CROCODILE COUNTRY

A SCIENCE 3D ADVENTURE

GRADE 5

By MIKE HEITHAUS Ph.D

symbio education™

KEY WORDS

Look for these words and try to figure out their meaning.

AQUATIC

ATMOSPHERE

BIOSPHERE

COURTSHIP

CROCODILIANS

DEPOSITION

ECTOTHERM

EROSION

ESTUARY

EVAPORATION

EXTINCTION

FORCE

SCAVENGE

TERRESTRIAL

TRANSPIRATION

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CROCODILE!

For millions of years crocodiles have been the undisputed master predators of their watery domains. Growing to enormous sizes and equipped with explosive power and some of the most powerful jaws on the planet, even big animals have to be careful coming to the water for a drink if a crocodile is around. Crocodiles and their alligator relatives can send a chill down the spine of somebody who doesn't know much about them. Although they can be dangerous to people, crocodiles and their relatives are important members of their ecosystems. Many of their populations were hunted to near **extinction**, but people have helped most species begin to recover and take back their place in ecosystems. People need to find ways to protect themselves, their pets, and these incredible reptiles. We are going on a mission to keep both crocs and people safe. But first, let's explore crocodiles and their world!

A Nile crocodile tries to catch a wildebeest.

CROCODILES, ALLIGATORS, CAIMANS AND GHARIALS

Crocodiles are reptiles. They are cold-blooded with tough skin and dry scales. They lay their eggs on land. The eggs are covered with leathery shells that keep them from drying out. Today, there 27 species sorted into three groups of "crocodiles." The groups are true crocodiles (17 species), alligators and caimans (8 species), and the gharials (2 species). Today, these groups together are called "**crocodilians**."

Saltwater crocodile

Crocodilians range in size from the dwarf crocodile that is less than two meters (6.2 feet) and 32 kilograms (70 pounds) to the saltwater crocodile that can grow to 7 meters (23 feet) and over 1,000 kilograms (2,200 pounds).

Dwarf crocodile

The easiest way to tell the three groups of living crocodilians apart is to look at their snouts. Alligators and caimans tend to have more rounded snouts. The teeth in their lower jaw aren't visible when their mouth is closed. This is because the teeth of their lower jaw fit into holes in the upper jaw. That means the teeth can only be seen from the upper jaw. Crocodiles have more narrow and triangular snouts. When their mouths are closed their teeth can be seen from both upper and lower jaws. Gharials are hard to miss! They have very long narrow jaws with a lot of very pointy teeth!

The first relatives of crocodiles appeared around 225 million years ago. These early crocodiles varied in size from fairly small to huge. *Deinosuchus* grew to 10 meters (31 feet) and 5,000 kilograms (11,000 pounds)! It lived around 75 million years ago. Dinosaurs would have been on its menu!

Deinosuchus riograndensis
10 meters long; lived 82 to 73 million years ago

Some ancient crocodiles grew to huge sizes.

Broad-snouted caiman

HABITATS

American alligators can tolerate cold temperatures. When the water starts to freeze around them, they stick their snouts above the surface to breathe through the ice.

Crocodiles and their relatives are mainly found in the tropics, where the temperatures are above freezing. Because they are **ectotherms**, their bodies are the same temperature as the air or water around them. If they stayed cold too long, they would die. But American alligators and Chinese alligators can live in some temperate areas. These are places where the air temperature gets below freezing in the winter.

Crocodiles change their behavior to warm up and cool down. When they want to warm their bodies up, they climb out of the water and bask in the sun. To stay cool in the tropical heat, crocodiles can find shade, take a dip in the cool water, or open their mouths. The **evaporation** of water from inside their mouths cools them down!

Nile crocodile

All species of crocodilians spend time in freshwater. Alligators, caimans, and gharials all live almost exclusively in freshwater. Recently, scientists learned that some alligators travel to saltwater habitats to feed. But because it is too salty, they can't stay long before they have to return to fresh water.


American alligator

Crocodilians are found in many different kinds of freshwater habitats. Some are in rivers with clear water and fast currents. Others are found in huge slow-moving rivers, ponds, backwaters, or lakes. Large shallow wetlands are home to a variety of crocodilians around the world. Some crocodilians can even live in areas where their watery homes dry up seasonally. They can dig burrows to sleep in through the dry season!


