

PiΣi

and the plastic soup



Pi $\leq$ i

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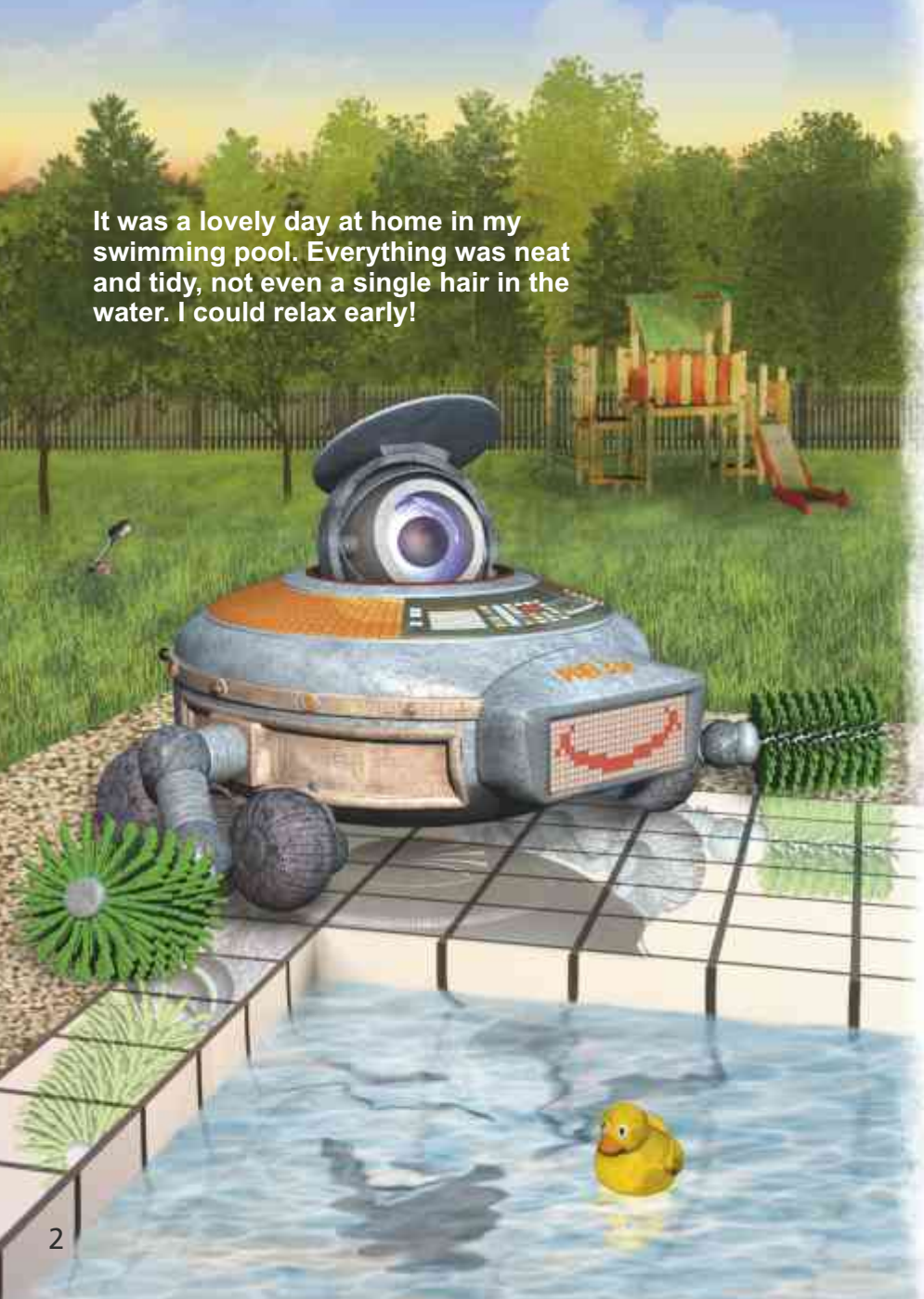
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A blue, cylindrical robot with a large, multi-colored eye (red, blue, and pink) is shown underwater. The robot has a sad expression on its face. It is holding a green, feathery plant in a clear plastic bag. The robot has a control panel with various buttons and a small screen displaying a red, jagged line. The background shows a blue underwater environment with bubbles and a shark swimming in the distance.

Oh dear, I'm so sad
I could cry – if I had
been programmed that
way. And all because
of this! Yeah, that's
right, all because of a
simple plastic bag!

Oh, you don't believe me? OK, until recently I wouldn't have believed it myself...
but it's true... yep... because.... well, I suppose I'd better start at the beginning...

It was a lovely day at home in my swimming pool. Everything was neat and tidy, not even a single hair in the water. I could relax early!



Yeah right! I was just settling down to sunbathe and recharge my solar cells, when suddenly a “hey Piwi!” disturbed my peace and quiet.



“Don’t you know that all your pool cleaning is a waste of time?” purred wild Wilma. I couldn’t make head nor tail of it! ●

“Everything looks squeaky clean at your place, but out there in the big wide world... well, just look at the stream: It looks like a pigsty!” ●

“What have pigsties got to do with me?” I asked. “Come on, I’ll show you!” she laughed. The sun was shining, my batteries were charged to the brim. There was nothing else to do. So why not follow Wilma?

