

Video Transcript - Forensic Ornithology - Bird Detective

Maggy Benson: [00:00:30] Smithsonian's Museum of Natural History has one of the largest bird collections in the world, with over 620,000 specimens. The collection is used by various scientists from all over the world, to learn more about birds. One unusual line of work is forensic ornithology. A forensic ornithologist determines the species of a bird from small fragments such as feathers, beaks, or tongues. There are only a few people in the world who do this sort of work, and we are lucky enough to have one here [00:01:00] at our museum, and we get to meet with her today.

Maggy Benson: Hi, thanks for joining us. I'm Maggy Benson, host of live from Q?rius, Smithsonian Science How? Today we have a really great show in store for you, and we're going to explore how and why people study bird remains. Before we get started, I want to ask you a question. You can respond using the poll that appears to the right of your video screen. All right. Would you want to study [00:01:30] the remains of dead birds? Yes, No, or Maybe, you're not sure? Take a moment to think about it, and put your answer to the right. If you can't see the window, then you may have to minimize your video screen.

Maggy Benson: All right, it looks like a lot of you are not sure. So, let's actually go to our expert and see what she thinks, and maybe shed some light on this. So today we have with us Dr. Carla [00:02:00] Dove, a forensic ornithologist at the Smithsonian's National Museum of Natural History. Thanks for joining us, Carla.

Carla Dove: Thanks for having me.

Maggy Benson: So, can you start off by telling us what a forensic ornithologist is?

Carla Dove: Well, yeah. So, an ornithologist is someone who studies birds, and the forensics part comes in because we use trace evidence, or pieces of beaks or bones, or microscopic feathers as our clues to solve mysteries.

Maggy Benson: Wow, so how do these cases come in?

Carla Dove: Well, we get our cases mainly [00:02:30] through the mail, and here's a stack of mail that we got recently.

Maggy Benson: Wow, is this a month's worth of mail, a day's worth of mail?

Carla Dove: Oh no, this is just a couple days from last week.

Maggy Benson: Wow.

Carla Dove: And so these are some of the cases, and they come in through the mail and we open the case to see what's inside.

Maggy Benson: Right, and this is a real case that you're opening right now?

Carla Dove: Yes, this is a real case. This came to us from an airport. It came from Charlotte, North Carolina, and what's inside is our little [00:03:00] present. There's some feather remains here from a bird.

Maggy Benson: Oh, I see.

Carla Dove: This happens to be a bird strike case, so the report that comes with this will tell us where the bird strike occurred and the date, and it will contain some of the material that we will use to identify the bird.

Maggy Benson: So, can you show us how you might identify a bird using what's in that bag?

Carla Dove: Yeah, yep. This one is kind of easy because we actually have some whole feathers here.

Maggy Benson: Oh, yeah.

Carla Dove: So we can look at the shape of the feather, we can look at the color, we can look at the texture [00:03:30] of the feather. We can maybe even see some of the different patterns that are on this feather, and these are clues that will help us identify the species of birds.

Maggy Benson: So, where do you start?

Carla Dove: Well in this case, because we have some pattern and some color, we would start by going out into the museum collection, but first we have to clean it, so we have a proper lab upstairs that we will make sure we get all the grit and grime off of it, or anything kind of ick that's on there and clean it up good, and [00:04:00] then take it down into the collection in the bird division upstairs where we have about 620,000 specimens like these on the table, and we'll try to match up the feather.

Maggy Benson: Oh my goodness. So we already have a student question. Are you ready to answer it?

Carla Dove: Yeah.

Maggy Benson: All right. So, this one comes from Elliot in Atlanta. Elliot wants to know how many cases do you get in a year?

Carla Dove: Oh, okay. We're pretty busy. There's four of us in our lab, and we process over 8,000 cases a year.

Maggy Benson: Wow, wow. That's amazing. So, you have to compare [00:04:30] each one of these pieces of evidence to your museum collection of 620,000 objects? That seems like a really big job.

Carla Dove: Yeah, well we have some help. We can narrow this down a little bit by using our clues. So if we have no idea where to start with this feather, we would look at the fluffy part of the feather. So if you look at a feather, it's composed of basically two parts, the top part and the bottom part, and the bottom part of the feather has this really fluffy, nice area here. [00:05:00] These are called plumulaceous barbs, and in this plumulaceous barbs we find really neat microscopic characters that will help us identify the species of bird.

