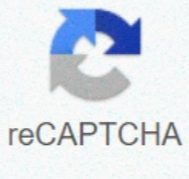




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All about starfish

June brought educators from around the country to Washington, DC, to experience Smithsonian research facilities, interact with scientists, and engage in activities to bring back to their classroom. These educators were participants in the Smithsonian Science Education Academies for Teachers (SSEATs), a weeklong event that focuses on the professional development of science educators. Dr. David Pawson interacts with attendees of SSEATs observing samples of echinoderms collected by Smithsonian scientists. Image: Smithsonian Science Education Center One of my favorite presentations was from Dr. David Pawson, a Senior Research Scientist and Curator of Echinoderms at the Smithsonian Institution. Dr. Pawson has years of experience working with marine life and has dedicated much of his work to one of the most well-known echinoderms, the starfish. We were very fortunate to have him share some of his knowledge and passion for these unique animals. Image: mr_Prof/iStock/Thinkstock Here are some facts you may or may not have known about starfish. Classification: Starfish are also referred to as sea stars because of their star-shaped appearance. They are a part of the phylum Echinodermata and are related to sand dollars, sea urchins, and sea cucumbers. Echinoderms are found in nearly all marine habitats and constitute a major proportion of the biomass. Starfish belong to the class Asterozoa, derived from the Greek words "aster" (a star) and "zoidos" (form, likeness, appearance). There are more than 1600 species of starfish alive today, and they have an important role in the community structure of the ocean floor. Feeding: Starfish are mostly predators and feed on invertebrates such as mussels and clams that live on the ocean floor. Several species have specialized feeding behaviors including eversion of their stomachs. This means the starfish extends its stomach out of its mouth and over the digestible parts of its prey. The prey tissue is partially digested outside of the body, then the starfish brings its stomach back inside into its 10 digestive glands to finish feeding. If you want to learn more about this process, check out this article in the Journal of Experimental Biology where researchers investigated the compound that plays a role in this feeding behavior. Movement: On their ventral side, starfish contain thousands of tube-like feet that contain cells that are specialized for adhesion. In a process that Dr. Pawson describes as "rapid gluing and ungluing," starfish can use these tube feet to move across a surface. Each foot has two sets of secretory cells that secrete compounds that allow the foot to first attach then detach to a surface. The first set of cells releases an adhesive material that bonds the fuzzy coat (the outermost layer of the tube foot) to the surface (ocean floor). A different substance is released from a second type of secretory cells that enables the foot to release from the ocean floor or other surfaces. Video of starfish movement. Video: Smithsonian Marine Station at Fort Pierce. Regeneration: Can you imagine having the ability to regrow a part of your body? Most species of starfish can regenerate, or regrow, damaged or lost arms. They can also shed arms as a means of defense. If an arm is damaged by a predator such as another starfish or a crab, the starfish can detach that arm and grow a new, healthy one. Or if a predator grabs onto the starfish by one of its arm it can detach that arm as a means to escape from the predator. Regeneration is one way starfish have remained abundant in the diverse marine world. Starfish and other echinoderms are extremely important to the biodiversity of our oceans. I hope that the next time you see a starfish while visiting the beach, you can take a moment to reflect in both their beauty and their importance to life on this planet. Image: Comstock Images/Stockbyte/Thinkstock References: Echinodermata. Available at: . (Accessed: 5th July 2017) Asterozoa. Available at: . (Accessed: 5th July 2017) Semmens, D. C. et al. Discovery of a novel neurophysin-associated neuropeptide that triggers cardiac stomach contraction and retraction in starfish. J. Exp. Biol. 216, 4047–4053 (2013). Hennebert, E. et al. Sea star tenacity mediated by a protein that fragments, then aggregates. Proc. Natl. Acad. Sci. 111, 6317–6322 (2014). Mladenov, P. V., Igdouira, S., Asotra, S. & Burke, R. D. Purification and Partial Characterization of an Autotomy-Promoting Factor from the Sea Star *Pycnopusia helianthoides*. Biol. Bull. 176, 169–175 (1989). Starfish (or sea stars) are beautiful marine animals found in a variety of colors, shapes, and sizes. All starfish resemble stars, and though the most common have only five