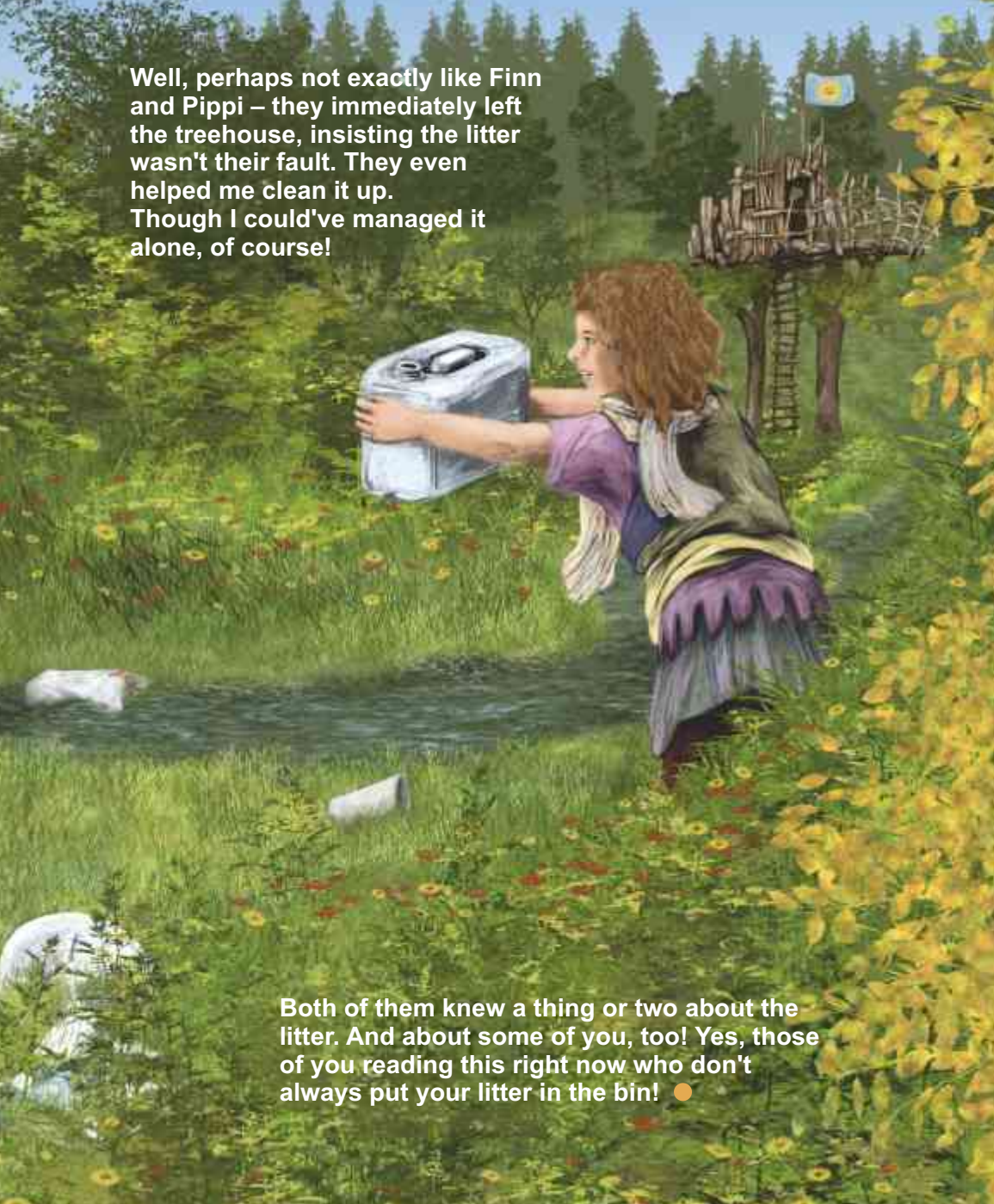
● Just so you don’t get the wrong impression: I’m not your average run-of-the-mill robot. In fact, I’m state-of-the-art! For the computer whizz-kids among you: adaptive dual-processing unit, solar powered, programmed to feel emotions, equipped with 17 sensors and micro-cameras, two 1 meganewton telescopic arms for brushing (by the way, just one of my brushes could easily sweep your school bus aside), I am also object-oriented... Still want to know more? Well, I’ve also got a 700 TeraByte knowledge database, and I will share some of its data with you from time to time to make things a little clearer for you – my little Piwipedia, so to speak! You won’t find anything like it anywhere, only here and now, and only if you’re smart anyhow! And my object-oriented programming will also become significant. So, prick up your ears!

● See, I even know idioms! Isn’t that cool? And that’s just one of them. One that simply means the stream was very dirty. As dirty as a pigsty. And the funny thing is, pigs are actually really clean animals. But that’s the thing with sayings: Nobody knows who decided pigs are dirty, the only thing we know is that they’re supposed to be dirty. Doesn’t make much sense, does it? But that’s the way it is, I guess.

There I met Finn and Pippi working on their treehouse. But I had no time for that – there were more important things to do: cleaning! I've never seen such a load of rubbish!



Wilma didn't want to get her paws dirty, but she told me where all this rubbish came from. ● That made me so sad. "It's all because of people like you, dropping litter!" I yelled to the kids.



Well, perhaps not exactly like Finn and Pippi – they immediately left the treehouse, insisting the litter wasn't their fault. They even helped me clean it up. Though I could've managed it alone, of course!

Both of them knew a thing or two about the litter. And about some of you, too! Yes, those of you reading this right now who don't always put your litter in the bin! ●

● Not all rubbish is the same. Some rubbish rots away quite fast, like a banana skin. Well, it might not look very nice, but that's all there is to it. It disappears with time. What I'm talking about is the kind of rubbish that hangs around for a long time – a very long time. Even long after you're gone! Yes, really! And most of it is plastic. Here's something for the Einsteins among you: Of every four pieces of this horrible rubbish, three are made of plastic! And how did they end up in this stream? I've asked myself the same question. At home in my pool, things aren't like that – because I keep it clean! The big question is: Where does all this rubbish come from?

● The answer to that is easy peasy lemon squeezy: It comes from people simply throwing stuff away. Or from overflowing bins. Or flooded gullies, where the waste comes up directly from the sewer. Or from tourists. A little piece of paper here, a plastic bottle there – and then a gust of wind comes along and blows it in all directions and before you know it, the waste is everywhere. It's by the stream. And in the stream, too. It's not that much you say? Well, think about it. Think about how many people there are in this world and how many of them throw things away – every single day.

Some even throw away their mobiles! As electronic scrap!
We had just finished cleaning. Everything was neatly
packed up and spick and span, just the way I like it.
And then suddenly, I swallowed one of those things!