Maggy Benson: Oh, interesting. So, do you go to the microscopic identification first, or do you go to the collar?

Carla Dove: It depends on what we have. In this case, we have the whole feather, so we'll go right to the collar and go right to the collections, and we can look at this feather and just by the shape of it we can probably guess that it's a tail feather, because of the way it's shaped, [00:05:30] and if we compare it to a museum specimen, we can see that this tail feather matches up perfectly with the specimen of a mourning dove.

Maggy Benson: Oh, yeah. I can see the colors line right up. So color and texture must both be important.

Carla Dove: Yeah, and see it doesn't match this pigeon or rock dove at all.

Maggy Benson: No.

Carla Dove: Which is another species of dove that may be at Charlotte Airport, so I think we know that in this case, the bird that hit this airplane was actually a mourning dove.

Maggy Benson: [00:06:00] Wow, that's so interesting. So, would you actually take that mourning dove feather and look at some of the microscope images of it?

Carla Dove: Well, yeah. We could do that. Or, we could look at another case that we have no clue about, and we might start there with the microscopic structure. So if we had a feather that we had no clue where to begin, we had no pattern or no color, we might go to the microscopic structure of the feather, and in that case we would look at the really tiny, fine details in the downy barbules, [00:06:30] and that might tell us what group of birds the feather came from. So for example, if we looked at a mallard duck, we might see these really nice triangular-shaped nodes at the tips of the barbules.

Maggy Benson: Oh, interesting.

Carla Dove: And then if we looked at the microstructure of a mourning dove, we might see these beautiful, crocus-shaped nodes that would tell us that it's a dove or a bird in that group.

Maggy Benson: Now, this isn't a normal microscope, though.

Carla Dove: No. We do use the normal light microscope for most of our identification work, but if we want to do deeper research and figure out what [00:07:00] these structures really look like three dimensionally, we would use a scanning electron microscope image, and these are some of the images that we have from the mourning dove. We can see the nice little barbules on there, and then the mallard duck has the triangular shaped nodes. So, these are some of the clues that we would use to separate groups of birds if we had no idea where to begin.

Maggy Benson: Wow. So, we have another student question, you ready for it?

Carla Dove: Yes.

Maggy Benson: Great. So, this one comes from [00:07:30] Andrew, and he wants to know, why did you become a bird scientist?

Carla Dove: Oh, well Andrew, that's a lot of fun. Studying birds is a great profession, and ornithology has a lot of different areas that you can study. You can study behavior, you can study their taxonomy and their systematics, and their evolution, you can study what they eat, how they breed, but I just so happen to really like birds ever since I was a small child, and so that's sort of where I focused [00:08:00] my research and my efforts, and I love studying birds.

Maggy Benson: It sounds really interesting.

Carla Dove: Yeah, it's fun.

Maggy Benson: So, I want to learn more about this forensic. So what happens if you get a case that doesn't have a full, intact feather? What happens then? Where do you start?

Carla Dove: Well, sometimes we get cases that actually have no feather remains at all. This is an example here of a bird strike case that just had some bird remains that was wiped off of the aircraft.

Maggy Benson: Oh, what's that called?

Carla Dove: This is called snarge.

Maggy Benson: Snarge?

Carla Dove: Don't worry Maggy, it's not a bad word. [00:08:30] Snarge is sort of bird ick. It's the stuff that we get in every day that doesn't have any physical remains that we can see, and so sometimes we have to use DNA analysis in these cases. So what we do at the museum here, is we have a new program called DNA bar coding, and we use a little snippet of the DNA and we have a library of known sequences that we have already prepared.

Maggy Benson: So, does every bird have its own unique DNA?

Carla Dove: Yep, every bird has a unique DNA, and so we [00:09:00] would take the unknown sample, we would extract the DNA here in our laboratory, and we would match it to a library of known sequences to come up with the species identification of the bird.

Maggy Benson: Wow, so it really sounds like between the microscope work, the identification with the collections and the DNA, you're really doing a lot of forensic science.

Carla Dove: Oh, yeah. We're like bird detectives.

Maggy Benson: Really cool. So you mentioned that that case had come in from a bird strike. Can you tell us about your work here at the Smithsonian [00:09:30] dealing with bird strikes? What is a bird strike?