arms, some of these animals can grow up to 40 arms. The amazing sea creatures—part of a group of animals known as echinoderms—travel using their tube feet. They can regenerate lost limbs and swallow large prey using their unusual stomachs. Carlos Agrazal/EyeEm/Getty Images Although sea stars live underwater and are commonly called "starfish," they are not true fish. They do not have gills, scales, or fins like fish do. Sea stars also move quite differently from fish. While fish propel themselves with their tails, sea stars have tiny tube feet to help them move along. Because they are not classified as fish, scientists prefer to call starfish "sea stars." Starfish and purple sea urchin. Kahl Moore/EyeEm/Getty Images Sea stars belong to the phylum Echinodermata. That means they are related to sand dollars, sea urchins, sea cucumbers, and sea lilies. Overall, this phylum contains approximately 7,000 species. Many echinoderms exhibit radial symmetry, meaning their body parts are arranged around a central axis. Many sea stars have five-point radial symmetry because their body has five sections. This means that they do not have an obvious left and right half, only a top side and a bottom side. Echinoderms also usually have spines, which are less pronounced in sea stars than they are in other organisms such as sea urchins. Colorful sea star in the Galapagos. Ed Robinson/Getty Images There are about 2,000 species of sea stars. Some live in the intertidal zone, while others live in the deep water of the ocean. While many species live in tropical areas, sea stars can also be found in cold areas—even the polar regions. Sun star with many arms. Joe Dovala/Getty Images While many people are most familiar with the five-armed species of sea stars, not all sea stars have just five arms. Some species have many more, such as the sun star, which can have up to 40 arms. Sea star regenerating four arms. Daniela Dirschel/Getty Images Amazingly, sea stars can regenerate lost arms, which is useful if a sea star is injured by a predator. It can lose an arm, escape, and grow a new arm later. Sea stars house most of their vital organs in their arms. This means that some species can even regenerate an entirely new sea star from just one arm and a portion of the star's central disc. This won't happen too quickly, though; it takes about a year for an arm to grow back. Crown-of-Thorns Starfish (*Acanthaster planci*) on Coral Reef, Phi Phi Islands, Thailand. Borut Furlan/WaterFrame/Getty Images Depending on the species, a sea star's skin may feel leathery or slightly prickly. Sea stars have a tough covering on their upper side, which is made up of plates of calcium carbonate with tiny spines on their surface. A sea star's spines are used for protection from predators, which include birds, fish, and sea otters. One very spiny sea star is the aptly named crown-of-thorns starfish. Closeup of the arms of a sea star under a pier, showing its tube feet. pfly/Flickr/CC BY-SA 2.0 Instead of blood, sea stars have a circulatory system made up primarily of seawater. Seawater is pumped into the animal's water vascular system through its sieve plate. This is a sort of trap door called a madreporite, often visible as a light-colored spot on the top of the starfish. From the madreporite, seawater moves into the sea star's tube feet, causing the arm to extend. Muscles within the tube feet are used to retract the limb. Tube Feet of Spiny Starfish. Borut Furlan/Getty Images Sea stars move using hundreds of tube feet located on their underside. The tube feet are filled with seawater, which the sea star brings in through the madreporite on its top side. Sea stars can move quicker than you might expect. If you get a chance, visit a tide pool or aquarium and take a moment to watch a sea star moving around. It is one of the most amazing sights in the ocean. Tube feet also help the sea star hold its prey, including clams and mussels. Karen Gowlett-Holmes/Getty Images Sea stars prey on bivalves like mussels and clams as well as small fish, snails, and barnacles. If you've ever tried to pry the shell of a clam or mussel open, you know how difficult it is. However, sea stars have a unique way of eating these creatures. A sea star's mouth is on its underside. When it catches its food, the sea star will wrap its arms around the animal's shell and pull it open just slightly. Then it does something amazing; the sea star pushes its stomach through its mouth and into the bivalve's shell. It then digests the animal and slides its stomach back into its own body. This unique feeding mechanism allows the sea star to eat larger prey than it would otherwise be able to fit into its tiny mouth. Common Sea Star (visible eye spots circled). Paul Kay/Getty Images Many people are surprised to learn that starfish have eyes. It's