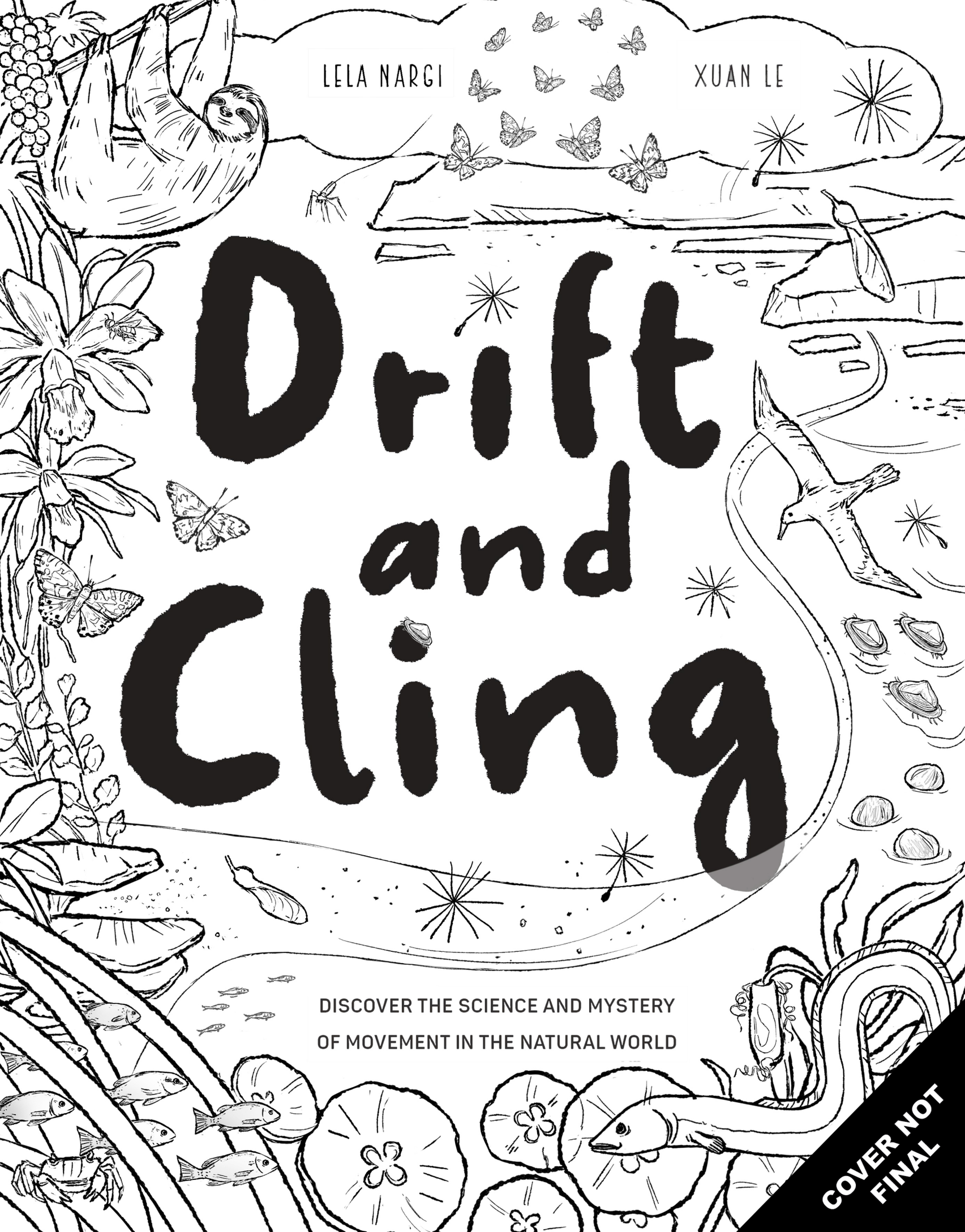
LELA NARGI
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