

# Emaline's TIDAL POOL Adventure

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*Emaline's Tidal Pool Adventure*

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## DEDICATION

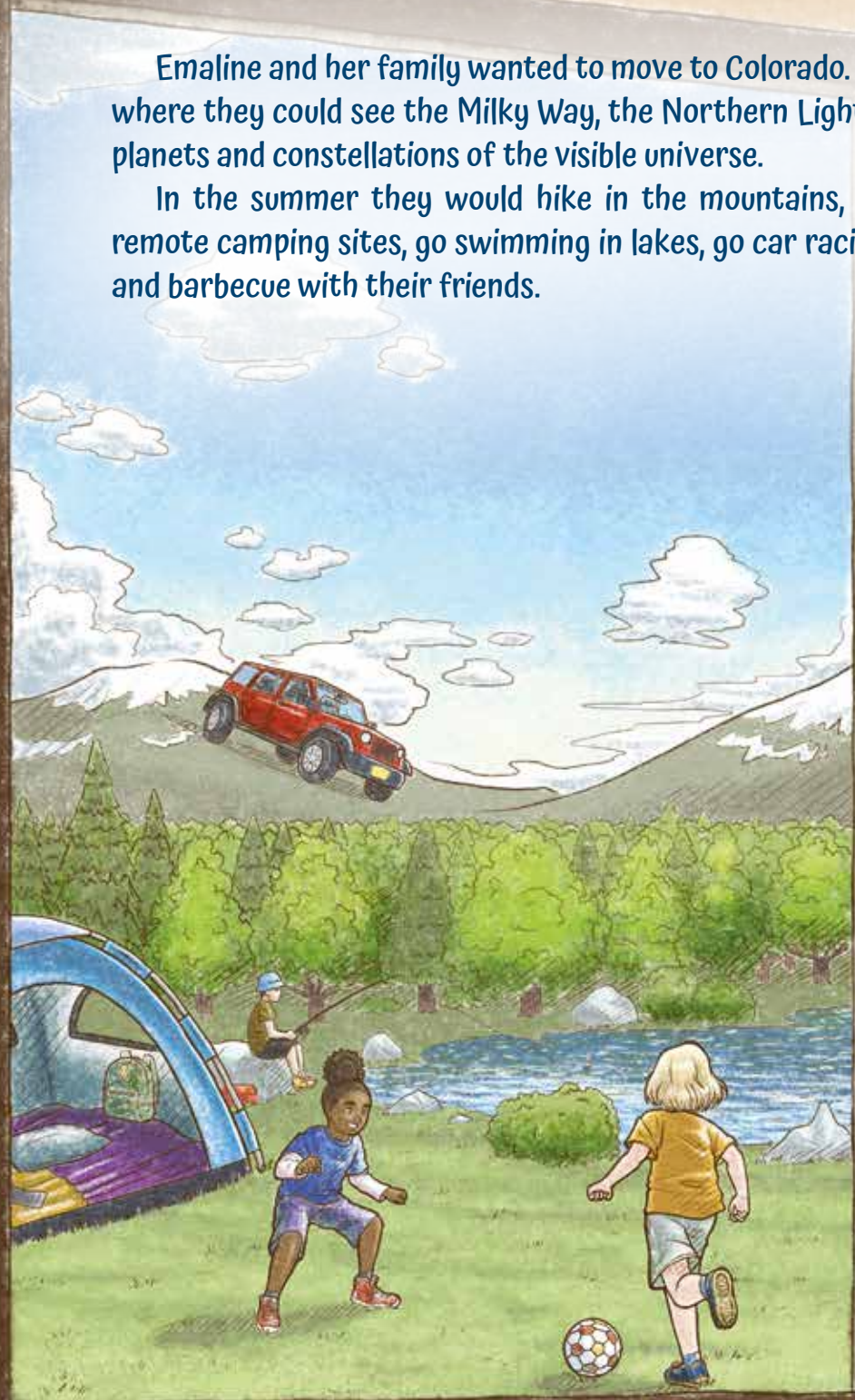
*I would like to dedicate this book to Stella Bertels, my one-and-a-half-year-old dog. She is very sweet and an amazing companion to me. She is the perfect dog for me, and we enjoy being around each other.*

Emaline and her family wanted to move to Colorado. They dreamed of starry nights where they could see the Milky Way, the Northern Lights, meteor showers, and all the planets and constellations of the visible universe.

In the summer they would hike in the mountains, go off-roading in the Jeep to remote camping sites, go swimming in lakes, go car racing, play all the summer sports, and barbecue with their friends.

In the winter, they would go skiing and sledding, and have snowball fights. Best of all, they could make snow angels and play in the snow with their dog, Stella.

During that first wonderful Colorado summer and winter, there was only one thing they all really, really missed.



# The Ocean

The ocean is truly unique. It is where all the forces of nature meet.

As you stand at the seashore where the ocean, land and sky meet and you feel the sand and water between your toes, the wind in your hair, and the warmth of the sun on your back. You know you are in a truly special place.

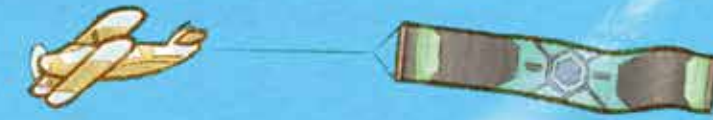
The Sun. Giving the Earth warmth and light.

The Sky. Big, blue, and beautiful, protecting us from the sun's rays.

The Air. Providing oxygen and carbon dioxide for all to live.

The Land. Where most humans and many animals live—and where many plants grow.

The Ocean. Covering three quarters of the Earth's surface and where there are still many undiscovered creatures.



As often as they could, Emaline, Stella, Christie (her mom), and Aaron (her dad) traveled to the beach. One of their favorite things to do is explore the tidal pools. On one particular occasion, a storm surge combined with a high-moon tide to fill the tidal pool with new water—along with many creatures!



Emaline, with Stella at her side, had barely set her backpack on the bed when she grabbed her snorkel and mask and hurried off to the tidal pool. She and Stella ran up to the edge of the water. It was beautifully clear. A hermit crab and stone crab were foraging by the shore, but they quickly backed up into deeper water, staring up at Emaline and Stella.

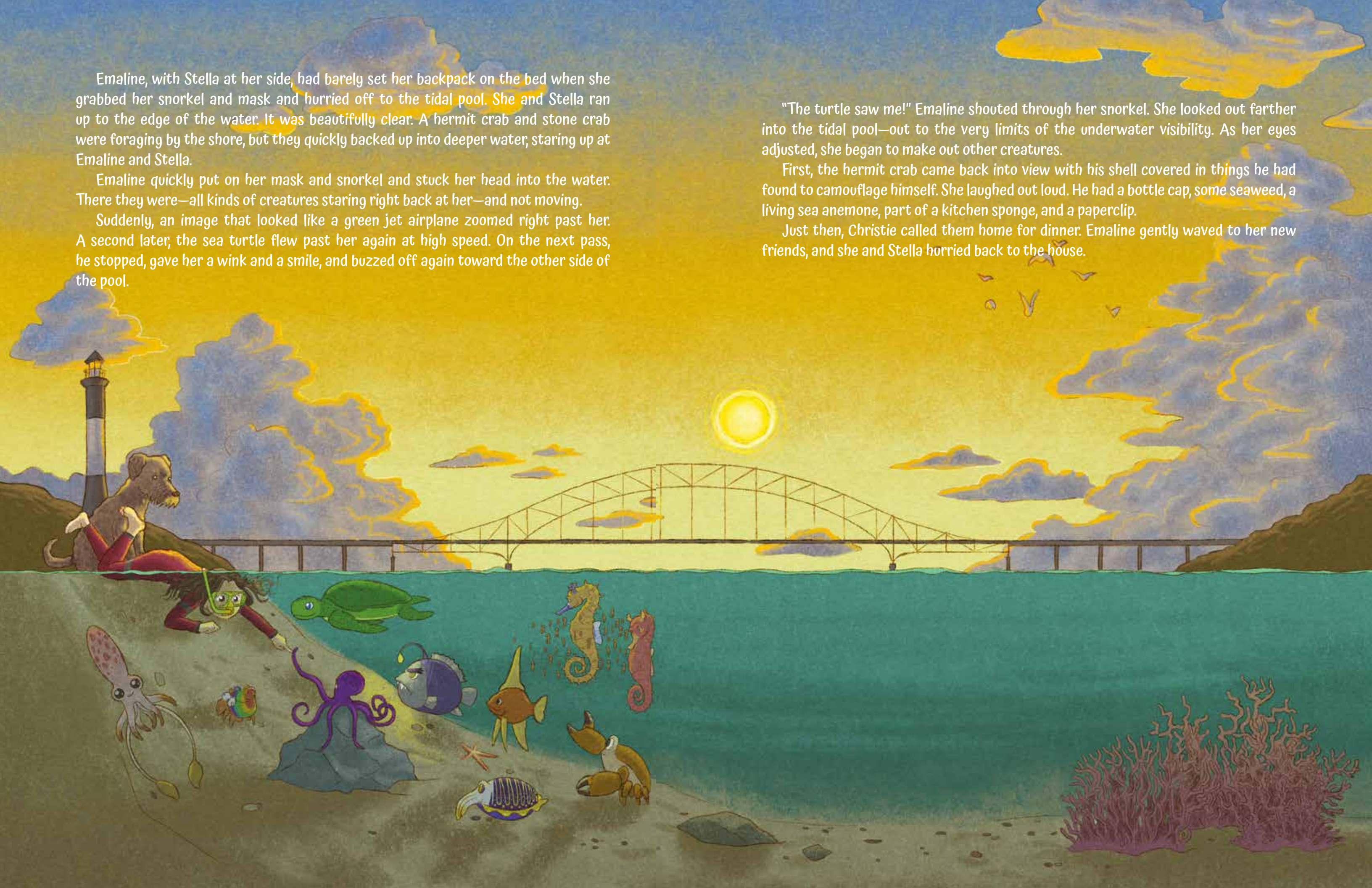
Emaline quickly put on her mask and snorkel and stuck her head into the water. There they were—all kinds of creatures staring right back at her—and not moving.

