Bugplanet: An Adventure into Speculative Biology and Interactive Media

by
Josie Dowd

A thesis presented to the Honors College of Middle Tennessee State University in partial fulfillment of the requirements for graduation from the University Honors College

Fall 2019

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ABSTRACT

This creative project is a guidebook of fictional creatures inspired by those I invented in my childhood after watching nature documentaries and science fiction films. Each organism has been updated and reimagined through the lens of speculative biology, a process using known scientific information to predict or theorize how living things might continue to evolve either on Earth or other planets. The book also contains interactive components through augmented reality, allowing readers to use a smart phone to scan the pages and view animations of the animals within, bringing them to life. This project is the culmination of my interests in art and science and my studies in animation, creating something I would've enjoyed as a child but also as an adult.

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INTRODUCTION

When I first began to really get into drawing, my main subjects were always animals. I began by copying realistic drawings from hefty animal encyclopedia books, sometimes even tracing printed out photographs of big cats and alligators until I could get them just right. When I ran out of creatures to depict, I would combine them into hybrids that looked like bits and pieces smushed together into awkward chimeras. Somewhere along the way, my animal encyclopedias were joined by dinosaur books, mythology books, guides to sci-fi universes, and nature documentaries which allowed me to think more critically about my creations. What niche did they fit into in an ecosystem? How did their adaptations help them to survive? Where did they call home? This culminated in my concentration pieces for AP art in high school, where I really started to dig into my critters and how they interacted with each other on an imaginary planet far away in space. I painted landscapes dotted with organisms living out their peaceful lives, but I couldn't convey the details underneath which would explain why they had certain teeth or fins. In this project, I have aimed to do just that by creating a guidebook to those creatures detailing their behaviors and biology with both static illustrations and animations bringing them to life.

RESEARCH

For this project, I researched the history of the speculative biology genre, ways to use augmented reality, and various aspects of biology and animal behaviors. Speculative biology, also called speculative evolution or speculative zoology, is described by Darren Naish as "the idea that we might be able to guess or imagine those creatures that could evolve in the future, on other worlds, or in other timelines" (Naish 2018). With deep roots in science fiction, Naish and others often cite H.G. Wells' *The Time Machine* as the beginning of the genre, with *After Man* by Dougal Dixon being the first large scale foray into the subject. *After Man* is a guide to the creatures of Earth far in the future after humanity has become extinct, written specifically as an experiment in applying the ideas of evolution to the future. As Dougal puts it, "Other popular-level books used evolution to tell the story of the past, but nobody had taken the whole process – the observable trends – and projected them into the future. I thought: I could do this" (Naish 2014).

Dougal would go on to create many more foundational speculative biology works, including one of my greatest childhood influences, the animated documentary series *The Future is Wild*. Dougal was brought on as a consultant for the project and ended up designing many of its most memorable creatures. The series was crafted with careful predictions of future geography and climates that would influence life on Earth, and although some of its facts ended up being not so factual, the final product's animation and compositing that brought imaginary organisms to life made up for it. In regard to their goals and concept, *The Future is Wild* website describes the process of using speculative biology very well: "Populating the future world with new creatures wasn't blind guesswork or

science fiction. There's a whole series of rules of how life evolves that we can test by looking back at the past. All we had to do was apply the same rules to the future and then add a little imagination!" (Adams). This approach is exactly how I went about creating my own animals, albeit for their own strange planet rather than ours.

As for the technological elements more entwined with my animation major, I enhanced my book of creatures with augmented reality (AR) which can be viewed through a smart phone. AR is when digital elements are incorporated into a real-world background, so my guidebook has animation of the creatures going about their lives which can be viewed over the physical background of the pages. In my research, I found that *The Future is Wild* had its own book adaptation written by Dougal Dixon which included AR segments, but these required viewing the book through a webcam onto a computer, creating a sort of separation between the reader and the media. By using the AR capabilities of current smart phones, I hoped to create a much more interactive experience with a less noticeable barrier for the viewer, requiring minimal set up and user-friendly technology. While developing an entire app for *Bugplanet* would've made the scanning experience completely customizable, that endeavor would basically be another project itself, so I settled on using a free AR service. After researching many options, the service which best suited these needs ended up being *Artivive*, an app designed for use in art galleries and exhibits. *Artivive* allows for art to be scanned without any QR codes, letting my final book maintain a cohesive artistic style and layout. The app can also be used immediately after download without any sort of account or payment, perfect for my purposes.

METHODOLOGY

After drawing my animals on paper with traditional pencils, I scanned them and went into Photoshop for coloring. This allowed me to try out different color schemes and layouts easily. I moved each page into Adobe InDesign for the final text layouts so that every text box would be stylistically consistent.

For the animations, I decided to use the same artwork from my pages to emphasize the idea that they were coming to life off the page. I separated the artwork into segments at the joints like a paper puppet, creating additional artwork as I went for structures that were hidden in the original drawing, such as the legs farther from the viewer. Using the free Adobe After Effects plug in DUIK, I created skeletal rigging structures for each animal and then connected each puppet piece to its corresponding bones. For example, the front leg of a dog-like animal would be separated into the shoulder, arm, forearm, hand, and claws, so I had artwork for each of those segments to attach to the program's bones. I made sure each of my animations could loop infinitely so that there wouldn't be any awkward jumps or skips when viewing them through *Artivive*. Uploading augmented reality art requires a trigger image to tell the program which animation to show and how to attach it to the real-world surface. In my case, every trigger image was simply the art for the creature's book page. The animations were exported at the same dimensions of the book pages so that they would lineup perfectly with the actual paper and cover it completely.

For printing and formatting, I decided to go with letter sized spiral bound books. Spiral bound was the most cost-effective way to have the pages lay flat, which is necessary for accurate scanning. If the book was bound any other way, the pages could flip back while being viewed, disrupting the tracking and animations.

BUGPLANET

The final version of Bugplanet is a fifty-page spiral bound guidebook. The book opens with a version of my speculative biology information research, the history of the project, how to scan the pages, and a brief explanation of the planet's geography and species groups. After this, the rest of the book is divided into five biomes, each with their own unique animals and at least one animation. There are a total of ten animations, with one in the introductory pages and the rest distributed throughout the book. The full guidebook is in the appendices, but here I will briefly describe the reasoning behind each segment and its creatures.

INTRODUCTORY PAGES

The introductory pages serve as an explanation of what the book is for readers unfamiliar with speculative biology, as well as the history and inspirations behind the project. I included some of my early artwork from high school to show where some of the creatures got their start and how they've changed as I've developed them over the years. For the scanning instructions, I decided to animate a creature from one of my pages with an array of related animals so that readers could use the book like an actual identification guide, flipping back and forth to find the matching animal. The organization page features a rough cladogram showcasing how all the animals are related to each other taxonomically, explaining why some of them share significant features and parts of their scientific names. I chose to incorporate closely related animals to show how they evolved for different niches and habitats like real animals. For example, polar bears and grizzly bears are both bears, but

have adapted for very different lifestyles and climates. My family of creatures called tetrauds illustrates the same kind of idea, with some better adapted for open plains and others for dense forests.

EQUATORIAL PLAINS

I decided to open the book with the equatorial plains because it is perhaps the most familiar compared to our own planet's plains and savannahs. By starting somewhere almost recognizable, the reader can slowly be introduced to the stranger and more fantastical creatures without becoming alienated. This segment in itself follows that pattern, opening with the hoppers which are very clearly modelled after kangaroos, and the mothalo and millitrittilo which serve as analogues to bison and wolves respectively. By the end of this section, we have the completely foreign great sifters, inspired by sea slugs and siphonophore jellyfish but transplanted to an aerial habitat rather than the deep ocean. This gradient of the familiar to the unfamiliar is designed to steadily ease readers into the universe.

THE BELT FORESTS

This was one of the first biomes I designed as a child, and it features many of my earliest creatures as well. The forest tetraud, fantail, and swooper all feature prominently in my older artwork, with most of the changes being streamlined and simplified designs. Because of my fondness and nostalgia, this section unintentionally hosts the most animations. Hopefully my connections with those creatures have made the animations some of the most inspired and interesting of the book. This is also the only part of the book with

scannable two-page spreads, which I was worried at first wouldn't work because of the spiral binding not being present in the trigger image. Thankfully my color choice of a white spiral blends in with most of the backgrounds, allowing the trigger image to work.

THE WHITE SWAMP

This biome originated as an aesthetic I wanted to include, featuring delicate fairy-like flora and colors. As I was working, I found ways to tie it into the rest of the world through the groundwater caves and relatives of my other creatures. The two tetrauds in this biome were put together to showcase how animals which would normally be competing can both exist in the same space by being active at different times. The two are akin to an owl and a hawk, both aerial predators going after the same types of prey, but one active in the day and one at night. In this way, they can survive with the same resources and habitat without butting heads.

THE RED SWAMP

Bugplanet's southern swamp was designed as a counterpart to the white swamp, two similar environments geographically distant from one another to show how organisms often come up with the same solutions to similar problems. A good modern example would be how both American and African hares have large ears for dissipating heat in their hot habitats. Between the swamps, I have variations of salamanders and swoopers. In both regions some of the salamander species have evolved fleshy layers and extensions along their backs to blend in with similar swamp vegetation. For the swoopers, I instead show a

slightly diverging path based on the swamps' respective water levels. Since the water level is higher in the red swamp, the swoopers there are more suited for semi-aquatic living than their white swamp cousins.

GROUNDWATER CAVES

My final biome for Bugplanet is the network of underwater caves which supplies water across the planet. I needed a solution for not having traditional large oceans to fuel the water cycle, so I turned to one of my oldest inspirations. The BBC series *Planet Earth* was a fundamental part of my childhood and continues to be a source of inspiration for me as my personal gold standard of documentaries. The caves episode from its first season was always my favorite, with its incredible rock formations and strange alien inhabitants, so I drew upon those features for my own upscaled version. I also brought in elements from one of my other favorite biomes, the deep ocean, in thermal vents and encrusting matts of bacteria and bivalves. The caves are really a love letter to some of my favorite environments on Earth, so as I continue to develop the Bugplanet universe I will definitely be adding more and more creatures to it.

CONCLUSIONS

Completing a book like this has always been one of my dream projects, and with my studies in animation I hope to create even more animations of my creatures, hopefully even a short film. This project was ambitious for me and I did not accomplish exactly my original plan, which was to include 3D animations made in Autodesk Maya, but I am satisfied with the 2D look and perhaps even happier with it. Using Maya would've added a higher level of interactivity to the animations, but my original timeline was not well designed for the kind of time needed, nor did it take into account unpredictable events that would put me behind schedule. I plan to continue working on Bugplanet, adding more animals, more nuanced biomes, and animations for every page, avoiding the need for markers showing which pages are scannable. This world is very dear to my heart, and although the thesis process has been taxing, I am glad I finally have a way to properly share it with others.

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APPENDICES

Here, Bugplanet in its entirety is included as images, but the spiral bound final copy will also be present in the thesis library. For the Forest Tetraud and Dancer pages (32-33 and 36- 37), I have added two images at the end to represent the appearance of the full-page spreads in the book. In order to view the animations on these pages, the images on page 61 must be scanned instead.

The scanning technology relies on the color of the images being as close to the original as possible. For this reason, scanning may not work perfectly on these printed pages. If any of the images are not scanning properly, the spiral bound copy should work instead.