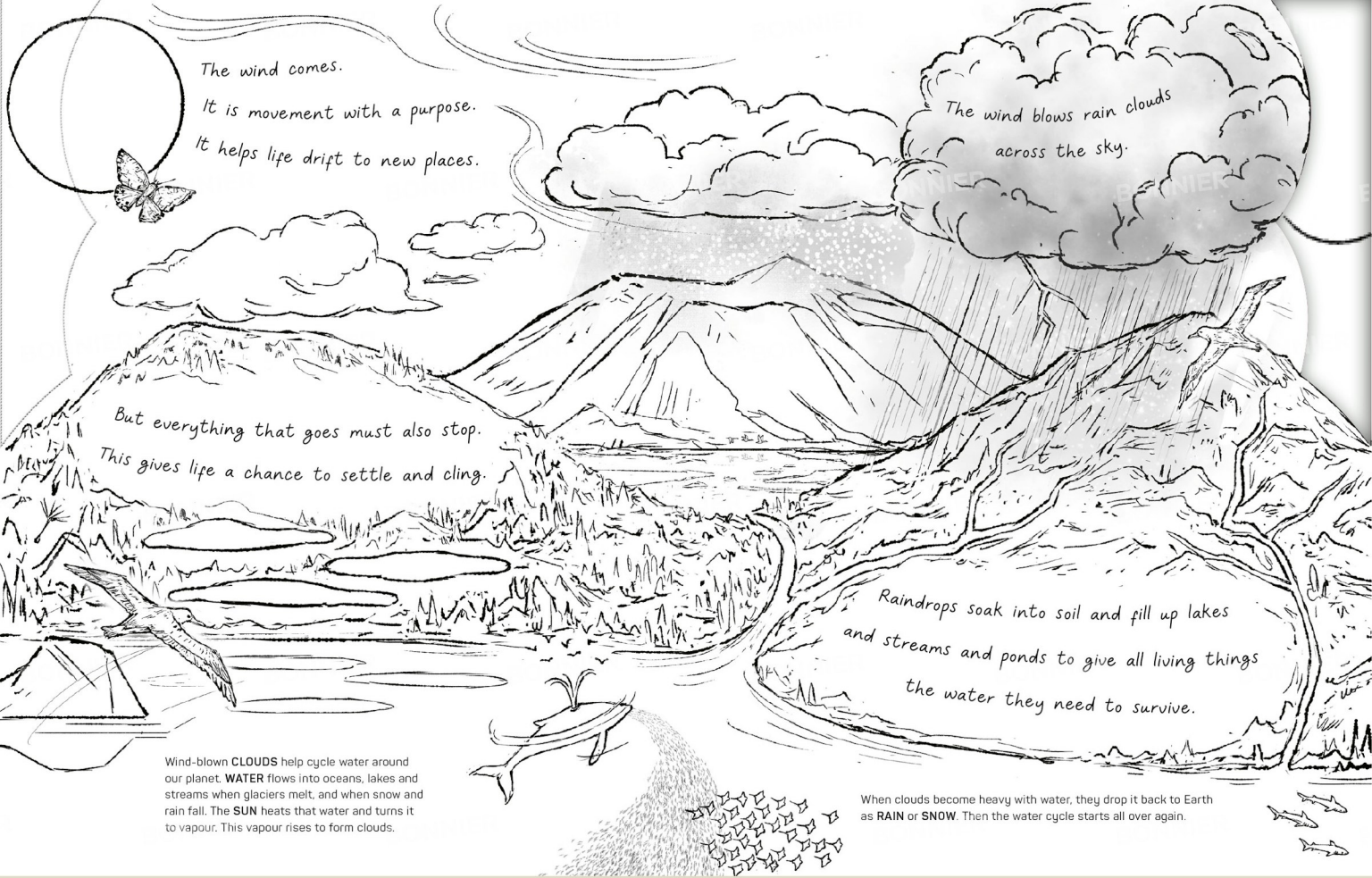
Drift and Cling
DISCOVER THE SCIENCE AND MYSTERY
OF MOVEMENT IN THE NATURAL WORLD
COVER NOT FINAL



