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# Polovina, Jeffrey ~ Oral History Interview

Edward Glazier



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# Interview with Dr. Jeffrey Polovina by Edward Glazier
*Summary Sheet and Transcript*

## Interviewee
Polovina, Jeffrey

## Interviewer
Glazier, Edward

## Date
August 1, 2016

## Place
Honolulu, Hawaii

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## Use Restrictions


## Biographical Note
Dr. Jeffrey Polovinawas born in Troy, New York on September 30, 1948. He obtained an undergraduate degree in mathematicsat Carnegie Mellon University and later a Ph.D. in statistics from the University of California, Berkley. He began his career in academics teaching at the University of San Diego. He moved to Hawaii and began working at the University of Hawaii Sea Grant office. He later went to work for the National Marine Fisheries Service and has served as the Chief of Ecosystem and Oceanography Division for most of his career. At the time of this interview in 2016, Dr. Polovina is planning his retirement from the center.

## Scope and Content Note
Interview contains discussions of: ecosystem modeling, oceanographic studies, methods of research in the Northwestern Hawaiian Islands, the Western Pacific Regional Fishery Management Council, ocean acidification, climate change, pelagic communities in the West, Central, and South Pacific, meteorological data, andthe future of marine research.

This interview with Dr. Jeff Polovina gives a glimpse into his life, his research, and the work done by the Honolulu branch of the National Marine Fisheries center from the late 1970s to the present.

## Indexed Names

Kamau, Howard
Inouye, Senator Daniel
Paulo, Walter
Shinsato, Bill
Shomura, Richard
Walsh, William

**Transcript**

**Edward Glazier:** This interview is being conducted as part of the Voices from the Science Center's project funded by the Northeast Fisheries Science Center. It is also part of the Voices of the Fisheries project supported by the National Marine Fisheries Service Office of Science and Technology. I'm Edward Glazier and today, August 1, 2016, I'm speaking with Dr. Jeffrey Polovina at the Pacific Island Fisheries Science Center in Honolulu. Dr. Polovina has worked for the past 35 years conducting ecosystem research throughout the Pacific and during much of that time he served as the Chief of the Ecosystem and Oceanography Division at the Center. Jeff, I thought maybe we could talk a little bit about your early career and then we'll progress through various topics from there.

**Jeffrey Polovina:** I was born in upstate New York, Troy, New York on September 30th 1948. I went to college and got a bachelor's degree in mathematics (Carnegie Mellon University) and was looking to do more applied work with mathematics and ended up going to the University of California[at Berkeley] and getting a Ph.D. in Mathematical Statistics, which is a little more applied branch of mathematics. I initially thought that, well, I would teach university, but I felt by the time I got my Ph.D. that statistics really wasn't a field that was really interesting to me. But I learned that [in] marine population dynamics there were areas where quantitative models could be used to estimate fish population changes and estimating population size based on removals and catch rates from fisheries. And I always loved the ocean. I grew up on the East Coast, sailing,and when I came to the West Coast and I'd taught for a year at San Diego, I got involved in SCUBA diving. So the idea of combining a career with an area that I really enjoyed was pretty ideal.

I didn't end up going right into fisheries, I ended up going through aquaculture. I got hired to look at, build population models of organisms in ponds that were being grown out for aquaculture, and using these models to determine what the optimal stocking size was, and harvest time. And I just happened, this was in Hawaii, I just happened,well I ended up in Hawaii because I was sailing, I took a break from from academic work, and sailed around, traveled and sailed around the Pacific and ended up in Hawaii and was offered a job there with the University of Hawaii SeaGrant Program. I heard the salaries were better over at National Marine Fisheriesand walked over to visit the lab director Richard Shomura and to see if he had any jobs. He asked me if I could do ecosystem modeling. And I said "sure."Well I wasn't really sure what that was but you knowwhen you're looking for a job that's . . . you want to be positive.