Carla Dove: Yeah, okay. So, a bird strike occurs when a bird and an aircraft collide, and of course usually there's not a whole lot left of the bird, and so what we do is we try to identify the species of birds, and that helps airfield managers, and pilots, and airport operations folks understand what birds are in their area and what they might be able to do to keep those birds from coming in and causing damage to aircraft or [00:10:00] causing problems on the airfield.

Maggy Benson: That sounds like it could be a serious problem.

Carla Dove: It could be. If you remember the case of the Hudson River, when US Airways flight 1549 landed into the Hudson River, that was because of a migratory population of Canada Geese caused that event to happen.

Maggy Benson: Oh, wow. So we have another question for you before we get more into the bird strikes.

Carla Dove: Okay.

Maggy Benson: And this one comes from Jason. Jason wants to know, what is the most common species involved in [00:10:30] plane strikes?

Carla Dove: Oh, that's a good question. Well, it's not what you might think. You might think of a big bird like a goose, or a gall, or a hawk, but the most common bird involved in bird strikes is a small bird called a horned lark. It's a little passerine.

It loves the open airfields. It likes to feed on the airfield. It likes to look around where it's open, and there are no predators around so it feels safe there.

Maggy Benson: So, if it stays on the airfields does that mean that these strikes happen more often than not when the planes are lower to the ground rather than [00:11:00] when they're high in the air?

Carla Dove: Yes. Most bird strikes occur on takeoff and landing. So, if we can do something to that immediate environment, we can really do a lot to prevent these bird strikes from happening.

Maggy Benson: Wow, so we have another question from Edmund.

Carla Dove: Okay.

Maggy Benson: And he wants to know why it's important to identify the birds that have struck all the planes?

Carla Dove: Okay, good question Edmund. If you can imagine there are 10,000 species of birds, and so knowing the exact species that are causing these problems on airfields is really the first step in preventing [00:11:30] this from happening. Knowing what the bird eats, where it likes to live, where it likes to hang out, when is it here, all of these things can tell us what we can do on the airfield environment to prevent these things from happening more often. So, if we know it's a bird that likes water, we may fill in the pond or the marsh. Maybe cutting the grass, maybe using propane cannons to scare the birds, border collies, falcons, all kinds of tools in the toolboxes that we can use to keep these birds away from airplanes, keep the planes [00:12:00] safe, and keep the birds safe.

Maggy Benson: So I wonder, do all airports use the same methodologies, or does it vary depending on where the airport is located and what kind of birds are on their airfields?

Carla Dove: It definitely varies, and different birds congregate in different airports, and so it really depends on the species you have on your airfield as to what you're gonna do about the problem, and that's where our work is so important, identification of the exact species of birds.

Maggy Benson: Wow, interesting. So it sounds like [00:12:30] airfields are doing a lot of work to be able to avoid air strikes, but happens when they can't avoid them? Are we safe when we fly?

Carla Dove: Yes, we're safe.

Maggy Benson: I'm a little scared.

Carla Dove: There's a whole team of people out there making you safe, so don't worry. We are just a part of it, so there are engineers who actually design aircraft to be safer, and they take bird weights into consideration when they design engines, when they design windscreens, and aircraft parts, and so knowing-

Maggy Benson: [00:13:00] It does a lot of damage to the airplane, then.

Carla Dove: It actually can do a lot of damage when a bird smacks into an airplane at a certain speed, and a certain body mass, and so what they try to do is figure out the average weight of the bird that's causing the damage, and once they do that they can do tests on the windshields, on the engines, so that these parts of the aircraft will actually withstand certain bird weights at certain speeds.

Maggy Benson: Interesting, so a lot of the data that you're gathering over years of work is actually informing [00:13:30] a lot of the engineering design for the aircraft that we fly in every day?

Carla Dove: Yep, it actually is taken into consideration.

Maggy Benson: That makes me feel a lot better.

Carla Dove: Yeah.

Maggy Benson: So, it sounds like you do a lot of work to better understand bird strikes and bird populations, but I understand that you do some work in the Florida Everglades as well, to better understand bird interactions with wildlife.

Carla Dove: Yes, and when you study ornithology you don't think that you'll ever be working with snakes, but you never know, [00:14:00] and so what we are doing with the biologists down in the Everglades National Park, is working with them on the diets of a predator there that lives in the Everglades now that's eating a lot of birds and other animals, too, and that's the Burmese python.

