

TRANSCRIPT

INTERVIEWEE: Emma Hickerson

INTERVIEWER: David Todd

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David Todd [00:00:02] Well. Good afternoon. My name is David Todd, and I have the privilege of being here with Emma Hickerson. 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 archive at the Briscoe Center for American History at the University of Texas at Austin.

David Todd [00:00:30] And, I want everybody to understand that she would have all rights to use the recording as she chooses.

David Todd [00:00:37] And I wanted to make sure that that's okay with you, Ms Hickerson.

Emma Hickerson [00:00:42] Absolutely. Thanks, David.

David Todd [00:00:43] Okay, well thank you. Let's get going.

David Todd [00:00:47] As I said, my name is David Todd. I'm representing the Conservation History Association of Texas, and I'm in Austin. We are conducting a remote interview with Emma Hickerson, who is based in the Sydney, Australia area.

David Todd [00:01:02] On my end, in Austin, it is Thursday, May 2nd, 2024. It's about 4:40 p.m. Central Time. And, where Ms Hickerson is in Australia, it's May 3rd, 2024, about 7:40 a.m.. We are resuming an interview that we started on April 30th. That would be Reel 4203 in our system of keeping track of these things. And there's more information on the previous recording, but as a shorthand kind of introduction, I did want to share that Ms Hickerson worked for NOAA, at the Flower Garden Banks National Marine Sanctuary from April 1997 through December 2021 as Research Coordinator.

David Todd [00:01:55] And, so we'll be talking about summer experiences based on that. Today, we'll continue talking to Ms Hickerson about her life and career and focus, about the Flower Garden and its associated reefs. When we left off before, we were planning to talk next about challenges that are facing those banks and reefs in the northern Gulf of Mexico, both those issues that are unique to the Flower Gardens and then some problems that are confronting all reefs worldwide.

David Todd [00:02:29] So, I thought I might just ask a question... I was sort of going through the laundry list of concerns about the Flower Gardens and, I guess one of the prominent ones is how the Flower Gardens can coexist with the oil and gas industry, which is, you know, very active in that area of the Gulf of Mexico. And, perhaps you can explore some of that. I've got some sort of leading questions if you'd like, or perhaps you'd like to discuss that without being guided around by the nose.

Emma Hickerson [00:03:07] Thanks, David for that. And it's good to be back again with you to talk about the Flower Garden Banks.

Emma Hickerson [00:03:12] So, something I wanted to point out to the listeners is that the Flower Garden Banks National Marine Sanctuary is a multi-use sanctuary. So, a lot of people think about a sanctuary, and they think it's closed off to all types of activities that could be interpreted as negative impacts or conflicting uses.

Emma Hickerson [00:03:35] But the Flower Garden Banks is a multi-use sanctuary, which means that fishing is allowed within the Sanctuary boundaries and oil and gas activity is actually allowed inside the Sanctuary boundaries, but outside some regulatory boundaries that have been outlined by the agency that oversees that industry, which is the Bureau of Ocean Energy Management and also BSEE, which is the Bureau of Safety and Environmental Enforcement.

Emma Hickerson [00:04:10] And it's, over the years, it's had many other names, Minerals Management Service and Bureau of Land Management. So other people may recognize it from other names.

Emma Hickerson [00:04:24] But so, the important thing is that, while the location of our Flower Garden Banks sits in amongst one of the most active oil and gas fields in the world, it comes along with it a very complex relationship.

Emma Hickerson [00:04:43] So, geologically speaking, the Flower Garden Banks, reefs and banks, are in the same geographic region and features as what the oil and gas industry are wanting to access. So, the reason the banks are formed on these salt domes ... So, the salt domes are features that have been driven over millions and millions of years where there is a very thick layer of salt with overlying sediment that's pushing down. You've got opposing forces, the salt wants to go up, the sediment wants to go down.

Emma Hickerson [00:05:31] And in weak areas, you've got faults and ridges that are pushed up by the underlying salt, and brings the seafloor closer to the surface, into the photic zone. And those bedrocks - the siltstone and claystone - provide hard structures for the biology to grow on.

Emma Hickerson [00:05:52] So, in a very simplistic way of thinking about this, is that you've got cupcakes, which are the salt domes, and you've got the frosting on top, which is all the biology that we're interested in. But forcing up of those salt domes creates these pockets, a couple of miles across that are, that serve as reservoirs for hydrocarbons that run up these faults and ridges into these reservoirs. So, that's the sort of the cake in the middle that oil and gas wants.

Emma Hickerson [00:06:32] But, in order to provide protection for the things that are growing on the top, originally the Bureau of Land Management put in a lot of effort and money into learning about that biology on top so that they could develop protective measures, but allow that extraction of hydrocarbons to occur.

Emma Hickerson [00:06:56] So, it's quite an interesting dance between protection of the things that are growing on the surface, in order to allow extraction of the resources underneath those salt domes.

Emma Hickerson [00:07:08] The industry has created technology and methods to gain access, like directional drilling, for instance, to allow extraction from outside those boundaries, I guess, of the salt domes go down and across to the resources underneath.

Emma Hickerson [00:07:34] So, the only way that a sanctuary could actually be functional and be designated is if oil and gas was supportive of the actions. So, there there is a lot of direct communication and collaboration between the protective agencies of the resources, and the regulatory agencies for oil and gas, and also direct collaboration with the oil and gas companies.

Emma Hickerson [00:08:08] The recent 2021 expansion effort was directly influenced by oil and gas. And the boundaries reflected that, in that the new boundaries for the expansion area really snugged up very tightly to the no-activity zones that had been developed by, actually, BLM in the '80s. So, it's based on quite old information. And unfortunately, because of the influence, a lot of the new information that we've collected for the last 25 years on the biology outside of those no-activity zones, was not incorporated into those decisions.

Emma Hickerson [00:09:00] However, the expansion was successful in a political environment that was not very environmentally friendly. So that, you know, in itself, is a bit of a success story, that an expansion happened under the Trump administration. But it happened because of those, that the boundaries did not end up really affecting oil and gas because the boundaries reflected the no-activity zones where oil and gas couldn't get direct access to anyway.

Emma Hickerson [00:09:43] So, it is a very interesting story about the negotiation and the coexistence of both environmental and extractive practices like oil and gas.

Emma Hickerson [00:10:01] So, if that helps add to that question, I hope that's what you were looking for.

David Todd [00:10:07] Yeah. I guess that's very helpful. And, I think it sort of sets the stage for understanding that there's a lot of coordination and collaboration and pressure that needs to be negotiated.

David Todd [00:10:24] So, there are a couple of issues that I was curious about, and I don't know if these things are significant or not, but maybe you can sort of fill us in. I understood that you took a cruise in 2010 following the Deepwater Horizon explosion, and I was wondering if you felt like that accident had an impact on the Flower Garden and the associated reefs, or if it was relatively insignificant.

Emma Hickerson [00:10:57] Well, that event was hugely significant, in general, for the Gulf of Mexico. But the resources in the Sanctuary in the northwest Gulf of Mexico in general really missed a bullet, so to speak, because of the current - the direction of the currents took it away, took the spill away from the Flower Garden Banks.

Emma Hickerson [00:11:31] It was very upsetting, obviously, when it happened. People were killed and there are probably decades of impacts to the area of the Deepwater Horizon spill, which was extensive once the final flow of the spill was realized around the site and south of the site, and also, primarily west of the site. And we probably won't know for decades what the impacts are. But there are, and not only from the spill, but from the response efforts,

using methods to pretty much force the, it was called dispersant, to force the oil down to the seafloor, rather than having it floating on the surface.

Emma Hickerson [00:12:34] There are impacts that are, directly or, I guess, indirectly, related to the Flower Garden Banks, to animals such as whale sharks. The whale sharks do visit the Flower Garden Banks in the warmer months of the year. And they travel over many hundreds, thousands of kilometers around the Gulf of Mexico looking for sources of food and that spill did directly impact whale sharks. There were whale sharks observed feeding on some of the oil on the surface. They are filter feeders. That use their very large mouth to scoop up things like fish eggs. And in the area of Bouma, Rezak Bank is a known site where there are fish spawning activities that the whale sharks are attracted to and start feeding on the surface of these lipid-rich fish eggs.

Emma Hickerson [00:13:37] But the spill coincided with when there sharks there, the whale sharks feeding, and they were scooping up oil. Now, we don't know what the fate of those animals are, but we're assuming that they died from that. So those are some animals that we would expect would visit the areas of the Flower Garden Banks, in fact, and Rezak and Bouma Bank are within the Sanctuary boundaries now, with the expansion. So, they are important animals that visit the Flower Garden Banks, but they were directly impacted.

Emma Hickerson [00:14:12] So, one of the outcomes of Deepwater Horizon was the enormous amount of funding for research that came out of that spill, in the form of damages. So, that actually has, somewhat, been a silver lining for the Gulf of Mexico as far as resources for funding for ongoing research related to topics surrounding impacts from oil and gas on the marine environment in the Gulf of Mexico. So the Flower Garden Banks has directly been benefited from that. And there are now ongoing projects that are being heavily funded and supported by that sort of pocket of money. So, that's a, you know, as I say, the silver lining from that oil and gas event.

Emma Hickerson [00:15:12] And while that was a very huge, acute event, there are spills every day in the Gulf of Mexico - small spills. So, that's, you know, something to keep in mind, that this is a chronic issue in the Gulf of Mexico. Some of the larger spills that are not as acute and large as the Deepwater Horizon do get picked up in a way and go through the court system. And there are fines, that come through court that the Flower Garden Banks has benefited from. So, there have been fines that have been directed to go through the National Marine Sanctuary Foundation and ultimately come to the Flower Garden Banks.

Emma Hickerson [00:16:08] And over the years that I was working the Flower Garden Banks, we actually spent a lot of those funds on our research cruises and it funded things like our remotely operated vehicle. So, we were able to directly benefit from funds that came through the legal system that were related to oil and gas spills in the Gulf of Mexico. So, I think that was a very good use of those resources, and really put us into a position where we could fund a lot of our activities.

Emma Hickerson [00:16:54] So that's another example of the machinations of the sometimes partnership, sometimes forced influences, of the activities that are going on in the Gulf of Mexico that feed into us on the environmental side.

David Todd [00:17:16] Okay. Well. Thank you. That's good to know.

David Todd [00:17:21] So, I understand that one of the new banks that were added, the McGrail Bank, and I guess it was added in 2021, it's really close to some of the major shipping lanes that feed, I guess, New Orleans and Houston. And I was curious, you know, from your experience at the Flower Garden Banks, how do you think that the Sanctuary coexists or has conflicts with that kind of navigation in the Gulf?

Emma Hickerson [00:18:05] Yeah, that's a really good point. The ports of Houston, Galveston, New Orleans are massive port systems in the U.S. world of transportation, and cruise ships and things like that. And they are very close to all of the Flower Garden Banks. Actually, the shipping channel goes right over the top of Elvers Bank, which is one of the expansion Banks. It is south of most of the other banks, but Elvers is on the southern side of the area of the Flower Garden Banks.

