

## #3 The Story of A Boring Sponge | Marine Discoveries In SG

### 00:00:00 Xiaoyun

Hello and welcome to *That's Wild*. I'm Xiaoyun, a nature guide and environmental educator. And I'll be your host for this podcast series, where we'll be talking to a variety of special guests about some wild and wonderful topics surrounding nature conservation in Singapore, our City in Nature. *That's Wild* is brought to you by the National Parks Board. If you like our content, don't forget to show your support by hitting that follow button and giving us a five-star rating.

For this episode, we're very excited to have Karenne, who's in charge of the Coastal and Marine and Terrestrial Branches in NParks' National Biodiversity Centre, as well as Sam, who is a coral reef researcher and a co-founder of Our Singapore Reefs.

They're here to talk about a surprising re-discovery of the Neptune's Cup sponge in Singapore and explore the different challenges that come with conserving this fascinating species, as well as the broader marine ecosystem that it lives in.

So, to start off this conversation, I wanted to ask – what draws you guys to the ocean?

### 00:00:57 Sam

Hi, I'm Sam! For me, from a young age, I was drawn to the sea. I would pester my parents and take me to the beach and sometimes to the aquariums after school. So, as I grew older, I started watching documentaries on Nat Geo, BBC and then I realised I could actually get up close to these marine animals through scuba diving. So, after obtaining my diving licence, I was very determined to explore every corner of the world. So, I think the seas, it holds many secrets, and that continues to captivate my imagination and really draws me to explore more.

### 00:01:27 Xiaoyun

How about you, Karenne?

### 00:01:28 Karenne

Hi, I'm Karenne! For me, I'm reminded of this quote by Dr. Jacques Cousteau, and he said: "The sea, once it's cast its spell, holds one in its net of wonder forever". And for me, that spell was cast the first time I went scuba diving. I think that was back in 1990. First dive at Pulau Aur and the minute I went underwater, the fear suddenly disappeared when I saw the biodiversity in front of me. And that was the point I realised I love the sea and I want to continue studying it and working on the marine environment.

**00:01:59 Xiaoyun**

We share that in common. Scuba diving is intense. Like it's all around you, right? It's like three dimensional.

So today we'll dive into our main topic, which is the Neptune's Cup sponge. So, to start off, maybe Sam you could share what is a sea sponge and what is its ecological role in the marine ecosystem.

**00:02:14 Sam**

So, sponges are one of the most simple animals on earth, and they don't have tissues and organs like us or other animals. And their body structure is actually very basic.

So I think also depending on the species and habitat, which is very very interesting, these sponges, they display a wide array of colours and shapes, even ranging from a few millimetres to several square metres in size. They provide shelter and they are home for marine life, including crabs, shrimps, fish, they can even trap bacteria and nutrients from water, and it continues to cycle through the whole aquatic ecosystem.

**00:02:49 Xiaoyun**

I think they are also important food for many species right, like many fishes, they might take a nibble off the sponge. Yeah, for myself, when I do intertidal walks, I always like look out for small pieces of sponges because maybe they broke off from a bigger piece underwater and they will still harbour all these animals like brittle stars especially.

**00:03:05 Karenne**

The other interesting thing about sponges compared to many other big taxa groups is that they are found from the shallowest intertidal areas to the deepest ocean. So, they really occupy such a wide breadth of the ocean space and in every space that they are found in, they play a very important ecological role. So – a very underappreciated group of animals actually, the sponge. I mean when we look at them, we think they are a piece of blob, but actually they play an incredibly important ecological role.

**00:03:31 Xiaoyun**

What about the Neptune's Cup sponge? What is the shape of it like; how does it look like?

**00:03:35 Karenne**

So, the Neptune's Cup sponge is really interesting. So, it's one of the largest species of sponge that we have, and it actually has two distinct shapes. So, one is more of a goblet type of shape, the other one is more like a bowl, and you can find both of them in the water. They are unique because they actually have a very robust stem that the cup or the bowl is sitting on and that's basically why it's called a Neptune's Cup, because it's so big you know, it's so magnificent that you would think that Neptune, the God of the Sea, would be using it as his chalice.