Maggy Benson: And why is the Burmese python now an issue?

Carla Dove: Well, the Burmese python is not native to this country. It's not native to the Everglades at all, and it probably got there by escaping from the pet trade or by being released [00:14:30] from owners, and what's happened is it's actually established itself there now and so its breeding population of snakes there, and they don't belong there. They're invasive.

Maggy Benson: Oh no.

Carla Dove: So, they're eating a lot of birds and the biologists down there are actually out there in the Everglades, catching these snakes and dissecting them, and looking into their stomachs and sending us remains of birds, and you can imagine [crosstalk 00:14:53].

Maggy Benson: Oh, lucky you.

Carla Dove: This is oftentimes a very smelly job we have here, but knowing [00:15:00] what these snakes are eating is a very important part of understanding how to control them, where to find them, and what birds we need to protect, and so we look at the evidence and in this case, we oftentimes can't get DNA from the sample because they're so contaminated with the snake, so we do have to use or morphological evidence of feather pieces, and beaks, and talons, and bones, and eggshells, and feathers to help us identify what species of birds these snakes are eating.

Maggy Benson: Interesting, so [00:15:30] I can that when you open up, we saw those gut pictures, it looked like some things were fully intact while other things were pretty digested.

Carla Dove: Yep.

Maggy Benson: And you can still find bird pieces in all of that?

Carla Dove: It depends on the level of digestion, and sometimes if it's just feather pieces of downy barbules, we may only be able to say that it's a duck and not that it's a mallard duck, but at least we can usually get it to some level of identification.

Maggy Benson: So, what have some of your findings been in some of this research?

Carla Dove: Yes, we have found a lot of birds [00:16:00] in the stomachs of these Burmese pythons, somewhere around 23 different species of birds have been consumed. Everything from a small little wren or meadowlark, all the way up to birds the size of great blue herons and wood storks. Turkey vultures, black vultures, I mean you name it, they even go actually into domestic barnyard and eat chickens and guinea fowl.

Maggy Benson: Oh my goodness. So are they exclusively feeding on birds?

Carla Dove: No, they're feeding on other things. [00:16:30] Everything that comes in their path. They're very opportunistic animals, and they will eat anything that comes in their way. Now this is not a native predator of these birds in the Everglades, and so the birds really haven't evolved a defense mechanism yet to deal with that, and so it's really devastating effect on the bird life and all of the animal life in the Everglades.

Maggy Benson: So, how does your identification work of what kind of birds that a Burmese python is preying on, help maybe the birds or help better understand [00:17:00] what's happening down in the Everglades?

Carla Dove: Well, we're early in the research part of this, but knowing the species of birds that they're preying on can actually help us, first of all document what they're

eating and show that they really are having a negative effect on the native avifauna there, but also it may help us in the future to learn where we need to focus our conservation efforts, and what parts of the environment where they're eating the most birds, maybe where we need to focus some effort on eradicating those snakes.

Maggy Benson: Interesting. So, we have another question for you. Are you [00:17:30] ready for it?

Carla Dove: I'm so ready.

Maggy Benson: All right, this one comes from John. John wants to know, urban bird diets are an environmental problem. Oh, are urban bird diets an environmental problem for the birds or the predators, or other wildlife?

Carla Dove: Are urban bird diets an environmental problem for the birds, or the predators, or other wildlife?

Maggy Benson: Or, maybe even human impact such as cars or (crosstalk) [00:17:55].

Carla Dove: If he's talking about junk food, the french fries [00:18:00] that we feed to the seagulls and the birds in the parking lot.

Maggy Benson: Maybe off the airplanes, people are- (laughter)

Carla Dove: Yeah. Yeah, I think birds need to eat their natural diets, and so feeding them sometimes can be not a good thing, especially if it attracts birds to an area. For example, at airports they put signs out, and they don't want the employees to feed the birds, and they don't want the birds to come around dumpsters and so they will actually have active programs there that will keep them away, and keep people from feeding the birds.

Maggy Benson: [00:18:30] Oh, wow. So that's just another technique in keeping them off of the airfield, then.

Carla Dove: Yeah.

Maggy Benson: Interesting. So, we've learned a lot about how to identify a bird from a feather, so I think we should ask the students another poll question.

Carla Dove: Okay.

Maggy Benson: All right, so students again, we're gonna ask you a question and you can respond using the window to the right of your video screen. So, should airports care about migrating birds? What [00:19:00] do you think? Yes, no, or not sure?

