

## ROUND 1 TEXT ONLY SUMMARIES Caution: Translation by Google Translate

Roots & Relicts are species that have endured mostly unchanged for MILLIONS of years or groups that were once widespread but now survive in small remnant populations. And tonight we will learn about sixteen amazing organisms!

### **Ginkgo (1) vs. Mycorrhizal Fungus (16)**

Ginkgo (*Ginkgo biloba*) bark varies from light grey to greyish brown and has two lobed, pale green leaves (bi-loba) that are often depicted in artwork. This tree routinely reaches 80-120 feet tall and can live for hundreds of years. Mycorrhizal Fungus (*Rhizophagus aggregatum*, previously *Glomus aggregatum*) is a pear-shaped microscopic fungus, pastel yellow to yellowish brown and typically develops a single projecting "hypha" that releases substances and absorbs nutrients. A single spore is 40-85 micrometers in diameter. There are 1,000,000 micrometers/meter, so Ginkgo is the height of 38 MILLION spores of this mycorrhizal fungus we'll call Rhizo.

Ginkgo stands in a warm temperate broadleaf forest on Mt. Jinfo in SW China. Surviving mass extinctions and escaping the glaciers of the Pleistocene, Ginkgo is the last descendent of ancestors dating to the Jurassic. Among the 5 main groups of living seed plants, there are hundreds of cycads, conifers, and gnetales species and 500,000+ species of angiosperms, but only one gymnosperm remains. Nearly unchanged for 200+ million years, Ginkgo is the sole survivor of gymnosperms. In the moist, deep, sandy soils, the substrate of root secretions and soil microorganisms (the Rhizosphere!) something already lurks in the Ginkgo's typical taproot system. Already within the cells of the roots of the Ginkgo... it's Rhizo!, the SYMBIOTIC arbuscular mycorrhiza fungi *Rhizophagus aggregatum*! Mycorrhiza "benefit host plants by enhancing water and nutrient uptake and by increasing host resistance to pathogens and other stressors" while gaining carbon from the host plant (Fernández et al. 2022). Basking in sunshine, Ginkgo photosynthesizes, sharing carbon with its littlest fungi friend Rhizo. #TeamworkMakesTheDreamWork GINKGO AND RHIZO TOGETHER ADVANCE TO ROUND 2! Narrated by Katie Hinde.

### **Alligator Gar (2) vs. Cyanobacteria (15)**

Alligator Gar (*Atractosteus spatula*) "belong to an ancient lineage of fish dating back over 200 million years" in the Age of Dinosaurs (David et al. 2018). With a thick armor of grey-green scales and a long toothy snout, Gar looks very prehistoric. There are 4 types of Cyanobacteria (*Prochlorococcus* spp.), two of which can synthesize atmospheric nitrogen. Combatant *Prochlorococcus* is not one of them. Its strength is being so tiny and resourceful that it is the dominant oxygen-producing plankton in nutrient poor areas of the ocean. Cyanobacteria make their own food, like plants, with light! And a by-product is oxygen. These microorganism masters ruled for at least the first 3.0-3.5 billion years of the Earth's history and are responsible for our oxygen rich atmosphere.

Our Alligator Gar combatant is a 68 year old queen weighing 350 lbs (159kg). In springtime, the waters of Trinity River, Texas begin to warm and soon she will migrate from the river estuary toward river areas with her preferred off-channel spawning habitat. Cyanobacteria is

a float in the Pacific Gyre when a large shipping container passes, creating a mist that sends Cyanobacteria airborne. #MMMagic translocates airborne Cyanobacteria to Texas, settling on the slightly rippling water surface. SPLASHHHHHH! WHAAM! Ambush attack! Alligator Gar strikes a swimming snake with lethal accuracy, propelling both Gar and snake to the surface of the water. Alligator Gar and snake send water droplets skyward, including Cyanobacteria as an aerosol particle caught in the spring breeze and flown from the field of battle! GAR LAUNCHES CYANOBACTERIA! Narrated by Tara Chestnut.

### **Friiled Shark (3) vs. Fern (14)**

Clocking in at 6.6ft (5.92 stoats) in length, the Friiled Shark (*Chlamydoselachus anguineus*) is an eel-like shark found near the ocean floor in the Atlantic and Pacific, named for its six pairs of wavy gill slits. This Shark's most striking feature is its curved, needle-sharp teeth (300 in total!). Behold, the humble Fern (*Claytosmunda claytoniana*)! In particular, our combatant is the Interrupted Fern, found in Eastern North America and Eastern Asia. A true relic, some of this species' closest relatives were alive in the Triassic, ~237 million years ago! The Interrupted Fern gets its name from the structure of their blades. In the middle of each blade is a section of dark-colored leaf structures that are used for reproduction. When they dry up and fall off, they leave an "interrupted" gap behind.