So, I guess that's how, you know, the Neptune's Cup sponge came about. But what's unique about this is it's a huge sponge and you would think that it's like any other sponge that grows from the surface of the sea floor up. Research has shown that it's actually what you call a boring sponge – not the yawn yawn boring sponge, but a sponge that bores into a substrate. So, when it starts off, it starts off as a larvae that bores into some kind of calcium substrate and from that it grows upwards.

So very unique compared to many other boring sponges – they tend to be very flat encrusting sponges. Neptune's Cup is a boring sponge that grows out and into the water column, forming this magnificent shape.

#### **00:04:41 Sam**

It's a giant, it can grow up to 1 metre tall.

#### **00:04:44 Karenne**

So the species that the sponge was described from was a specimen that was collected from Singapore. We call that a type specimen. So a type specimen is sitting somewhere in a museum in Europe. But the first individual that was used to describe the sponge came from Singapore. So, in a way, it's very significant to Singapore because it was a sponge that was described from Singapore waters.

Back in the day in the 1800s, many of the sponges were actually collected and moved to Europe because collectors like to have trophies. So, this was really a trophy animal that was collected from the region. Probably back in the day, they used nets to dredge. So, if you have a long net in the water and you drag it along the sea floor, you pick up whatever that's in the water. So that's probably one of the ways that they collected this sponge.

#### **00:05:26 Xiaoyun**

So do you think that all those collections for European customers; did it lead to its population decline?

**00:05:32 Karenne**

I mean, I think possibly it's one of the reasons why it led to the population decline, but I guess you must also acknowledge that back then, you know, when trade was really booming, there was a lot of activity in the water. So, there were a lot of impacts to the environment even back in the day. So that's possibly one of the reasons that could have impacted the sponge population. But to me, after working on the marine environment for such a long time, sometimes I think we say they disappear because we don't see them – but it doesn't mean they're not there. It's just that we don't know where to find them, you know?

**00:06:03 Xiaoyun**

Karenne, maybe you could share more about 'rediscovering', in inverted commas, the sponges.

**00:06:08 Karenne**

Sure. I mean, it was a really interesting experience for me. So, we were doing a seafloor survey, mapping out the seafloor. So usually you lay a tape, you know, so I was the one behind the tape with a GPS tethered to a float on the surface just to mark out the areas, so I was going out with a GPS and the tape just happened to land next to this strange-looking thing I've never seen in our waters before. So, I just had enough time to take my little dive knife out, took a small piece, and I continued. So, I got back, I called Dr. Lim Swee Cheng, who's the sponge guy in Singapore. So, I call him and say look, I saw this thing that looks a bit strange, you know, it's this whitish coloured thing on a stem. He was so excited. And his excitement kind of rubbed off on me, and I became very excited about it. So, he came that very evening to pick up the specimen. Next morning, he called to say it's the sponge he has been looking for, for the last few years because he was working on this research project to document sponge populations in Singapore.

**00:07:02 Xiaoyun**

So, in general, why do you guys think that there are such discoveries or rediscoveries in Singapore? Actually not just in our marine environment, but even on the terrestrial side.

Nature in Singapore is like – almost every single month there are at least 20 contributions of some new behaviour or some new rediscovery. So maybe you guys can speak about the marine side of things.

**00:07:21 Karenne**

I think discoveries are always... the opportunity for discovery is always there. You just need to be at the right place at the right time. Oftentimes, we are not there looking for something, so you don't know what you're seeing. Like for the Neptune's Cup for example, I'm sure other places where they have found it, people have seen it. If you don't know what you're looking at, it's not a discovery. So it is just having the right expertise at the right time, taking the photos and just being aware that this could be something different. You capture it, and that gets confirmed as a discovery. So I think that's exciting.