Emma Hickerson [00:18:48] So, yes. So, we do take those those interactions into account when we're looking at management of these areas. The Sanctuary is a no-anchor zone, so there is no dropping of anchor in the Sanctuary boundaries. The final push for designation of the Sanctuary was actually triggered, which was a very, you know, lengthy decadal process, actually was pushed over the line by the incident where a tanker dropped anchor at the Flower Garden Banks at the East Flower Garden Bank. Saw a nice shallow spot and dropped anchor.

Emma Hickerson [00:19:37] These anchors - I don't know the dimensions - but they are absolutely massive. And then the chains associated with them are also massive. And when those ships are dragging anchor or swinging on anchor, they were just toppling and scouring the coral heads and doing massive amounts of damage.

Emma Hickerson [00:20:05] So, in 2001, I think it was, the International Maritime Organization actually implemented the first-ever no-activity zone through their actions, because of the fact that the ships that were using the shipping lane in close proximity to the National Marine Sanctuary, to the Flower Garden Banks, were internationally flagged and the Sanctuary boundaries and no-activity regulations associated with the Sanctuary were only on U.S. charts. So, in order to get them onto the international charts, that regulation was put in place through the IMO, the International Maritime Organization.

Emma Hickerson [00:20:55] So then, that meant that the international shipping fleet then had those regulations on their charts.

Emma Hickerson [00:21:07] So, that's why that all happened.

Emma Hickerson [00:21:09] And we haven't had any anchoring incidents at the East or West Flower Garden Banks. We did, however, in the last couple of years, have an anchoring incident at Geyer Bank. So, it didn't, it hasn't stopped it. But it has allowed for the identification of the Sanctuary boundaries and notes are on the international charts. So, as I say, while it hasn't stopped it, it doesn't happen as much and the risk has been greatly reduced.

Emma Hickerson [00:21:45] The other threats from shipping come from the fact that those tankers have very deep drafts. And in reality, if one of those tankers that had a very deep draft came across the Flower Garden Banks, there's potential that they could actually hit the corals even though they're, you know, 54 feet deep. So, some of these massive supertankers are actually a threat for mechanical damage from hitting the Banks. That's never happened. We hope it doesn't ever happen, but that is, you know, a very slight risk. But it's there.

Emma Hickerson [00:22:33] The other possible risk to the marine environment, and the integrity of the environment, is the introduction of invasive species through ballast exchange, also from transportation of organisms on the hulls of the ships. So, that has not been studied. But I think, I think at some point, it will warrant some more input and investigation, because the reality is that the ports are getting bigger. They're bringing bigger ships in. There's a lot more transportation and movement. It's a high level of movement at the moment, but I don't think we have started to understand what that potential risk is.

Emma Hickerson [00:23:33] I will say that another potential risk from the movement and transportation of invasive species, or the introduction of invasive species, comes along with the presence of oil and gas structures. So, if you look at a map of the Gulf of Mexico, and you can go on the Flower Garden Bank website or other sites, and plot where the, visualize where the oil and gas structures are. It's a spider web of thousands of platforms in the Gulf of Mexico.

Emma Hickerson [00:24:15] And they're all growing encrusting organisms and provide habitat for, they do provide habitat for marine organisms, but they also, because of the introduced structure, provide opportunities for the spread of invasive species. So, they're ultimately acting as vectors for invasive species.

Emma Hickerson [00:24:38] And we think that some of the species that are now at the Flower Garden Banks and established, for instance, the Sergeant Major, have sort of island-hopped their way over to the Flower Garden Banks. That is a Caribbean species. So, it's, you know, not quite so invasive. It's an introduced. It's extended its range through the movement of probably island-hopping.

Emma Hickerson [00:25:02] But there is a species of coral called Tubastraea that gets photographed a lot by underwater photographers because it is quite beautiful. It's a beautiful, very fleshy, orange-yellow polyp, and very showy. It's quite large. But it is an invasive species from the Pacific. Doesn't belong in the Caribbean or the Gulf of Mexico. And it loves artificial structures. So, some of the platforms are just covered in this very showy, very beautiful Tubastraea. But I think it's, you know, it's out-competing some of the native species.

Emma Hickerson [00:25:47] And it has shown up at the Flower Garden Banks. When we first saw it, we actually saw at Geyer Bank, and we were on a cruise with, it's one of the ships that are contracted by NASA to pick up the rockets - the Liberty Star. So, we got to go out with their team to do some ROV work at one point many years ago. And one of our agreements with them was to take their divers on the ship to go diving, to do some work with us on a research basis. So, that was actually a really nice little collaboration where they were providing their ship for us to do some ROV work, to do some exploration. But we, in turn, took them to Geyer Bank and got them to help us remove some two Tubastraea that we had found growing at Geyer Bank.

Emma Hickerson [00:26:48] And it was interesting over there, because there's not a whole lot of the structure, hard structure, that you see as a coral reef over there at Geyer Bank. But the Tubastraea had actually embedded into to the softer substrate. So, it was really somewhat insidious and unexpected that it was growing in this softer substrate.

Emma Hickerson [00:27:16] It was hard to remove. And we sort of understood at that point, we weren't going to be able to remove it. And then it did eventually turn up at the Flower Garden Banks. There's a patch on the West Flower Garden Bank that was quite overgrown by,

or there were hundreds of colonies of Tubastraea on one outcropping at the West Flower Garden Bank. So, while it was quite a focus area of the Tubastraea, we didn't see it in a whole lot of other places, but so we did try to remove it in that area. But it came back very quickly and we realized at that point, the action of removal was probably spreading it. So, we sort of stopped that engagement with the removal process.

Emma Hickerson [00:28:14] And it's a species that has established itself now. It's not quite, it's not all over the Bank. But we do see it popping up here and there. And it's been brought to the Flower Garden Banks through this vector process by the oil and gas platforms.

Emma Hickerson [00:28:38] So, that's an unintended consequence of having all of these artificial structure in an area that also harbors these biological communities.

David Todd [00:28:54] That's so interesting. I mean, I've heard a good deal about the Rigs to Reefs program, and it just never occurred to me that, you know, there's this dark side of that, that, you know, it may be a vehicle for spreading invasives.

David Todd [00:29:12] So, you know, we were talking earlier about navigation, and I wanted to explore that issue for the Flower Garden just a little bit more because I think that you were involved in installing mooring buoys back in 2012, if I'm not mistaken. And I'd love to hear about the purpose and role for those buoys and what it was like putting those in. Sounds like it's not a simple task at all.

Emma Hickerson [00:29:44] You're right there. It is actually. They're very important management tools to protect the fragile coral reef habitats. There is, as I said, no anchoring allowed in the Sanctuary. Before the mooring buoys were put in, the regulations basically said, "Find a sand patch to put your anchor in".

Emma Hickerson [00:30:05] But that was for vessels under 100 feet, but that was a very onerous task in the sense that it was very hard to see where the sand patches are. We didn't have maps for them.

Emma Hickerson [00:30:20] The first mooring buoys were actually installed at Stetson Bank by a wonderful group of recreational divers and the group was called "GREAT", the Gulf Reef Environmental Action Team. They were also very active in promotion and elevating the Sanctuary for designation. So, so they're an important group in the eyes of the history of the Flower Garden Banks.

Emma Hickerson [00:30:54] But the moorings, we have moorings installed at the East and West Flower Garden Banks and Stetson Bank. And the Sanctuary maintains those mooring buoys.

Emma Hickerson [00:31:06] It's actually quite a difficult task because you have to drill into reef rock to install a U-bolt. So, you drill two parallel holes into the reef rock. So, reef rock is dead coral reef. And so you have to select a good place that is structurally sound enough to accommodate a mooring and big ships pulling on it - big vessels.

Emma Hickerson [00:31:39] I will say that the mooring buoys are limited to vessels under 100 foot because they're just not structurally sound enough for anything bigger.

Emma Hickerson [00:31:50] So, you've got in the reef rock at the Flower Garden Banks, we drill using an underwater drill that's pneumatic. So, it's got a long hose going up to a ship that has the compressor on board. So, you have to have good conditions, so the boat's not swinging.

Emma Hickerson [00:32:20] You have divers in the water sort of managing the big line going down to this big pneumatic drill. And then you've got teams of divers rotating through to actually do the drilling work.

Emma Hickerson [00:32:35] So, the drill bit is a long cylinder with a diamond tip, so it's very sharp, so it can cut through the reef rock, the calcium carbonate reef rock. And it's quite physical, and you hang weights off the drill so that it actually helps you push down into the reef rock as you're drilling. And then you've got extension tubes so that you can drill deeper. So, you're drilling about four feet down into the reef rock in these parallel, these two parallel holes, one at a time.

Emma Hickerson [00:33:20] But then as you're going down, you have to pull a drill bit out and pull the coral out of the drill bit, and then start again going deeper. So you've got these, actually, beautiful tubes, cores, of coral that are really interesting to look at scientifically. They're not of huge value. I think that they're probably more of value educationally because ...

Emma Hickerson [00:33:50] Going down one of these tangents here. Sorry about this, David.

Emma Hickerson [00:33:52] But corals lay down annual skeletons so you can count the age of coral, if you know where the top of the coral is, and what age that was then. When we do aging of corals, we actually core corals that are alive rather than these dead reef rocks. So, that's the difference between the benefit of these cores scientifically versus educationally.

Emma Hickerson [00:34:16] So, going back to the coring, the mooring: once you've got the two parallel poles deep enough and at the right width to accommodate this stainless steel U-bolt, that U-bolt is put into place, and then cemented into place. And that's allowed to dry for a few days, until you can put the shackles on.

Emma Hickerson [00:34:51] The shackle goes on, actually, by jumping the shackle from the boat with divers going down to the U-bolt, shackling on, and that shackle is attached to the buoy line. That goes to the surface with the big mooring buoy on the surface.

Emma Hickerson [00:35:14] So, it does take a lot of expertise and experienced divers to do that safely, and good conditions to do that safely. So, it's a lot of heavy work and a lot of teamwork. And the U-bolts wear out. The shackles wear out. So, it's a full-time job.

Emma Hickerson [00:35:36] And sometimes, unfortunately, the conditions are such that it just is beyond the capability of the Sanctuary program to get them maintained at a regular pace to accommodate U-bolts wearing out, shackles wearing out. So, it is a bit of a frustration. And it takes a lot of effort and time and money. They're very expensive.

Emma Hickerson [00:36:07] So, I will say that I touched on the selection of a mooring buoy site is very important, and that, as I said, it had to be structurally sound. We did have one unfortunate, kind of amusing incident where we had installed a mooring buoy. And I think it probably actually was because of a hurricane. But that whole coral head toppled. And the mooring buoy's U-bolt actually ended up underneath the toppled coral.

Emma Hickerson [00:36:48] So, it's on a huge magnitude. But things like that can happen at the Flower Garden Banks. These corals are the size of, you know, vehicles. They are massive. But they can actually be structurally damaged during hurricane events.

Emma Hickerson [00:37:04] So that's that. We just picked the wrong coral head that day for the installation of the mooring buoy.