Nile crocodile

No species of crocodile lives only in saltwater. But some species are at home in the oceans. The American crocodile can be found in shallow ocean waters. The saltwater crocodile of northern Australia and Asia is usually found in large rivers or **estuaries**. But they are sometimes found far out to sea. One saltwater crocodile traveled 590 kilometers (366 miles) across open ocean in just 25 days. That is one reason they are found in so many places, including on remote islands!


American crocodile

Crocodiles are built for the water, but they can also be pretty fast on land! If needed, they can walk for long distances to find a new place to live. They can also "belly run" on land at speeds of up to 10 kilometers per hour (6 miles per hour). The freshwater crocodile of Australia can gallop at up to 17 kilometers per hour (11 miles per hour)!


Nile crocodile

Some crocodile species are at home in the ocean (top). In Africa, several species of crocodiles spend a lot of their time hunting on land in forests and swampy areas. They can be fast on their feet (bottom).

CROC MENUS

Crocodiles don't have to eat a lot. In fact, a big crocodile that has been eating well may be able to go a year without eating! But they prefer to eat often.

Crocodiles and their relatives are almost all carnivores. They eat meat. While some species occasionally eat fruit, most populations don't eat any plants at all. Many species are generalists. That means they will eat just about anything they can get their mouths on. And when they do catch something, they don't let go easily! In fact, crocodiles have one of the strongest bites on the planet! They don't chew their prey. They either swallow it whole, or they tear it into chunks. With their impressive jaws, crocodiles can grab onto prey and roll their bodies until they separate smaller pieces to swallow.

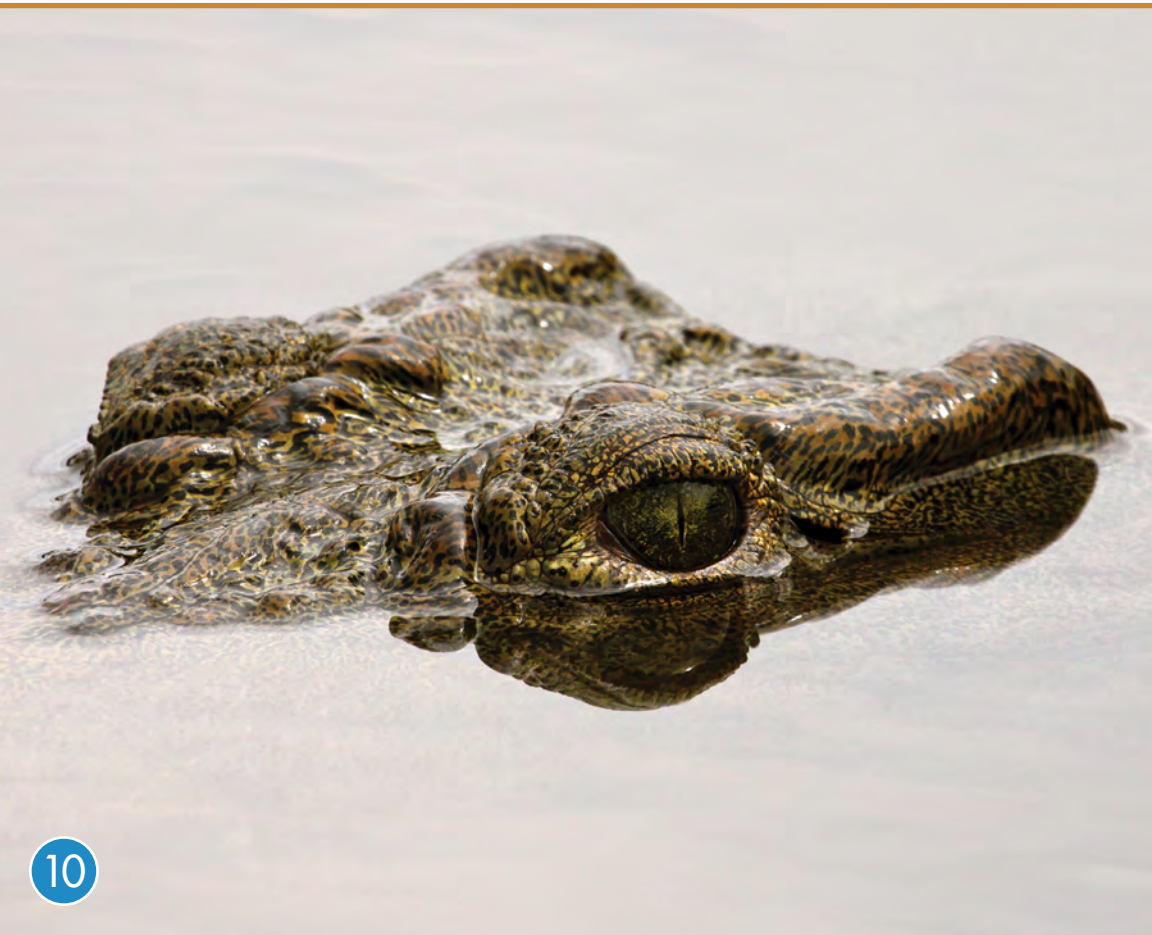
Crocodilians eat **aquatic** prey like fish, turtles, crabs, snails, amphibians, and sometimes even small sharks. They also eat **terrestrial** prey like birds, raccoons, wild pigs, deer, wildebeest, zebra and many more. In fact, just about any animal that comes to drink in crocodile territory is at risk. Only the animals that are too big to handle are safe. Crocodiles also won't overlook a free meal and will **scavenge** dead animals.

