

**TRANSCRIPT**

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**David Todd** [00:00:04] Well, good morning. I'm David Todd. And I have the great privilege of being here with Dr. Joan Holt. And with her permission, we plan on recording this interview for research and educational work on behalf of a non-profit group called the Conservation History Association of Texas, and for a book and a website for Texas A&M University Press, and finally, for an archive at the Briscoe Center for American History at the University of Texas at Austin.

**David Todd** [00:00:37] And I want to stress that she would have all rights to use the recording as she sees fit. It is hers.

**David Todd** [00:00:44] And I wanted to make sure that that's okay with you, Dr. Holt, before we proceeded.

**Joan Holt** [00:00:49] Yes, it is.

**David Todd** [00:00:51] Great. Okay. Well, thank you so much.

**David Todd** [00:00:54] Okay, Well, let's get started. It is Wednesday, June 21st, 2023, the summer solstice. It's about 10:15 Central Time.

**David Todd** [00:01:06] My name is David Todd, and I am representing the Conservation Industry Association of Texas, and I am in Austin. And we are conducting a remote audio interview with Dr. John Holt, who is based in the Port Aransas, Texas, area.

**David Todd** [00:01:23] Dr. Holt is professor emerita of marine science at the University of Texas Marine Science Institute in Port Aransas, where she spent over 35 years as a researcher, a teacher and administrator. Her research has focused on captive spawning and rearing of redfish, spotted trout, cobia and flounder. And of special interest to us today, she organized two international meetings on the American tarpon and that resulted in key reports on tarpon ecology, growth and distribution.

**David Todd** [00:01:58] Today, we'll talk about Dr. Holt's life and career to date, and especially focus on what she's learned about the history of Atlantic tarpon over those years.

**David Todd** [00:02:12] So, I wanted to thank you before we went any further. This is very kind of you.

**Joan Holt** [00:02:17] You're welcome.

**David Todd** [00:02:19] Well, thanks.

**David Todd** [00:02:20] So why don't we start by asking you to tell us about your childhood and early years, and if there might have been some people or events in your life that influenced your early interest in animals and fish in particular?

**Joan Holt** [00:02:35] Well, I grew up in Fort Worth, in a large family. There were five or six children at that point. We lived on the edge of town in a semi-rural area, and so we had chickens and there were horses next door. And it was a very large area, probably an acre that we lived on, and we spent a lot of time outdoors. In fact, we were outside much more than we were inside then.

**Joan Holt** [00:03:06] And my grandparents lived on a farm in nearby Burleson, Texas, and we went there often. And during the summers I spent my summers there. And my siblings and I spent a lot of time. It had a lot of trees and some open fields for cows and some crops, but it was mostly pretty rural. And we learned to swim in the stock tank and to fish with grasshoppers on a safety pin, which wasn't very effective. But we enjoyed doing that. I guess every summer, until I went to college, I was there, just playing in the trees and in the woods and catching grasshoppers and running from the cows. We were always afraid the cows were going to get us, so we always ran from them.

**Joan Holt** [00:03:59] After that, after I graduated from high school, I went, well, after I graduated from grade school (I went to an all girls' high school in Fort Worth, which was Our Lady of Victory), and it was an interesting experience because with no boys there, you weren't distracted very much, and it was a much more competitive atmosphere. I enjoyed chemistry and biology and my teachers, the nuns, encouraged my interest and I felt like I could accomplish anything I wanted. And it was a good feeling that I could do those sorts of things.

**Joan Holt** [00:04:44] My teachers helped me with a scholarship that I got to attend the University of St Thomas in Houston. And being the first in my extended family to go to college, it was important to do well.

**Joan Holt** [00:04:59] My family drove me to Houston and it was the first time we had ever seen the ocean. So we got to see ships and it was just a fun time just to see that.

**Joan Holt** [00:05:11] At the University of St. Thomas, I majored in biology. I thought I was going to do chemistry because I imagined myself in a white coat and these test tubes with gurgling chemicals and colors in them. But, that didn't work out because I really found that I loved biology more. So I ended up majoring in biology.

**Joan Holt** [00:05:36] And after two years in Houston, I came back to Fort Worth and finished my degree at Arlington State University, which is now University of Texas, Arlington. And I majored in biology there. And I continued with the master's program at UT-Arlington.

**Joan Holt** [00:05:59] And took all kinds of wonderful courses that got me in the field - ichthyology, mammalogy herpetology - really things that I enjoyed a whole lot, going out and measuring trees or catching fish or mammals.

**Joan Holt** [00:06:19] And for my Master's, I did a study of homing in cotton rats, which is a funny thing, but cotton rats are an important field mammal, a rodent, that I guess may have caused problems with cotton. I don't really know that. But they were called cotton rats.

**Joan Holt** [00:06:45] And I would catch them and release them at various distances from the site that they were trapped and some for up to a mile. I'd take them in the car, drive them a mile, let them go. And amazingly, many of these cotton rats would return right back to the same spot, and I'd catch them in the trap again the next day or two days later.

**Joan Holt** [00:07:08] So, they were, if they were adults and mature and maybe had young, they came back very quickly. If they were juveniles, they didn't come back at all. So I guess I just helped them disperse.

**Joan Holt** [00:07:24] The interest in the outdoors [made me want to go on for my Ph.D. and study something that would be similar but not mammalogy, because I thought, "What can you do with that, really with a degree in Mammalogy?"

**Joan Holt** [00:07:41] I went to Texas A&M University, in the Department of Wildlife and Fisheries, and worked with a professor, Dr. Strawn, who was doing a project in Galveston Bay and Trinity Bay to determine the effects of the power plant on the animals that lived in the water. And I took part in that, along with four or five other students, all men. I was the only woman in the Wildlife and Fisheries graduate program at that time.

**Joan Holt** [00:08:19] So I would go out and catch the larval stages of shrimp and fish and identify those and see how many and where they were located in the bay, in relationship to that power plant.

**Joan Holt** [00:08:35] There I met Scott Holt, who worked with me on the boats collecting fish. Many of the other male graduate students did not want to work with me on the boat, but Scott was very happy to work with me. So that really began our first knowledge of each other and of our interest. So I worked with him on the boats collecting fish and eventually came back to College Station, finished my thesis and graduated in 1976.

**Joan Holt** [00:09:09] Scott had had finished the year before, and he got a master's degree in Wildlife and Fisheries and moved to Port Aransas to begin working on a project that was going on at the UT Marine lab there. After I was almost finished, I hadn't written my thesis yet, my dissertation yet (I had all the data and all of it analyzed, but I hadn't written it up), so I also went down to UT Marine Science Institute and began working as a researcher while I was finishing my degree.

**Joan Holt** [00:09:48] Eventually, I began to work with Dr. Arnold in the Fisheries and Mariculture Laboratory, raising redfish. He had figured out how to spawn redfish in captivity, but there was not enough information on how to raise the young. So that was my job was to figure out how can we do this in an effective way.

**Joan Holt** [00:10:13] The most challenging part was the larval stage, and that's the stage when the fish is in the plankton still, is out in the water in the plankton, feeding on the zooplankton and they are no scales and no fins and just the tail that they use to swim by and a mouth to feed.

**Joan Holt** [00:10:38] And so this is a pretty special stage that happens in many marine fish, and they needed special water quality and I had to try to find the food that they would eat and how much of it they would need and work that out, which was, it really took me almost a year to come up, perfect a technique for raising them very successfully.

**Joan Holt** [00:11:03] I guess that the take-home message was once I had figured it out for redfish, that it was very easy to do for their close cousins. Spotted sea trout and croaker are in the same family. Their larvae are similar and they were, I was able to rear them in the same way and describe their development and how they changed over time because that hadn't been described at that time.

