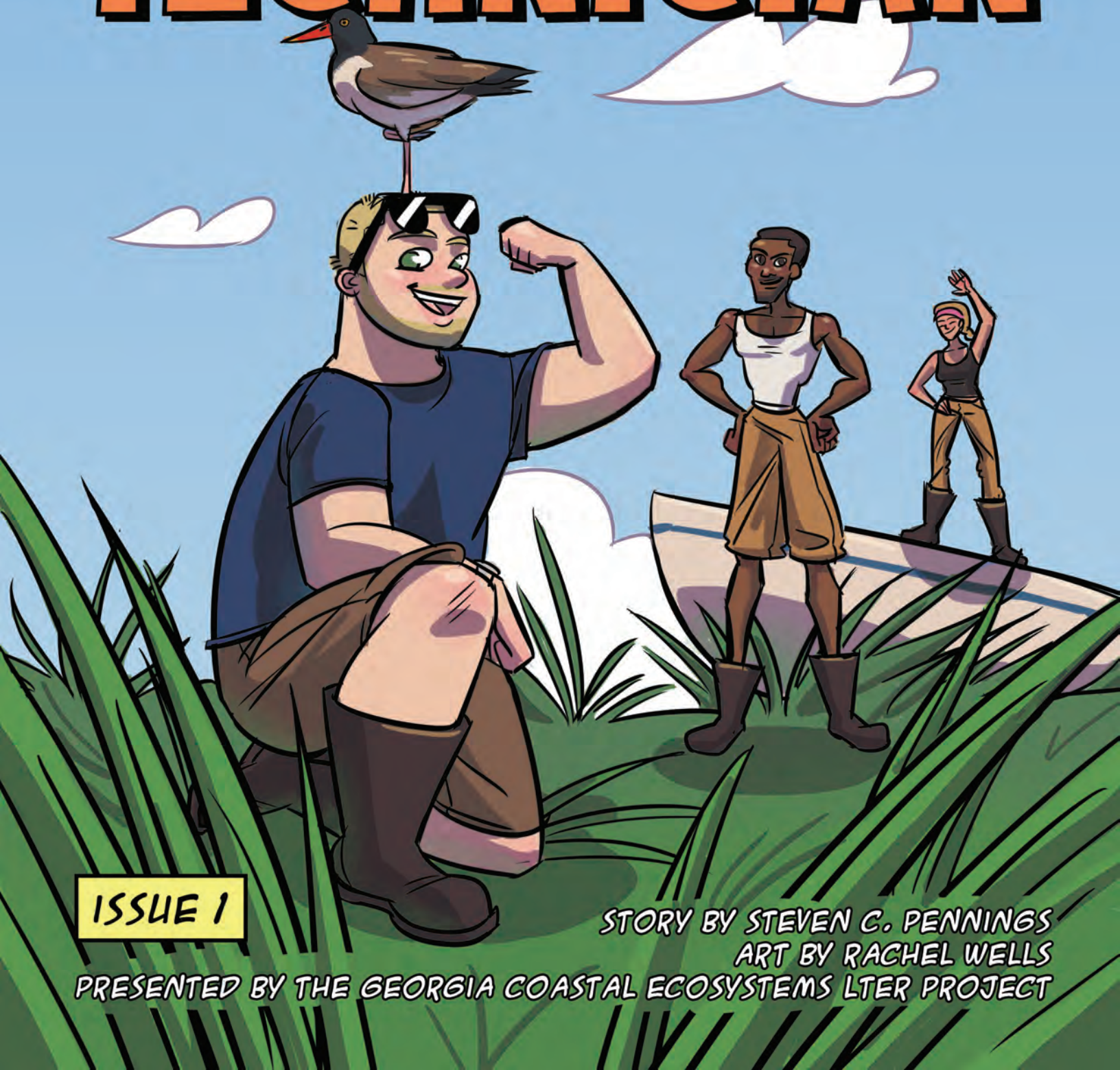


THE ADVENTURES OF **JACOB THE TECHNICIAN**



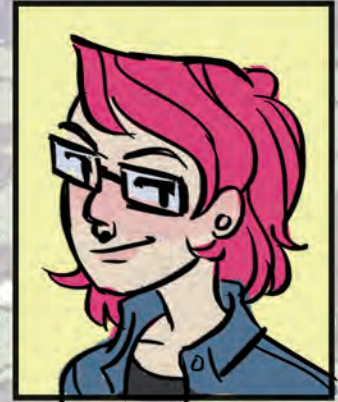
ISSUE 1

STORY BY STEVEN C. PENNINGS
ART BY RACHEL WELLS

PRESENTED BY THE GEORGIA COASTAL ECOSYSTEMS LTER PROJECT



STEVE PENNINGS IS A PROFESSOR IN THE DEPARTMENT OF BIOLOGY AND BIOCHEMISTRY AT THE UNIVERSITY OF HOUSTON. READ ABOUT HIS WORK AT NSMNI.UH.EDU/STEVE



RACHEL WELLS IS A CARTOONIST AND ILLUSTRATOR BASED IN SAVANNAH, GEORGIA. SHE EARNED HER SEQUENTIAL ART DEGREE FROM THE SAVANNAH COLLEGE OF ART AND DESIGN IN 2017. CHECK OUT HER WORK AT BEHANCE.NET/RACHELAWELLS



MERYLL ALBER IS A PROFESSOR IN THE MARINE SCIENCES DEPARTMENT AT THE UNIVERSITY OF GEORGIA, AND THE DIRECTOR OF THE GCE-LTER PROJECT. HER CHILDREN'S BOOK, **"AND THE TIDE COMES IN..."** PORTRAYS THE ADVENTURES OF TWO KIDS IN A SOUTHEASTERN SALT MARSH. JACOB READS IT TO HIS OWN CHILDREN ALMOST EVERY NIGHT.