Wind-blown **CLOUDS** help cycle water around our planet. **WATER** flows into oceans, lakes and streams when glaciers melt, and when snow and rain fall. The **SUN** heats that water and turns it to vapour. This vapour rises to form clouds.

When clouds become heavy with water, they drop it back to Earth as **RAIN** or **SNOW**. Then the water cycle starts all over again.

The wind snatches ash from the plume of an erupting volcano.

It carries these tiny specks of rock and glass

up and up to drift with the clouds.

Some ash bits cling together.

They become too heavy to drift very far.

They fall down and down, blanketing the land.

VOLCANOES spit out **MAGMA** – hot liquid rock from deep inside the Earth. Above ground, liquid rock is known as **LAVA**.

An ash **PLUME** may drift for thousands of kilometres or even circle the globe.

ASH can pile up so deeply on the ground that it buries whole towns.

Some volcanoes are very **EXPLOSIVE**, and blast lava out with such force that it instantly becomes ash and rises many kilometres into the atmosphere. Other volcanoes erupt more gently and form flowing rivers of lava.

Caption here

As it breaks down over time, volcanic ash releases **MINERALS** into the soil. That rich soil then feeds crops like olives and grapes. This is why so many farms and vineyards are planted at the foot of volcanoes.

A gust of wind whistles over grass.
Spiderlings climb to the tops of stalks.
Bottoms in the air, they shoot silk into
the wind to parachute to new meadows.

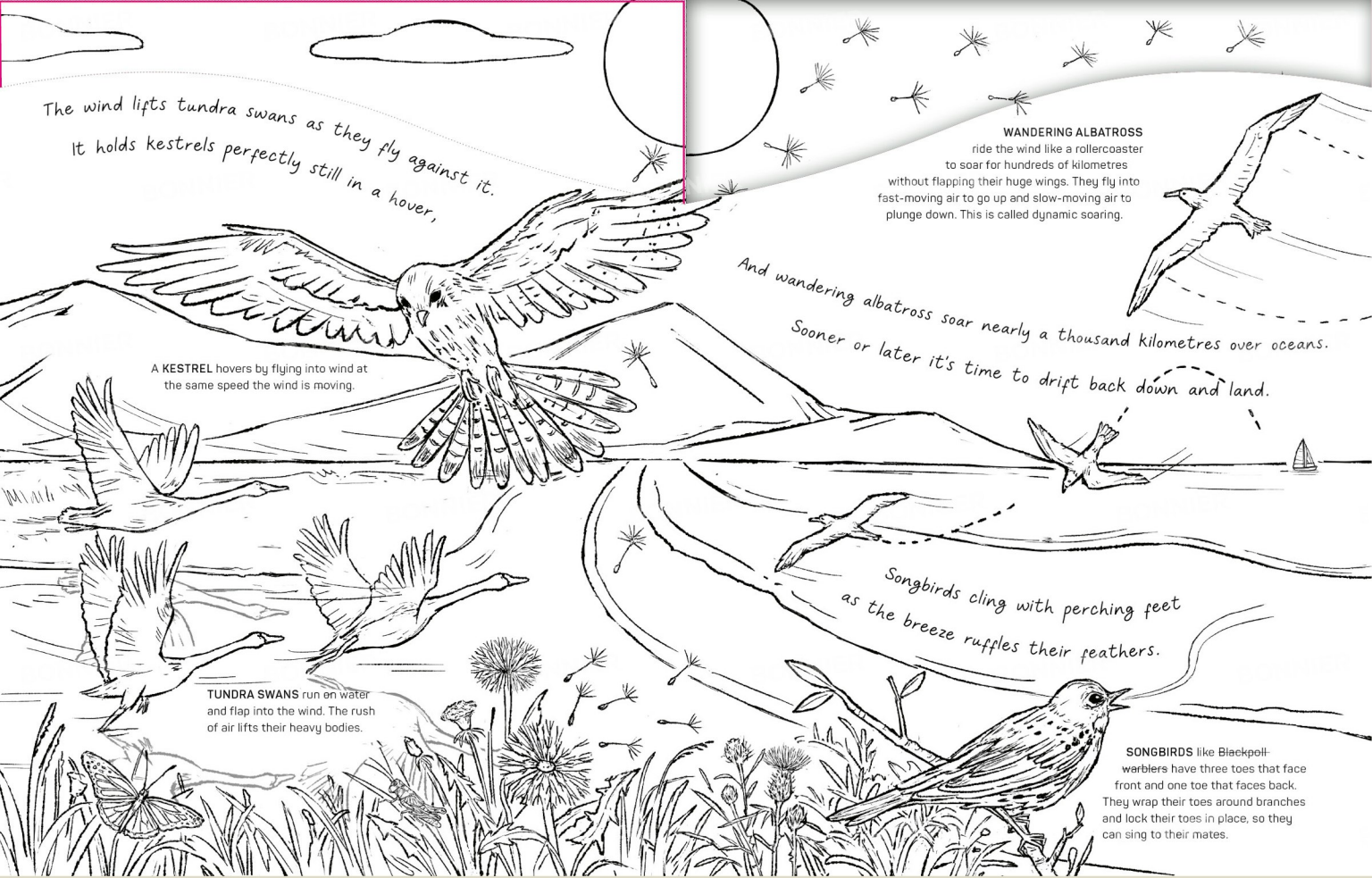
When the spiders land they cling to grass and branches,
spinning webs that will capture tasty insect prey.