**EG:** What year was that?

**JP:** That was in 1978.

**EG:** Wow, that's quite early for ecosystem thinking.

**JP:** Yeah, well the Center, I mean, Lab at that time, so the Honolulu Lab was part of the Southwest Fisheries Science Center, and Richard Shomuraand some of the other -- well, Fish and Wildlife, State of Hawaii, the university -- all had this project evaluating the resources of the Northwest Hawaiian Islands. And they had been working on this project since the mid '70s and had a program review and one of the reviewers said they needed to bring an ecosystem model together to integrate all these different parts people were studying - plankton, and tiger sharks, and sea birds, and corals, and coral fish - and so there was a need to bring this all together in an ecosystem model. So I was hired part-time at first, and then full time and . . That was my first job, really, was to build an ecosystem model. And we chose the island of French Frigate Shoals where people were studying 20 different components of the ecosystem. And so this model was a way to really do a budget to see how, what animals were eating, what tiger sharks were eating versus the biomass of reeffish and the productivity there. If that all made sense or if there were some gaps in the energy flow, we were missing things and that model subsequently has been used by lots of different investigators around the world and adapted and modified and improved upon. But it's become the basic, most widely used ecosystem modeling approach.

**EG:** Could we step back a minute and . . . did you say where you did your doctoral work?

**JP:** University of California, Berkeley.

**EG:** Berkley. Okay, and what was the topic there?

**JP:** Well, that was, you know, mathematical statistics.

**EG:** Okay.

**JP:** So I was interested in building a robust estimation approach when you had missing data . . . This was a part of my thesis.

**EG:** Okay, yeah, that seems quite pertinent [to fisheries research].

**JP:** Yeah. I mean - you know,it's funny that having a quantitative background. When I–when I started working in fisheries, I never really had any biological courses or training. And for some people that presented some problems and it was a bit of a challenge for me. But it's easier, I think, to come in with quantitative skills and pick up the ecology, than it is probably to come in with the ecology because – and pick up the quantitative skills, because it allowed me to…to think of things from the standpoint of experimental design, morerigorous approaches. It's allowed me to learn whole parts of marine science. It's quite quantitative, ecosystem modeling, climate modeling, population modeling so– and oceanography so having a quantitative background is really a good foundation and but I was really interested in the oceanography and I– and I was really fortunate that Richard Shomura, ourLab Director, took the time to mentor me in those early years. He would call me into his office on some bogus question and we'd just sit and we'd talk and he'd sort of – he'd sort of ask questions like "Well, gee, why is it that we see, you know, where there's rocks and vertical relief that's where all the fish are? And we'd go out

on flat areas and there's no fish out there, and, you know, what's, what's behind that? You know, what is regulating how large a population can get?" And we – we talked about the role of predators and prey, and bottom-up food webs, top-down removals, impacts that way. And I really gained an appreciation of a way of thinking about the ecosystem that I hadn't really had because I came from a statistical background and a modeling background and so that was so valuable to spend a number of years just learning more from an ecological perspective on the marine system. And that got me very interested. I started out doing stock assessments for bottom fish and lobsters taking commercial fisheries data and fitting models to it. But I realized that just fishery removals were only one small part of …of understanding what causes populations and ecosystems to change and the other parts were related to the oceanography, what the ocean conditions were doing, the temperature, the productivity, what the predators and the prey were doing. So that really led to a lifelong interest in the broad scale ecological sciences.

**EG:** Very interesting. Was that early stock assessment work done for management purposes?

**JP:** Right, yeah. They–uh… they the Northwest Hawaiian Islands had and the Hawaiian archipelago had fisheries for spiny lobsters, and bottom fish and so one of our main clients was the Western Pacific Regional Fisheries Management Council. They were responsible for managing some of these fisheries and– and so providing them stock assessments was a primary product.

**EG:** And that was fairly early work I mean um…

**JP:** Yeah.

**EG:** They weren't too – we were far from the years when fisheries development was at the fore. I mean, these were early management efforts.

**JP:** Absolutely. I mean that's– that's– that's the biggest change over the years has been– when we began work up in the Northwest Hawaiian, islands the whole focus was to find resources that would be economically beneficial to the State of Hawaii. It was really, identifying resources and then identifying what sustainable yields would be so they wouldn't be over-exploited, and then I took on a project out in the Western Pacific in the Marianas, doing the same thing, taking our research vessel out there for many years, mapping the bottom fish, the shrimp resources and estimating sustainable yields that could be then used for fisheries development. So this was in the late '70s the early '80s and really the focus was to promote increase utilization of marine resources in the archipelago systems and in the open ocean system. I mean, it was in the '75 that the Magnuson-Stevens Act was passed and they had areas within 200 miles that were excluding foreign fishing and so this was an opportunity to develop the U.S. resources.

