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OCEANOGRAPHY PROJECT

MARTIN JOHNSON

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## MARTIN JOHNSON

In 1916, Martin Johnson's job as a fisherman in the Puget Sound area sparked his interest in the ocean. Pursuing this interest, he attended the University of Washington. However, his college career was interrupted in 1918 by a stint in the Army coast artillery. Returning to college and later graduating, Johnson became a high school teacher in Seattle. Unable to continue with his graduate studies, he returned to the University of Washington in the position of curator at the Puget Sound Marine Biological Station at Friday Harbor.

He was awarded his Ph.D. in 1931 and then accepted a position with the International Passamaquoddy Bay Fisheries Commission. It was here that he actually began his career as a marine biologist; it was here that he conducted a study of the effects of the construction of a proposed dam on the herring population.

Upon completion of this report, Johnson returned to Friday Harbor to study marine wood borers that destroy wood. In 1934, then, he was granted a staff position by the Scripps Institution of Oceanography. Thus, his next eight years were his seagoing days, working on several plankton surveys.

With the onset of World War II, Johnson transferred to the University of California Division of War Research. He was initially contacted to discover what was causing the underwater crackling noise, which he later attributed to snapping shrimp. However, he then became involved with the deep scattering layer. After a brief return to Scripps, the Division of War Research recalled Professor Johnson to Bikini for "Operation Crossroads." Here he was able to survey plankton organisms and to observe the underwater noise changes in relation to the atomic bombs.

After his participation on the Capricorn Expedition, where he also studied plankton, Johnson became interested particularly in lobster larvae floating in plankton. However, now most of his work concerns material collected by other scientists on other expeditions.

Now back at Scripps and teaching, Johnson, accompanied by Sverdrup and Fleming, realized that there was no standard text that they felt integrated oceanography sufficiently. Consequently these three scientists wrote The Oceans as an expression of their concept of general oceanography.

TEXAS A&M UNIVERSITY  
ORAL HISTORY COLLECTION  
HISTORY OF OCEANOGRAPHY

INTERVIEWEE: Martin Johnson

INTERVIEWER: Robert A. Calvert

PLACE: Scripps Institution of Oceanography, La Jolla,  
California

TIME: 9:00 AM

DATE: July 16, 1976

RC: Professor Johnson, what first interested you in the ocean and oceanography?

MJ: Well, I think, perhaps, the first inspiration I got towards that was while I was working as a fisherman with the Alaska Packers in the Puget Sound area.

RC: This was 1916 to 1922?

MJ: That's somewhere near that. That was about the time I think I started, yes. About 1916, I think.

RC: Where was your home state?

MJ: My home state was Washington at that time. I originally came from the prairie countries in the central states.

RC: And then drifted up to Alaska in 1916?

MJ: No, I didn't get to Alaska.

RC: Oh, okay, just the Sound area itself.

MJ: Yes.

RC: And then you go into the Army in 1918. I have you in the Army in 1918. Is that correct?

MJ: Yes. Yes, I was a mere musician in the coast artillery during the latter part of the war.

RC: And while in the Army, did you always intend to return back to college and work in marine biology?

MJ: Yes. As a matter of fact, I was at the University of Washington when I was drafted into the Army.

RC: And then came back to the University of Washington in 1919?

MJ: That's right.

RC: And I see for a brief time you were a science teacher in Seattle.

MJ: That's right. I was a science teacher for a while in Seattle High School.

RC: Did you work on marine sciences while in Seattle High School?

MJ: My time was practically all taken up with high school work at that time.

RC: And then you returned directly from high school to graduate work?

MJ: Yes, that's right. I returned directly to the University of Washington. They asked that I come back as curator at the Puget Sound Marine Biological Station at Friday Harbor.

RC: And what did you do as curator there?

MJ: A better question is, what didn't I do? But, at any rate, I assisted in various types of experiments that people had that came there from different universities to work there during the summer; that was one of the things. I kept a number of the experiments going during their absence. And then I was also collector, of course, of material to be sent out to the University of Washington and other schools--prepared material in this way.

RC: Now, while you were at the biological station, did you collect data then for your Ph.D. dissertation?

