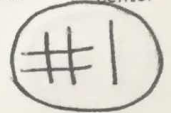
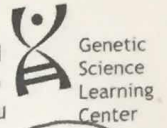


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# Reproductive Strategies

## Animal Profile:

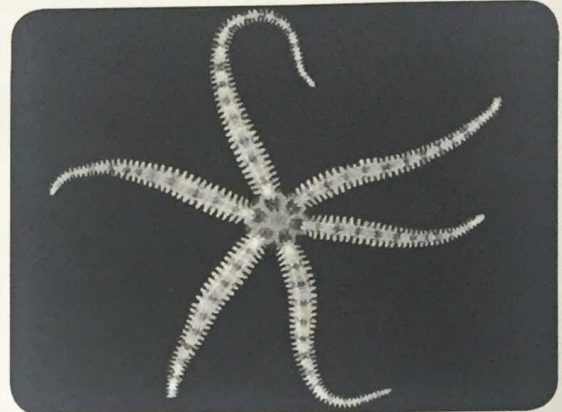
### BRITTLE STAR (*Ophiactis savignyi*)

Peer into the hole of a sea sponge and you may catch a glimpse of “the world’s most common brittle star,” *Ophiactis savignyi*. These brittle stars are tiny - only an inch or two across with arms stretched. They inhabit virtually all of the world’s tropical and sub-tropical ocean habitats.

Brittle stars are related to sea stars, or starfish, and have a similar body structure. They’ve got a central disk, which holds all the important stuff like the mouth, stomach and reproductive organs. Then there are the arms - long, slender, wavy and edged with short spines. These arms are what give brittle stars their name. They can break off voluntarily and regenerate.

*O. savignyi* takes the ability to regenerate one step further and actually splits in half in order to reproduce. When fission happens, the brittle star fractures down the middle of its disk, creating two identical 3-armed brittle stars. These stars then grow new arms from their empty arm-spaces. But this isn’t the only way *O. savignyi* reproduces. Like all brittle stars, they also reproduce sexually. At certain times of the year, large females and males raise their disks off the surface, balance on their legs, and release sperm and eggs into the ocean. When the sperm and eggs meet they produce larvae that float away to new habitats.

Fission is the main way that *Ophiocomella* reproduces, but since they don’t move far or fast, this results in large groups of brittle star clones in one area. Scientists believe that sexual reproduction might be a good way for the brittle star to populate new areas far away from their clone-filled sponge homes.



Michael Roy

*Ophiactis savignyi*



Tamara McGovern

A recently divided *Ophiactis savignyi*. Three tiny arms are beginning to regenerate.

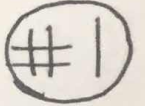


Ellen Muller - [www.phase.com/imagine](http://www.phase.com/imagine)

Brittle star spawning.

Name \_\_\_\_\_

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# Reproductive Strategies

## Animal Profile:

### BLUE-HEADED WRASSE

(*Thalassoma bifasciatum*)



Adult male Blue-Headed Wrasse

Many animals are born male or female and stay that way for the rest of their lives.

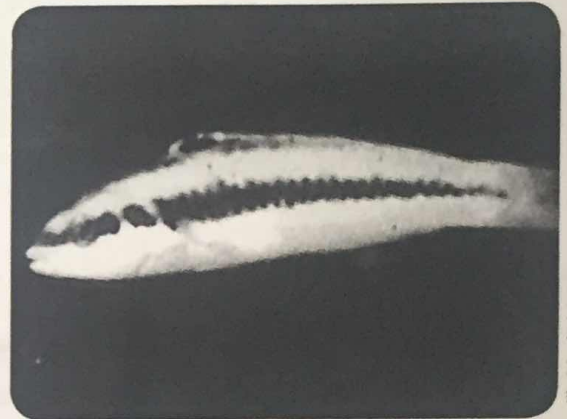
Not so with the blue-headed wrasse, a tropical fish that darts about amongst the corals and sponges in shallow Caribbean waters. Females of this fish can completely transform into males when the conditions are right.

Blue-headed wrasses, like many reef fish, are small and brilliantly colored. Most of them - young males and females - are yellow and sport a greenish-black stripe on their sides. The others - the few, the proud, and the powerful - are older males with showy blue heads, green bodies, and thick black and white stripes around their collars.