Emma Hickerson [00:37:10] But also we need to think about things like when vessels are swinging on those mooring buoys. We have to spread them out so that there is no interaction between the vessels. You'd think that mostly the vessels would all be leaning or pulling in the same direction. But we've honestly been out there in slack days, where boats are sort of spinning on their moorings in different directions. So, you really have to be careful in the placement of those U-bolts so that they do accommodate the swing of the vessels and the length of the lines and things like that.

David Todd [00:37:51] Yeah, it sounds really dynamic and complicated.

David Todd [00:37:56] You know, you mentioned in passing that, one of these moorings was affected by a storm, possibly, that toppled the coral. And, I understood that you cruised after a series of hurricanes that have crossed the Flower Gardens area - Rita in 2005, Ike in 2008, and Harvey in 2017. What did you observe? What sort of impact did you see, if any? I mean, these features are so deep. Did you see an effect or not?

Emma Hickerson [00:38:41] You know, that's a very interesting observation. In 2005, after, first of all, Katrina and then Rita were here in the Gulf of Mexico, that was the first time that I'd gone to the Flower Garden Banks after a hurricane event, a large hurricane event, and seen the mechanical damage that can be caused by these storms.

Emma Hickerson [00:39:07] So, as I said, the Flower Garden Banks is dominated by these massive brain and star corals, just a very high percent cover, over 50% cover. And it just looks like a plateau of coral. And these massive corals are the size of vehicles. They're ranging in all sizes, but there are really, really large corals. And it doesn't look like it could be impacted because it is, as you said, quite deep.

Emma Hickerson [00:39:47] But after going out there after a storm, there were obvious sort of extraction sites where these corals had been plucked out of the reef and thrown across the reef. They were ended up in other, you know, you can see scour marks where they'd hit other corals, or they'd end up on the sand flats.

Emma Hickerson [00:40:10] The big massive barrel sponges had been sheared off, probably by the moving of these large corals across the reef. Some of the big barrel sponges had been filled up with movement of sand. So they were sort of just bowls of sand. And in the sand patches, you could see a lot of sand movement, sediment movement.

Emma Hickerson [00:40:37] And on the flanks of the bank, it was really interesting there. While you do have some of the big large boulder corals there, you also have these stands of finger coral that are a lot closer to the substrate. And they're in these fields of the finger coral. They're a lot more fragile and delicate.

Emma Hickerson [00:41:05] And in areas we would see these blowout holes where either something had hit them, or there was water movement that scoured out these blowout holes.

Emma Hickerson [00:41:19] And, also in places it looked really like those finger corals had collapsed in place.

[00:41:29] So, in seeing all these impacts, I was quite stunned that the amount of impact and it was pretty, pretty sad to see it.

Emma Hickerson [00:41:39] But, thinking about the mechanisms of what was happening, I thought that there were probably, potentially, these vortexes of energy in the water column that had caused some of this plucking-out of these huge, massive boulder corals. There was, potentially, pressure waves from the big seas that had traveled down, kinetically, through the water column, and that, I assume, was the cause of these collapsed finger coral areas, because if it was, if it was something moving laterally, those corals would not have been there, but they really look like they've been collapsed in place.

Emma Hickerson [00:42:33] So, you know, one of the descriptions of the Flower Garden Banks is that it has been formed ... the look and feel of the Flower Garden Banks is really influenced by the hurricanes. And after seeing the mechanical damage from this storm, it really, it really was instilled in me is that's true. The shape and feel of the Flower Garden Banks is from these storms.

Emma Hickerson [00:43:09] So, a lot of the times you'll get these bio-eroders in the form of sponges and things like that, that will bore out the base of a very large coral head, primarily the brain corals. Pseudodiploria is the species. And you get these formations of mushroom-looking corals because the sides and the base have been scoured out. And then you've got these corals that are still living, sort of up on this pedestal. But these hurricanes will come through and knock them all down and create new space for settlement about the corals.

Emma Hickerson [00:43:51] But it's just a mechanism of why the Flower Garden Banks looks like it does. And it's sort of a cyclic effect. You've got a long period of time where you don't have any big storms, you've got these mushroom corals, and then they get knocked back. Probably now that we're in a scenario with more frequent storms and higher intensity storms, you won't get those mushroom corals developing quite so often. So, it'll be interesting to see how that is impacted.

Emma Hickerson [00:44:27] I will say that after a few years, it was probably right before actually hurricane Ike, that I remember diving with G.P. Schmahl, the Superintendent, and because we had been diving after Rita and Katrina, and that's when we had just like, "Oh man, the Flower Garden Banks just got knocked back by this storm." But then right before hurricane Ike, it was probably a year before, we did a dive together and we both came up saying, "Wow, the reef really has come back from the storm. It looks great."

Emma Hickerson [00:45:04] And then we'd have another storm right on top of it. So, I think it is cyclical and it's just the influence of these storms on the look and feel of the Flower Garden Banks is really evident, once you see it go through a couple of storms. And it is really interesting.

Emma Hickerson [00:45:27] I will say also that in the deeper areas, down below the coral cap, we were doing ROV surveys and we see these big sand waves, and it's obvious that these

big storms are really getting down quite deep and influencing the sand wave patterns on the seafloor down, you know, several hundred feet.

David Todd [00:45:54] That's interesting. It makes me think of, you know, what you sometimes see in forests in the Big Thicket after storms. I know when Rita came through and there were these, you know, minor twisters that were spun off, and there be an opening in the woods. Just remarkable change that last, you know, far after the storm passes.

Emma Hickerson [00:46:24] Yes.

David Todd [00:46:26] So, I was intrigued about one creature from the Flower Garden complex, and that's the sea urchin. And I was hoping that you could use your experience and give us a little insight about what I understand was a pretty serious sea urchin die-off, back in the '70s and '80s. And then once again, I think there was another die-off in 2016. And I was curious if you can help us understand why those things happen.

Emma Hickerson [00:47:02] Yeah. So, the sea urchin, the spiny sea urchin, it's diadema, is the genus of that sea urchin, antillarum is the species, were a very obvious and very high-density organism on Caribbean reefs. And then in the 1980s, the early 1980s, there was a mass die-off of these invertebrates throughout the Caribbean, including the Flower Garden Banks. Almost decimated the entire population.

Emma Hickerson [00:47:47] I will say that there has been no evidence of what caused it. No proof of it, of the smoking gun, of what caused that die-off? So, there was no pathogen identified. So, we don't know, is the bottom line.

Emma Hickerson [00:48:16] And there was in the recent outbreak, I heard from colleagues... Well, in 2016, we didn't see any evidence of it on the Flower Garden Banks. There was actually 1 in '22, in the Caribbean, but the Flower Garden Banks wasn't impacted.

Emma Hickerson [00:48:34] I will say that the numbers of the sea urchins have slowly been coming back, Caribbean-wide. I don't know how the latest mortality event affected that recovery, right?

Emma Hickerson [00:48:49] But at the Flower Garden Banks, we have seen increased numbers. We do sea urchin surveys at night during our long-term monitoring and we have got quite good recovery rates at the Flower Garden banks, especially the West Flower Garden Bank. The East Flower Garden Bank, not so much. So, I don't know what the difference is there.

Emma Hickerson [00:49:17] But the one place where we kind of joke that we could probably repopulate the East and West Flower Garden Banks is Stetson Bank. There are a huge number of sea urchins there.

Emma Hickerson [00:49:30] So, I did want to talk a little bit about Stetson Bank, because I have missed out on talking about that in relation to the coring, the mooring installations, and the storm events.

Emma Hickerson [00:49:48] So, Stetson Bank is really interesting: one of the things being the fact that there are so many sea urchins there. And, one of the things about Stetson Bank is

there are not that many places to hide. So, maybe we're just seeing them: they're more obvious. We see them more clearly.

Emma Hickerson [00:50:08] But Stetson Bank is not a coral reef. It's a coral community. And it's, it's siltstone / claystone dominated 'scape. That you can see literally see the geology right in front of your face. A lot of people talk about it looking like a moonscape.

Emma Hickerson [00:50:30] And so, as I say, there are not that many places to hide. The marine invertebrates are all out there on top of it, and you can see them. And there's a lot of color there because of the encrusting sponges, the high density of fish. And because it's a siltstone / claystone environment, it is really, really difficult to install mooring buoys there.

Emma Hickerson [00:50:56] The drilling process is is really sticky and mucky. And the sediment wants to fall into the hole as you're drilling. You have to use a different kind of bit. And you have to drill deeper - probably six feet or more into the substrate to get those anchors in place, those mooring buoys, those U-bolts. And they don't last as long because of the substrate. It's, as I say, sort of a very crumbly, unstable substrate to be working in.

Emma Hickerson [00:51:31] But because of the pinnacle areas of Stetson Bank, it really needs the placement of the mooring buoys there because anchors just do damage very quickly to the environment, to the point that I think even fishing gear dragging across the pinnacles reduces the integrity of those pinnacle areas. So, you can see impacts more readily at Stetson Bank from mechanical damage.

Emma Hickerson [00:52:08] And so, when we have a big storm coming through, it really scours out those pinnacle areas. And cleans out all of the rubble and some of the patches of areas of the pinnacles, you can see them actually slide off. So, you can see big break points and loss of structure from the storm. So it's a very different area from the East and West Flower Garden Banks.

Emma Hickerson [00:52:38] And now we've got all of the other reefs and banks in the Sanctuary, 14 additional banks. And, there is another bank called Sonnier Bank, which is sort of at the same latitude as Stetson Bank. So, it's a really good place to do comparative studies at a bank that's in a different location in the northwest Gulf of Mexico, but at the same latitude. So, we've never really had that ability within the Sanctuary to do some comparisons between sites. But now we have another one that's very similar to Stetson Bank.

David Todd [00:53:14] That's intriguing. And I guess, I think you mentioned earlier, that sometimes East and West Flower Garden Banks were useful to compare one against the other.

Emma Hickerson [00:53:26] Yes.

David Todd [00:53:27] So, I think that, in 2016, you were involved in a response to some bleaching that was seen at the Flower Gardens, and I was wondering, what do you think the cause of it was? And then what can you do about bleaching?

Emma Hickerson [00:53:52] So, I will talk about what bleaching is first, perhaps, David, to help people understand what we're talking about. Coral bleaching is a response to things like warm water or to polluted water.

Emma Hickerson [00:54:19] So, a coral is an animal. It's also a mineral. And it's also got a plant component to it. So, a coral, the soft tissue bits, on a coral are the animal. And it's laying down the calcium carbonate skeleton over hundreds of years sometimes. And that's the mineral component of the coral. And then within the coral's tissues are things that we call zooxanthellae that are photosynthesizing, just like plants. So, that's an algae, symbiotic algae. And that algae is photosynthesizing and providing energy, a form of food, to the coral animal.

Emma Hickerson [00:55:12] The coral animal is a colony, so it's joined to all the colony through the tissue. And so, it's passing around energy and food. So, the coral animal is only getting energy from photosynthesis during the day. And at night, it puts out the polyps, which are the feeding tentacles, and it grabs zooplankton from the water column. It has a mouth in the center of its polyp. And so it's grabbing food and feeding itself and sharing that energy through the gathering of plankton throughout the colony.