**Joan Holt** [00:11:31] I also worked with flounder, which was more difficult because flounder start as a regular fish. That is, the eyes are on both sides of the head and the tail on a little juvenile fish. And during their development, they have to migrate the eye over to the other side, when they become flat fish. And their fins and their eye has to migrate over. And so that's kind of a special period where it's pretty specific to those kinds of fish, and it needs to be done in a way that they are able to change their food when they change their habits.

**Joan Holt** [00:12:19] I taught graduate courses there, as well as doing the research. And, at the time, everybody was research scientists. There wasn't a department at that time. And so all the scientists had to do the teaching that we did in the summer when students came down from UT-Austin.

**Joan Holt** [00:12:42] And later we developed a department, a Marine Science Department, which was part of UT-Austin. But all the students and graduate students and the courses were down in Port Aransas.

**Joan Holt** [00:12:57] So I became an associate professor and had many graduate students and post-docs that worked with me, learning the secrets of marine fish larvae and juveniles. So I really enjoyed working with all the graduate students. That was one of the pleasures of being a professor, an associate professor, is having graduate students that you can help guide through their careers. Many, many, many students came through from, they were all UT-Austin, but spent their time in Port Aransas doing the research and studies.

**Joan Holt** [00:13:45] When Dr. Arnold, who ran Fisheries and Mariculture retired, I became the director of Fisheries and Mariculture and continued work on marine fishes. We worked with cobia and also I began working with ornamental reef fishes, the idea being that if we could produce those in captivity, they wouldn't have to go out to the reefs and collect all the fish that were sometimes causing some issues in areas where they were overfished.

**Joan Holt** [00:14:21] That was fun work and very, very challenging because some were fairly easy to raise and others were impossible to figure out what the larvae needed or where they would be, because fish on coral reefs spawn and the eggs go up into the water column, they hatch into a larva and those larvae are then in the water column, floating away from the reef, finding the conditions that are perfect in the area around a reef of temperature and salinity, oxygen and the food may be abundant there.

**Joan Holt** [00:15:01] So it was challenging to find food for them. And what they really wanted were copepods, which were quite difficult to raise and produce. So I had limited success on that, but I think it inspired others to try to work on the coral reef fishes, the marine ornamentals, and there are people still today doing that and trying to produce those small fish for the aquarium trade.

**Joan Holt** [00:15:31] I retired in 2010, but I was asked to stay on as acting chair of the Marine Science Department for a year while they were getting a new director. And then the next year

they asked me to be an acting director for the Marine Science Institute. So I finally retired in 2012.

**Joan Holt** [00:15:54] Okay?

**David Todd** [00:15:58] Sounds like they couldn't let you go.

**David Todd** [00:16:03] So just to back up a little bit, I think you've had such a interesting life from those early days in Fort Worth and Burleson and then, you know, in university. And I was wondering if there were any individuals - your parents, friends, family members - that might have shared this kind of interest in the outdoors. It sounds like you did a lot with your siblings. But was there anybody else that might have been influential?

**Joan Holt** [00:16:45] Well, I think that my interest in the outdoors was because that's all we had. You know, we didn't have all the TVs and the computers and cell phones and all the games that people have now. There was really nothing to do. You didn't want to sit inside the house. So out you went.

**Joan Holt** [00:17:10] And I don't remember being influenced particularly, except for the fact that my grandparents had this farm. And so we were able to to go out there and spend the time with them. But even then, nobody in my family fished or hunted. So we really just enjoyed being outside for being outside, I think.

**Joan Holt** [00:17:34] My teachers at high school were very encouraging in the sciences, and encouraged me to pursue my interest in chemistry and biology.

**David Todd** [00:17:48] Yeah, it sounds like the nuns were a good backer for you. That's wonderful.

**David Todd** [00:17:58] So something else that we often ask people is whether there was some sort of a general interest item of the culture, whether it is books or films or TV, that might have caught your interest and been encouraging and inspiring for you to explore and work in the natural sciences.

**Joan Holt** [00:18:24] As we were growing up, we really didn't go to the movies. And of course we had a TV when I was a teenager, but we only watched a few things on TV on Sunday, so that was not an important part of my life.

**Joan Holt** [00:18:40] Books, maybe. I remember my favorite book was Huckleberry Finn, and so that was sort of a young boy that spent a lot of time outdoors and doing lots of fun things, and I enjoyed that very much. But even though I read a lot, I don't think I was inspired by reading to go outdoors.

**Joan Holt** [00:19:06] I think it was just part of our nature and part of our life in my family for the kids to get outside and do things.

**Joan Holt** [00:19:15] My youngest sister, one of my younger sisters, who also has a master's in ornithology, told me that when she was young (and that by then I was not paying much attention to the young kids: I was in high school or college), that she would go out for hours at a time and play in water puddles and catch little fish and all kinds of things. So she really also enjoyed just being outdoors, because you could be outdoors.

**David Todd** [00:19:49] Well, that's remarkable. So sometimes I guess it's not the people in your life. It's maybe more the opportunities and experiences that you have to explore on your own. Is that fair to say?

**Joan Holt** [00:20:00] Exactly.

**David Todd** [00:20:02] Yeah. Well, so you gave us a nice introduction to your research with so many different kinds of fish, whether it was, you know, redfish or the spotted sea trout or cobia or flounder. You know, today I was hoping that we could particularly learn about your work with the Atlantic tarpon. And I was hoping that you could tell us maybe what your first encounter was with an Atlantic tarpon.

**Joan Holt** [00:20:34] Well, I've actually never caught an Atlantic tarpon, but my first encounter was a big scale that a friend of mine brought me, that was from the fish that he had caught from a tarpon. And that scale was amazing. It's, you know, three inches across - a really large, hard scale. And then, of course, my next encounter was with the scales at the Tarpon Inn. So that is really my encounters with Atlantic tarpon, other than seeing them in a tank, perhaps a small tarpon in a tank at Sea World.

**Joan Holt** [00:21:18] So, I was really interested in tarpon, because Paul Swacina, of Tarpon Tomorrow, came to us and said, this is really something that we should get involved in because of the history of Port Aransas. Port Aransas was known as the Texas tarpon center, the center of Texas tarpon for many, many years. And in fact, in the early 1900s it was called Tarpon, Texas. In the late 1880s and early 1900s, tarpon were the fish that everyone came to Port Aransas to catch.

**Joan Holt** [00:22:04] And with the history of that, he said that Port Aransas is a perfect place to have a tarpon symposium. So I agreed, Scott and I agreed, to work with him to try to develop a symposium on Atlantic tarpon. And that's how it began.

**David Todd** [00:22:25] Okay, well, maybe this would be a good point to just get your basic outline of the tarpon's life history and the ecological niche that they fill. And then maybe we can talk some more about the particulars of tarpon that maybe you can explain. But what's sort of the basic outline of their life and their role?

**Joan Holt** [00:22:58] Tarpon spawn in oceanic waters. And they release the eggs and sperm into the water. It's called broadcast spawning. Many marine fish do that - redfish (red drum), for example. And the larvae hatch into what is called a leptocephalus larva. And that is what the eels produce and the bone fish. It's a special larval stage that's transparent and flat.

**Joan Holt** [00:23:28] And they, it's not clear what they feed on, but perhaps particulate organic carbon, or what you would call marine snow in the ocean is what they feed on. And these larvae - no maternal care, as in most marine fish. The larvae are moved by currents to the coastal waters and at 20 or 30 days they might reach the coast and transform into these juvenile fish, which are miniature tarpon.

**Joan Holt** [00:24:00] And they enter into coastal lagoons or bays. And they feed and grow up in these estuaries, and eventually move to near-shore waters.

**Joan Holt** [00:24:14] They reach sexual maturity at five or six years old and at a very large size - four or five feet long fish.