BUGPLANET

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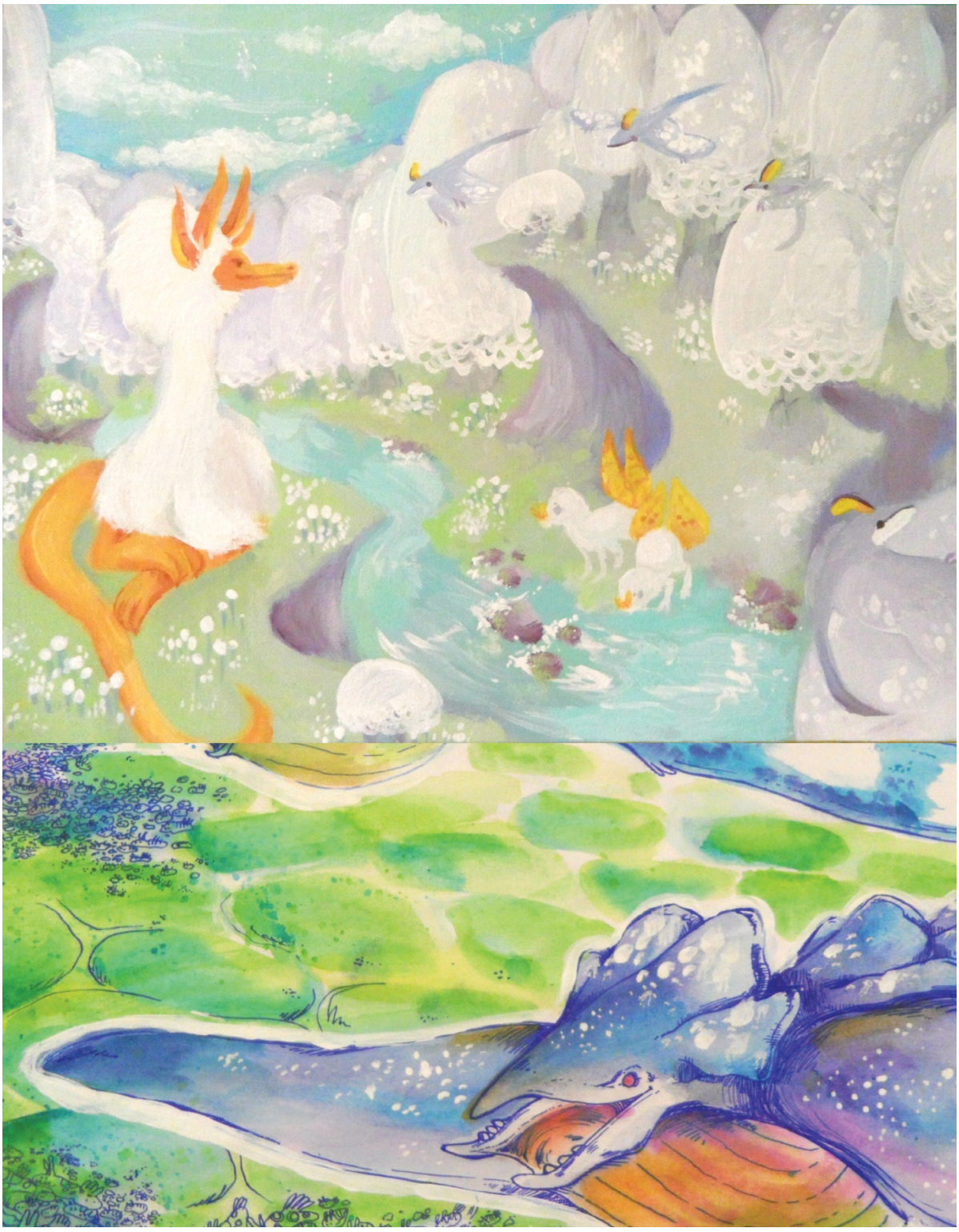
What is Bugplanet?

When I first began to really get into drawing, my main subjects were always animals. I began by copying realistic drawings from hefty animal encyclopedia books, sometimes even tracing printed out photographs of big cats and alligators until I could get them just right. When I ran out of creatures to depict, I would combine them into hybrids that looked like bits and pieces smushed together into awkward chimeras. Somewhere along the way, my animal encyclopedias were joined by dinosaur books, mythology books, guides to sci-fi universes, and nature documentaries which had me thinking more critically about my creations. What niche did they fit into in an ecosystem? How did their adaptations help them to survive? Where did they call home? Bugplanet is the culmination of these early creations reimagined and reworked into more plausible animals that could exist on their own strange little planet far away. The art featured on these introductory pages shows early concepts of some of Bugplanet's creatures. Many have changed significantly, but perhaps you can tell what they went on to become throughout the rest of the book.



Speculative Biology

Speculative biology, also called speculative evolution or speculative zoology, is described by Darren Naish as "the idea that we might be able to guess or imagine those creatures that could evolve in the future, on other worlds, or in other timelines" (Naish 2018). With deep roots in science fiction, Naish and others often cite H.G. Wells' *The Time Machine* as the beginning of the genre, with *After Man* by Dougal Dixon being the first large scale foray into the subject. *After Man* is a guide to the creatures of Earth far in the future after mankind has become extinct, written specifically as an experiment in applying the ideas of evolution to the future. As Dougal puts it, "Other popular-level books used evolution to tell the story of the past, but nobody had taken the whole process – the observable trends – and projected them into the future. I thought: I could do this" (Naish 2014).

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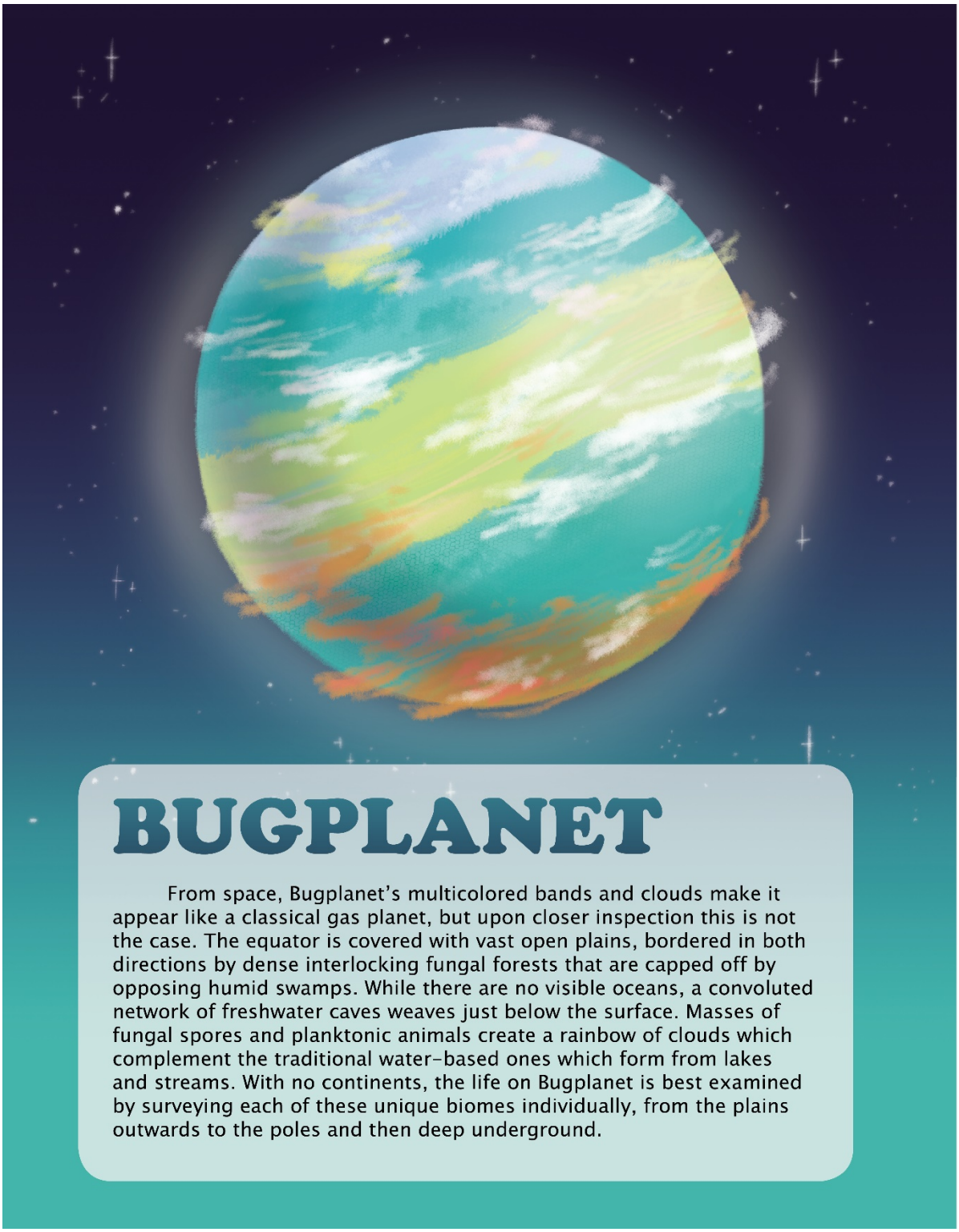
While researching for this book, I came across so many more works I loved that I didn't know were so heavily tied into speculative biology, from *Alien Planet*, the docufiction adaptation of Wayne Douglas Barlowe's *Expedition*, to *Spore*, the life-simulation game where you build your own creatures. As it turned out, speculative biology was a much greater part of my life than I ever thought it was, and now I have even more content to explore as I continue to sculpt Bugplanet into a full-fledged world of its own.

How to see Bugplanet's creatures come to life!

Pages marked with the symbol in the corner of this page can be scanned using the app *Artivive* on any sort of smart phone or tablet. All you need to do is download the application, and then aim the camera at a marked page in this book. After a brief loading bar, the creatures will appear animated right on the page, acting out their signature behaviors in motion.

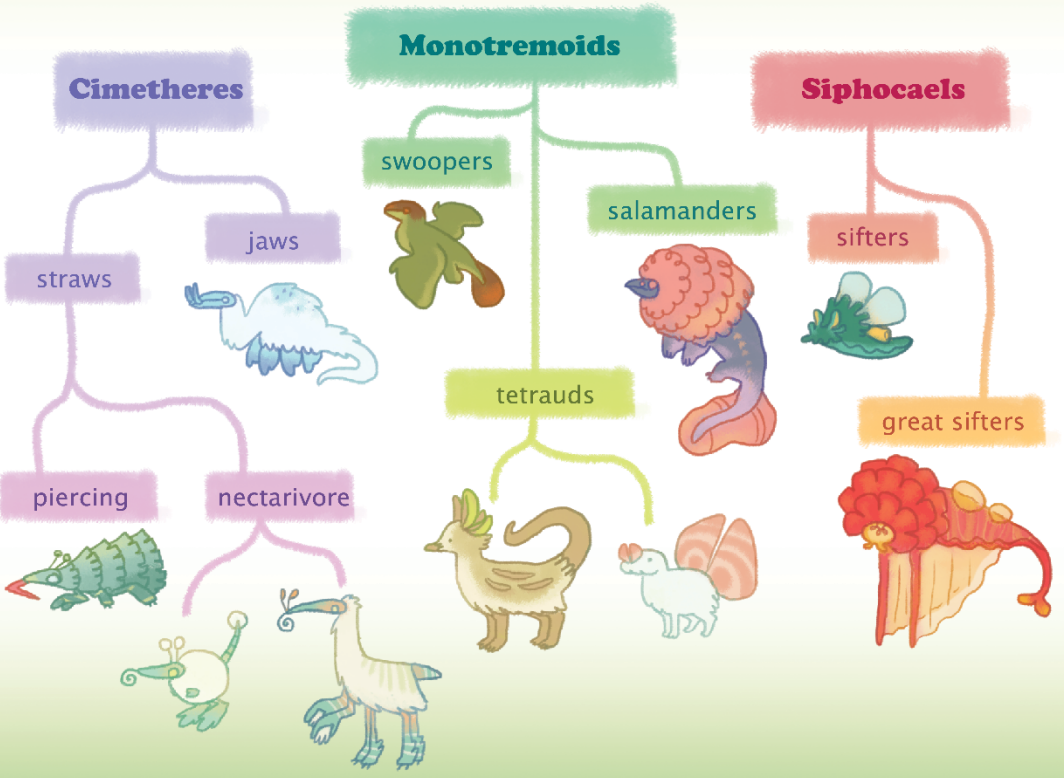
Try scanning this page to test out the app! See if you can identify which creature is animated here using the book as a guide.



BUGPLANET

From space, Bugplanet's multicolored bands and clouds make it appear like a classical gas planet, but upon closer inspection this is not the case. The equator is covered with vast open plains, bordered in both directions by dense interlocking fungal forests that are capped off by opposing humid swamps. While there are no visible oceans, a convoluted network of freshwater caves weaves just below the surface. Masses of fungal spores and planktonic animals create a rainbow of clouds which complement the traditional water-based ones which form from lakes and streams. With no continents, the life on Bugplanet is best examined by surveying each of these unique biomes individually, from the plains outwards to the poles and then deep underground.

ORGANIZATION



Without genetic research, the fauna of Bugplanet has to be organized by morphological information. Three main groups of animals have so far been discovered: the insect-like Cimetheres, the oviparous Monotremoids, and the soft-bodied Siphocaels.