Female African SOCIAL VELVET SPIDERS balloon as adults. They release many strands of silk that fan out into triangular sails, propelling them long distances to find new mates.

Spiders have silk glands in their abdomens that produce liquid silk. When pushed through their spinnerets, it turns to thread. This thread catches the wind to make spiders airborne. It's a mode of travel called 'ballooning'. Ballooning spiders can jet for hundreds of kilometres.

Hundreds of GOLDEN ORB spiderlings balloon a few days after hatching from a single egg sac. They use the wind in this in this way to spread out so they can all find enough food.

To cling to surfaces when they land, spiders, like these CRAB SPIDERS, have tiny hairs on their legs that are covered with even tinier hairs called setules.



The hot summer wind rises on the Eurasian steppe.
It scatters sand that has drifted from a Chinese desert.

TUMBLEWEEDS start as Russian thistle bushes. They are native to a grassland called the Steppe that stretches from Hungary to Mongolia. In one year, thistles grow, die and detach from the soil. Wind blows them hundreds of kilometres over land, scattering their thousands of seeds.

It skitters tumbleweeds across the plains.
It scoops up dandelion, milkweed, maple and cottonwood seeds.

Maple seeds nestle in pods called **SAMARAS**. These pods act like propellers, whirring away on a breeze.

A dried-out dandelion or cottonwood seed is attached to a plume called a **PAPPUS**. Its hairs catch wind like sails.

Other seeds have no need for the wind.
They hitch rides by clinging to passing animals.

Some seeds cling with hooks or spines. **COCKLEBURS** hitchhike through wetlands tangled in squirrel and rabbit fur.

Grazing **SHEEP** may be covered in narrowleaf clover, wild carrot, and hare's foot plantain seeds. The seeds brush off their coats and land in soil.

Some plants don't need soil to settle
Their roots remain above the ground,
seeking out tree bark to cling to for
They pull water right from the air.

Air plants, or EPIPHYTES, often make their homes on other plants but they don't take anything from them. They use their host plants for stability and feed on water and nutrients from the air.

Spanish moss hangs on to branches with the help of tiny scales called TRICHOMES.

Someone else
clings to these
clinging plants.
Look close.
Look closer!