It definitely wasn't just any old scrap! But I was lucky it didn't
turn me into scrap either! It was a very smart, top-of-the-range,
turbo-charged smartphone ● that some nerd must have lost.
It went bing bong bang inside of me...

**Splash splash into the stream and off we go!
And so, my long journey began...**



**...but now I was some kind of a reprogrammed super robot.
Like a miracle, all the features of the smartphone had merged
into my system. I could now measure and analyse chemicals,
temperature and depth of the stream, and so much more... ●**

● I almost forgot:
Electronic scrap, metals
and chemicals can also
be rubbish, beside the
“normal” plastic waste.

● A little example:
There were also insecti-
cides in the water that
the rain had washed
down from the fields. I
knew automatically
how much was in the
stream. And I could
locate myself via satel-
lite – that’s called GPS,
you know, and... by
the way, do you know
why some plastic rub-
bish sinks and some
doesn’t? So, there are
so many variety of
plastics. And some are
heavier than water and
therefore sinks. But also
light plastic can sink!
for example if algae and
bacteria or dirt sit on it
when the plastic is
travelling long enough
in the sea. Then it gets
so heavy that it sinks.
Most of the plastic in
the sea has already
sunk to the seafloor. In
the beginning plastic
usually floats. In the
stream, in the river...

...Luckily, I could still do all the things I could before.
Most of all swimming. The river's current was no
match for me. I managed to get out all by myself!



Well, with a little help from Ronnie, who helped me avoid some dangerous
eddies. It was a good job that Ronnie the sewer rat came along! He was a
long way from his sewer, of course, but rats are always on the move.

**Kids, I've never seen a river as big as this before!
But Ronnie just laughed: "It's nothing compared
to the sea."**

**My newly acquired super-computer told me all there is
to know about the sea. But Ronnie was even faster:
"Every river flows into the sea. ● And from there –"
He was suddenly interrupted by a loud wail...**

● Well, every river flows, every kid knows that. But even some adults don't know that the amount of water on our planet always stays the same. It never changes! The water goes through a cycle: the rivers lead to the sea, the seawater evaporates into clouds, then it rains somewhere and the rain sinks into the soil, deeper and deeper until it hits a hard surface – the ground layer so to speak. And from there it flows under the ground. That's called subterranean water. And that surfaces somewhere again, in springs and things like that... and from there, it flows into the rivers or into the water works, from which you get your water at home when you turn on the tap. And after you finish showering the water runs down the drains, and from there it's piped to the waste water treatment plant and from there... you guessed it, it makes its way back to the river! Bingo, just like a merry-go-round!

● Do you see those two pipes over there? That's where all the rubbish comes from! It took me some time to understand what Ronnie just told me: all the water from the sink, shower, bathtub, toilet and even from the washing machine and dishwasher goes into the sewer. That means the sewage pipes deep down under your streets. And all these pipes lead to Rome... of course not, I'm just kidding... they lead to the waste water treatment plant. The plant is supposed to "purify" all the dirty bits and pieces from the water and so make the water "pure" again. And then other pipes – like that one to the right in the picture – carry the "purified" water away from the treatment plant back to the rivers and to nature. There's only one problem: A waste water treatment plant can't do everything. But we'll get to that later. (●). First, back to the second pipe: The water from there is from storm drains. It doesn't have to go to the treatment plant because it's already quite clean. Instead, it's collected in a sewage system of its own. But anything that washes down into the storm drain with the rain doesn't really get filtered out. That's how little bits of paper and cigarette butts from the gutter get into the river.!

For my next glorious deed...
OK, ours... Ronnie's and mine,
to be precise. Some whimper-
ing ducklings were trapped in a
tangle of plastic and couldn't
get out... Then we came
around the corner... erm...
the shrubbery...



Even for a super robot like me, it wasn't easy to stay calm.
When the little ones were clambering all over me, I sensed
something new: After the re-programming ...hehe, as you can
see...I had become ticklish... ●



But we did it in the end. Quite a lot of plastic came from one of the pipes. It was a drainage pipe. The other one was from the waste water treatment plant. ● “It cleans the waste water from the cities and then pipes it to the sea,” Ronnie explained.

But the cleaned water wasn't clean at all: Although the treatment plants try to filter out all impurities, there still remains microplastic in it; also chemicals, e.g. remnants of medicines. ●●

● Two pipes – because rainwater and waste water are separated into different sewage systems. But my database tells me that some cities only have one sewage network: The rainwater flows along with the waste water from households and factories to the waste water treatment plant, where it gets cleaned. A lot of the plastic waste that's washed away with the rainwater will then be fished out. That sounds much better, don't you think? Maybe you could go and find out how it works where you live!

● Microplastics are so small pieces of plastic; they are so piddly that you can't even see them with naked eyes, some you only could see with a great microscope. Some of them come from cosmetics, like cleansers and body scrubs and things like that. Yeah, I know, you probably don't use those much, you mucky pups, but your parents, grandparents and teachers definitely do. Ask them if they've ever heard of microplastics! Some years ago, they used sand and almond bran as a scrub instead. But there is much more microplastic in form of fibers coming out the sewage plant pipe. When you wash clothes made of synthetic fibers such as nylon, acrylic and especially polyester, thousands of fibers break off and these tiny little lint can not be fully filtered out in the sewage treatment plants. It gets washed away with the river into the sea, where it's often eaten by fish and mussels... and then? Exactly! Think of that the next time you eat mussels or fish... It's not very healthy, let's put it that way! But the wastewater treatment plant operators are working on it to ensure that only clean water comes from their outlets. But that's not so easy.

● OK, OK – for the little clever clogs among you: I confess, I wasn't quite telling the whole truth here, “micro” doesn't come from “piddly” it comes from a Greek word meaning tiny. So it means tiny plastic bits. But “piddly” is such a funny word, I bet you won't forget it in a hurry!

