Zachary Mason: This is Zach Mason. It is August 26, 2020. I am interviewing Jay Grove remotely. I am calling in from my home office in Baltimore, Maryland. This interview is part of the NOAA Heritage Program Project combining NOAA data with oral histories to illustrate two decades of change in the Florida Reef Tract. Jay, could you go ahead and introduce yourself, tell us your current job title, and where you are calling in from?

Laura Jay Grove: Sure. My name is Laura Jay Grove. I am calling in from my home office in Fort Lauderdale. However, I work with the Southeast Fisheries Science Center in Miami. My official job title is a research fishery biologist. Right now I'm the unit lead for the Coral Reef Fish Ecology Group, and I'm also the lead of the National Coral Reef Monitoring Program for the fish side in the Atlantic basin.

ZM: Excellent, thank you. So, let us start right from the beginning. Can you tell me where and when you were born?

JG: I was born in 1983, so I'm getting up there. I was born in Morristown, New Jersey. I spent about a month of my life there, so I know nothing about that area of New Jersey. My parents took jobs in New York City. They're originally from Pennsylvania. The best place for them to live and commute from was Connecticut, so I landed in Connecticut within the first few months of my life.

ZM: What did your parents do for a living?

JG: My mom worked in finance, and my dad worked in insurance. They're both now retired and enjoying their life. [laughter]

ZM: Where in Connecticut did you end up moving?

JG: Norwalk, Connecticut. So, it is a coastal town in southwest Connecticut. I spent a lot of time experiencing water estuaries that were – that's all I'm going to say for that. [laughter] I can expand more later. [laughter]

ZM: So, growing up, was there anything in particular that got you interested in water, the ocean, fish, or was that later?

JG: No. Growing up is when I decided I wanted to be a marine biologist. I made that decision in elementary school. I think everybody just said, "Oh, yes, sure, maybe that will happen. Maybe it won't. Keep your options open." However, I was pretty adamant that that's what I wanted to do. I think it stemmed from – my father had a boat, when I was, I don't know, seven, eight years old. So, we spent our weekends out on the small islands on Long Island Sound. I had the opportunity to walk the beach. There are a lot of horseshoe crabs in the intertidal zone there, other crab species. Also, my parents were very big on education and learning, so in the summers, did spend a lot of time playing as kids do, and swimming and doing other things. We had an annual membership to the Maritime Center, which is an aquarium in Norwalk. I spent every rainy day at the aquarium, and I'm sure that led to this career path as well.

ZM: The aquarium really interested you?

JG: I was just fascinated by how different species were in the ocean, right? So, you could get in those tanks. You could look up close. They had sand tiger sharks that were swimming around. To me, they looked very stoic, and they were huge. I could sit by that tank forever and watch them swim around. But then they also had harbor seals, and I would – I knew the timings of the feedings, and I would go down there and watch them feed the harbor seals. Then they had a touch tank that you could touch and pet all the invertebrates. I was probably one of those little bit more obnoxious kids that started to learn everything. If they told me something was happening, and – they would pick up an animal and try and tell me a fun fact, and I already knew that fun fact, so I would share another fun fact back with them. I'm sure they didn't like seeing me show up. But I really enjoyed getting to hold all the animals. So, there wasn't something in particular. I think it was just that there was so much life that you could see in all the tanks, that just from the surface, looking at Long Island Sound, you couldn't see it. That was really fascinating to me, that there was this whole other world that I got a glimpse of every time I went to the aquarium.

ZM: You made this decision in elementary school, like you said. Going through middle school, high school, and then preparing to go into college, did you still feel really certain that this was the right path for you?

JG: I did. [laughter] People tried to talk me out of it a little bit. "Where are you going to live? What are you going to do? There aren't that many career options." I felt pretty convinced. I took all the science classes that I could, that were offered at my high school. I went and declared my freshman year of college. My opinion was, "If you had something that you really want to do, I would rather try and do that. If I don't succeed, I can always try something else." But why not go after my first option?

ZM: I am just kind of curious, did you have a location and a specialization in mind at this point when you declared your freshman year, or not yet?

JG: No. Very similar to what I mentioned with the aquarium, I didn't enter into college with any defined thing that I wanted to look at. I was hoping to learn in college and decide from there. The more that I learned about the marine world, the more interested I was, and the more I realized that I had to learn about it, but also really didn't have a set area that I wanted to work in. That note actually holds through my career as I pursued higher level degrees. I took a more circuitous path and a less direct path than other people. It's because I truly have a lot of interest, and it was hard for me to narrow down where I wanted to specialize and what I wanted to do.

ZM: You mentioned that you took a more circuitous path. So far, it seems like you are on like a beeline towards this eventual career. We will probably get into what makes it circuitous in a little bit. But for your bachelors, you went to somewhere in New Hampshire, correct?

JG: Yes. I went to the University of New Hampshire State College there. It has a great marine biology program. I chose it because of its marine biology program, but also the comfort that I felt on campus. I really wanted to have an undergrad location where I felt comfortable and I felt

like I could learn. University of New Hampshire offered a lot of opportunity with our coursework to get out in the Great Bay Estuary, to get out in the Gulf of Maine, and also to be able to go down to off the coast of Massachusetts. So, just had a lot of options. That's the reason why I chose this school. I ended up, once I started there, taking the intro to marine biology course. From there, I started working in a lab. It was Dr. Larry Harris' invertebrate lab. I started off getting all my experience in invertebrates, looking at nudibranchs, biofouling communities, predation preferences, some invasive crab species. Those were all the graduate students' projects that were going on. As an undergrad, I was assisting in whatever capacity they needed.

ZM: Were you a scuba diver yet or did that come later?

JG: Scuba diving is something I've been doing for a long time. I got certified as soon as you could, at twelve years old. My mom and dad got certified together in the [19]80s. My mom ended up developing asthma and always had some problems with her ears, so she had to stop diving. My dad loved to dive and was in need of a dive buddy by the time I came around. I had a great love of the ocean. So, it ended up working out, and I was enlisted or enrolled in those classes as soon as I could be. I started diving at twelve years old. So, my dad was my dive buddy all through – I think it's end of middle school and through high school.

ZM: Where did you guys go diving?

JG: We would go on Long Island Sound. It was cold, murky. I had probably zero body fat at that time in my life as an athlete, so I remember just shivering underwater. It was a little spooky as a kid too sometimes. With the lack of visibility, you see a shadow move by, and you had to get comfortable out there. My dad and I had different interests while we were diving. My dad loved to try and find old shipwrecks on the map and would try and isolate them. Then he would love just to go down and dive and see them. Even then my interest was like, "Oh, cool. You found a long nail. That's great." I would follow the lobster around on the debris, or I would track all the biological life while my dad was interested in learning more about the shipwrecks. So, we went together. We often had some different goals in mind. However, we did go clamming together. I had a clamming license. My dad and I would always get clams. So, we made homemade clam chowder from all the clams that we collected together. That was a fun summer activity in memory.

ZM: Did you guys ever take any trips outside of the Long Island Sound?

JG: We did to Florida. My mom, since she doesn't scuba dive – and my brother actually has a fear of the ocean and water. So, my family is very divided. My father and I did. We would get to go diving for a day, maybe, or so, on family vacations. So, we went down to Florida. That's actually where I ended up getting my certification, outside the Fort Lauderdale area where I now live. Then we went to Aruba in Dominican Republic at the end of high school. So, I saw some of the coral reef ecosystems then. I don't think I really quite understood what I was looking at. But I did get to experience a different type of ecosystem, and that was really interesting to me.

ZM: We might jump back into that a little bit later. But for now, let us get back to our chronology. We are in about your freshman year of college. Can you remind me what year

about that would be?

JG: 2001.

ZM: 2001.

JG: 2001 was my freshman year of college. It was an interesting freshman year, obviously. September 11, 2001 is when the Twin Towers fell. So, I was from the tri-state area where a lot of people I knew worked. In New York City, it was a very confusing time to be away from home for the first time. September was right after college started. So, just a very strange time to be starting college, and how the country changed after that, as far as going from generally a peacetime to more of a wartime. That's been extended out now for a long period of time. So, that was something that I actually did think about a fair amount in college, because it was shifting our opinions. It's happening right that freshman year when we were entering in.

ZM: Can you elaborate on that a little bit? What were you thinking about exactly?

JG: I wasn't thinking about anything in particular, but I had friends that were at West Point, so they were in the Army. So, you knew your just life path was changing. I think it made things a little bit more serious. "What do you want to do? What do you want to pursue? Do you still want to pursue this thinking things through?" For me, it just solidified my path of, "Yes, I know what I want to do, and I'm going to keep my head down and keep going forward in this direction." But it did make you think a little more seriously about the future, because it wasn't all of a sudden as much fun anymore. Reality struck. Up until that point, you're just graduating middle school and high school and onto the next step in college, which was supposed to be another four-year bubble. I think just having college uprooted a little bit in the beginning didn't – it was still a bubble, and it was great and it was fun. But it did make you think a little bit more seriously about real-life issues.

ZM: After that four-year bubble, you went to get your master is degree, correct?

JG: No. This is where my circuitous path begins. I actually took three years off, which is, I've come to find, not as common in this field. A lot of people went straight through in school. So, when I graduated college, I knew that I wanted to go back and get a graduate degree. But I wasn't quite sure where, how, what I wanted to do. I thought, rather than just being one of the people – all the students kept telling me and teachers, "If you don't do it now, you won't do it. You'll get sucked into something else and you just got to keep plowing through. I kept saying, "I really don't know what I want to do." I have no idea. I feel very confused about that. So, I decided I was going to go back, and I was just going to take my own path and hope that it worked out for me. So, the year after college, I stayed up in the New England area. I looked and applied to some different science education internships and some vet assistant. I didn't know what I wanted to do. "Do you want to go back and be a marine mammal vet or do I want to go do research?" I was very conflicted. So, I ended up working at a veterinary hospital for a year after college in Maine. There, I learned a lot about what it was like to work in an office setting, learned a lot about blood chemistry, parasites, a lot of surgeries, a lot of different components of animal care that I ended up using some of later in my master's degree when I did physiology.