But I think that's also because there are very few people working on certain taxonomic groups. And so Singapore, although it is very, very small; there's still a lot of undiscovered areas. And whenever you have undiscovered areas, there's always that opportunity to discover new species. But for the marine environment in particular, I think one of the reasons Singapore has very rich biodiversity is because Singapore is located in a very unique position. It's at the southern end of the Malay Peninsula. And the water bodies that feed into the waterways south of Singapore, they come from the South China Sea, they come from the Indian Ocean, both from the Andaman Sea side, as well as the southern Indian Ocean. So we have water that is originating from different oceans coming through Singapore, and that brings with it larvae that is found in all these areas. So I think one of the reasons Singapore has rich biodiversity is because we are fed by waters that come from diverse oceans.

**00:08:45 Xiaoyun**

I've been very proudly telling my intertidal guests that we have tiger anemone, which is endemic to Singapore. I think the story was that there's a researcher from Queensland. She went on an intertidal walk at Changi Beach with some local folks. And then they saw the anemone, but she couldn't recognise it. And then for the next maybe eight years, they went around comparing that photo of the anemone with every other photo, and confirming that it's indeed a species that's only found in Singapore. And then two days ago, my guest asked, actually is it definitely endemic to Singapore? Maybe it's found in Malaysia too. And I'm like, yeah, it's all about whether there are Malaysians there, whether they're looking at it. And as you said, if there's nobody looking at it with the right expertise, it can just be easily overlooked.

**00:09:24 Sam**

And it's very tricky because some of them are cryptic. So they might look the same as any other species. And you must know what kind of picture or features to take or to highlight, so the taxonomists can actually identify it accurately.

**00:09:36 KARENNE**

But actually this points to a really important point about having the right expertise. And that is something that is, not just in Singapore, but globally. You know, we are losing that whole interest in taxonomy. Taxonomy is not an easy discipline, it's a discipline that requires a lot of observational skills, a lot of patience, and there are not that many people doing it, so when you don't have a lot of taxonomists, you don't have the domain expertise, and you lose the opportunity to actually discover a new species. So I think there is a drive, you know, at least in the marine community, to encourage people to focus on certain taxa. And it's nice to know when you hear that people are focusing on a particular group. It means that there's opportunity to discover, because experts are the ones who will be able to tell you whether this is a new record or a new species to science.

**00:10:23 Xiaoyun**

So Sam and Karenne, do you think that discovering new species is important?

**00:10:26 Sam**

Yeah. So, I feel that it's important. And to really discover these new species right, it brings a profound sense of hope, I guess, particularly in this sense as we navigate through this very murky and gloomy time; all this ongoing extinction crisis, with all these environmental challenges, together with biodiversity loss. So despite the rapid urbanisation of our coastlines over the past decade, our marine environment really continues to thrive and I think this richness and resilience of our marine biodiversity underscores the importance of conserving this habitat. When you find new species, right, it means that we have the opportunity to study these species in their natural habitats, not just based on museum collections, or all these non-living samples, but it also allows us to gain insights into, you know, how they grow, what they eat, what they like to do, where they stay; their abundance, distribution and all this can really help us to understand the threats to these species, and they can help us to manage our resources as well.

**00:11:29 Xiaoyun**

For me, I think your words 'profound hope' – I feel that as well, because like, it's a gloomy and dark landscape of biodiversity crisis, but it's also pretty gloomy and dark in our waters. And yet you guys were able to see it (the Neptune's Cup sponge) in person. I think that is a testament to a lot of your enthusiasm and your commitment to marine ecosystems.

Before we continue, let's take a pause here for a fun mid-episode break. In the spirit of our podcast title, *That's Wild*, Karenne and Sam will now share something wild about an animal or plant that you guys may not have known before.

**00:12:03 Karenne**

The animal that I find incredibly fascinating is the sponge crab. It is a particular relationship between a crab and a sponge. So, this species of crab, it has modified back legs that point upwards, and what it does is it actually goes out and looks for a sponge. So, if it finds a sponge that it thinks is ideal, it will cut it into the right shape, then it hangs it on its back, and it just walks around with the sponge on its back. Now, the sponge, depending on what species it collects, acts as a camouflage. So, sometimes you just see this blob moving on the reef – it's actually a sponge crab.