Emma Hickerson [00:56:02] In conditions that are stressing the coral that zooxanthellae, or the symbiotic algae, is expelled into the water column. So, it's leaving the body of the corals. That zooxanthellae, or that symbiotic algae, is what's giving the coral tissue its color. So, when that algae has left, and you're looking at a white coral, what you're actually looking at is through the opaque tissue of the coral animal at the white, stark white coral skeleton, calcium carbonate skeleton.

Emma Hickerson [00:56:46] And that's what is referred to as coral bleaching.

Emma Hickerson [00:56:51] So the coral animal is still alive. But the symbiotic algae is no longer in the tissue, so it's in a stressed situation.

Emma Hickerson [00:57:01] The coral animal can survive just from eating at night, feeding at night, using its tentacles for a few weeks. But after that, if the conditions don't change to a more favorable scenario, and the algae is not re-recruited into the coral tissue, the coral animal dies. And that's when you have a mortality event from bleaching.

Emma Hickerson [00:57:30] So, a bleaching event is not lethal, if it's short-term. Now in the Gulf of Mexico, in the Flower Garden Banks, we've actually seen, you know, multiple bleaching events. 2005 was one of the bleaching events that was really quite foundational for my understanding of what's going on with bleaching.

Emma Hickerson [00:57:54] The temperature, water temperature, was elevated. Hurricane Katrina actually came close to the Flower Garden Banks, but brought with it quite warm water, which influenced the stressful conditions at the East and West Flower Garden Banks. And we had a resulting bleaching event where the zooxanthellae was expelled. We had bleached corals. But then, a couple of months later, I can't remember the period between the two events, but Hurricane Rita came through and actually brought cooler water and sort of stopped that bleaching event in its tracks. So, hurricanes can actually be a positive influence on the ecosystem and the coral bleaching events.

Emma Hickerson [00:58:46] So, we have, you know, we were measuring temperature of the water at that time. So, we actually we could plot it and plot it against the bleaching events so we could see it quite, visualize what had happened there.

Emma Hickerson [00:59:03] So, once the conditions returned to a more favorable scenario, then those zooxanthellae that are in the water will be reincorporated into the coral tissue. The

coral tissue gets its color back, and it's got two sources of food, once again, photosynthesis and from extracting, directly feeding from the water column. And the corals are good to go.

Emma Hickerson [00:59:35] But what's happening now, I think a coral bleaching event does compromise the integrity and health, in general, of the corals. Just like humans, if you get sick, your resources are down. You don't have as much strength. And it takes time to build that strength back up.

Emma Hickerson [00:59:57] And what's happening now in a warmer climate environment is that bleaching is occurring more often. And the coral is more compromised and doesn't have the ability to bounce back from these events quite so often.

Emma Hickerson [01:00:23] So multiple bleaching events will probably, you know, ultimately cause the demise of coral reefs. And that's what's happened in the Florida Keys. They become more susceptible to coral disease, for instance. So, it's just a parade of insults to the coral reef that ultimately ends in the death of a coral reef.

Emma Hickerson [01:00:46] So, the Flower Garden Banks is lucky so far that we are somewhat insulated by the depth of the water and the ability to be buffered from the warm water. But it's definitely been warming up over time. We've seen that reflected in our water quality data records, since we've been collecting it anyway.

Emma Hickerson [01:01:16] And we know that the coral reefs have been surviving for, you know, thousands of years. But now we're starting to see more regular bleaching events.

Emma Hickerson [01:01:26] So, you know, we can't control a lot of that as managers. What we control are limiting the ... there are things that we can manage and things that we can't. So, climate change is one of those big things that we can't really manage.

Emma Hickerson [01:01:41] But we can we can take some of the pressures off the resources as managers that may allow the corals to be stronger. So, a more healthy ecosystem that has all its components in place - the fish, the crustaceans, and the associated invertebrates and sponge environments and things like that, even the algae is important on the reefs.

Emma Hickerson [01:02:15] Now, the algae, I will say, is important for other reasons. Too much algae is not a good thing for coral. It can overgrow coral, and kill the coral by overshadowing the coral. But in a balanced environment, you've got enough herbivores that are grazing down the algae. So, this is actually why one of the important things that happened with the diadema die-off. Diademas are grazers. They eat algae.

Emma Hickerson [01:02:47] And after the diadema died off, you don't have that level of grazing. So, a lot of coral reefs in the Caribbean actually succumbed from overgrowth of the algae and died.

Emma Hickerson [01:03:01] That didn't happen at the Flower Garden Banks. I guess we had a balanced population of healthy grazers, like Parrotfish, for instance, that graze, and Surgeonfish and things like that, and other mollusks that are in there grazing.

Emma Hickerson [01:03:18] But in places where you don't have a balance of the ecosystem, you don't have enough grazers, one little one ... well, not little, but one change to the food web, and it can crash.

Emma Hickerson [01:03:31] So, that's, you know, that's one reason the Flower Garden Banks has really been held up as an example of what a fully functional ecosystem looks like in a world where coral reefs are declining. And the Flower Garden Banks really seems to have all of its components in place to be that iconic balance of what a coral reef system looks like. So, it's a good comparison site to look at for what other reefs are missing and what they need.

David Todd [01:04:06] Okay.

David Todd [01:04:09] So, another one of these stressors that I guess is just ubiquitous and it's difficult to deny its impact, but maybe you can make the reef more resilient. I don't know. I'm hoping. But, I understand that, in 2019, you helped install a buoy to track acidification of the ocean. And I guess that's a factor that could affect the ability of these coral skeletons to be built over the years. Can you talk about that concern, and about the installation of the buoy and, you know, efforts to try to understand what's going on?

Emma Hickerson [01:04:52] Yeah. So, that was an effort to install a very sort of complex instrument on the seafloor. It's a big, big, a big package. We installed, first, an anchor. We had to figure out how to put the anchor, to anchor the system. And then we put the instrument on to the anchor system. So that, you know, the logistics of doing that with very experienced, working divers was quite complex. And we had to have really good sea conditions to do that.

Emma Hickerson [01:05:37] So, that was a good test of our divers and our equipment on the vessel because we had to use our A-frame to lower the anchor and safely do it with divers guiding the placement of the anchor into a sand flat that we had identified. And then we ferried the different components of the equipment down to the sea floor and then installed the whole structure onto the anchor system. It was a instrument that was built by a Texas A&M University professor, Dr. Niall Slowey, and it was dedicated to measuring the conditions related to oceans acidification, which is related, closely related, to climate change.

Emma Hickerson [01:06:43] So, the ocean increases in acidity through a series of chemical reactions, by absorbing carbon from the atmosphere in the form of carbon dioxide. But when the atmospheric carbon is released through respiration, we're all releasing carbon dioxide. All the living creatures are releasing carbon dioxide. And through also through the burning of fossil fossil fuels. So, the more fossil fuels are burned, the more CO₂ is in the atmosphere.

Emma Hickerson [01:07:13] And the ocean absorbs, I think, about 30% of the carbon in the atmosphere. So, the more carbon that's released, the more, the more uptake that is required by the ocean.

Emma Hickerson [01:07:32] So, the process is that the carbon dioxide mixes with the water and creates a carbonic acid, which subsequently releases hydrogen ions into the water. And this increases the ocean's acidity. And that's what we're measuring when we're measuring pH.

Emma Hickerson [01:08:03] Now, we're not saying that the ocean is acidic. It's still more alkaline, but it's decreasing in pH, which is moving to the more acidic side. And there's been a 30% increase in the pH over recent years, and it's predicted to fall. Right now it's about 8.1 pH. And the prediction, with the way we're going, is that it will fall to about 7.7 by the end of the century.

Emma Hickerson [01:08:45] And so the carbonic acid binds with carbonate ions, which are the building blocks that allow marine organisms to build skeletons. So, that's going to directly affect and influence how corals are able to build skeletons, how mollusks were able to build their shells. And think of oysters: they won't be able to build their shells in that changed scenario.

Emma Hickerson [01:09:18] There is a physiological impact to fish called acidosis. So, it will impact our food supply.

Emma Hickerson [01:09:34] One thing that's interesting to think about is that in the tropical climate, the warmer water can't absorb as much carbon dioxide. So, it's really the colder water climates that are going to be, and are, more susceptible to ocean acidification. There have been impacts already recorded in, you know, in Antarctic waters.

Emma Hickerson [01:10:00] But we, as managers and researchers, we are monitoring the levels of ocean acidification by taking water samples, putting these instruments in, and doing biological surveys to just sort of look at the trends and impacts - possible migration and adaptation of species.

Emma Hickerson [01:10:25] One of these big, complex things that we can't really do a whole lot, but we can measure things as managers of the Sanctuary, but also understand what, as a community and as a population and species, what we can do personally to change our impacts on a very personal scale, so we can make decisions to reduce our carbon footprint.

Emma Hickerson [01:10:53] That may not look measurable from one person, but if you look at a community level, a city level or a country level, it really does have real life influence and potential if you consider the really harsh consequences of a changing environment, climate change and the trickle-down effects of things like ocean acidification.

David Todd [01:11:26] Okay. Well put.

David Todd [01:11:32] So, something else I wanted to explore with you, with your help, is the impact of fishing. I understand that you worked on a impact workshop back in 2007, and I thought maybe from that experience you could tell us a little bit about, you know, what impact recreational and commercial fishing might have had on the Flower Gardens and other reefs. I understand that spearfishing and bottom fishing are banned at the Flower Gardens, but trolling and commercial fishing are allowed. So, I guess there's been some balancing and some negotiation there. Can you talk a little bit about, you know, what's the history of that?

Emma Hickerson [01:12:26] You're correct. Once again, just a reminder that the Sanctuary is a multi-use Sanctuary, so fishing is allowed. The Sanctuary areas are also, most of the areas, not all of them, are also identified as Habitat Areas of Particular Concern. So, those regulations are actually under the auspices of the National Marine Fisheries Service. And that regulates the ability for fishing vessels to anchor. They don't allow fishing vessels to anchor in HAPCs. They don't, they control the types of fishing gear that can be used in the HAPCs.

Emma Hickerson [01:13:08] So, they're, without the Sanctuary, there are some regulations in place, but it doesn't capture all of the Sanctuary zones. And it doesn't regulate things like spearfishing. So, the Sanctuary regulations do not allow spearfishing to occur within the Sanctuary boundaries. And also, the bottom-tending gear is regulated through the HAPC, so traps are not allowed. Trawls are not allowed. And long lining is not allowed.

Emma Hickerson [01:13:49] But, trolling is allowed, which, you know, it's a matter of interpretation. It's a little ambiguous because, while long-lining is not allowed. Trolling is a form of fishing, where it's a single line with many hooks hanging off it and the boat is moving. So, the conventional hook and line is defined as a single line terminating in a single hook. So, trolling has multiple hooks, but they're coming off single lines.