MJ: Yes, I did. I got my Master's degree there first on material that I had worked on while I was there, and I got the material that I used for my Doctor's thesis while I was there. But I returned to Washington, to the main campus, to finish up my studies.

RC: That was in 1931, then, that your Ph.D. was awarded. And I notice in '32 and '33, you work for something called the International Fisheries.

MJ: Yes. I was asked to join the scientific staff of the International Passamaquoddy Bay Fisheries Commission in connection with the proposed building of a dam across certain straits between islands up there--a proposal, I think, that was first suggested by President Roosevelt at that time. I worked with them. Our work there covered surveys of the biology in both the Gulf of Maine and the Bay of Fundy and Passamaquoddy Bay, with respect to see what the dam might do to the herring fisheries that were important in the area at the time.

RC: And it was an impact study, then, so to speak?

MJ: Yes, I think you would call it that.

RC: And then you moved from there. Was this job only a temporary job? Was it a job to end after the impact study was over?

MJ: Yes.

RC: Because in 1933, you go to the University of Washington ocean labs.

MJ: Yes, that's right. After the commission was disbanded and we had written our report, or were writing it--which we did after it was finished, actually--I returned to Washington and to the Oceanographic Laboratories at Friday Harbor again.

RC: And what did you work on at Friday Harbor? What was your primary interest there?

MJ: Well, I worked on plankton, and I worked especially on marine wood borers that destroy wood. It was an especially good opportunity to do that because we were right near docks and other wharfs that were being destroyed from time to time. There I was able to show that the marine gribble has a definite short migratory period in which it attacks new wood.

RC: Now, but you're only there a year and then you go to Scripps Institution of Oceanography in '34. What was the first contact you made with Scripps?

MJ: The first contact I made with Scripps was a letter I wrote to Director Vaughn, T. Wayland Vaughn. I told him I wanted a position where I could study oceanography, and he offered me a position on the staff. So I came down and have been here ever since with only periods off to teach elsewhere.

RC: How large was the staff when you arrived here?

MJ: I would guess there were about eight or nine scientific members, and each of us had one assistant. As far as I know, that constituted the scientific staff. We had only one boat, a converted fisheries boat, at that time--a small boat.

RC: In the period between '34 and '42, did you make any voyages in terms of scientific research?

MJ: Yes. The Scripps--that was the name of the boat.... We made several trips, but they were only short trips actually, only about as far as the islands and so on. But I also made trips on a Coast and Geodetic Survey boat off the coast some distance in order to get farther out to sea where we could do things.

RC: And what were you primarily working on then?

MJ: I was working on the plankton at that time, taking collections with plankton nets and getting salinities and temperatures and so on.

RC: With whom else were you associated here at Scripps, in particular, in terms of your work?

MJ: Well, I was pretty much by myself because the other members all had their oceanographic discipline that they were working on. And plankton study, which had been started years earlier, had been practically dropped entirely. So I took over and started the work on the plankton surveys that have been a major subject ever since.

RC: When.... Let's see now. In this process, though, Vaughn is replaced, is he not, as director between '34 and '42?

MJ: Yes. I don't recall the exact years, but he was replaced along about that time by Harald Sverdrup of Norway.

RC: Did the direction of the institution seem to change with the replacing of directors?

MJ: Well, let me say this. Dr. Vaughn was very anxious for people to go to sea. This was one of his big problems, to get people to go out to sea and study the ocean. And when Sverdrup came here, of course, he had done a great deal of this kind of work and inspired the people to go out. And what's more, he was able to get a ship that was more ocean-worthy than the ones we had before. So it was about that time that we really began to feel what the ocean was like, aside from going out on Navy ships or whatever ships we could get on before that.

RC: Well, shortly after the change in direction, World War II advances. Who first made contact with you to work for the University of California Division of War Research?