Our combatants meet in battle in Suruga Bay, Japan. Friiled Shark is rising from the depths toward the surface to follow the daily movements of squid, which makes up about 60% of her diet. Meanwhile, in the Minnesota forest, Interrupted Fern shifts in the spring breeze. Fern's deep root system holds it steady. Interrupted Ferns grow large rhizomes, a modified stem that expands underground into a system of rootin' and shootin' goodness, allowing fern clones to pop-up nearby. Suddenly #MMMagic translocates Interrupted Fern UNDERWATER at the border of the twilight and sunlight realms of Surgura Bay.

Detecting a change in the movement of the water with sensory cells along her body (her lateral line), Friiled Shark swims in her long, eel-like body. The Friiled Shark body plan is inherited from ancestors arising 350 million years ago in the Carboniferous and why this species is considered a 'living fossil'. Friiled Shark, mouth wide to catch prey whole, swims into the Fern's wiry roots that get thoroughly caught in Friiled Sharks multi-row teeth as "each tooth consists of three backwardly directed briar-like fangs" (Gudger 1937). Swimming forward, Friiled Shark thrashes her eel-like body and whipping her head against the fern, dragging the fern with force in the ocean water. Friiled Sharks violent thrashing creates turbulence, chaotic changes in pressure and flow against the plant until Friiled Shark RIPS Fern into disintegrating pieces! With a final thrash of her head, Friiled Shark breaks free, between two fern chunks drifting slowly toward the midnight realm of the ocean and off the field of battle. FRILLED SHARK SHREDS FERN! Narrated by Erin Rowland-Schaefer.

### **Coelacanth (4) vs Mudskipper (13)**

Coelacanth (*Latimeria chalumnae*) is a BIG FISH, 2m long and 100kg with muscular, fleshy, and paired shoulder (pectoral) and hip (pelvic) fins, like our arms and legs (but she doesn't walk). Coelacanth also has a nonfunctional (vestigial) lung that does not breathe air. Mudskipper (*Periophthalmodon schlosseri*) is a SMALL FISH, < 0.3m long with large front

(pectoral) fins. Mudskippers spend time in the water and on land (amphibious) and they can BREATHE AIR. But Mudskippers don't use lungs to breathe when on land; they absorb oxygen through their skin and mouth lining.

Coelacanth is active at night (nocturnal) exploring the waters near Grande Comore Island off the eastern coast of Africa in the Indian Ocean. Nighttime is feeding time and Coelacanth is hungry. Meanwhile, it's low tide in the mangrove forests along the Gigis River in Malaysia. Mudskipper is mending her burrow, spitting a wad of mud out into the mudflat. She dives down into the shallow pool to retrieve more mud. But Mudskipper never reaches her burrow! Instead, she's transported to the home field of Coelacanth, 400 m below the water's surface off the coast of Grand Comore.

Mudskipper is fully submerged in cold, deep water, with the surface nowhere in sight. Coelacanth propels herself forward using her fins, then she glides. She prefers these deep depths where prey can be abundant. Coelacanth slowly drifts toward Mudskipper. Mudskipper's maximum water depth is usually around 2m; she's in much deeper water than normal. Mudskipper frantically flaps her large pectoral fins, trying to find the light of the surface. Coelacanth continues to drift towards Mudskipper. Mudskipper's frantic fin flapping suddenly slows. Mudskipper is highly adapted to terrestrial life; her gills are not suitable for full-time aquatic respiration. She's not getting enough oxygen! Coelacanth continues slowly drifting closer and closer. Mudskipper is unable to move, watching the big fish approach. Mudskipper twitches a pectoral fin and Coelacanth strikes with a rapid movement of her jaws #blinkandyoumissit, swallowing Mudskipper whole! COELACANTH INGESTS MUDSKIPPER! Narrated by Jessica Light.

### **Ringed Seal (5) vs. Olm (12)**

The Ringed Seal (*Pusa hispida saimensis*) is a medium sized pinniped, which at its largest can be ~5.5feet long and ~270lbs. They have short heads, cat-like snouts, and their bellies have silver fur, with silver rings on the darker fur of their sides and back. The Olm (*Proteus anguinus*) is an amphibian with a long eel-like body, skin covered eyes that can't see but can detect light, with lifespans similar to humans. They reach adulthood around 15 years of age and live 70-100 years. Females are larger than males.