Suddenly, an image that looked like a green jet airplane zoomed right past her. A second later, the sea turtle flew past her again at high speed. On the next pass, he stopped, gave her a wink and a smile, and buzzed off again toward the other side of the pool.

"The turtle saw me!" Emaline shouted through her snorkel. She looked out farther into the tidal pool—out to the very limits of the underwater visibility. As her eyes adjusted, she began to make out other creatures.

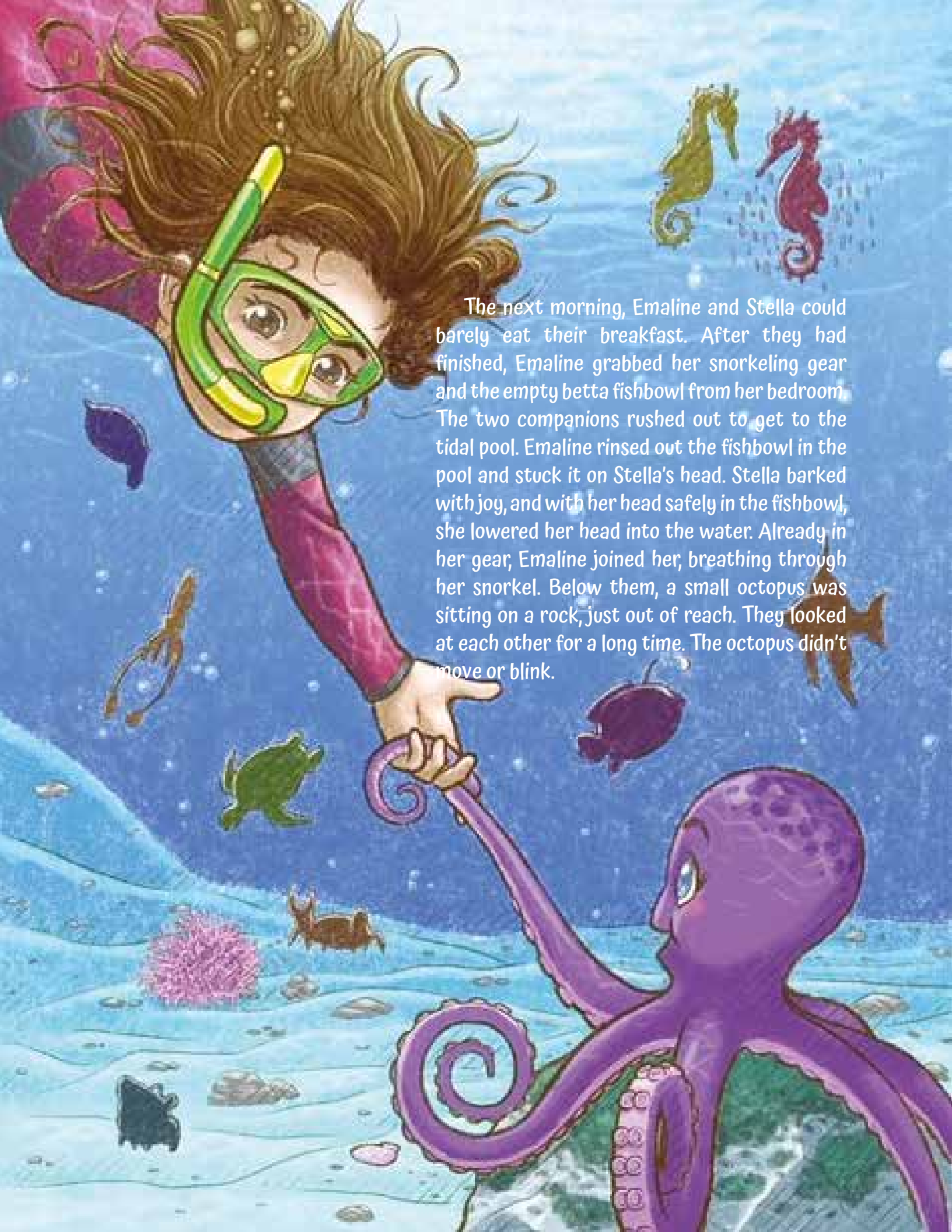
First, the hermit crab came back into view with his shell covered in things he had found to camouflage himself. She laughed out loud. He had a bottle cap, some seaweed, a living sea anemone, part of a kitchen sponge, and a paperclip.

Just then, Christie called them home for dinner. Emaline gently waved to her new friends, and she and Stella hurried back to the house.





At the dinner table, Emaline could barely contain herself as she began her story with Stella next to her on the floor. Waving her arms, she told Mom and Dad what she and Stella had seen. Her parents just looked at each other with a smile. Emaline described the turtle, the hermit crab, and many of the other creatures that were too far away to be sure what they were. "You don't believe me, do you!" Emaline exclaimed, looking crushed. Stella jumped up on the empty chair next to her and howled as if to say, "It's true! I saw them, too! They were so cute! AwwwwOooooh!"



The next morning, Emaline and Stella could barely eat their breakfast. After they had finished, Emaline grabbed her snorkeling gear and the empty betta fishbowl from her bedroom. The two companions rushed out to get to the tidal pool. Emaline rinsed out the fishbowl in the pool and stuck it on Stella's head. Stella barked with joy, and with her head safely in the fishbowl, she lowered her head into the water. Already in her gear, Emaline joined her, breathing through her snorkel. Below them, a small octopus was sitting on a rock, just out of reach. They looked at each other for a long time. The octopus didn't move or blink.

All the other creatures were looking at her as well. Poor Stella was having trouble learning to look into the water through a fishbowl and was trying not to move or bark, figuring it would scare the creatures away.

The octopus was a beautiful lilac color, and she slowly put out one tentacle toward Emaline, who slowly reached out with her pointer finger. The octopus placed the tentacle gently around Emaline's finger—an octopus handshake!

Emaline knew that the octopus was using its tentacles to "smell and taste" her, and that it was checking to see if she gave off any electrical signals that many sea creatures use to talk to each other. The octopus gently pulled back her tentacle and, still watching Emaline's and Stella's shadows, retreated back into the depths with her friends.

Emaline was happily screaming through her snorkel. Stella pulled her head from the water, shook off the fishbowl, and began to bark. They raced back to the house to tell Mom and Dad.

Emaline ran into the house screaming, "I shook tentacles with an octopus!" But her parents were not there. They had gone to the beach, so Emaline and Stella ran to their favorite spot. Splashing into the water, Emaline grabbed her mom's hand and screamed, "I shook hands with an octopus!" Her mom and dad gave each other the same look again—just like last night at dinner. "You have to believe me! It's true!" Emaline said as Stella ran back and forth on the shore howling. "It's true! It's true! I'll prove it to you. Let's get your masks and snorkels and I'll prove it." "Of course, we believe you!" said Mom. They collected their things and headed back to the house.

Emaline and Stella ran ahead to the house and found her parents' dive-gear bag from last summer. A bit dusty, all of their snorkel gear was there, and she dragged it to the door just as Mom and Dad arrived. "Let's go!" Emaline ordered, and the four of them walked the 200 feet to the tidal pool.



Stella was first to the pool and stuck her head into the fishbowl. Emaline—quickly putting on her mask and snorkel—joined Stella, and they silently slid their faces into the water. Mom and Dad laughed at Stella in her fishbowl helmet. Then they heard Emaline yelling through her snorkel and Stella yipping at something. Waving her arms frantically, Emaline motioned her parents to come and look. Putting on their masks and snorkels, they lowered their heads into another world.

Many creatures were there—just out of reach but seemingly unafraid. Maybe because they had already gotten comfortable seeing Emaline and Stella? Seeing two more creatures that looked the same didn't seem to concern them.

This first experience would lead the family to learn all about their new underwater neighbors. Every day for the next week, they would visit the tidal pool. And every night they would look their new friends up on the internet and talk about how each one is unique. Even more unique than people!





All of a sudden, Aaron saw a green flash—the same one Emaline saw. Then it happened again. Then once again, but it stopped. It was a miniature sea turtle, about eight inches long. The turtle gave him a nod and a wink, and just like a jet plane it blasted off toward the other side of the pool. Emaline named him Flipper.

There are several species of sea turtles. They are reptiles that have existed on Earth for over 100 million years. This means their ancestors were around at the time of the dinosaurs!