But after a year, I decided that while a lot of the emergencies were very stimulating and exciting for me, the routine appointments just didn't hold and captivate my attention the way that I wanted them to. So, I knew it wasn't the right fit. So, I did not apply to graduate school then. [laughter] I decided that I wanted to see the Pacific Ocean. I wanted to go and I wanted to move out west, and I wanted to experience something different. Maybe that would help me make the decision about my future. So, I moved out to – drove out to California on a long trip with two of my girlfriends and some animals in the car. We took off for a series of weeks and saw the country and landed in San Diego. I ended up living for two years in San Diego, one year working for a biotech company where I worked for more on the business side, on sales and marketing for a DNA and RNA stabilization company. So, I had the science background, but was really trying to apply the communication aspect. Then also decided that wasn't the best fit for me. So, I went into marine science education for the final year there and really enjoyed that part of it, the hands-on, really explaining science, but decided, yes, I'm just teaching things, but I wanted to be learning some new things. That's what really got into research. So, I actually volunteered at Scripps for Dr. Jeffrey Graham. He did a lot of different things. He was a shark researcher. He really liked animal physiology. He worked with mud skippers. When I met him, he had mud skippers out on a treadmill, walking, to look at their air consumption. He was a very interesting gentleman. I helped work with some of his Ph.D. students. That really is what sparked me to get back into research.

ZM: There is a lot to unpack there. [laughter] There was a big change that has occurred here, right? So, since elementary school, you were, it sounds like, just very driven and on the singular path. Then all of a sudden, it is kind of like, "What am I doing? Where am I going?" Do you know why, or was there a reason for this change or uncertainty at this point?

JG: I don't think it was uncertainty. I knew I wanted to go on, but I wanted to see the world. I was very curious. I really wanted to see the world. The idea of just going back to another classroom and another lab, I felt like I wasn't going to give it my all. My head was going to be other places. I was going to be listening to stories of different people traveling and different people trying different things. I was ready to try something different. All I knew was school. All I knew was going to school. I felt like I want to go back to school and I want to do that, but I was a little tired of it at the time, too. So, how can I get some life experience and really focus, that when I go back, I want to be there one-hundred percent, not just eighty-five percent, and I'm questioning myself for fifteen percent. I want to be there one-hundred percent and know that I'm in the right place for me. I don't think I knew I was in the right place. I think I knew I had to take some time off to come to that conclusion.

ZM: After all of these experiences, working in the marine mammal vet lab, and then going out to California, you said that you were pretty certain that you wanted to go back. So, what did you do? Where did you go? What did you study?

JG: [laughter] Life comes full circle. I ended up returning to the Gulf of Maine because that was the best program and opportunity for me. I did apply a lot of different places and was interested in working in all regions, but was looking for the program that had the best fit for what I was looking for. At that time, since I was working in a shark lab out in California, I was interested in pursuing that further. I was really interested. So, I went back to get my master's in marine

science at the University of New England. There, I did fish physiology, but really focused on elasmobranchs. So, looking at non-lethal measures to detect reproduction in sharks and skates. So, my thesis focused on the little skate, which is a common skate species in the Gulf of Maine. But I also worked on projects with blacknose sharks, great white sharks – that us scientists just call white sharks, but that's the public – and worked on a number of these papers, the (Rundle?) skate, all looking at it from a reproductive capacity.

ZM: You said your experience with blood chemistry and other physiology from your time working as a veterinary – was it tech or assistant?

JG: Assistant, yes.

ZM: That helped with your master is degree. Can you elaborate a little bit on that?

JG: Sure. So, for my particular thesis, I had to draw blood from the skate's tail weekly for an entire year. So, I had a lot of experience drawing blood from cats and dogs. Skates were a little bit different. But being familiar with the correct positioning of your hands and how to get the blood, and if it's not – if you didn't get the vein quite correctly, how do you mitigate that? So, that was helpful. The skills were helpful, as well as then collecting the blood, splitting it down, collecting the plasma. Then on my research, I was using a radioimmunoassay, which was taking that plasma and marking it to try and figure out how much of the reproductive hormones were in it. So, estradiol, progesterone, testosterone. As in humans, if you get tested, can say, yes, you're pregnant or you're not. That's one way to see if a species – or the levels aren't high enough that you could even be reproducing. That's important, especially with something with a larger species like the white shark. We had a lot of large fish that we had received blood samples for. Those larger fish, based on the analyses, weren't mature yet. So, it helps say, "While this is a big fish, they're still not of reproductive age," without euthanizing that animal. In the little skate, we were looking more at the cycle. So, are they reproducing during certain times of the year, or are they reproducing all year round? What does that mean for the species? Well, if they're reproducing all year round, that means they have a great opportunity to lay more egg cases and have more output of young, and hopefully, more success, where if they only reproduce one time during the year that one event must be pretty successful.

ZM: Looking back now, or at least from my point of view, it seems like that three-year detour was actually really helpful, building up experience and specialized skills that maybe other people would not have, and that helped you in your graduate work. But at the time, did it seem like that, or did you feel like, "Now, I am three years behind?"

JG: At the time, it felt like, now, three years behind. [laughter] It was helpful. I'm glad that I did it. The more time I get from those years off, the happier and happier I am that I did it. They really gave me a life perspective, what it was like to work for a paycheck that I was solely relying on to support me, what I was looking for. But yes, of course, I was entering into a degree where other people were three years younger than me entering into the same degree. That was a little different at the time. Now, I don't think it's a big deal. Like you said, I did learn from each of those experiences. The marine science education, I ended up doing an NSF, National Science Foundation, GK-twelve fellowship, which is to teach scientists to be better communicators. I did

that program for two years in my master's. I think that also doing the marine science education out in California helped me with that. That's an area that I want to be good at. I always want to keep improving, because I think being able to communicate your science is really the most important thing. Just doing science without any visibility isn't helping. I think you really need to be able to break science down into clean, clear, and crisp concepts that can be relayed to all audiences.

ZM: Do you think scientists are generally bad communicators?

JG: That's what the NSF GK-twelve program suggests. [laughter] That's why they started it. I would say, in my career, I've seen all types. Some scientists can communicate well. But some scientists, even if they're good communicators, don't feel comfortable communicating to different audiences. So, I found that some of the best science communicators, sometimes, are not people – they're not a people person. They don't want to communicate. So, while they have the capability of breaking it down, they don't want to. Then there are others that feel very comfortable like, "Oh, I'll talk to anyone." But their description is clear as mud. It's really challenging. So, I've seen all different types. I think that there are good science communicators. But I think, as a whole, as a community, a lot of people get into the science field to be stewards for the environment or stewards for the animals and gotten to this path because maybe they didn't want to interact with humans so much. So, communicating science to humans is not necessarily their goal or something that they are as comfortable doing.

ZM: Your master is degree wraps up in about – what year was that?

JG: I think I started in 2008. It was a three-year program, so 2011.

ZM: 2011. Then did you go right to your Ph.D. or was there a break there?

JG: This time, I decided I wanted to go straight through. I knew what I wanted to do. So, I really liked working with marine physiology and really enjoyed working with shark species, but decided that I started – this is the reason why I would also suggest people getting a master's and a Ph.D., because you can always change direction. So, while I liked what I was doing, I decided that I had a lot of lab skill sets. I would help out other graduate students in my master's in the field. But my unique skill set that I published on was all lab-based, and it wasn't something that I wanted to do long-term. So, I made a decision that, okay, I have this skill set. That's great. What I really want to do is work more in the field. I want to work with a species that is a recreationally and commercially important species. I wanted to have value. I want there to be a fishery behind it. That was something that was important to me, to get all different sides. So, started as an undergrad. I'm doing biophilic communities, marine vertebrates. I feel like I started to understand that. Then I did fish physiology and sharks, which are great, but there's not a huge fishery for them. Then I felt like I'm in this fisheries field and wanted to get the full perspective. I really wanted to get out there and work on a species that there was management for. That was one of the reasons why I ended up in the Gulf of Mexico, working with red snapper, which is arguably the hottest fish species there for recreationally and commercially important and management at the moment, and when I was there.

ZM: You did your Ph.D. at Auburn in Alabama. Is that kind of why you chose to go so far away from – so previously, you are in New England, right? You grew up in Connecticut. You went to University of New Hampshire. Then you stayed in Maine for your master is, and then all the way to Alabama. That is a big change. Can you elaborate on that a little bit?

JG: Yes, sure. Let me restart that. Sure. I think the big thing to understand is that the more I traveled – I did a study abroad and undergrad, and I went to Australia. I saw the coral reef ecosystem there. I grew up in New England, and I did a lot of work in the Gulf of Maine. I ended up living in California and did work in the Pacific. I realized the more that I traveled and the more that I saw each system – ecosystem was different, and that each of them had their own nuances. I thought that while I knew what I wanted to research, I wasn't as set in particular about where I was located. Getting a better understanding of all the different ecosystems was only going to help me, and I thought it was important. The Gulf of Mexico is a gigantic fishery. Again, I was targeting a fishery in the United States. So, Alabama was a target – not necessarily my target, but the Gulf of Mexico as a different system was of interest to me.

ZM: Oh, sorry. I was just going to say, you were targeting fisheries. Can you explain a little bit why you were targeting fisheries?

JG: Sure. I wanted to do something in the marine world. I had started to wander down a path where fish were going to be my topic of research, right? So, stemming away from invertebrates or mammals or turtles or anything else, fish became my focus. If you wanted, in my opinion, to make an impact – I could study some obscure fish which really could be important. Maybe I would make a grand discovery that it was an indicator species and it could be really helpful, or I could go after something that – every fish that is targeted by fishers are managed. There's a lot of opportunities to work in a lot of different systems for species that are managed. If I want to do something meaningful, understanding how the fisheries management process worked to the information that feeds into the different models and a little bit more about the species, that's what I was looking to do.

ZM: This might be kind of an odd question, but when did you make the transition? It sounds like maybe it is not even a conscious thing. Maybe this is from the beginning too, but when did you make the transition to wanting to do something meaningful as opposed to "I want to be a marine biologist" because that is something that you were interested in?

JG: I'm not sure. That's a really good question. It wasn't something that happened that I can think of. It wasn't a specific point in time. As I got more involved, as I got more curious, I still wanted to learn, but I realized that just learning to learn – this, I think, maybe goes back to the communication side. Just learning to learn something and putting it out there that nobody was going to pay attention to, while I thought that was still valuable and interesting – I'm still really interested in obscure things. However, I do feel like if this is what I'm going to dedicate my career to, learning and assisting with a larger process is probably the most important. I don't think that happened overnight. I don't think there was a split decision. I think that just happened naturally over time.