There are 8,000 species of parasitic bugs called SCALE INSECTS. They are covered by a waxy or powdery coating that sticks them to plant stems and leaves as they suck plant their sap.

The scent of their flowers
drifts across the rainforest,
so bees and other pollinators
can find them.

ORCHIDS have hair-covered roots that help them cling to a host tree. Another, spongy, root absorbs water. Different species of orchids lure in hoverflies and orchard bees to pollinate them. They do this by emitting sweet scents that are carried on the wind.

STRANGLER FIG trees start as epiphytes. Their roots grow and grow to touch then pierce the ground. Then they strangle their host tree.

On the wind, maple samaras
gust far from a mother tree.

Where land meets ocean in Okinawa, Japan,
mangroves stand on tall stilt roots.

They hold on in soft mud as they're
battered by salty waves.

Baby mangroves fall into the water
and float till they get stuck in shallows.
Then they grow and grow.

When this maple seed lands in rich soil, it will send roots deep into the earth. The roots of maple trees grow sideways. They can reach three times farther than their branches.

Some special **ROOTS** of mangrove trees grow upward, above the water line, acting like snorkels so the tree can breathe underwater.

[Red mangrove] trees grow long green pods among their roots, called **PROPAGULES**. When these sprout they break off from the mother tree and drift off on the tides and currents to find new places to grow.

MANGROVE TREE CRABS live in the mud beneath the trees, feeding on their dropped leaves.

When fully grown their roots will act as nurseries for fish like **SNAPPER** and **SEA TROUT**.

The wind ruffles streams, rivers and estuaries.
Its movement pushes along the seeds
floating on their surfaces.

Strong winds help **OCEAN CURRENTS** form. These strong, swirling currents have an important function. They carry nutrients to ocean

The Northern Equatorial current picks up **SEA MANGO** seeds from the Pacific islands and drops them on beaches in Japan. Sea mango trees produce fruit that is pretty — and poisonous!

The South Atlantic current carries **SEA HEARTS**, the seeds of a flowering vine, from South Africa to Texas in the USA. Up to 15 of these heart-shaped seeds grow in each giant pod.

The wind blows like a gale across the ocean, tugging at its waters and swirling them into currents. The currents now snatch up the seeds and set them sailing for distant lands.

A current called the Gulf Stream brings **GRAY NICKERNUTS** from the Caribbean across the north Atlantic Ocean to Scotland. Gray nicker plants grow like vines on mangrove trees. Their spiky green fruit pods split open to drop their seeds into water.

The East Australian current brings **CANDLENUTS** from Australia to New Zealand. Candlenut trees produce oily nuts that can be burned to make light.

Along the coast, strong winds and tides
pull dead trees and branches out to sea,
like they were as light as cotton balls.