THE **GEORGIA COASTAL ECOSYSTEMS LONG-TERM ECOLOGICAL RESEARCH (GCE-LTER) PROJECT** IS ONE OF MANY LONG-TERM ECOLOGICAL RESEARCH PROJECTS FUNDED BY THE NATIONAL SCIENCE FOUNDATION. THESE PROJECTS SEEK TO DOCUMENT AND UNDERSTAND LONG-TERM CHANGE IN A VARIETY OF ECOSYSTEMS. LEARN MORE ABOUT THE GCE-LTER AT GCE-LTER.MARSCI.UGA.EDU



TEACHING ABOUT SALT MARSHES

FOR IDEAS ABOUT HOW TO USE SALT MARSHES IN EDUCATION, VISIT GCE-SCHOOLYARD.UGA.EDU/SCHOOLYARD/OVERVIEW.HTM WHERE YOU CAN FIND SUPPLEMENTARY MATERIALS AND LESSON PLANS BASED ON **"AND THE TIDE COMES IN..."** YOU'RE WELCOME TO SUBMIT YOUR ARTWORK BASED ON "THE ADVENTURES OF JACOB" TO STEVE PENNINGS AT SCPENNIN@CENTRAL.UH.EDU

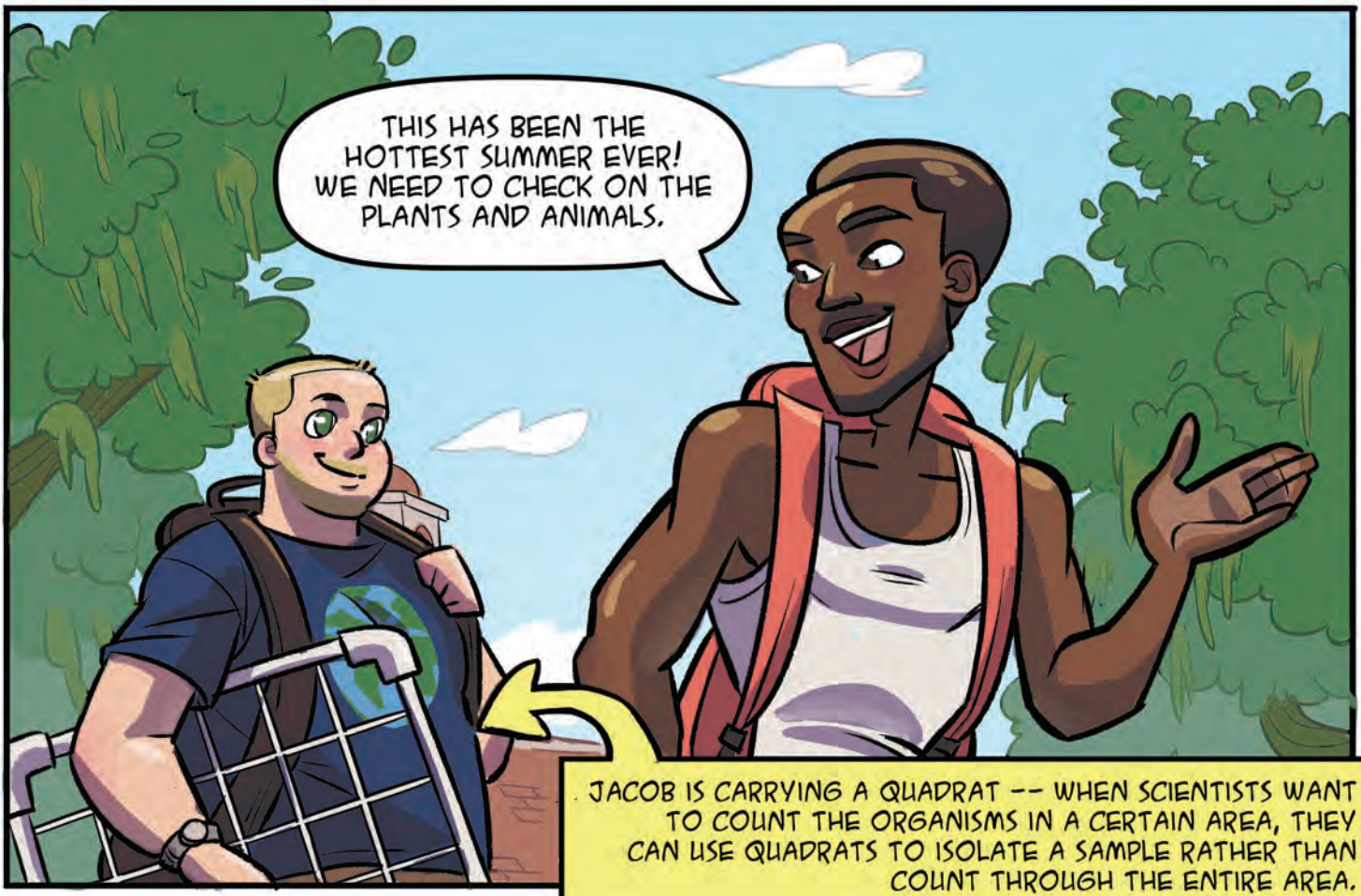
YOU CAN BE A CITIZEN SCIENTIST

THE GCE-LTER PROJECT NEEDS CITIZEN SCIENTISTS LIKE YOU TO HELP US ALIGN THOUSANDS OF PHOTOS INTO A HIGH-RESOLUTION MOSAIC OF THE SALT MARSH, AND IDENTIFY THE SPECIES IN EACH PHOTO. DO YOUR PART AT SCALINGUPMARSHSCIENCE.MARSCI.UGA.EDU AND MARSHEXPLORER.MARSCI.UGA.EDU MAKE SURE YOU HAVE A GOOD INTERNET CONNECTION!