Big blue-headed males defend territories around the reefs, where they strut their stuff until the smaller yellow females find them attractive. When this happens, the female swims with the male and spawns (releases her eggs). The male quickly fertilizes them with his sperm before they float away into the ocean. Blue-headed males can mate with as many as 100 females per day!

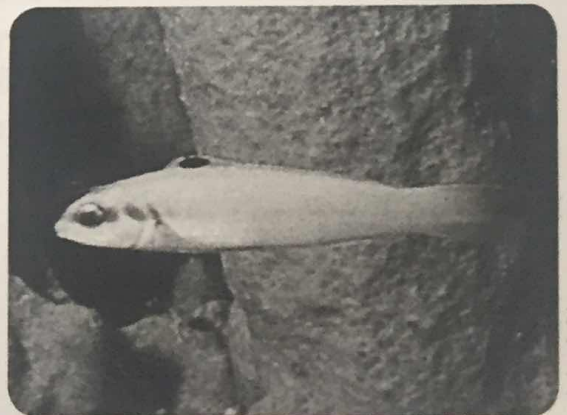
Of course, these big males can lose their territories because of nasty little things like death and rivalry. When that happens, the largest yellow female in the area may morph into a blue-headed male and begin defending a territory. So, some of the blue-headed males were born male, while others were born female.

For the females that transform into males, this is a great deal. They can get a lot of their genes into the next generation by laying eggs when they are younger, and then fertilizing eggs as males when they're older.



Virginia O. Skinner

Adult female or young male Blue-Headed Wrasse



Virginia O. Skinner

Juvenile Blue-Headed Wrasse

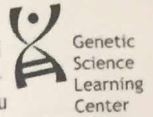


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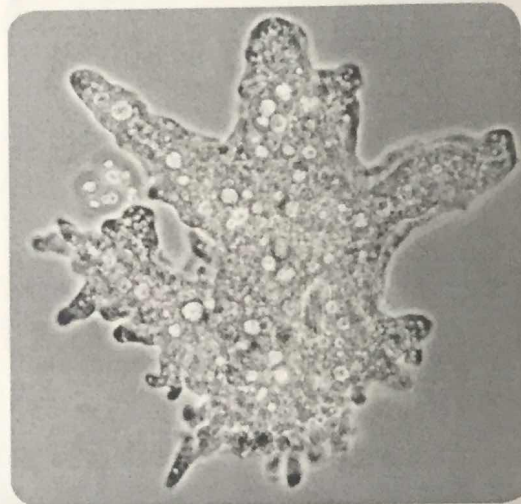
#2

# Reproductive Strategies

## Animal Profile:

### **AMOEBIA** (*Amoeba proteus*)

Take one look through a microscope at a drop of healthy pond water and you'll find a ton of one-celled organisms zooming about. Some of these cells move by fluttering tiny hair-like cilia, while others are propelled by large whip-like flagella. You'll also come across a lot of blobby cells creeping about and engulfing other cells by extensions of their bodies. These one-celled critters are known as amoeba, and they move and feed by extending bulges called pseudopodia (false feet). When an amoeba moves, it reaches pseudopodia away from its edges and anchors them at their tips. The rest of the cell's insides stream into the pseudopodia until the entire amoeba has slurped into a new location.



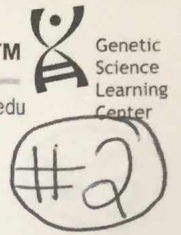
Steve Durr

*Amoeba proteus* with several green algae trapped inside food vacuoles.

Amoebas are found all over the place, from oceans to soil. They play a very important ecological role by making meals of the huge number of bacteria, algae, and small protists found on this planet. One common amoeba is the giant amoeba, *Amoeba proteus*. Giant amoebas reproduce by binary fission, a fancy word that means splitting in two. When a giant amoeba begins to divide, it pulls its pseudopodia in to form a kind of ball. After its nucleus doubles, the amoeba constricts in the middle, as if a belt were being pulled tighter and tighter around the cell. Finally, the two new cells pinch apart, send out pseudopodia, and slink away from each other. In this way, two identical "daughter" cells are created from one. When conditions are right, this amoeba can divide every 48 hours.