MJ: I got the request from the director down there and from some other people who were acquainted with my work here, asking me to come out and see if I could help them solve the problem of ambient underwater noise--a crackling, or a very disabling type of crackling noise, that they had first thought might be something the matter with their instruments. They soon eliminated that, and there was no hint of any kind as to what this noise was. And why they picked on me, I don't know, except for the fact that I was a marine biologist and had done a good deal of work along this line. So I was asked to see if I could solve the problem of what this disabling noise might be. It seemed like nothing I would ever be able to solve either. But following it up, learning where it occurred, I finally concluded what was causing the noise and started predicting where it should be found as additional proof of what I was running into. It turned out that it was due to snapping shrimp, small animals that live on the bottom of the ocean at certain depths only and on only certain types of bottom and only in the tropical-subtropical areas. With this information, it was possible to predict where the noise would be found within the distributional area of snapping shrimp, all the way across the Pacific and the Atlantic as well. It was also possible to say something of what the noise would be like: would it be persistent or would it just be occasional? We found, of course, that

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once it's there, it's always there--particularly high at...around sunset and evening.

RC: So you arrived at discovering a deep scattering layer by travelling all the way down through the Gulf. Is that correct?

MJ: Now you're beginning to talk about something else.

RC: Okay.

MJ: We just talked about noise that's being produced by animals, the snapping shrimp and other animals such as the fish. For example, I found the so-called croaker chorus out here at the end of Scripps' piers. Now, you speak of the deep scattering layer. Now, that's another problem. That's where the animals, in this case, reflect sound rather than make the sound. They reflect sound that has been sent out by the transducers, the instruments used in the study. In that case, after I had rather cleared up this problem of the underwater crackling noise, they had this other noise, or rather other reflection. The fathometers recorded a false bottom, and they were uncertain about what this might be, what causes it. They finally called me in to see if I could do anything about that problem. At first it seemed as if I couldn't because I was interested particularly in the small organisms at that time, and it seemed as if they would hardly reflect sound back. But I made a prediction that if it's biological, I should be able to tell in a 24-hour period. I predicted that if it was produced by animals, the deep scattering layer would come up to the surface in the evening and go back down again in the morning. This had not been observed before. They knew there was a layer there, but they had not observed this movement. So we went out, and I had two assistants to operate the fathometer. I worked with the net as fast as I could, collecting also within the layer where the sound was reflected. And sure enough, the layer came up in the evening and went down again in the morning. And from then on, of course, a lot of people became interested in the layer and have learned a good deal about it since then. But it seemed, at that time, that the major thing was the plankton moving up and down and perhaps larger organisms following it, feeding on it, and that they were probably the ones that were giving the major reflection that was being picked up by the instruments.

RC: Were these the two primary problems that you worked on while you were at the University of California Division of War Research?

MJ: Yes, these were the major problems I worked on during that time. I'll have to take that back because after I had returned, I was asked to come out again to go to Bikini for the Crossroads Project down there with the atomic bombs. So I went down there and made surveys before the tests and then immediately after the tests in the lagoon and outside of the lagoon.

RC: What sort of surveys were you making?

- MJ: I was making surveys on the plankton organisms and on the type of noise that occurred in the lagoon with the hope that, perhaps, I would be able to say something about the bomb silencing the organisms. And I found there that immediately under the underwater explosion, there was some silencing of the snapping shrimp; but in the perimeters, in the outside areas, and some distances away, it didn't seem to affect them.
- RC: How long were you in "Operation Crossroads"? Were you one of those people that had gone in two weeks before, or were you....
- MJ: No. I was there before and I was there quite some time afterwards, taking surveys there and in some of the other lagoons like Rongelapt and Eniwetok.
- RC: Did you go back to any of the later tests with the hydrogen bomb?
- MJ: Yes. I was back there again with the hydrogen bomb. I was stationed at that time mainly at Bikini, but I was there through that and made some tests at that time.
- RC: The same sort of tests?
- MJ: Well, not in the area of the bomb, at that time. We were concerned with what was happening at Bikini at that time.
- RC: In particular, what were you concerned with in terms of Bikini?
- MJ: Well, I was personally concerned with seeing what changes had taken place since the first bomb. And that was what I was really more concerned with, I think, than anything else because the other studies were mainly physical studies of what impact the blast might have through the distance between the atolls.
- RC: Did you discover the atolls to be resilient in terms of recovering from the....
- MJ: I thought so, yes. I didn't see much change.
- RC: How were you tapped for "Operation Crossroads"? Who personally contacted you?
- MJ: Well, I think perhaps Roger Revelle might have been the first. I can't say exactly, but I expect it came through Dr. Revelle.
- RC: How long had you known Roger Revelle?
- MJ: Well, I had known Roger Revelle ever since I first came down here. He was a student when I came here; that would be in '34. And I knew Roger right along all the time.
- RC: He goes into the military when you go to the University of California Division of War Research, though.