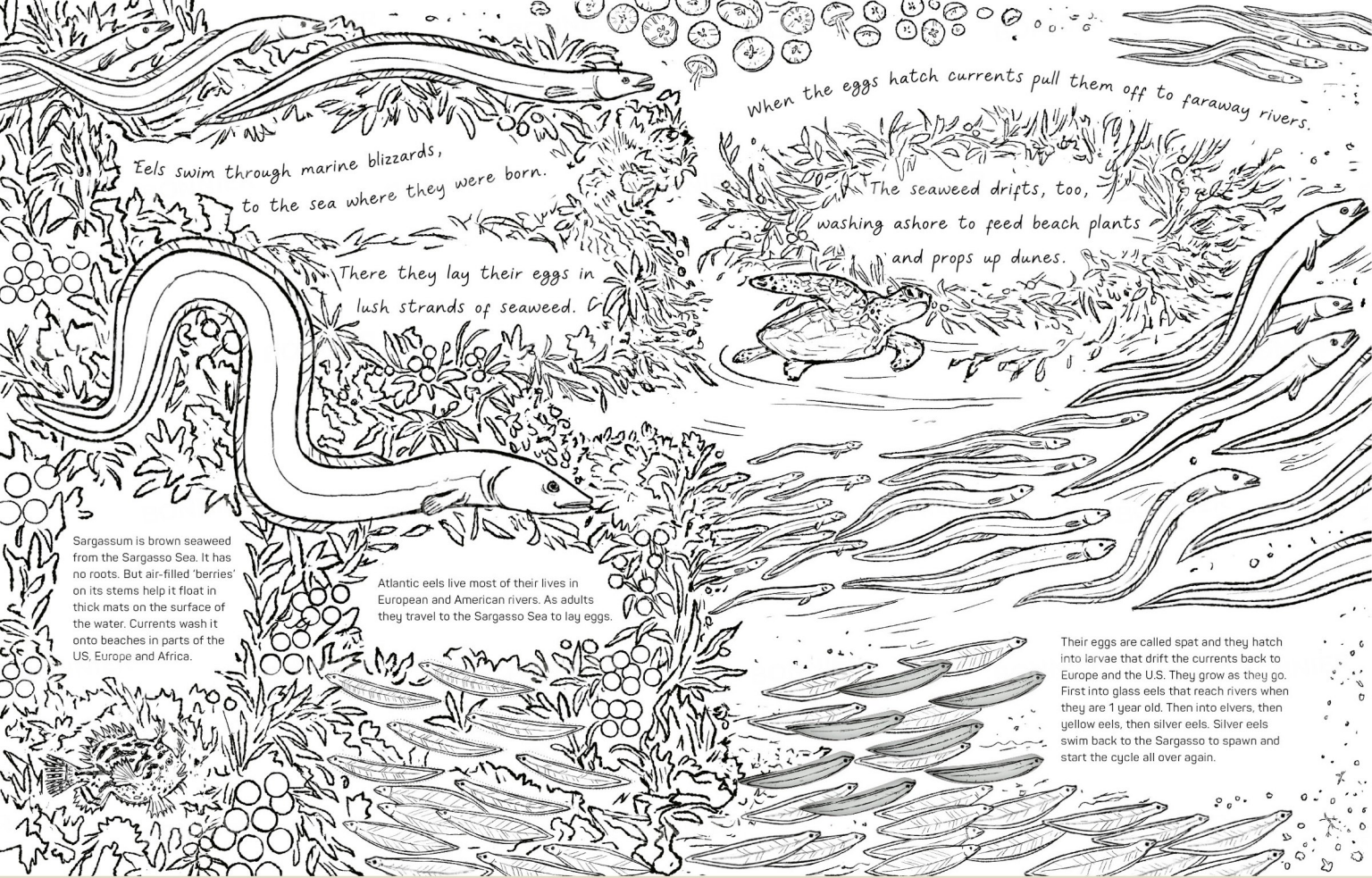
Trees growing beside rivers and streams may fall in when they die and get pulled out to sea, becoming **DRIFTWOOD**. They may travel ocean currents for a year or more.