But, beyond just camouflage, a lot of sponges have toxic compounds in them, so they're not really predated upon. So, that kind of protects the crab, because if a predator looks at the sponge, it says oh that's toxic, it may not eat it, so the crab is protected. And at the same time, sponges are sessile. So, the sponge benefits by being able to move around on its own now, and then depending on where it goes, it can filter water from where it is. So, it's a mutualistic relationship that benefits both species. But I find it amusing when I see this blob moving around the reef, and then when you look under the sponge, you see these tiny little legs holding onto the sponge.

**00:13:16 Sam**

Yeah, so I've been diving in Singapore, and being out at sea for about 10 years, but I have only seen them twice. And they are very elusive – they are the Indo-Pacific Humpback Dolphin, also known as the pink dolphin. So yes, we do have them in Singapore waters. So, fun fact is when they are born, they are grey. So, as they slowly become mature, the colour changes slowly to pink.

**00:13:41 Xiaoyun**

That's wild!

So maybe here we would segue to talk about some of the threats to the sponges' survival now, and maybe Karenne you could share about the study that you did last year.

**00:13:50 Karenne**

So when we rediscovered the sponge, we also realised that there was so little knowledge and information about this sponge, we knew nothing about it. We knew nothing about its biology, nothing about its ecology. So, we knew that we needed to study the sponge to understand it a bit better. We had a couple of projects that were done. We looked at the growth rate of the

sponge. Again, because they grow so big, we thought that they are slow-growing animals, but we found that they actually grow quite fast.

One of the things we observed – and it was very interesting because this sponge is also food for animals, and we think the sea turtle actually eats the sponge. So it's a very important food source for the endangered Hawksbill Turtle. So, when we were monitoring some of these sponges, there was one point where a few of them had these massive bites on the rim of the cup, really massive. They look like a jagged saw, around the edge – probably about 10-centimetre chunks were eaten. So, we thought, this sponge is going to die. We came back two months later to monitor, and it completely healed and it grew back. So, we realised that this sponge actually grows very fast.

Then the other thing we wanted to look at was: are these sponges related to each other? As part of this, from the same sample that we collected, they did DNA analysis. Unfortunately, we found that all the sponges that we had – so at that time, we had about six individuals we were monitoring – all six of them had very similar genetic profiles. So basically, the study showed that the population in Singapore is very isolated. They're all basically the same population.

That means if there's a disease that comes, it can wipe out entire populations. Genetic diversity is important for any species, even humans. When you have a lot of inbreeding, you get a lot of genetic defects that appear, same for any animal species. So, the greater the genetic diversity, the greater the resilience, especially when it comes to dealing with environmental changes.

#### **00:15:46 Xiaoyun**

So maybe we can talk about, or discuss some of the things that NParks is doing now to conserve the sponge?

#### **00:15:53 Karenne**

We started off with filling knowledge gaps. I think if you want to have a conservation plan, you need to actually understand the species a bit better. So, we started by monitoring the sponge growth. We looked at what eats it, whether it has any disease associated with it. So, we decided to do an island-wide survey of the sponge. But it's very hard to do the survey on our own, because it takes a lot of resources. So, we're very fortunate because we do have a huge team of very dedicated volunteers, citizen scientists, and scientists who help us with that. And Sam can talk a bit about that, because she leads this programme now to go and document this. So, once we understand what's in our waters, how big the populations are, then we can come up with a conservation plan. If they are actually widespread, then we may not have to do that much



more except to make sure that these areas are kept, as far as possible, in a condition that encourages them to grow.

**00:16:49 Sam**

Yeah, I think so far, it's really an opportunity to lead some of these divers to go and hunt for these treasures. And it's really nice, and I tell you, we treat the dive very seriously okay. We have proper planning, we have to come up with search patterns. All the trainings from your diving, your rescue training – how to do a U-shape, how to do the circular kind of search patterns, what should you do to find something.

And then all this practice, you really take it and turn it into something that you never knew you needed for this Neptune's Cup hunt. So even things like, how do we communicate underwater, what do we do if we find one, what kind of data or photos do you need to take if you find one, and how do you make sure that this is actually a Neptune's Cup.