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# Reproductive Strategies

## Animal Profile:

### **DUCK LEECH** (*Theromyzon tessulatum*)

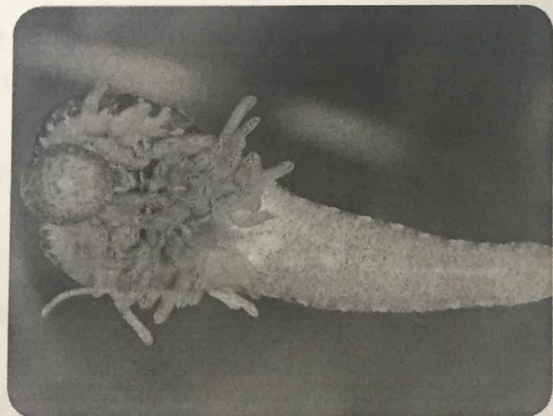
Leeches are the stuff of horror movies and doomed journeys into infested waters, and this leech is no exception to the rule. It has the disgusting habit of attaching itself to nostrils, eyes, throats and even brains. Thankfully for humans, it only does this in ducks and other waterfowl, earning it the common name “duck leech.”



Biopix.dk

The duck leech does a fair job getting around and probably gets spread as ducks move from pond to pond. This leech, like all leeches, is a hermaphrodite, meaning that a leech has both male and female reproductive parts. But that doesn't mean it can move into a pond all alone, reproduce with itself, and start a new leech population. It still takes two to tango, as they say, and a leech requires sperm from another leech to fertilize its eggs.

When the duck leech reproduces, two leeches rub together and give each other their sperm. Each leech will use the other's sperm to fertilize its eggs before placing them in gooey cocoons for protection. The leech attaches the cocoons, which hold as many as 400 eggs, to a rock or other sheltered place. The parent then waves its body over the eggs, passing fresh oxygen-rich air over them with the movement of its body. After 21 days, all 400 of the developing young leeches attach to their parent's belly. They remain attached there until the parent finds a suitable bird for a meal. When that happens, the young bloodsuckers leave their parent behind and attach to the host for their first blood meal. The parent dies shortly thereafter, but not before giving hundreds of new eyeball-suckers a shot at the game of life.



Biopix.dk

Young attached to the underside of a parent leech.



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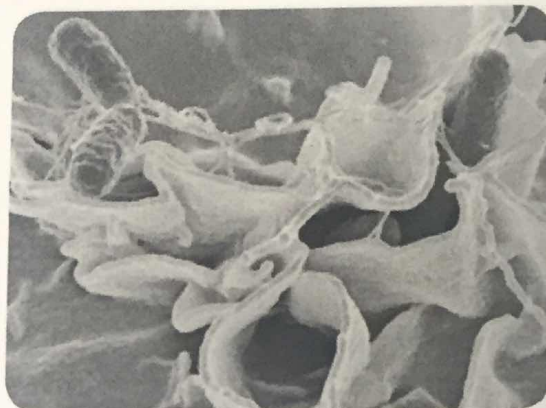
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# Reproductive Strategies

## Animal Profile:

### **SALMONELLA** (*Salmonella typhimurium*)

There are times when we eat something and our stomachs hurt badly, and then there are times when they hurt REALLY badly. When it hurts dreadfully bad, it could be from food poisoning, which leads to fever, nausea and diarrhea. Yick. And that's a mild case of food poisoning! Some of the more life-threatening cases can send a person to the hospital.



Rocky Mountain Laboratories, NIAID, NIH

*Salmonella* (rod-shaped) invading human cells.

The interesting thing is, it's not poisoning at all, but the result of a sinister bacteria known as *Salmonella*. This one-celled, rod-shaped bacteria is fairly common, and can be found naturally in raw eggs, raw meats, on the bodies of some reptiles, and in animal feces. It's when *Salmonella* finds itself in the warm growth chambers of our bodies that it hits pay dirt.