Sea turtles cannot breathe underwater and need to come to the surface for air. They can hold their breath for as long as 7 hours if they are resting or sleeping. Sea turtles are the only reptile to travel worldwide. Some migrate thousands of miles across entire oceans between feeding.

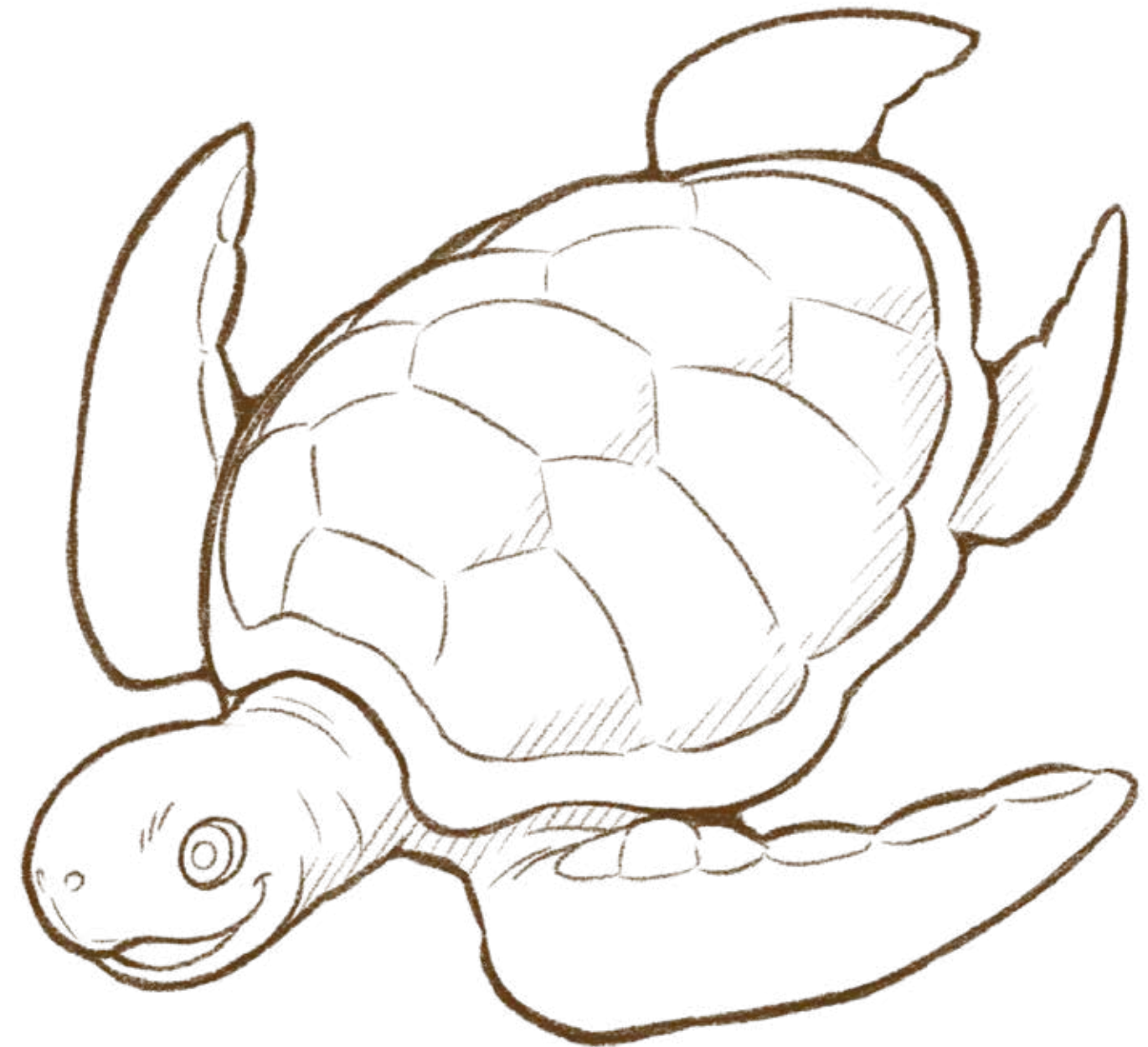
They always return to the same nesting grounds. Females only come ashore to lay their eggs, traveling thousands of miles to the exact same beaches where they were born! Scientists think they use the Earth's magnetic field and the stars to navigate across the oceans back to their birthplaces. They may also use their sense of smell to locate the beach where they were born. During sea turtle nesting season, a female can lay up to 180 eggs at a time—as often as six times!

While sea turtles mostly live in shallow waters, they are known to dive to deeper depths in search of food, cooler temperatures, or protection from predators. Leatherback sea turtles can dive 4,035 feet deep—almost a mile! Depending on the species, a sea turtle's diet can consist of seagrasses, jellyfish, sponges, sea urchins, sea anemones, mollusks, crabs and other crustaceans.

Sea turtles typically live long lives, sometimes more than 70 years. Most marine turtles take decades to mature to adulthood—between 20 and 30 years. All sea turtle species are endangered. The causes are many: range from loss of beaches where they were born to human development where they can no longer lay their eggs; boaters hitting them with propellers; poachers killing turtles for shells. Tragically, many turtles eat jellyfish and are injured or killed by eating plastic they mistake for their favorite food.

But do not despair! It's not over for the sea turtle. Young people like you, and your families, can help them by contributing to the World Wildlife Federation, educating others, and by donating your time to help people working in the oceans to help turtles survive. You can do it!

Ask your parents to help you search Google for "BBC Earth Kids Sea Turtles"



Use your crayons to color your sea turtle and give them a name.



Down near a rock was some seaweed, and tucked into the sand was the hermit crab Emaline had met the first day. Now Mom and Dad would see that Emaline was not exaggerating. It was all there—the bottle cap, paperclip, and the newest addition, an Apple AirPods. The crab came in close—but well out of reach of Christie and Aaron—and did a pirouette in the sand so all could see the "house" decorations. They could see the stalked eyes as it gave a wink, very proud of its creation. Emaline named him "Hermy."

Hermit crabs most commonly found in pet stores are known as "purple pinchers" (*Coenobita clypeatus*). They originate from the Caribbean and are one of the hardiest species. Despite the name, hermit crabs live in large groups and are very social.

Hermit crabs communicate by chirping. Their soft, high-pitched chirps sound like a small frog. Chirping can mean there's a territorial dispute or that a crab was startled. Hermit crabs have modified gills that allow them to breathe on land. Water stored in their shells creates humidity, allowing for the exchange of oxygen. Crabs have no bones and rely on an outside skeleton (exoskeleton) that replaces their skin like many insects, lobsters and other crabs.

Female hermit crabs can hold hundreds of eggs inside their shells until they mature. When her eggs are ready to hatch, she heads to a tide pool or ocean and releases them. Hermit crabs must shed their exoskeleton to grow. The average crab molts once a year. They must swap out their seashells as they grow. Some hermits will try on several shells before making a commitment. In captivity, hermit crabs can live up to forty years when kept in the right conditions. Much of the wild hermit's survival depends on finding the right size empty seashell to protect its soft body from predators.

Hermit crabs are scavengers by nature and like to pick at their food. Some of their favorite foods are cooked chicken on the bone, ribs, pork, fish, broccoli, apples, mangoes, unsalted nuts, corn on the cob, cooked egg served with bits of broken eggshell, and occasionally a little bit of un-greasy pizza. (Yes, seriously—eggshells and pizza!)

Hermit crabs do not carry human diseases. As with any pet, it is important to wash your hands. Before interacting with your hermit crabs or their food, it is extremely important to clean your hands thoroughly to remove any trace of sunscreen or insect repellent.

Under supervision, hermit crabs enjoy exploring their surrounding environment. LEGO® buildings, dollhouses, and obstacle courses made from blocks are great exercise, and they provide enrichment. It's fun to watch them explore. Hermit crabs make fun and interesting pets that never cease to amaze. With proper care, your hermit crabs can live long, happy lives.

Ask your parents to help you search Google for "BBC Earth Kids Hermit Crabs"



Use your crayons to color your hermit crab and give them a name.



Emaline always saw the hermit and stone crabs on the edge of the water as she approached the pool. At first, the hermit just scurried away, while the stone crab put up both claws and backed into the water. After several visits, the crabs no longer bothered running away.

There are over 300 species of crabs. The stone crab typically has a red-brown shell. They get to be only about four inches across their shell, but they are best known for their huge claws.

Looking like the giant muscled arms on a wrestler, the claws are tools to break the outside shells of their prey and are used like a knife and fork. They also fight off other crabs. Stone crabs are social creatures and very territorial. Males are known to fight to the death if they both like the same female crab. Emaline named him "Arnold" for his huge claws.

Like Maine lobsters with similar claws, most crabs are left and right "handed." The huge claw is called the "crusher claw." The other smaller and more articulate claw is the "pincer," which is primarily used for dissecting their primary prey and placing it in their mouth. Sort of like we use a knife and fork.

Like all crabs, and many other creatures from lobsters to most insects, crabs have exoskeletons. That means that their skeletons are on the outside (exo means "external" or "outside"). Their hard outside shell both protects them from injuries—like a knight's armor—but it also supports the inner soft body, which has no bones. Humans are different. We have an internal skeleton that supports our soft tissue and grows with us as we get taller. Very cool!