true. The eyes are there—just not in the place you would expect. Sea stars have an eye spot at the end of each arm. This means that a five-armed sea star has five eyes, while the 40-armed sun star has 40 eyes. Each sea star eye is very simple and looks like a red spot. It doesn't see much detail but it can sense light and dark, which is just enough for the environments the animals live in. Marcos Welsh/Design Pics/Getty Images Starfish belong to the animal class Asterozoa. These echinoderms all have several arms arranged around a central disk. Asterozoa is the classification for "true stars." These animals are in a separate class from brittle stars and basket stars, which have a more defined separation between their arms and their central disk. Doug Steakley/Getty Images Male and female sea stars are hard to tell apart because they look identical. While many animal species reproduce using only one method, sea stars are a little different. Sea stars can reproduce sexually. They do this by releasing sperm and eggs (called gametes) into the water. The sperm fertilizes the gametes and produces swimming larvae, which eventually settle on the ocean floor, growing into adult sea stars. Sea stars can also reproduce asexually through regeneration, which is what happens when the animals lose an arm. A *Forbes* sea star (*Asterias forbesi*) photographed Sedge Island Natural Resource Education Center in New JerseyA *Forbes* sea star (*Asterias forbesi*) photographed Sedge Island Natural Resource Education Center in New Jersey/Photograph by Joel Sartore, National Geographic Photo ArkCommon Name: Starfish (Sea Stars)Scientific Name: AsterozoaAverage Life Span: In The Wild: Up to 35 yearsSize relative to a teacup: Marine scientists have undertaken the difficult task of replacing the beloved starfish's common name with sea star because, well, the starfish is not a fish. It's an echinoderm, closely related to sea urchins and sand dollars.Population:There are some 2,000 species of sea star living in all the world's oceans, from tropical habitats to the cold seafloor. The five-arm varieties are the most common, hence their name, but species with 10, 20, and even 40 arms exist.Defensive Adaptations:They have bony, calcified skin, which protects them from most predators, and many wear striking colors that camouflage them or scare off potential attackers. Purely marine animals, there are no freshwater sea stars, and only a few live in brackish water.Regeneration:Beyond their distinctive shape, sea stars are famous for their ability to regenerate limbs, and in some cases, entire bodies. They accomplish this by housing most or all of their vital organs in their arms. Some require the central body to be intact to regenerate, but a few species can grow an entirely new sea star just from a portion of a severed limb.Unusual Feeding:Most sea stars also have the remarkable ability to consume prey outside their bodies. Using tiny, suction-cupped tube feet, they pry open clams or oysters, and their sack-like cardiac stomach emerges from their mouth and oozes inside the shell. The stomach then envelops the prey to digest it, and finally withdraws back into the body.WATCH: Why Are So Many Starfish Dying?A syndrome known as sea star wasting disease causes the animal to lose limbs and eventually disintegrate, leaving behind a pile of white goo. X Sign Up (free) to like it Your like shows your appreciation. Authors want to know. Sign Up (free) to save it Sign Up (free) to follow it X Save to: There are more than 2000 different species of starfish all over the world and these unique marine animals have diverse shapes, colours and come in a variety of sizes. Though known as "starfish", these creatures are not really fishes. They do not have fins to swim nor do they breathe through gills. Due to this, the marine scientists are working on changing the name to "sea star" which sounds more appropriate and nowadays the name sea star is pretty common as well. They have an unusual and peculiar anatomy, having no brain or blood but still able to digest food perfectly well. Let us find out more about the top ten facts about starfish. Below are some weird, yet fascinating facts about Starfish these unique marine species, Facts About Starfish That Will Surprise You 1. A STARFISH IS NOT REALLY A FISH Starfish live underwater but that is where their similarity to a fish ends. As mentioned above, the starfish is not really a fish. They do not have gills, fins or scales and they are actually related to sea urchins, sand dollars and sea cucumbers all of which are echinoderms. Sea stars actually belong to the class 'Asterozoa'. It is one of the interesting facts about Starfish. Also, read about deadliest fishes in the world. 