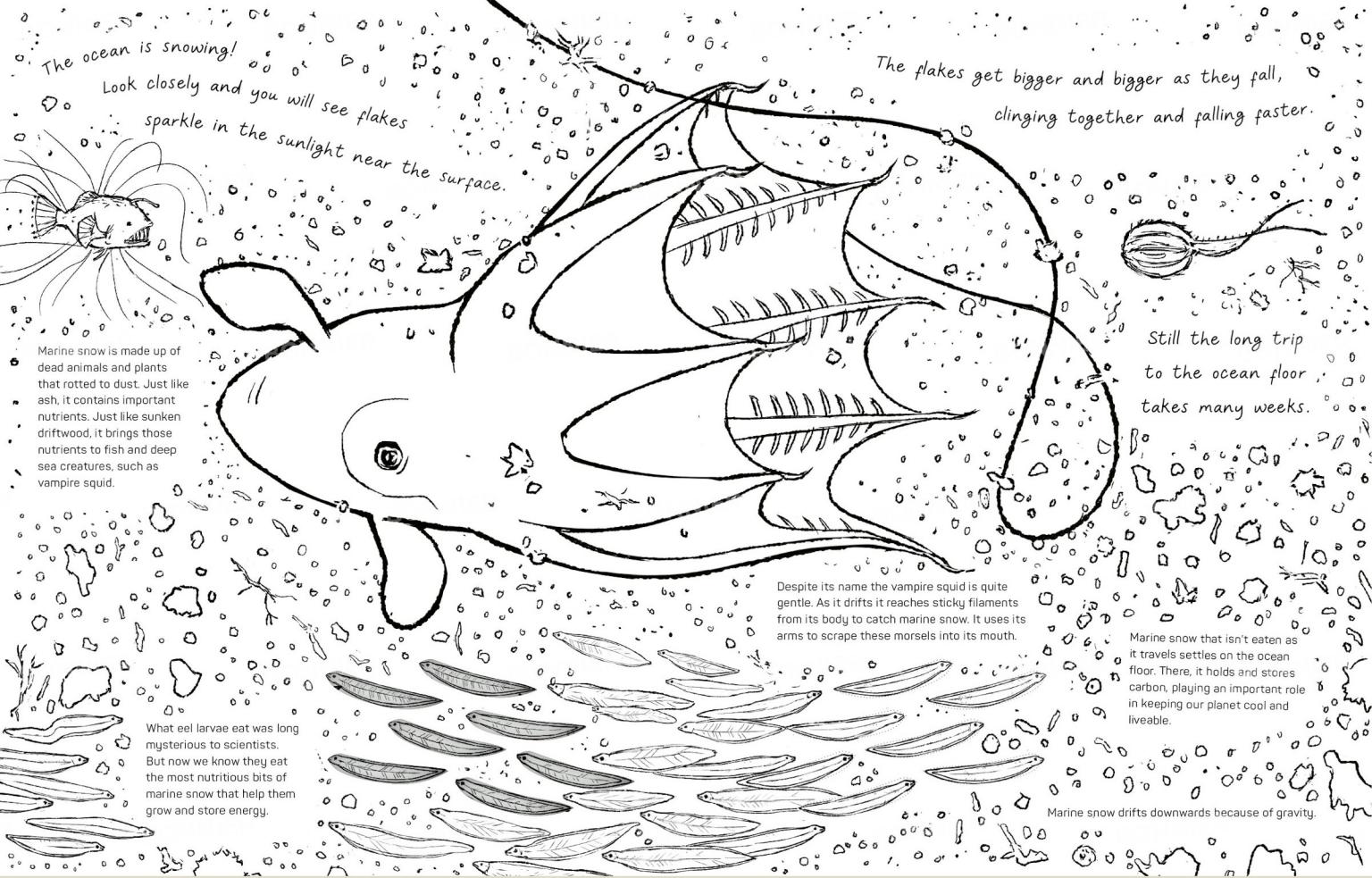
When driftwood washes ashore, **DRIFTWOOD HOPPERS** hop off to colonize a new land.

They drift on the surface. Perhaps they will reach distant shores.
In the woody holes of these stumps are castaways
hoping to catch rides to exotic new islands.

Some driftwood may **SINK** to the bottom of the ocean. There, it rots to feed bacteria, worms and other marine life on the seafloor.

In northern parts of the world, tiny **CRUSTACEANS** called driftwood hoppers, or talitrids, move into holes in driftwood. Here they live their whole lives, even raising their young at sea. Driftwood hoppers may get eaten if their home joins a floating reef. This is an island of driftwood where all kinds of fish, such as tuna, and birds, such as pelicans, take shelter (and also eat each other!) in the ocean.





Many whales travel the world's oceans in an endless search for food.
But even these gentle ocean giants
cannot remain in motion forever.