**Joan Holt** [00:24:25] So, they start their cycle again. And they might live a very long, long time. I think females are thought to live 50 years or so and males 30 years. So it's the potential to produce a lot. But there's stochastic events that occur so that maybe some years the larvae do well and other years they don't do well.

**Joan Holt** [00:24:54] I remember hearing about a time in Florida when a hurricane came through and it really moved the larvae into the coast, so they had a very large input that year. But other years perhaps not so many. So it's stochastic. It happens sometimes very well, or at other times not. But they have many years to reproduce.

**Joan Holt** [00:25:20] And of course, we always say what the ultimate answer is, is a replacement, right? If you're a female, there'll be a female replaced, or a male, a male replaced. So any more than that is extra. And that's reproduced.

**David Todd** [00:25:36] And what sort of role do they play? What's the niche that they fill in the ecosystem?

**Joan Holt** [00:25:43] Well, the niche is ... they're omnivorous. They feed on a lot of fish. So they probably are unique in their overall life history pattern. But other than that, they don't have a particular niche that's unusual, I don't think.

**David Todd** [00:26:09] Okay. You know, one thing that I was fascinated by, I was reading "Migrations and Movements of Atlantic Tarpon", a fine article, and I was struck by how ancient it appears the tarpon is as a species, you know, that maybe it has been around as much as 100 million years. And I was wondering if you could talk to us a little bit about that long trajectory, that long arc in their history and what sort of strategies do you think have allowed the tarpon to survive in so many different kinds of conditions?

**Joan Holt** [00:26:51] Well, because tarpon are spawning in the ocean, that certainly is a very steady place for reproduction to occur. The oceans don't, until recently, haven't changed a whole lot in temperature and water quality. And so that certainly is one important thing.

**Joan Holt** [00:27:16] And the young that can live in coastal estuaries can handle conditions that have low oxygen. It doesn't bother them because they gulp air, and take it in so that they don't need to have high oxygen levels like many other marine fish larvae have to have. So that's probably a reason why they have been able to. Even the adults gulp air as well. And in fact, they say you see them rolling over at the surface and gulping air even in the coastal waters.

**Joan Holt** [00:27:53] So, that is a wonderful attribute that allows them to take advantage of many conditions that other fish can't handle. That may be a reason to help in establishing their longevity, is that they were able to breathe air.

**Joan Holt** [00:28:14] And because they're so long-lived, they have a long, long time to produce young and in the conditions that are appropriate for its survival. So maybe that's another reason. If you live ten years or 50 years, it makes a big difference in whether there are tarpon that grow up and survive. So maybe that's why they've been able to last so long.

**Joan Holt** [00:28:48] They are certainly primitive-looking. And the young are too. The leptocephalus have fangs, even. The leptocephalus larva has fangs. And that's a real primitive-looking. So I'm not surprised that they might have been around for a very, very, very long time. And I hope they will continue to be around for the future.

**David Todd** [00:29:14] Do you think that they're, and this is just a layperson speculating, so this is pretty presumptuous, but do you think that having these heavy scales might have protected them from predators?

**Joan Holt** [00:29:28] Yes. I really wonder what their predators might be. I haven't read anything or heard anything about the predators, but certainly the very thick, heavy scales would protect them. What are we thinking? The dinosaurs perhaps would reach out and try to get them? Or perhaps some early tyrant that we don't even know about. But I think that would help. Yeah.

**David Todd** [00:29:56] Okay.

**David Todd** [00:29:57] Well, this is something you touched on a moment earlier, but maybe you can help us understand this sort of history, much more recent, of people and tarpon, particularly in Texas. I understand that, from what you were saying, that Port Aransas was for many years kind of the center of tarpon fishing. And I was hoping that you could give us some sense of what the origins of sport fishing for tarpon might have been, and how Port Aransas got to be so associated with tarpon fishing.

**Joan Holt** [00:30:40] As early as the 1880s, Port Aransas was considered the Texas tarpon capital of the world. I think it's quite interesting because there was very little of Port Aransas at that time. It was just some small fishing camps and some people that that lived in the dunes or lived along the water's edge. But it wasn't very many people here at that time.

**Joan Holt** [00:31:09] And the pass that is there now had been moving south from where the lighthouse is, which was where the pass originally was. And it was moving south. And so changing where the boundaries were of Port Aransas and San Jose that are there now.

**Joan Holt** [00:31:33] In the early eighteen, I guess the late 1880s, the government, the U.S. government, decided to stabilize that bar so that it could be used for shipping and began to build the rock jetties. And these jetties were right at Port Aransas as we know it today, and probably allowed a lot more access to get to the coastal waters to get out and catch these tarpon.

**Joan Holt** [00:32:11] I've heard of the Tarpon Club that was established in the late, well, I guess 1880s, '89, on San Jose Island. But I really don't have many details about that. The Tarpon Inn was built in the late 1800s, and in the 1900s became famous, or not so famous, to tarpon fishermen, many famous and not so famous tarpon fisherman. So this was the center then of where tarpon fishermen would come and fish, with the guides that would take them out to the fishing tournaments, the fishing along the coastal edge using the Farley boats that were built at that time.

**Joan Holt** [00:33:04] The Deep Sea Roundup, which is going to be held again this year, which is the 87th annual Deep Sea Roundup at the end of June, was first known as the Tarpon Rodeo. And it was organized by the Boatmen's Association that was boat captains worked together



and kind of did things to advertise Port Aransas as being a place to come for tarpon and had this Tarpon Rodeo every year, that was eventually renamed the Deep Sea Roundup.

[00:33:43] Interestingly, now you can catch tarpon, but it's completely catch-and-release for the tournament. And that I think has changed a whole lot in many places. But for a long, long time the tarpon were caught and the tarpon scales were brought in and put on the walls of the Tarpon Inn. The scales would have the weight and the length of the fish and the name of the fisherman, including the scale that FDR, Franklin Delano Roosevelt, caught in the thirties, is on that wall in the Tarpon Inn, the Tarpon Inn that was then being used very much by these fishermen and guests and people that came.

**David Todd** [00:34:40] You know, one thing that I think is interesting and and maybe you can kind of elucidate here is that it sounds like the tarpon was kind of your prototypical sport fish. I mean, from what I understand, you can't eat it. So it was really a trophy fish. And I'm curious about that whole culture that grew up around it. This wasn't, you know, fishing for meat to put on the table, but more something that was a pretty elite sport with guides and boats and a whole culture around sport fishing. Is there anything you could talk to us about, about that early history with the tarpon?

**Joan Holt** [00:35:34] I think that tarpon have always been a game fish because they are so much fun evidently to catch. They jump and they fly through the air and roll. And so it's a real challenge to a fisherman. Therefore, I think that fishermen catch, or try to catch, tarpon not to eat. Of course, you never, you do not eat tarpon, I understand. It doesn't taste good at all, at least to our taste. And so it's, the challenge is to catch it.

**Joan Holt** [00:36:15] And I think that, even today, people are still wanting to catch tarpon. And there's places out of Freeport and off Galveston, and off of South Padre, where they have guides that specialize in taking people out to catch these tarpon. They're probably not as big and don't give the real fight that the giant ones do, but they are still evidently, even a 30 or 40 inch tarpon is really a fun one to catch and people love it.

**Joan Holt** [00:36:49] So I think this whole interest in tarpon was the thrill of catching a tarpon, seeing it jump, seeing it flop in the water and go up into the air maybe 20 feet, and back down into the water as you have it on the end of the line, might be really, really exciting.

**David Todd** [00:37:08] I bet. That sounds terrific. I can just picture it. Of course, I've never actually had the good fortune to do it, but I'd like the way you explain it.

**David Todd** [00:37:19] So, you and your husband, Scott, became noted tarpon scholars, and I'm wondering, how was it you found that you had this shared interest in tarpon?