**EG:** We've come quite a long way now,too.

**JP:** The pendulum's totally swung! Uh… now it's people want to protect the ecosystems, and– and if in some sense it seems like, you know, the pendulum has swung so far that the idea of having sustainable fisheries in the U.S. is under threat. I think there's a sense that well, if we protect our areas that will be that – there's a general feeling that we should do more of that, but then the question is well, where do these, where do these fishery products come from? We're

importing lobster, importing shrimp, and so in some sense, there's a danger of exploiting overfishing overseas while we're closing big areas around these archipelagos. But I think there's a balance that's needed and because we do value– the public does value knowing that there are protected areas in the ocean, just like parks that maintain a fully complete ecosystem. It's just that the balance of trying to make sure we recognize there's also a need for well-managed fisheries.

**EG:** One um… troublesome part of that is that it appears that even scientific work is possibly going to be prohibited in some of these reserves. You know, after so many years of generating scientific information that would inform the management of fisheries. Suddenly we're at a point where we, we, may not even allow that to occur. Is that a concern of yours? I mean, some of these executive orders have seemed to proceed without a lot of scientific input.

**JP:** Certainly, it's a lot more difficult in these – in these reserves to do work. We used to work up there…extensively. We don't do much anymore, just because of the regulations…and the issues. But there's– there's– but there are, you know, a coral program, a monk seal program, a turtle program is doing work up there, it's just not the kind of invasive surveys that um…that we used to do in the past. We used to harvest fish and look at the diets and so it's still possible and its… there's just a lot more oversight on it which comes with additional work but it's certainly still possible to do that.

**EG:** I wanted to ask you a little bit about some of the more enjoyable projects you've been involved in, or maybe some of the ones you deem most important or that had an outcome you were particularly glad to have occurred.

**JP:** Yeah, well, some of the … the development of the Ecopath model was very satisfying.It brought together a team of people collecting data and has been the basis for a lot of ecosystem modeling, going forward.

**EG:** I mean to ask what the name of the model was.Ecopath?

**JP:**Ecopath. And some of the other work that we've done, I guess, in terms of the actual research itself um… putting tags on animals. The technology has allowed us to understand how animals, pelagic animals in particular was my focus, things like turtles, tunas, and sharks use the ocean. Putting tags, putting small electronic tags on animals that report back by a satellite where the animals were moving, and where they're diving, what depths they're using, have really provided a lot of insights about how animals see the ocean. How they use the ocean. What are hotspots. What are migratory pathways, and so we really been able to contribute a lot to the field of science through these– these projects by combining in particular the movements of animals, but also developing techniques from satellite, remotely sensed data to understand more about what it is the oceanographic characteristics, where animals are foraging, where animals are migrating. So that's, seeing again, that's part of the big picture, seeing how that sort of all ties together has been satisfying developing tools and approaches.

We've – our understanding of large scale ocean changes and how that's linked to populations, ecosystems and populations, has been a pretty interesting area of development, and we've

certainly been part of that with some of our work in Hawaii, but it looks at this whole concept of that populations might change in response to large scale atmospheric changes which can impact the ocean, which can impact the food webs. These are referred to regime shifts and it was in the late '80s that we were a part of a group that studying these all across the Pacific and so changes off of Japan, off of California, and off of Hawaii, often very simultaneously, linked to very large scale atmospheric changes and documenting those changes provided a new picture on how populations change. They might be fluctuating year to year over decades and then rapidly reorganize into another state.

**EG:** We hear so much about um…ENSO [*El Niño Southern Oscillation]*, but we don't hear that much about the PDO, PacificDecadal Oscillation. I often wonder why, does one supersede the other?

**JP:** No, I think they just, I mean the PDO is very important for these decadal changes and the ENSO is, can be a very dominant effect but it has inter-annual time scale so we'll see PDO effects that could affect organisms in the Northwest Hawaiian islands on decadal scales, whereas the ENSO is inter-annual, yeah.