Emma Hickerson [01:14:29] So, it's an interesting interpretation, as I say, a little ambiguous, which allows for that technique to capture multiple fish.

Emma Hickerson [01:14:44] So, when you're looking at a trolling ... I've been offshore and looking at a trolling event happening and it's hard for me to say personally, whether that's legal or not, but the ruling on the definition is that trolling is allowed.

Emma Hickerson [01:15:02] So, there are techniques that may be a little counterintuitive to what you would think should be allowed in a Sanctuary. And also, there are species that are vulnerable to a legal form of fishing, but the species is not regulated as far as catch goes. And that falls under the auspices, once again, under the Fisheries Management Council, through the National Marine Fishery Service, which is related to the National Marine Fisheries Service, so that the Gulf of Mexico Fisheries Management Council regulates the bag limits and things like that.

Emma Hickerson [01:15:41] And there's a one particular ... I'm just going to talk about one particular species, which is the wahoo, which is a very, it's, it's a popular fish for sport fishermen to go after in the winter season. And for years, ever since I've been at the Flower Garden Banks, the wahoo season was targeted very heavily by recreational fishers. But there was never a bag limit. There has been no management plan for that species.

Emma Hickerson [01:16:15] And, I always thought that that was an issue. And we talked about it through the Sanctuary Advisory Council. We brought it up multiple times to suggest to the Gulf of Mexico Fisheries Management Council that they look at that, because of the pressure that was being put on this fish. And it's not until recently that I think, even since I've left, that there is more conversation surrounding that topic. So, it's never happened in the past. And it sounds like potentially, now that the fishermen are saying, "Well, what's happened to wahoo? We're not seeing them anymore."

Emma Hickerson [01:16:55] Well, that's that's what happens when you don't have a bag limit and you've got a high pressure of fishing on on a resource that's not endless.

Emma Hickerson [01:17:08] So, there are complicated, there are complications around those conversations. And I think even though we allow fishing in the Sanctuary, there have been impacts that we haven't measured very well. We don't have quantitative data surrounding the overfishing. We have qualitative data and anecdotal information.

Emma Hickerson [01:17:40] So, I personally (know that this is my personal opinion), is that we should have some no-fishing areas to build up populations, but other areas that are fished for things like snapper and grouper and the mackerel and things like that. Mackerel are pelagic, so they're moving around quite a bit, but they seem to like these banks, sort of aggregation areas in the winter months.

Emma Hickerson [01:18:10] And that's another question why they're aggregating. Are they feeding? Are they breeding? We don't know. So there's a lot to learn about these fish.

Emma Hickerson [01:18:19] Marissa Nuttall, who was my research assistant and really my right hand for many, many years. She still works at the Flower Garden Banks. She's actually, she's doing her Ph.D. right now, and she's doing a fascinating study tracking, she's doing an acoustic survey tracking quite a few different species of fish. She's working with Dr. Jay Walker at Texas A&M - Galveston. And they've got a network of receivers throughout the Sanctuary and across the northwest Gulf of Mexico banks.

Emma Hickerson [01:18:53] And, they're tracking, they've caught and put transmitters on both recreationally important fish and just biologically important fish, including things like Parrotfish, and invasive species like lionfish to learn more about their movement locally, and also pelagic species. Just to look at their movement between the banks and around the banks and how they use the banks.

Emma Hickerson [01:19:22] She did tell me ... I'll just go on a little tangent here. She did tell me, recently that they picked up four, four or five Great White Sharks in the Sanctuary boundaries, which is exciting and horrifying at the same time. But wow, that's really exciting. But they had been tagged up on the northeast coast, and they were now in the Gulf of Mexico. They've probably always been in the Gulf of Mexico, but because she had those that scientific equipment, the acoustic receivers in the Flower Garden Banks, they were able to pick those animals up and let the researchers know in another area that they'd found, that they'd turned up in the Gulf of Mexico.

Emma Hickerson [01:20:12] So that was really exciting.

Emma Hickerson [01:20:14] But, that's just an example of how much we don't know about these marine areas. And I personally think that we should be doing more to protect these really special places like these reefs and banks in the northwest Gulf of Mexico, so that they are true sanctuaries, not just in name, but also in management.

David Todd [01:20:46] So, I wanted to ask you just two more questions, if you can still spare the time, about these challenges, the impacts that you're trying to work to control. One is about coral disease. I think you mentioned that the Caribbean had really serious outbreaks and that I believe that in 2005, you were involved in a response, I guess at the Flower Gardens. Can you tell us a little bit about what your role was here and what the the issue was with this coral disease?

Emma Hickerson [01:21:24] Yeah. So, I think first of all, I wanted to put on the record that band in 2005 we did not document any coral disease. So, we had an anomaly occurring that we saw some, we wanted to know what was going on and coral disease was one of the suspects. But we were seeing these white sort of bands of dead coral starting at the bottom of the corals and sort of moving forward, moving, progressing upwards.

Emma Hickerson [01:21:57] And so, we did a lot of coral surveys, underwater coral surveys, and we put some nails into some of the affected corals to sort of track where that line of mortality was occurring and how fast and how much it was moving. We took samples. There was no resulting pathogen that could be identified. And so, we thought perhaps it was, something that was in the sand that was causing some of these effects because it was on the bottom of the corals.

[01:22:43] You know, in hindsight, it may have been some hypoxic situation where it was low oxygen levels that were located in the depressions where the sand were. And that relates to a huge mortality event that happened, oh gosh, I'm going to lose the year that happened. But, it was a few years before I left the Sanctuary. We were doing a long-term monitoring cruise at the East Flower Garden Bank, and we got a call from the recreational dive boat that they just seen what they thought was a lot of things that were dead.

Emma Hickerson [01:23:33] So, we were finishing up our monitoring at one mooring buoy, and it was only a few hundred feet from where the dive boat was doing their dives, where they'd seen a very disturbing event. So, we had lines all in the water, so we had to sort of finish that up and clean up our site before we got over the next day to where they thought. . . We were thinking, "Oh, maybe a shrimp boat has come up and put, you know, deposited their, you know, some bycatch or something like that".

Emma Hickerson [01:24:05] But we, the superintendent, G.P. Schmahl, and I were the first ones who got in, and we were met by a pretty devastating sight. And, the water was milky, a lot of flocculant matter floating through the water. And when we got down to the corals, the tissue coral, the tissues of the coral were just sloughing off. There was a very, obviously a very acute event had happened and killed everything. It killed the corals, the sponges, the invertebrates. The fish had swum away.

Emma Hickerson [01:24:52] And it was quite striking and strange because there were skeletons of things like brittle stars and sea urchins that normally when they die, you have this quite intact skeleton that you can pick up and handle and it just stays intact.

Emma Hickerson [01:25:14] But when we were touching some of these things, trying to sample them, to understand what was going on, they completely disintegrated. So, the chemistry of these skeletons was just totally disrupted. And it was pretty horrific to be quite honest. It was ... I was incredibly upset and disturbed by it, by seeing that.

Emma Hickerson [01:25:40] And we didn't ... because we had no idea what was going on and how extensive it was, or if it was something that would spread across the whole bank. B.

Emma Hickerson [01:25:49] And so we started, and we dropped everything at that point and we started doing some surveys to try to find the edge of that impacted area, trying to find, trying to determine the extent of the damage and what it could have been.

Emma Hickerson [01:26:14] So, actually, one of the calls we made was to the dive center. And their first reaction was, "Are your divers safe to be diving in this area?" Which was a very good concern.

Emma Hickerson [01:26:32] So, we ended up doing multiple cruises to measure the outcome of that area.

Emma Hickerson [01:26:42] But we had a bleaching event on the heels of that event, so it was interesting to try to discern the differences between bleaching and this acute event, mass mortality event.

Emma Hickerson [01:26:57] But one thing that was striking about this event was that it looked like it had come from the bottom up. So, that something very dense, a lot more dense than the surrounding seawater, had occurred in that area.

Emma Hickerson [01:27:12] We did end up having a conference focused on that mass mortality event. And, I am going to just read something to that if I can find it. Basically, we didn't find a smoking gun of what happened during that event. But we did have a room full of Ph.Ds discussing what might have happened. So, the bottom line was that ... I'm still looking ... that after a couple of days of conferencing and arguing what these PhDs were all seeing, because we had measurements all around the general area, in the Gulf of Mexico. But they were also storm events. There was a bleaching event. So, while we had no smoking gun that anybody could agree to, we did come up with a statement that describes what possibly happened.

Emma Hickerson [01:28:25] So the statement that was agreed upon was that low dissolved oxygen was the most likely contributing factor of the 2016 highly localized mortality event at the East Flower Garden Bank. So, instrumentation on and around the reef documented low surface salinity and higher than average sea water temperatures. That high organic matter was detected by remote sensing and unusually high levels of freshwater outflow from the Gulf of Mexico rivers was also measured. The linkages between the conditions measured on the reef at the time of the event and the dissolved oxygen factor were undetermined, and the mechanism resulting in the highly localized nature of the mortality event cannot be determined.

Emma Hickerson [01:29:14] So, we don't know what happened, but it's likely associated with low dissolved oxygen, which creates these pockets of very high-density, low-oxygen, which can kill the corals and the invertebrates, so things that couldn't move out of the way.

[01:29:33] So, that, possibly, may be related to what we were seeing in pockets way back in the early years when we were seeing a little bit of mortality, but not as big an event as what we saw in 2016.

Emma Hickerson [01:29:55] It might even relate to something like the salt, the brine, burping out these highly saline pockets of water that like the ultra-saline water, can also create these mortality events.

Emma Hickerson [01:30:14] So, you know, we don't know. If we don't have the instruments measuring that sort of stuff, we don't know. All we can see is the resulting death of the of the organisms.

David Todd [01:30:26] Well, if you don't mind like a rank amateur speculating here, but I remember reading that in August of 2016, there were these freakish rainstorms in Louisiana with enormous flooding and runoff. And would that have been about the same time, or maybe not coinciding with this?

Emma Hickerson [01:30:50] Yeah. So, it was. So, we did have these, and as was noted and agreed upon by this roomful of experts, that there were unusually high levels of freshwater outflow from the Gulf Coast rivers. So, that's reflecting exactly what you said. So, we did have a lot of rainfall, a lot of outflow that could have, that could have contributed to this event.

Emma Hickerson [01:31:15] But we don't have, as I said, a smoking gun. And the proof of that, that could be a contributing factor? Yes. Or it could be something completely different, as I say, as this burping out of super saline, 200 parts per thousand, water from the dissolution of the salt dome. Yeah. Don't know.

David Todd [01:31:44] The mysteries continue. I guess, it's endlessly intriguing. This is great.

David Todd [01:31:50] So let me ask you one last question about, you know, issues for the Flower Gardens. And I think it's intriguing to me because it, on the one hand you want to learn more about the reef, but in the same sense, that research can have unanticipated consequences. What I'm thinking about was the multibeam bathymetric mapping that that's been done around these features. And, I know that fishermen love to have more data about what the bottom looks like. And I'm curious if having that extra data for scientific reasons can have, you know, unanticipated problems with fishermen, for example, taking advantage of that extra information.