**Joan Holt** [00:37:37] Scott and I share a whole lot all the time. We worked with the redfish and he worked with the redfish in the wild, and I worked with them in the lab. But we always shared this work. If I had a graduate student doing a project in the lab that needed to go to the field to either verify what they were finding or to give them some ideas of what to look at, Scott was the go-to guy because he was such a field person.

**Joan Holt** [00:38:05] He did take the boats out and would go take my students and they would get the work they needed to do out there. He was often a co-P.I. on our projects and the co-P.I. on the written papers because of that. So we were used to working together, each in our niche, to come up with a good solution to problems.

**Joan Holt** [00:38:35] And so, when the tarpon symposium idea came up, we discussed it and decided to, both of us, organize and help. I would do what I could do best, and he would do what he could do best, and make sure that we got this symposium to be appropriate.

**Joan Holt** [00:38:55] And we invited the people to take part. Some were field people and some were people that knew about tarpon from fishing. And so we had fishermen, we had Parks and Wildlife and other management groups, and we had scientists and researchers. So it was a really good collaborative group that could reinforce each other and answer questions that the other group didn't know much about.

**Joan Holt** [00:39:25] And it seemed to be the way that we should tackle the issues of tarpon. What's going on with tarpon? We needed to have the fish captains, the fishermen. We needed to have the agencies that were, or were not, managing those fish. And then we needed the researchers or scientists that were doing, trying to, understand the tarpon. And I don't think you could do it without those groups working together. We just didn't know enough at that time.

**Joan Holt** [00:40:00] So, we got a really good representation. And that worked well because Scott and I had different contacts, and different people that we could bring in to make this work.

**David Todd** [00:40:18] Well, so one of the outcomes of the symposia, and I'm sure there were many others, but in 2004, I think you've prepared a really intriguing paper called, "What Historic Tarpon Scales Can Tell Us about the Tarpon Fishery Collapse in Texas." And I thought it just brought up lots of really intriguing history about the tarpon, and I was hoping that you could talk about that paper and some of the insights that you gained about the tarpon fishery.

**Joan Holt** [00:41:00] I think I was inspired from the first symposium to do this. I had a student come on in the summer from UT-Austin and wanted a project, and I said, "Well, would you be willing to take all the data off of the tarpon scales at the Tarpon Inn?" There was a history of one scale from each fisherman that's put on the wall of the Tarpon Inn area where you check in. And their information on there was the length of the fish, oftentimes the weight of the fish and of course, the date and the name of the angler.

**Joan Holt** [00:41:42] And there were oh, oh, gosh, large numbers of these scales on the wall.

**Joan Holt** [00:41:53] And the student said, "Yes, I'd like to do that - set up a database of all that data."

**Joan Holt** [00:42:01] And so I approached the people that were running the Tarpon Inn and asked them if we could do that. And they said, "Well, you can, but you can't touch any of the scales. You can't take them down."

**Joan Holt** [00:42:14] And so what this enterprising student did was bring in a big ladder and went up and down that ladder, taking the data off of each of the scales that were on the wall, because it was quite all the way up to the, I guess, eight feet at the top, down to about eye-level. And he took this ladder, counted and took all the information down and put it in the computer as he went so that he had the data - the date, the weight of the fish, and the length of the fish.

**Joan Holt** [00:42:50] And these data were then brought together, and I worked to try to understand what had happened to the fish. Could we tell anything about the history of why there was a lot of fish in the early 1900s and why there were very few after that?

**Joan Holt** [00:43:12] And so, this data was entered into the computer and we analyzed the data and looked at a lot of different questions.

**Joan Holt** [00:43:24] One was how many were there caught, in what years? And of course, the very big catches were in the fifties, the twenties to the fifties, with a big drop during the forties, and that we attributed to World War II and people not traveling and going fishing because they were involved in the war.

**Joan Holt** [00:43:49] And then after that, in the fifties, it came back up a little bit. But after that, the numbers never, never approached what they were in the early years.

**Joan Holt** [00:44:00] The problem looked to be in the young fish. We could, by looking at the lengths, we could tell, somewhat, the age of the fish. And sexually mature fish were still being caught in the fifties, but the young fish were really absent, the smaller fish. And it looked like recruitment failure, that is, that there were not young fish coming in. And the old fish that could live, remember, they could live 60, 50 years - you could still get them, occasionally, coming in. And the numbers had dwindled. But the biggest loss was in the the smaller fish, the less-developed fish.

**Joan Holt** [00:44:51] So we assumed that it looked like it could be recruitment failure.

**Joan Holt** [00:44:56] We did have a caveat that, of course, it could be that people didn't want to put small fish on there anymore. I mean, that's possible. I don't know why there would be a change in attitude, but that is a possibility.

**Joan Holt** [00:45:08] But, when we went to Mexico for the second Tarpon Symposium that was organized, that we organized in Veracruz, several of the fishing captains said they had also seen a reduction in the numbers after the fifties along their coastline.

**Joan Holt** [00:45:30] So, it wasn't just happening, it was specifically happening on the western Gulf population and not in tarpon as a whole. So, what I should explain is that it's now pretty clear that tarpon on Florida, on the East Coast, are different than the tarpon in the western Gulf of Mexico. They don't mix very much and they certainly don't interbreed. Their differences are genetic.

**Joan Holt** [00:46:03] And then the differences that were shown by the tags that the fish from Veracruz come up here.

**Joan Holt** [00:46:11] The fish from Florida, don't come onto this coast.

**Joan Holt** [00:46:14] So there's two separate populations of tarpon.

**Joan Holt** [00:46:18] And we were encouraged to know that that they were seeing it there, too. So maybe there was something overall happening to recruitment of tarpon in the Gulf. And that is certainly something interesting to see from that data that we were able to collect from the Tarpon Inn, based on the scales, we could look at the sizes and the numbers and the weights of those fish and see where differences occurred over time.

**David Todd** [00:46:55] Well, so this is really interesting. So you've got a clue that it seems that there's low recruitment, that there are fewer younger fish coming in to the western Gulf population. Did you go further to try to speculate about why recruitment would have been low and what might be causing that?

**Joan Holt** [00:47:22] Well, I think there were a lot of potential reasons for recruitment to be low. And one would be that the young somehow were not surviving. The life history of tarpon, as I said earlier, is that the juveniles go up into bays and coastal lagoons and spend their first year there feeding on, first, insects and copepods and, later, on crabs and shrimp and small fish. And they spend their first year there and then come out into the coastal waters.

**Joan Holt** [00:48:08] And it's possible that there were problems with that occurring. One, there is a lot of gill netting for snook coming out of those rivers and a lot of tarpon could have been caught, or were said to be caught, in those as bycatch.

**Joan Holt** [00:48:30] It could be that some of the bays where they would normally go were polluted, or that there was an absence of fresh water. You know, in the fifties, there was a severe drought in Texas, so maybe there wasn't enough fresh water in the bays, in the lagoons for them.

**Joan Holt** [00:48:54] They can gulp air, and they don't have to have very good water quality. But it could be it's important that they don't have hypersaline conditions either. Nobody's ever tested that but that would be a good guess.

**Joan Holt** [00:49:11] And in all, I'm not sure that there were a lot of juvenile tarpon coming into Texas waters. There certainly are. And they have been caught, but maybe not nearly as many as are in the waters of the Yucatan and the Sea of Cortez. So that may have happened there. That might have been the change that happened, that tarpon were not growing. There were not enough of them to grow up to be large tarpon.

**David Todd** [00:49:45] Sort of do you think that there might have been any issue with parasitism?

**Joan Holt** [00:49:57] I don't know. I've never heard of anything that would affect the large, larger fish.

**Joan Holt** [00:50:05] Some of the fishermen in Mexico, the boat captains, said that there was a lot of targeted fishing on the large tarpon down there, and they were sold in the market for food. So evidently somebody made eat the tarpon in South and Central America and Mexico, and maybe that has had a big effect. They, the captains there, seemed to think that was.