The combatants meet at Lake Saimaa, Finland, where a population of freshwater ringed seals became landlocked since the last glacial period and has been isolated for 9500 years. Ringed Seal is hauled out in his snow lair. Since the lake began to freeze in December, Ringed Seal has used the sharp claws of his front flipper to carve and maintain a breathing and access hole into the lake water through the ice. As snow drifts formed, growing deepest in February and March, Ringed Seal dug and excavated his winter lair with snow providing insulation and defense from wind, along with the blubber that is half his winter body mass. Meanwhile in Slovenia, an apex predator- THE OLM- hunts bugs and fishes in the "subterranean, freshwater lakes and streams of limestone caves in the Dinaric Alps" (Meaton 2011). In this Stygian realm, the Olm relies on hearing, scent, and taste to hunt prey and "unidentified receptors to orientate in Earth's magnetic field" to navigate aquatic and terrestrial cave systems descending hundreds of feet (Zakšek et al. 2023).

Olm is MMMagically translocated to the snow lair, ripped from the aquatic environment where the Olm breathes with gills and skin, the Olm seems to be air gulping for her internal lungs to breathe. Olm smells and hears the nearby lake waters and scramble slithers RIGHT PAST THE SEAL'S FACE. Olm has no known predators in her home habitat and is unaware of the dangers at the exhale of fishy breath in the darkness of the snow lair. Ringed Seal's teeth snap onto Olm's torso and tosses Olm back to be swallowed whole! But the writhing Olm is THREE TIMES BIGGER than the smelt and perch Ringed Seal normally swallows whole! Ringed Seal hock-a-loogies the Olm through the hole in the ice INTO THE 42 DEGREES FARENHEIT LAKE WATERS! Lake Saimaa is within the water temperature of Olm's home cave system, catching her breath, Olm swims away from the field of battle. RINGED SEAL DEFEATS OLM! Narrated by Katie Hinde.

### **Starry Sturgeon (6) vs. Tuatara (11)**

Clocking in at a whopping 180lbs (364 stoats) and 7.2feet (6.5 stoats) long, the Starry Sturgeon (*Acipenser stellatus*) is a real aquatic heavyweight. Maxing out at 29 years old, these fish are also older and wiser, making for a powerful combatant. Sturgeons as a group are known for their elongated snouts (formally "rostra"). They contain electroreceptors, which allow them to sense electric fields in the water! Like their cousins the paddlefish, Sturgeon use these electroreceptors to tell when dinner is nearby! Don't be deceived! Even though Tuatara (*Sphenodon punctatus*) look like lizards, they are in fact the only living member of the order Rhynchocephalia, which means "beak head"! The name Tuatara comes from a Māori word meaning "peaks or spikes on the back." This reptile tips the scales at 2.2 lbs (4.5 stoats).

The combatants battle it out in Eastern Europe. In winter Starry Sturgeon lurked along the bed of the Black Sea, chowing down on fish, worms, and crustaceans detected with her whisker-like sensory organ (barbels). Without teeth, she suctions prey into her large, bottom-facing mouths. But Starry Sturgeon is abandoning the Black Sea, as she is laden with eggs. She swims against the current of the Danube River delta, heading upriver for the spring spawning! Meanwhile, on Stephens Island in New Zealand, the morning dawn ends Tuatara's nocturnal hunting. After a summer of hunting seabird eggs and nestlings, in the austral autumn Tuatara's meals are primarily bugs and other invertebrates. All of a sudden #MMMagic translocates Tuatara to the chilly waters of the Danube River but Tuatara is cold tolerant and can swim in waters down to 41F!

Starry Sturgeon swims closer... closer... closer... to the Tuatara. Starry Sturgeon swims right up to Tuatara and then submerges to the riverbed. Starry Sturgeon don't feed during their spring migration! OH NO... a drift bottom gillnet has captured the CRITICALLY ENDANGERED Starry Sturgeon as illegal poachers seek a criminal payday for her eggs aka CAVIAR!!! Recently, tests have been developed to tell apart the eggs of different sturgeon species to assist in stopping the illegal trade of endangered sturgeon caviar, but that deterrent isn't enough to stop these opportunistic poachers. TUATARA OUTLASTS STURGEON!! Narrated by Erin Rowland-Schaefer.

**Asian Forest Tortoise (8) vs. Platypus (9):** The Asian Forest Tortoise (*Manouria emys*), also called the Brown Tortoise, is the largest tortoise inhabiting Asia, with a shades of brown to black shell varying slightly among individuals and more between geographic regions. The Tortoise can live to 150 years old. The genus *Manouria* are "the most 'basal' extant tortoises, with a strong association to aquatic environments" (Natchev et al. 2015)

As a small brown aquatic mammal, "The platypus gives the appearance of several animals combined into one" with a bill like a duck, a body like a groundhog, webbed feet like an otter, and the tail of a beaver. (Pasitschniak-Arts & Marinelli 1998). Duckbill platypus (*Ornithorhynchus anatinus*) are one of the few monotremes, an ancient lineage of mammals that still lay eggs like the ancestors of marsupials and placental (Eutherian) mammals. Monotremes get their name 'one hole' because they lay eggs, pee, and poop through the same plumbing.