Cimetheres are divided by whether their mouthparts form into biting jaws or long straws, with the latter further divided into piercing and nectar-drinking categories. Monotremoids, animals with both reptilian and mammalian qualities, branch into swoopers, salamanders, and tetrauds. Lastly, Siphocaels split between the simple sifters and their more complex relatives. The insect-like Cimetheres make up the majority of megafauna, giving Bugplanet its name.

EQUATORIAL PLAINS

Covering the middle of the planet, vast rainbow tinted plains provide a home for a variety of creatures, from massive soaring filter feeders to tiny kangaroo-like hoppers. Rather than thin grasses, the nutrient-poor soil here is populated by hardy succulent-like plants which serve as grazing material for animals with long piercing tongues. With little cover, they must use either speed or size to evade predators, dashing along well-trodden trails or relying on sheer intimidation. Although beautiful, life is not easy on the wide open equatorial plains.

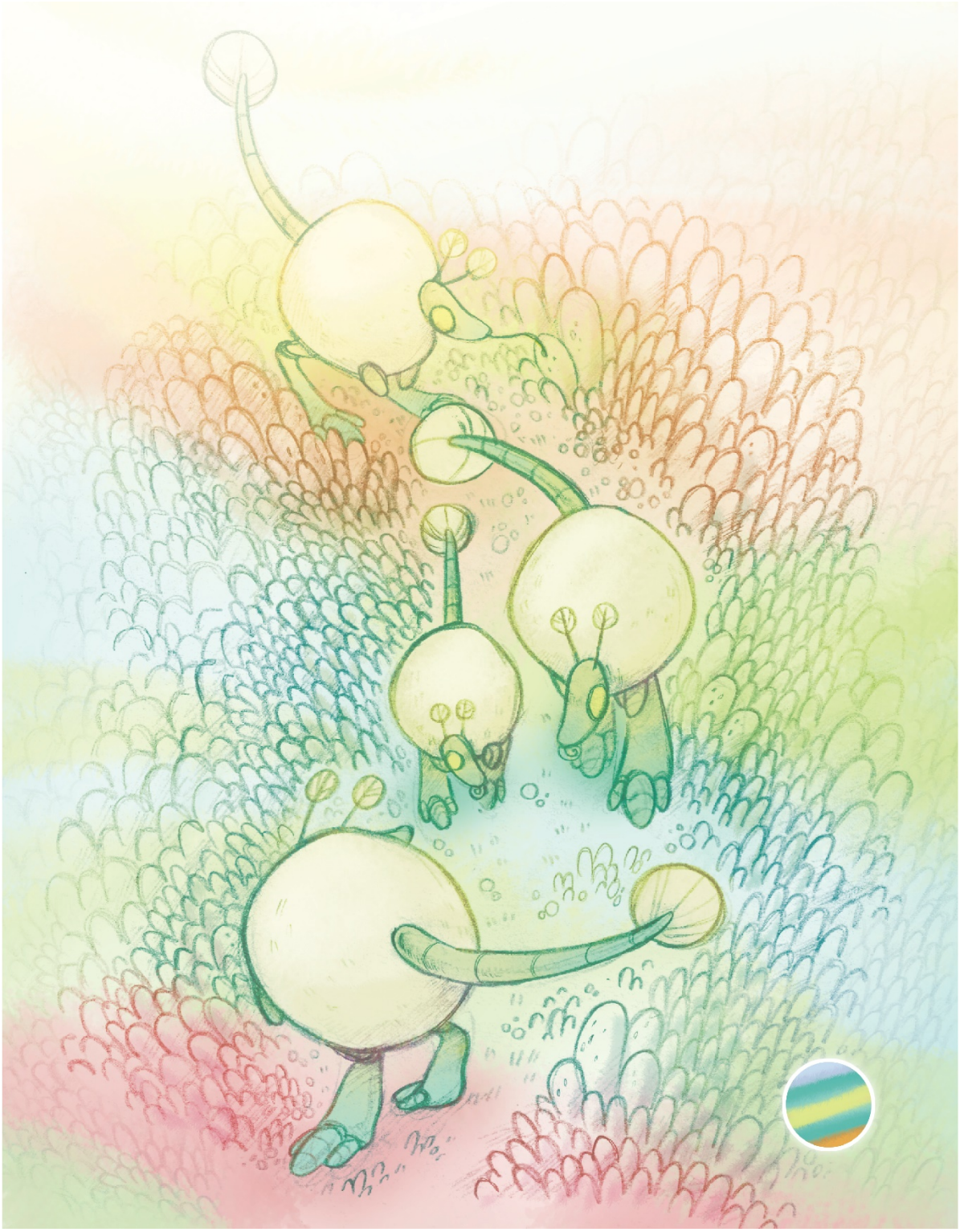
Plains Hopper

Entomacropus praesulto

Bounding through the taller patches of foliage, hoppers search out the juiciest succulents to feed on. When unfurled, their long tongues can be the length of their entire body, perfect for draining even the largest plants of nectar. They tend to stay in small family groups, utilizing both safety in numbers and more antennae to sniff out food.

Adults will take turns keeping watch while the rest of the family feeds, wary of the tetrauds which often hunt them for a quick snack.

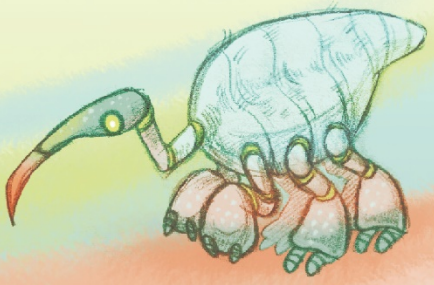
Hoppers belong to the large family of insect-like animals common on Bugplanet, recognizable from downy fur, segmented bodies, and six limbs. While they may appear to only have four, the almost vestigial front arms of the Hopper are actually its first two sets of limbs merged together.



Spectrulent Piercer

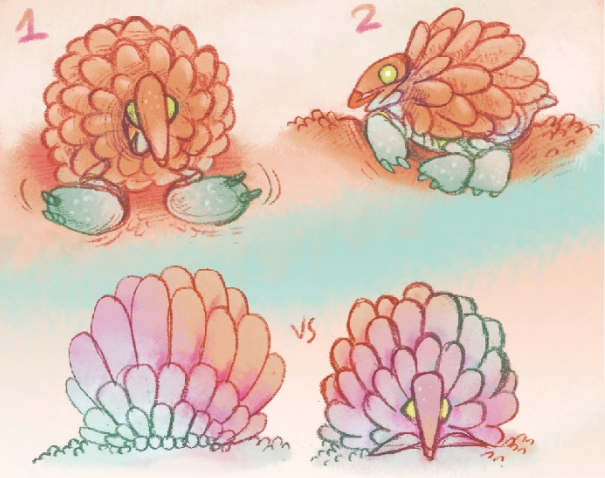
Percutiocimex opalus

Spectrulent piercers are deadly ambush predators which disguise themselves as spectrulents, a type of succulent which grows in a bush-like arrangement. Spectrulents get their varied colors from the soil they grow in, so piercers routinely feed on dirt as well as their prey to maintain the colors of their territory. If they must move, they can shed their hairs and quickly regrow a new camouflaging coat.



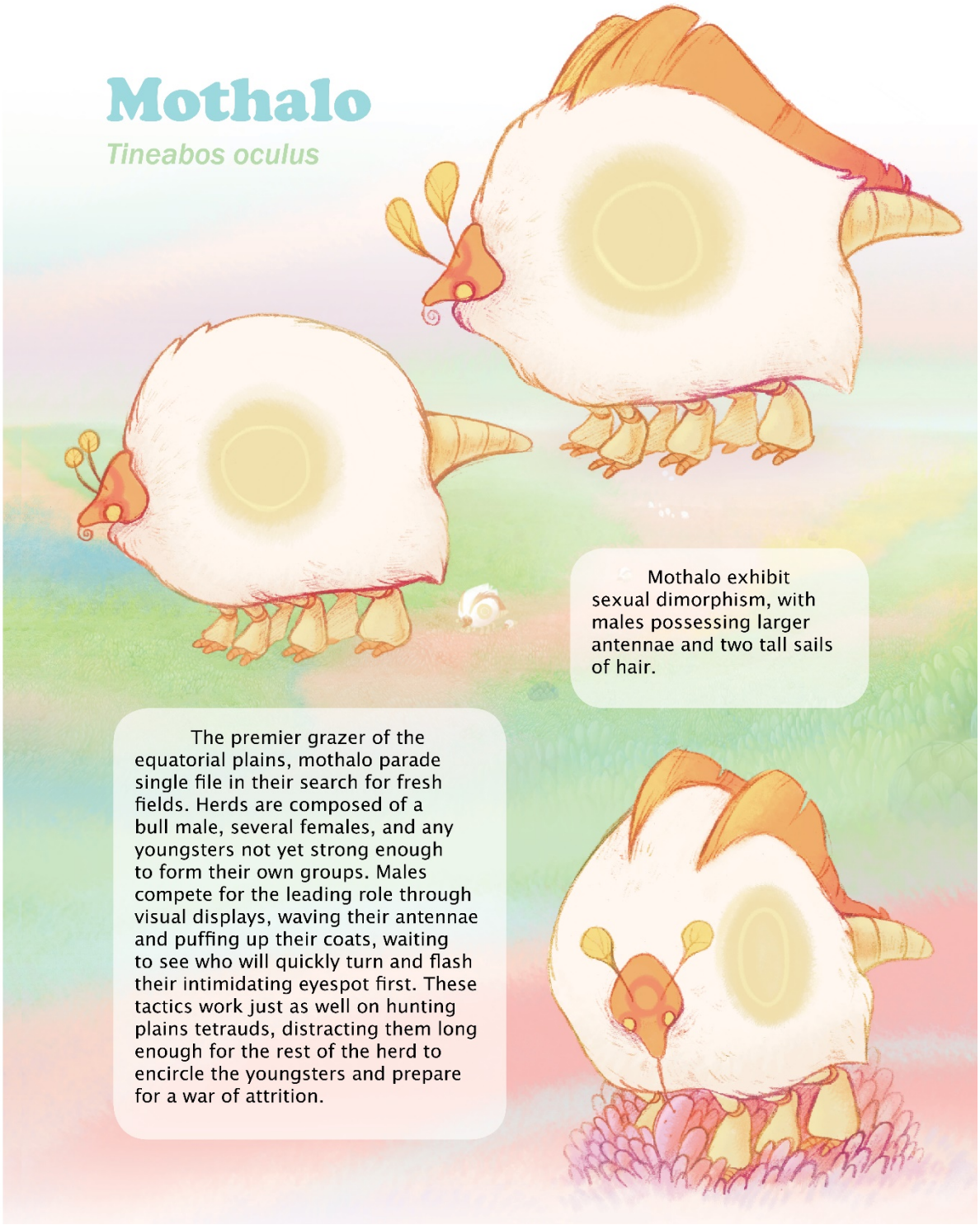
The process of setting up an ambush is a simple one. First, the animal uses its broad first pair of legs to scoop out a shallow area of dirt. Once deep enough to fit all of its limbs, it can then settle inside so that only its head and coat are visible. Holding its head in a vertical position helps to further blend in.

With a closer look, a real spectrulent and a piercer are not too hard to tell apart. The real plants have smaller pearl-like leaflets at the base, while the piercer may instead show the top of its front legs. Piercers also can't disguise their large green eyes, but that isn't a problem if their territory is also green.



Mothalo

Tineabos oculus



Mothalo exhibit sexual dimorphism, with males possessing larger antennae and two tall sails of hair.

The premier grazer of the equatorial plains, mothalo parade single file in their search for fresh fields. Herds are composed of a bull male, several females, and any youngsters not yet strong enough to form their own groups. Males compete for the leading role through visual displays, waving their antennae and puffing up their coats, waiting to see who will quickly turn and flash their intimidating eyespot first. These tactics work just as well on hunting plains tetrauds, distracting them long enough for the rest of the herd to encircle the youngsters and prepare for a war of attrition.