**Joan Holt** [00:50:33] In Mexico, tarpon are by law only sports fish. But there's a lot, evidently, a lot being caught for food fish and utilized and sent to markets that are done illegally.

**Joan Holt** [00:50:53] So, we didn't really know what it was.

**Joan Holt** [00:50:55] But my guess is that since there were still big fish, you know, through the sixties, that it was something happening to the smaller fish that was coming out of the lagoons.

**David Todd** [00:51:12] I see.

**David Todd** [00:51:13] Well and I think you mention the drought of the 1950s, and I'm curious if maybe another sort of hydrologic issue might have been the construction of many dams that perhaps changed the freshwater inflows. Do you think that could have been a factor?

**Joan Holt** [00:51:37] I think that dams on the rivers definitely decreased the freshwater inflow. I'm particularly aware of the one here on the Nueces, this river where most of the water is held back from Nueces and Corpus Christi Bay. And there was an agreement with the state that a certain amount of fresh water had to be released back into the bay at certain times of the year for the fish and the shrimp production that has to occur there.

**Joan Holt** [00:52:11] So, I know that those changes could have made a drastic difference because we see it here.

**Joan Holt** [00:52:19] I guess the question is how many tarpon were utilizing Texas waters? Certainly, it's easy to understand that they might have used the waters in south Texas because they're much warmer. There's kind of a narrow temperature range for tarpon. And that's what drives migration. So they come up following, the tarpon come up the coast into Texas following the bait that they're feeding.

**Joan Holt** [00:52:56] Maybe those big bait balls that used to be so prevalent that they fed on are not there as much anymore, or were reduced by the drought or by the changes in salinity.

**Joan Holt** [00:53:15] They always go back in the fall as the temperatures start to drop. So it's cool water that, they don't like cool water, they don't do well in cool water. So, they always migrate with the temperatures.

**Joan Holt** [00:53:29] So, how many might of ever use the bays here? I talked to Andy Landry. He did some studies of it and, and he found tarpon *leptocephalus*, not the *leptocephalus*, he found the larvae, tarpon larvae up in some of the lagoons and bays. But he didn't find lots and lots of them and suggested that maybe they never had used them that much in Texas.

**David Todd** [00:53:55] Well, that's interesting. It sounds like mysteries abound.

**Joan Holt** [00:54:01] They do.

**David Todd** [00:54:02] And I think that from, you know, briefly reading your paper, you were cautious, I guess, about making any conclusions, because you said there might have been some bias, some sort of skews or gaps in the data. I think you mentioned that that, you know, the decline in fishing during World War II might have had some sort of impact, or that maybe fishermen weren't so proud of their smaller fish, so they didn't put the scales up on the walls.

**David Todd** [00:54:40] I was curious if you could talk a little bit about, you know, the data shortcomings said that I guess all scientists deal with, and that might have been a factor here in that tarpon study.

**Joan Holt** [00:54:55] For the tarpon study, we relied upon the fishermen putting their weights and lengths on correctly. Right. And the dates - I assume the dates were pretty good. And I don't know what the circumstances were. Was there someone there with them? The

guide that wrote that information down, or did the fisherman himself do it? And so that's always an issue, whether you make yours a little bit larger or a little bit heavier or something.

**Joan Holt** [00:55:29] But it's citizen science. And in general, I think things might even out over the many, many, many scales that were put up there because there is a nice, clear pattern.

**Joan Holt** [00:55:44] But, the lack of small fish scales could be accounted for by a lot of different ways. Either the small fish weren't here, or the fishermen did not want to put a small fish weight up on the board.

**Joan Holt** [00:56:00] Or, there weren't many fishermen in the sixties, fifties and sixties, fishing for them. And I don't know that that happened. I have not heard any evidence that people stopped being interested in them.

**Joan Holt** [00:56:18] And, of course, they're very interested in tarpon now. And a lot of people go out, and you can still go out into the ship channel and the coastal waters and catch tarpon, I understand - maybe not the really great big old tarpon that were prevalent back in the thirties and forties, but certainly a nice tarpon from that can jump in the water and be lots of fun.

**Joan Holt** [00:56:48] So, people are still catching them here, but I don't know how to get, how to find out how many are, what the sizes are anymore.

**Joan Holt** [00:56:59] So, that data was important because at least we had that. And we realized that there may be human bias or error, but overall the picture was pretty clear. And so I think it's pretty, the data that we saw looked pretty good up until the fifties. But I don't know what the data would look like now because we don't have any written records of it.

**Joan Holt** [00:57:30] As far as I know, people just go catch them. And I know Scott worked with some fishermen outside of Freeport to put tags on tarpon. And so he had a better idea of what might be there and what size fishes they were dealing with.

**David Todd** [00:57:54] Yeah, I think that was actually something I was hoping that you could talk to us about, was this some more recent work that Scott and others have undertaken to understand more about the tarpon's life history and its migrations using these acoustic and satellite tags. And I was wondering if you could talk about that process and maybe what some of the lessons you've learned might include.

**Joan Holt** [00:58:27] Satellite tags, or pop-up tags have been used on a lot of fish, but more recently, I guess in the last, well, since the interest in tarpon and the Tarpon Tomorrow group of people and the Bonefish and Tarpon and people got very excited about trying to raise funds to get these tags. And so it's an expensive process, I think.

**Joan Holt** [00:58:57] They were able to get tags and tagged a lot of fish in Florida, lots and lots of fish there, and then extended it over into Texas with some funds. And so, Scott went, Scott Holt, went out quite a few times to work with tarpon fishermen and to put these satellite tags, which are injected under the scales of the tarpon. And they stay on a certain length of time and then they pop off. And where they pop off then tells us where they ended up and you know where they started.

**Joan Holt** [00:59:39] So, you can look at the movement, if they move. And I think I read Jerry Ault said that one that was put on in Mexico when we were down there at Veracruz, popped

off in Corpus Christi very quickly afterwards, within a couple of days. So they do travel and move.

**Joan Holt** [01:00:01] But they've never seen any movement from Florida into Texas, or Texas into Florida. So those fish seem to be in the western Gulf of Mexico, or the eastern Gulf of Mexico and up the Atlantic.

**Joan Holt** [01:00:16] And even though we haven't done any work there, I should mention that tarpon are also caught, and very active, in Central America and South America and off the coast of Africa and up the East Coast to about North Carolina.

**Joan Holt** [01:00:33] So, they move in those areas. And, we've not done any work with any movement back and forth between those areas. Is not considered to be movement that way because of the ocean currents.

**Joan Holt** [01:00:48] But, the satellite tracking and tagging has really been helpful in supporting the genetic data, which showed that they are different populations off of Mexico, Texas and Florida. So Florida to the east, and Mexico and Texas to the west. So the western Gulf of Mexico and the eastern Gulf of Mexico populations are separated. And one reason they think is that there's currents that occur around the Mississippi River that would not allow larvae to be able to come across so that they stay east or west. The larvae probably are not so much close to shore in the west as they are on the East Coast.

**David Todd** [01:01:46] Neat. Well, it's great to see these mysteries be at least partially answered.

**David Todd** [01:01:54] You know, I've read some critique of fishery research that sort of laments the difference between the kind of attention that recreational fishing gets, versus commercial fishing. And I thought while we were talking about research on the tarpon, which I guess is mostly a sport or recreational fish, that this might be something to talk to you about and whether that's something that you see as a problem, or not so much.

**Joan Holt** [01:02:28] Well, there is less information for sport fish. And one reason is that the National Marine Fisheries Service is directed to manage commercial fish, and that's what they do.

