailable for some practical reason. It's just unknowable, directly. So, you do it in an indirect way. Let's say I want to compare the amount of food available in one part of the ocean as opposed to another part of the ocean. I can't directly measure the amount of food. It's just too difficult. What do I do? I count the number of animals there. I find out the number, the amount of life that's in these two spots. And if I find that there's five times as much life in one area as there is in another, unless there's some other extenuating circumstance, I can almost guarantee the reason is that one spot is getting more food than the other. This is using a bioassay, and we all do it in all kinds of different ways.

Harkewicz: I was reading one of your articles about vent organisms and how they eat and you said something about making analogies between non-vent representatives of the same animal group and vent animals. And then later on in this same article you talked about the fact that recent biochemical and molecular techniques have

shown that vent animals that look like non-vent animals actually weren't related.[62] So, I wondered if that problemitizes the whole analogy idea?

Hessler: I don't think that gives much trouble to a lot of people these days, and the reason is simple. If you want to know whether an animal that you got at the vent was the same species as an animal that one's collecting away from the vents, you can do a genetic analysis and find out right then and there. That wasn't always true. When we were first attacking vents that technique was not comfortably available, then you had to worry about it a lot. And physiologists had to worry because they had to figure out whether these organisms had a very plastic physiology. Could they really live at vents and at non-vents, or was it because they were different organisms. Biogeographers had to worry about that a lot because they wanted to know how animals could get from one vent to another. Well, they did it because they could also live at non-vents. It's a non-issue. But if they actually had to island hop, it's a big issue, and so they worried about that a lot. Why are animals that live in the Atlantic so similar to animals that live in the Pacific? Is it because they're not the same animal? Is it because they're island hopping at a rapid rate? Or is it because they're just walking from one spot to another? Nowadays we have ways of analyzing that question directly. In the old days we did not. I suspect, when that publication was written genomics were still not as routine as they are today.

Harkewicz: I can verify when the—I actually have it right here somewhere. This was '95, 1995.

Hessler: That's early enough. It tells you two things that I think most people at least feel, and most of this audience probably knows very well, and that is, there is practically a big bang in knowledge going on right now. It is awesome to know how in a few years you can look back and discover how antiquated a life you were leading then as compared to now. And here's an example. Ninety-five, why that's practically nothing in terms of human life. In terms of progress in science, it is an enormous difference that one decade makes, an enormous difference. And, the second point I want to make is the point we made about whether we should feel uncomfortable about genomics coming into Scripps. This whole conversation that we've had in the last ten minutes points out so beautifully that it is now part and parcel about all the other things that we do.

Harkewicz: Right. So, you talked about being, when we started our conversation today you talked about feeling burned out for a number of reasons, personal and career-wise. Did you, when you went back into carcinology, which I guess is what your original love was, as you said, did you feel like some of that burnout left, or did you have a renewed interest in that kind of thing? Or, was it just a change of pace, maybe?

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[62] Robert R. Hessler and Victoria Kaharl, "The Deep-Sea Hydrothermal Vent Community: An Overview" in S.E. Humphris, R. A. Zeirenberg, and S J. Mullieneaux (eds.), *Seafloor Hydrothermal Systems: Physical, Chemical, Biological, and Geological Interactions*, Geophysical Monograph 91 (1995): 72 – 84.

Hessler: You know, my urge to continue science in carcinology has also waned, and I want to explore that for a little bit. There are a couple of reasons. One crept up on me, and one surprised me. The one that crept up on me was the development of cataracts in my lenses and the fact that my vision was degrading in general. I have now had both lenses replaced and so my vision is much better than it was before the cataracts were removed, but I have to use different glasses if I'm looking at a distance and different glasses if I'm using, looking close up, and no glasses if I use a microscope. It is so inconvenient to do microscope work now, looking in the microscope, looking away from the microscope, that I find it's no fun anymore. Once I reveled in it. It's just no fun. And so I realized, really not more than a year ago, that there's a whole bunch of that science that I had every intention to go back to that I'm probably not going to go back to. I still love doing my research in Sweden with my colleague, because we're doing electron microscopy and this eyesight thing affects me only peripherally. Although my colleague, who is seventy-five, also has eye problems, we two old men somehow managed to solve it and still get this work done. Another problem that struck me was that my memory is crashing at a great rate. Just in this interview you've been able to hear where I've forgotten words, names, and so on. And while I regret having forgotten them I know this is a real thing. This is not my wanting to have forgotten. I've just forgotten. And, it is absolutely appalling how much of what I once had at my fingertips in the way of scientific facts are no longer available to me. And, as part of all of this I'm no longer as up on the literature. And so it makes it harder for me to write scientific papers. All of these things make it just less fun to do science, even the science that I'm doing in Sweden, although I've no intention of abandoning that. And there may be other things that I will continue to do. I haven't decided yet.