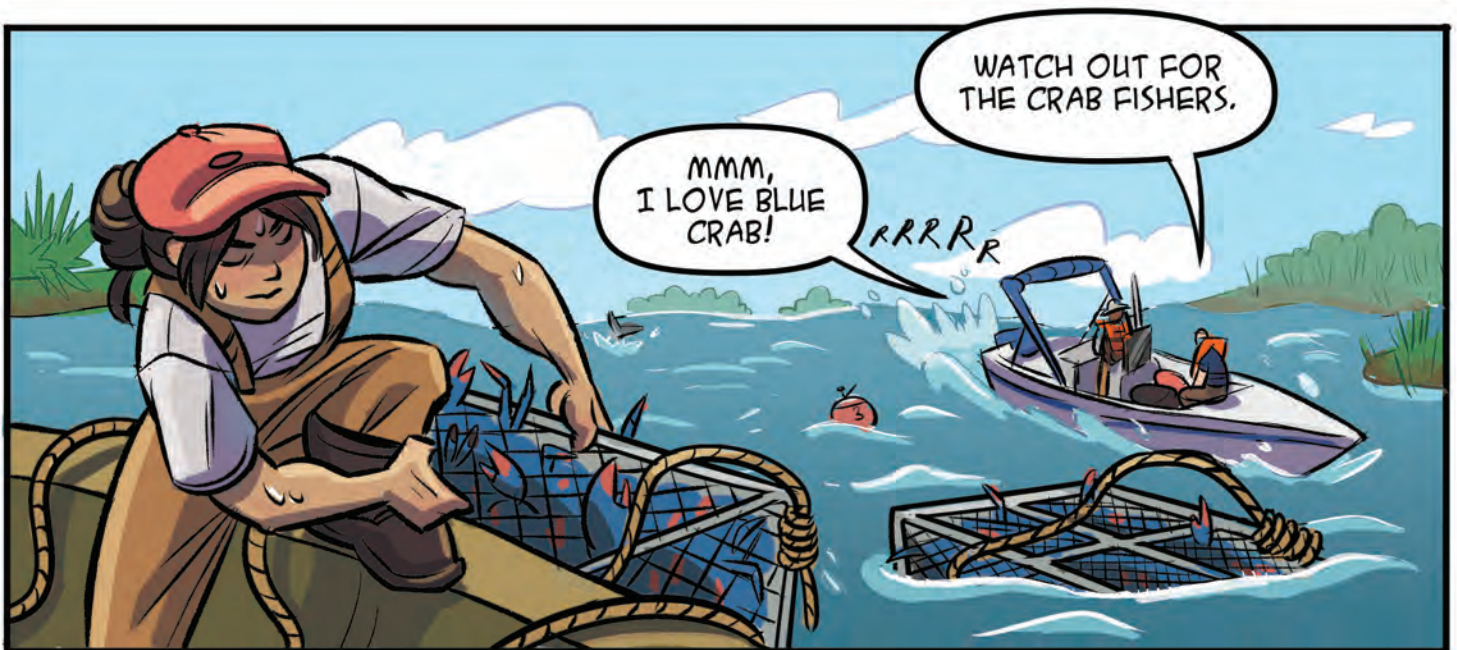
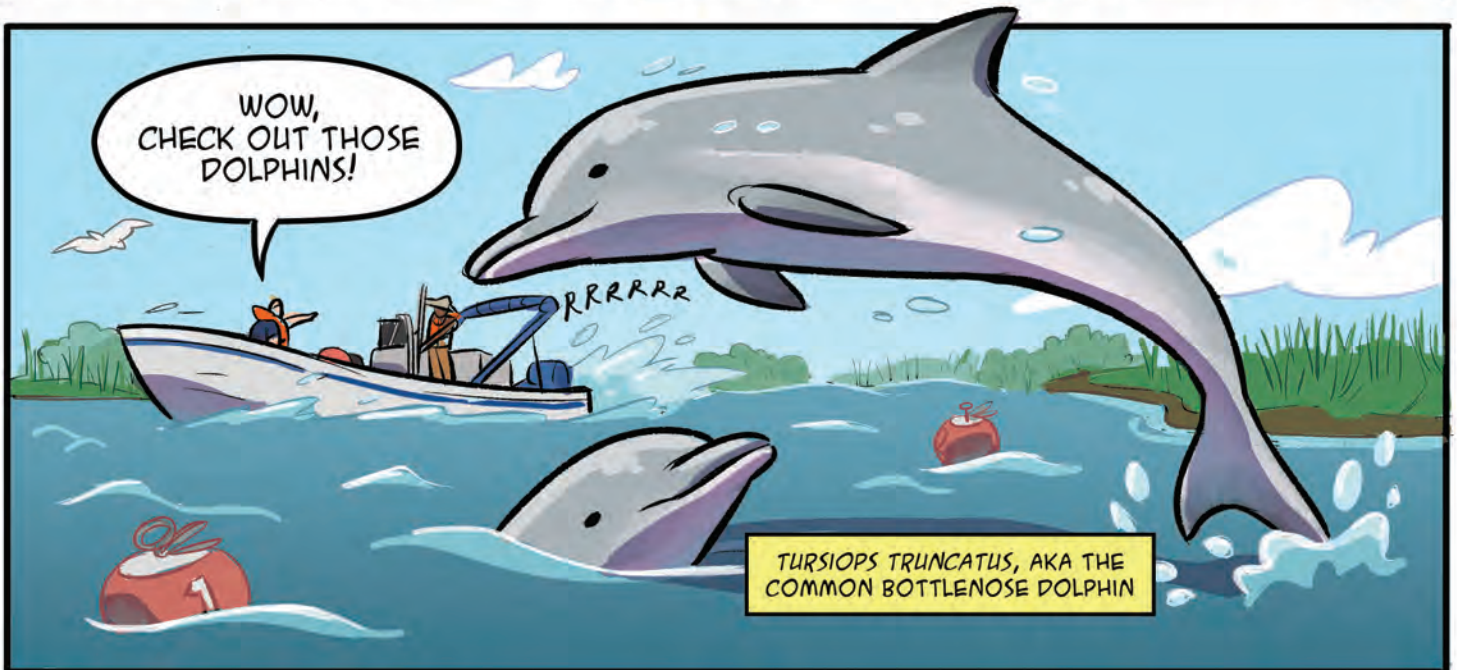
Update: This project is completed; thanks for everyone who helped



MEET DONTRECE AND JACOB -- THEY WORK FOR THE GCE-LTER (THAT'S THE GEORGIA COASTAL ECOSYSTEMS LONG-TERM ECOLOGICAL RESEARCH), HELPING STUDY THE ESTUARIES, SOUNDS AND MARSHES IN AND AROUND SAPELO ISLAND.