A crab's shell does not grow, so it must shed (or "molt") to get out of its shell when it grows out of it. It's an amazing process that crabs have in common with many creatures, including the lobsters and insects we mentioned before. Stone crabs have five pairs of legs, although only the front pair are claws.

Stone crabs are not currently endangered. Females lay up to 100,000 eggs, twice per year.

Ask your parents to help you search Google for "BBC Earth Kids Stone Crabs"



Use your crayons to color your stone crab and give them a name.



One of the first things Emaline saw when she put her head in the water was what looked like an advertising blimp you'd see up in the sky. The creature had a body covered in rolling lights that changed colors. It flashed like a Christmas tree to say hello when it noticed Emaline so she named him "Flash."

It was a cuttlefish! There are more than 120 different species of cuttlefish. They are solitary animals and can be found in all the world's oceans. While most live in shallow waters, some species can be found at depths of more than 3,000 feet!

Cuttlefish actually are not fish, but intelligent ocean invertebrates within the nautilus, squid and octopus family. These cephalopods (which means "head foot") have claspers they can extend very quickly to catch prey.

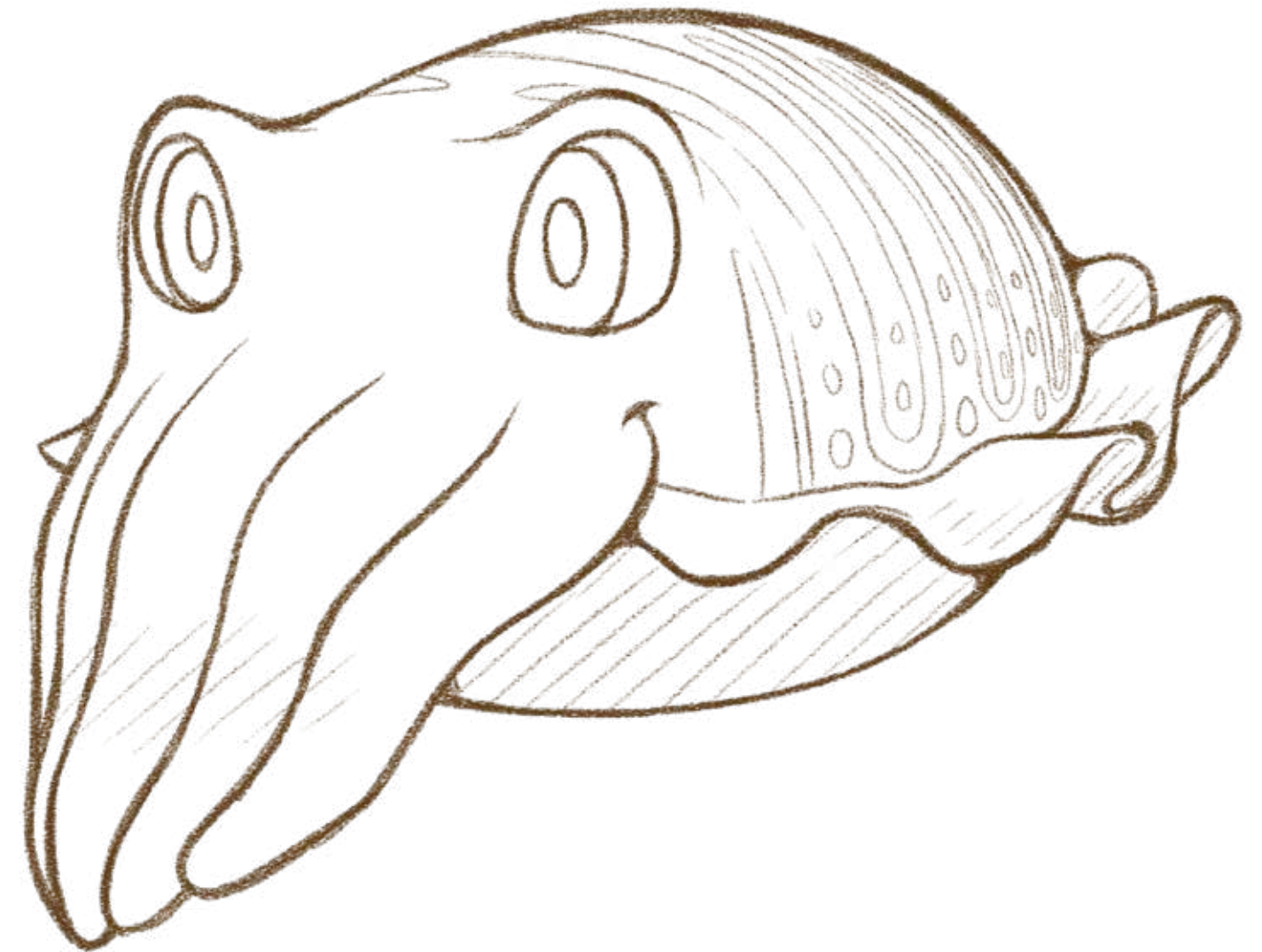
Scientists think cuttlefish are colorblind. Despite this, cuttlefish have a highly sophisticated color-changing capability. Their W-shaped eyes let them look forward, sideways, and backwards at the same time.

Like other cephalopods, cuttlefish are masters of disguise. By controlling the 10 million color cells (called "chromatophores") within their skin, they can quickly change color, pattern, and texture—sometimes completing the illusion by making shapes with their tentacles to better blend in with the background. Cuttlefish move in the water using long lateral fins on each side of their bodies and can maneuver forward, backwards and sideways, just like a silent helicopter. When frightened, they can eject water and cover great distances quickly, just like their relatives, the octopus, nautilus and squid.

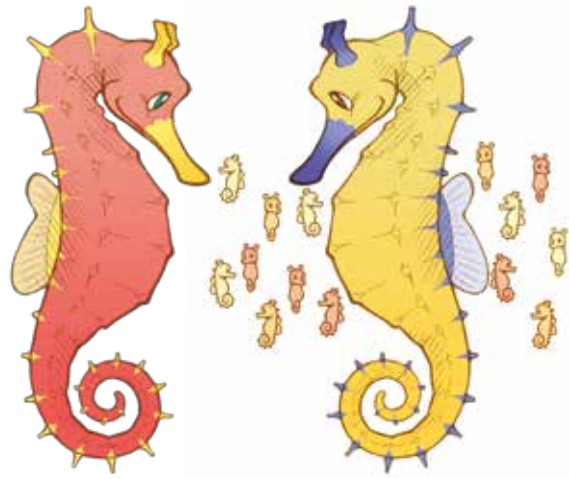
Cuttlefish can count, plan for the future, remember the past, and use lots of ways to evade predators. They can hide in a cloud of ink, and like their cephalopod relatives, can change colors instantly to blend in with their surroundings.

Cuttlefish have three hearts! Two push blood through the gills, where it picks up oxygen dissolved in the ocean water. The third heart pushes the oxygenated blood out to the rest of the body. The blood itself is blue-green in color because it contains hemocyanin, a copper-colored protein typical in cephalopods. Unlike cuttlefish, octopi and squids, all mammals' blood contains iron-rich protein hemoglobin, which makes the blood look red.

Ask your parents to help you search Google for "BBC Earth Kids Cuttlefish"



Use your crayons to color your cuttlefish and give them a name.



Emaline spotted two seahorses hanging on to a piece of seaweed. She remembered from school that seahorses have prehensile tails that hold on to seagrass and other objects, especially when they "roost" at night. They do not swim well or fast. Attaching to floating seaweed, seagrass or marine debris allows them to travel much farther than they could swim on their own.

Seahorses may look like horses, but actually they are fish that happen to swim upright. They are relatively small, and range from about the size of a thumbnail to more than a foot long. There are over 50 species of seahorses. Many of those were discovered only within the last decade. There are probably many more yet to be discovered!

It can be difficult to spot seahorses. Besides their small size, they are experts in camouflage, and many have patterns on their bodies similar to their habitat. This lets them seamlessly blend into coral or seagrass, allowing them to both hide from predators and sneak up on prey. Unfortunately, seahorses can't always hide. One of the biggest threats to their population is illegal capture by humans for use in traditional medicines and home aquariums.

Seahorses have a unique breeding ritual. Seahorse mates will greet one another with an intricate dance that involves mirroring each other's movements, swimming side-by-side and more. This is a way for each to check in with their partner and make sure they're okay and ready to mate. When it comes time to breed, females place eggs in a small pouch on the male's body. That's right, the male seahorse takes the lead when it comes to the labor part of birthing. There are multiple breeding events throughout the season.

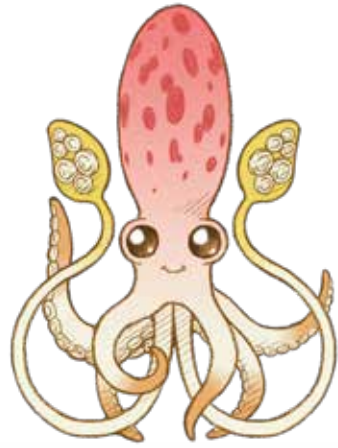
The process can take anywhere from two to five weeks, depending on the species, and the happy couple will dance every morning. Seahorse couples will stay together for an entire breeding season, and some species stay together for several years. In fact, some seahorses get so worried about losing their partners in a rogue current that they hold on to each other's tails!