When *Salmonella* from infected food reaches our small intestine, it divides rapidly, producing copies of itself through simple division. These bacteria continue to rapidly divide, increasing in number and infecting other cells. This causes our immune system to respond, but *Salmonella* does a good job of fending it off. It takes about 12-72 hours to feel the effects of a *Salmonella* invasion. Our bodies can fight off some *Salmonella* infections, but we generally need the help of antibiotics to overcome them.

Thankfully, *Salmonella* is not one of those extreme bacteria that can survive the freezing temperatures of the Arctic or the boiling heat of volcanic thermal vents. Humans have adapted to *Salmonella's* existence by cooking, pasteurizing, and freezing our foods and drinks, which does a good job of killing the bacteria. Still, *Salmonella* infection is common enough and turns up where people aren't washing their hands or cooking meat thoroughly.

Name \_\_\_\_\_

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#3

# Reproductive Strategies

## Animal Profile:

### GRIZZLY BEAR (*Ursus arctos horribilis*)

Grizzly bears used to roam throughout the Great Plains of North America, hunting elk and moose and nibbling on berries and grasses. Grizzly bears still do these things, of course, but habitat loss and hunting have confined the bears to rough, mountainous areas. In the lower 48 states, they're only found in Montana, Idaho, Wyoming and Washington.



US Fish and Wildlife Service/Larry Aumiller

Grizzly bears are enormous animals that require large territories, especially when food becomes hard to find. Males can weigh as much as 453.6 kg (1000 pounds), females can clock-in around 317.5 kg (700 pounds), and their territories can be as large as 906.5 square kilometers (350 square miles). Though grizzlies spend most of their days wandering around alone, they come together to mate during early summer. During mating, the male deposits his sperm into the female, where her eggs are fertilized. Females delay implantation of the fertilized eggs, so the embryos don't begin developing until the females are nestled into their warm dens in November. Mothers give birth 8 weeks later to between 1 and 4 cubs. Until they leave the den in late spring, the cubs live off their mom's milk, which means mom has to eat enough in the summer and fall to survive hibernation and to feed her cubs, too!

Cubs stay with their mother for 3 years or so. She won't reproduce again until they leave her side. Because reproduction and growth are slow and the bears need large territories with a lot of food to survive, grizzlies are sensitive to over-hunting and habitat loss. Thankfully, they're protected by the Endangered Species Act, and many conservation and wildlife biologists are working to keep the grizzlies a part of our natural world.



US Fish and Wildlife Service/ Terry Talletsbo



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# Reproductive Strategies

#4

## Animal Profile:

### **DESERT GRASSLANDS WHIPTAIL LIZARD** (*Aspidoscelis uniparens*)

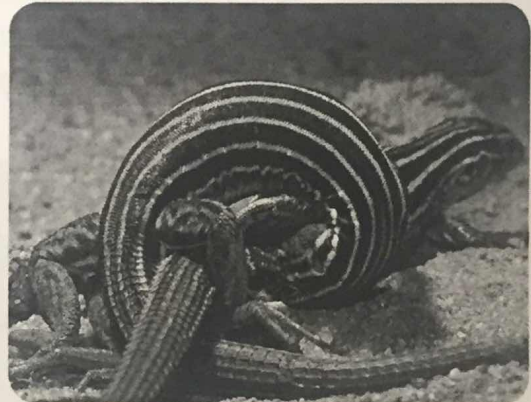
Nothing is ever what it seems in the world of reproduction. Take the example of the desert grassland whiptail, a species of lizard that lives in the southwestern United States. These lizards have long sleek bodies with lines that go from nose to tail. They race around in the dry leaves and branches eating termites, grasshoppers, beetles and many other insects. Like normal lizards, the whiptails perform courtship, mate and lay their eggs.



NPS - Sally King

Sounds pretty ordinary, right? But if we took a closer look, we'd find that not a single one of these lizards is a male! This all-female whiptail species is able to reproduce without fertilization, a process that is called parthenogenesis.

In this species, females take turns playing male during courtship and mating. If the "female" is interested, the "male" will wrap around her and grip "his" jaws around her body. The couple will stay like this for 5 to 10 minutes. This is called pseudocopulation or false mating, because no males or sperm are involved.



© David Crews, Ph.D., University of Texas at Austin

Two female desert grasslands whiptail lizards engaged in pseudocopulation.