JACOB IS CARRYING A QUADRAT -- WHEN SCIENTISTS WANT TO COUNT THE ORGANISMS IN A CERTAIN AREA, THEY CAN USE QUADRATS TO ISOLATE A SAMPLE RATHER THAN COUNT THROUGH THE ENTIRE AREA.





YIKES,
LET'S NOT SAMPLE
OVER *THERE!*

I LOVE EATING
ALLIGATOR.

ALLIGATOR MISSISSIPPIENSIS,
AKA THE AMERICAN ALLIGATOR

IF YOU'RE
NOT CAREFUL
THEY'LL EAT
YOU.

IN THE 50S AND 60S, ALLIGATORS WERE NEARLY HUNTED TO
EXTINCTION -- THANKS TO CONSERVATION EFFORTS, THEY'RE
ALIVE AND THRIVING TODAY!



ALRIGHT,
HOW MANY SNAILS
DO YOU SEE?

HOW TALL
ARE THE MARSH
PLANTS?

FRENCH
PEOPLE EAT
SNAILS.



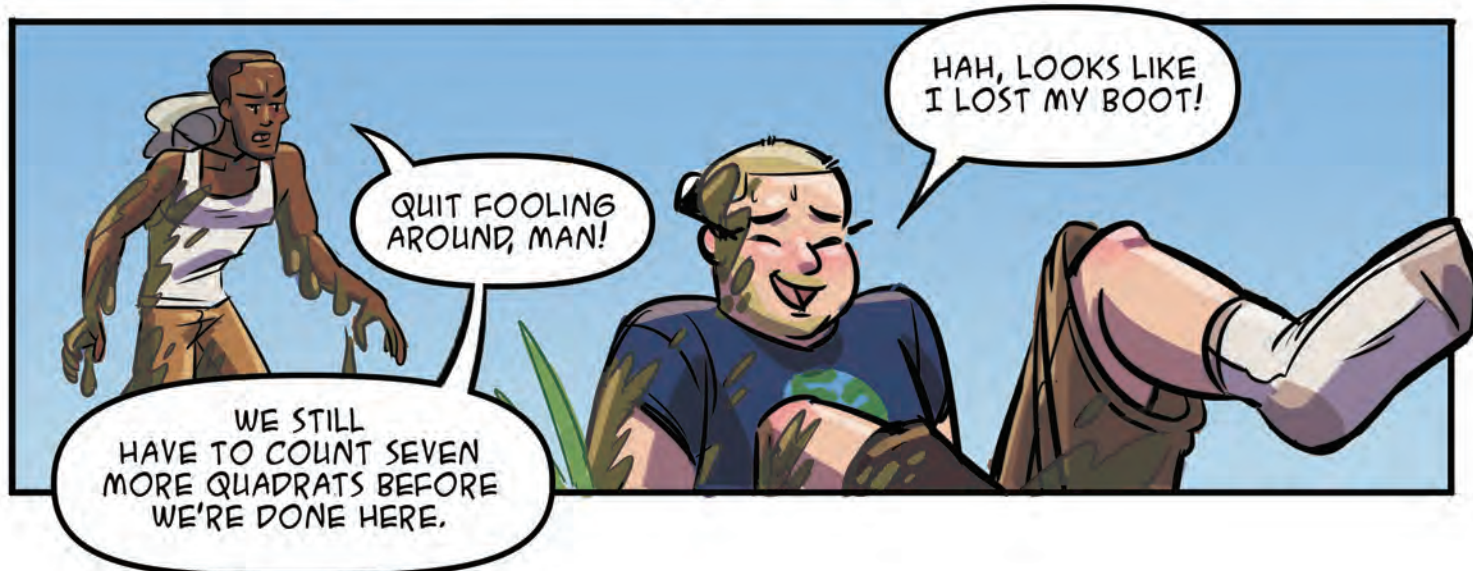
LOTS OF
FIDDLER CRABS
HERE. NO ONE
EATS THEM.

EXCEPT
RACCOONS, BIRDS,
AND FISH...

UCA PUGNAX, AKA THE
ATLANTIC MARSH FIDDLER CRAB



HOW COULD DONTRECE AND JACOB TEST THESE TWO HYPOTHESES?



LATER, WHEN IT'S TIME TO GO...

AW NO! OUR
BOAT IS SITTING
IN THE MUD!!

LOOKS LIKE
THE TIDE WENT
OUT...

AND NOW
WE'RE STUCK!

...HEY ALYSSA,
JACOB FORGOT THE
TIDE WAS GOING OUT,
AND OUR BOAT'S
STUCK.

CAN YOU
COME RESCUE
US?

I HOPE
THOSE ALLIGATORS
AREN'T HUNGRY.

I FORGOT MY
CHEF BOYARDEE...

ALLIGATORS PREFER TO EAT FISH,
CRABS, AND TURTLES, NOT HUMANS.



HOW
YA DOIN',
ALYSSA?