Maggy Benson: All right, so it looks like yes. So, a lot of our students have been paying attention.

Carla Dove: Yay, good job.

Maggy Benson: What do you think?

Carla Dove: Good job, students.

Maggy Benson: All right, we have another question for you. Are you ready for it?

Carla Dove: Yes.

Maggy Benson: This one comes from James in Boston, and he wants to know what happens when there are huge groups of migrating birds? Isn't [00:19:30] that a threat to airplanes?

Carla Dove: Yes, that's a very big threat to airplanes, and it's becoming more of a threat because today we have more of these large birds out there than we had 20 or 30 years ago. If you think of an example like a Canada goose, we have more of those birds out there now, so big huge populations of migrating birds are a problem, and the research now is sort of trying to focus on using some kind of radar to detect these birds when they're off the airfield, to be able to identify these huge migrating flocks of birds.

Maggy Benson: [00:20:00] Interesting, so I'm sure that the migrating populations are different depending on where you are in the country?

Carla Dove: Yes, they are different and Spring and Fall, of course, are the busiest times in the bird strike lab. That's when birds are migrating North, or in the fall when they're coming back with all their babies, so there's a lot of birds out there moving around. Knowing when these birds are migrating, and what time of the day, and the altitudes is all very important information that helps us avoid this whenever we are designing flight paths, if we're military flights, [00:20:30] or even just knowing what birds are coming through that area at that time increases your knowledge about the risk of a bird strike.

Maggy Benson: Interesting, so do you see any trends in the migration patterns changing, maybe with climate change or some other kind of fluctuation?

Carla Dove: Well, that's interesting. Not so much in migration, but I can think of one example where the species range has been changing. A black vulture is a species of bird that used to be thought of as a Southern bird, lived [00:21:00] in the Southern states, and as the climate changes and it gets warmer, these birds can actually start to creep a little bit further north, and their ranges can expand. So, now we're seeing them in some of the more mid and Northern states. So, what that means is that airports that never had to worry about a species like this in the past, now all of a sudden they have to worry about the black vulture.

Maggy Benson: Wow, I guess your job is always-

Carla Dove: Changing.

Maggy Benson: Changing, and in demand. [00:21:30] All right, let's go to another student question.

Carla Dove: Okay.

Maggy Benson: All right, so this one comes from Maisy in Virginia, and she wants to know what's with the name and the job? They go together so well. Carla Dove.

Carla Dove: Yeah, good job. I get this question probably weekly. People do make the connection that my last name is very similar to my field of study, which is birds, [00:22:00] and it is my name. I never changed my name, that was the name I was born with, and it just happens to be a coincidence.

Maggy Benson: A wonderful coincidence.

Carla Dove: Yeah, it helps people remember my name.

Maggy Benson: Absolutely. So, do you have a team that you work with on all of this?

Carla Dove: Yes, we have four people in our lab, and all of us do different parts of the program. So, we get about 8,000 cases a year, mostly from bird strikes [00:22:30] and bird strikes can cause a lot of damage to aircraft, somewhere between 5 and 600 million dollars a year, and so we have a team of scientists. We have some people who look at the morphology of feathers, we have a genetics specialist who looks at the DNA of the birds, and so all of us together, we use all of the evidence. We look at all of the pieces of the puzzle, we sit down, and we make these identifications as a group usually, and so we have some that are specialize in microscopes, some [00:23:00] are specialized in DNA, and it all fits together.

Maggy Benson: Cool, so we have another question for you.

Carla Dove: Okay.

Maggy Benson: This one comes from School Without Walls and they want to know, birds used to be your passion. Now is it your job, or do you still enjoy it and like to do things like bird watching?

Carla Dove: Let me tell you something out there. If you can find a job that's your passion, you will be a very happy person in life. Yes, I love my job. I go home [00:23:30] and I look at birds. I feed birds. I go birding when I go on vacation, so it's a very, very wonderful experience to love what you do and even if it's your passion and it's your hobby, and you can make it your job, it's perfect.

Maggy Benson: Great question.

Carla Dove: Yeah, go for that one.

Maggy Benson: Yeah. Okay, we have another question from Amanda from Hartford, and she wants to know how does a student go about becoming a forensic ornithologist? Do you recommend any courses or any [00:24:00] subjects to study?