Emaline decided to name the male seahorse "Land Biscuit" and the female seahorse "Sea biscuit."

Ask your parents to help you search Google for "BBC Earth Kids Seahorses"



Use your crayons to color the seahorses and give them a name.



Emaline could just make out a bullet-like creature passing by, just beyond her reach. It was about eight inches long and had huge eyes—the size of a quarter. It was a squid!

Squids are cephalopods and are closely related to the cuttlefish, nautilus and octopus. With an elongated soft body and giant eyes, the head attaches directly to eight arms and two clasper tentacles surrounding a beak-like mouth.

About 160 million years ago, cephalopods had external shells and were called ammonites. These ancient ancestors started losing their shells around 100 million years ago due to pressures from adapting marine predators. Many marine invertebrates had to develop new defenses or risk being wiped out. This meant ditching the heavy shell, which made it difficult to escape from a threat. The cephalopods we know today don't have any shells to slow them down. They can quickly hydrojet away from danger.

Squid play an important role in the worldwide food chain—both as hunters and prey. The two long clasper tentacles shoot out at high speed to grab prey, and the eight arms hold and control it. The beak then cuts the food into suitable-size chunks for swallowing. Squid are rapid swimmers, moving by jet propulsion, and mostly locate their prey by sight—even in very low light, thanks to those large eyes. Cephalopods are among the most intelligent of invertebrates. Groups of Humboldt squid, each one up to four feet long, have been observed hunting cooperatively. But squid are also preyed upon by sharks and other fish, seabirds, seals, and cetaceans (including sperm whales).

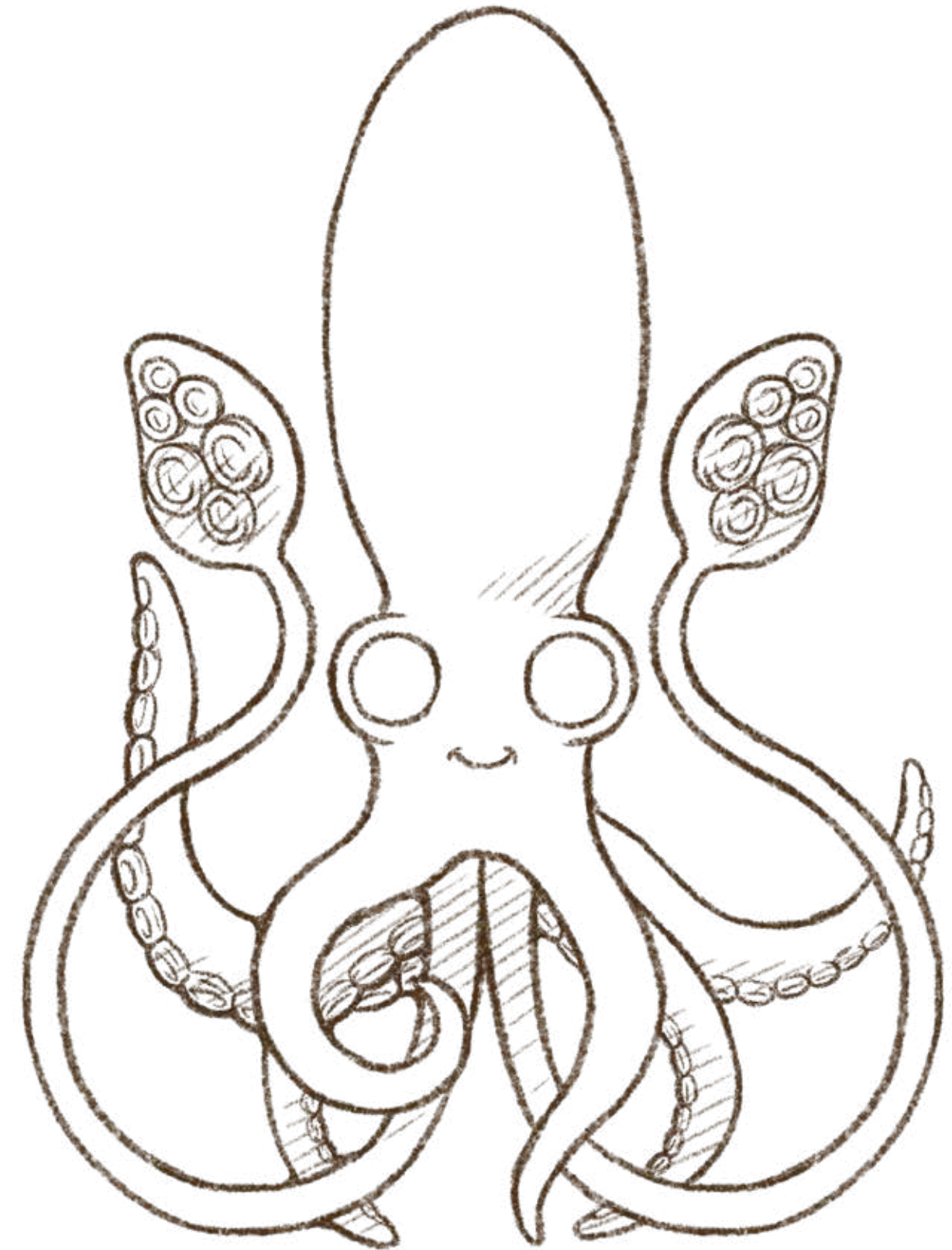
Giant squid over 30-feet long have been found dead, but we know they get much larger. And we also know that sometimes this prey becomes the predator. Giant squid and sperm whales often fight to the death in waters over 2,000 feet deep. Large clasper suction marks have been found on whales that imply that some giant squid grow to lengths of over 120 feet! These huge creatures have been featured in literature since classical times, especially in tales of giant squid and sea monsters. Some stories may even be true!

Like cuttlefish, squid have three hearts—two to circulate green blood to their gills and a third to circulate blood through the body. The blood itself is blue-green in color because it contains hemocyanin, a copper-containing protein typical in cephalopods, including cuttlefish, octopi and squids. Mammals' blood is different. It's red because it contains iron-rich protein hemoglobin.

All cephalopods have skin pigmentation cells called chromatophores. They are the ocean masters of color change for camouflage and signaling. Some species can eject a cloud of ink to distract predators.

Squid are a favorite human food and are used in cuisines around the world. When squid is human food, it's often called "calamari." Emaline decided she would call her new squid friend "Inky Calamari." She also decided it would be quite some time before she would try any more calamari for dinner!

Ask your parents to help you search Google for "BBC Earth Kids Squid."



Use your crayons to color your squid and give them a name.



Emaline was seeing so many creatures moving around the tidal pool that she had missed a fish on the bottom hidden next to a big rock. It was so very different, with huge teeth and an always-open mouth. Her mom, Christie, helped her find it online. Turns out, it was an anglerfish, and it had a unique adaptation on its forehead. Emaline decided to call the anglerfish "Fang."

They also read that all the larger anglerfish are female and the thing on its forehead is actually part of the dorsal fin. But it looks like a fishing rod with a worm-like "lure" moving on the end of a rod. The male anglerfish is tiny and lives "attached" to the female, feeding off her blood supply. Emaline thought that was kind of creepy!

The next morning, Emaline and Stella headed to the pool. They stuck their heads in, and Emaline waved at the anglerfish, trying to make friends as she did with the other creatures. The fish saw her, but did not move. With its mouth wide open, only the fishing "pole" dorsal fin moved up and down, hoping to attract a small fish to eat. Emaline watched for a long time. There were not many small fish in the tidal pool, and the ones that were there knew what the angler was up to. Emaline thought, "She must be hungry!"

They ran back to the house, and Emaline grabbed her dad by the hand yelling, "The anglerfish is starving! Can you help me feed her?"

"How?" asked her Dad. "She will bite you if you go anywhere near her mouth!" He suspected Emaline already had a plan.

"We'll take the hook off the fishing rod and tie a piece of hotdog on the line. If we're gentle, it will stay on till Fang bites it." Emaline ran to the refrigerator and took out one of the leftover hotdogs. She gave a quarter to Stella and she ate a quarter, leaving half for Fang. "Let's go. Hurry!" she yelled.

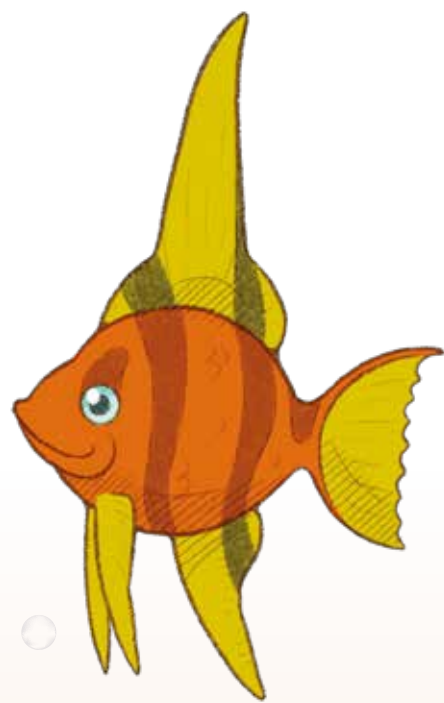
She and Stella rushed ahead and Dad followed with the fishing rod. When they got to the pool, Emaline put the fishing line through a small piece of the hotdog, and looped it around. It stayed on. "Okay, Dad, lower it very slowly, and I'll give you signals." She put on her snorkel gear, dunked her head, and started using crane hand signals to tell her dad where to place the hotdog. She signaled "boom out" and "load down," and the food slowly descended over Fang's head.