The tangle of plastic surrounding the ducklings was nothing compared to the things that were waiting at the lake. Ronnie insisted on showing me a lake, because...



...all I have to say is: from above it looks idyllic but on the bottom, it's rotten! Ouch! It still hurts where that beer can hit me! ●

That joker of an angler with the beer can soon stopped laughing when I told him a few things about the cigarette hanging from the corner of his mouth – the one that he certainly would have thrown into the water along with his can. ●



Ronnie lent him his diving goggles. Then he finally got it, because... well, what do you think? Exactly! As you already know by now, dirty water leads to dirty fish and guess what's on the plate for Friday night's supper? Bingo! The fisher promised us he would clean up the place with the help of some of his mates. Now there was only one thing I wanted...

● Streams flow into lakes. And out of them. A lot of rubbish gets into the lakes that way. There are some lakes without any streams, but even those end up full of rubbish because certain "clever" people think it's a good idea to just dump waste straight into the lake. Seriously – that happens quite a lot! For example, anglers sometimes get their fishing line tangled in a knot. And what do they do then? Instead of trying to untangle it, they just cut it and dump it in the lake. Some folk even dump old toilets and bicycles in there! Really! I've seen it!

● Well, you may think it's only a little cigarette butt, but I say: Smoking is bad for your health! And not only for smokers, but also for the environment! Our beautiful planet is like an ashtray! Cigarette butts are the most common type of rubbish in the countryside. Of every six cigarettes smoked, five are dumped on the ground. And do you know how many that is per year? 4.5 trillion! That number doesn't mean anything to you? Okay, let's put it another way: If you put all the dumped cigarette butts in a row, you would have a chain of cigarettes so long that it could reach all the way to the moon and back 60 times! And each one of them contains pure poison: not only nicotine, but also other bad stuff like arsenic and heavy metals like lead, copper, chrome and cadmium... And here's another fact for you: If you put just one cigarette butt in a bucket filled with one litre of water, and then you put a fish in the same bucket, the fish wouldn't survive. That's crazy, isn't it? And even if you did the same experiment with an unused cigarette, the fish would still die. Seriously! Those things are full of so much unhealthy stuff, whether they've been smoked or not, they're still poisonous.

● So, time for another maths lesson. Because when I say “loads of rubbish”, it doesn’t really mean anything to you, does it? So... you have to think of all that plastic in the sea like this: Imagine a big 12-ton bin lorry. If you put all the plastic waste from the sea into such lorries and lined them up, you’d get a row so long it could go all the way around the earth twice. Just think about it: a double line of lorries all around the belly of the planet. Every single one of them filled to the brim with plastic waste. And all of that is floating in our wonderful seas right now!

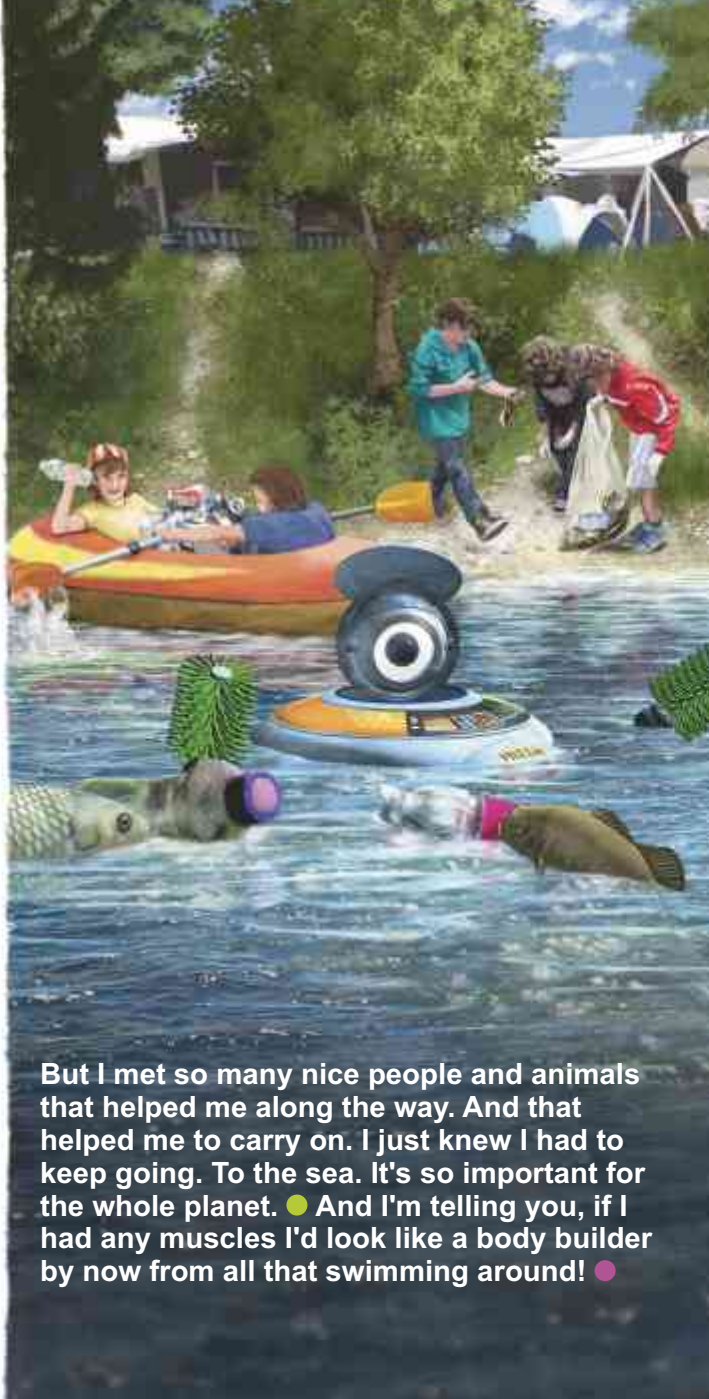
● And to finish off our maths lesson: The amount of waste is growing and growing! In the past, there wasn’t much plastic around. But today everything is packaged in plastic.... cheese, sausages, refrigerators, new furniture and stuff like that... and even more is used in many industries like building and car manufacturing. That’s why there’s so much plastic around nowadays. A total of 335 million tons of plastic, were produced in 2016 around the world. And 2017 it was already 348 million tons, and it will be more and more every year. And a lot of that is dumped in the sea. In 2010, 10 million tons of plastic were dumped in the sea. That’s a lot. How much is it, you say? Well, let’s go back to the bin lorries, and let’s put all that plastic waste in them. Imagine again the garbage trucks: then the truck chain reaches all the way to America across the Atlantic. And that happens every year! year for year!