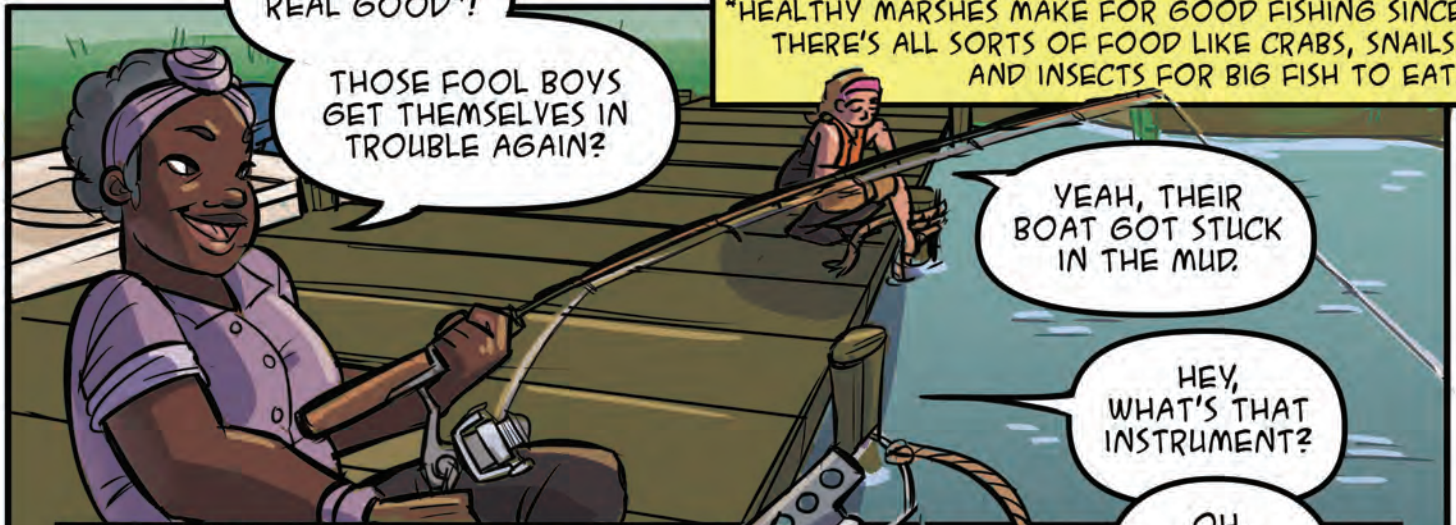
EH, LOOKS LIKE
I HAVE TO GO RESCUE
JACOB AND DONTRECE
AGAIN...

HOW'S
THE FISHING
TODAY?

THE FISHIN'S
REAL GOOD*!

THOSE FOOL BOYS
GET THEMSELVES IN
TROUBLE AGAIN?

*HEALTHY MARSHES MAKE FOR GOOD FISHING SINCE
THERE'S ALL SORTS OF FOOD LIKE CRABS, SNAILS,
AND INSECTS FOR BIG FISH TO EAT.



YEAH, THEIR
BOAT GOT STUCK
IN THE MUD.

HEY,
WHAT'S THAT
INSTRUMENT?

OH,
THIS IS A
MICROCAT.

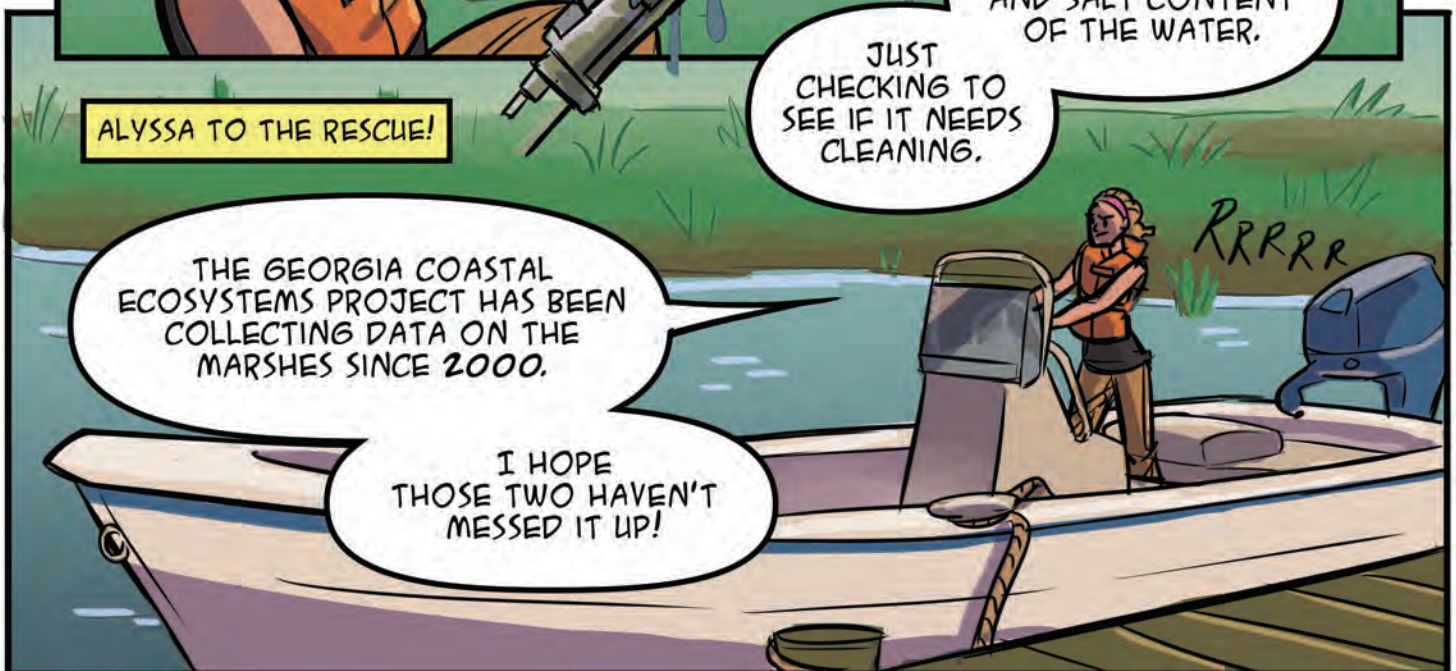
IT MEASURES
THE TEMPERATURES
AND SALT CONTENT
OF THE WATER.