**EG:** Yeah so, it seems, it's in the news. I guess–

**JP:** It is because it's a strong feature and it has a lot of ramifications and so. It is storms off California very dramatic, sea lion die-offs in California. Hawaii is sort of– the main islands– are sort of in an area where we don't– we're sort of above– far enough above the equator that we don't really see the ENSO effects, and we're far enough south of the temperate zones that we don't really see so much of the mid latitude response of the ENSO, so we're sort of in an area– although this past year, we've seen a lot of coral bleaching that's partly linked to ENSO and partly linked to PDO.

**EG:** And in recent years I – it seems we don't have a truly extensive database on cyclonic activity but the distribution of cyclones appears to be, at least in my short time in Hawaii, seems to be a greater frequency of storms seem to be making their way to the islands.

**JP:** Yeah.

**EG:** Does that um… I would think that upwelling associated with the presence of cyclones might have some implications for pelagics. Do you have any ideas about that?

**JP:** That is an interesting…We've looked at some of that. I–I–I think that– I think that a lot of the climate models are suggesting that both the heat in the Eastern Pacific will increase, generating cyclones and the wind fields will be such that will allow them to propagate further. So we probably will be seeing, in the future, more cyclones coming though. And they do, of course, produce increased mixing, which would bring nutrients up but their footprint is probably fairly small um… we've seen – it's been interesting, we've seen turtles with tags encounter these types of storms and they'll dive under the storm and you can tell they're being disturbed by it. They'll go deeper for a period of time and then come back up to the surface so they're able to survive them that way. But overall, I think the implication of climate change, and we've been doing a fair amount of work using the output of climate models and coupling them with ecosystem

models to look at how the pelagic system will change, and we see the pelagic subtropical region, the region that the tunas, and bill fishes, and oceanic sharks use will expand northward and eastward into the Eastern Pacific, but the carrying capacity will decline, the amount of productivity per unit of area will get lower because there's increased stratification, warming of the surface, which makes it more difficult to mix up the cold nutrients, so the overall projected impacts will be less productivity, less able to support populations of pelagic animals.

**EG:** Does that mean productivity will shift elsewhere? Be redistributed somehow?

**JP:** Certainly, I think that in the subtropical Pacific and the Pacific Islands region, we're getting– there's very little of positive that we know about from climate change impacts. The pelagic system is going to be less productive, the tunas will be, have a lower number of tunas, the carrying capacity will be lower. Coral reef ecosystems will suffer with increased bleaching with increased ocean acidification. Sea level rise will have impacts on a variety of factors, agriculture, freshwater, human habitation. Whereas you go to other parts of the Pacific, the Northern mid latitudes and more northern latitudes, there'll be winners and losers that some animals that move northward, or that take advantage of the warmer conditionswill do better and those that are more cold tolerant will do less well. Down here in the Pacific Islands region, it seems like we haven't identified any real winners…

**EG:** Interesting. The work environment for you folks at the NMFS lab and Kewalo Basin and um..now the group is in Fort Island– it's evolved over time. I was at the lab years ago, but I've been asking people about that. How has that affected your work– or have you enjoyed the changes? Or a shift from the campus to elsewhere has been notable?

**JP:** Well, first let me just follow up on the most enjoyable work–

**EG:** Oh sure.

**JP:** – yeah, a couple things. So I've just had a tremendous opportunity to work in lots of different ecosystems. I've been – a lot of people told me over the years that I have the best job in the agency because I have a small team of people who are really talented and, so we're able to engage and working in a number of different ecosystems. I've been out in western Australia actually, in the water, putting tags on big whale sharks. Been on research cruises down in Antarctica. Had a couple Fulbrights in Kenya and the Galapagos. Worked on ecosystems all along the Pacific Rim, the Pacific Islands. So seeing lots of different ecosystems has been interesting, and I guess, I see myself as more of an ecological detective. We–we're usually looking for, trying to understand why there's been a change or why we're seeing increases or decreases in certain communities, or trying to understand why animals are migrating in certain areas.

And there other thing that's been really enjoyable is just mentoring people in my team and bringing in people who are fairly new to the field and then over the years, seeing them grow and take on more responsibility. Many of the alumni of my program now are higher levels in the agency and that's been satisfying to–to mentor, to mentor younger staff. So, the working environment, being with the university, had a real advantage of developing some collaborations

with faculty over there and oceanography and being on the faculty– the affiliate faculty - in two departments over there, allowed me to serve on student committees, go to seminars, have graduate students that we'd employ. Moving out to Fort Island, of course, has been really positive, a much better facility, a much better lab spaces. People are all together in the different programs uh…close to the ships. That's worked really well. The downside has been, it's much more difficult to interact with colleagues at the university or go to seminars or get on campus for student committees and things of that nature. Overall, I think it's been positive but there is that downside.