Emma Hickerson [01:32:48] Absolutely. One of my, you know, one of the things I'm very proud about is the level of data acquisition we've been able to do that supported, sort of, in some ways, the boundary expansion - not as quite as much as I would like it to have. But, one of the huge efforts that we were able to do is the acquisition of the high-resolution multibeam bathymetry, primarily conducted by, first of all, by Dr. Jim Gardner from USGS (he moved on to the University of New Hampshire), but also by NOAA, and we did get a lot of mapping done by NOAA, the NOAA fleet.

Emma Hickerson [01:33:41] And I'm very proud of it because we were able to use that data to then plan our ROV operations for many years, many years, and just dozens and dozens of dedicated cruises, characterizing and exploring the reefs and banks of the northwest Gulf of Mexico. We know a lot more than we did 25 years ago.

Emma Hickerson [01:34:06] However, I also feel extremely guilty about the acquisition of that multibeam data set because it basically gave a roadmap, sea map to the fishes for extraction because ... and they pretty much thanked me for it in person, to my face, it was like, "Oh, thank you for those maps. We now can go directly to where the fish are." It's like, "Oh, yes, I know that."

Emma Hickerson [01:34:35] But, because it was a government acquisition, we're bound to releasing it to the public. And, it is a double-edged sword. I absolutely agree with that. And I do feel somewhat responsible to providing that roadmap to the fish, to the fishes. Because there are special species in the Northwest Gulf, Mexico, like the marbled grouper, that are found in numbers like nowhere else in the Caribbean, that I revealed where they live.

Emma Hickerson [01:35:10] So, and, you know, this is another reason why I sort of think that there are places that we should protect and limit fishing activities. The grouper, a long-lived fish (we're eating things that are older than us), and I don't think that that's right.

Emma Hickerson [01:35:36] While the sanctuary program is multi-use, there are aspects of that that I think we can do a better job in on the environmental side for protection of the resources and the things that live there. So, that's, you know, that's my personal take on those things.

David Todd [01:35:54] Now, I had a question that occurred to me while we were talking, and it's not something that I mentioned in anything we've written. So, if this is off-base, please, please tell me, and we can move on. But, I was thinking about all your sea turtle research, and I'd had some interesting conversations with a fellow named Charles Caillouet (I think I pronounced his name right), who has been studying Kemp's ridleys for a long time. And he was really stumped at how the Kemp's ridleys had had this wonderful sort of trajectory of recovery. And then they just plateaued. And he speculated that there was some sort of a limit, a new limit, a cap, on the carrying capacity of the Gulf. And, I was wondering if, you know, with your work with loggerheads, if that may give you any insight into his suspicions.

Emma Hickerson [01:37:03] I'm assuming, and I know that name. He was with Fisheries in Galveston, I think. Is that right?

David Todd [01:37:11] Yes. That's right. Exactly. Yeah.

Emma Hickerson [01:37:14] He was... Yes. So, I haven't talked to him about this topic, and I'm not sure I've ever talked to him, but I'm assuming that the carrying capacity that he was referring to has changed because of the elevated activity and, maybe, less resilient Gulf of Mexico and less habitat. You know, the Kemp's ridley's story is quite magnificent in its recovery. But, it was primarily due to protection of the mass nesting areas in Mexico, but also bringing some of those eggs from Mexico and imprinting them onto Texas shores many, many years ago. And in the last few years, those hatchlings have grown up and come back to these adopted Texas beaches to increase their nesting range.

Emma Hickerson [01:38:36] But they're still affected by man's, you know, human consumption of things like shrimp. And there's a lot of, you know, the shrimping industry is pretty healthy in the Gulf of Mexico. It's caused the demise of habitats. You know, areas are trawled over and over again. And if you're a sea turtle, and you're getting caught in the nets over and over again, regardless if they have what's called a TED, a Turtle Excluder Device. These are air-breathing reptiles. They need to come up to the surface for air. And if you're trapped in a net and you're fighting to get out, and then you're really pooped from doing that once, and then you get scooped up again and you do it twice or three times, that may be the end of you.

[01:39:29] So, if that ... Yes, we're building up a population, but we're not stopping these mechanical and physical impacts from happening in their in their habitat.

Emma Hickerson [01:39:47] You know, the Gulf of Mexico was a very different place in the early, I think, the early 19th century. There was a green sea turtle cannery down on the coast of Texas and Louisiana, maybe Louisiana. But, there was a viable, really healthy population of green sea turtles. Well, that cannery took care of that. There are still green sea turtles in the Gulf of Mexico, but not like the numbers that they used to be. And I'm not sure if they're even nesting in the Texas coast anymore.

Emma Hickerson [01:40:22] But there was also a viable population of the manatees in Texas. But the decimation of their seagrass habitat by, primarily, shrimping is really responsible for them not being here on the Gulf Coast anymore.

Emma Hickerson [01:40:41] So, the ecosystem has extraordinarily changed. And I can see why that that statement would be made, that the carrying capacity for sea turtles is changed.

Probably the carrying capacity for many things has changed because of the human destruction and impacts on the natural resources.

David Todd [01:41:05] Okay. Well. It's good to get your thoughts about this. I'm sorry to blindsides you about that, but I thought, this woman knows something about this stuff, I'm sure.

Emma Hickerson [01:41:17] Well, let's shift to a few last questions about your personal career, and I wanted to ask you, first, I saw some of your photographs, which are lovely. I mean, they're beautiful. There's one looking up at a manta ray who's cruising above you, and there's just bright blue outline and this black image. Stunning. And I was wondering, is, is that just a happenstance, or is that a regular thing that you like to do, underwater photography.

Emma Hickerson [01:41:59] Well, David, I have that photograph on my wall, so I know the exact photo you're talking about. That photo has been picked up by a variety of uses. It was picked up in, I think, it was in either the Washington Post or the New York Times. I'm not sure which one. But, it is a silhouette of a manta ray. And I remember taking that photo. It was actually taken on film rather than digital. It was before digital cameras. And I remember waiting for that manta ray. Because diving, I will say, diving with film limits you to how many photos you can take, if you recall. We had a roll of 36 images and you can't see what you're actually taking. It's not a digital screen or anything like that. So, you know, you hope that you have all the settings right on the camera.

Emma Hickerson [01:42:56] And I remember just wanting that picture of the manta ray silhouetted in front of the sun that was beaming through the water. So, I do remember saying just, you know, talking to myself in my head as I do when I'm diving, like, "No, wait, wait, wait, ...", and then click. So, I do remember taking that photo. And that was taken probably in, I don't know, it was maybe '98, so a long time ago.

Emma Hickerson [01:43:26] And some of the photos that I'm most proud of are the ones that I took on film because of the level of ... it's a different level of understanding of your camera and controlling what shot you want versus the thousand, or you know, the hundreds of photos you can take on a dive now with a digital camera. You don't have to really plan the image. You just shoot away.

Emma Hickerson [01:43:57] So, I when I first started diving at the Flower Garden Banks, I mean, I had always sort of liked photography, but not immersed in it. But I started collecting video footage first, before, I was doing a lot of still. But I did a little bit of still photography here and there, and I got some really lovely shots that I'm very proud of with the film cameras. And, I was doing a lot of videography.

Emma Hickerson [01:44:29] And I was very dedicated to annotating the video so that we could know, first of all, it was personal to me that I needed to be able to go back to those videos to to do highlight clips, and pull some observations from the footage that I needed to go to. So, I started out very early on creating these annotation files for all the videos that I was shooting.

Emma Hickerson [01:44:59] And I did shift to still photography at some point, and I was doing a lot of still photography. And really, it became a part of my objective and responsibility to get these images out in a medium that was digestible for public consumption because I had this huge opportunity to be able to bring the sea, bring the marine world of the Flower Garden

Banks to people who would never get to see the Flower Garden Banks. So it's been really a level of responsibility that I took on myself.

Emma Hickerson [01:45:52] It was not ever officially a part of my job, but I was there, I had the ability and interest to take these images of both video and photographs and bring them back, and make use of them as much as possible.

Emma Hickerson [01:46:09] So, I really enjoyed that part of the world at the Flower Garden Banks and when G.P. Schmahl started coming to the Flower Garden Banks, well, he started in his position as Superintendent in about '98, '99, he also was a keen photographer. So, then I switched full-time on to video, pretty much, because I didn't want to be in direct competition with my boss.

Emma Hickerson [01:46:40] So, it was a nice balance of doing video and he was doing a lot of photography. And, you know, I did pick up a still camera every now and then and continue to take photos.

Emma Hickerson [01:46:52] And then we had the opportunity to do some 360 imagery, panoramics, that are used for education and outreach.

Emma Hickerson [01:47:05] And I've also really enjoyed working directly with artists to use their talent and creativity, linked with our imagery, my imagery, imagery that we've taken using the ROVs, to develop programs and activities and displays and exhibits that highlight through interpretation of science, through their art.

Emma Hickerson [01:47:38] So, one really enjoyable and successful endeavor was in partnership with a fellow Aussie, Jackie Stanley, who is a wonderful artist and author of children's marine-themed children's books. So, she's an ocean educator. And I met her through her son, who is a diver, in College Station. That is when I was in grad school, and I met him at the dive shop that I worked at, "See you Underwater". And he introduced me to his mom, Jackie Stanley. And she's from Sydney also. So, we're two Sydneyites loving Texas.

Emma Hickerson [01:48:23] And her husband, Rod, is and was deeply, heavily involved in exploration using underwater technology. So, he worked with Bill Newton many, many, many years ago in development of single-person dive suits, that ended up being used in the commercial world.

Emma Hickerson [01:48:54] But Jackie and I were just these very natural, fast friends. And we came up with an activity that was ultimately adopted into Our Ocean Day activities at the NOAA offices down in Galveston. And what we did was we came up with a mural activity that had a different theme every year. So, we had (this ran for about eight years), and Jackie was tasked with painting a twelve-foot by six-foot mural every year, that we have now displayed in the offices. They're absolutely stunning. They're so vibrant and colorful and so detailed and complex in presenting whatever the topic of that year was.

Emma Hickerson [01:49:56] So, we had sharks and rays of the of the Flower Garden Banks. We had marine mammals of the Gulf of Mexico. We had shallow water habitats of the Flower Garden Banks. We had mesophotic habitats of the Gulf of Mexico. We migrated over in to the West coast and did kelp forests of the West Coast sanctuaries. And we did sea turtles of the Gulf of Mexico. These were just absolutely stunning murals that Jackie did.

Emma Hickerson [01:50:31] But the activity was that we gridded them out into squares. I think they were, I don't know, four-by-four squares, or six-by-six squares. I can't really remember. But we gridded them out, using string and just gridded out this mural, this beautiful mural that Jackie did that was on the wall. We gridded them out. And then we got canvass squares and sketched out the outline of each square, and there were several hundred of these squares, a couple of hundred squares, I think.