ZM: At this point, were you aware of threats to different fisheries? Protecting fisheries, was that

something on your mind?

JG: Not initially. Initially, I didn't really understand fisheries, right? That was almost the impetus to start studying fisheries, was to say, "Oh, here. Here's a huge sector – if you want to study fish and review fish ecology – that I really need to understand better, and I don't have a grasp on." So, I think entering into it was more of a "Let me learn about this, because I know that it's important." I know that it could potentially be in my career path moving forward, and I just don't have any knowledge about it.

ZM: Can you explain a little bit about what your experience at Auburn was like, what exactly were you studying, what was your dissertation on? Things like that.

JG: Sure. I studied under Dr. Stephen Szedlmayer. Steve was a great adviser. He has dedicated twenty-plus years of his career to studying red snapper in the Gulf of Mexico. Originally, I wasn't quite sure what I wanted to work on when I got there, but I knew I was going to be working on red snapper. I ended up doing telemetry of red snapper, which was building off his – originally, in the nineteen [19]90s, Steve had some of the first studies of red snapper. Then over time, telemetry studies have advanced. The technology has advanced. Rather than active listening, you can go to passive listening. Rather than not knowing exactly where a fish is in the array, then you can go to the VPS array system where you can tell where a fish is within a meter of where they are. Technology changes. So, you can repeat some of the same studies and do new studies and learn new things, even if that fish has already been studied before, because the technology has improved. One of the things that I wanted to do was look at the movement of red snapper and the mortality of the red snapper. That's fishery-independent mortality. There are two ways to estimate mortality. It either can be from the docks, from landings. You can ask recreational and commercial fishermen like, "How many pounds did you land? How many fish did you catch?" Or you can do it without any input from the fishermen. You could tag fish on this VPS array for the first time – which is what I used, the VEMCO VPS array. You could actually see when a fish was removed from the array. So, we didn't need to rely on fishermen to get these data. Fishery – it's called fishing mortality – is something that can be inputted into stock assessment models. It was something that I was interested in, so I looked at red snapper mortality. I looked at movement. They have high site fidelity. They hang out on a particular reef site for very long periods of time. In the region that I was studying them, that hasn't been published true throughout the entire Gulf of Mexico, but where I was looking at them off the coast of Alabama. They also changed their movements by season. So, I have the first 3D movement paper on red snapper, which was really interesting and fun to do, showing that these fish that were originally thought to be more of a demersal fish species – so hanging out around the bottom – actually regularly used the entire water column, especially in the spring months. I have a lot of different hypotheses as to why that could be the case, but wasn't able to nail anything down specifically.

ZM: Can you explain a little bit about how telemetry works in that process?

JG: Telemetry is essentially a sound. It's a sound pinging with an individual code. A fish is tagged, and that tag can be an external tag and attached to a fin. I did internal surgery with red snapper. Another graduate student at the lab did this with gray triggerfish. This is an

individually coded tag, so we can say, "ID number 100." That tag, that transmitter, goes inside of the fish. The fish were released back down, and underwater, we deploy receivers or listening devices. So, essentially, this transmitter transmits its unique ID code every so often at a designated time on a designated frequency, and the receiver is set to pick up that code. So, by creating this receiver array – a number of different receivers underwater – you can tell if a fish is moving or staying put on a single reef site or if they're emigrating – so they swim to a nearby reef site where I had receivers. So, you could say, "Okay. This fish not only moved, but it moved to this steel cage or concrete artificial reef structure." We could really track that, okay, just by listening to sound, it spends seventy-five percent of its time on this one reef site, but twenty-five percent of its time on this other reef site. That's generally what can be detected from telemetry. Then the other thing to consider is batteries die over time. I had six-year tags, so my fish generally didn't have that issue. If anything, they were caught by fishermen and returned to us by fishermen. We gave rewards. The receivers need to be downloaded and changed out and batteries, which we all did by scuba.

ZM: You said this system is pretty precise. You can track individual fish at that level. But that is a new development or relatively new development?

JG: Yes. The VEMCO VPS positioning system is new. It came out maybe in 2014, maybe before that. But it wasn't really used and hadn't been used on two main species. When I started working on my dissertation, there had been some published studies, but they were short. They had been going on for six months, a year long, nothing really long, where my studies went on for three years – so really picked up and did some of these larger analyses. Like I mentioned, I had some pressure tags in some of them so you could determine depth. That really allowed us to give 3D home ranges, 3D volume use, rather than area use of the fish species for the first time.

ZM: That is really interesting. Pressure tags, is that something that is currently still being used? I know you said it was new when you were working on it. I feel like there is probably a lot of different applications for that. It is still being used widely?

JG: Sure. Pressure tags in of themselves have been around for longer than the VPS system. It was just a new way to track them. Pressure tags have been attached to satellite tags to track highly migratory species. They have been used to track other species, too. While I was doing work, they had accelerometer tags to determine how fast the fish is moving. They now have temperature sensors so that you can tell if your tag was eaten by something that maybe has a higher body temperature, right? There's a bunch of different technology that's advancing with telemetry. It's not just the technology of the tag. Pressure tags have been around for a long time. But it was the application of how it was used that was different, because before, you were just getting, "This is my depth. This is my depth." That's great, but you're looking at things in 2D. You're looking at the bottom in my depth, and then you're looking at how far am I moving from a point. The environment that a fish is in is 3D. So, it was the unique part of the study, was bringing together the latitude, longitude, and depth and looking at them all at the same time, which is how a fish is really using their environment. But we had only, up until that point, looked at them individually, "Oh, the fish spends most of its time towards the bottom, and then it moves this much." Nobody had really pieced together – or very few studies – I think only three or four had been done before I published the red snapper one – that I found, at least, had really

started to look together.

ZM: Then why is it important at what depth a fish spends most of its time?

JG: It's important to understand if you're interested in eating. So, there's big debates. Red snapper's a generalist, so it didn't really provide too much information for us, because they can eat fish out of the water column. They can eat fish in the bottom. But for a species that you don't know anything about or that maybe isn't as much of a generalist, it can give you an idea of where they're spending their time. If they were down at the bottom for the majority of the time but then only came up during a certain times a year, maybe you could relate that to spawning. Maybe there was a certain prey species that's available, or maybe it has to do with a vessel activity above. Red snapper have been known to greet boats at the surface pretty much coming off the bottom. I don't think that's the reason for all their movements. There are studies from the late eighteen-hundreds that suggest that red snapper got their name because they were snapping at bare hooks off of a boat off of Pensacola. They were rising in the water column from depth to snap at these bare hooks. That's been documented for a long time. Do I think that's the reason why they're moving up and down all the time? No. Could it be related? Sure. It really can give you information for a species that you don't know a ton about. With red snapper, it gave us the indication that the species – while we knew they elevated in the water column, we didn't realize how often they were up in the water column, and that was interesting. It could also be tied to oceanography, oceanographic events. That area in Alabama is known to have hypoxic water layers. So, not enough oxygen at the bottom. Maybe they're up in the water column because there's no oxygen in the bottom. They can't be there. If that's true, then that can apply out to a number of different species. That would be true for all the other reef species on the reef, and would really affect their prey source. If their prey source that they're relying on is on the bottom, but they can't survive because there's low water oxygen, then maybe during those times of year, they are feeding in the water column, and that affects what are the species there. Is it menhaden? That's a fishery. How's that fishery being managed? It's all connected.

ZM: I guess this is a really broad question. I was kind of going to get into this later, but you mentioned everything is connected. A lot of people might not understand the connection between fish that live on a coral reef and then the health and wellbeing of a coral reef itself. I know that this is a big topic, but can you explain what kind of a relationship reef fish have with coral reefs?

JG: Sure. I think I'm going to answer this question a little bit broadly. But what I will say is, studying in the Gulf of Mexico with red snapper, what I realized was red snapper were on artificial reefs. There's a huge debate that my previous supervisor, Jim Bohnsack, started, which is, are red snapper attracted or produced by artificial reefs. Not going to get into that here, but what I am going to say is that red snapper were found on artificial reefs in areas that they weren't found before, before those reefs existed. So, you drop artificial reefs in the coast of Alabama, and all of a sudden, red snapper appeared, and there became a fishery that you could have with red snapper. I think if I frame it that way, that's where I started from. So, I realized that red snapper or any reef fish in their habitat are intrinsically linked. Do all fish end up on artificial reefs? No. But coral reef fish are similarly linked to their habitat and their habitat health and what structure is available, the health of the coral. It's interesting when you're underwater, you

can see a old mortality. So, a dead piece of, let's say, acropora palmatas, your elkhorn coral, and you have live pieces across a sperm group, it would be all there. All the fish are around that live piece of coral. There are some fish around these dead pieces of coral, but not nearly as many as over the live pieces. So, there's something going on. Even if I don't quite understand what it is that's going on, there's something that's going on that is really linking these fish. Whether they've co-evolved together, whether there's some benefits, maybe it protects them better from predators, their coloration – but they gravitate towards this healthy system. So, if a system changes and an area that used to be healthy coral is now gorgonians or sea fans, you see different species. If the coral is overgrown by something like palythoa which can be very toxic, you don't ever see any fish hanging out over on top of palythoa. So, the habitat and the fish are linked. They're so closely linked. I know that a lot of fish biologists – and I've said this before – think that coral can just be slimy rocks. I think most of us have changed our minds. But really, if you want to study reef fish, you have to understand that the reason why the reef fish are there is because of the habitat. If the habitat's gone, whether it's an artificial reef or it's the health of coral or the existence of a coral reef, you're not going to see the same fish there. So, I think it's an important thing that everybody understands you can't have coral reef fish without coral reef. If it's something that you enjoy to go snorkeling on, if it's a tourism industry, if it's for fishing purposes, if it's for diving, whatever the purpose is for you to go and enjoy those fish species that are out there, it's important to understand the habitat is the reason why those fish species are there. So, even if you think, "Oh, I just love fish," you have to take the habitat into consideration.

ZM: The natural extension of that then is why are these reef fish important, and why should we care about them?