**EG:** Right. Wonder if there's anything to be done to help get students over here? I–I mean it's, there's some distance and traffic and uh…

**JP:** Yeah, and the base access.

**EG:** Right, base access…right. What uh… I've asked people also about the region and what you might consider unique about the region in terms of affording research opportunities that you might not otherwise have had, or– what is– how about the context of all this?

**JP:** Yeah.

**EG:** Being out in uh… one of the most remote archipelagos in the world

**JP:** Yeah.

**EG:** It doesn't seem so, it seems like we're sometimes right there on the mainland, but we're not. We're a long way from anywhere.

**JP:** Yeah and one of the things that means is there's…the staff out here is relatively small for the number of issues and problems. It's characterized by a high diverse ecosystem, so there's many species and–and a range of issues and a relatively small staff to address those. So, it's been really positive from the standpoint of you can, sort of, take on projects and work on lots of different things, whereas in a another facility where you have a large staff, you might be assigned to one project with maybe a team of people so, you can get to be acknowledged or recognized by making a contribution um… in–in a– without a lot of competing– I guess I don't quite know how to say that but it's sort of like you're a– um… you can be a you know big fish in a big pond, I don't know, it's sort of uh… you can really uh… have the opportunity to work on lots of different problems. You don't get pigeon holed and there's a real needto address issues that are really intellectually challenging. But I guess it's characterized by that diversity of ecosystem, and diversity of problems is not– there's not one or two big fisheries that are dominating everything that all the attention goes to.

**EG:** Right and we have um… Guam, and the Commonwealth of the Northern Marianas, um… American Samoa, these are all part of the region and they are quite distant from each other.

**JP:** Yeah.

**EG:** And from Hawaii.

**JP:** Yeah. Over the years we've, you know, we've worked on and across the Pacific with bottom fish issues, various surveys that we have…oceanographic surveys, and part of what we like to do is bring staff from these departments out on cruises to develop collaborationsand service mentoring and training as well.

**EG:** You went through a few of the technological changes that have occurred. That–that led me to think about the new research vessels you have at hand now. The *Cromwell* sounds like it was a trusted vessel for a long time, but rolled quite a bit from what, I hear.

**JP:** Yeah.

**EG:** How– are you enjoying the new research vessels?

**JP:** Yeah, I've done all my field work on the *Cromwell* um… and I've only been on one cruise on the newer *Setti*. It's got a different feel because it's so much bigger, you're off the water, but it is a lot more stable and can certainly bring a lot more people on a field party. The uh… when I started on the *Cromwell,* I remember someone we–we uh… had movies at night and you had to um… you had a I guess it was a 16mm projector that was– we'd get these movies from the navy and you had the actual projector in the galley projecting against a screen or a wall and even if we– even in a fairly sheltered area, someone would have to sit next to the projector and catch it in case we rolled too much and it fell over. Of course, now everything's all on video and people can watch movies in their own room and uh… so it had that sort of camaraderie where you would just have to assemble in a commonareas and there was more opportunity to– some of the evenings I spent with some of the Hawaiian crew like Howard Kamau sitting on the fantail doing nightlights and just talking about his experiences were a really rewarding part of that whole cruise experience, getting to know some of the different backgrounds of people that were part of the crew and were part of the old Hawaiian experience when I was in my early 30s was really a memorable experience.

**EG:** A lot of those folks are gone or leaving now. One of the benefits of oral history is to capture some of that. It's often the case though that it comes too late. I can think of some old fishermen that are gone now who would have been wonderful to interview

**JP:** Uh huh, sure.

**EG:** Walter Paulo from the big island and folks like that. I think he was part of the original long line effort uh… out of Cross, if I remember. Did you get work out of Cross Seamount at all?