- MJ: Yes, I think he was in there before I went into the Division of War Research. I've forgotten how long it was before.
- RC: So, did you see much of him while you were involved in the Division of War Research?
- MJ: I saw a fair amount of him, yes, because, as I mentioned earlier, I had trips to Washington, D.C., and trips up and down the coast; and he was always very helpful in getting me on proper ships with orders that helped me in my work that I was to do. So, I did have contact with him.
- RC: Now, after "Operation Crossroads," were you involved with the ONR in terms of funding, here at Scripps?
- MJ: Yes, I was for one year. I was involved in the study of wood boring organisms along with Dr. Menzies. After that, I have not been involved in any contract work, directly at least.
- RC: Alright, now, there are two or three questions, sir, I'd like to ask you right here about the "Crossroads". Did there seem to be a sort of an esprit de corps, both at the Division of War Research and at "Operation Crossroads," among scientists about a new break into the future, should I say, of oceanography?
- MJ: Well, I think that there was a feeling that the Navy was really getting interested in oceanography. In the early days when I was with International Fisheries Commission, the Navy seemed to have mainly an interest in keeping its ships on the surface of the water and paying rather little attention to the details. But during the war and following the tests, the Navy, of course, became exceedingly interested and has been one of the leaders, of course, right along and one of the supporters of oceanography.
- RC: Okay. And in terms of ONR support, as it's attached here to Scripps Institution, did that seem to make you optimistic about the future of oceanography, if I may use that word?
- MJ: Yes, I think so. I think I could say that because they provided funds that we had difficulty getting elsewhere.
- RC: When you returned to Scripps after the war was over, did there seem to be some sort of new direction, in terms of work to be done at Scripps Institution?
- MJ: No. I don't know if there was any great change in our objectives. We had all looked in this direction before we ever went on these various projects. This had been our big aim for the very beginning.
- RC: What about an increase in terms of size of the fleet and in size of the staff at Scripps. Did this come rather quickly?
- MJ: Yes, I think this is true. Following the war, the tests at Bikini,

and so on, our fleet and other facilities did begin to grow much more quickly than before.

RC: Were you involved in more voyages after the war, should I say?

MJ: Yes. I think perhaps I can mention there, particularly, the Capricorn Expedition, which covered a large part of the tropical area and subtropical areas of the Pacific Ocean. I was on one of the ships during that complete period.

RC: What did you do on Capricorn?

MJ: I was interested there particularly in making collections and studying the plankton.

RC: And did it seem to you as if, in terms of international cooperation, you were involved or did you realize the growth of international cooperation during these years in terms of oceanography?

MJ: Well, I had nothing particularly to do with that. But I can say that about that time, we began to hear about other people that were doing oceanographic work, or that wanted to do oceanographic work, and it became a period of great exchange of reprints and correspondence with different people in different parts of the world. And I think this resulted largely from the work that we did during the war.

RC: And after Capricorn?

MJ: After Capricorn, I have been concerned mainly with work on material that has been collected by other expeditions, particularly the expedition to the South China Sea and the California Cooperative Investigation up and down the coast, working on material on both of those collections. And during that time, I have been particularly interested in the recognition, distribution, and ecology of lobster larvae. The lobster that we're concerned with has a floating period in the plankton of up to eight or nine or more months--a very hazardous period about which we've known practically nothing--and we were unable to recognize the larva of our local species when we did find it. So these are things I have attempted to clear up and also to study the drift of other larva, particularly lobster larvae in a tropical area.

RC: You worked in the tropical area, now? I seem to have made an error. Are you working in the tropical area now?