**Joan Holt** [01:02:42] Sports fish like redfish, trout, tarpon - they're not part of their mission. And states often will manage the game fish. So, Texas has a very strong management (Texas Parks and Wildlife), strong management of the game fish that occur here - redfish and trout, speckled trout.

**Joan Holt** [01:03:06] But tarpon are international. So that makes it really difficult. And so there's little management of the tarpon fishery except for states limiting take. Mexico supposedly limits it for sports fishing. And Texas has a tag that you buy for over-size, for record-sized fish that you could keep as a trophy. But and other states as well have those kinds of management. So management of a sports fish is left up to the state or whoever would like to manage it.

**Joan Holt** [01:03:44] The National Marine Fisheries Service only manages commercial fisheries, so that's where a great deal of data is collected and utilized to understand fish populations. And that's the reason why.

**Joan Holt** [01:03:57] There's not a lot of research information for recreational fishing, especially international fisheries.

**David Todd** [01:04:07] That's really interesting because I guess, you know, over the past few decades, recreational fishing seems to generate a lot of revenue for coastal towns and it certainly consumes a lot of time for the sports anglers that are involved in it. But maybe this National Marine Fisheries Service mandate just dates back a number of years where that wasn't so much the case. Or what do you think the reason might be?

**Joan Holt** [01:04:40] Right. I think sports fishing is probably a recent phenomena, that fishing for commercial fishes has been going on for a long time. The sports fishing, I think, happens relatively recently. In fact, in the sixties when CCA first started, they worked very, very hard to get redfish as a sports fish. At that time, redfish and trout and all of these fishes were commercially harvested, and were really important because people needed to buy fish all over the state. Restaurants needed fish.

**Joan Holt** [01:05:26] And I well remember at one time we were working on the redfish there early on, and a helicopter landed outside our laboratory at the Fisheries and Mariculture Lab. And this guy came running in and it was Perry Bass, and he said, "Are you the people raising redfish?" And we said, "Well, we're working on it. We're trying." And he said, "Well, I think if we could produce redfish for aquaculture, then they wouldn't have an argument from the restauranteurs, restaurant people, that there's no available fish if we make redfish, a sports fish.

**Joan Holt** [01:06:12] And so, that was really interesting that the work we were doing did support aquaculture, and it was utilized several places and businesses that decided to produce redfish as an aquaculture product that could be sold to market and that helped CCA have more leverage to get this passed through the state legislature.

**Joan Holt** [01:06:39] So, only in recent time have redfish and trout, in the sixties, become sports fish.

**Joan Holt** [01:06:48] So, it's something that was managed as perhaps a commercial fish, but no more. And the state then took the responsibility of managing those sports fish.

**David Todd** [01:07:02] Okay. Well, this is really interesting - the whole split between the federal government and the state, and between the commercial data and the state data and regulations. Thanks for explaining that.

**David Todd** [01:07:17] So, one of the roles that Texas Parks and Wildlife has played, as I understand it, with the tarpon, and I think you mentioned this in passing, but maybe we talk a little bit more about it, was the passage of catch-and-release regulations back in 1991, and then instituting these trophy tags for the really big fish that anglers might catch.

**David Todd** [01:07:41] And I was curious if you could talk a little bit about the origins of that, that kind of regulation and whether you think it's effective or not.

**Joan Holt** [01:07:53] Well, Texas Parks and Wildlife began their catch-and-release for tarpon in '91. So you have a trophy tag that you can buy, and you can use it for a certain size, a record-size fish.



**Joan Holt** [01:08:05] And the idea was that a lot of people are out there fishing for tarpon and they're not really big tarpon. And you want to make sure that you release them unharmed because they don't want to eat them anyway. And there's no reason to kill these fish.

**Joan Holt** [01:08:25] You know, there's also regulations on large redfish. If you catch an oversize, a 30-inch redfish, you can't keep it unless you have a special tag and to release those back into the wild.

**Joan Holt** [01:08:38] And I think that that's important because there have been in the past, not necessarily here, but in other states and other areas, tarpon tournaments in which everything's brought in dead. And in fact, we used to also see that with the billfish, that marlin and sailfish were brought in and hung up so people could look at them.

**Joan Holt** [01:09:06] And so, the state also regulates those by having a certain number that can have a tag with. But you can't kill every fish that you catch out there.

**Joan Holt** [01:09:19] I think it really helps. I think it's important. Tournaments like the Deep Sea Roundup have said, "Okay, we won't have any kill tournaments for tarpon, or for the billfish."

**Joan Holt** [01:09:32] And people bring in recordings of their catch out in the Gulf. So they take a video of it, and release the fish and bring it back into the weigh station where the judges are. And there is a special judge that can look at the films and tell whether it was a white marlin, a blue marlin, a tarpon, or whatever from those videos.

**Joan Holt** [01:10:02] And the catch is based not on weight, but on time of catch. So the earliest one is the best. And so it's based on something that allows the ... it really stops the kill fish.

**Joan Holt** [01:10:17] And we used to do that, used to have the dead fish hang up there for everybody to see. And it really is sad to see that happen and very good that the state has come up with these regulations. And I think it does help the fish.

**David Todd** [01:10:32] That's encouraging.

**Joan Holt** [01:10:37] So, you have had tons of experience with breeding and working with these very young fish. I know that you've been active with redfish and other species, and I was curious if you ever tried to work with tarpon or if you know of others that did and, you know, what the strategies were and why, from what little I know, has not really been as successful as folks hoped.

**Joan Holt** [01:11:14] Well, I've certainly spawned and reared a whole large variety of fish. The redfish is the biggest one that we have worked with and they're, you know, sexually mature at 30 inches or so, a couple of feet, two and a half feet. And that's a big fish to put in a tank - a big fish. And it's just really fun to see these big redfish swimming around in a circle in the tank.

**Joan Holt** [01:11:42] The problem with tarpon is that they're extra large. So working with tarpon would mean working with very, very large fish. They're four, four and a half feet long for spawning fish. So that's an amazing thing to begin with.

**Joan Holt** [01:12:09] The second, I think, issue that I see is that the leptocephalus larva, and that's a very difficult stage. The leptocephalus is a flat clear larva that's feeding on, we don't know exactly what, but maybe particulate organic carbon. Where do you get that and how do you produce it? I don't know.

**Joan Holt** [01:12:34] But the leptocephalus larva lasts for 20 to 30 days, and so they have to have absolutely ideal conditions. And the food - it would have to be determined, I think that would be very, very difficult.

**Joan Holt** [01:12:49] So, those two issues would certainly make it difficult to close the life history on the fish. That is, take a spawning fish, have it spawn and raise it up to a juvenile stage or an adult stage, which we can do with redfish, trout and the state hatcheries here in Corpus and in other areas of Texas have done that.

**Joan Holt** [01:13:21] They spawn - the redfish and the trout and flounder - and are now putting them out into the bays in various numbers. Some are more and some or less. Redfish, a lot. The trout, somewhat. And flounder is more difficult, but they are doing that as well.

**Joan Holt** [01:13:41] But whether you could do that with Atlantic tarpon I think would be really, really hard because of the larval stage, which is quite difficult and the large spawning size of the fish.

**Joan Holt** [01:13:53] I have heard of some success with leptocephalus larvae from eels that have been reared, so there may be some information that would have helped with that. But there are very particular environmental requirements for that stage.

**Joan Holt** [01:14:13] Some people have brought in larvae and grown them up and looked at them, to a certain stage, just to look at development and understand that. So there's been a little of that. But I think captive breeding would be a real challenge and require a gigantic facility with very good control over the temperature and the salinity and quality of water.