JG: Reef fish are important for a number of different reasons. There are a number of figures that show, from an economic standpoint, how important they are to the state of Florida or island communities. They bring in lots of money in tourism; subsidence fishing, maybe if you're an island territory; recreational fishing, so charter boats, people make their livelihoods off of them; fishing for fun, as a pleasure; commercial fishing, so fishing as a career; all the hotels and infrastructure, bait shops, and scuba shops and everything that's built around these coral reef ecosystems. So, they're important for different reasons to different people. But what they do is they support a community. People are interested in these reef fish for different reasons. The coral reefs themselves have additional benefits that – I'm just going to stop there. [laughter]

ZM: No, that is fine. We have taken a bit of a detour here, but back to the chronology. What year did you finish up with your Ph.D.?

JG: 2015.

ZM: 2015. Then you started work with NOAA in 2016, I think?

JG: I did. I was very fortunate to graduate and get hired by the agency that I wanted to get hired by immediately, following graduation.

ZM: Can you elaborate a little bit on that? What was that like? It was pretty immediate after

graduation. People had said, "There is not a lot of jobs. What are you going to do?" It does not seem like –

JG: "You're going to have to post-doc."

ZM: What was that like?

JG: "You're going to have to post-doc for three to five years." [laughter] What it was like for me is I was very fortunate. So, I wanted to work again with reef fish. That was something I knew I wanted to do. What I didn't touch on as part of my Ph.D., I also did underwater fish surveys. So, I did stationary point count for some of the other students' projects in the lab. So, doing a reef visual census, but on artificial reefs in Alabama. So, when my position became available, it was doing underwater stationary point counts on coral reefs. For me, it seems like a natural transition. Great. I'm really interested in artificial reefs. This was neat. I'd really like to move on, again, to the natural system. I'd like to keep learning. All the fisheries models and – based in ecology that I learned apply to coral reef fish. It's just looking at the different habitat, and it's more species. So, it's a lot more species to look at. So, for me, when the position became available, it was an exciting and almost natural stuff, and where I wanted to go. I got lucky that they didn't hold my artificial reef experience too much against me and saw the potential that I had to bring with my background in fisheries as well as doing the same surveys, just in a different environment.

ZM: Can you elaborate a little bit on stationary point count for maybe people who do not understand exactly what that is?

JG: Sure. So, stationary point count is a method to count fish underwater. This goes back to different survey types – so, fishery-dependent survey done by landings, looking at fishermen. Fishery-independent survey can be a number of different survey methods. Any of them can be used. It's just saying that scientists are going out and they're collecting the data independent of the fishery. So, this could be longlining for different species or different fishing methods. One of the non-invasive, again, ways to do this is to count fish underwater. This is where they're located in their environment. So, stationary point count is a method. It's a survey design that allows for you to quantitatively assess a reef fish community. So, for you to look and get abundance or richness, as well as sizing fish to the nearest centimeter, which is needed for management. When you go down the method that we use here at NOAA, it's Bohnsack and Bannerot from 1986, essentially what that means is two scuba divers have a flag, and that's up to the surface of the buoy marked with a GPS – so you can tell exactly where you are on the reef tract – to send down to the reef tract, to tie off on something that's not living or you're not going to harm by tying off onto the bottom. Your scuba diver buddy and you swim out 7.5 meters from that middle point. You look back, you turn back, and you look at the flag and you say, "That's 7.5 meters away." And then what you do is you spin in the circle and you say, "7.5 meters all around me, is my cylinder from the seabed all the way up to the surface. These are the fish that I'm going to count inside this cylinder." So, it's a set space. You're not just counting all the fish that you see. In order to come up with these estimates, you have to have a set space. Then the other thing too is to have a set time. This makes it all standardized. For the first five minutes that you're underwater, you are supposed to stay still. Let the fish acclimate to you. Some fish

can be very shy for different reasons, and they hide and not come out. For the first five minutes, you're just writing down what species of fish that you see. That's it. Just what species. You're spinning slowly, maybe, just writing it down, what species do you see. If there's a species that may be a species that's – a jack species, for example, that might swim through, and I know that's going to be my only opportunity to see that jack species, it's not going to hang around and be there when I'm going to start sizing them later, I will write down that jack species, the number that I see, and the sizes, because I don't expect that jack species to be there. However, after that first five minutes, the second five minutes, you look around and you add any new species that you see. Any of the species that you have right now, you go back down your checklist, and you size them and you write the number of them. So, for species that aren't targeted, you do a minimum size and maximum size, and a mean size for species that are targeted. So, snappers, groupers, and trigger fish, hogfish, you write down the exact length and centimeters – up to ten fish, which some of the species certainly – yellowtail snapper, you could see schools of. But it's very rare that I would see more than one black grouper. Maybe I'll see a couple. But you can really get the sizes from each of those. Then from ten to fifteen minutes, your next five-minute chunk, you're wrapping up any sizing. You are writing down any new species that you see, but you're also doing a quick habitat assessment to say – so that you can – we can begin to link this reef fish community to the topography on the bottom, what's happening, or where the fish are located. This is also when you'll pick up some of your more cryptic species – maybe some goby, some blennies, any of the species that may be hiding out underneath rock ledges – making sure that you're getting the full community snapshot. That's what it is. It's a snapshot of the reef. If I were to go down five minutes later, I may see a different species swim by. But the stationary point count is a standardized space and time that gives us a snapshot – a repeatable snapshot of the reef. You have a dive buddy because we understand that there's a lot of variability. Your two measurements are averaged together so that you're really making sure that you got a full snapshot of that reef. Then over time, all the different snapshots of all the different dives throughout the entire reef tract you can start to get a picture of what fish are present, what the community looks like, what the richness looks like, and densities and abundances of fish.

ZM: I am sorry, I think we had a little bit of microphone interference. I got most of that. That sounded great. But just the procedure for the stationary point count in the first five minutes. Could you go over that one more time?

JG: Okay. So, do you want me to say, "Coming down from the surface," or do you want me to start when we're underwater?

ZM: Yes. When you are tying off, you are already underwater, and that 7.5 meters.

JG: Okay. The first five minutes you're tying off, you and your dive buddy are swimming in opposite directions of one another, 7.5 meters apart. Then you turn around and you look at the flag and you say, "Okay. That's what 7.5 meters looks like." Then you spin around in a circle and find identifying features on the bottom that maybe are 7.5 meters away, so you know how to keep your circle and your cylinder intact. So, you know what 7.5 meters looks like around you. From the seabed to the sea floor, that creates a standardized cylinder, and that's what you're counting fish in. For the first five minutes, you're just recording all the unique fish species that you see. So, any fish that's new, you just write them down on the list. If there's a fish species

that swims through that you don't expect to be there, maybe a jack species that's going to swim through quickly and not be there, you might write down the number and sizes for those, because you won't have the opportunity after five minutes. But most of the fish that we're surveying are reef fish. They're reef associated. They're going to hang out around the bottom, and you'll be able to see them after five minutes. If anything, they're more active after that period of time. They get acclimated to you and they start to come out. There are a lot of species that you won't see until five to ten minutes. They were there the entire time, and they'll show up eight feet away from you. They felt comfortable after being down there. No disturbances were made to poke their head out.

ZM: How are you writing all of this down? Can you explain the technology that is used for that?

JG: Sure. We are incredibly low-tech with our survey recording. We have a sheet of paper that looks like any sheet of paper on the surface that has different columns on it, and it's printed on waterproof paper. So, we have a clipboard. The sheet of paper is rubber-banded down so it doesn't float away. We have a pencil that's also tied off to the clipboard. Pencils, especially the mechanical pencils, float, which is a problem. If you let go of it for a second underwater, it won't be there. So, we have a pencil, a waterproof sheet of paper, and a clipboard. We are just spinning around in circles writing underwater.

ZM: You were initially hired by NOAA to do a lot of these surveys, but that is not exactly what you are doing now. Well, actually, first, where were you doing these surveys?

JG: So, with NOAA, started doing these surveys as part of – so surveys in Florida, these reef visual census surveys, started in the late [19]90s. They're a gigantic partnership between the State of Florida, other federal agencies, academic partners. They absolutely could not be done without this large partnership. The partnership really evolved and established in the early two thousands. All throughout this period of time, NOAA and the University of Miami – who really developed the statistical design for our sampling scheme for sampling – the state and other federal partners got on board early two thousands, and then this got absorbed into funding as part of the National Coral Reef Monitoring Program in 2013. So, when I joined in 2016, this reef survey that had been going on for not quite twenty years, but almost twenty years, in different forms, was now part of the National Coral Reef Monitoring Program. So, I joined as part of the National Coral Reef Monitoring Program, and with that came some changes. Florida used to be sampled every year. As part of the National Coral Reef Monitoring Program funding, Florida is now sampled every other year, as is every other Atlantic jurisdiction. So, I complete these surveys in Florida, but also, the surveys are completed in Puerto Rico, Flower Garden Banks, and in the U.S. Virgin Islands. Two regions are done each year. So, right now, our sampling schedule is Florida and the Flower Garden Banks are done at the same time, and Puerto Rico and the U.S. Virgin Islands are done at the same time.

ZM: Speaking of the National Coral Reef Monitoring Program, there is something that they have been putting out – a publication, I guess – status reports for Flower Garden Banks and for Florida. It looks like you were involved in both of those. So, these status reports, give an overview of how reefs and reef fish or reef fish populations are doing. Can you explain a little

bit about what these status reports are and your role in putting them together?