A lot of the prey that crocodilians eat have hard parts like thick bones, shells, and hooves. But they have the most acidic stomachs of all vertebrates. That helps them digest these hard substances.

CROCODILE BEHAVIOR

Crocodilians have the most complex brains of any reptile. Their brains help them do many impressive behaviors. They also have incredible sensory systems. They have a good sense of smell and hearing. Special receptors on their skin detect minute vibrations in the water. These "dome pressure receptors" are a crocodile super sense! They detect touch, temperature, and chemicals. A complex brain combined with amazing senses results in one impressive predator.

Most crocodilians are ambush hunters. With nostrils at the end of their snouts and eyes on the top of their heads, they can lie motionless while they wait for prey to approach. Then they can burst at incredible speeds to grab their meals!



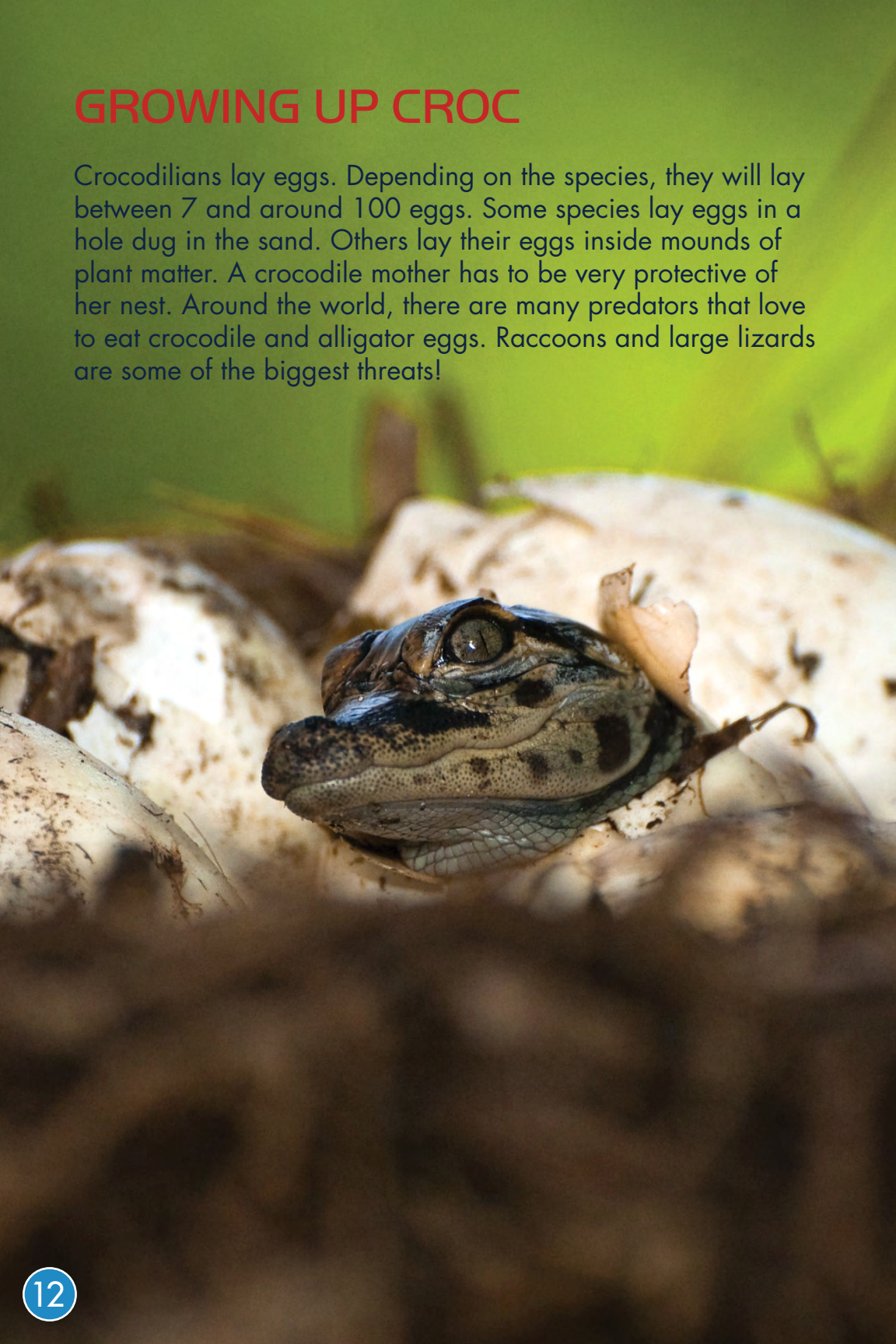
Crocodiles can be found together in very large numbers. Most species are not territorial. But, during the breeding season they stake out their own territories. For crocodiles, size matters. The biggest individuals will usually get better basking spots. They also get the most food when a group is eating a large animal. And, larger males are often most successful at mating.