**Joan Holt** [01:14:41] So, I'm not ready to try it, even though I have a lot of experience.

**Joan Holt** [01:14:47] But I think that's probably going to be ... the more important would be to make sure that the juveniles have a good place, a good lagoon system, estuarine system, to grow up in and that the adults survive long enough to spawn, in nature. And that would be much, much better.

**David Todd** [01:15:14] Boy, it must be so difficult and challenging to, first of all, understand these kinds and stages of development and then replicate them.

**Joan Holt** [01:15:27] Exactly.

**David Todd** [01:15:27] Just, you know, the logistics and the ability to mimic these very specific conditions. Wow.

**David Todd** [01:15:36] Well, so just to maybe summarize this, I'm curious, as you've looked and thought about the tarpon. Have you come up with any thoughts about what would be the most promising ways to restore it? I mean, we've talked a little bit about the catch-and-release program and the trophy tags, but are there any other sort of approaches that you think might be productive?

**Joan Holt** [01:16:08] I think to bring tarpon fishery back to Texas, we need to work with the tarpon fishermen and scientists in Mexico. I think that's the key.

**Joan Holt** [01:16:18] We need to work with them to protect the spawning fish from long-liners and the juveniles leaving the rivers from bycatch.

**Joan Holt** [01:16:29] Even though Mexico says that tarpon is only a sports fish, there's very little enforcement, particularly in rural areas or areas that are outside the main movement of the government.

**Joan Holt** [01:16:46] And, of course, there's a lot of issues in Mexico anyway with other things that are not handled very well.

**Joan Holt** [01:16:56] And I think if we can work with the scientists and with the fishermen and the boat captains down there, that maybe we could begin to see where the issues are and bring attention to those.

**Joan Holt** [01:17:08] I was very disappointed that after the Mexico meeting, nothing really happened. We didn't follow up in any way or have any more tarpon strategies except listening to them and talking to them about what they did know.

**Joan Holt** [01:17:25] And I feel like that would really help if somehow we could get money to get the scientists and fishermen and managers here to interact with those in Mexico and see where we could help and how we could understand what their problems are and issues and can they be resolved.

**David Todd** [01:17:57] So, this is probably just me being clueless, but the problem with, I think you mentioned longline fishing and then bycatch, can you just elaborate a little bit more about how that might affect tarpon and their recovery?

**Joan Holt** [01:18:19] The bycatch of tarpon coming out of the river really would put a dent in the numbers of tarpon that can survive and grow. And if they are being caught in these nets that are put in to catch others, species, then it makes it impossible for the tarpon lifecycle to be completed.

**Joan Holt** [01:18:42] And if there's a, there is already a great variability year to year, probably, in the number of tarpon larvae that go up into the bays and estuaries and the lagoons. But if those numbers and their survival may or may not be high, I don't know. In Florida, they seem to have a fairly good survival, but I don't know what they have in Mexico in the lagoons.

**Joan Holt** [01:19:10] And if those are captured, then you don't have any fish to grow up.

**Joan Holt** [01:19:17] They're very long-lived, so there's a lot of tarpon out there. And but the long-liners are targeting the large tarpon, at least according to these fishing guides and fishermen in Mexico. They said that they see them target great large tarpon and collect them and send them into the market.

**Joan Holt** [01:19:39] Who, what market? I don't know.

**Joan Holt** [01:19:41] But that is something that would definitely cause a dent in the population if there is a commercial catch that's very concentrated on those large tarpon.

**Joan Holt** [01:19:58] So you don't have the young coming in and growing up and the large ones that would be long-lived and could produce for a long time, might being collected in long lines.

**Joan Holt** [01:20:07] So, what's, what's left?

**Joan Holt** [01:20:09] I know there's a lot of tarpon, evidently, in Costa Rica, but that population stays within that area. And a lot of tarpon off of Africa, I understand. But those also stay in that area. They don't come across the ocean.

**Joan Holt** [01:20:24] So, different populations have different trajectories based on whether they're protected, and truly protected, or not.

**David Todd** [01:20:34] I see. Okay. Well, that helps a lot. Thank you for explaining that.

**David Todd** [01:20:39] Um, so it sounds like some of the impetus, or at least the funding, for your work with tarpon came from Tarpon Tomorrow and Paul Swacina.

**Joan Holt** [01:20:58] Mmhmm.

**David Todd** [01:20:58] And I gather that non-profits have been a pretty big part of sportfishing in general. You mentioned CCA, and I gather that there's Tarpon Trust and Texas Tarpon Collaborative. You know, I'd like to learn more about the role these non-profits. They don't seem like the usual suspects - the state and federal agencies nor in the academic realm like yourself. What sort of, you know, niche do they fill, do you think?

**Joan Holt** [01:21:35] It's clear that the non-profits are what supported the tarpon symposia that occurred. Bonefish and Tarpon group has really been responsible for the work in Florida, and that money had, I guess, supported Jerry Ault's tagging and its efforts, and it supported the second tarpon symposium there. So that's that. I think that money's still there and still working and still interested in bonefish and tarpon, but that's on the eastern population.

**Joan Holt** [01:22:15] I don't really know what happened with Paul Swacina's group. I guess. I don't know. But that group has kind of slowed down in what they're interested in doing, I think.

**Joan Holt** [01:22:35] CCA probably would still be interested if somebody would write a proposal to them and come up with an idea that perhaps we need to go to Mexico and work with them because that's where our tarpon are, and come up with some positive plans to try to see if these issues are as serious as they seem to be, are reported by the fishing guides there and see if something could be done about it.

**Joan Holt** [01:23:07] But I don't know what else besides private money and interest on the side getting a scientist that's interested in doing that.

**David Todd** [01:23:21] Okay.

**David Todd** [01:23:22] Well, we've talked a good deal about fish, tarpon and spotted sea trout and redfish, flounder. But I understand that you have a broad interest in nature study and conservation. And I was hoping that you might talk about some of your work with birds and your interest there.

**Joan Holt** [01:23:52] I became really interested in birds when I met Scott because he knew some birds and was very interested in birds at, I guess, college, just finishing undergraduate, and going into graduate school. And we would be driving down the road at 60 miles an hour and he'd say, "There's a mockingbird, there's a such and such." And I'd say, "I don't believe you, Scott. How do I know? You know, you're just saying something as we drive by." But he did know. And he got me interested, even though I knew something about birds, but I didn't know very much about birds until I met him.

**Joan Holt** [01:24:32] And we became interested in birding. We were at Galveston at the time doing our research there, and he would take me birdwatching. And looking up in the tall trees and trying to see these birds, it was really difficult. And so when we came to Port Aransas, it was much nicer because we had an A-frame home and I could sit on the back porch and look down at birds instead of up at birds.

**Joan Holt** [01:24:59] And we had a lot of birds at Port Aransas. It's a very good place for birdwatching.

**Joan Holt** [01:25:04] And my sister came down to work for me and she also was interested in birds. She had gotten her master's degree, studying the quetzal, no, studying the emerald toucanet in Costa Rica. So, she had gotten involved in birding, when we took her birding. And she took it on to her master's degree. So she moved down here and worked with me for a while and we birding a whole lot and learned lots of birds that are on island and on the sites that have been set up by the Birding Classic that set up... Well, the Great Texas Birding Trail set up sites in Port Aransas that we worked with them just to pick those sites. And one is called the Birding Center and another one is called Paradise Pond. But areas where you can go and watch the birds and see what's there and how it changes with the season.

**Joan Holt** [01:26:06] And the eBird came up with a program that you can put the birds you see in that program - how long it was, where it was and how many you saw. And then that's shared. Cornell University shares that database with researchers and scientists, and they can understand bird populations now, based on all of these bird lists that people put in.

**Joan Holt** [01:26:34] The Texas Parks and Wildlife, Madge Lindsay, was really involved in setting up birding sites on the Great Texas Birding Trails. And that was really important to be able to go all along the coast and find information on where to go and what birds you might see at those sites.