So, the thing is, it is actually very rewarding. And I think just last week, we went for a dive and we found three! So, when you go there, and then you find one in the shadows, you start to swim a bit deeper to actually see the whole Neptune's Cup; it was crazy because I think it was huge... I think it was about 80cm.

**00:18:02 Karenne**

Wow. That's about as large as the second one that we found, it has grown to about that size. So, that's a large one.

**00:18:08 Sam**

That's so interesting. And then you can hear all the screaming, and all of them cheering underwater. And after that, you know, even when we surface to the water, you see them beaming with smiles.

Like oh my god let's do it again, we need to find more, so it motivates them to help find more. And they keep asking, when's the next dive? When's the next dive? Yes, we are going soon, we are going soon. It's a very exciting, very interesting experience, I would say.

**00:18:30 Karenne**

And I think this is really important – leveraging on the community to help us with a task that is important, but you don't have the resources to do. This allows the community to build the capacity, but we also give them, like you say, an objective. A hunt is always fun, right? You know, you've got something very specific you're looking for. So, we're very grateful that there

are divers who are willing to spend a day, or a weekend out doing this, you know. So they're not just taking photographs of nice biodiversity, they're there doing a very specific task. And we are grateful for that.

**00:19:06 Xiaoyun**

Okay. So maybe at this point, we will zoom out and maybe you could share some of the common marine conservation challenges that are encountered in Singapore and as well as in the region.

**00:19:16 Karenne**

So, when you talk about conservation, you talk about environmental management, you're actually not managing the environment. You never manage the environment – the environment can handle itself without any problem. You manage people and the activities that impact the environment. So that's where our focus is. If you want to manage the environment, you work with the groups that have activities that could impact the environment, and I think that has seen the biggest change in Singapore, in bringing about effective conservation measures by working with different agencies, by working with the industry to make sure that their activities, as far as possible, do not impact the environment. So, from a management perspective, I think that's really important – understanding that environment doesn't need managing; you need to manage people and the activities that impact the environment.

**00:20:02 Sam**

I think one of the biggest challenges that we have is really coastal development. Our coastline is always changing. Every time our land becomes bigger and bigger, and so I always tell the students, you know, eventually Singapore's map would be just a diamond, very easy to draw. Because it would just expand like this, right? So unfortunately, because all these activities have led to a lot of habitat loss and everything, and then we have lost a lot of our natural coastline. And because of that, a lot of dredging by the coastline has resulted in chronic sedimentation. That's why our visibility is always like this. And we also face multiple threats like climate change, and pollution also.

So, I remember in 2016 when I was doing a reef survey, and it was during the bleaching. That period was so sad. So, when you dive into the sea, you're hoping to see a vibrant reef and all of that, but everything was just white. There's no life, and it's all ghostly white, and it's just like you're swimming through a ghost town. And that kind of feeling is like, wow, I wish I'll never experience this again.

**00:21:06 Karenne**

Yeah, I agree. There are challenges, but with challenges come opportunities too, right? Given Singapore's context, we know the limitations that we have, but we also know that with what we have left, we can do something, and we can do something positive. And I think this is where research comes into play, finding solutions to restore areas that have been degraded, but also finding opportunities to create new areas where biodiversity can come back on their own. I'm reminded of this term by a fictional character, Dr. Ian Malcolm, from Jurassic Park, and he says: "Nature always finds a way".

And it's true. And I find that in the marine environment, they are not picky, you know, you give them the right environment, they will come back. So, give them a place to settle, and they will settle. So that's where the opportunity comes in. And I think that's where we are actually shifting some of the management, where besides looking at conserving whatever we have left, we're also looking at creating opportunities where development doesn't need to be a zero-sum game. You can actually get positive biodiversity outcomes if you plan it well, and you design for biodiversity. So basically, you have very biodiversity-positive designs, which thankfully is actually happening now. A lot of agencies are now looking at how do you increase biodiversity through nature-based solutions, for example.