JUST
CHECKING TO
SEE IF IT NEEDS
CLEANING.

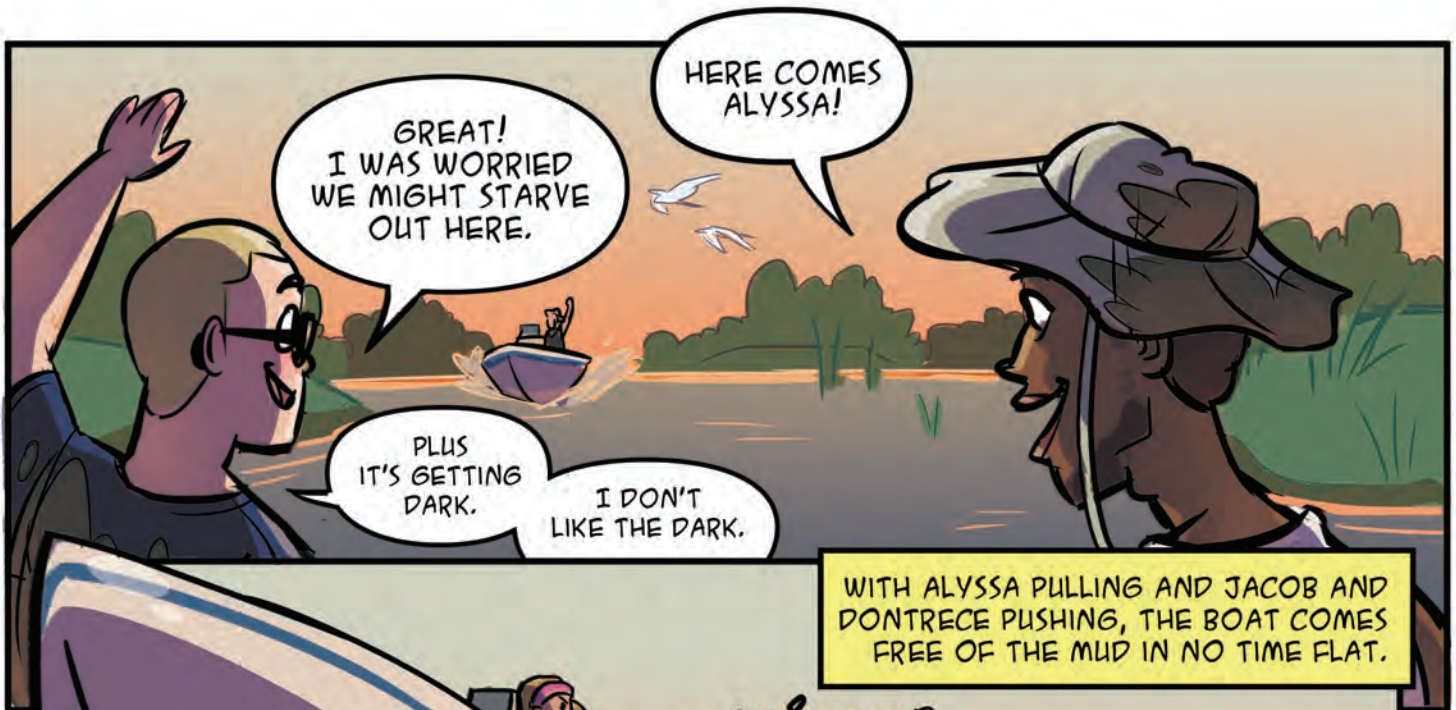
ALYSSA TO THE RESCUE!

THE GEORGIA COASTAL
ECOSYSTEMS PROJECT HAS BEEN
COLLECTING DATA ON THE
MARSHES SINCE 2000.

I HOPE
THOSE TWO HAVEN'T
MESSED IT UP!



RRRRR



AMERICAN ALLIGATOR

ALLIGATOR MISSISSIPPIENSIS

ON AVERAGE, THESE HEFTY REPTILES GROW AROUND 9-15 FEET (3-4.6 METERS), AND LARGE MALES CAN WEIGH UP TO 1,000 POUNDS (453 KG).

WITH THEIR HULKING, ARMORED BODIES AND MENACING JAWS, THESE POWERFUL PREDATORS ARE PERHAPS THE AMERICAN SOUTH'S MOST CELEBRATED CRITTER. YOU CAN FIND THEM HANGING OUT IN SWAMPS, MARSHES, RIVERS, AND LAKES ALONG THE ATLANTIC COAST AND THE GULF OF MEXICO -- JUST DON'T GET TOO CLOSE!

ALLIGATORS CAN SPEND A LOT OF TIME IN THE SALT MARSH, BUT HAVE TO VISIT FRESHWATER HABITATS NOW AND THEN TO FLUSH SALT OUT OF THEIR BODIES.

CHECK OUT THIS NEST! ALLIGATORS START BREEDING AT ABOUT 10-15 YEARS OF AGE. THE FEMALE LAYS AROUND 35-50 EGGS AT A TIME, AND HER EGGS WILL TAKE 65 DAYS TO INCUBATE AND HATCH.

BE WARNED THAT MOTHER GATORS ARE FIERCELY PROTECTIVE OF THEIR YOUNG!

BABIES ARE ONLY 6-8 INCHES (15-20 CM) AS HATCHLINGS, AND STICK WITH MOM FOR UP TO A YEAR UNTIL READY TO FEND FOR THEMSELVES.

ALLIGATORS HAVE UP TO 80 TEETH IN THEIR MOUTH AT ANY GIVEN MOMENT, WHICH EVENTUALLY GROW BACK WHEN THEY FALL OUT. A GATOR CAN GO THROUGH MORE THAN 3,000 TEETH IN ITS LIFETIME!

ALLIGATORS ARE SOME OF THE ONLY REPTILES THAT OFFER MATERNAL CARE TO THEIR YOUNG!