**Joan Holt** [01:26:58] It was finally turned into a Birding Classic, the Great Texas Birding Classic, which was just coastal at first and included groups that were birders, along with townspeople that maybe didn't know anything about birds but needed to see about it. So we would invite the mayor, we'd invite a real estate agent, a banker, and have two or three birders and have birding competitions with these groups. And it was really amazing.

**Joan Holt** [01:27:33] At a place called Paradise Pond, in fact, they call it the Joan and Scott Holt Paradise Pond, now, we discovered it, and when we took that group there, the mayor was

going, "I never even saw this place. I didn't even know we had it." So they went about, set about obtaining that land for a birding site.

**Joan Holt** [01:27:56] And then, the Great Texas Birding Classic has funds every year that you can propose different projects for and get them to do the project. And so we had funds that were used to build the boardwalk and finish the projects at both of those sites.

**Joan Holt** [01:28:18] And now, they're used by hundreds and thousands of people every year. In fact, sometimes you can't get in the parking lots because there's so many people there at these birding sites. A lot of them are photographers that are taking pictures of the birds. A lot of them come out to see the alligator that's in the pond. And many of them are amazed by all the birds. Many ducks stay in these coastal areas all winter long. And of course, herons and egrets and everything you can imagine. And our city bird is the roseate spoonbill. So we have many of those. And it's a pink bird: who can't be impressed by a pink bird?

**Joan Holt** [01:29:02] Anyway, we take part a lot and encourage the public to understand how important it is to set aside these lands and areas where nature can be king, and then you can go in there and you can be a voyeur and watch it.

**Joan Holt** [01:29:21] So we have done that in several places in Port Aransas, and have a large nature preserve here now, and it's very, very popular. We take part in the Great Texas Birding Classic every year.

**Joan Holt** [01:29:33] And one area that we do is called the Big Sit. And the Big Sit is an area that's a certain size, that the birders have to stay in that area and count birds they can see from that site. And then we compete with others in the state that are doing the same thing.

**Joan Holt** [01:29:56] So, that's one of the ways we encourage birding. We bring not only birders out there, but we also invite the sheriff or the city manager, or a banker or real estate agents, those people, to come out and help us and take part and they see how popular it is.

**Joan Holt** [01:30:16] So, I think it's a really good thing that Port Aransas has done. And a great thing that the state has done to encourage this birding all over the state. And people just love it and it's just a way to get out. But it's also a good excuse to preserve habitat, because if you don't have habitat, you don't have the birds.

**David Todd** [01:30:38] Yeah, it's great. It sounds like you're developing this wonderful information, kind of a citizen science based ....

**Joan Holt** [01:30:46] Right.

**David Todd** [01:30:47] Dataset. But also, I love the opportunity that you've built to introduce people, you know, especially people who are influential like, you know, I think you mentioned the sheriff and the mayor and local realtors and bankers who, you know, this may be foreign to, but then they learn that it's fun, and productive for the community, I guess.

**Joan Holt** [01:31:08] It is. And we use funds that the city gets from hotel / motel tax. We can also use those funds, and it's better if we're going to use those funds that everybody understands how important those funds are, how many people it brings in, and why it's useful for the city to spend that money.

**David Todd** [01:31:30] Well, good. Well, so I just had a couple more questions, if you can still spare some more time.

**David Todd** [01:31:39] I thought we might look into the future a bit. We talked maybe more about things in the past and current days. One thing that I think a lot of people are discussing is, is climate change. And I'd be curious to know what sort of impact you foresee or have already noticed in how climate change is affecting tarpon and their migrations or maybe other creatures too.

**Joan Holt** [01:32:10] Well, climate change could certainly affect tarpon migration. I had read that they prefer a temperature of 58 to 60 water temperature, that's, in the winter here, much cooler than that, so that they move south. And it could be as everything, the longer the Texas waters stay warm, the more the tarpon would stay in the Texas waters before migrating south.

**Joan Holt** [01:32:43] And what temperature does to water is that it reduces the oxygen-holding capacity. So there's much less oxygen in water that's warm. And that's not a problem for tarpon larvae or juveniles because they gulp air and they don't have to have oxygen in the water. It would be a problem for a lot of things like redfish and trout. They need to have oxygenated water, but tarpon could take advantage of that and do well without competition for the food.

**Joan Holt** [01:33:19] So, it's possible that they would remain longer, and that the young would survive well as the temperature changes. And maybe that's why they've been around thousands of years, because they can adapt to those kinds of conditions by moving into the proper water quality, water temperature that they need for spawning, so they can maintain that 58 to 60 degrees that maybe they need. It would happen here if it was warmer, but it wouldn't be so good for other fish, I don't think.

**Joan Holt** [01:33:52] But for these long-lived, hard-scaled, air-breathing fish, it wouldn't be that big a problem.

**David Todd** [01:34:01] Okay.

**David Todd** [01:34:03] Well, you seem to have a broad horizon about, you know, your interest in nature and wildlife, you know, from the fish that you studied for many years, and then these birds that have been such an important hobby for you. Do you have any sort of outlook about the future of wildlife conservation in Texas?

**Joan Holt** [01:34:29] You know, wildlife conservation, of course, depends upon private interest and the state interest. And I think that Texas Parks and Wildlife does a great job conserving wildlife and fish in Texas. And if they're allowed to continue on their current trajectory, we would have a healthy population of fish and wildlife. They manage deer very well. They manage redfish. They do a great job. It just depends on what the state legislators think about what they're doing. But I think right now they do a good job. And if they could continue doing that, that that we would have good populations of fish and wildlife.

**Joan Holt** [01:35:11] And of course, conservation of international wildlife, like the tarpon, depends upon private funding, I think. And so, if we continue to have interest from private funding, then that would be important for continuing research and understanding of these fish.

**Joan Holt** [01:35:35] The CCA, I think, you know, someone could probably write a proposal to them about doing something and that they would get funding to help understand these population dynamics of fish like the tarpon.

**Joan Holt** [01:35:52] So, I don't know, I feel pretty good about it. I hope that there will be more interest in the future from private funding and for people to ask for that private funding to get these studies done that are needed to be done to finish, finally, understanding what's going on with tarpon in the western Gulf of Mexico.

**David Todd** [01:36:23] This has been really wonderful. Thank you.

**David Todd** [01:36:27] Is there anything else that you'd like to add that maybe we skipped over, or that I gave short shrift to?

**Joan Holt** [01:36:37] No, I think you were very comprehensive in your questioning. And I appreciate that. And I appreciate the chance to talk about fish and birds and nature and all the things that I truly love.

**Joan Holt** [01:36:52] I have a garden out back that I grow a lot of vegetables in. And I have zizotes milkweed for butterflies, for monarch butterflies. And I really enjoy having these kinds of opportunities and it's a good, good time to be here, I think.

**David Todd** [01:37:15] Yeah, well, great. From butterflies to birds to fish, I think you've got it covered. Sounds like a fun life.

**David Todd** [01:37:27] Well, I wanted to thank you for participating and doubly the chance to talk to both you and your spouse, because it's always fun to see folks who have a partnership in these kind of studies.

**Joan Holt** [01:37:43] Well, good. I hope this is useful and I hope somebody reads it someday.

**David Todd** [01:37:50] Well, I think it's been really valuable. And I just wanted to thank you again for taking time out of your day to join us. Thank you so much. All right.

**Joan Holt** [01:37:59] Thank you so much, Todd. And thank you for organizing this and getting it done.

**David Todd** [01:38:04] I will let you get back to what you're normally scheduled Wednesday might have been. How about that?

**Joan Holt** [01:38:09] Okay. Goodbye.

**David Todd** [01:38:14] Thank you very much.

**Joan Holt** [01:38:15] Mmhmm.