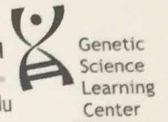
The "female" from this mating pair will eventually lay her eggs, which all hatch into copies of their mom. Females will "mate" and lay 2 to 3 eggs about 3 times over the breeding season. It turns out that females who lay eggs after "mating" with another female lay more eggs than females who don't mate. Laying a few more eggs is definitely an advantage in the harsh desert where survival of the young is difficult.

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# Reproductive Strategies

## Animal Profile:

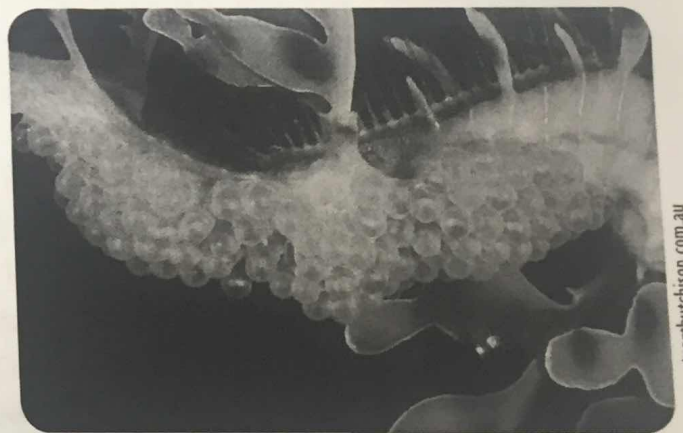
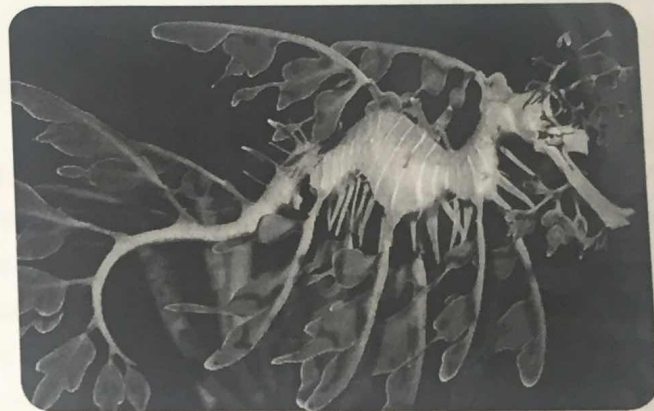
### LEAFY SEA DRAGON (*Phycodurus eques*)

Dragons lurk in the cool waters off the southwestern Australian coast, but they aren't the mythical beasts that devour huge ships before slipping away into the deep. Instead, these dragons are calm, gorgeous fish known as leafy sea dragons (*Phycodurus eques*). Though not as large as mythical dragons, leafy sea dragons can be pretty big. They grow up to 51 cm (1.7 feet) in length and have long leaf-like

appendages sprouting from their bodies. This leafiness helps them blend in with their seaweed habitat,

protecting them from predators and giving them an advantage while hunting for food. Like their cousins the seahorses, leafy sea dragons have long tubular snouts they use to suck up tiny shrimp. To hunt, they drift around camouflaged as a piece of seaweed and ambush their small crunchy prey.

Leafy sea dragons and their relatives reproduce in a way that's rare in the fish world: the males carry and hatch the young instead of the females. When sea dragons mate, the female finds a potential dad and deposits her eggs underneath his tail where his sperm fertilize them. Pregnant dads can have as many as 200 incubating eggs tucked tightly beneath their tails. It pays to have a dad that looks like seaweed, because the eggs are protected from predators there. The eggs cling for 4-5 weeks before they hatch. The young are less than 2.5 cm (1 inch) long when they finally hatch. Many of them, sadly, will become little fishy snacks for larger fish, but the lucky ones who survive will grow up to be beautiful adults. Getting protection from dad when they were developing likely gave them one fin up in the vast ocean world.



Eggs attached under a male sea dragon's tail.