ALLIGATORS ARE CARNIVOROUS -- THEY EAT A VARIETY OF MARSH LIFE, FROM FISH AND TURTLES TO SNAILS, CRABS, BIRDS, AND SMALL MAMMALS. THEY DON'T SEEM TO BE TOO PICKY THOUGH -- THEY'VE BEEN KNOWN TO EAT SEEDS, CARRION, AND EVEN HUMAN LITTER!

ITS WEBBED FEET AND MIGHTY TAIL MAKE THE ALLIGATOR A TALENTED SWIMMER. THEY TEND TO BE HEAVY AND UNWIDELY ON LAND, BUT CAN SPRINT AS FAST AS 11 MPH (17 KM/H) IN SHORT BURSTS, SO WATCH YOUR DISTANCE!

CONSIDER: HOW MIGHT ALLIGATORS BE IMPORTANT TO THEIR ECOSYSTEM? WHAT DO YOU THINK WOULD HAPPEN IF WE LET THE AMERICAN ALLIGATOR GO EXTINCT?

ATLANTIC MARSH FIDDLER CRAB

UCA PUGNAX

LOOK AT THESE CUTE LITTLE GUYS! THESE FIDDLERS OCCUPY SALTWATER MARSHES ALONG THE MID-ATLANTIC COAST AND ONLY GROW TO AROUND ONE INCH (2.54 CM) LONG.

THEY MAINLY EAT BITS OF DEAD CORDGRASS, ALGAE, AND SMALL ANIMALS FOUND IN THE MUD.

SURELY BY NOW YOU'VE NOTICED THESE CRITTERS' STRANGE CLAWS -- MALES GROW A MAJOR CLAW MANY TIMES THE SIZE OF ITS MINOR CLAW, WHILE FEMALES GROW CLAWS THAT ARE ABOUT THE SAME SIZE.

THE ATLANTIC MARSH FIDDLER LIVES AN AVERAGE OF JUST 12-18 MONTHS.

WHAT PURPOSE DO YOU THINK THE MALE'S MAJOR CLAW HAS? HINT: IT'S NOT FOR FIGHTING!

IF A MALE'S FIDDLE CLAW FALLS OFF, IT EVENTUALLY GROWS BACK TO THE SIZE OF A NORMAL CLAW, WHILE THE OPPOSITE CLAW WILL GROW LARGER AND BECOME THE NEW FIDDLE CLAW!

THE MALE'S MAJOR CLAW, OR "FIDDLE" CLAW, MAKES IT MORE DIFFICULT FOR HIM TO FEED PROPERLY, SO IT TAKES HIM TWICE AS LONG TO EAT AS A FEMALE CRAB.

FIDDLER CRABS ALSO LIKE TO CONSTRUCT BURROWS, WHICH THEY USE FOR A VARIETY OF PURPOSES: REST, PROTECTION, HIBERNATION, AND MATING, JUST TO NAME A FEW!

THE BURROWS ARE USUALLY ABOUT HALF AN INCH (1.3 CM) WIDE AND 11-36 INCHES (30-92 CM) DEEP, AND END IN A SMALL ROOM, LIKE A LITTLE APARTMENT.

DESPITE THEIR TINY SIZE, FIDDLER CRABS PLAY A HUGE ROLE IN THEIR ECOSYSTEM: NOT ONLY ARE THEY AN IMPORTANT FOOD SOURCE FOR MARSH BIRDS, BLUE CRABS, AND OTHER PREDATORS, BUT THEY ALSO HELP CLEAN THE SAND AS THEY DIG FOR NUTRIENTS. KNOWING THIS, CONSIDER THE WAYS IN WHICH CHEMICAL POLLUTION MIGHT THREATEN THE EXISTENCE OF FIDDLER CRABS.

EASTERN MUDSNAIL

ILYANASSA OBSOLETA

THESE CRITTERS MIGHT BE SMALL, BUT THAT DOESN'T MEAN THEY'RE NOT AN IMPORTANT PART OF THE MARSH ECOSYSTEM! EASTERN MUDSNAILS CAN BE FOUND THROUGHOUT THE ATLANTIC COAST, FROM NOVA SCOTIA TO GEORGIA.

THESE SNAILS ARE IDENTIFIED BY THEIR BLACK OR DARK BROWN SHELLS, ABOUT 0.5-1 INCH (1.5-3 CM) IN LENGTH. THEIR SHELLS ARE OFTEN COVERED IN ALGAE OR MUD, WHICH SERVES AS THE PERFECT CAMOUFLAGE FROM PREDATORS LIKE BIRDS AND FISH.

AS DETRITUS FEEDERS, EASTERN MUDSNAILS LIKE TO TRAVERSE MUDFLATS AND SHALLOW OCEAN BOTTOMS TO EAT CARRION AND OTHER ORGANIC MATTER. THEY CAN EVEN USE THEIR SENSITIVE CHEMORECEPTOR SENSE OF SMELL TO TRACK DOWN DECAYING FLESH FROM LONG DISTANCES!