JG: Sure. So, the National Coral Reef Monitoring Program looks at all U.S. coral reefs in the Pacific basin as well as the Atlantic basin. I'm currently working on the team that's for the Atlantic basin. I am the coordinator for Florida, but also, I'm the lead fish scientist for the Southeast Fisheries Science Center as part of this National Coral Reef Monitoring Program. So, my role is really to look at these fish data and to – or the purpose of these status reports are to look at the health of the U.S. coral reefs. So, this has never really been done at an ecosystem level. Quite a challenge. So, NCRMP, which is what we call the National Coral Reef Monitoring Program, is looking at these from a fish perspective. There's a coral or benthic category. There's a water quality – for lack of better term – category, and then there's a sociology category. So, it has four different pillars. My role is to participate in the fisheries pillar and to create a metric or a method to evaluate reef fish health that was accurate, that could describe the whole system, that was repeatable, and that, to the best of our ability, could be compared between different regions. So, whatever method I created or came up with or worked towards could be used in Florida. We also did it in the U.S. Virgin Islands, Puerto Rico, and Flower Garden Banks. How could we come up with something that's fair and representative for all these regions? So, I actually worked with the University of Miami, some of the University of Miami folks, namely, Steve Smith, who's a professor there that helped do some of the statistical design for the RBC program, and went back and forth. We created a new method to be able to compare fish from a reference population to the entire reef tract. This method that we looked at, one of the things that was really important was a lot of our reference areas have this great habitat, and maybe have different habitat types than some of the other regions. You don't want to penalize these other areas just because they don't naturally have those habitat types. That's not fair. So, how do you make a comparison from this reference population to these other areas? We were able to come up with a method to do that. We used that same method in all the different regions that we sampled. Some of the metrics that we produced were looking at species richness, which you could compare from a reference area to the other areas. We looked at fish density. So, this is targeted fish density, looking at juveniles separately from adults of your targeted species. For example, in Florida, that would be red grouper, black grouper, yellowtail snapper, mutton snapper, hogfish, gray triggerfish, just to name some – really looking at it for difference between juveniles and adults – or fish that are recruited to the fishery is important, because you want to know if they're recruiting to the habitat. So, if there's a lot of juveniles, but not a lot of adults, that's great. That means that the fish are continuing to populate the reefs. Once they get to a certain size, they're fished off the reefs. If you don't have a lot of juveniles and you don't have a lot of adults, that's not good. That shows that the system's not quite healthy. Actually, a pretty healthy system has a lot of adults and not so many of your juvenile fish. So, it was a way to look at all the different areas in Florida. In Florida, in particular, we divided it from Dry Tortugas as a domain, a region to be sampled separately, and Florida Keys and Southeast Florida. We also came up with a sustainability metric. That was just looking at it as a reef tract as a whole using some fisheries statistics equations.

ZM: Before we get too far into all that, how did you go from being hired to do stationary point count surveys to the lead fish scientist in the National Coral Reef Monitoring Program? Can you talk about that transition a little bit?

JG: Sure. I got hired on to NCRMP, and I was co-hired at the same time with another scientist. He is a little bit more senior than me, so he took the lead position at first. Then I did the coordinator role, and then became the co-fisheries scientist for the data side. So, it was a process that just happened naturally. I mean, you have to learn all the different survey methods. Then I, at the time, was the dive safety officer. I am no longer the dive safety officer, but at the time, was the dive safety officer. So, I spent a lot of time in the water. Then I coordinated, so I spent a lot of time really understanding the intricacies. Then I moved on to the data side where I started allocating the samples – so, why are we sampling, where, when. How is this stratified? Is it stratified by depth? Near shore to offshore, by subregion – so, from east to west or north to south, depending on what reef tract you're on – so really trying to understand the bones of the system, and then working my way up towards the lead position. That other scientist ended up taking another position. So, I was the right fit, timing, place, and knowledge to assume the new role.

ZM: Yes. It sounds like you have had a few different positions that are very varied, right? Some of them seem like you would be spending a ton of time in the water, like dive safety officer. Then being in charge of everything on the data side seems more like you are in the office and not so much out in the field. Is there a variation? Which one do you prefer? Do you get a lot of time now to go out into the field?

JG: So, first, I'd like to respond by saying I have an incredible team that I have that works as part of NCRMP. It's not just me. We have an established data manager, Jeremiah Blondeau, that does an immense amount of the data quality, QA, QC. That's not my role. So, my role is really to take the data, once it's already been through this incredible processing and the analysis review, is that – to share it with different agencies to make sure that different groups are using the data appropriately, and to figure out, if we have a question like a status report, how do we best answer your questions with our data. So, I don't do all of the data. I think that does mean that I have time for some other components. Then same thing with the field side. While I coordinate, that actually is a lot on land. We now have Caitlin Langwiser as our dive safety officer. Having these varied roles allows me to get into the field as much as I want to, for the most part. So, I had a very heavy field in the beginning of my career with NOAA for the first two years. Then it's been heavier office for me since. Now, I think I've actually gotten to the point that if COVID didn't happen this year, I would have been able to have a better balance. I need variety. I think that's one of the things that you probably have taken from this interview, is I'm curious. I like to learn in different arenas. I don't like being stagnant and doing the same thing. So, the ability to be able to work with the data and have some office time, the ability to interface with different agencies, the public, that's important to me. Then coordinating and participating in the science and getting underwater and collecting and learning – because that's when you're going out, actually really learning, is watching fish underwater. You will see them do something on any reef site. It doesn't even have to be the best reef site that you've been to with the most abundant fish and all the variety. You could be on a reef site that would be "boring," like a rubble reef site, and you'll see a fish doing an interesting behavior that you've never seen them do before. You can always learn from nature. So, I think that I make an effort to get underwater because that's where I'm learning. It's also what sparks new ideas for new proposals, new projects. "Hey, did you notice we didn't see that many of this species this year? Do you think that's just a coincidence, or do you think something's going on? Maybe we should look into that more."

ZM: I have a question that is not exactly related. You are part of the Southeast Florida Coral Reef Initiative technical advisory team as well, correct?

JG: Correct.

ZM: Can you explain what your role here is on the website? It sounds like you are responsible for wrangling together a ton of different agencies to support a large survey effort in Florida. Can you elaborate on that a little bit?

JG: Sure. So, the Southeast Florida Coral Reef Initiative technical advisory committee is really run by the Florida Department of Environmental Protection, FDEP. This group is really combined of experts from the technical advisory committee. It's combined of experts from different areas that are supposed to help the larger Southeast Florida community and this board to develop and interpret research and help to identify and implement priority actions, anything that can really help to reduce threats on Florida's coral reefs. I joined the TAC – is what they call it, the technical advisory committee – this year, officially. I presented in previous years, keeping all of those important experts up to date on the NCRMP surveys – s, on the fish surveys as they happen in Southeast Florida – but then also trying to do my job to connect it to the broader reef tract, since we do survey in other areas, and say, "Hey, this is something we saw in Southeast Florida, but we didn't see it in the Florida Keys. Why is that?" Take a look at information in that way, where you can have a bigger picture. Since I've just started this year, I would say that a lot of the focus topics have been – as they should be, water quality has been a big focus, and the coral themselves, as they're going underneath a major event with stony coral tissue loss disease. So, from a fisheries perspective – and that's my perspective on the committee – I agree. I think the water quality issues need to be fixed if I want there to be habitat for my fish species. How do we figure out how to best study, manage, intervene, restore whatever needs to be done with corals? Because again, that's the habitat. So far, in my limited experience, it hasn't been too much with the fishery. I do report and give updates. So, if we do want to start moving and talking about a fish-specific direction, we can do that. But at the moment, we haven't yet. The things that the SEFCRI is tackling are really important. People know a little bit about coral reef and coral reef health. Maybe you heard, "Don't wear certain sunscreens. They can be toxic to the corals." That's true. But really, on a large scale, we have, in Southeast Florida, a lot of coastlines that are very developed. So, you have beach nourishment going on. You have sand being dropped onto the beaches that eventually washes out to the coral reefs. I think the first thing I noticed when I moved to South Florida in Fort Lauderdale, as I was walking on the beach – and growing up everywhere else I've ever walked – the closer you get to the water, the harder the sand is. So, it's easier to walk and make tracks close to the water. Because the beach is so heavily nourished, it's hard. It's just still soft. It's really soft sand the entire way down to the water. So, it never gets easier. In fact, I think it's harder when you get closer to the water. Because there's so much of this fresh sand around, you don't have the species of bivalves or crabs that you typically build holes and burrow in the sand. Typically, when you're walking along by the water's edge, there's all this movement and activity of maybe a crab trying to escape you. You don't see that here. That's because of the beach nourishment. Then there are canals. So, instead of having a natural shoreline with maybe mangroves, which could be a fish habitat, especially for juveniles and early life stages, you'll see concrete walls. So, that doesn't create the

same free landscape that those fish need to be able to grow up in that system, for there to be prey there for them. So, living coastlines, taking care of septic tanks to make sure that you don't have all these nutrients leaching out into something that should be a low-nutrient system, the water flow has been altered, all of these topics that SEFCRI TAC has really been focused on, I support. But I'm just starting in my role on that committee.

ZM: We have touched on it a little bit. I think why I bring this up is part of that little excerpt from their website said that you are supposed to report on status and trends. So, we have a lot going on here. You have already mentioned the RBC data set, which I would like to start getting into. I guess this is a big question, but what are the trends that we are seeing with fish in Florida?

JG: So, status and trends, all the information that I report to anybody is from the RBC data set that we're talking about. In Southeast Florida in particular, I do see a lower species richness when we were doing the status reports, which is a great way to compare Southeast Florida to other regions. Otherwise, I'm just looking at trends, and I haven't really compared them. These status reports were published in May of 2020. So, this is recent. It just happens. You can see that there's lower species richness in Southeast Florida. That could be natural to a certain extent, because it is at the upper end of the reef tract, the more northern edge. However, it could be also due to different habitat quality, which, the coral section and benthic section of the status report show that it's lower there, lowest there compared to any region in Florida. As far as fish go, in Florida, we did look at targeted species. We also looked at ornamentals, which are really a unique subset of fish in Florida. There's unique subset of fish anywhere. So, ornamentals – meaning, your parrotfish, your angelfish – these are the fish that if you don't know that much about coral reefs probably what – the fish you're excited to see if you're on the reef, because they're colorful. I mean, they're great. They make up a huge component of the community. In Florida, it's really unique, because those fish are protected. They can't be fished, where in the Caribbean they can be. So, you see a lot of these ornamental species. In Southeast Florida and all regions of Florida, our ornamental species that are protected from being landed are doing great. We have all the large parrotfish species. So, rainbow parrotfish, midnight parrotfish, you don't see in the islands at all. They're pretty much gone from those regions. But we still have those large-bodied species, and barely good numbers of them throughout Florida. When you start getting into the targeted species, what you notice in particular in Southeast Florida is there's less juveniles and less adults. That reef tract in Southeast Florida is very narrow and it's long. It's incredibly densely populated. Millions and millions of people live on the coast there. So, it's very easy to access the reef. You can swim out to the reef from shore. These reefs are located in twenty feet of water. Maybe the next one's forty or sixty feet. Then there's one a little bit deeper. There's a lot of access to these fish. Reef fish in general are actually very long-lived species that don't reproduce until later. So, they're something that's easily targeted by fishermen, because they're found on a known location. They're found on a reef that you can easily identify. Especially now, with your depth finder, everything is – all this technology. They are a long-lived species. They don't reproduce that much. They are slower growing. So, it makes sense. If you have a lot of pressure on these fish species, you don't see as many of them. Then if there's not as much juvenile habitat, you don't see as many juveniles. That's something that we see in Southeast Florida, is compared to other regions in Florida, they have less of the targeted species.