It happened so quickly that Emaline didn't even see Fang eat it. It was just gone! Just then, Mom called them to dinner. Emaline ripped the remaining hotdog into smaller pieces and threw them into the pool, sharing it with all of her friends.

Ask your parents to help search Google for "BBC Earth Kids Anglerfish"



Use your crayons to color your anglerfish and give her a name.



On the fifth day, Emaline saw a new fish. She was not sure what it was, but it reminded her of a fancy aquarium fish. But why was it in the tidal pool? Just then the fish chased after Flipper the turtle, and he was scared. Emaline took some mental notes on the shape and colors of the fish and headed back to the house to check the internet. She scrolled through the freshwater fish on the PetSmart website. There it was—an angelfish. But the tidal pool was saltwater, and that freshwater angelfish couldn't possibly live there. She kept reading and soon learned that there are also saltwater species of angelfish, and they live in the warm waters of the Caribbean and Florida.

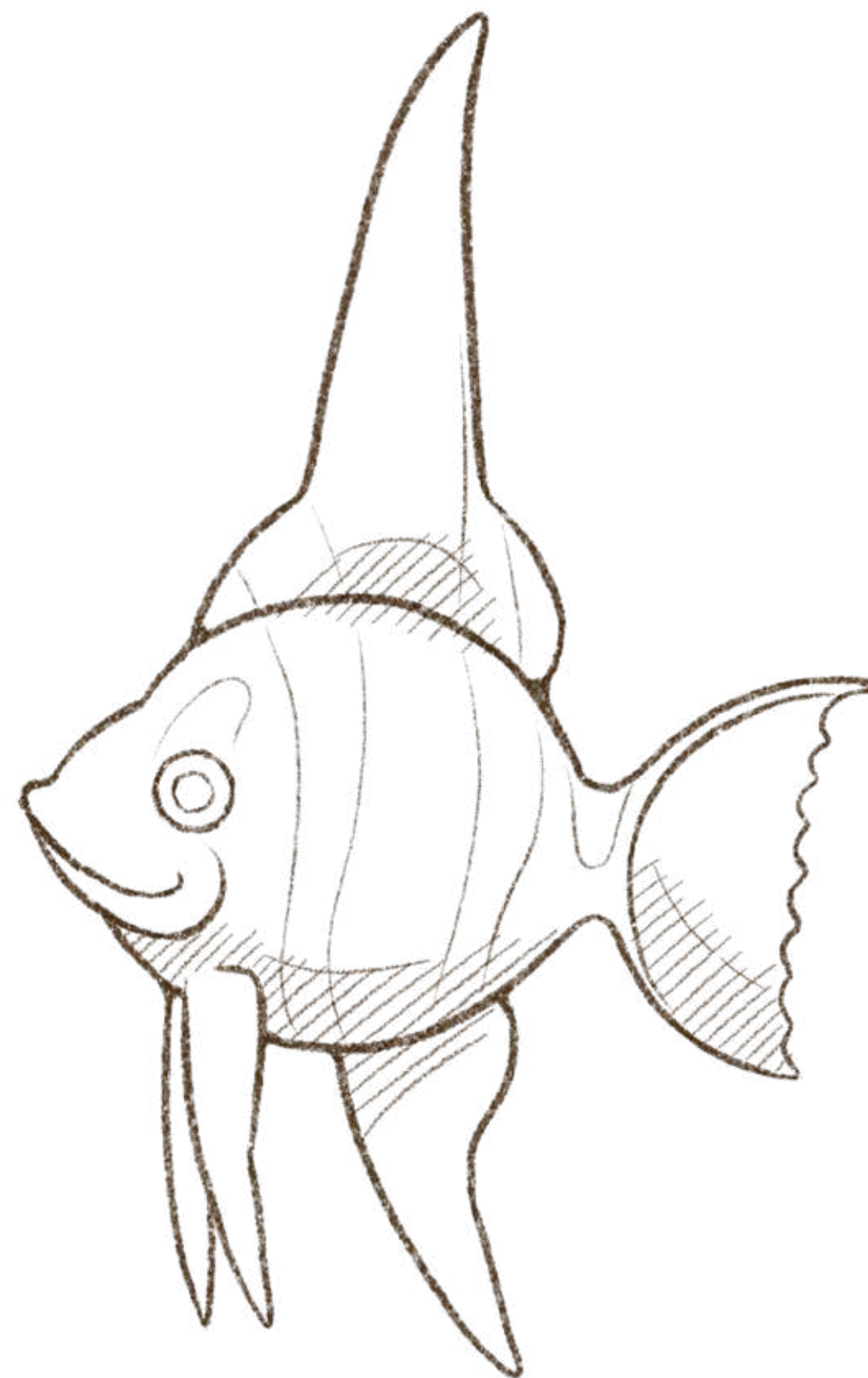
Emaline decided to call her Grandpa Glenn. He's a diver and marine researcher and would have a good idea about this creature. She explained the whole story of the tidal pool and the creatures she was meeting. He said, "Emaline, this story sounds like a book. Let's do one!"

He explained what she'd seen, "This time of year, an underwater current from the Gulf of Mexico curls around Florida. The current flows in the ocean water just like a river flows on the land. That underwater current carries warm water and tropical fish all the way to the Arctic. The current is one of the strongest weather influencers in the world, using the rotation of the Earth to move all that thermal energy. During the summer, the current can come to shore where you are, and if you're lucky, you'll see tropical fish. She will only be able to live in the tidal pool—so you be good to her." They promised to talk again soon.

The internet went on to say how there are both salt and freshwater species. South American species live in murky water, so the spines within their fins, both on the top and bottom, act like whiskers on a cat. Emaline learned that angelfish are very popular pet aquarium fish, and they certainly add a lot of beauty to a tank. However, they are not always the easiest fish to care for unless you know a few important facts about them and their needs.

Now Emaline was worried about her fish friends—especially the tropical angelfish—so she kept reading until dinnertime.

Ask your parents to help you search Google for "BBC Earth Kids Angelfish"



Use your crayons to color your angelfish and give them a name.





Emaline's favorite sea creature was the octopus. Maybe it was because they were Grandpa Glenn's favorite as well—and because they are so very different from humans. Yet in many ways they are humanlike and even capable of doing things humans can't do. Emaline remembered Grandpa saying that each tentacle has its own brain and operates independently, but they also coordinate with the "main brain" so the tentacles can act together to capture food.

The octopus is the most intelligent of all the cephalopods, and their brain power is much greater than most people realize. Octopi have distant memory—they remember what has happened in their past. Plus, they can anticipate what might occur in the future based on the things they remember. Their bodies are amazing, too. An octopus can squeeze through tiny holes no larger than the space between its camera-like eyes. They can change colors and skin textures on command and become nearly impossible to see. Two or more octopi appear to cooperate telepathically to coordinate a hunt (or to frustrate researchers trying to capture them).

Grandpa Glenn says that the octopus' intelligence level is far greater than humans can actually measure. But it's commonly agreed that they have cognitive and physical abilities that even humans can't match. Here's something wild to think about: A few scientists are suggesting that the octopus is so unique that it may have evolved from a life that didn't originate on Earth! The theory is called panspermia, and it supports the possibility that frozen eggs (or another simple life form), which eventually evolved into the octopus and its cephalopod cousins, were carried to Earth on an icy comet some 540 million years ago. The theory sounds a little crazy, and it's far from being accepted by everyone. But who knows, maybe Emaline was shaking the tentacle of an alien!

Emaline was lying still in the water as the octopus came into clear view. Not moving or blinking, they looked at each other for a long time. The only sounds were Emaline breathing through her snorkel and the sound of her own heart pounding.