And if you can do that, you start creating biodiversity-positive projects that will bring back perhaps even more biodiversity than what was there before, if you are creative about it. But for us to do it effectively, we need the science. And that's where the researchers come in, because they provide the knowledge to help us translate that into something we can apply. So that synergy is really incredibly important.

**00:22:49 Sam**

Yeah, I totally agree with that. If you do it right, they'll come. You know, when you go diving and you see all these walls, corals are actually growing. So how can we engineer these kinds of structures to make it more biophilic and biodiversity encouraging? What materials should we use, what kind of design, or even planting some coral. I think that is something that we are trying to work on. And we really have interesting results also. So for example, even corals, we have 250 of these hard coral species, but which ones of them really adapt well to the incoming climate, or you know, which one is more resilient to coastal development, which one will do well? So we're trying to put all these pieces together.

**00:23:31 Xiaoyun**

I think I'd like us to segue a bit to how we think citizen science can help this effort. Because beyond the very important involvement of researchers, we of course want the broader population to be supportive and involved in this effort.

**00:23:48 Sam**

Okay, I think many of you can also help to be our eyes. So, let's say if you spend a lot of time outdoors, diving, doing intertidal walks, you can actually help us to look out for certain signs. You really don't need to be a scientist to make a meaningful impact on protecting the environment and also the wildlife. So, in today's age, right, even with the camera on your phone, you can contribute valuable observations and data on biodiversity, changes in the environment, impacts to the environment, that can actually provide very important information for scientists, researchers, conservationists to study.

Like recently there's been ghost nets, so that's also something to highlight also. Ghost nets can impact a lot of things, like marine animals, shipping, if they get entangled in the coral reef, it's a nightmare. So, let's say if you're a diver, or if you see some of these nets when you're at the intertidal zone, you can actually report it. So we can take immediate action to remove it, so that anything else will not get hurt.

**00:24:49 Karenne**

And maybe just to add to that, you might ask the question, so I'm a citizen scientist. How do I then report all of these? Who do I report it to? And actually, there are many avenues to do it. But we also have this resource called Biome. It is an online platform where you can report biodiversity records. And there's a companion app called Singapore Biodiversity Atlas. So, with that, you can take a photo and you can upload it. And that gets captured on a portal where anyone has access to that information. So, you can go and see who reported coral bleaching, for example, if you put it on. So there are these resources available. If people use it, you build that database. And it is with data that you can actually understand what's happening out there, and come up with the necessary conservation actions that you need.

**00:25:37 Xiaoyun**

I think very much like what what drew you guys to the ocean, I think the ocean is fascinating for a lot of people once they know what to look out for. And it's not just the big charismatic megafauna that captures people – I've noticed that even small flower crabs or just seeing a sponge on the sea shore and the brittle stars that live in the sponge are very fascinating because nobody expects that amount of diversity on our shores. And it's all about, as you said, tapping on this citizen science, their enthusiasm, and maybe channelling that towards

conservation efforts. Showing them that they can be part of a bigger project in Singapore to manage our environment, or rather, manage our human impacts on the environment.

**00:26:18 Karenne**

Yeah, I think sometimes when people think about Singapore's environment – we have such small water spaces, the visibility isn't great, there's a lot of sediments – people tend to get very discouraged. And in times like this, I'm always reminded of another phrase that someone both me and Sam have worked with – and that's Professor Chou Loke Ming – and there's something he said that I think is a mantra to many of us who continue doing what we are doing. And he says: "Our corals haven't given up. And because they haven't, neither should we."

And that's where the work of finding solutions, working on new restoration techniques, finding out what works, what doesn't work, is really important, because they don't give up. They will always find a way, and we just need to give them a helping hand where we can, and find the opportunities to allow them to come back.

**00:27:11 Xiaoyun**

And with that, we've come to the end of our episode. Thank you, Karenne and Sam, for joining us today. More information about marine conservation efforts and citizen science programs such as our Intertidal Watch can be found on our website, which is linked in our episode shownotes. Do share your thoughts on this discussion with us on NParks' socials and give us a follow if you've enjoyed our content. My name is Xiaoyun, and thank you so much for listening to *That's Wild*. Stay tuned for more exciting conversations to come!