Compared to other reptiles, crocodilians are very vocal. Some species make more than 20 different sounds. They can bellow, chirp, and hiss. Many calls are used in **courtship** displays. Males of some species bellow to attract females and engage in other displays like splashing their head on the water. Other sounds are used to communicate with rivals during mating season. Babies make "alarm calls" when they are in trouble. When adults hear a baby in distress, they will come to protect the baby!

The loud roar of an American alligator's mating call causes the water around it to vibrate!

GROWING UP CROC

Crocodilians lay eggs. Depending on the species, they will lay between 7 and around 100 eggs. Some species lay eggs in a hole dug in the sand. Others lay their eggs inside mounds of plant matter. A crocodile mother has to be very protective of her nest. Around the world, there are many predators that love to eat crocodile and alligator eggs. Raccoons and large lizards are some of the biggest threats!



After about two to three months, the eggs hatch. Whether the baby that hatches is a male or a female depends on the temperature of the egg while it developed. At lower temperatures, females are produced. Males are produced at higher temperatures.

Babies have a tough piece of skin on the tip of their snouts called an "egg tooth" that helps them break through the shell. They quickly lose the egg tooth once they hatch. Babies stay together in the same area near their nest. They benefit from their mother's protection. Because of their small size, baby crocodiles have many predators including wading birds like herons. But a protective mom helps improve their chances of survival!

Alligators and some crocodiles build mounds of vegetation where they lay their eggs. Females protect the nest from egg predators.

WHY CROCS ROCK

Not only are crocodiles and their relatives awesome animals, they are also important for ecosystems. They are sometimes known as "ecosystem engineers." The burrows (or holes) they dig that fill with water provide habitats for other species. In the Everglades of Florida, American alligators create "ponds." These ponds are a place where fish and other animals can live when much of the marsh dries up. Crocodiles and alligators may affect other species too. For example, gators may keep racoons away from areas where birds called egrets nest. That protects the bird eggs from being eaten by raccoons.

Nile crocodile

NILE CROCODILE!