And then there is this second thing, the surprise. And the surprise is that the real issue that pushes my life forward is to have a passion for something to keep my life going. I've discovered that my passion has always been the passion to be creative. For the past forty years or so, whatever it was, when I was in academia, the passion was to be creative in science. And then, in the last five years of my employment and all of the years of my retirement, I have gradually become more and more interested in attempting art, learning art. I've discovered that much of my passion, most of my passion, has turned toward that, I am passionate about being creative in art. This does not mean that I've been successful, *[laugh*] but it doesn't matter. The pursuit is passionate. I wasn't all successful in science, either, but that pursuit was passionate. And so for both of those reasons science simply isn't as important to me anymore as it once was. Did I miss your question or . . .

Harkewicz: No. No. That's, that's what I was asking. You know, I wanted to ask you about that, too, because earlier you had said that you were studying painting, and it's interesting that you said what drove you was wanting to know what something looked like. And here you are interested in art at this point in your life. So I

wondered before when we were talking about photography, did you ever translate your photography work into more of an artistic or creative pursuit?

Hessler: Well, the answer is yes. I've had a camera for a long time and I used to like to take pictures. I would like to take really good pictures. Of course, a really good picture can be a good document but it can also be a very creative image, which is hard. I think I discovered long ago that while I can take a competent picture I am no photographic artist. And so that does not loom large in my life anymore, also because I would rather be a creative artist in other ways. I've tried many art forms. I used to do needlepoint a lot. I've largely abandoned that because it is so time consuming to turn out a good creative piece.

Harkewicz: What about the fact that you said you were so concerned about documenting what something looks like, or making somebody look like they actually look? Do you feel that that affects your creativity at all?

Hessler: Yeah. It sure does. It holds me back. Why can't I let loose? I have spent all of my scientific life being picky. I'm a really picky person, and this has served me well. It prevents me from making mistakes. It has certainly contributed to the success of the many successful publications that I had. I've discovered that it was something that my students credited me with and tried to emulate. Not the whole way, but at least discovered that it was something that couldn't do you a lot of harm. So, it served me well to be picky. And now I'm discovering that it holds me back. I can't break loose. I'm having trouble being an impressionist. I could never be a Van Gogh, no matter how much I admire what he does. And I'm still working on that.

Harkewicz: So, what kind of art do you enjoy doing?

Hessler: I like doing portraiture. I like doing figurative art, painting people. Love doing nudes, particularly women. I do sculpture, all figurative, all an attempt to be as accurate as possible. “Wouldn't it be,” I think to myself, “Wouldn't it be possible to,” to use an expression I use a lot, “to nail that person?” [*Laugh*] To really be able to do something where anyone saying “Wow, you really captured her.” And recently I did. I did a sculpture where one of my art teachers complimented me by saying that, when he looked at a photograph of it, he said, “I can't tell what scale this is. I can't tell whether it's small or whether it's big.” And I thought to myself, “Wow, I really did it.” Those are the things I like to do, but I'm going more toward still lifes, eventually. I will probably do landscapes, although I have trouble liking other people's landscapes, except for a few, and therefore I am plagued with the question, “Why should I want to do a landscape? Why should anyone even want to look at a picture of a landscape?” I haven't answered that question, so I don't do it. I understand, with still lives, I understand the figurative art.

Harkewicz: It sounds like you're too caught up in that left brain, you know? Thinking too much about why you should do something?

Hessler: Yes.

Harkewicz: So, you're talking about paintings, or drawings, or both, or paint, strictly painting?

Hessler: Particularly paintings. Most people don't do landscapes in drawing. Oddly enough, I've come to like drawing the most over painting because I like the possibility of really nailing the person, the mood, the object with just as few lines as possible. And it's escaped me so far, but I've seen people do it and it is so moving when you see a sketch capture it all. And I'm still going for that.

Harkewicz: So, in that case, do you really think that your need to nail somebody, or make them be as realistic as possible, does it have to conflict with your desire to be creative? Does it have to hold you back?

Hessler: No. No, it does not conflict. The question is, does it take a better man than I to be able to merge them? And I'm still working on it. I'm fighting hard. It usually alludes me. And where I can do it, it takes a lot of work and all I can say is as time goes on it takes less and less work. And so I'm getting there. A friend of mine in Denmark who is not an artist herself, but is a real aficionado of art and has very, very good taste, told me, when I showed her some photographs of what I'd done when I go over there every year, she said, “I wish you hadn't started so late.” And what she was saying is, “I can see you're improving but you're also running out of time.” And I keep saying the same thing myself, “I'm running out of time.” And it's what's given me the permission to turn down all kinds of things if they are not toward the goal that I regard as being important. I just say, “No. I'm running out of time.”

Harkewicz: Good for you. Do you find your eyesight is that causing any problems with your artwork at all?

Hessler: Sometimes. If I am looking at a subject that's distant and also a subject, or looking at my canvas, I can't see them in the same point of view and then I'm in real trouble. It usually means that I have to get closer to the model.

Harkewicz: You wouldn't want to try to do like Monet and have it be all blurry or anything like that?