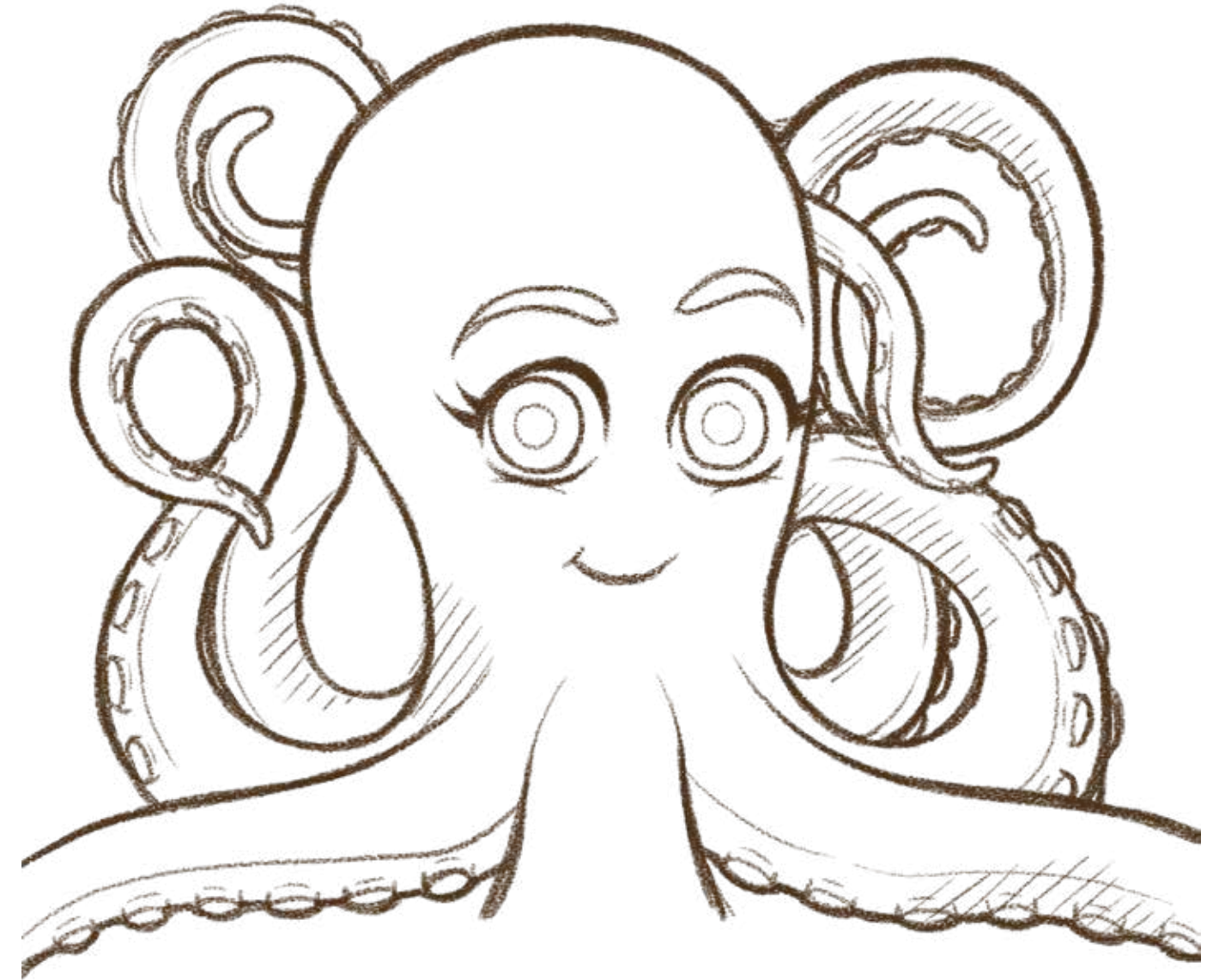
The octopus could tell that Emaline was no threat, and that they were both nervous. When the octopus slowly put out one tentacle, Emaline remained still. The octopus stretched out its tentacle even farther into the space between them, and curled just the very tip—like a finger inviting Emaline to come closer.

Emaline eased her hand forward but otherwise remained still. She slowly pointed her finger toward the octopus. The single tentacle cautiously encircled Emaline's hand, its sensors testing the water for her scent and checking to see if this gentle, unfamiliar girl was broadcasting any signals that might help it identify her. Emaline could tell that the octopus was just checking her out. The creature liked her smell and sensed the electrical pulses created by Emaline's heartbeat. Now, the two slowly came closer.

The octopus gently wrapped its tentacle around Emaline's hand. It felt very smooth but a little sticky as it examined her. Emaline did not hear a thing. But she felt it—the presence of another intelligent being—an equal in many ways, but dramatically different in others.

Emaline would never be the same.

Ask your parents to help you search Google for "BBC Earth Kids Octopus"



Use your crayons to color your octopus and give it a name.

As they knew it would, vacation time was coming to an end. The day before they had to leave for Colorado, Emaline and Stella spent most of their time in the tidal pool. But they just couldn't make themselves say goodbye to their new friends. It was just too hard.

The next day, Mom and Dad asked Emaline why she and Stella were acting so sad, just lying on the floor. "We never said goodbye to our friends," said Emaline. "They will wonder what happened to us when we leave." Mom said, "Well, then you two should get out to that pool right now and give those creatures a proper goodbye!" With Stella on her heels, Emaline jumped up, charged into the bedroom and quickly changed into her swimsuit. As they rushed toward the front door, Mom handed Emaline her snorkel gear and Stella's fishbowl.

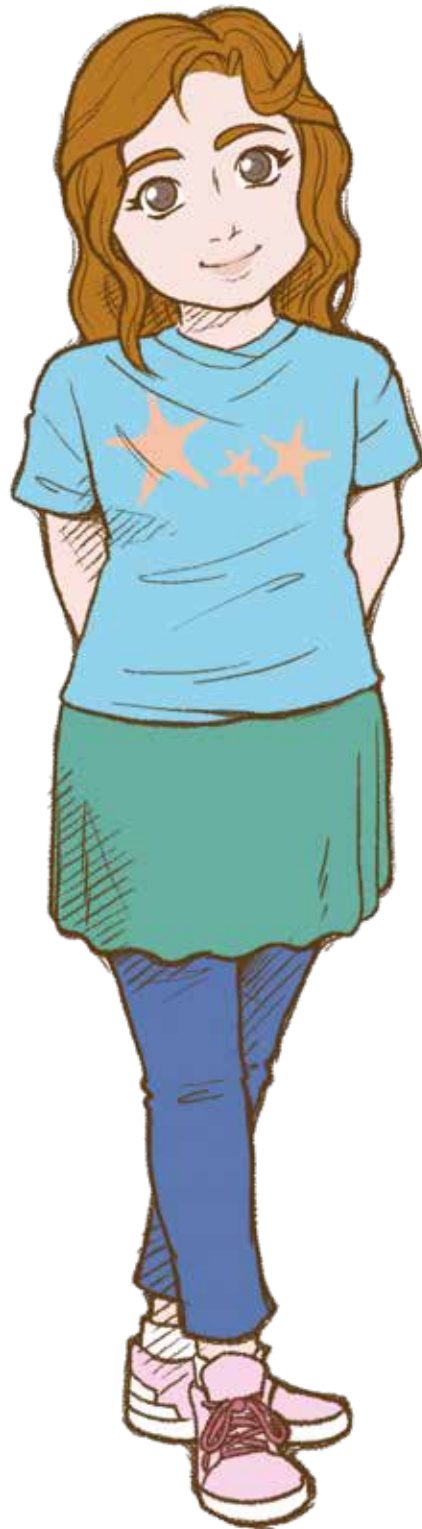
At the pool, they were both underwater in a flash. Emaline began to talk through her snorkel, but even she couldn't understand what she was saying. But that didn't seem to matter to her friends. They understood that the time had come to say goodbye. As Emaline held out her hand, several of the creatures swam closer, and some lightly touched her arm. Lilac the Octopus wrapped four tentacles around Emaline's hand and gave it a gentle squeeze—an octopus hug!

Then the ferry whistle blew. Emaline, Stella and their friends had indeed said a proper goodbye. The pair ran back to the house and quickly dried off. Emaline changed into her travel clothes, and the family was off to the Ferry Dock. They boarded the ferry, and as it slowly pulled away from the dock, it passed the tidal pool. Emaline, Stella, Aaron and Christie could see all of the creatures waving their final goodbye at the surface and at the water's edge. The family returned the wave, and Stella barked. Mom and Dad had never seen anything so amazing..

As the tidal pool shrank from view, Emaline sighed, "I know I'll never see them again, but I'm sure they'll be visiting me in my dreams. I will never, ever forget my Tidal Pool Adventure." Mom and Dad shared yet another loving smile.







## Emaline and Stella



Emaline Mae Butler is a 4th grader residing in Colorado with her mom and dad, dog Stella, as well as the frogs and fish in her aquarium.

Emaline has lots of interests. She loves drawing, writing and storytelling. She's learning piano and has acted in local theater company performances of "Annie," "Harry Potter," and "The Aristocats." She enjoys mountain hiking, roller coasters, and traveling to new places with her family.

Emaline's parents, Christie and Aaron, are aerospace engineers who met while working on the International Space Station program at NASA. Her extended family includes musicians, artists, engineers, pilots, architects, educators, and (no surprise) scuba divers.

Despite living in landlocked locations her whole life, Emaline's passion for the ocean and the animals that live there began at a very young age. Recently, Emaline snorkeled with her family in the Caribbean and met real-life creatures like the ones in this book. The trip reinforced her (current) dream of someday becoming a marine biologist. She's a huge fan of underwater scientists, including Sylvia Earle, PhD, and "The Shark Lady," Eugenia Clark, MA, PhD.

This book's concept, underwater characters, and storyline are largely Emaline's, with a little help from family and friends—especially her Papa Tom, a musician and pilot, and her Grandpa Glenn, who inspires her with stories from his career as a commercial diver, and is a true expert at answering all of her questions about our amazing underwater world.

# glossary

Here are some of the words and terms you may have learned in this book.

## **adaptation** [ ad-uhp-tey-shuhn ]

A change made in response to the environment. For instance, when ammonites lost their shells and became squid so that they could move more quickly to escape from predators.