**JP:** No I didn't. Um…uh… no.

**EG:** Any of the seamounts– have seamounts been part of your…?

**JP:** No, not really, no. I think they're an important part of the ecosystem but we haven't really done– we had one project looking at the acoustics and some of the trawl catches on the seamounts. Yeah, some of these old fishermen were interesting to deal with. There was this guy Bill Shinsato who was a bottom fish fisherman. When I first started working here, I spent a fair amount of time analyzing some of the commercial bottom fish data and I thoughtI identified a pattern of how the species would change in the ecosystem with fishing and was using some of

the data that Bill Shinsato provided and I went down to his boat to talk to him about it and he came out of the engine room, up to the deck all covered in oil and grease and I explained that I used his data and found that, you know, when I looked at the locations of the catches there were quite different patterns depending on early in the fishery and later in the fishery and he sort oflaughed and said "well, I never put down the right locations anyway because I don't want anyone to know" so after like 6 months of work analyzing this fishery data that soured me to use fishery data for some time but it's gotten better with the long line boats, much more accurate in their reporting.

**EG:** Right, and now VMS [Vessel Monitoring System] is being used in much of the country.

**JP:** Yeah, yeah, yeah so…yeah the fisheries are providing a lot more really good data uh…size data and the observer data and sowe're learning a lot about the ecosystem from those tools. We have a lot of satellite, remotely sensed data that are measuring all parts of the surface of the ocean, the temperature, the currents, the amount of plankton, winds. We have vertical structure information coming from floats and buoys. We have ocean models that have really come of age that are giving us a lot of oceanographic information. So thinking about how that technology has changed our– the data availability from, you know, the late '80s where we had very little information. 1982-83 it was a year later– it was a big El Nino, one of the big El Nino's of the century and we're working up in the Northwest Hawaiian islands sampling lobster and it wasn't until a year later that we learned there was a big El Nino up there. Now, of course, we get weekly forecasts and can predict El Nino's or at least predict the likelihood of them, and track them as they occur so… speaking of technological–technological changes both the uh… putting tags on animals and sending fleets of animals out to see how they're using the ocean, but also the amount of data we have now available has really been a big change.

**EG:** That's fantastic what's available now, even to the public.

**JP:** It is.

**EG:** I look– look at meteorological data, as if it's– it's almost real time. I think there's a 6 hour initialization of global temperatures now that's available to the public. Incredible.

**JP:** Yeah.

**EG:** Could you talk a little bit about the integrated ecosystem assessment program? I think you're key to that here in Hawaii is…West Hawaii I believe?

**JP;** Yeah so for a number of years now,we've been conducting work off west Hawaii and the idea of the integrated ecosystem assessment is to begin by doing some scoping sessions, meeting with some managers and stakeholders in the community to identify what some of the issues are and some of the concerns. Looking at collecting some data to fill in some blanks in our knowledge of ecosystems. Building some models to identify how management strategies might impact the ecosystem. Developing indicators to look at how the ecosystem is changing and so this is a broad generic approach and we've applied to the West Hawaii system and some of the areas of focus are both the new shore, the coral eco–reef ecosystem, and there we really

benefitted from the work the state of Hawaii is doing with Bill Walsh, really an extensive survey system with their fishery reserves.

**EG:** Was that calculated into the original decision to uh… to work that–

**JP:** It was, yeah. I mean West Hawaii was picked because it was attractable system but a really unique system that's got the largest contiguous reef in the Hawaiian archipelago It just has a diverse, very passionate community of users. We hold science symposiums over there and we get tremendous turnout from NGOs [non-governmental organizations], from federal and state agencies, but also just from the– a lot of residents there that want to know about the water quality because they swim there everyday or they want to know about what the impact of aquaculture– cage culture - is, or energy impacts there's a lot of– of uses of that ecosystem from tourism, fishing, cage culture, energy, so it's an ideal area to try to bring a lot of these disparate uses and interests together. We've expanded beyond the corals, we've looked at … there's quite a number of protected species in that area and one of the products is we've identified areas where there's key forage habitat for some cetaceans, and how they're linked to a food web that's based on a community of organisms that are related to the bathymetry, to the island topography.

**EG:** Right, I wouldn't want to say that anything's truly fully bounded at all, but that system does seem to have some discernable bounds in a way. They are localized interactions.