MJ: No. I was working on material that was collected in the tropical area. I have been working here at Scripps Institution practically all the time, except for summer periods when I have taught up at the University of Washington. But the material has been collected mostly by fisheries' surveys in which the University of California, Scripps Institution, and, also international ships have been involved. And I've just been working on this kind of material. That's what

I'm really doing most of the present time. With respect to the increase in the study of oceanography, there's something I perhaps should have mentioned earlier--that Dr. Sverdrup and Dr. Fleming and I, together with other members of the staff, started a course in oceanography in which the different branches of oceanography were covered by the different specialists. We carried this on for several years. And this led to a considerable number of people coming here to get their degrees in oceanography, perhaps some of them getting it in meteorology. But this has been, I think, one of the things that has contributed a great deal to the study of oceanography. It actually resulted in writing the oceanography text, of which I am co-author along with Sverdrup and Fleming.

RC: But the textbook called The Oceans, though, which has pretty well been a standard text, did that evolve from lecture notes from work in that course?

MJ: Well, much more than that, I'd say. But, at any rate, that was what inspired us to do it, because when we started to teach, we found there was no real text that integrated things enough. There were texts to be true, but there was none that covered it the way that we felt it should be covered. So we started to think in terms of a sort of a syllabus, a small thing, but it kept growing. And, over four years, this is what we got.

RC: Was this the first course which integrated specialists in their discipline in a general course in oceanography, to your knowledge?

MJ: Well, as far as I know, it was the only course that attacked it from the same way that we did. I'm sure that people were taught in various universities integrating things, integrating subjects, but certainly there was no text.

RC: Now, when moves come to establish the University of California-San Diego here on the campus, did this seem to upgrade the science activity in this area?

MJ: When they....?

RC: When they established the University, was that....?

MJ: Oh. Well, I think it's certainly been a great convenience; and, I think, Scripps has been able to maintain its character in this. In other words, Scripps Institution was largely responsible for the establishment of the campus here. And there's always the feeling that finally "the tail would wag the dog". But it has turned out, I think, very well. It has done one thing. Formerly, when we had students working for us for a doctorate degree, we often found that they were short in some subject matter, so we had to ask them to return to UCLA or to Berkeley for further studies. Here and now, it is much more convenient in that respect so I think that we have been gainers in this way.

RC: What about the increase in the size of the staff since you've been here?

MJ: Well, the staff has increased tremendously. I don't even know how many people we have here now myself.

RC: Did there seem to be more interchange among faculty when the institution was smaller?

MJ: Yes, I think this is true. There was more interchange than there is now. I feel that there has developed certain divisions where people know, perhaps, too little about what the other fellow is doing. This, I suppose, is something that is bound to happen because we used to have our weekly meetings, our weekly seminars; and there we would speak about what we were doing, whether we were ready to publish on it or not. As a matter of fact, very often we found that an efficient manner was to call on somebody just an hour or two before he was asked to speak so that he would come up there and speak of the problems that he has. And, in this way, I think we learned a great deal and were able to give a great deal of help to different members of the staff.

RC: Now, did there seem to be an institutional policy of going to sea in this period--that is, were you encouraged to go to sea? Did most people seem to go? Did you stay out there a longer period of time?

MJ: Yes. This was a period in which there wasn't any excessive pressure, but there was a little pressure to get out all the time and see what happens out at sea--to take our rubber boots off and stop just working in the tide pools or off the end of the pier and to get out and see what really happens in the ocean. And I think we succeeded in really doing that. Dr. Sverdrup was largely responsible; he came right with us and stood for six hours on and six hours off, just like the rest of us. And I think it was all to the good.

RC: I notice now that you're working on expedition collections. Do you see the trend in oceanography to be more and more laboratory work and accumulating and evaluating through the use of computers and so forth, data acquired elsewhere?

MJ: Well, I think there's much more of that than there was before, but the laboratory work.... Of course, we've always had this, and this always goes along with the field work. It's difficult for me to say, I think, just whether we have more of the laboratory work. Perhaps we do have more of the laboratory work than we did before because, as I've already said, collections come in and they have to be worked on. And when you have several ships going out collecting, in a month's time you can collect so much material that it takes you a year or two or three years to work it out. So it does require an enormous amount of laboratory work of various types. And, also, of course, there is experimental work with live materials and so on and more facilities to do this kind of work than we had before.