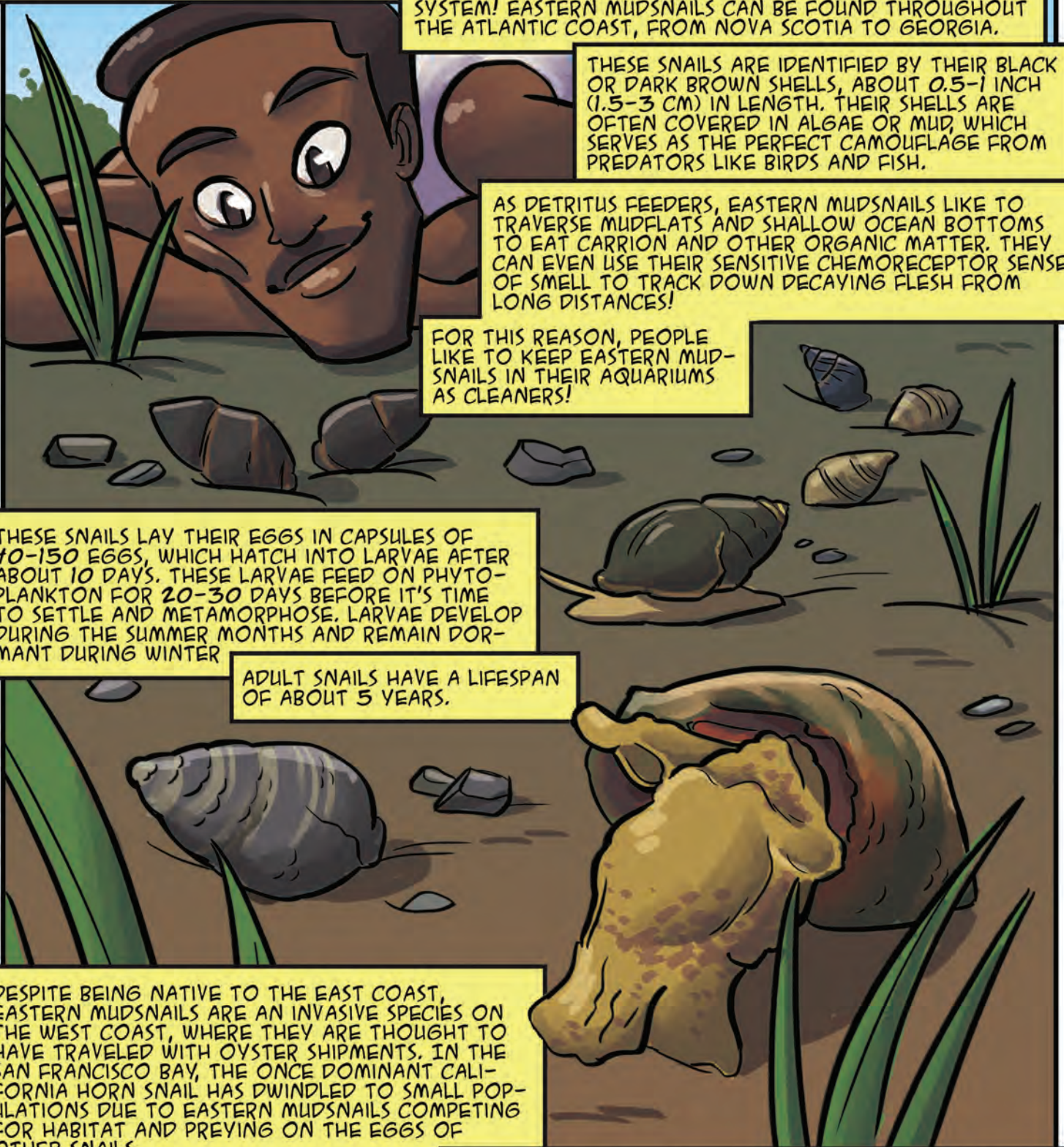
FOR THIS REASON, PEOPLE LIKE TO KEEP EASTERN MUDSNAILS IN THEIR AQUARIUMS AS CLEANERS!

THESE SNAILS LAY THEIR EGGS IN CAPSULES OF 40-150 EGGS, WHICH HATCH INTO LARVAE AFTER ABOUT 10 DAYS. THESE LARVAE FEED ON PHYTOPLANKTON FOR 20-30 DAYS BEFORE IT'S TIME TO SETTLE AND METAMORPHOSE. LARVAE DEVELOP DURING THE SUMMER MONTHS AND REMAIN DORMANT DURING WINTER.

ADULT SNAILS HAVE A LIFESPAN OF ABOUT 5 YEARS.

DESPITE BEING NATIVE TO THE EAST COAST, EASTERN MUDSNAILS ARE AN INVASIVE SPECIES ON THE WEST COAST, WHERE THEY ARE THOUGHT TO HAVE TRAVELED WITH OYSTER SHIPMENTS. IN THE SAN FRANCISCO BAY, THE ONCE DOMINANT CALIFORNIA HORN SNAIL HAS DWINDLED TO SMALL POPULATIONS DUE TO EASTERN MUDSNAILS COMPETING FOR HABITAT AND PREYING ON THE EGGS OF OTHER SNAILS.

WITH THIS IN MIND, CONSIDER HOW THE EASTERN MUDSNAIL POPULATION COULD BE AFFECTED BY ANOTHER INVASIVE SNAIL SPECIES. WHAT MIGHT HAPPEN IF THE EASTERN MUDSNAIL DIED OUT?



WOW MARTA, THIS CRAB YOU GUYS CAUGHT LOOKS DELICIOUS!

RIGHT? WE'VE GOT A HEALTHY, THRIVING MARSH TO THANK FOR THAT!

NOW LET'S DIG IN!

THANKS FOR READING!

1. AMERICAN ALLIGATOR (ALLIGATOR MISSISSIPPIENSIS) - REPTILES
2. EASTERN MUDSNAIL (LIVANASSA ORSOLETA) - INVERTEBRATES
3. NORTH AMERICAN RACCOON (PROCYON LOTOR) - MAMMALS
4. ATLANTIC MARSH FIDDLER CRAB (UGA PUENAX) - INVERTEBRATES
5. GREAT BLUE HERON (ARDEA HERODIAS) - BIRDS
6. BOTTLENOSE DOLPHIN (TURSIOPS TRUNCATUS) - MAMMALS
7. PERENNIAL SALT MARSH ASTER (SYMPHYOTRICHUM TENNIFOLIUM) - PLANTS
8. AMERICAN GREEN TREE FROG (HYLA CINEREA) - AMPHIBIANS
9. BROWN WATERSNAKE (NERODIA TAXISPLOTA) - REPTILES
10. SMOOTH CORDGRASS (SPARTINA ALTERNIFLORA) - PLANTS
11. COMMON EGRET (ARDEA ALBA) - BIRDS
12. DIAMONDBACK TERRAPIN (MALACLEMYS TERRAPIN) - REPTILES