**JP:** There are, yeah, some of the recruitment of yellow tang seems to be really uh… the scale of the island's scale uh… There's some really interesting oceanography there in terms of eddies that spin up there uh… warm-core and cold-core eddies that aren't found anywhere else in the archipelago um... due to the size of the island and the sighting of it in the tradewinds in the North equatorial current area.

**EG:** And the orographics there?

**JP:** Exactly, yeah, yeah.

**EG:** It's an exciting program. How – where does it stand? I think you've done two majors or you've had two symposiums.

**JP:** Right, yeah, and we've just completed a document that provides ecosystem indicators looking at…taking a lot of the data that's available. Mostly from this first cut, it's the coral reef data. Looking at changes in coral cover, changes in fish composition, fish biomass, changes in the environment, changes in things like um… you know, the number of septic tanks and other factors that could impact the near-shore environment um… and uh… unfortunately, this year was the – well, 2015, 2016, uh… in 2015, we had very high coral bleaching across that coast and very high coral mortality so the bad news is that it's high mortality, the good news is we have a monitoring program to look at the recovery of corals and learn more about how resilient some corals, or what causes some regions to be more resilient than others. Is it the oceanography? Is it the composition of fish that are in a community? Is it the human use of it that, to try learn something about why some parts of West Hawaii suffered high mortalities from bleaching and why other parts seem to be fairly immune.

**EG:** So is you - I think you're saying that there is some recovery when there is a mass bleaching event. Is that the end of the line or?

**JP:** Yeah, it varies there – in – in – in some cases, they recover. Zooxanthellaethese organisms that provide – convert sunlight into energy they recruit back into the corals and in other cases, there is no recovery, algae overgrows the corals and they break apart eventually.

**EG:** Does that still leave a platform for potential growth in the distant future?

**JP:** It could, it could. It could be a platform for other coral settlement on that hard substrata, and um… in the short term, it certainly still provides habitat for organisms that want to hide in it and use it as shelter but over the long term, if there's not a recovery of new coral or re-growth of coral there, then you'dlose the complex habitat and lose your fish community.

**EG:** Would you say this happened in other parts of Oahu?

**JP:** Yeah, it's been island wide um… and it started in 2014 and now 2015 and we're unclear if we're going to see it again in 2016. So, it's been a fairly anomalous event, or an unprecedented event, to see so much bleaching and so much mortality.

**EG:** Do you have a sense of causal factors here?

**JP:** Well, it is the warming. The temperatures around Hawaii…it's related to those increased cyclones, it's a combination of both warming in the equatorial region, the El Nino, and the Pacific Decadal Oscillations, the weaker tradewinds, the increased persistence of the sub-tropical high, which is related to weaker tradewinds that have impacted temperatures in 2015, very warm, 2 degrees centigrade above the maximum we've ever seen in the past two decades from satellite data. So 2015 was quite anomalous and the bleaching is pretty much just a direct response to that.

**EG:**To temperature – how about acidification?

**JP:** Well, we've seen in – in – in oceanographic samplings uh… the ocean is becoming more corrosive, acidification is an issue. I'm not aware of whether that's – in Hawaii how that's linked. The thinking is that it'll result in slower growth rate and higher mortality and I'm not sure to what extent that's been documented. It's certainly a phenomenon that's been observed in other environments and laboratory environments.

**EG:** But here at least it seems the predominant factors is temperature.

**JP:** Right, by the dominant factor is bleaching and it's temperature.

**EG:** Gotcha. Very interesting. Well, we might start to wrap this up a bit. Do you have any thoughts about the future of ecosystem level research, and maybe NOAA research in the region?

**JP:** Well, yeah, I think it's – it's a great time we're – the tools are getting better, the uh… the uh… opportunities uh… are still there, there's still moving uh… moving the management forward to more of an ecosystem approach is uh… is gaining traction uh… the climate issues are very real and they're only going to get more severe, um… and – so I think it's an area – the

research that I've been doing in terms of ecosystems and climate is only going to gain more attention and become more of an important area to pursue.

**EG:** I have noticed that some – maybe we could say, relatively highly specialized scientists in the marine realm have been less ready to grasp ecosystem concepts and programs. Perhaps I often - well, I often hear that they feel there hasn't been sufficient advancement in the field to be able to contribute significantly to ecosystem - ecosystem thinking but at the same time if you're an ecologist or ecologically minded you – you're ready to go and you need data, and how do you feel about that? How do – do you think it's possible to move ecosystem based management forward in the absence or perceived absence of certain kinds of data or analysis?