Millitrittilo

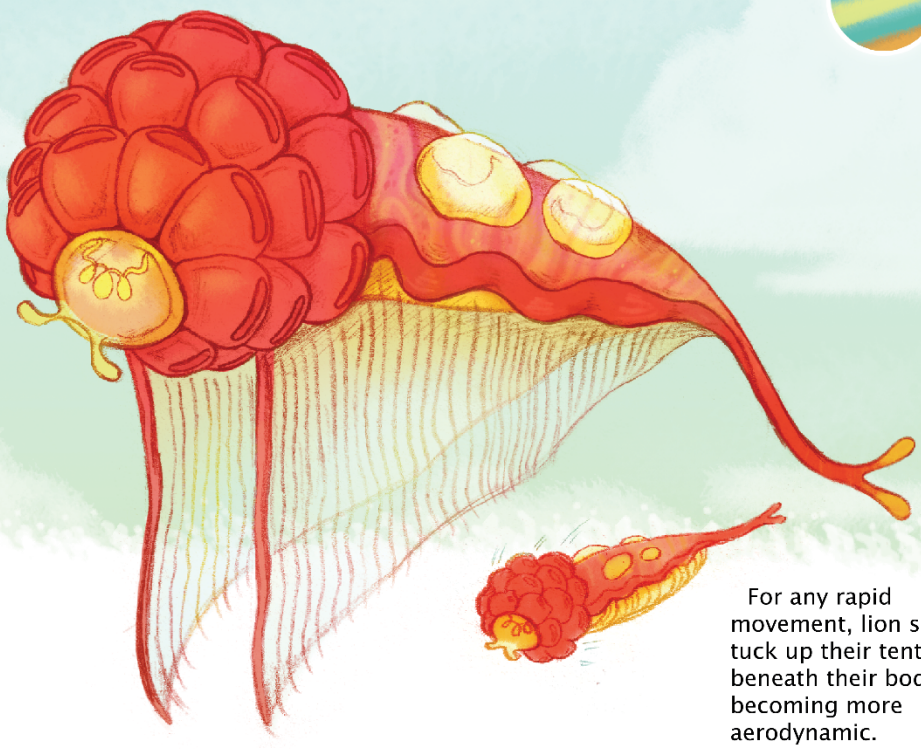
Tetraud millitrittilo

Named for their four ears, various species of tetrauds populate Bugplanet, but the plains variety is unusually social. The species name *millitrittilo* refers to the complex chirping vocalizations they use to communicate, particularly while hunting in packs. Nothing is off the menu for these creatures, but mothalo pose the biggest threat with their heavy bodies and powerful legs. Often times however, the risk is worth the reward when one grazer can feed the entire family.

Plains tetrauds are also unique for their almost complete fur covering. The relatively flat nature of the plains presents no buffer for cold and constant winds, so a layer of insulation provides welcome comfort. Juveniles start life with ragged spotty coats, but once fully grown their fur becomes wool-like in density.

All the members of a pack contribute to protecting and raising their young. With little shelter on the plains, a watchful older sibling could be the only thing keeping a pup safe from a hiding spectrulent piercer. Like Earth's monotremes, tetrauds lay eggs which must also be watched over, as a determined hopper or mothalo could pierce through the shell for an especially nutritious meal. Adults however have very little to worry about, sitting at the top of the plains food chain as one of the most intelligent and powerful creatures on Bugplanet. Their chirps and whistles are intricate enough to assign name sounds to family members, further enhancing their ambush hunting planning abilities.

The Great Sifters

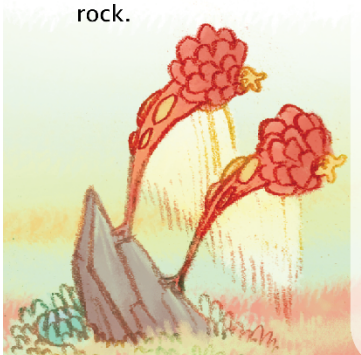


For any rapid movement, lion sifters tuck up their tentacles beneath their bodies, becoming more aerodynamic.

Lion Sifter

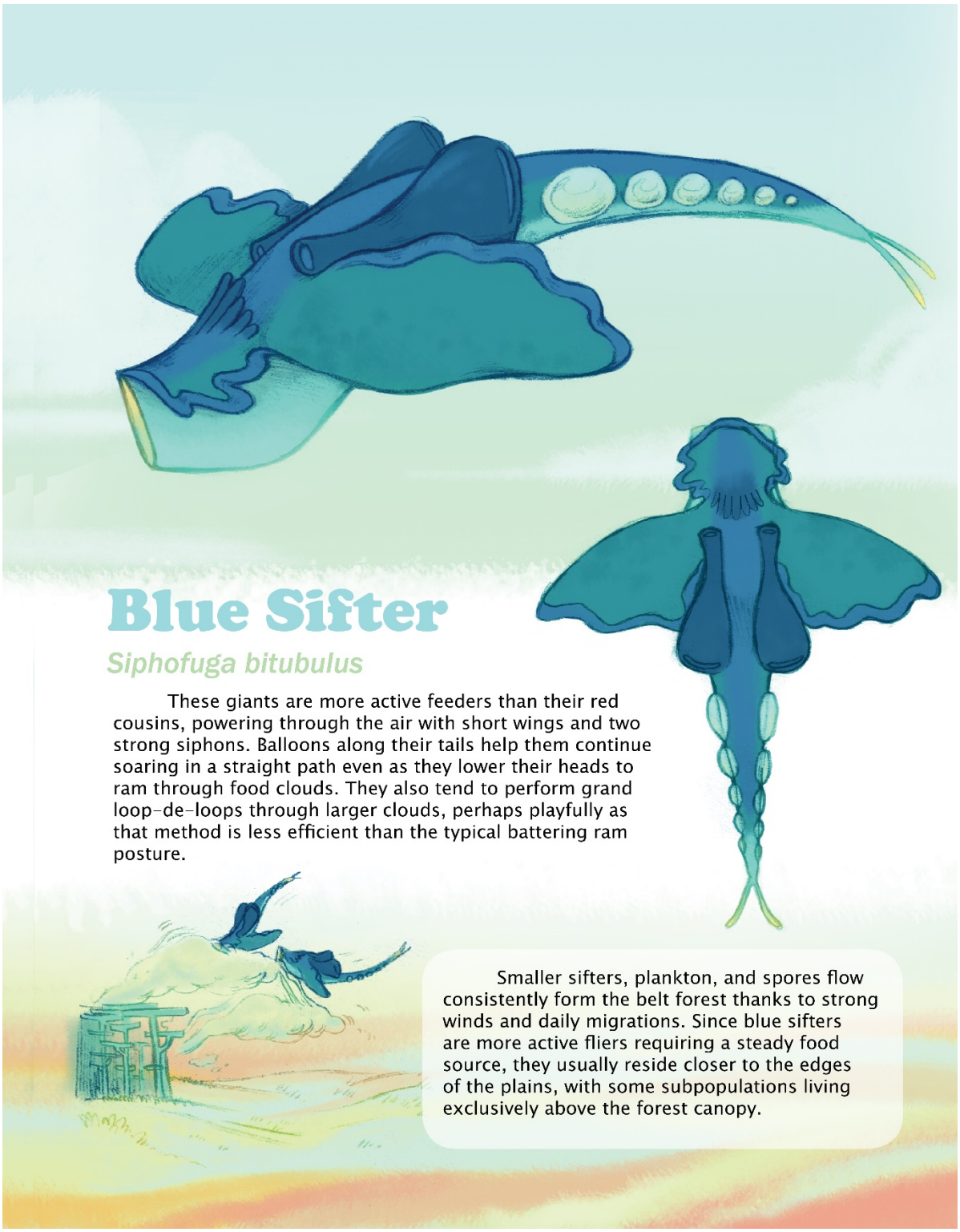
Siphofuga velamentum

Lion sifters spend most of their time aloft, but when resting they use a specialized foot organ to anchor themselves to rock.



Sporting a magnificent mane of propulsion bells, lion sifters slowly cruise high above the equatorial plains in search of food. They stay in the air through a combination of gas filled balloons and lightweight tissues. To control their leisurely flight, the bells around their heads pump air in various directions like siphons. With control over each individual bell, lion sifters can make even the most minute of adjustments to their trajectories.

Their curtain-like tentacles are equipped with thousands of tiny hooks which activate when touched, ensnaring smaller airborne organisms and spores. Weighed down by their catch, they then find a place to rest, curling their tentacles up towards their mouth to comb through their findings.



Blue Sifter

Siphofuga bitubulus

These giants are more active feeders than their red cousins, powering through the air with short wings and two strong siphons. Balloons along their tails help them continue soaring in a straight path even as they lower their heads to ram through food clouds. They also tend to perform grand loop-de-loops through larger clouds, perhaps playfully as that method is less efficient than the typical battering ram posture.

Smaller sifters, plankton, and spores flow consistently form the belt forest thanks to strong winds and daily migrations. Since blue sifters are more active fliers requiring a steady food source, they usually reside closer to the edges of the plains, with some subpopulations living exclusively above the forest canopy.

THE BELT FORESTS

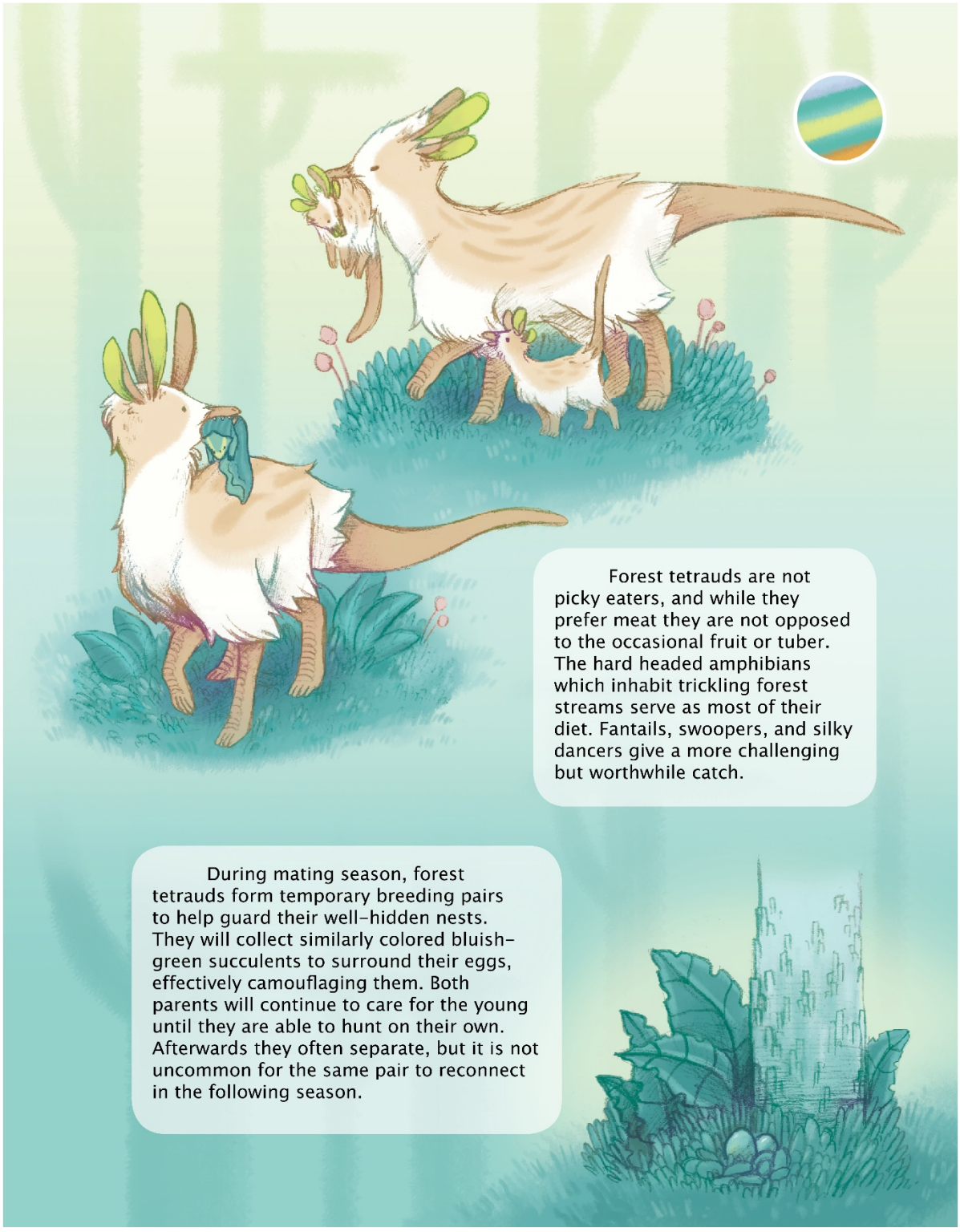
Flanking the plains on the north and south, the fungal belt forests cover much of Bugplanet. Towering mushroom-like trees interlock their wide crowns on the canopy level, creating a somewhat hexagonal matrix from a bird's eye view. The dim light that filters through the cracks allows for low growing shrubs and fungi to flourish, but the forest floor is generally sparse with vegetation. Creatures here live complicated interwoven lives, hidden by low light and rolling mists.