Carla Dove: Yes. Forensics is a hot topic now with all of the TV shows, and CSI, and all of that, but it's really not as glamorous as it is on TV. As you can see, we mess around with a lot of goopy, icky stuff, so you have to want to do that first of all, and then you have to take classes in biology. You have to be good in science and math. You have to, perhaps, want to go on and do graduate work, and do higher level education kind of work. [00:24:30] Study hard, follow your passions, and take good classes, and jump on opportunities when they come your way.

Maggy Benson: Maybe internships, or volunteer opportunities, too.

Carla Dove: Internships and volunteers is how we all start.

Maggy Benson: All right. So Mike has another question, and this one's about bird strikes.

Carla Dove: Okay.

Maggy Benson: So, Mike wants to know how much testing do aircraft and engine manufactures to test equipment survivability and improvement? What kind of testing do they do?

Carla Dove: Well, they do have a machine called a Rooster Booster.

Maggy Benson: [00:25:00] What is a Rooster Booster?

Carla Dove: It's just what it sounds like. These are engine manufacturers, and so they have to test engines, and so there's a machine called a Rooster Booster that, they actually take a dead bird from the supermarket of the right weight, and so they're not going out there and shooting live birds, but they will take that bird and they will put the weight of the bird that they want to test the engine for, shoot it at the engine, and it has to pass that test before that engine can go to the next stage. If it doesn't pass [00:25:30] the bird test, it goes back to the drawing board.

Maggy Benson: So, the engine must be on, and they're actually processing that bird through the engine?

Carla Dove: Yeah, I've never seen it. I've been doing this for a long time, and I've never been invited to see this happen, but this is what I understand happens.

Maggy Benson: Well it sounds like to keep us safe, tests like this need to happen.

Carla Dove: Yeah, and again, it uses the data that we provide on the weights of birds, and so knowing what weight of supermarket goose or chicken that they need to buy comes from the data that [00:26:00] we provide from species identifications.

Maggy Benson: Very cool. So, we have one more question.

Carla Dove: All right.

Maggy Benson: All right, this one comes from Andrew, and Andrew wants to know what was one of your favorite or one of your least favorite cases to work on?

Carla Dove: Oh, wow. That's a tough one. Don't ask me that one, Andrew. Favorite cases have to be the ones that give you some satisfaction. It might be a tough one, and you've seen that feather and you know that pattern, you just don't know where it came from, and then you [00:26:30] finally figure it out and you're like, "That's it. I got it."

Maggy Benson: A real detective.

Carla Dove: Yeah.

Maggy Benson: Well, thank you for answering those questions, and thank you for asking all of those questions. Unfortunately, we're already out of time, but we really appreciate it, and we've learned so much today about ornithology and especially the line of forensic ornithology.

Carla Dove: Well, thank you for having me.

Maggy Benson: Yeah, this has been wonderful. Thank you so much. So, if you want to learn more about Carla's work, you can actually go to [00:27:00] birdstrike.org to learn about plane and bird collisions, also called bird strikes, or you could go to qrius.si.edu.

Maggy Benson: So, thanks again for joining us today. We really hope that you learned a lot here on our show. Please join us next time on February 27th, when we meet with another forensic scientist, but this time forensic anthropology with Kari Bruwelheide. It should be exciting, and if [00:27:30] you're ever in Washington, D.C. make sure to check out Q?rius at the Smithsonian's National Museum of Natural History and come in for a free school program. Thank you so much for joining us, we hope to see you next time on Smithsonian Science How?

Speaker 3: On [00:28:00] the next season of Smithsonian Science How?, on the Fairfax Network.

Maggy Benson: Wow.

- Speaker 4: In order to cut a gemstone this big, you've got to have a big crystal. This is just simple quartz, and this particular specimen is from Brazil. It's almost 20,000 [00:28:30] carats.
- Speaker 5: And the question is, how big would an asteroid have to be that it actually would be a problem? And it looks like the one at the end of the Cretaceous was six miles in diameter. Big explosion, it made a huge hole, very difficult to stay alive.
- Maggy Benson: It was a bad day on Earth.
- Speaker 5: A very bad day, maybe the worst day on Earth that we know about.
- Speaker 6: There's a huge diversity of animals that live in the open ocean. These and many, many more are shapes, and sizes, and [00:29:00] colors, and just incredible diversity out there.