Today the long monsoon season is winding down in the Tabin Wildlife Reserve in Malaysian Borneo. Forest Tortoise forages close to a nearby stream. Meanwhile, in a stream flowing into Lake St. Clair, Tasmania, a male Platypus is hunting freshwater shrimp and other invertebrates with his eyes, ears, and nostrils closed, hunting by detecting the electrical signals and movements of prey! (These are known as electroreception and mechanoreception respectively). In March, Platypus has little use for his spurs. His crural gland that makes venom is currently shrunken, but will enlarge for mating season and male-male combat in August and September.

Back in Borneo, the forest canopy is dense. With little sunlight reaching the forest floor, Forest Tortoise stands up on his back legs -nearly vertical- to reach the lowest leaves of a flowering plant in the elephant ear genus *Alocasia*. Forest Tortoise stretches her face forward to grasp the last leaves with her jaw, more like an aquatic turtle, instead of using her tongue to help grasp her food item as more terrestrially-adapted tortoises do.

#MMM Magic translocates Platypus to the thick shrubbery beside Forest Tortoise, but on the side furthest from the stream that seems less daunting than this new forest! Forest Tortoise is not interested in eating any of the stems or branches and begins to drop her massive 50lb body back down to all four legs... #ImYellingTimber. The 3-pound Platypus is trotting on squat legs to the stream and rushes directly under Forest Tortoise.

<SPLASH> <WHOMP!> Platypus dives into the stream and swims away just before Tortoise's crushing body hits the forest debris on the forest floor. TORTOISE OUTLASTS PLATYPUS! Narrated by Katie Hinde.

### **Great White Pelican (7) vs. Atlantic Horseshoe Crab (10)**

In this corner <waves toward Africa & south Asia> we have a 33 lb (15kg) male Pelican (*Pelecanus onocrotalus*) who is buffy white with black flight feathers and a long yellow bill that has a flappy gular pouch on the lower bill. Pelicans have massive beaks and fishing techniques that arose over 30 million years ago and were identical to living pelicans in the early Oligocene. In this corner <waves toward the North American Atlantic Coast> we have Horseshoe Crab (*Limulus polyphemus*) #NotReallyACrab, the 11 lb (4.8kg) female is olive in

color with a smooth upper shell and undersides that are nightmare fuel. Horseshoe crabs "are the closest living relatives of the trilobites, have persisted for 200 million years" and their very similar ancestors are found in the fossil record back to half a billion years ago (Walls et al. 2002).

The combatants meet in Sundarbans National Park in NE India, the world's largest area of mangrove forests, where Pelican is gathered in a breeding colony. He is signaling to females with a "a-ooogh" advertising display. Meanwhile, on the Georgia coast, Horseshoe Crab prepares for the breeding season in May. She gorges on small invertebrates that crawl and burrow on the seabed, sucking tasty morsels into her mouth, which is situated in the middle of her legs, when #MMMAGIC translocates Horseshoe Crab to shallowest muddy waters in the intertidal zone of Pelican's colony. Horseshoe Crab arrives UPSIDE DOWN, her armor in mud and her vulnerable undersides skyward!

Nearby shorebirds surround Horseshoe Crab, their beaks dart to claim eggs on her undercarriage as Horseshoe Crab slap-flips her lance-like tail (telson) to try to turn herself over. The shorebird melee attracts Pelican's attention. Rather awkwardly, Pelican flaps his wings and kicks his short legs with large, webbed feet to take off from the surface of the water and investigate an opportunity for a scavenged meal. Horseshoe Crab successfully flips herself over with her telson and scrambles into deeper waters, sending scores of fish (~0.5lbs) scattering in silvery flashes. Pelican, large wings gliding low over the water, spots the darting silver fish exactly his preferred size and dives to scoop fish and water into his expandable, bucket-like throat pouch. Pelican lowers his massive beak scooping up water, fish and Horseshoe Crab! As Horseshoe Crab accidentally scuttles into his throat, INSTANTLY TURN THRASHING, HORSESHOE CRAB'S SHARP, LANCE-LIKE TELSON IMPALES PELICAN'S POUCH! Pelican heaves out water and fish out of his pouch, violently dislodging Horseshoe Crab from his throat! Horseshoe Crab lands in the water, drifting down BUT HER TELSON WAS RIPPED FROM HER BODY AND IS STILL IMPALED IN PELICAN'S FLESH! IMPALED & AWKWARD, PELICAN LAUNCHES AWAY, departing the field of battle, leaving the injured Horseshoe Crab in the coastal shallows. HORSESHOE CRAB DEFEATS PELICAN! Narrated by Tara Chestnut.

### **Coelecanth vs Mudskipper**

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### **Starry Sturgeon vs. Tuatara**

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