Forest Tetraud

Tetraud viridicolor

Amongst the sparse belt forest undergrowth, these agile generalist tetrauds search for prey with their acute hearing and sense of smell. The ability to rotate all four ears gives them a 360 degree range of hearing, so even the smallest rustle of foliage can indicate a potential meal.

While not nearly as social as their plains counterparts, they do have a wide range of calls. In the occasional cooperative hunting event, the green areas on their bodies can faintly bioluminesce, allowing continual communication when silence is necessary.

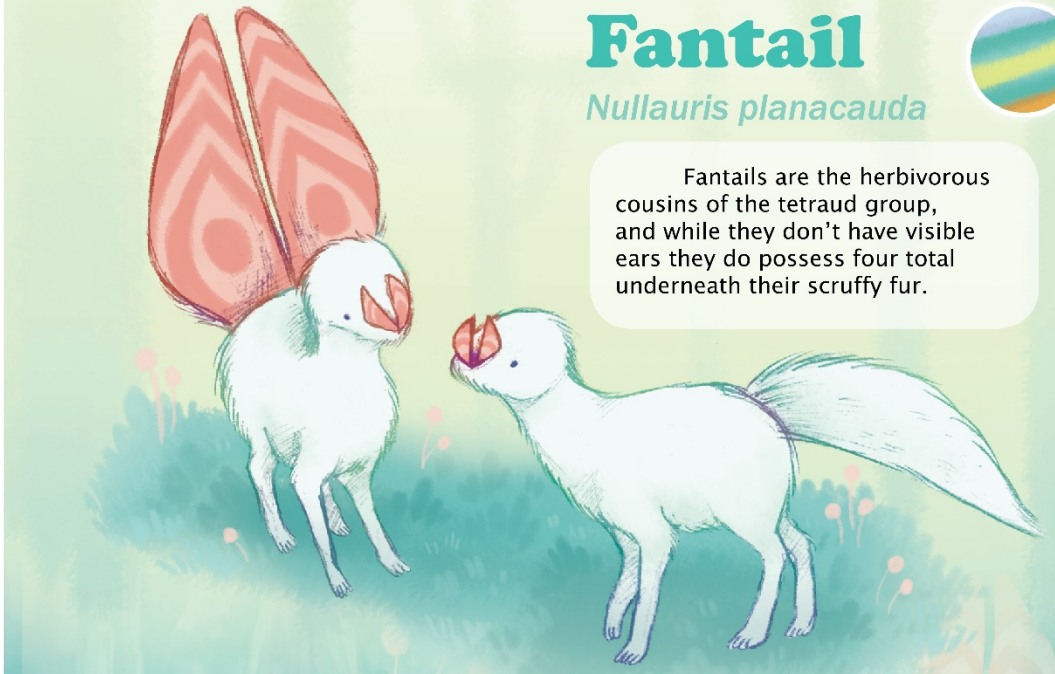


Forest tetrauds are not picky eaters, and while they prefer meat they are not opposed to the occasional fruit or tuber. The hard headed amphibians which inhabit trickling forest streams serve as most of their diet. Fantails, swoopers, and silky dancers give a more challenging but worthwhile catch.

During mating season, forest tetrauds form temporary breeding pairs to help guard their well-hidden nests. They will collect similarly colored bluish-green succulents to surround their eggs, effectively camouflaging them. Both parents will continue to care for the young until they are able to hunt on their own. Afterwards they often separate, but it is not uncommon for the same pair to reconnect in the following season.

Fantail

Nullauris planacauda



Fantails are the herbivorous cousins of the tetraud group, and while they don't have visible ears they do possess four total underneath their scruffy fur.

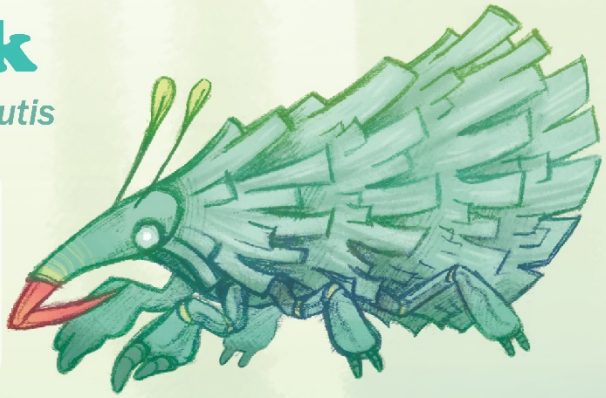
Having a bright red tail in a green forest would make any creature stand out like a sore thumb, but fantails have a clever solution for this problem. The two lobes of their tail possess a fair degree of rotation at the base, allowing them to fold open and closed like a card. The outer surface is covered in more fur to match the rest of the body. Through this folding mechanism, they can use their tails for everything from mating displays to intimidating forest tetrauds with a sudden flash of color and eyespots.

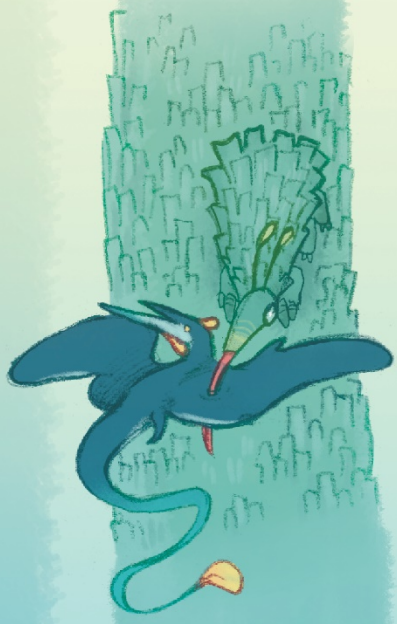
Fantails form permanent monogamous pairs through a flashy duet dance with their bright tails and noses. Every individual has a unique and recognizable pattern on both the nose and tail surfaces, allowing for easy identification.

Barkback

Percutiocimex arborcutis

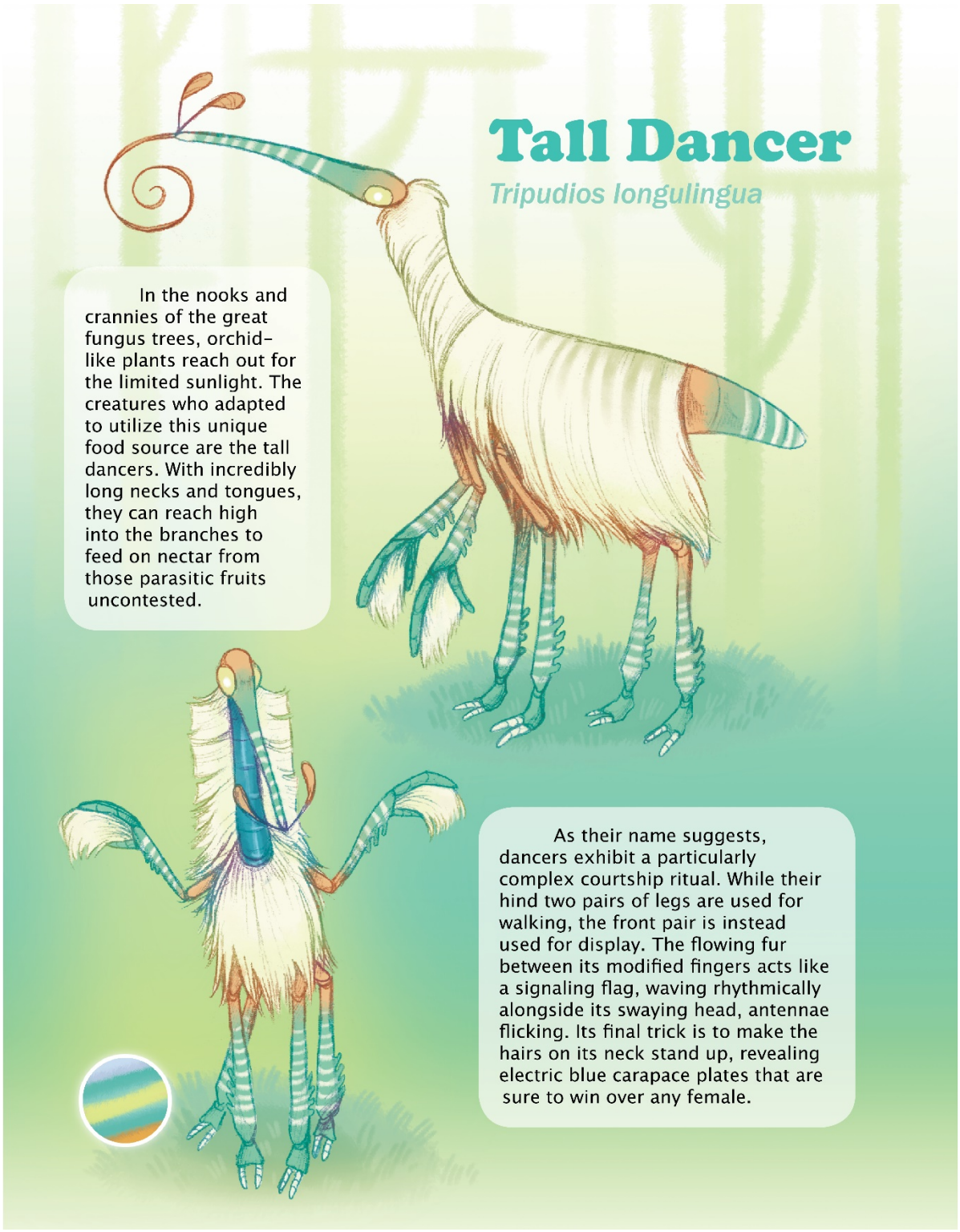
Like the spectrulent piercer of the open plains, barkbacks rely on surprise and disguise to catch prey. Their sharp folding tongues can extend in an instant into a deadly spear-like weapon.





Barkbacks must be careful to position themselves correctly to match the direction of the fungal trees they perch on. When successful, even swoopers have trouble spotting the outline of their conical bodies against plated trunks. After spearing prey, Barckbacks deliver a mild numbing poison through the surface of their tongues, giving them time to use their more flexible front legs to maneuver the food into a position in which it can be sucked dry.

Unlike spectrulent piercers, barkbacks must collect their disguise from nature. Their front arms are designed to easily dig away chunks of bark, and their longer back legs can then help position them along their segments while the middle legs keep hold of the tree surface. Their bodies produce a sticky material where the segments join together, allowing for neat layered rows of bark pieces.


Tall Dancer
Tripudios longulingua
In the nooks and crannies of the great fungus trees, orchid-like plants reach out for the limited sunlight. The creatures who adapted to utilize this unique food source are the tall dancers. With incredibly long necks and tongues, they can reach high into the branches to feed on nectar from those parasitic fruits uncontested.
As their name suggests, dancers exhibit a particularly complex courtship ritual. While their hind two pairs of legs are used for walking, the front pair is instead used for display. The flowing fur between its modified fingers acts like a signaling flag, waving rhythmically alongside its swaying head, antennae flicking. Its final trick is to make the hairs on its neck stand up, revealing electric blue carapace plates that are sure to win over any female.

Silky Dancer

Tripudios semaphorus

Silkies graze on lower foliage and fruits with their own long tongues, staying out of competition with their larger relatives. Their front legs have been extremely modified, with the visible portion simply being a long finger, the usual arm joints bunched together at the base for ample rotation. Silkies tend to live closer to the plains edges of the forest where there is more light and fewer trees, compensating for their poor eyesight.

The flag arms of silky dancers are adorned with greenish rings. When dancing, they bob up and down, separating the hairs through wind so that the rings seem to appear and disappear. Silkies dance a simple duet that concludes with pheromone-based antennae communication.