2. They have no brain or blood It might sound ridiculous that they survive without blood or brain, but sea stars have an uncommon and simple way to survive. Seawater is pumped throughout their body as a replacement for blood, and this consists of the peculiar 'water vascular system'. The use of water saves space as there is no need for an intricate blood system in the body and this also serves very well because it can never run out of seawater. So, starfish blood is actually filtered seawater! 3. Starfish is an expert with the art of regeneration and can regenerate its own arms Another peculiar character of the sea star is the regeneration of their arms and sometimes their entire body! This attribute works to its advantage in various situations. The starfish may lose their arms when they come in contact with a predator or if they are stranded in any other threatening situation. Arms can take days, months, or even years to fully regenerate. But it can regenerate itself into a new starfish with its central disk and with only one arm attached. Sounds pretty cool, right? 4. Starfish have eyes Yes! Without blood, brain and even a Central Nervous System, it might look a bit out of the ordinary that they have eyes. Just to further add to their peculiar anatomy, their eyes are located on the end of their arms. Whilst their eyes may not be as good as our eyes, they are able to detect different shades of light- which means it can sense light and dark- which is just enough for them to survive in their environment and allows them to pray for food and pull out of the way of predators. You will also like reading about beautiful fishes in the world. 5. Starfish move with hundreds of tube feet Starfish is equipped with hundreds of tiny little feet at the underside and end of each of their arms. To move from one place to another, seawater is filled into its tube feet, causing the arm to move just like a foot would. This mechanism allows the starfish to move - much quicker than you might expect it to! - and the tube feet also help in catching and holding its prey. One of the shocking facts about Starfish. 6. Starfish can eat outside their body Due to their incredibly tiny mouth present on the underside of their body, it would be impossible for the sea stars to consume only through its mouth. But they have adopted a shrewd way to eat things larger than its own mouth. Interestingly, starfish have 2 stomachs, one to begin the digestion in its body and the other to expand itself and engulf the prey. With the help of this unique digestive system, it can digest complex organisms. To break it down in simpler terms, they have a stomach that can digest food even outside their bodies. This allows the food to be further broken down into simpler parts of their bodies. Also, read about beautiful jellyfish in the world. 7. Not all starfish come star-shaped Almost all starfish are shaped similar to a star, which is how they get their group name- 'starfish'. However, there are always exceptions. The Cushion Starfish has a round ball-like shape but resembles all the genetic characteristics needed to be a starfish. But that is not all. Some species have several more arms. For example, the Sun starfish can have up to 40 arms! 8. THEY CANNOT SURVIVE IN FRESHWATER Sea stars have different body chemistry which makes them unsuitable for freshwaters and so, they prefer saltwater. All the time. In order to survive, they prefer to stay in saltwater environments and tend to inhabit coral reefs, wet sandy patches among other salty areas. If you by any chance, put a starfish in freshwater, it would eventually die. 9. SEA STARS CAN BE REALLY HEAVY Ranging from 5 to 11 inches, sea stars can be pretty heavy for their size. Their usual weight is 3-6 lbs, but there are about 2000 species of them and there are those which weigh 11 lbs. and even more. 10. THEY HAVE A HARD AND Leathery Skin Starfish are layered with its outer skin made from calcium carbonate. This strong material makes the skin tough and difficult for hunters to break down and hence giving them extra protection. Some species of starfish will even take a step further with several additional spines on their skin, acting as a layer of armor to avert predators. DID YOU KNOW? The average life expectancy of a sea star is 35 years! These are the 10 facts of Starfish. Additionally known as Sea Star they are one of the most beautiful creatures on planet Earth. Starfish reproduce sexually by releasing sperms and eggs known as gametes into the water. Later sperm fertilizes and the gametes and produces swimming larvae that settle on the ocean floor growing into an adult sea star, however, they can also grow asexually through regeneration but that happens when species loses an arm. The sea species can be seen all over the world, however, the largest population is in Indian and Pacific oceans.

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