## **anemone** [ uh-nem-uh-nee ]

Typically, a small, sedentary marine animal having a column-shaped body and one or more tentacles surrounding its mouth. Named after the flower your mom may grow in her garden. Sea anemones may live up to 100 years.

## **angelfish**

A colorful saltwater fish found on shallow tropical reefs and in many aquariums. There are also freshwater angelfish, but their colors aren't as brilliant. The Gulf Stream carried the angelfish in this story far from its home.

## **anglerfish**

A bony saltwater fish with a large mouth, sharp teeth, and a special fin ray on its head that acts as a lure to catch other fish. Fang seemed to like hotdogs, too.

## **ammonite** [ am-uh-nahyt ]

An extinct sea creature with a coiled shell from which modern squid evolved. We know about ammonites because of the fossils they left behind.

## **calamari** [ kal-uh-mahr-ee ]

Squid that is used as food for people. It can be eaten cooked or raw. Or in Emaline's case, not at all.

## **cephalopod** [ sef-uh-luh-pod ]

A sea creature having tentacles attached to its head. It can move quickly by squirting out water under high pressure. Cephalopods often have arms with suckers around the front of their heads, large eyes, and a sac filled with ink when they need camouflage.

## **cetacean** [ si-tey-shuhn ]

Aquatic sea creatures that are mammals, including whales, orcas (killer whales) and dolphins. All of these sea creatures feed on their mothers' milk when they are babies. Emaline thinks that milk would be hard to drink while swimming in the ocean!

## **chromatophore** [ kruh-mat-uh-fawr ]

A cell that produces a temporary color that's used to camouflage certain sea creatures while hunting or hiding. Even some land creatures have these cells, including chameleons.

## **Coenobita Clypeatus** [ see-nuh-bee-tuh ] [ klip-ee-ey-tus ]

A species of hermit crabs native to the Western Atlantic Ocean. They live in empty seashells to protect their soft undersides, and they sometimes decorate their shells with items they find.

## **cognitive** [ kog-ni-tiv ]

Relating to the ability to know, understand and remember. The octopus has extremely high cognitive abilities.

## **comet** [ kom-it ]

A space object that orbits the Sun, made up of frozen gasses, rock and dust. As they get closer to the Sun, they may form a "tail" of melted dust and gas that's millions of miles long. NASA knows of 3,743 comets, but there are probably billions in our solar system!

## **constellation** [ kon-stuh-ley-shuhn ]

A grouping of stars named for its shape, as viewed from Earth. Ursa Major (large bear), Canis major (large dog), Orion (hunter with a bow), Pisces (fish) are a few examples.

## **Crustacean** [ kruh-stey-shuhn ]

A class of sea creatures typically having a hard shell or crust, including lobsters, shrimps, and crabs.

## **cuttlefish** [ kuht-l-fish ]

A cephalopod that has eight arms and two tentacles with suckers. It can squirt black ink into the water to escape threats. They have a unique internal shell called a cuttlebone, which is used to control their buoyancy (how "floaty" they are).

## **Earth's Magnetic Field**

A geomagnetic field that extends from our planet's core into space. It's the invisible force that makes compasses point north and helps humans and many animals navigate. It also helps protect us from some of the Sun's harmful rays.

## **exoskeleton** [ ek-soh-skel-i-tn ]

A hard outside shell that protects the soft tissues of animals that don't have bony skeletons.

## **hemocyanin** [ hee-muh-sahy-uh-nin ]

A blue, copper-containing protein in many sea creatures that makes their blood appear blue-green in color.

## **hemoglobin** [ hee-muh-gloh-bin ]

A protein in a mammals' red blood cells that carries oxygen and makes the blood appear red.

## **hermit crab**

Any number of crab types that protect their soft abdomen by living in castoff shells from snails and certain other shelled animals. Hermit crabs have to move into larger shells as they outgrow older ones.

## **Invertebrate** [ in-vur-tuh-brit, -breyt ]

An animal without a backbone.

## **Jellyfish**

Sea creatures with soft, jelly-like structures. Many have umbrella-shaped bodies and long tentacles that trail from them. A sting from certain kinds of jellyfish tentacles can be very painful to humans.

## **meteor** [ mee-tee-er ]

An icy or metallic "space rock" that enters the Earth's atmosphere at high speed, creating a bright flare or what many people call a "shooting star." Earth gets 17,000 meteors per year. Around 17 per day reach the ground and then are called meteorites.

## **meteorite** [ mee-tee-uh-rahyt ]

A "space rock" that passes through the Earth's atmosphere and reaches the surface. Space rocks smaller than a football field typically break apart in the atmosphere and burn up. Usually less than 5 percent of the original object will make it to the ground, and they range between the size of a pebble and a fist.

**Milky Way**

The Earth's home galaxy, which contains approximately a trillion stars, including our own sun and other planets in our solar system. You can see through the edge of the Milky Way disc on a clear dark night when you're away from city lights.

**Mollusk** [ mol-uhsk ]

An invertebrate creature with a shell of one or more pieces that covers all or part of its body. There are 100,000 species of mollusks, including clams, snails, and scallops. Although they no longer have shells, squids and octopi are also mollusks.

**molt** [ mohlt ]

To shed shells or other body coverings that will be replaced as the animal grows.

**nautilus** [ not-l-uhs ]

A sea creature with a spiral shell with chambers and shiny insides.

**Northern Lights**

Beautiful dancing rays of light resulting from the Sun's energy impacting the Earth's upper atmosphere. Mostly visible from far-northern locations (and from space). There are also Southern Lights.

**octopus** [ ok-tuh-puhs ]

An intelligent sea creature with a soft oval body and buggy eyes. They have eight flexible tentacles that feature strong suckers. More than one octopus can be called either octopi (Latin) or octopuses (English).

**oxygenate** [ ok-si-juh-neyt ]

To enrich the blood with oxygen. Humans do it with their lungs. Fish do it with gills.

**panspermia** [ pan-spur-mee-uh ]

An controversial, unproven theory that life originated in space and is continuously distributed throughout the Universe by comets and meteorites.

**pigmentation** [ pig-muhn-tey-shuhn ]

Coloring or tinting the skin with colored substances called pigments. Many sea creatures use pigmentation to make it difficult for prey or predators to see them.

**pincers** [ pin-serz ] or **pinchers** [ pin-cherz ]

A gripping tool made up of two movable parts; for instance, a crab's claw. If you're not careful, you might get a pinch from a pincer!

**predator** [ pred-uh-ter, -tawr ]

A creature that exists by preying on other creatures. A predator that isn't normally prey to others is called "apex predator."

**prehensile** [ pri-hen-sil, -sahyl ]

The ability to grasp or take hold of something. Like the seahorse, an opossum has a prehensile tail.

**seahorse**

A fish whose head looks like the tiny head of a horse. Seahorses have prehensile tails to anchor themselves to coral reefs or other objects, even each other.

**sea turtle**

Turtles that live in warmer ocean waters that have paddle-like flippers and hard or leathery shells. Although they return to the surface to breathe air, they can remain underwater for 4 to 7 hours. They can live 50 years or more.

**Sea urchin** [ ur-chin ]

Urchins have rounded or flattened shapes and hard, sharp spines that stick out to protect them. They live in shallow water attached to coral, rocks, and crevices. They release venom if they attach to an object, so stepping on an urchin and getting stung is a real pain!

**Snorkel** [ snawr-kuhl ]

A tube that allows a person to breath through their mouth while their face is just under the water. Using a mask and snorkel allowed Emaline to see her underwater friends more clearly, and for a much longer period of time, than just holding her breath.

**species** [ spee-sheez, -seez ]

The basic way we organize and sort the animal kingdom. Animals in a certain species look similar and are able to reproduce babies of the same species. Members of different but similar species may be able to breed, but they are not able to reproduce young.

**sponge** [ spuhnj ]

An aquatic creature with a porous (full of holes) structure that allows water to circulate through it. Sponges used by humans these days are mostly artificial, not creatures from the sea. They are manufactured and produced in a factory.

**squid** [ skwid ]

A cephalopod with a slender body with ten arms, two of which are round pads used to clasp prey. Squid descended from ancient ammonites. Emaline thinks the very first squid must have felt kind of weird because it didn't have a shell like everyone else.

**stone crab**

A crab found in the western North Atlantic Ocean. It is harvested for food by removing the large claw and returning the crab to the ocean. Most survive and grow a new claw.

**tentacle** [ ten-tuh-kuhl ]

A slender, arm-like organ that allows certain sea creatures to touch, capture and hold items and prey. Octopus, jellyfish and sea anemone have tentacles. The tentacles of all jellyfish have chemicals called toxins that help them capture food.

**thermal** [ thur-muhl ]

Something caused by or associated with heat or temperature.

**tropical** [ trop-i-kuhl ]

A place with a hot, humid climate. The tropics are regions located north and south of the Earth's equator. Plants and animals in tropical areas are often very different from those in cooler places.

**whale**

A large mammal with a fish-like body and flippers that have evolved over millions of years from limbs. Like all other mammals, whales breathe air. Some whales can stay underwater for 90 minutes. Scientists tell us that whales are related to hippopotamuses.