Swooper

Delapsae mangirostra

Swoopers feed on the migratory colonies of air sifters and plankton which frequent the higher forest levels. Their long lower jaws dip into the cloud-like schools, skimming out a few good morsels with each curving dive. Although they are of little use in flight, their long tails instead serve as anchors when they rest, wrapping tightly around tree branches. At night, swoopers sleep in large colonies hanging from trees. Competition for plants with enough branches is tense between neighboring territorial groups, so aerial spats are not uncommon.

Forest Sifters

Siphoreno sp.

Alongside vegetation, small air sifting creatures make up the base levels of Bugplanet's food chains. Ranging from microscopic and planktonic to football-sized, these creatures feed on each other, floating fungal spores, and the bacterial mats that encrust many rocks and tree trunks. Leisurely floating from food source to food source, some simply follow the wind all the way to the plains.

a. Twinballast, carnivorous nomad
b. Velloon, speed based predator
c. Pearl Orb, algae eater
d. Polypdorsum, algae and bacteria eater
e. Crown Orb, algae eater
f. Viridisipho, filter feeder
g. Lime Fly, parasite of other sifters
h. Yellow Chitonslug, rock-scraping bacteria eater
i. Violoon, wandering filter feeder
j. Crimson Chitonslug, bacteria eater with internal balloons

THE WHITE SWAMP

At the planet's poles, humid swamps rest over fertile grounds hollowed by seismic activity and pooling water. Geothermal vents in the underwater caves help keep the White Swamp nice and toasty, and the warmer waters make comfortable homes for many amphibious creatures. Lace-like mushrooms grow to incredible sizes in the rich earth, providing unique shelters for most of the land's animals. The spores released by these trees are the some of the first to make the long and windy journey south to the equatorial plains, but upon arrival the climate there is not suitable for them to take root.

Pygmy Tetraud

Tetraud parvulus

Nimble and skittish, these small tetrauds playfully explore the great northern swamp's winding forests, searching for small prey and safe places to sleep. Their large secondary ears assist in both finding prey and hearing the high-pitched calls of their species. Although generally solitary, these animals are cooperative with each other, passing messages along about good places to hunt or hide and where the territories of their dangerous larger cousins should be avoided. These creatures are nocturnal as to further steer clear of those larger carnivores. During the day, they sleep under younger and smaller lace mushrooms, only emerging after dark to hunt for sifters confused by moonlight and bioluminescent stalk fungi.

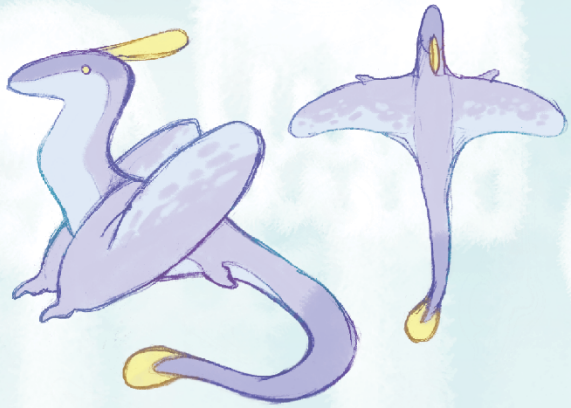
Powerful hind legs let pygmy tetrauds leap three times their height into the air after flying prey, quickly snatching them with sharp pointed teeth. Although short, their sturdy tails help them balance during these maneuvers.

Yellow-crested Swooper

Delapsae flavocrista

Compared to forest swoopers, these animals are larger and more sluggish, preferring to bask on large lace mushroom caps in the warm sunlight whenever they can. Their colonies are smaller, but much louder, as their more traditionally shaped snouts make for great bellowing honks.

Although risky, these swoopers will hunt for small fish and amphibians in swamp pools when sifters are nowhere to be found. Strength in numbers gives them a bit of confidence against the threat of large predators just beneath the surface.



The bright yellow coloration of their mouths helps chicks get the attention of their parents when they bring back food to the nest. Retaining this coloration into adulthood, it then serves the dual purpose of intimidation display and continual begging. Even long after they've become independent, yellow-crested swoopers will remember their parents and follow them around hoping for a quick snack.

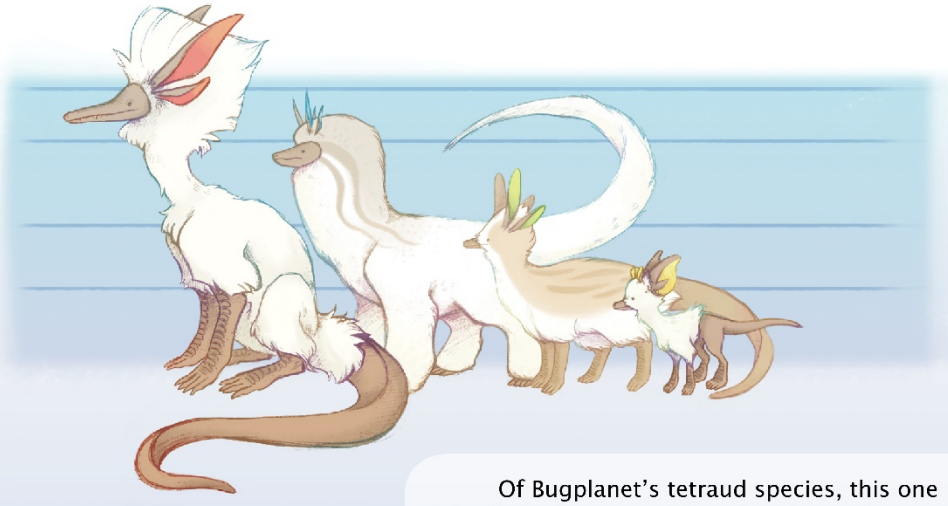
Crimson Tetraud

Tetraud bellarutilis

The top land predator of the white swamps, these ambush hunters control vast individual territories that competing carnivores dare not enter. Their long snouts lessen the general power of their bites, but give them the reach necessary for catching speedy fish and swoopers.

Crimson tetrauds are not afraid to take a dip in the water either, with their broad tails beneficial to both balance and swimming, and their long necks held above the water's surface.

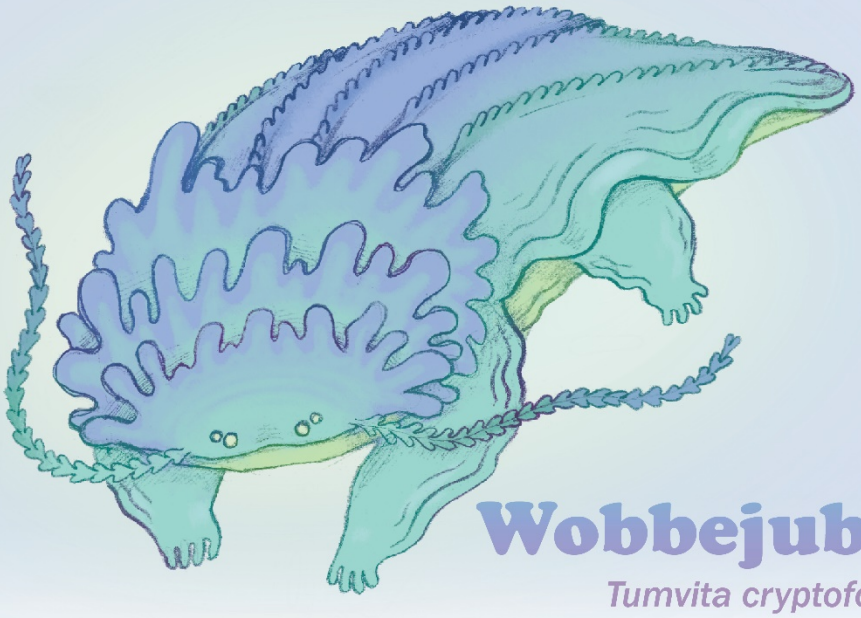
These animals sport a significant fur crest unlike their relatives, and while its purpose is not entirely understood, it may help in intimidation when contesting over territory borders.



Of Bugplanet's tetraud species, this one is both the largest and heaviest. Even when sitting down it towers over the plains variety, and its tail alone is longer than both smaller species. While they are all very visually different, the color coding of their bioluminescence may have helped differentiate between species in the past before they had become so diverse.

When catching a hard-headed amphibian, crimson tetrauds must either eat around the thick skull or find a way to break it to reach the nutritious insides. Individuals have been seen using either their claws or their heavy tails, perhaps representing different family lineages which passed down different techniques to their young.

Females care for their young on their own, as the males are preoccupied with territorial squabbles. They usually lay only one egg, dedicating all of their resources to it. Because of this, their population numbers are typically low, but individuals have high levels of skill and intelligence.

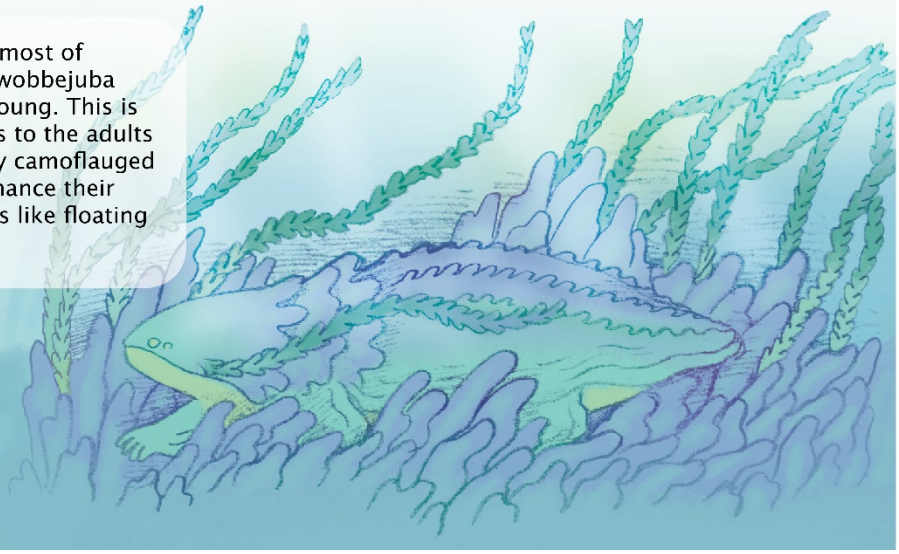


Wobbejuba

Tumvita cryptofolia

These enormous creatures lay quietly beneath the surface of the white swamp's many pools and rivers, camouflaging themselves amongst the layered aquatic plants. Both their sensory whiskers and frilly skin have evolved to closely resemble the underwater flora, selling the illusion that their large bodies are simply clumps of foliage. Smaller amphibians, fish, and even land animals straying too close to the water's edge are all fair game for these ambush predators.

Unlike most of its relatives, wobbejuba guard their young. This is advantageous to the adults as the equally camoflauged juvenilles enhance their own disguises like floating debris.



Tusked Nessen

Remuspes fractudens

Once wading grazers, this species slowly evolved paddle-like legs and specialized lungs to reach deeper and more nutritious food sources. While they are usually spotted resting at the surface, nessens dive to gouge weeds from the sediment with their eponymous tusks.

They rest for extended periods of time, allowing algae and stalked fungus to grow on the tops of their humped backs. If trapped in a disconnected swamp pool, they can drag themselves on land to a new home, but their specialized limbs make it slow and difficult. In this state, their only defense against predators is the threat of swinging tusks and a heavy sweeping tail.