I wanted to see the sea that Ronnie had told me so much about. What would it look like? All the rivers and lakes were so full of rubbish.



How do I know that? Easy, I cleaned and cleaned all along my journey – because that’s what I like to do best – and I saw the huge amount of waste with my own eyes! ● Sometimes my courage just vanished... ●

...and I felt homesick for my little world where everything was neat and tidy. And I didn't want to hear any more about waste and rubbish! ●



But I met so many nice people and animals that helped me along the way. And that helped me to carry on. I just knew I had to keep going. To the sea. It's so important for the whole planet. ● And I'm telling you, if I had any muscles I'd look like a body builder by now from all that swimming around! ●

● You're not the only one who gets tired doing maths!

● A little reminder: the water cycle... and the weather that influences the seas... and all the animals living in the sea, swallowing the plastic, because the sun and the seawater make the plastic brittle and crumbly, so it disintegrates into small bits and is easily swallowed by the creatures of the sea... and we eat some of those creatures, along with all the plastic inside of them...

● My brain is already big enough, thanks to the hacker smartphone I swallowed. Just so you don't think I'm telling you a load of old codswallop! (That's another idiom; just ask your mum and dad what it means, if you don't know it).

And then it happened! I had finally reached the sea and this shabby harbour when a sack suddenly flew over my head! ●



And a very thick one at that! Used for fertiliser!
Of course, I panicked and got completely tangled up in it. This wouldn't have been so bad but the stupid thing was also covering my solar cells. ●

A painting of a harbor scene. In the foreground, a large, colorful pile of plastic waste, including bottles, containers, and debris, is scattered along the shore. A seagull is swimming in the water in the bottom left corner. In the background, there's a stone wall with various objects like a tire, a coiled rope, and a net hanging from it. The water is dark blue with some ripples.

With all my frantic wriggling to get free, my batteries were empty in no time. A total loss of power. Complete blackout. Thank heavens that didn't happen in the water! ●

If I had gone into stand-by mode there – ● maybe I would have woken up in Madagascar or some place! Or I might not have woken up at all... Oh, I don't even want to think about it!

● They're called woven fibre bags or sacks, because they're made of plastic fibres. So, kind of like wires, but made from plastic, and that makes the sacks really strong so they don't tear. They are often used for fertiliser for the fields on farms. Sometimes the farmers simply forget to take the empty sacks away and they just leave them where they've emptied them. Then along comes a breeze or a gust of wind and the fibre sacks are blown into rivers or directly into the sea and with their wire-like fibres they get caught everywhere – just as I got caught in one of them. How awful!

● The solar cells are these panels that encircle my body, all around the edge. They can convert the light of the sun into electricity. And electricity is life... Life for robots like me, I mean. They charge my batteries so I have power to do things. If something covers them up then they can't charge at all, which is the beginning of the end. I have less and less energy, I become sleepy and tired – just like you – and when my batteries are empty... it's good night for me!

● One thing I realised, just before my lights went out: Harbours are extremely polluted. It's because the sea is so calm there, whereas out at sea there's always movement with the current. That's the reason so much rubbish collects in the harbours.

● You're still with me, aren't you? I'm talking about a robot nap, meaning there wasn't any juice left in my system. (No, no, not apple or orange juice, it's just another word for power my little kiddywinks). Maybe you could ponder whether I also dream like you do. What do you think?

Or in the clutches
of this Popeye look-
alike! With one tug,
he had torn the bag
– and all my lights
came back on! ●



“Arr who and what might ye be there,
matey?” ● he grumbled. I was so happy to
have power again I didn't even hesitate...

“My name is Piwi! And I am the farthest-travelled pool-cleaning robot the world has ever seen! Not to mention I've also carried out the biggest river clean-up in history!”

Yeaaaaah, I know! I was being a show-off. And stupid, too! Because the fella said delightedly, “Well shiver me timbers! We be needin' someone like ye on our sweet little Mary Anne!” And with that, he simply took me along!

● Right, you've been paying attention: Of course, it took several minutes before my batteries were fully charged again and I had enough energy so my sweet little (camera) eye could see the beautiful sun again.

● I could only understand him because, luckily, I am equipped with a dialect converter. I roughly translated what he had asked me: “What and who are you?”

No, no, it had nothing to do with a woman!
'Mary Anne' was just the name of his ship. ●
And I was supposed to make everything
ship shape again.



That didn't bother me at all! As you should know by now,
I like to clean things, and this would be a fine opportunity
to go to sea and 'sea' more of the world... ●
no, the problem was something else: that they simply
dump waste in the sea! ● THAT was bothering me!

A large fishing vessel is shown from a low angle, tilted upwards. Several people are visible on the deck, some looking down at the water. A small, blue, robot-like creature with a propeller on its head is swimming in the water, surrounded by various pieces of trash like plastic bottles and a green brush. The sea is dark blue with white foam from the ship's wake. The sky is overcast with grey clouds, and several seagulls are flying around.

But they didn't want to listen to me lecturing them about waste. They just laughed!

And the sailor sneered: "Off you go then, swim after our waste and analyse it! You'll know even more clever stuff about it then!" SPLASH!!!

● A fishing vessel to be precise.

● For the little know-it-alls among you, wondering if the super-robot can't spell, that's just another great play on words, isn't it?