ZM: What are some of these targeted species?

JG: Red grouper would be one, yellowtail snapper, gray snapper, mutton snapper. Gray triggerfish is a big one in Southeast Florida.

ZM: This is all reflected in the data, in that RBC data set. Is it a noticeable decrease when you are out diving? Can you actually see the difference?

JG: No. There are good sites, really densely populated reef fish sites in every single region. When we report this data, it can be pretty sensitive, because what I'm saying could sound really bad like, "Oh, I don't want to go to Southeast Florida because you just said the reef fish populations were low there." That shouldn't be the case. There are some incredibly unique habitats. They have these deep ridges north of West Palm Beach that are just incredible ecosystems. There are lots of goliath grouper. There are a lot of other reef fish that are in that area. I've seen some of the larger shark species down in Broward County. I've seen some amazing reefs, lots of reef-building coral, very healthy, just teeming with fish. Then even farther south, in Miami-Dade, I've probably seen one of my healthier acropora cervicornis or staghorn coral thickets. Right off Miami, there's this beautiful reef. So, it depends. There are spectacular dive sites in Southeast Florida. There are spectacular fishing sites. However, as a whole, when you roll this all up out of all the surveys that we do, we see that there's less compared to other regions, or their trend isn't as good as some of the other regions like the Dry Tortugas, which naturally is seventy miles off the coast of Key West. It has this natural distance that it's not easy for people to drive their boat, like Southeast Florida, a mile. Maybe their boat ramp is two miles from their house, and then they're not even a mile to the reef, and they're there versus seventy miles. You have to get all the way down to Key West. You have to have a boat that can drive that far, or you have to rent a boat, have the finances to rent a boat that can go that far, go all the way out there. That distance creates a level of protection. Then out there, there's also spatial protection. There's something called the RNA, research natural area, as far as the Dry Tortugas National Park where there's no fishing allowed. So, they have spatial protection for these larger species there as well that, theoretically, these targeted species can live and reproduce. Their offspring will spill over into the surrounding area, making fishing better in all areas of the Dry Tortugas. That doesn't exist in Southeast Florida. There's no spatial protection. The only protection that exists are fishing length regulations, which are effective, but obviously, those exist in other areas with spatial protection and the distance from shore. It's just all these added layers. So, it's not Southeast Florida's fault. I don't want to make it sound like there's nothing good to be seen in Southeast Florida. But generally speaking, the reef tract is in worse condition there than it is in some of these more remote locations.

ZM: Yes, that makes sense. I am just wondering, because you can still see some really great sites, and you can still see these fish and these ornamental fish, do you think we have the problem of shifting baselines a little bit? So, people who have never seen a reef before, and they are diving in Southeast Florida, come and see what is, at least to them, absolutely amazing, whereas we are seeing a decline in some reef fish population. Even though there are still some great things happening in Southeast Florida, people might not even realize that some populations are under threat. Do you see that as a problem, or the fact that there are still some good things is a benefit as well?

JG: I see it as a major problem. I think shifting baselines is one of the biggest problems that we encounter as researchers. I have heard people snorkeling on my local beach get out of the water on an area that I just came back, thinking, "Wow, I only saw three healthy coral heads here," come back out of the water and be like, "That was the coolest thing I have ever seen. All these fish were swimming around. I've never seen anything like it. It's amazing." I'm thinking, "That reef really wasn't healthy. There weren't a lot of diversity in the fish species that we saw. They weren't of anything sizable. I would never categorize that as a good reef. But if that's all that you saw, you're absolutely correct." They think it's great. I think shifting baselines are one of the hardest things to combat, because even me, I started in this field in 2016. I've seen change. It's been four years. I've seen change, especially because of stony coral tissue loss disease that's run rampant through the reefs that I've watched move and kill coral in my short time here. Then if you think about that, that's four years. I would argue, a lot of fishery scientists, we all, ourselves, are subject to shifting baselines, because fisheries management went into place in the nineteen [19]90s. You don't start management unless there's already been a large decline. So, the declines happened in the [19]50s, the [19]60s, the [19]70s when nobody was out there collecting data. Nobody has any data that we can use to really compare. So, when fishery scientists that I work with got involved in the [19]80s and [19]90s, they got involved when they were – the fish communities were in rough shape. They were in "dire straits." So, they started and created these large-scale management. It's federal management plans, which is how you have – things like the Florida Keys National Sanctuary came into place, and Dry Tortugas National Park put in the RNA later on. There's all these spatial preservation areas. All the management for catch, this all occurred in the nineteen [19]90s. So, when we look at data, even as fishery scientists, I'm comparing it to data from the nineteen [19]90s. That's at a low point. That was considered a low point by my predecessors, that even when I look at the best of what I have, it's still low. So, I think all of us are shifting baselines. I think it's a problem for fisheries professionals. I think it's also a problem for the public. The people that are most adamant that change is occurring have seen it occur with their own eyes. This is true in anything in life. Many people have to experience it for themselves before they're willing to jump on board and understand that it's happening. So, any of the really old-time fishermen in the Florida Keys, they'll tell stories. "I used to catch tons of yellowtail snapper over here like it was nothing." They wanted to fish and they wanted no regulations, and they wanted all the capability of catching the fish. Then, now, forty years later, they are some of the biggest supporters of, "This needs to be managed. The system has really changed. We've seen this change in our lifetime." So, it changes. Shifting baselines are something we're always going to have to target. With this too comes technology. We don't have that many pictures from before or snapshots of the reef. So, it's really hard to tell people. Some of the coral folks, actually, there's – sadly, they were documenting in the [19]80s and [19]90s. You can go back to the same reef, because they don't move around, and take the same photo from the same spot. You can really look at side-by-side images what changed. It's harder for the fisheries professionals like the fish folks, for example, to do that, because if you show somebody a picture of a reef that had a lot of fish, they're like, "Well, they just move deeper," or, "They just move somewhere else," or, "You just caught them on a good day this day. Go back a different time and there'll be different fish there." They're correct with all of those things, potentially. It's just hard for us to make a comparison. We can go back to the same landings photos from the sixties and seventies, but we don't have any fresh material that we can show.

ZM: You bring up a really interesting point. Corals do not move, right? They are fixed. I mean, for the most part, they stay in the same location. But fish do. So, photographs, people can see as subjective. Yes, the fish could have been somewhere else. I guess I should preface this by saying there is a bunch of different coral data sets floating around by different agencies and organizations, and they are all in different formats. For Florida Fish data, it is the RBC data set, right? It goes back decades. Multiple agencies are collaborating to add data to this data set, all using the same format. Do you think that the difficulty in showing change over time led to a centralized data set to show these trends?

JG: I'm not sure if that's the reason why we ended up with a single data set. I think all of the agencies have the same goal in mind. So, whether you're the National Park Service or the State of Florida or NOAA, the National Marine Fisheries Service, you're looking to make sure that fish species that exist today are there tomorrow and are there for future generations. To understand what's there, you need to have a way to survey, to understand what you're even working with. I think all of the scientists from all these groups are bright, and all came up with the same general type of survey. They had different methods on how they were implementing them. What we realized is fish do move around. So, it is challenging, because you can't just pick the same three sites and feel like you're capturing the reef tract. You realize there's a lot of variability in the data that you view from high-relief habitats. So, any of these habitats that have a lot of coral heads, for example, there's a lot of nooks and crannies for fish to hide in or maybe swim out of your range of view. So, you need to take more samples to make sure that you're really getting a good snapshot of what's happening. All the groups were trying to do it, but the reef tract is connected, and the fish are connected. Juveniles may move from, let's say, where the National Park Service is surveying to an area that NOAA was surveying, to maybe an area that the state was surveying, all within their life. How do you capture that? So, my understanding of the story is that the University of Miami and Southeast Fisheries Science Center were working together. This was told to me. It's like an old fable to me, an old tale that happened. But they were all working on surveying reef – or they were working together and surveying reef fish, and they were out in a boat in the Florida Keys. They pulled up next to a State of Florida that was also out there. They were talking to them, "Well, what are you doing?" The State of Florida boat said, "We're surveying reef fish." They said, "Oh, so are we." Then it got into, "We're all doing this. Why don't we work together because it is a connected system?" That wasn't a simple decision. There were a lot of growing pains. There are different fish survey methods. There are different survey designs. After a series of years of going back and forth, and each agency making sure that it's rigorous, scientifically sound, it meets the needs of their agency, whether they're going to be running stock assessments – State of Florida runs stock assessments. Does it meet their protection needs in the national park? Does it check the boxes for each agency's needs? Because everybody's not going to buy into the survey and spend tons of money if it's not meeting their needs. So, they developed the survey, RBC, and the design, that met all the different agency needs and can be used for any capacity. All got together and decided that that was the best way to tackle the reef tract. It also allowed money to go so much further. Rather than just surveying your little region, you now have – in the Florida Keys, for example, NOAA samples in Key West region. We sample all the way down Key West. Then FWC Marathon samples the Middle Keys. Then we jump in and sample – we, meaning NOAA, jump in and sample the Upper Keys – Islamorada and Key Largo. Then Biscayne National Park, Park Service, surveys the next

portion. That's also assisted by inventory monitoring, which is part of the National Park Service. They help out there. Then we survey up in Key Biscayne, because that's where our office is located. So, it's this collaborative effort, but as a whole, then we can say, "Here's what's happening in the Florida Keys." This is helpful for somebody like Biscayne National Park. They can say, "Here's what's happening in the park. This is how it's the same or different or whatever they want to look at, as it compares to the larger Keys ecosystem." All the different agencies decided it was advantageous. But now, it's something that we work on together every year – or every other year in Florida.

ZM: You have dove in Florida a couple of times when you were a lot younger. I know you mentioned stony coral tissue loss disease. What do you think was the biggest change that you have seen in Florida? It could be with the reef fish. It could be with the actual reef. What, what are the big changes that you are seeing?