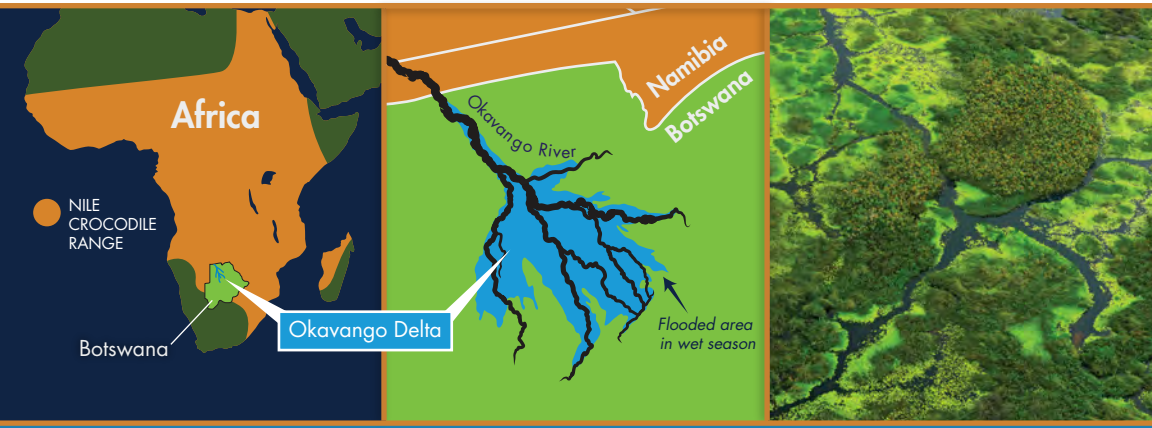
Nile crocodiles are native to Africa. They are found in rivers, lakes, and wetlands on the continent and in Western Madagascar. Nile crocodiles are the second largest species of crocodile in the world. The largest grow to be over 6 meters (20 feet) long and can weigh 1,000 kilograms (2,200 pounds)! But most are smaller and typically grow to between 3 and 4 meters. Like other crocodilians, male Nile crocodiles are bigger than females.

Female crocodiles dig a nest into the sand near the water. Then they lay between 25 to 80 eggs. Bigger females lay more eggs. Females guard their nests for the 90 days before the eggs hatch. They have to protect their eggs from predators like the Nile monitor lizard! When they hear their babies chirping as they try to break through their eggs, they start digging them out of the sand. When the hatchlings emerge from the nest, the mothers carry them to the water in their mouths! They even use their mouths to help babies get out of their eggs!

A mother Nile crocodile may protect her young for up to two years after they hatch! Sometimes she will scoop them up in her mouth to keep them safe. Large lizards, big fish, birds of prey, snakes, and mammals all eat small crocodiles. When they are small, young Nile crocodiles seem to spend a lot of time on land. They eat a lot of terrestrial insects! Once they are about 1.2 meters (4 feet), they are ready to venture away from mom! We still don't know how long Nile crocodiles live, but it may be 70 to 100 years!

OKAVANGO

Botswana is one of the most amazing places in Africa to see wildlife, including Nile crocodiles! The Okavango Delta is the best place to observe them! It is a huge wetland, but its size changes a lot between the two seasons in the delta. In fact, floods in the wet season may triple its size!



Left: Range of the Nile crocodile in Africa. Middle: The location of the Okavango Delta in Botswana. Right: The Okavango Delta full of water in the wet season.

The Okavango Delta shows how water shapes the land. Heavy rains fall upstream of the delta. Water that fell from the **atmosphere** causes floods that **erode** sediment and carry it downstream. The flowing water cuts through the land. As the water reaches the delta, it slows down and the sediment falls to the bottom. This is called **deposition**. The water in the delta stops flowing. But this is not its last stop! The hot sun causes evaporation. Water vapor moves back into the atmosphere. Other water is taken up by plants and enters the **biosphere**. Some of this water in plants is released back to the atmosphere through plant leaves. This is called **transpiration**.

As the rains stop and evaporation and transpiration continue, the land dries out. The water recedes. The Okavango becomes a very different place.

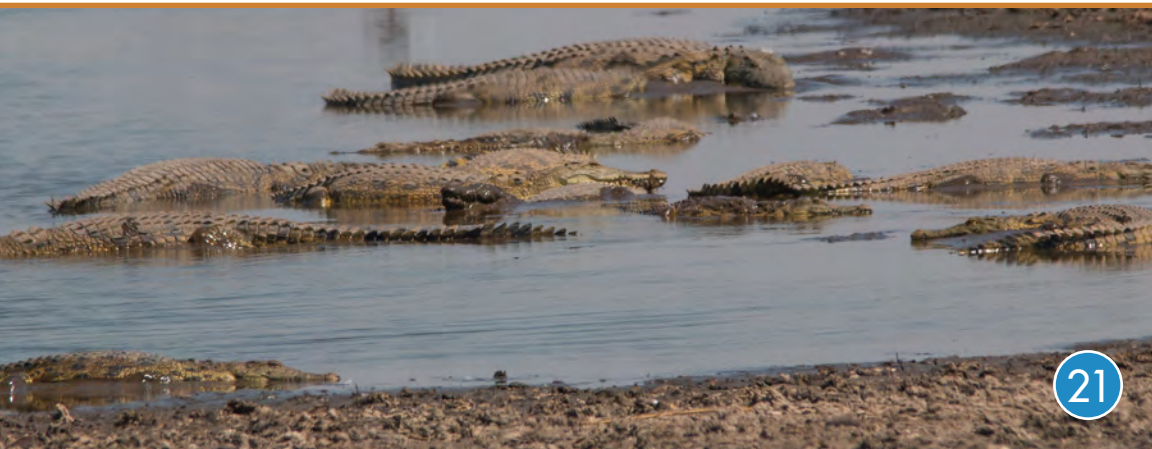
The animals of the Okavango have adapted to its seasonal changes. In the wet season, predators and prey that normally don't spend time swimming or walking through waters have to swim, wade or run. They have to do this to get to islands with food, chase their prey, or escape from predators. Even lions in the Okavango take to the waters! And when these animals cross the waters, they may encounter a Nile crocodile!