● There are some kinds of waste we're allowed to throw into the sea. These are things which dissolve in the water and are not harmful. But that's not what we're talking about here. When I say waste, I am always referring to waste with a long "lifespan" containing harmful substances. Most of it is plastic. And nobody is allowed to throw that overboard willy-nilly. Because firstly, well you already know what happens then. But secondly, there is also a law against it. It's called MARPOL. And that's short for MARine POLLution, meaning littering of the sea, as I've sussed out already. It's an international treaty intended to bring pollution of the seas under control. It contains a whole lot of regulations, and one of them is about dumping waste in the sea. And no one is allowed to throw plastic stuff into the sea. That's it! And it doesn't matter if it's on the high seas or near the shore! Not a single bit!

Well, now you know why I ended up here!
And why I am so miffed about the plastic bag.
Oh, what a downer!

And it's because plastic waste is
everywhere: in lakes and rivers
and the sea! And it's because quite
a lot of people are simply daft, like
that eejit sailor there. ●●



OK, OK, it's true – not everyone is that stupid. If you like you can call it thoughtlessness, or laziness, or always having something more important to think about. ●

But this muscle man and his "Mary Anne", I'm going to report them if it's the last thing I do! All it takes is a short GPS positioning ● and then a zippy radio message along with some photographic proof sent to the harbour police! Hey presto! ●

● Yeah, I listened to what he said and started to analyse the high seas: My goodness, there are remnants of weed-killers and insecticides – utterly poisonous – and flame retardant... what's that? It's a chemical to prevent stuff like clothes and fabric from catching fire! And there are microplastics everywhere – which you can only see if you look very closely.

● But I can do it: I can feel it and I can analyse it! The plastic gets brittle from the sun and dissolves with the waves, it gets smaller and smaller, until it's piddly (as you will remember). But it will never go away. Never ever! And it releases a lot of toxic substances. Oh I also forgot about the emollients, these make plastic flexible. And all of that bad stuff ends up inside the creatures living in the sea! And from there... exactly, it ends up in our bellies! At least sometimes.

● One thing has slipped my mind: the poisonous substances I've detected – pesticides, fungicides and herbicides as they are called – they are drawn to plastics as if by magic. They accumulate on the plastic in huge quantities, much more than in the surrounding seawater! They gather on the plastic and, along with the microplastics, they make their way bit by bit to our table. What can I say? Yummy! And not only that, there are also bacteria and even little beasties cruising along on the plastic, traveling the seas and doing a world tour – like tiny hitchhikers! They go to places they've never been before. And that's quite dangerous, because the bacteria can cause diseases against which humans and animals are defenceless. And the hitchhiking beasties can change the ecological balance by eating other animals and spreading themselves far and wide.

● I've told you before, I'm sure you remember: It's a feature of every mobile nowadays. Satellites can locate where I am and thus also where the 'Mary Anne' is. I mean the fishing vessel, of course.

● OK, that might take a bit of time because, being so far from the shore, we need to find out which authority is responsible for pressing charges. However, they know how to deal with it and they'll punish these litter louts!

“Hey hey hey... a plastic bag is not for eating! It can be really painful and clog up your insides! It's so dangerous!” ● I don't believe it, she really wanted to eat it. “What's your name by the way?” ●



“Sally – and now, give us the bag!
Oh, thanks a lot, it looks just like my favourite dish!” ●

Do you know what turtles like to eat the most? My driver is just telling me “Jellyfish, ● everyone knows that! And now, fasten your seatbelt! I owe you – and I’m speeding you to shore at 47 knots.” ●

„What's a funny fellow like you doing all alone on the high seas anyway?”– Well, what am I doing here? “I want to clean up the sea and the world – but it seems like a pretty tough job for just little old me!”

● Well, you and me, we can tell right away that this is a plastic bag. But animals don't know what plastic bags are and get them mixed up with their food, thinking: “That looks yummy!” By the way, do you know how long it takes for a plastic bottle to decompose completely? Well, even longer than our lifespan. In fact, according to lab tests it takes more than 450 years! Just imagine that: If Columbus had drunk a bottle of Cola and thrown it into the sea at the time he discovered America, the bottle would probably still be around!