Hessler: I don't say anything is impossible when it comes to art. The other evening I was having dinner with my wife and our waitress was a charming young woman wearing a white men's shirt and a beautiful red tie, and she had a black ponytail and she was really handsome. And I said, “I try to do art. Would you like to pose?” And she said, “Hmm. That sounds interesting. Yeah. Maybe.” I said, “We can't pursue this further unless you give me your name and telephone number,” and she did. And I haven't contacted her yet, but the reason why I raised this is that if I do succeed in getting her to pose what I want to do is one of the clothed

portraits in the style of Modigliani, which he did so well and in such an interesting way. I'd like to see whether I could imitate that technique. So I am perfectly up to imitating other people's techniques if I think that I can do it.

Harkewicz: But would you have to nail that, too, then?

Hessler: I'd try. Or, maybe I would approach it and succeed in some other interesting new way. It's always possible. I guess what I'm saying is, I don't believe I've got a style of my own yet, other than to be picky and I'm trying to lose that.

Harkewicz: A picky style? I understand that, believe me.

Hessler: I want to say two more things.

Harkewicz: Okay.

Hessler: One is, toward the end of my doing my research here where I was describing the skeletal musculature of the swimming legs on shrimp, I found that my anatomical studies became more and more artistic, more interesting just to look at. And now I look at them as much as a good piece of art as a good piece of science. And I was really pleased to do that. Because in a way, maybe all of my scientific and anatomical work was always really a secret yearning to do art.

Harkewicz: Before you started the photography, did you do drawing?

Hessler: Loved to do drawing. And, when I finally had an excuse to do scientific drawings, I always loved doing that. It was clearly a talent trying to hide and also trying to come out. But one more thing that I want to say. At the very beginning you asked how I got into Scripps and it was the result of having me making a couple of sharp right turns. You could ask the question, “Is there a time in one's life where this doesn't stop?” And my answer's “No.” We are always taking advantage of surprise opportunities. If we're smart, we are. We don't slavishly pick a way of doing it and stick with it. And while I don't want to be too critical, I will be a little critical of those of my colleagues who reach retirement age and continue to come into Scripps everyday and do their business. And I think to myself, “Get a life. Don't you have anything better to do?” And some of them are so creative in science that they don't have anything better to do. I had something better to do and I made another sharp, this time a left, turn.

Harkewicz: But if they're creative in science, do you see that as a problem?

Hessler: Nope. Nope. It's what they picked. It's if they do it because they haven't got anything better to do that I become suspicious. If it's just a matter of habit, if it's just habit, I feel a little sorry for them. I'm sorry, I do. Your life should not be habit, and you should like waking up in the morning.

Harkewicz: I think it's very interesting to have talked to you because it sort of does seem like, regardless of all your right and left turns, it seems sort of like you had sort of a circular kind of thing, though, coming back to the drawing, and things like that?

Hessler: I guess so. It's . . .

Harkewicz: Maybe it's a matter of rediscovering what you really want to do or something?

Hessler: Maybe. There's something else I didn't say about retirement, and it's scary when you think about it. It relates to this in a way because I've almost gone back to a world in which I can be childish in demanding my own way. I don't do it by stepping over other people, but nevertheless, I'm doing what I want which is something you expect children to do, and then you gradually lose this as you gain maturity. But it also says something about retirement in another way and why in a way retirement is even more childish than being a child. It occurred to me one day about a year ago that being retired was the first time in my life that I was my own boss. From the day I was born someone else was my boss; the nurse, my mother, my teachers, my professors, my employers. They controlled my schedule for my entire life up, until the age of about sixty-seven when I finally retired. And then, if I was smart, I was in charge in my life and that's where I took charge. Isn't that appalling in a way, that you're only finishing what, maybe the last two, maybe three-fifths of being, of doing someone else's bidding and you've still got a long way to go before you can say, “No, I'm going to do my own bidding”?

Harkewicz: Well . . . .

Hessler: It's extraordinary.

Harkewicz: Well, you're fortunate, though, actually that you came to that conclusion, because some people probably don't ever do things for themselves that they want to do. Some people are always answering to someone else.

Hessler: Maybe they don't, but you should. Because if I wake up and I find that I'm disturbed about something and I suddenly realize that I'm feeling guilty about something that I'm supposed to have done, I have to decide, “Am I supposed to because it was part of my schedule or someone else's?” If I was supposed to because of someone else's schedule, I really have to re-inspect it and decide whether it deserves to be on my agenda at all.

Harkewicz: Do you think society could function if everybody lived like they were retired?

Hessler: Absolutely not. [*Laugh*] But everyone has always regarded retirement as being the reward for having lived a responsible life. And I'm telling you, and I hope you remember, why retirement is a reward. The reward is that you are now in charge of your own agenda. Nothing else. There may be other perks also, but that's the primary perk.

Harkewicz: Well, I can't think of a better place to end unless you wanted to add something else?

Hessler: I can't really think of anything right now. It was fun to be able to talk about all those personal things.

Harkewicz: It was great to talk to you.

Hessler: I'm glad you enjoyed it.

Harkewicz: Well, thank you. ##

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