THE RED SWAMP

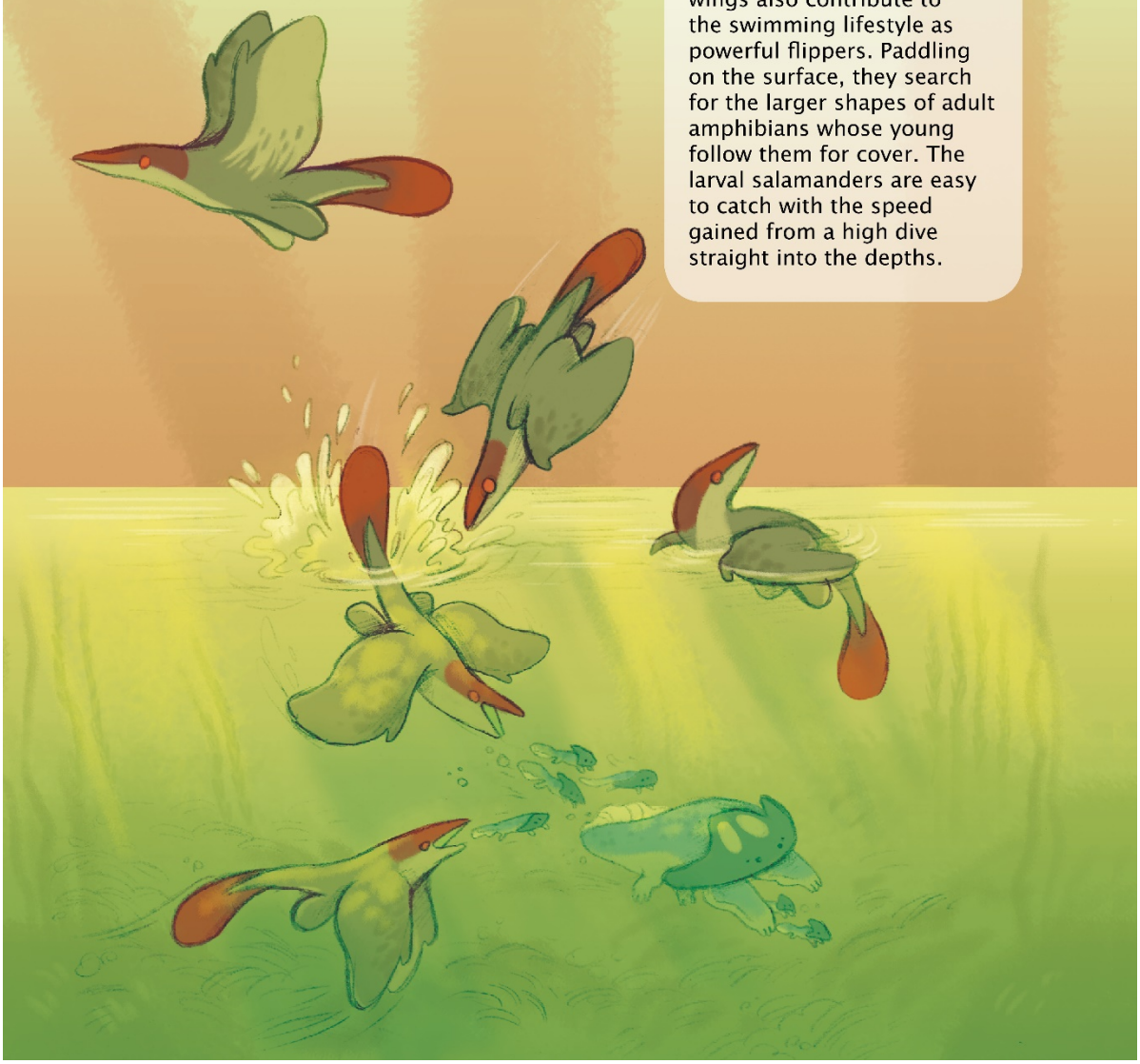
Bugplanet's southern pole is also capped by a great humid swamp, but the life here is unique from its Northern counterpart. There is little solid land here, with the bases of most trees submerged by the thick green water. Sparse islands provide relative safety, but even then the ground is soft and prone to breaking away when oversaturated. Small sifters thrive on the ample fungus population, whose spores create a constant reddish-orange mist floating above the water.

Tuffo

Delapsae anatina

Perhaps the most active and agile of the swooper family, tuffos are more solitary than their relatives. Breeding pairs will bravely defend the small islands they claim for nesting, sometimes even to the death.

While their cousins have near vestigial hind limbs, tuffos have kept theirs larger and paddle-shaped to help when chasing fast prey underwater. Their shorter wings also contribute to the swimming lifestyle as powerful flippers. Paddling on the surface, they search for the larger shapes of adult amphibians whose young follow them for cover. The larval salamanders are easy to catch with the speed gained from a high dive straight into the depths.



Scoopstilt

Altecrus cavomanus

The long limbs of the scoopstilt allow it to traverse swampy waters without worrying about holding its breath or getting its fur wet. These creatures are only so tall though, and therefore avoid deeper waters where they can't keep their heads above the surface. Their fin-like fur sails aid in balance, especially in shallower waters where more of their legs are exposed.

Their namesake front limbs are specialized to dredge up algal and bacterial colonies from the waterbed, allowing them to pick through with their long tongues for small crustaceans and aquatic sifters.

Balancing Reiher

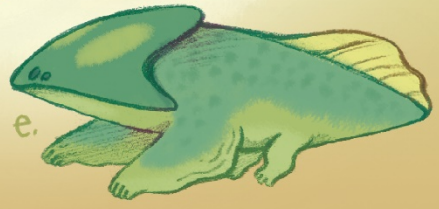
Ardeacimex rostrosaeta

Waiting at the edge of the land, balancing reihers use their incredibly long antennae to detect prey animals in the water. By staying completely still, their feelers sway naturally in the current, appearing like plant matter to creatures underneath. The fan-like tips are sensitive enough to detect even the smallest of movements, so reihers must carefully chose which targets are worth giving away their presence to capture. Once that is decided, they thrust their long beaks downwards to pluck prey from the water, leaving most amphibians no time to realize what has suddenly brought them above water. When eating bullheads, this beak also helps them pry away the hard coverings to reach more meat.

These creatures have some of the most unusual adaptations in the red swamp. Their middle pair of legs have become modified to work like climbing anchors, pinning them securely in place while they wait motionless for prey to pass by. The downside to these limbs is they have no swimming adaptations, and are thus very vulnerable when travelling to new hunting grounds.

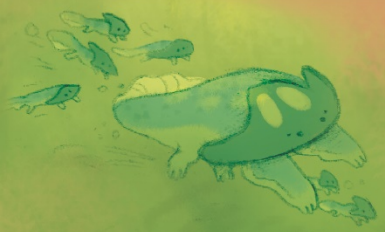
Bullheads

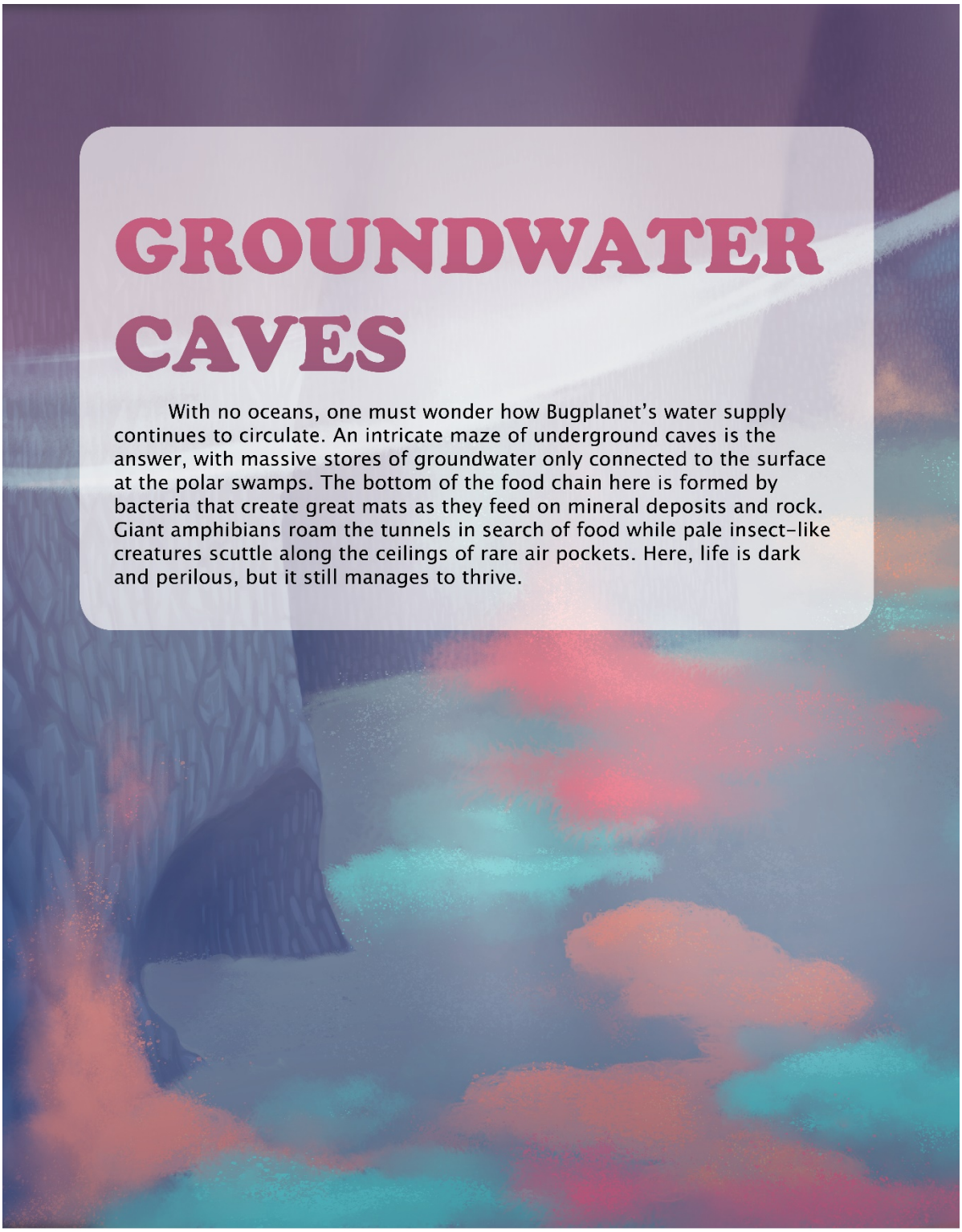
Galeadurus sp.



The bullheads are a diverse group of salamander-like organisms inhabiting the red swamp's waters. Up against unpredictable reiher and tuffo attacks, most species have developed armored skulls which make it more difficult to be swallowed or eaten. Lucky individuals may escape capture only having lost a chunk of their tail.

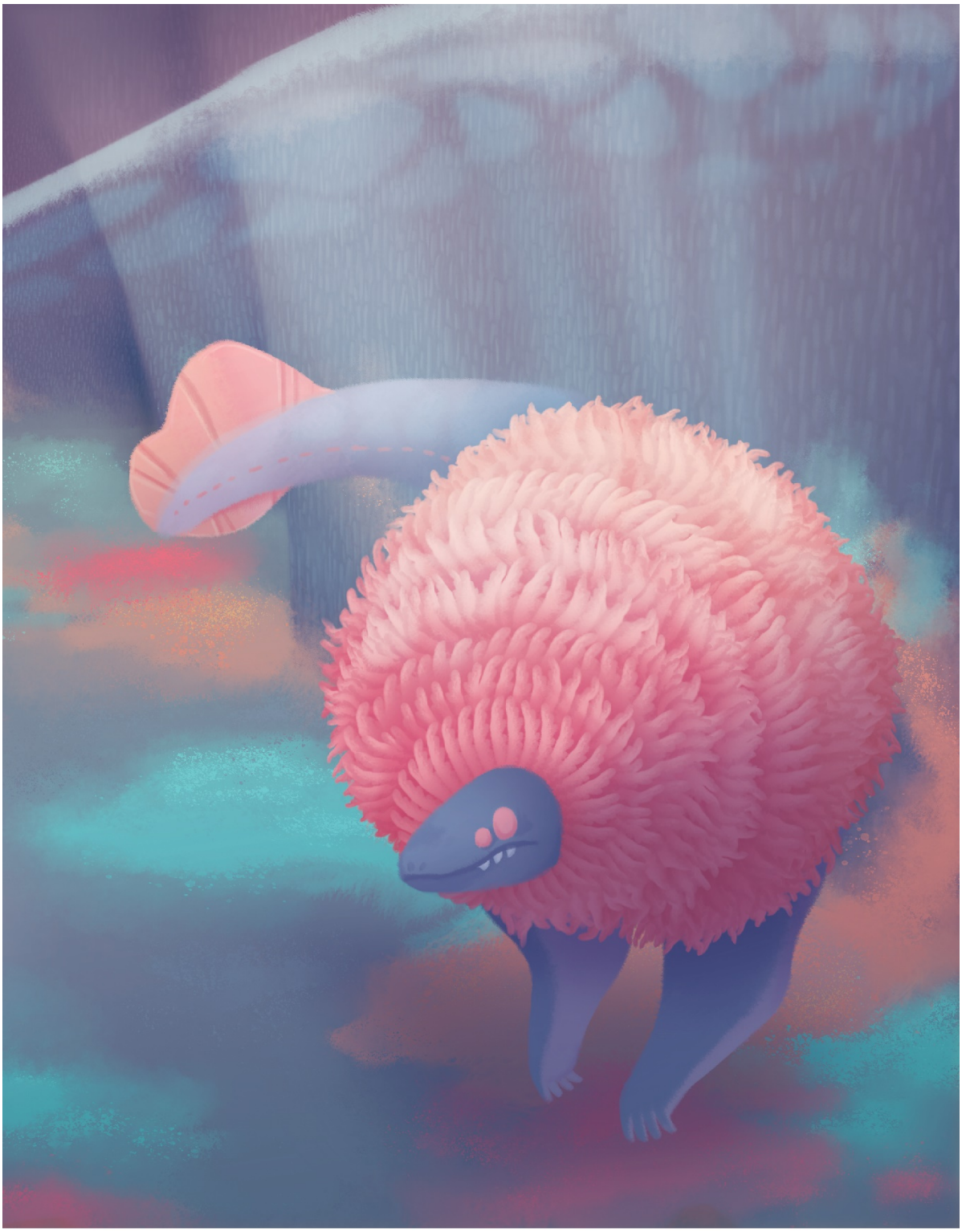
a. Tritoro – a generalist relying on heavy armor for defense, they eat anything they can fit in their wide mouths
b. Wiggleback – a small camouflaged ambusher with intimidating eyespots, possibly related to the wobbejuba
c. Dusky Boomerang – distinguishable by its large skull protrusions, they often burrow into the mud to ambush prey
d. Ignicorn – the horn deters predators while also being useful in intraspecific combat over mates and territories
e. Tealfin – uses its sloping skull to root around in the waterbed, one of the few bullhead that cares for its young