JG: For me, as I mentioned, it's harder to see what's going on with the reef fish population when you're underwater, because you can hit these really beautiful sites and then these not so nice sites. But together, collectively, they make up the reef tract. So, it's just the composition that you're surveying each day. It's a little harder to see, while you're underwater, changes in fish populations. It's very easy to see changes to the reef tract. I've noticed, in my four years, corals dying due to disease. So, more dead corals on the reef. I've noticed how some of the areas have been covered up by some of the storms that have come through. So, you can have shifting sand, and that's natural. That happens. But in areas maybe that there were gorgonians, the sand covered them, and there aren't any more. You can have gorgonians popping up in new areas. The algae is ephemeral. It changes, comes and goes. What I would notice too is I think it just seems to be changing in a direction that you're just not seeing as many healthy coral. There are species that are gone. Within my four years of being here, pillar coral, dendrogyra has completely – I think there are no more known colonies in Southeast Florida. When I showed up, I think there was few. Then stony coral tissue loss disease spread through the Florida Keys. We were out surveying for fish, actually, and by random selection of a spot, I ended up diving down, and there was a beautiful colony there. I was like, "Oh, wow. We really don't see pillar coral all that much in the Florida Keys." So, we wrote down the location, and we shared it with some of the coral researchers that we knew that were going in and looking at taking fragments of colonies before stony coral tissue loss disease got there. That researcher was like, "Oh, I think we know where all the colonies are." Then she contacted me back and said, "Wow, this is a new colony. We didn't know that this colony existed." So, we felt good about that. We shared the spot of new colony. Then she contacted a year later and said, "This colony has been hit pretty badly by stony coral tissue loss disease, and it's probably gone. We don't suspect that it's going to make it." So, even within my period of time here, things that I have seen have disappeared. It's just the easiest to see. It doesn't mean that other things aren't happening. The water quality could have changed during that period of time, but I have no way of seeing that when I'm underwater. Is it a little bit better? Is it a little bit worse? I don't know. The fish could be changing, but it's harder to tell. Really, the coral is the easiest.

ZM: Looking back, getting into this field is difficult. I think there are a few themes throughout your career so far. One, I think, has to be doing the opposite of what people say, right? They said that there is not enough jobs. It is tough to get into this field. Where will you live? Then

they said if you do not go back for your masters right after your undergrad degree, you will never go back. You wo not be able to do what you want to do. You did it all anyway. It must have been tough at times. You are doing a lot of intense fieldwork. It is not easy. Looking back, going through all of this, how do you feel about these choices and about the decision to push through when maybe people were not as encouraging as they could have been?

JG: It's interesting that that's what you took away, because I do consider myself to be a rule follower. So, it's very interesting that I came across as doing what I thought was best. But I think you're right. I did. I did what I thought was best for me. I listened to people and I listened to their advice. I'm always learning, and there's a ton to learn from people. Ultimately, you have to make the decision on what works best for you. I would go back and do everything exactly the same. Why? Because I know now, looking at it on the other end, that I ended up exactly where I want to be. Maybe I would feel differently if I wasn't in a spot where I am today. However, I feel like all my experiences – I pull from them all the time. I pull from marine science education, some of the facts that I learned in California, or stuff about sharks. There's things that I hear myself now in an outreach event, "Share with a child." They think it's all because you work with NOAA, and it's like, no. But I learned that, factor that fun way to represent the data in a different part of my career. So, I was always learning. I did what was best for me. I took the risk, because I knew that I wanted to be in the field. For me, it paid off. I don't have any regrets, and I would do it again, because maybe if I did it the way that everybody told me to, I wouldn't end up where I am. I don't know.

ZM: You mentioned going into fisheries because it seemed like it held a higher probability of being able to make a difference. Now that you are here, do you do you feel like you are making a difference?

JG: Not enough. I think that change is slow. To make a difference, it takes a lot of work. I do think I'm in the field to make a difference. I do think I'm trying hard. But some of making a difference is doing maybe some more of these mundane tasks. Keeping the survey going, which is a long-term survey, that's something that you repeat every year. It's not the sexiest type of research. I'm not discovering something brand new tomorrow. But this long data set is how we understand change. It's how fisheries management can go into place. It's how we can test management. So, data from the RBC survey has been used in stock assessments by NOAA and by National Marine Fisheries Service. We've used some for black grouper and yellowtail snapper. My job right now is to have it used for more species. So, I'm working with stock assessment biologists in the center to say, "Okay, you've used it for some, but let's really get this data used for others," because these are the data from coral reef. You either get it from the fishermen or you get it from fishery-independent, and you get it from us. There's also species that can't be landed in Florida that there's – either because they're threatened and endangered, or there's no harvest for them or no take for them. An example of that species would be goliath grouper. How are you monitoring the goliath grouper population in Florida? You can't fish this species, so fishermen aren't landing them. How do you know how they're doing? This survey is the only way to figure that out, right? So, finding ways, because we see them underwater and we count them, but we can show trends over time. So, I am making a difference, but it's slow. So, in Florida, I'm really pushing for more species to be involved in our stock assessments. Then, really, where this method works well is in data-limited fisheries where you don't get reliable

fishery-dependent data. So, maybe reliable data from the recreational or the commercial fisheries. That's a gigantic problem in the U.S. Caribbean at the moment. They run something that are called data-limited stock assessments. This RBC method is something that can really inform those data-limited stock assessments. So, this year, I have a project going, and trying to figure out exactly what information is needed from our RBC data set, how we can manipulate the data or digest it or process it or create a package or variable or whatever they need so that it can be picked up and used in the Caribbean. So, change is slow, but working on that. There's a need there, and we're working on that. In Florida, it's getting it picked up more. But I will say that as far as management goes, that's from NOAA's perspective. Again, we have other agency partners. We have a lot of academic institutions that are publishing a number of different studies on this. So, Florida Department of Environmental Protection, Florida Fish and Wildlife, National Park Service, EPA, Environmental Protection Agency, we have a bunch of groups that are working – we have the counties, Miami-Dade County. We have the Broward County. Then in the Caribbean, we have territories. So, we have DPNR – I forgot that one – which is Department of Planning and Natural Resources in the Virgin Islands, and then DENR which is Department of Environmental and Natural Resources in Puerto Rico. Those are easy for me to embark. All of these groups can use these data too. So, in Florida, the State of Florida runs their stock assessments for the catch, which – the coral reefs that we're studying in Florida are in state waters. They're within three miles of shore. So, while we're collecting these data, the State of Florida is really what sets the fishing regulations for the fish that I'm surveying. They're using RBC data to make these decisions. Then out in the Dry Tortugas, the RNA, that protected area, is managed by both FWC and the Park Service. The state owns the land and the Park Service owns the water. So, they co-manage together, and they use the RBC data to create this spatial no-take area. It was five years initially. Then it got a scientific review by both agencies and it was approved for another five years, and then got another review. It went so well and that it got approved for another twenty years. So, they're not going to be looking at this for a while. So, RBC data is making a difference, even if it's not just NOAA that's doing it. Most recently, in 2019, the Florida Keys National Marine Sanctuary helped them use RBC data for their draft environmental impact statement, which is what they are using to discuss proposed new zoning in the sanctuary, to look at sanctuary boundaries, regulations, measures. The fish data that they're using to make all of these changes in the sanctuary is RBC. So, that's underway. Then also, Biscayne National Park just put in new regulations on July 1, 2020 – so last month – looking at different sizes and numbers of their targeted species that can be caught, because they want to increase the size by twenty percent and increase the abundance of these species by twenty percent. They're using RBC data to collect, to test, to see if their management applications are effective. So, it's being used, and every single agency and group, including myself, are trying to make sure that it's used as well as it can be and in every area that it can be. We're all pushing for the same goals, that there's this comprehensive data set that's essentially – the methods and the survey design had become the national standard. It's used by MCRMP in every basin. Every U.S. coral reef is surveyed using this strategy. What can we do with it? Is it a national status report? Is it a jurisdictional status report? Is it stock assessment? Is it to do rezoning? Is it to create special protection? Is it just to report out on the reef tract? Is it to give information to the public? There are so many different avenues.

ZM: So, are you really invested in other people using RBC? How does it feel personally? Because I feel like you have been really involved in this data set. How does it feel that it is being

used in so many different applications?

JG: I think it's great. I mean, I became a civil servant. I chose to do a path where I was hoping to have data. I didn't go down a research path and become a professor at university. I chose to work with a publicly available data set. If the public or different agencies are using the data, then I'm doing my job. If they're not, then I'm not doing my job. So, the more people that are using it and comparing it to different regions and using it to promote and progress the science, the better.

ZM: I know we are five minutes over time. I have two more questions. Do you have time?

JG: Yes, go ahead.

ZM: As we are going through, at least for your educational career, I noticed that most of the professors you mentioned were men. So, I feel like, at least in this field and in the academic realm of things, it can be very male dominated. So, as a woman in science, have you ever faced any kind of discrimination or were you ever held to a double standard coming up through your education and then into your work experience?

JG: Obviously, this is a very sensitive subject, and it's one that's getting more visibility. It's not something that I've openly talked about before. Does discrimination exist in the field? Yes, I would say it does. Have I experienced it? Yes. However, there have been a lot of great opportunities that I've had that have been given to me by male mentors and advisors that have been fantastic. So, it's not a one-size-fits-all. I think there's a lot of reasons why women haven't carried on in the field before. I think women generations in front of me faced much larger discrimination, probably, than I did. That's why there's not as many of them. A lot of master students are women, and then a lot of Ph.D. students are women. Then sometimes, they choose that they don't want to continue on in science. Afterwards, their priorities have changed. Some of them don't get hired. There's definitely good old boys clubs that I think exist. However, in the federal government, I have not experienced that. So, I've been very fortunate in my last four years to not experience that at all. I feel like it's been fair. I've been given fair opportunities. I think it's hard when you're younger. You're told early in your career, "If there is any discrimination that goes on, you can't really say anything. You're young, and whoever that person is with power over you has the ability to not let you publish. If you don't publish, you perish and – or has the ability not to give you a good recommendation." So, it's something that's not talked about, because if you talk about it, it could reflect poorly on you, and all you want to do is move on to the next best and brightest opportunity. Let me think if I have anything else to add. I would say that the discrimination that I currently face as a professional is that – or what I've noticed is a lot of professional women have a chip on their shoulder. I know why they have it there. I understand why they got it. Not necessarily my generation. This is generations ahead of me. It's because people are always second-guessing. You have to continuously prove yourself. Part of that's good, right? Don't take everything I'm saying as I'm saying it. Please challenge me. Please make sure that I'm doing sound science. Please just don't take everything that I'm saying. But sometimes, it's hard if you're always consistently having to prove yourself, when it should be something that is accepted. I have made a concerted effort at my detriment at times, I think. I don't want to be a woman with a huge chip on my shoulder. I want to be

approachable. I want to be nice. I don't want to make it in the field because I was cutthroat. I don't want to make it because I was mean and got there. Maybe I've missed out on some opportunities because of that. But at the end of the day, that's how I want to look back on my career, is that I was friendly and approachable. But I have noticed, even in professional interviews, they'll call the older gentleman a doctor. Doctors also, they'll call the older woman a doctor. But then me, they don't say anything. I don't think it's intentional. I think they just see me. I'm younger. I'm approachable. I'm laughing with them. But in its own way, it is a little bit of its – it's their thought process. It's not intentionally discriminating, but it is. Because then, later on, when I go to show somebody that interview, or my supervisor, I wasn't given the same level of professional courtesy as some of the other people. That does hurt me in my career, even if it's not intentional. So, I think that it does exist with women, without getting into any specifics. But I think it's surmountable. I think just stick with your ethics, your value, your hard work, your brainpower, and you can overcome it. In most cases, I was not subjected to anything that I could not overcome.