Emma Hickerson [01:51:11] And we invited the public to recreate her mural during Ocean Discovery Day. So, they picked a square they wanted to paint. We gave them the associated canvas tile and they painted away. And we had, you know, in a chaotic two-hour period, we had a stream of children and adults coming in and wanting to paint their square. And it was one of the most successful and preferred activity during Ocean Discovery Day. And it was, it was brilliant.

Emma Hickerson [01:51:50] And, what we were able to do during that two-hour period, we, I always gave Jackie a list of species of whatever we were painting, and then I printed out photos of the marine organisms that were presented in the mural. And we had them on the wall in the painting room, and we had our volunteers and myself working in that room and talking about the ecology, the biology, and the importance of these animals that they were painting. And it was a really lovely touchpoint for education and to just chat about the marine species and the ecosystem.

Emma Hickerson [01:52:36] And people were so enthusiastic about it, that it was one of their favorite activities.

Emma Hickerson [01:52:41] And that's one of my favorite sort of outreach activities that was a wonderful collaboration with a dear friend.

Emma Hickerson [01:52:50] So, we did that for quite a lot, quite a few years, eight years, I think it was. The coral reef mural was developed into an activity that's accessible and downloadable on the Flower Garden Banks website as an educational activity.

Emma Hickerson [01:53:10] And, ultimately, I started working with another, more recently, another artist, Janavi Mahimatura Folmsbee. She's an artist up in, based in Houston again, who, in the last couple of years has had a huge impact on Houston. So, I invite anybody who's going, flying, through the international airport in Houston to go to the Aquarius Tunnel, which is a 200-foot tunnel connecting a couple of the terminals. You actually don't have to have a boarding pass to get to it.

Emma Hickerson [01:54:02] But it is an immersion into the Flower Garden Banks through Janavi's most spectacular artwork - from the walls on both sides, to the carpet, to these lenticular lighting features in the roof where the scene in the lights are illuminated, but as you walk past them, they transition from a photograph to her artwork. It's just gorgeous, just stunning. So, it's a very accessible public display that's tied to the mesophotic habitats and the shallow water habitats of the Flower Garden Banks. So, it's really elevated the awareness of the Flower Garden Banks in a very public space.

Emma Hickerson [01:54:56] So, the enjoyment I get from working with these very talented artist has been just immeasurable. It's just been wonderful. And I still work with both of them, quite regularly discussing notes. Jackie and I scheme. We're always scheming and it's started to happen with Janavi, too, now.

Emma Hickerson [01:55:18] So, now I'm living on the shores of the Pacific Ocean. And I've been taking a lot of photographs of rock pools and some of the organisms that live in the water here and in the south coast of New South Wales, south of Sydney.

Emma Hickerson [01:55:36] And Janavi has just latched on to the rock pools and the importance of those communities. And she's now visiting rock pool communities in the US and telling the story of their importance and their habitats through her art. So, she's about to, I think, open an exhibition focusing on rock pools.

Emma Hickerson [01:56:00] And, one thing that I've been pointing out to Janavi is the importance of marine algae and coralline algae and things like that. And this really ties back to the whole discussion of climate change, because these algae are photosynthesizing. So, they're taking that carbon dioxide and photosynthesizing through their processes and releasing oxygen that we're breathing.

Emma Hickerson [01:56:27] And there are expansive, extensive fields of habitat in and around the mesophotic habitats of the Flower Garden Banks that are primarily based on coralline algae as a major building block in these big fields of rhodoliths and these coralline algae beds and their photosynthesizing. They are really important in the chemical processes of climate in that their processes...

Emma Hickerson [01:57:10] And I'm not going to get into the chemistry of this because I'm just a bystander in this conversation.

Emma Hickerson [01:57:18] But they ultimately release a chemical in their process called DMSP, which is dimethylsulfoxonium propionate, or something like that. Probably butchered that completely. But it releases particles into the atmosphere ultimately that create more cloud cover, which in effect is more shading and cooling of the oceans.

Emma Hickerson [01:57:50] But if that community is compromised and is no longer functional, doing its photosynthesizing and also its DMSP chemical reactions, not releasing particles in the ocean, that means less cloud cover, ultimately impacting climate.

Emma Hickerson [01:58:12] So, those very important linkages in ocean chemistry, I think, are very practical ways of talking about climate change and why we need a healthy ocean. Because a healthy ocean means a healthier climate. And it's also creating oxygen that we're breathing. It's about, I think, 25% or 30%, maybe more, 50%, of the oxygen that we're breathing, is from the ocean chemistry and the turnover of the carbon cycle and releasing oxygen for us to breathe.

Emma Hickerson [01:58:55] So, if there is a declining health of the ocean in general, it not only means the quality of oxygen that we're breathing, it's also the decline in food resources. It also means the decline in things like the ability for us to learn about medicines, of chemical components of some of these marine organisms that can be very beneficial to human health.

Emma Hickerson [01:59:32] So, the coral reefs in particular are referred to as the rainforests of the ocean. So, while they comprise about 1% of the ocean habitat, their biodiversity contains about 25% of the species in the marine world. So, they're these hotspots of biodiversity that are functionally really important.

Emma Hickerson [02:00:02] So, the ocean regulates our climate and provides the air we breathe. If we don't have these very beautiful and complex habitats in our ocean, the ocean won't be able to function as a life support system for us. Our food security will be compromised. The ocean, as we know, provides jobs and livelihoods to our human world. It provides an area for transportation, and for marine and coastal resources, and tourism.

Emma Hickerson [02:00:42] And, while we want to be able to use and enjoy these resources, we have to do it in a very, in an educated way and a protective way, to protect, to keep the resiliency and the health of those resources.

Emma Hickerson [02:01:05] I don't know where that question started, but I went off in a really random way.

David Todd [02:01:11] No this is great. It's, it's all connected.

David Todd [02:01:15] And, I think we had started by just, I guess my admiration for your photography and videography.

David Todd [02:01:22] And, I wanted to ask you just a last question. I think that you were inducted into the Women Divers Hall of Fame in 2015, and, gosh, how many dives you've taken over? I saw one count - 1500. Countless, let's say, "countless". And I was curious if if you can share the experience of being underwater with those of us who, you know, may touch the bottom of a swimming pool, but it's not the same. What what can you tell us about that underwater world that you've been able to visit so often?

Emma Hickerson [02:02:08] Well, I will say, and thank you for recognizing that induction into the Women Divers Hall of Fame. That really, was humbling. And it really took me back. And I didn't really think that I deserved that, that pedestal. But, and I actually, when I was nominated, I asked the person who nominated me to withdraw the nomination because it was just too much. But then she sent me the letters of support, and I recognized the value that other people had seen of the work that I had done. And I wanted to honor their desire for me to be awarded that position. So it was, as I say, extremely humbling. And, but I've made some amazing lifelong friends through that program, and it's an extraordinary, extraordinary group of women.

Emma Hickerson [02:03:11] And it's, you know, looking back at it, it's been such a privilege to be able to enjoy and explore these areas. And one of the key things about the Flower Garden Banks, it doesn't matter how many dives I've done out there, I mean, I've done, you know, over a thousand dives just at the Flower Garden Banks. I've done, yes, you're right, over 1500 dives. There are a lot of people out there who done a lot more than me.

Emma Hickerson [02:03:38] But the dives I've done are primarily at the Flower Garden Banks. They're all sort of couched as deeper dives. A lot of people rack up dives - long dives in very shallow areas. But we were going 100 miles offshore to do our diving, so it's a little bit different as far as comparing apples to apples.

Emma Hickerson [02:04:01] But, the real joy of working at the Flower Garden Banks, besides being involved in all of the exciting work and discoveries, was working with equally passionate people and people that are a lot smarter than me in their different areas of expertise, and learning so much from them, and being exposed to all of these different people and their, disciplines.

Emma Hickerson [02:04:32] But also, during that time, being underwater, always finding something new you've never seen before. So, I was always on the look-out for that. You know, being born with this biological brain, I just inventory everything I see. And then as soon as I see something that I've never seen before, it just catches my eye and it's like, "Wow, what's that?" And I have to know more about it. Or some sort of unique behavior that I've never seen.

Emma Hickerson [02:05:02] And that's where the, you know, documentation through the videography and the photography really becomes important. A lot of time we tell a joke, it's like, where there's no picture, there's no proof. So, it didn't happen. So, some of it is that.

Emma Hickerson [02:05:17] But also just for my enjoyment. I mean, I still just go back all the time to look at my photos and experiences of the underwater world, at the Flower Garden Banks. So, and I really think that part of what I've been doing and what J.G.P. Schmahl has been doing in the video and photography is really a big part of our legacy for the Flower Garden Banks, because that is a solid record of what is and what has been at the Flower Garden Banks.

Emma Hickerson [02:05:49] And, I don't think anybody, to date, has sort of taken the time to inventory and organize and document what we were seeing in such an intensive way as we did. And I can see reflected in a couple of years that I've been, that they've been used extensively, those images, throughout the educational posts that I've seen. So, I'm really grateful that we were able to do that and that we've been able to provide that long-term record in images that that will continue to be used for many years.

Emma Hickerson [02:06:29] But I'll go back to my experiences. Some of my favorite experiences were seeing things like coral spawning. So the East and West Flower Garden Banks, as I mentioned, has very high coral cover, and very large corals, extensive, acres and acres of coral, and over 50% coral coverage. And they're primarily dominated by mass-spawning corals.

Emma Hickerson [02:06:58] So, corals can be either male or female, or they can be both sexes. And in 1990, coral spawning was first observed by recreational divers at the Flower Garden Banks. It had been documented elsewhere in the coral reefs in the Great Barrier Reef, but, never the Flower Garden Banks. So, on a particular night in August, divers saw this mass-spawning event. And so, researchers started going back at the exact same time to see if it happened again the next year or so, and it did.

Emma Hickerson [02:07:37] So, it turns out that seven to ten days after the full moon in August is when these mass-spawning corals spawn at the Flower Garden Banks. And over time, we were able to document the mass spawning event. And I was able to pull together a lot of observations and create a coral-spawning calendar for the Flower Garden Banks, which is on the website, because we get the question all the time, when will the coral-spawning happen this year?

Emma Hickerson [02:08:11] And in fact, I was the go-to person for the last 20 years or so for the recreational dive boats to schedule their coral-spawning cruises. So, annually I'd get a call, "When will the coral-spawning happen this year. When should the boats go out?" And so, I'd give them that information based on the full moon.

Emma Hickerson [02:08:33] But it gets tricky, because sometimes there are two full moons in the month of August. So, you'll get either a split spawn or you'll get two spawns. And based on historical records, I'd sort of make my educated guess as to what would happen.

Emma Hickerson [02:08:50] But also, it gets even trickier when the full moon falls very close to midnight. So, do you count that night as the first night after the full moon, or the next night after the first full moon? So once again, I used old records to sort of make my educated guess.

Emma Hickerson [02:09:11] But there's a lot riding on that guess, a lot riding on that guess. So, this is a company asking for me to give them a time of when the corals will spawn in the middle of the Gulf of Mexico. And I honestly will tell you I've never been wrong, but it's based on a lot of information historically.