RC: Do you see any new directions, let's say, that marine biology will take in relationship to oceanography in the future?

MJ: Well, we can't start too much new direction yet, I think, in oceanography itself. We have a lot to do yet with what we've been carrying on for the last 10, 15, or 25 years. We have a lot of collecting to do in order to evaluate the various impacts on the animals and plants in the sea. In many cases, we may recognize the adult, but we don't know the young stage. Very often this is the critical period in the animal's life. So there's a great deal of traditional, biological, oceanographic work to be done--surveys at sea. And this, I'm sure, will be carried on for a long time. There will be more and more work, I think, going on with respect to the energies in the sea, the building up of organic materials and its utilization by the different organisms, all the way along, clear up to the harvestable fisheries products. And I think we will continue doing that kind of thing for a long time yet.

RC: Now, over the last several years, it's been very popular in magazines and in, if I may call it, pop writing, that the sea will be, in effect, the protein source for man in the future. Would you agree with that?

MJ: Well, I think we will get more than we are getting now, but it is not an inexhaustible thing by any means. But I think that we can harvest things that we are not now harvesting that perhaps would contribute to the resources that man can use. And this would, perhaps, be along the line of utilizing certain plankton organisms. We can easily destroy a fisheries by over-fishing. But it's going to be pretty hard to do very much of depleting the plankton material, I think, because it's so widely distributed and so abundant that it would recover very quickly. I think now, particularly of certain Euphausiids, certain krill, that occur in the Antarctic in tremendous numbers and perhaps elsewhere. I'm sure that we are missing many things that the whale is able to get. The whale knows better where to go collecting than we do. And we may learn a good deal about where we can go and collect and get material other than the normal fisheries products that we usually depend on at the present time.

RC: Then is it fair to say that you see a future for mariculture, aquaculture, and these sorts of ideas?

MJ: Yes, I do. I think there is. This is aside from the field collecting?

RC: Right.

MJ: I think there's a great deal that we can learn about that, but I think there's another way that we might go at it, also. And that is to improve the environment because in many cases, I think, we could increase our product if we could make the habitat more extensive--such as artificial reefs, for example, where lobsters and crabs and certain types of fish find hiding places. I think a great deal

could be done along that line. Otherwise, it's a matter of experimentation. Certain animals are perhaps more usable for that kind of work than others. Speaking of invertebrates, of course, mainly the crustacea and the mollusks, I think, are the ones that are most promising. And, of course, a good deal has been done on both now.

RC: Now, there has been, also, in terms of pop writing--if I may use that.... I'm thinking, particularly, about this week's Newsweek, with certain assorted naturalists talking about the oceans dying, the dangers of destroying the species in the ocean, the ecology changing until the ocean is no longer productive. Has this been your reaction to the oceans?

MJ: Well, the ocean can stand a lot of change and recover, I think. But certain areas subject to pollution of various types, I think, are in danger. And I think this is something that has to be watched very closely so that we don't destroy the various areas where we get fish. And some of our major organic-producing areas are coastal areas, so this means that pollution might very easily be a very serious matter.

RC: Well, now, I know this is a very difficult question to answer, but, in terms of your own work, what single accomplishment do you consider perhaps your greatest achievement?

MJ: Several people wouldn't agree with me on this, I'm sure: some would very likely say the discovery of the underwater noises and the information provided on the prediction of this noise and how it will behave and so on, others might say it was the work on the deep scattering layer. Personally, I think my greatest contribution has been in the field of marine biology that has dealt with the primary source of organic material--that is, the phytoplankton and the utilization of phytoplankton, really the realization that you have to have something that can graze on it. And if you have something that can graze on it, you have to know something about that. So this means that we have to put in a great deal of study on the microorganisms in the sea and how the microorganisms are affected by the various factors in the environment and how they, in turn, are utilized by the fish that we harvest from the sea. In other words, my greatest contribution, I think, has been in general oceanography as expressed, I think, in the text The Oceans. If I were to write my part again, I would use the same outline.

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