**JP:** Well, yeah I – certainly you need data uh… you need an understanding, so it does take time. I think having that as a framework allows you to uh… identify the kinds of data you need. For example, we just started a lancet fish diet study. Collecting lancetfish brought back by the observers and longline fleets, and that's provided us a time series of the community of organisms that go between phytoplankton, zooplankton, and the apex predators which we never had before which helps us understand food webs and how the energy is transferred so by looking at an ecosystem approach you identify gaps where you need data. The more challenging aspect is moving it into management. You know, managers are very comfortable with concepts like maximum sustainable yield but when you try to say well, we're going to balance sort of maximum multi-species yield from this system against loss of uh, loss of key species or – or depleting certain – more vulnerable species like some of the sharks and elasmobranchs um… so how do you back off on achieving the maximum multi-species yield to balance the diversity of needs when you take an ecosystem approach. That's – that's not quite as cut and dry. And so it'll be a gradual approach. I think it'll become…eventually it will be –

**EG:** It appears indispensable really.

**JP:** Yeah, I think it'sindispensable. I think it's the way to go and uh… yeah.

**EG:** Anything else? We have time if you want to add anything at all.

**JP:** I'm just looking over your questions here just to see if uh… I think we've touched on them. I guess the only – there was one aspect on… one of the challenges we went through, was before we became a Science Center, we were the Honolulu Lab which was a branch of the uh… Southwest Fisheries Science Center and then in 2004 when senator Inouye enacted some legislation that allowed us to become our own independent Science Center. I was the Acting Science Center Director that year and that was quite a challenging time because we – we really didn't know what it meant to be a Science Center and we are learning our way through the whole system and all of a sudden at the table in Silver Spring, representing our center and competing with other centers for funding and attention and building our own financial management center out in the Pacific and taking on all of the duties that had previously been taken on by the Southwest Center so it was quite a challenge for all the staff and I think that year that I was the Acting Science Center Director, in one year I traveled 120,000 miles just back and forth to D.C. and out to the Pacific for work in the some of these RMFO [regional fishery management organization] activities and so it was quite a dynamic year and since that we've continued to

grow and strengthen our role as a Science Center and  but it taught me that I really enjoy having a small team and investigating problems and not…uh…no interest in being a high-level manager.

**EG:** There is one thing we didn't talk about, the regional fishery management organizations (RMFOs) and the, you know, Western [and Central]Pacific[Fisheries]Commission um… you know, especially with the pelagicsthere's a lot of pressure on pelagic stocks from purse seine vessels. Do you feel like there's sufficient interaction between this region and some of the regional entities that would help facilitate better overall management of an ocean that's only bounded politically, it's not bounded in other ways?

**JP:** Yeah, well, I – my perspective is that there – they have a long way to go to take an ecosystem approach. Their focus is managing yellow fin, striped marlin, and big eye tuna individually species against overfishing or being overfished and um… but in the process we're seeing a lot of changes in the species compositions, size structure of the ecosystem so I've – I felt that they need to be more proactive and be more attuned to climate change impacts. I think there's been a significant advance in reducing interactions with turtles and cetaceans, at least in the Hawaii long line fishery and its' efforts have been promoted by the RMFOs but I – I – I do think they tend to be back in the single species management approach… paradigm.

**EG:** Given your uh… imminent departure uh… toward retirement, do you feel you've got some folks who can help fill the gap and perhaps push that agenda forward, not only within the region but – but beyond?

**JP:** Um… well, we've had capacity and they've sort of moved on to other management positions in the Center. We have a fairly young staff now uh… but I think uh… they certainly have a lot of potential and I hope to stay engaged and continue working with them down the road.

**EG:** Excellent.

**JP:** I – just looking to try to transition from a scientist to a scientist emeritus and we'll see how that, how that works out.

**EG:** Well that's good news. You'll be sorely missed I know. So if you can have some presence, I think that'd be much –

**JP:** I'm still passionate about the science and uh… just want to have a little more flexibility and uh…

**EG:** You bet, so yeah. Thank you Jeff, thank you so much.

**JP:** Sure, it's a pleasure.

**EG:** I appreciate it. You bet.