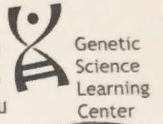


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#5

# Reproductive Strategies

## Plant Profile:

### MEADOW GARLIC

(Liliaceae: *Allium canadense*)

Long before settlers ventured into North America with their European garlic and onions, Native Americans were likely spicing-up their cooking with a native garlic known as meadow garlic. This garlic, called *Allium canadense* by botanists, grows wild from Florida to Canada. Surprisingly, it belongs to the same family as garden-variety lilies - those big colorful flowers that perch in flower vases and add splashes of color to many gardens around the world. Even though it's called meadow garlic, it really smells and tastes more like an onion. Rubbing the leaves and stems emits a definite bad breath, onion smell.



Larry Allain @ USGS National Wetlands Research Center

Meadow garlic, also known as wild garlic, grows from bulbs like other lilies in its family. The bulbs lie dormant underground over winter, storing energy for the burst of growth and reproduction that comes in spring and early summer. Bees aren't turned off by the onion smell, and they buzz around pollinating the small, pink or white flowers. Although each flower has both male and female reproductive parts, it can't mate with itself. The bees are needed to move pollen from one plant to another. This produces fertile seeds that eventually disperse and grow into new plants that have a mix of genes from the two parent plants.

But meadow garlic doesn't only depend on bees or other pollinators to spread itself around. Perched underneath the flowers are clusters of little, nubby growths called bulblets. The bulblets are outgrowths of the plant, and when dropped, sprout into new plants identical to their parent. The bulblets provide enough start-up energy for the new plants to grow and eventually produce flowers and bulblets of their own. The ability of plants in the lily family to reproduce both with and without fertilization means they can spread easily. Some lilies have actually become pests by taking over pastures, gardens, and roadsides across the country.

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#5

# Reproductive Strategies

## Animal Profile:

### RED KANGAROO (*Macropus rufus*)

In the desolate, dry plains of central Australia, mobs roam around the countryside. But these aren't mobs of people. Mobs are actually the official name for groups of red kangaroos, *Macropus rufus*. And unlike angry mobs of people, mobs of red kangaroos aren't usually to be feared. They are skittish and will scatter when frightened. When they're really moving, red kangaroos can leap as far as 3.7 meters (12 feet) in one jump and reach speeds of 56 kph (34.8 mph)!



Chris Willis

A mother red kangaroo with a joey in her pouch.

Red kangaroos are one of the largest marsupials, and herbivorous mobs of them bounce about eating grasses and other vegetation. They're usually headed by the most mature female and include lots of other females and young kangaroos, called joeys. When it's mating time, males will sometimes box each other for females with their powerful jumping legs. The winning male deposits his sperm in the female, where an egg is fertilized.

After mating, females give birth to one baby kangaroo, which has only gestated for about 33 days. The young are very undeveloped after such a short time. Like most marsupials, baby red kangaroos spend a lot of time growing in their mom's pouches. When it's born, a young kangaroo is tiny, pink, hairless, and blind, but it knows to head straight for the pouch. It swims through mom's fur to get there, where it attaches to a nipple and finishes developing. After about 7 months, a joey gets too big for mom's pouch and will leave to bounce around next to her. Once this happens, the mom gives birth to another tiny pink baby. Females can continuously give birth and usually have about 3 joeys every two years.



Geoff Shaw - <http://kangaroo.genome.org.au>

A newborn kangaroo in its mother's pouch.



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# Reproductive Strategies

## Animal Profile:

### **SAND SCORPION** (*Paruroctonus mesaensis*)

Sinister beasts are underfoot when the sun goes down in the dunes of the Mojave Desert. The sand scorpion, which spends its days in a burrow underground, emerges to sting, kill and munch its prey. Shine an ultraviolet light into the night, and the ground will come alive with yellow-green glowing scorpions, out devouring beetles, crickets, other scorpions, and even cannibalizing their own kind. If it's the right time of year, glowing scorpions might also be dancing the night away.