ZM: Would you feel comfortable discussing any specific instances? You can feel free to say no.

JG: So, here's the problem. When you talk about things, it could identify who the person is. These people can be traced back in your – this is a problem on both sides. It's a problem because, even now, as a professional ten years removed, I'm still being silent about it. That's a problem. I made my career of not being confrontational about that and by working hard. So, it's a challenging situation, because I do want to bring light to issues that happened and in the ways that women are discriminating against and how it can be really challenging when you're starting in your career. But giving specifics is not something that I'm at a – I don't like to make waves in that arena. I've seen published articles that recently came out about women in graduate school and everything they have to go through. I read the article and I've seen this. Yes, that happened to me." I would say there's sometimes pressure – I'm just going to speak generally – at conferences, when you're younger in your career, to make sure that you socialize and drink a fair amount. If you don't, then you're uptight and you're stiff, or you need to go out and you need to party and you need to – older professors in the field might hit on you, and you're just supposed to smile and take it. People can assume – this is general, again – that you got to a point because of a relationship with somebody, which is not okay. Fishermen – I work sometimes on commercial boats – some of the things that they say are wholly and wildly inappropriate. Is it okay? No. I've taken it with a grain of salt. I'm entering into their environment. This is how they interact with one another. This is who they are. I'm probably perpetuating the problem by not saying something, but you just have to roll with that if you want to have a good rapport with them. I'm not saying that that's okay. It just exists. So, no, I'm not willing to get into specifics. I will say that I've never met a woman in the field that hasn't experienced something. There are greater or lesser degrees that we've experienced it, but discrimination happens, obviously. It's 2020. In a lot of different ways, I feel very fortunate that I don't feel like I'm faced with it today in the same way. I feel I am respected for my work. I don't think that I'm getting opportunities or not getting opportunities because I'm a woman in the field. Especially in fisheries, the only women that I interact with that are in more senior positions happened to be in – most of them are in the federal government or state agencies. I don't see a lot of them in academia. The ones that did make it in academia didn't have a family. They had to make a decision. They chose to have either not have a family and have a career. Very rarely do I see a woman in a high position in academia that had

both. So, maybe if I went down a different path, I would view that differently – where all the males appear to be able to have families and a career in comparison, if that's what they want.

ZM: There is a lot to unpack there. I am not sure I am trying to unpack all of it, but I think I would just like to touch on the theme of a double standard. You mentioned family and career. Then, also, you mentioned a potential chip on the shoulder of a lot of women in this field. I am wondering if maybe, looking at it, you see that as being kind of a double standard as well, because there are a lot of men who come off as maybe mean or angry or assertive, and that is just kind of a quirk that they have and people seem to accept it. But even when you are describing other women in the field, it is like a chip on their shoulder. That is something that you have actively tried to minimize yourself.

JG: Yes. If you're considered to be assertive, you're abrasive. A man's assertive. A woman's abrasive if they do that. It is something that you have to be conscientious of if that's not the perception that you want. Someone would say, "I don't care. I'm going to speak my mind regardless." And that's great. I'm very cognizant of relationships. I want to make sure that I'm being interpreted correctly, because I like having longstanding relationships. I like to be collaborative. I like to work in teams, and I don't ever want to be perceived as somebody that isn't a team player and can't do that. I don't need to be the best to have my name on the front of everything. But I do want my name in a good place if I work for it. If I put in the effort, I don't want my name six people back on a publication, because that's – just because I'm not as vocal about it. But then I choose. I pick and choose which scientists I want to work with that I think are fair and reasonable.

ZM: Getting started, did you have any female role models or mentors that kind of stood out to you?

JG: I had very few female role models in the marine science field. My mother and my great aunt are probably the two role models in my family. My great-aunt got an accounting degree, because she decided that women could be secretaries, but they could also be accountants. This is after the Great Depression. She was born in 1910. She worked as a secretary, got secretary pay, but went to night school and got her accounting degree. Even if they wouldn't pay her as an accountant, she did the books, and she continued on. She was all about education and moving forward and bettering yourself. Even if people say you can't do it, you can do it. My mom also started in finance where there weren't as many women in her generation. She'll tell stories about how when she had me, people were calling her three or four weeks later, "Can you return to the office now?" She would be just like, "I have a three-week-old baby. I can't do that." But there was no maternity leave. There was no expectation. It was just women in her field didn't have children in the same way that you can today. While they weren't in the marine science fields, and I didn't – just by chance, there are a lot of good females that could have been mentors. I just didn't happen to cross paths with them myself. I actually brought this up to one of my colleagues who's probably in his fifties. I just said, "It's really interesting. All my fisheries mentors and everybody that I've had has all been male advisors. I've never worked for a woman until actually my most recent supervisor that just started last month. I've never had a woman supervisor." He made a comment, he said, "Huh, that's really interesting. My best supervisor that I ever had was for my masters, and it was a woman. She was fantastic. She was detail oriented. She really had

this broader picture. She really thought about the relationships of things. She was really savvy with statistics and math." He said that she really carved out a path in his mind, and also his perception of other female researchers. So, I didn't have that. But I saw women in other fields, and I knew that I could do that. I think it's just like I said, by chance. I could have ended up at a different university and worked for a woman. There were women at the universities that I worked for. They just never were in the field that I was interested in.

ZM: Finally, if you could give some advice to a new generation of potential marine biologists, what would you tell them?

JG: Oh, boy. Perseverance? Perseverance. I think it's important to trust in yourself, trust in your abilities, and to continue to set and follow your own path. This field, science in general, if you write for funding or publications or competing for jobs, you're going to encounter rejection. I've never met a scientist in the field that hasn't encountered rejection. It's what you do with that rejection and how you take it and turn it into something. Can you learn from that rejection? Just keep going. I've had jobs that I've applied for that I've gotten, and then had multiple offers at the same time, and that feels amazing. But then I've been in application situations where I've applied to many number of jobs and gotten a lot of rejections before somebody finally said yes to me. But I kept sending emails or kept making the phone calls and putting myself out there and kept trying to get the experience. What do I need? What's the next step? What do I need and how can I do that? Then the other thing that I would say is stay focused. Stay dedicated. But it's okay to take a little bit of a different path like I did, and it ultimately could help you in the end. It doesn't mean that your career is over. Timing is everything. There's a lot of hard work in this field. It has to do with a lot of brains, a lot of talent, a lot of hard work. But ultimately, getting the position, there's a heavy amount of luck involved, which is something that you have no control over. For example, the position that I ended up with in NOAA, am I qualified? Do I think I work hard for this position? Absolutely. But this position happened to be posted at the right time for me to come out and receive it. If it was posted four years before, I wouldn't have had the experience. If it was posted four years after, I probably would have been embedded in a different career path that I wouldn't have looked at it. So, the timing has to work out too. This is a very challenging field. It produces highly qualified and highly talented individuals at all levels – undergrad, masters, and Ph.D. – more than there are jobs in the field. So, it's not a guaranteed position. It's not like you go to school and you get a business degree and you work in business. So, it's a shoo-in. It's a challenging field. I think making sure that you understand that when you go into that and making sure that you have a backup plan if it doesn't work – I minored and did a lot in education because that's a good backup option for me. I never ended up needing it, but it was always a nice feather in my cap to be able to fall back on if I needed it. I don't want to sound like it's impossible to get a job in the field, but I do get torn about this when people ask, "My daughter wants to be a marine biologist. What do you think?" It's like, "If she really wants to do it, do it." But you're not doing it because you want to make a ton of money. You're not doing it because you want to get a ton of notoriety. I could have gone to dental school for less years of education and probably get to take Fridays off and do everything else. But it's not what I wanted to do. I love what I do. I said, "I think that's really it. Make sure that it's something that you really love. It's not a field that you want to get into and realize that it wasn't quite for you, just because it is a lot of schooling – and also understanding that in order to get a job in the fields, you pretty much always need a higher degree – a master's, a Ph.D. – and also

understanding the differences between a master's and Ph.D.." There are people that are so smart and very well qualified that could have gone on to get a Ph.D., but the end job that they wanted required a master's. If they got a Ph.D., they'd be overqualified for that job. Some of the smartest individuals I work with have masters. A Ph.D., what does that mean? What role and what job does that have? It's probably less field time. I'm one of the unique cases that I have field time. A lot of PHDs don't have field time. It's a lot more writing for funding, looking at these management plans and progress. It's dealing with more of the administrative side of running a group. If that's something that you're interested in, great. But often, you take your hand directly out of some of the ongoing research, and you take a step back. Is that something you're okay with? So, making sure too that you understand what your end goal is and making sure that you're getting the appropriate degree for what you're targeting.

ZM: Awesome. Well, we have gone substantially over our time. Sorry about that.

JG: No, I'm fine.

ZM: Okay. Well, yes, it was just really great talking with you. It was fun for me at least. I learned a lot. I really appreciate it. I know it is a long interview.

JG: Absolutely. Let me know if you need anything else.

ZM: All right. Thanks, Jay.

JG: Okay.

ZM: Bye.

[end of transcript]