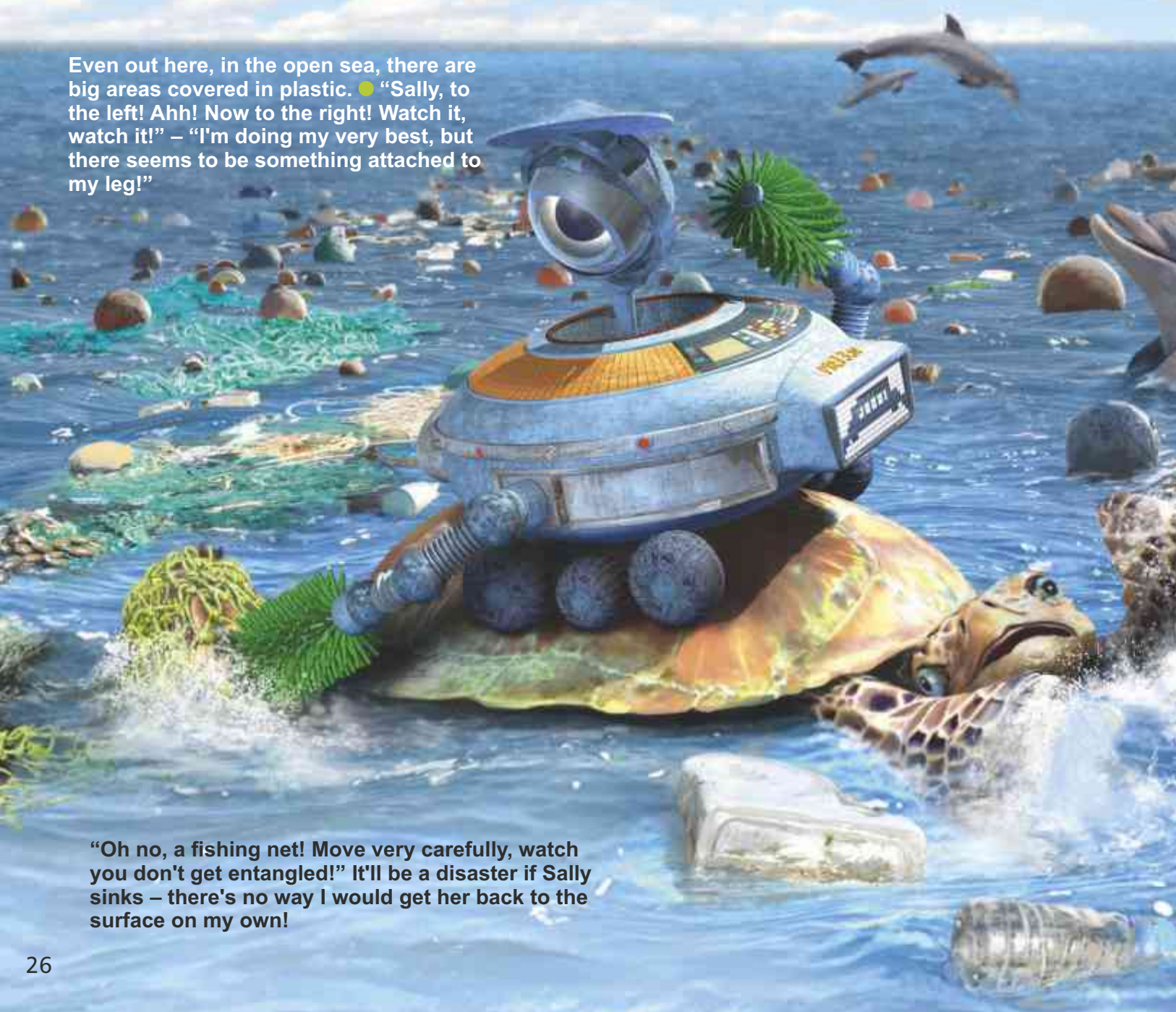
● Oh, before I forget: Plastic bags usually last about 20 years, which is as long as it takes for you to grow up. Just imagine how long it is until you're grown up!

● And do you know how many of these bags are churned out in Europe every year? Let's go back to Piwi's maths lesson. Hold on to your hats: On average, every person in Europe uses one plastic bag every two days. That means nearly 200 bags in a single year. About 15 of them are dumped somewhere out in nature. Each one weighs about 6g so we come to a total of 100g of plastic. That's about half a glass full of plastic. Doesn't sound too much, you think? Well, think again. Is there something missing in this calculation? Exactly, that's only the amount for one person in Europe. If every single European emptied his half a glass full of plastic into a bin lorry, we would end up with 4,000 lorries filled with all the plastic bags that are dumped in the environment. And that's only in Europe!

● And plastic bags look very much like jellyfish when seen under water. That's why Sally nearly swallowed one.

● Nah, she didn't want to tie knots in my brushes or anything, it's a unit of speed on the seas, and 47 knots is about as fast as a jet ski!

Even out here, in the open sea, there are big areas covered in plastic. ● “Sally, to the left! Ahh! Now to the right! Watch it, watch it!” – “I’m doing my very best, but there seems to be something attached to my leg!”



“Oh no, a fishing net! Move very carefully, watch you don’t get entangled!” It’ll be a disaster if Sally sinks – there’s no way I would get her back to the surface on my own!

A dolphin is shown leaping from a sea filled with plastic waste. In the foreground, a large pile of colorful plastic debris, including ropes, nets, and fragments, floats on the water's surface. A seagull is perched on this debris. Another dolphin is visible in the background, also surrounded by the trash. The scene illustrates the impact of marine pollution on wildlife.

“It’s best not to move at all, Sally. Just go with the flow, maybe we can somehow swing ourselves out of this plastic trap.” ●

Sally immediately stopped moving: “Ok, you’re right, I know enough terrible stories of friends who... Look over there!” What luck! Dolphins! “Hey you – world champions of swimming –, could you lend us a hand... I mean a flapper?”

● So-called rubbish whirlpools are especially notorious. They come into being because there are five well-known and enormous circular currents in the seas. When plastic parts get caught up in them, it’s like they’re entering a roundabout. And as the amount of plastic keeps increasing, it creates this gigantic whirlpool of rubbish. It’s estimated that plastic parts go around this roundabout for 16 years. You’re nearly grown up by then. Exposed to the sun (as you will remember) they become brittle and the waves break them up into ever smaller parts until they’re only half the size of the nail on your pinkie. And some fish mistake them for their favourite meal – plankton – and eat them.

● Maybe you’ve already heard fairy tales about ghost ships? Yeah? Well, those are just made-up stories of ships sailing around and they’re not true. But what do exist are ghost nets! These are fishing nets that have been lost and are floating around in the sea. It is reckoned that every tenth piece of rubbish in the sea is a ghost net. And that’s really bad because they continue to catch things. The nets sink when they are full and lie on the sea floor, so when fish get caught in them they go literally down to the ground and perish. Once the poor fish have decomposed or been eaten, the empty nets drift back to the surface, where they start catching things again. Up and down, again and again, because fishing nets last hundreds of years! It is estimated that 25,000 nets are lost every year in Europe alone. If you were to put them all in a straight line, you’d get a gigantic fishing net stretching from the Alps to the North Sea! A lot of stuff would get caught in that, I can tell you.