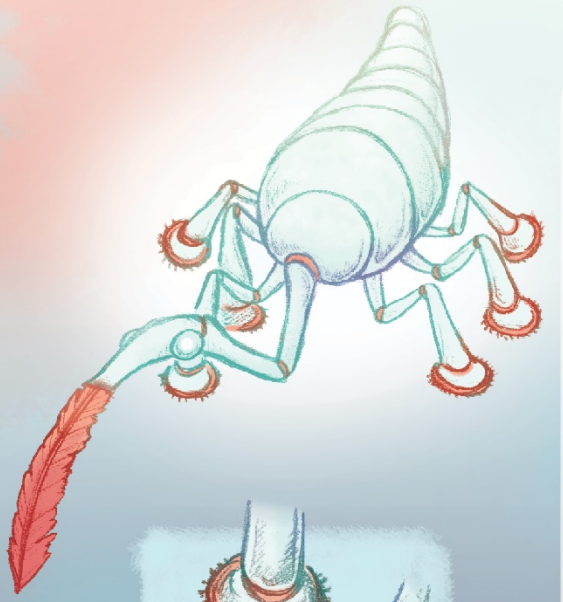
GROUNDWATER CAVES

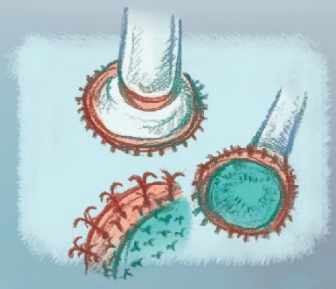
With no oceans, one must wonder how Bugplanet's water supply continues to circulate. An intricate maze of underground caves is the answer, with massive stores of groundwater only connected to the surface at the polar swamps. The bottom of the food chain here is formed by bacteria that create great mats as they feed on mineral deposits and rock. Giant amphibians roam the tunnels in search of food while pale insect-like creatures scuttle along the ceilings of rare air pockets. Here, life is dark and perilous, but it still manages to thrive.



Feathertongue

Rostropluma candidus

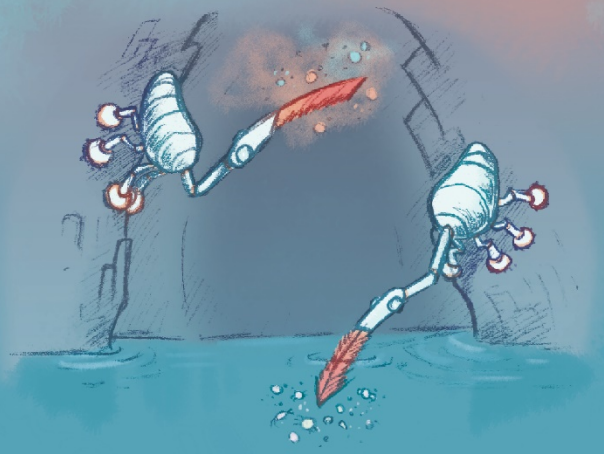




Bug-like animals are generally underrepresented in the caves biome compared to amphibians, but the charismatic feathertongue leaves a big impression. Its suction cup shaped feet help it traverse slick cave ceilings and walls with ease. The bottoms of these feet are in fact coated with rings of tiny hook-like hairs, functioning not unlike the foot scales of a gecko. These adaptations help them stay out of the way of the large predators below, but a hungry salamander will not hesitate to jump out of the water in an attempt to catch a feathertongue.

Living in the dark, these animals have little need for color, instead investing their resources in large eyes with excellent low light vision. What little light there is in the caves is provided by bioluminescense, and thus is relatively dim.

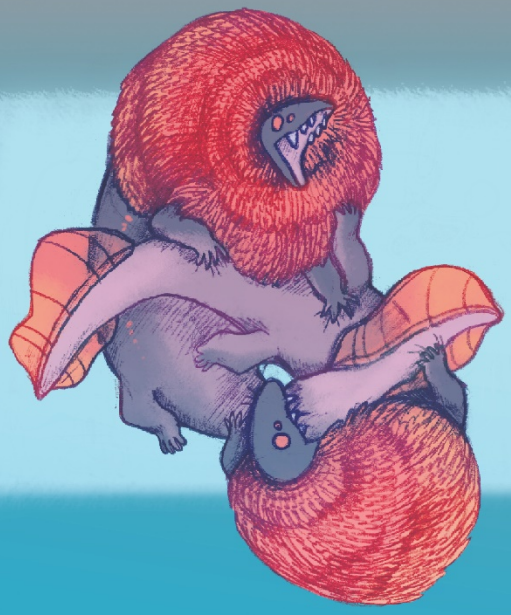
Feathertongues feed both above and below the water. Above, spore clouds and tiny air sifters clog the air pockets, and below schools of microscopic plankton and young crustaceans play at the surface. The fluffy ridges along their sharp tongues capture and filter these food sources efficiently.



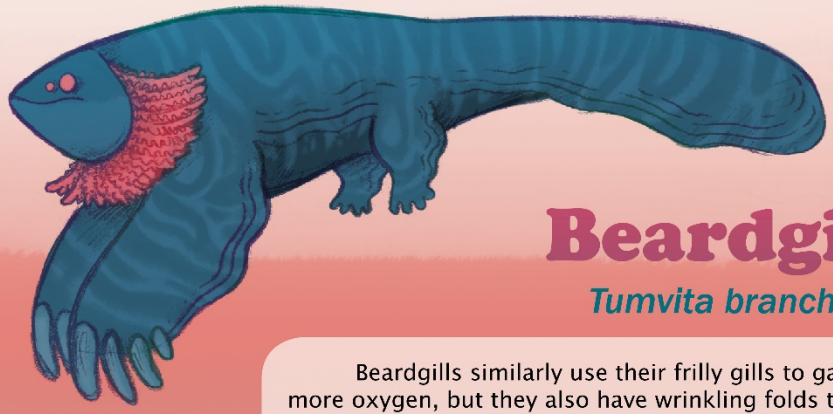
Gillmane

Tumvita corona

Gillmanes are completely aquatic, utilizing their namesake gill layers to extract ample oxygen from the water to suit their active lifestyles. They engage in fierce battles over territory and mates, but their intimidating manes are not just bluffing. The larger the mane, the more oxygen they can collect through its greater surface area. Their teeth are nothing to laugh at either, easily tearing through rival's soft skin. Bright pink lateral lines allow them to easily sense both prey and rivals in the dark by detecting the movement and vibration of water, further adding to their impressive arsenal of abilities.



Gillmanes are formidable opponents for any cave dweller, but they are extremely vulnerable as larva. Larval salamanders make up most of the prey for adults, and poor eyesight means they are often attacked by their own species. Young of the Gillmanes and others must do whatever they can to quickly grow to sizes where they can defend themselves.



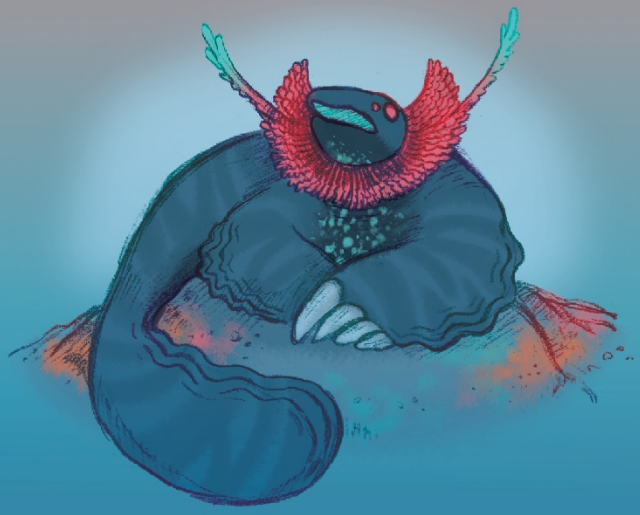
Beardgill

Tumvita branchiuba

Beardgills similarly use their frilly gills to gain more oxygen, but they also have wrinkling folds to increase the surface area from which they can breathe through their skin. Everything about the beardgill is specially tailored for their many characteristic behaviors, specifically digging and nesting.

These large salamanders feed exclusively on the chemosynthetic mollusks that inhabit specific cave regions. To find these mollusks, beardgills use their sense of smell to first locate the hot chemical beds where those animals live. They next use their powerful claws to either dig for subterranean species or scrape them off the walls. These claws also make crushing the shells easy, allowing them to slurp up the mollusks inside.

In breeding season, male beardgills develop two longer gill tendrils and bioluminescent belly freckles. They use these to put on dazzling displays for potential mates, waving their broad tails back and forth across their stomachs to create the effect of flashing lights. These features are desirable for their intimidation functions, as males will continue to guard their nests until the eggs hatch.



Males use their claws and tails to form the nesting mounds which they display above, allowing females to judge both their nest-building and defense skills. After digging up piles of sediment, they pat it down into a dome shape with their tails and then create a shallow scoop at the top for the eggs. They will continue to guard the mound until the larva emerge. Having not yet devloped digging claws, larva feed on plankton and bacterial mats.

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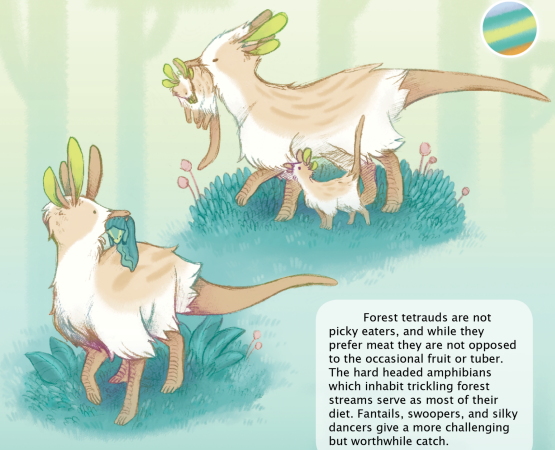
Forest Tetraud

Tetraud viridicolor

Amongst the sparse belt forest undergrowth, these agile generalist tetrauds search for prey with their acute hearing and sense of smell. The ability to rotate all four ears gives them a 360 degree range of hearing, so even the smallest rustle of foliage can indicate a potential meal.

While not nearly as social as their plains counterparts, they do have a wide range of calls. In the occasional cooperative hunting event, the green areas on their bodies can faintly bioluminesce, allowing continual communication when silence is necessary.



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