In the Okavango and through a lot of their range, Nile crocodiles share their watery home with hippos. The hippopotamus is a large mammal that spends most of its time in the water. But, to feed, hippos come ashore at night to graze. Hippos may look too big and clumsy to be dangerous, but looks can be deceiving. Hippos have huge teeth that they use in battles with other hippos. They can run and swim quickly. Entering a hippo's territory can be dangerous. Even Nile crocodiles won't fight with hippos very often!

After the dry season, the wildlife, farmers, and other people living in the delta are ready for the waters to return!

Lagoons and water holes form across the drying landscape when the waters begin to recede. The vegetation dries out. Life becomes more challenging for animals that have to concentrate into smaller areas. Hippos and crocodiles have to live in closer contact. Fish get forced into smaller areas, making them easier prey. Land animals have fewer places to come and drink. If they aren't careful, there might be a Nile crocodile waiting to ambush them!

The town of Muan is in the Okavango Delta. Every fall, its river systems fill with water. The water is a relief for the animals and farmers that depend on it. However, the waters can also bring Nile crocodiles.



CROCS IN HUMAN COUNTRY

Because crocodiles are predators that can grow to a large size, they can be dangerous. They can attack people, livestock, and pets. That means people need to find ways to stay safe from crocodiles. Years ago, people hunted them so much that their populations nearly disappeared in some areas. People now understand that crocodilians are important for the ecosystem, but they still need to keep safe.

How can people live with crocodiles? In some parts of the world, signs warn people not to swim or get close to the water in areas where crocodiles are found. In other areas, fences are built to keep crocodiles out of places that people can't avoid. Another method includes catching crocodiles that come too close to where people live. Then they take the crocodiles far away to a new home.

In Muan, the community works together to remove Nile crocodiles from their waters. But, they don't want to kill them.

Brent and Grant Reed are key members of the croc removal team. They are also safari guides and naturalists. They grew up in the Okavango. They understand the behaviors of crocodiles and use that knowledge to figure out ways to catch the crocs. They also collect scientific data on the crocodiles when they catch them!

Signs help educate people on how to stay safe around crocodiles.

CROCS IN TROUBLE

Many types of crocodilians used to be in big trouble. Their populations reached very low levels. Crocodiles and their eggs were hunted for food, and their skins were used for leather and other products. They were killed because they were dangerous.

Luckily, most types of crocodilians are doing much better now. Hunting protections have helped American alligator populations grow. In the 1960s they were protected because they were in danger of going extinct. The strong protection helped! They are now abundant again and are no longer an endangered species. Populations of other species of crocodiles have recovered too. The creation of crocodile farms has also helped increase their numbers. These farms keep people from hunting wild crocodiles. People get the food and products they need to make a living. Nile crocodiles are one of the most farmed species.

Crocodilians still aren't completely safe. When people destroy their habitats for agriculture or cities, or pollute the waters where crocodiles live, crocodiles may need to move or they will die out. Changes in temperatures and climate can also be a problem for crocodiles because the sex of babies is determined by the temperature of the egg as it develops! At lower temperatures, mostly females are produced. When eggs incubate at warmer temperatures, males hatch out. What do you think would happen if it gets too hot?