Emma Hickerson [02:09:30] The most weight put on my prediction was actually standing on the back of the boat with these videographers that are world-renowned, Howard and Michele Hall, who do the Deep Sea 3D and a lot of other 3D cinematographic features. And they had this massive rig that look like a submersible that was the 3D camera for their 3D videography. And it had to be launched with an A-frame. And the researcher was standing on the deck and I was standing on the deck, and, we were advising for the film as the videographers to get in the water, because this rig can only take seven minutes of video at a time, then they have to bring it back up and change the reel out, or change the film out.

Emma Hickerson [02:10:35] So, all this spawn was coming up to the surface. And this spawn is lipid-filled, so it sits on the surface and it floats. And so, you get these drifts of red pinkish spawn. You can actually smell it. It smells like watermelon.

Emma Hickerson [02:10:53] And the videographers, everyone, was geared up. And the videographers were going, "Should we get in? Should we get in? We're going to miss it. We're going to miss it." I said, "No, no. Wait till 9:15. That's when you'll get, you know, that's when I would get in, that's when you get different species spawning and crossover between the brain corals shifting to the star corals. You might get some other corals earlier. You might get some brain corals later."

Emma Hickerson [02:11:21] And so, it was really a bit of a tense moment with, you know, these very, very famous videographers wanting to get in the water and you were trying to hold them off. But anyway, it worked out very well. And they got their shots.

Emma Hickerson [02:11:37] A few years later, we, I don't know why I agreed to this, but we agreed to do a telepresence during coral spawning. So, there are people on shore waiting for the coral spawning when I said that the corals would spawn. And there were watch parties happening on shore at Moody Gardens and other places. We ended up having horrific weather, but we got the camera gear in, and it was all up-linked to the surface through cabling. And we had the telepresence set up to beam the live footage of coral spawning going to shore. But we actually, it was not divers - we had an ROV doing it, and we actually documented it live when the coral spawn was going to spawn, and they spawned on cue.

Emma Hickerson [02:12:32] But boy, that was a lot of stress.

Emma Hickerson [02:12:37] So, but that's been really fun to do, and to see, because it is a spectacular event where there's nothing happening, and then, all of a sudden, a coral head goes. You can see the coral sitting there with eggs in its mouths, ready to go. And so, the

females will release the eggs. The males will release sperm that looks like, just smoke coming out of them. Or, if you've got these egg and sperm bundles in the colonies that are both male and female and then the whole reef will go. It's just like an underwater snowstorm when you've got these lipid-filled bundles rising from the the corals, going upwards, and you can see them in your beams of light.

Emma Hickerson [02:13:22] And sometimes, I've been very lucky to see what I can only explain as waves of coral being released over a coral head. So, you've got this massive coral head and the release of the bundles. You can see the bundles sitting just poised, ready to be released in the tentacles in the mouths of the corals. And then from one side of the coral, they start releasing. And it's like a wave that goes over the head of the coral in a release, a beautiful release of these, the next generation of corals.

Emma Hickerson [02:13:57] And I've captured that on film several times. That's in the highlights reel with the Flower Garden Banks coral spawning, if anyone wants to watch it.

[02:14:07] But it's, you know, just the screaming that happens in my head when I capture those moments is just, "Yep", to me only. But it's just so gratifying to capture those moments, to witness those moments. And it's just also, you know, a lot of it's just using these things in different ways, other people on the reef are seeing the same things.

Emma Hickerson [02:14:34] But one of my favorite things also is to see someone who's never dived the Flower Garden Banks ever, do their first dive, and I like to be on the back deck to see them come up and just ... their reaction of what their experience was like. It's just, you know, it's just one of my favorite things to see. It's usually commenting on, "Oh my gosh, I've never seen so much coral in my entire life."

Emma Hickerson [02:14:58] So, it is a special place. I've had the pleasure of, you know, encountering whale sharks and schooling hammerheads, whale sharks during the warmer months, schooling hammerheads during the winter months (t's hard to get to the Flower Garden Banks in the winter), schools of spotted eagle rays, manta rays throughout the year.

Emma Hickerson [02:15:22] And one particular instance was I was doing a fish count, staring at a coral head in front of me. I was on the edge of the bank, and I was just aware of a presence behind me. And I turned around and there was a manta ray barrel-rolling right behind my head, doing some feeding. It's just magnificent, just the things that unexpectedly turn up. Sometimes you're looking for things and sometimes you're not.

Emma Hickerson [02:15:48] The loggerheads are always fun to see. You know, I have a special place in my heart for the turtles since I did my my Master's degree looking at them.

Emma Hickerson [02:15:59] And then just these special one-off encounters.

Emma Hickerson [02:16:04] My brother actually was diving with me years and years ago. It was about 2021 or so, maybe it was the year before that. But we were just doing sort of a fun dive at the big sand flat at the West Flower Garden Bank. And there was a huge, you know, a large subadult loggerhead sea turtle who was wrapped in, had been entangled by a long line. And at the time, I had a sea turtle permit, issued by National Marine Fishery Service to handle this endangered species.

Emma Hickerson [02:16:42] So, I handed off my camera. As I disentangled this turtle, who is sort of immobilized because of the long line, her flippers were sort of immobilized, and she just let me take it off her, and unwrap her flippers. And she sort of slowly swam away, got the movement back into flippers. They were probably, you know, like your hand goes to sleep or something. And then she turned around and came straight back to me and just stopped right in front of me. And I gave her a little scratch on the back of her neck. And it was just the most exquisite experience.

Emma Hickerson [02:17:22] And that was all on film. So, because my dive buddy, Melanie, who was also with us, she filmed it. So, that was an extraordinary experience.

Emma Hickerson [02:17:34] And then another time, I was hanging off the back of the boat doing my safety stop. As a diver, you have to do a little decompression stop. And I was hanging off the line at the back of the boat, and there was a, we usually get these huge schools of Barracuda under the boat, like hundreds of them sometimes. These are big fish with big pointy teeth, but they're all there, just hanging out and using the shade structure, I guess, of the boat.

Emma Hickerson [02:17:59] And this one Barracuda had a huge lure hanging out of its mouth. And it was like a Christmas tree. And, I don't know, I felt like it was sort of sidling up to me. It was quite close. So, I just slowly pulled my scissors out of my pocket and sidled over to it and just snipped that lure out of its mouth and freed it from that piece of fishing equipment.

Emma Hickerson [02:18:41] And that felt really good to be able to do that. It's probably not the best, safest thing to do, in hindsight, but it just felt like the moment was right and the fish was acting calmly enough that it was safe to do so.

Emma Hickerson [02:18:54] So there are little moments like that that have really stuck in my brain as wonderful memories, that I feel extraordinarily thankful for to be able to have experienced as not only a career but a lifestyle.

Emma Hickerson [02:19:14] I was talking about new discoveries. We've documented multiple new species in the Sanctuary when I was working there, both on the reef and in the deeper waters.

Emma Hickerson [02:19:28] And, we actually described a species of wrasse, *Halichoeres burekae*, which was a very colorful wrasse - purple and yellow and red and white and green. And of course, we had to name it the Mardi Gras wrasse, and the *burekae*, the species name, was after a pair of photographers, Joyce and Frank Burak, who first photographed it. After Lesley Wayland, who was the first, she first found it. But then the Buraks photographed it and was named *burakae*.

Emma Hickerson [02:20:08] So, it was the male that was all those very distinctive Mardi Gras-like colors. But it's only found at the Flower Garden Banks. I think there has been now a sighting down in the Bay of Campeche, but it's, somewhat unique to the cFlower Garden Banks.

Emma Hickerson [02:20:24] The females are salmon in color with a white stripe and a little yellow nose. But the males are quite spectacular. But you don't see them very much. And I'm not sure when the last time they were seen is.

Emma Hickerson [02:20:37] But those, those are magnificent moments to step away for the golden years, to think about.

David Todd [02:20:44] The golden years. Yes. Well, that's many years from now.

David Todd [02:20:49] I love the way you can distill, you know, decades of diving with a lot of diverse, wonderful experiences in just a few of these little vignettes about, you know, the Loggerhead and the Barracuda, and this funny Mardi Gras, fish - perfect name, perfect name.

David Todd [02:21:11] Well, I just have one last question, since I know you had a, I guess, an obligation quite soon. Do you have anything you'd like to add, because I know we've covered a lot of ground, but is there some kind of a gap that you'd want to just finish up on?

Emma Hickerson [02:21:31] Yeah, I think so. I've covered a lot of ground. And I could probably go on for several more hours, but I want to repeat the thought about the some of the most important and most significant memories are with the people that I worked with, and the passion that they have, and their carrying forth to protect and manage the Flower Garden Banks, and the friendships that I've made over the years.

Emma Hickerson [02:22:07] And the Flower Garden Banks is such a special place. It really holds out as a complete ecosystem that I think warrants a lot more protection than it currently has in a world of declining health in the marine ecosystems where it seems to be, you know, it's probably not un-impacted, it's impacted in ways, but not as acute as other areas.

Emma Hickerson [02:22:40] And the one thing I've see happening in the environmental climate of decline is that a lot of money is being put into places that are in decline and declining, and may or may not be places that can be saved. Where, I think the same amount of resources and effort need to be poured into places like the Flower Garden Banks. I don't think it is. So, I would like to see a change in that way.

Emma Hickerson [02:23:15] And also just stepping up to protections that are more sanctuary-like than not, like keeping these places from being fished, that we know are extractive and detrimental to the ecosystems.

Emma Hickerson [02:23:31] So, I think that, you know, I might be finished with my work at Flower Garden Banks, but I think the data that we collected over 25 years of the northwest Gulf of Mexico reefs and banks that was not used as an important component of the drawing of the boundaries, for instance at the new sanctuary expansion. That is still highly relevant and important data that is just sitting there waiting to be taken up as, as we think about protecting places because we can, and we know about them, and not have these conflicting interests taking center stage and priority in those conversations.

Emma Hickerson [02:24:28] So, I think there's a lot more to be done. We've done a lot of the work to be able to provide that voice for these areas, and I hope that that's taken into account and used in years to come to protect these places and afford them the protection that they want.

David Todd [02:24:49] I think that's a wonderful phrase to end on, giving voice to these areas. You've done that in spades. And I really appreciate it because it's clearly a special area.

And, you know, you've put a lot of heart and passion and thought into it, and so thank you for that, and thank you for sharing it with us. Very nice of you.

Emma Hickerson [02:25:14] Thank you, David, for giving me the opportunity to walk down, you know, my memory lane of the last 25 years at the Flower Garden Banks, and just to revisit some of these memories. So, I really appreciate that.

David Todd [02:25:25] It's been good. Thank you so much. Have a good day. And, again, thank you. I will cut off the recording in just a moment, and, in the next, you know, week or so, I'll be working on the transcript and get you a recording and a written record, so that you can take a look at that, and see how it fits. Okay?

Emma Hickerson [02:25:50] Thanks. Thanks, David. Have a great day yourself.

David Todd [02:25:51] Yeah. You bet. Bye now.