BARNACLES are crustaceans, like crabs. As babies, called nauplii, they float in currents. Then they use a cement-like substance that they make in their glands to attach to turtles or baleen whales. They cling there for their whole lives. They collect the plankton they eat with their dangling legs.

There are five major **CURRENTS** in the ocean, known as gyres. Many migrating animals travel on these ocean 'highways' to search for food.

Whales may travel a million kilometres in their lifetimes, breathing cold winds in and out when they breach the ocean's surface. **BALEEN** whales like blue whales eat mostly krill and other tiny animals. **TOOTHED** whales like sperm whales eat squid and deep-water fish. They all find lots of tasty prey in warm waters during their breeding season, and in Arctic and Antarctic waters during non-breeding season.

When it's time to rest,
they drift to sleep,
floating beneath the waves.

When **SPERM WHALES** sleep they drift dive, floating upright with their heads near the top of the water and their bodies hanging down.

The barnacles that cling tight to
whale skin seem always to be sleeping.
But they are busy, busy, busy.

Many icebergs that float the ocean have split off from the Petermann Glacier in Greenland. They drift on currents for several years before they melt.

Huge blocks of ice break free

from glaciers and are blown south.

Icebergs also support animals above water. The sand on their surfaces heats up in the sun to make melting pools full of bacteria, algae and water bears. These make tasty snacks for the fish that are eaten in turn by **PETRELS**, **SEALS** and **POLAR BEARS**. Seeds blown over from land may also sprout and grow on icebergs. An iceberg that's run aground makes a cozy wind shelter for **LEOPARD SEALS** and **SEABIRDS**.

They shed nutrients for thousands of kilometres,

feeding plankton and krill.

Icebergs fertilise the ocean as they travel, giving off nutrients like iron and oxygen. Some nutrients come from sand on their surfaces called **CRYOCONITE**. The wind blows that sand more than 6,000 kilometres from the Gobi Desert.

Whales, sea turtles and jellyfish

follow in the icebergs' trails.

They are having a feast!

What you see is really the tip of the iceberg! Icebergs extend over 300 metres down into the ocean and may get stuck where it's shallow. The iceberg below water feeds and shelters **KRILL**, **COPEPODS** and **ICEFISH**.

Jellyfish drift past anemones that cling to icebergs, rocks, reefs, even crabs and sea sponges.

Bits of sea sponge break off and then they drift, too.

They will cling again once they find a new home to stick themselves to.

Anemones gobble jellyfish up for a snack – yum!

Some people think jellyfish only drift. But these invertebrates can sense currents and swim both with and against them.

In turn, sea sponges anchor themselves with tiny strong hairs made of glass, called spicules, that crust onto a surface. There they stay, eating phytoplankton and zooplankton they pick out of the water.

Most anemones are shaped like columns. One end of the column is a mouth. The other end of the column contains a slimy foot, called a pedal disc, that sticks to surfaces. Sometimes anemones suction to sea sponges.

Sea sponges reproduce in three ways. They grow bulbs that break off and grow into new sponges. Or they break off pieces of themselves that grow into new sponges. Or they lay eggs. Eggs and sponge bits drift on currents, then attach themselves to rocks.

In warm southern waters where the winds are tame,
sharks drift on currents to get their rest.
Clever passengers cling to their bellies.

Others are not so lucky,
and find themselves
inside a shark's huge
mouth instead.

Grey reef sharks must keep moving so that oxygen-filled water always moves through their gills. That's how they breathe. When it's time to rest they enter slim channels of the ocean that have strong currents. The currents keep the sharks in motion – and breathing – as they sleep.

The whale shark is the largest fish species. It swims slowly near the water's surface with its mouth feeding feeding on plankton and small fish through its gill rakers. This is known as filter feeding.

Remora fish have head fins that suction them to the underbellies of sharks. Remora eat parasites off a shark's skin and from inside its mouth. In return, sharks protect remora from predators.

Some shark species, such as nurse sharks and wobbegongs, rest or "sit" on the seafloor. They use their pectoral fins to prop themselves up.