Orinoco crocodiles

STUDYING CROCODILES

Scientists around the world are racing to learn more about crocodilians. They want to know more about them so they can protect threatened species. They want to learn about their habitats. They want to understand how important crocodilians are to ecosystems. They want to know how far they can move. To do these studies, scientists use a lot of methods. Some are low-tech, such as using a flashlight to count crocodiles at night. Because their eyes have a special layer that helps them see in low light, their eyes glow! That makes counting easy. To learn about what they eat, sometimes scientists just need to watch them and record what they do and what they eat. To see where crocs go, scientists use high-tech devices. They can catch the crocodiles and attach special tags to them. These tags send signals to satellites which then send e-mails to scientists that provide the animal's location.

How are young Nile crocodiles doing in the Okavango? Vince Shacks and the Okavango Crocodile Research Team are trying to find out! They collect data from Nile crocodiles that they capture. They use the data they collect to help people protect crocodile populations. The data can also help keep people safe.

FORCE IT!

You are almost ready to join the mission to learn about Nile crocodiles and help find ways for people and crocs to coexist. But, understanding matter and **force** is critical for scientists studying crocodiles. Crocodiles have amazing jaw muscles for biting down. They generate a tremendous amount of force. This force helps them crush bones and hold onto large struggling prey. But the muscles that open the jaws don't generate much force. In fact, they can't generate enough force to break a few wraps of tape! That is pretty handy for working with crocodiles. Once a scientist gets the croc's mouth shut, they can keep it closed with tape!

Force plays an important role in crocodile feeding and restraint. It is also critical to building a trap to catch a crocodile that needs to be moved. The force of a croc's bite is strong, but the force from their tail is also incredible. A crocodile trap must be able to withstand a lot of force. It needs to be built with the right materials.

Matter is anything that takes up space. Mass is the amount of matter in an object. Matter has many properties. Some of them are color, shape, texture, and hardness. Another is density, or the amount of mass in a particular volume. Denser materials tend to be stronger, and when working with crocs, strong materials are needed.

Now, let's head to Botswana!

GLOSSARY

AQUATIC
living in water

ATMOSPHERE
the air surrounding the Earth

BIOSPHERE
all the life on Earth

COURTSHIP
animal behavior aimed at attracting a mate

CROCODILIANS
crocodiles, alligators, caimans, and gharials

DEPOSITION
the settling of soil or rocks in an area after being moved by wind or water

ECTOTHERM
an animal that gets its heat from the environment; cold-blooded

EROSION
the gradual wearing away of soil, rock, or land by wind or water

ESTUARY
an area where freshwater and saltwater meet

EVAPORATION
the process of liquid turning into gas

EXTINCTION
when a species or type of organism disappears forever

FORCE
a push or pull

SCAVENGE
to feed on dead animals

TERRESTRIAL
living on land

TRANSPIRATION
the process by which water is released into the atmosphere through plant leaves

PHOTO CREDITS

Abbreviation Key: SS = Shutterstock.com

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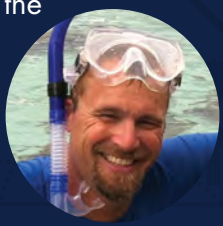
SCIENCE 3D

Thanks for exploring with us! Our science adventures take us around the world to uncover secrets of the most amazing animals and places. Our mission and passion is to share these scientific discoveries with you. There are so many cool things to see out there, even in your own backyard, so get outside and explore!

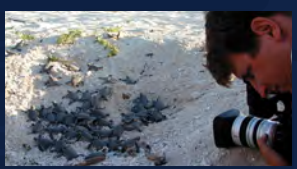
MIKE HEITHAUS PH.D.



Dr. Mike Heithaus is a scientist, explorer, author, educator, and television host. He is a professor of biology and Dean of the College of Arts, Sciences & Education at Florida International University. Mike and his students study sharks, whales, sea turtles, and other large marine animals around the world. They also work with people to help protect these species. Mike loves sharing his work with others. He has written text books and helped create programs for students in elementary, middle, and high school. He has been on television programs including on PBS, National Geographic, and Discovery Channel's Shark Week.

PATRICK GREENE

As a wildlife filmmaker, Patrick has always had a passion for animals. He started to draw pictures of sharks and whales when he was just five years old. Later, he went to college to become a marine biologist and learned a lot about science. Then he got a job in television and learned how to make videos, too. Since then, he's gone all over the world studying and filming wild animals. He's made shows for National Geographic, PBS and ABC, and even won an Emmy Award. He loves making videos to teach students about science and about the many creatures that share our world.



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