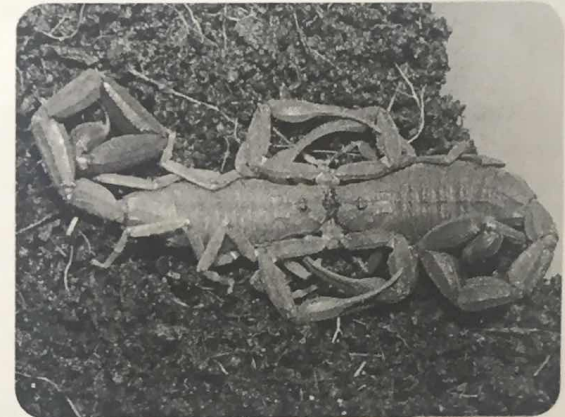
Yep, that's right, sand scorpions dance during courtship. Males grasp the females by their pinchers, or pedipalps, and move them around in circles. After dancing for a while, the male deposits a packet of sperm on a stick or other surface. Then, he moves the female until she is on top of the sperm. She takes in the sperm and fertilizes her eggs internally. The dance ends here, and the male usually skitters off to find more mates. But every now and then, the female rears back, stings the male, and eats him for her next meal!

Young sand scorpions spend about 12 months developing inside their mother before they are born live. After they're born, they quickly crawl onto their mom's back where they stay until they're big enough to leave the burrow. On average, a sand scorpion mom has about 33 newborns hitching rides on her back. But things aren't always easy there either, and sometimes the young eat each other or the mom eats the young. Clearly, stingers don't make life trouble-free for the sand scorpion, but they're still able to be a very successful organism in their dry, sandy habitats.



Philip H. Brownell, Ph.D.

Sand scorpion (*Paruroctonus mesaensis*) capturing a burrowing cockroach. Photo taken under UV illumination..



© T.C. van der Ende - scorpology.com

Scorpions (*Tityus trinitatis*) engaged in courtship dance.



<http://scorpion.ammh.org>

Mother scorpion (*syntropis*) carrying babies on her back.



<http://scorpion.ammh.org>

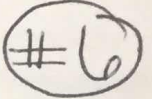
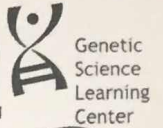
Spermatophor from a male scorpion.

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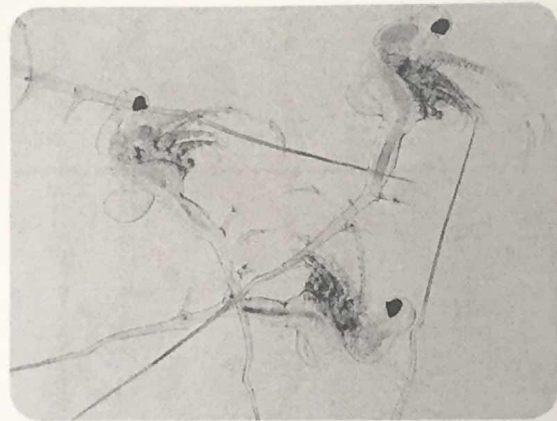


# Reproductive Strategies

## Animal Profile:

### SPINY WATER FLEA (*Bythotrephes longimanus*)

There's a tiny, transparent crustacean that swims jerkily around in the Great Lakes. It spikes fish in their mouths with its long tail and gobbles up other microscopic aquatic animals (zooplankton). It's called the spiny water flea, but it's more related to crabs and lobsters than to any insects. Though many different kinds of water fleas are common in ponds and streams, the spiny water flea is not a welcome visitor. It's an invader from European waters and it competes with local fish and water fleas for food. It's protected from predators by its nasty barbed tail, which makes up 70% of its 2 cm long body.



Pieter Johnson, University of Colorado at Boulder

Spiny water fleas are a threat to ecosystems because of their power to rapidly reproduce. Like all water fleas, this one alternates between asexual and sexual phases. Most of the time, a female produces eggs without fertilization. She releases about 10 eggs into the brood chamber on her back, where they develop into young clones within several days. During summer, females can produce clones of themselves every 2 weeks.



Pieter Johnson, University of Colorado at Boulder

When food becomes scarce or temperatures change, some females produce spiny little males. These males mate with other females that have produced special eggs used for fertilization, called "resting eggs." They're called this because after these eggs are fertilized, they leave the mom and remain dormant before hatching. Many water flea resting eggs can survive drying or being eaten by fish.

Different reproductive forms of spiny water fleas. Male (left), female with asexual eggs (center), and female with sexual eggs (right).

Spiny water fleas seem to have a lot on their side, and they're in the Great Lakes to stay. Still, biologists are working hard to keep them from spreading into too many more lakes in the future.