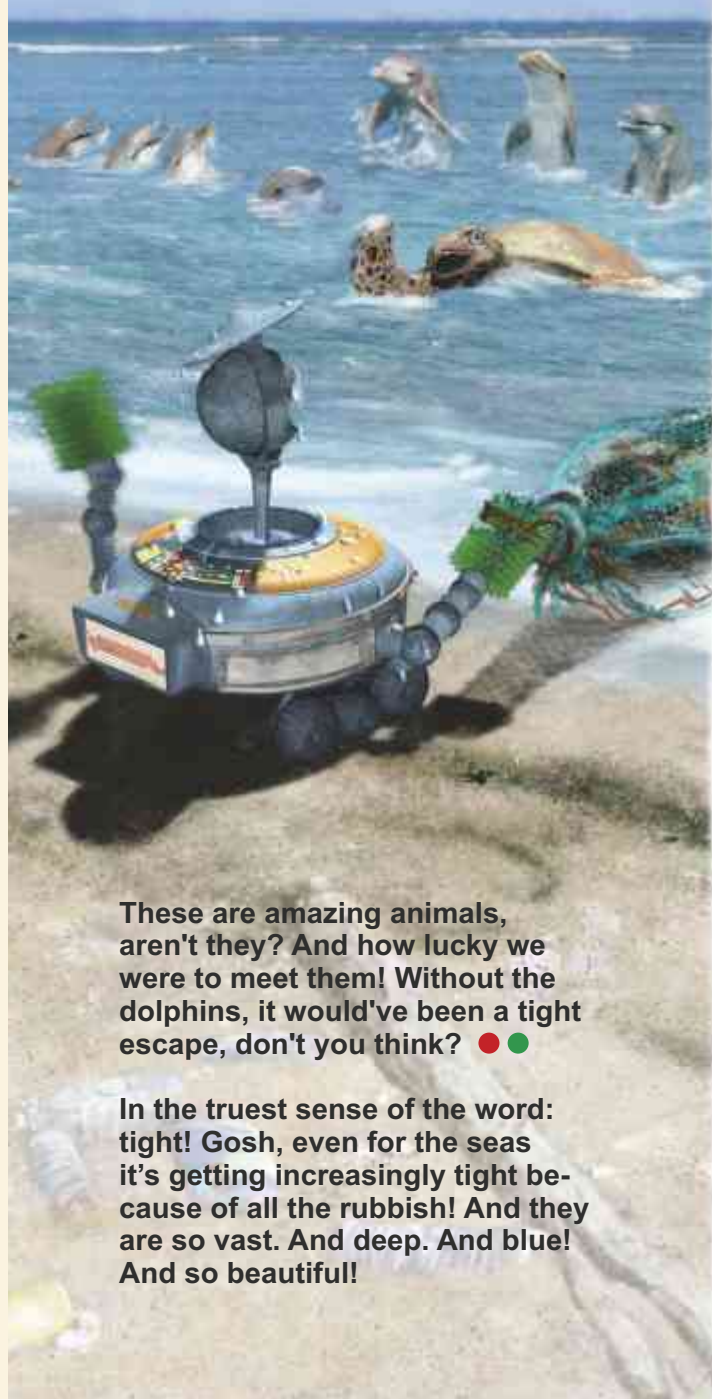
● That's maybe the first ghost net ever that was used for good: I managed to fish quite a lot of rubbish out of the sea! They're great for that, the awful things! Goodness, I feel like I'm starring in my own horror film: "Piwi: The Ghostly Fisherman"

● All these fantastic animals are endangered, as they often mistake the plastic for food and swallow it. Then it can hurt the stomach or clog the digestive system or the animals are no more hungry because their stomach is full of plastic. More than a million seabirds and thousands of marine creatures die every year through our plastic waste. It's no problem for me, I can handle plastic very well, but my robot heart breaks when I think about what it does to the animals. And to you humans too, because you only have to put two and two together – which you already can – and it's clear as purified waste water: Sooner or later it'll end up in your stomachs as well. And then what? Well, that's the big question, isn't it? It's like an experiment on a very large scale, because no one really knows what plastic does to humans. What it does to animals we know and see – sad as it is.

● These are called "pellets". Plastic is made up of them. And how do they get on to the beach? Well, something always goes wrong. Also in factories using the pellets. There are just some pellets crumbled and during cleaning they landed in the gullies and in the rainwater sewer, or with the wind directly in rivers. Yes, and you know that, in the end it rinses into the sea. And that's happening around the world, all the time, and that's why there are billions of pellets in the sea and at the beaches. And these horrible things don't just dissolve. No, they show up somewhere else sooner or later and can be found on every beach. Take Britain, for instance, it is an established fact that every tenth grain of sand is in fact plastic! Every tenth!!! So, next time you're at the beach, take a very close look at the sand! Just like I'm doing now!

● And the smaller, the nastier they are. A fleece jacket made of polyester loses almost 1 million microfibers per wash, an acrylic scarf 300 thousand fibers and a pair of nylon socks 136 thousand fibers. This really is an unthinkable number of fibers (source: life-mermaids.eu/en/). And a large part of them ends up in the rivers and finally in the sea.

● No and no, and definitely no: I am no whining weepy robot! I've done all I could, everything, and now I'm simply frustrated. And I have the right to feel that way after having seen all this rubbish. Don't you agree? Maybe you feel the same right now.



These are amazing animals, aren't they? And how lucky we were to meet them! Without the dolphins, it would've been a tight escape, don't you think? ● ●

In the truest sense of the word: tight! Gosh, even for the seas it's getting increasingly tight because of all the rubbish! And they are so vast. And deep. And blue! And so beautiful!

A cartoon robot with a large, expressive eye and a wide-brimmed hat stands on a sandy beach. The beach is covered in trash, including a large pile of colorful plastic waste on the left and a crab in the background. The robot has green brush-like appendages on its arms and a colorful control panel on its chest. It looks frustrated, with its mouth open as if speaking.

Jeez, now me, a little robot, is sitting here before this
marvellous sea with a net full of rubbish! And all these
little crumbs are to blame! ●

You can try to clean it up,
but the rubbish just keeps on coming! ●
It's all for nothing, I can't do it on my own!
Everything I did on my journey was in vain! ●

...However... Finn and Pippi helped me a great deal... And Ronny also said he and his mates would begin collecting rubbish on their wanderings...



...And the angler... he wanted to clean the lake... and was going to ask friends to help him...



...And on the journey... at the river... everywhere, there were people joining in... They even wanted to organise clean-ups...



...And maybe the harbour guards have already busted the 'Mary Anne'...



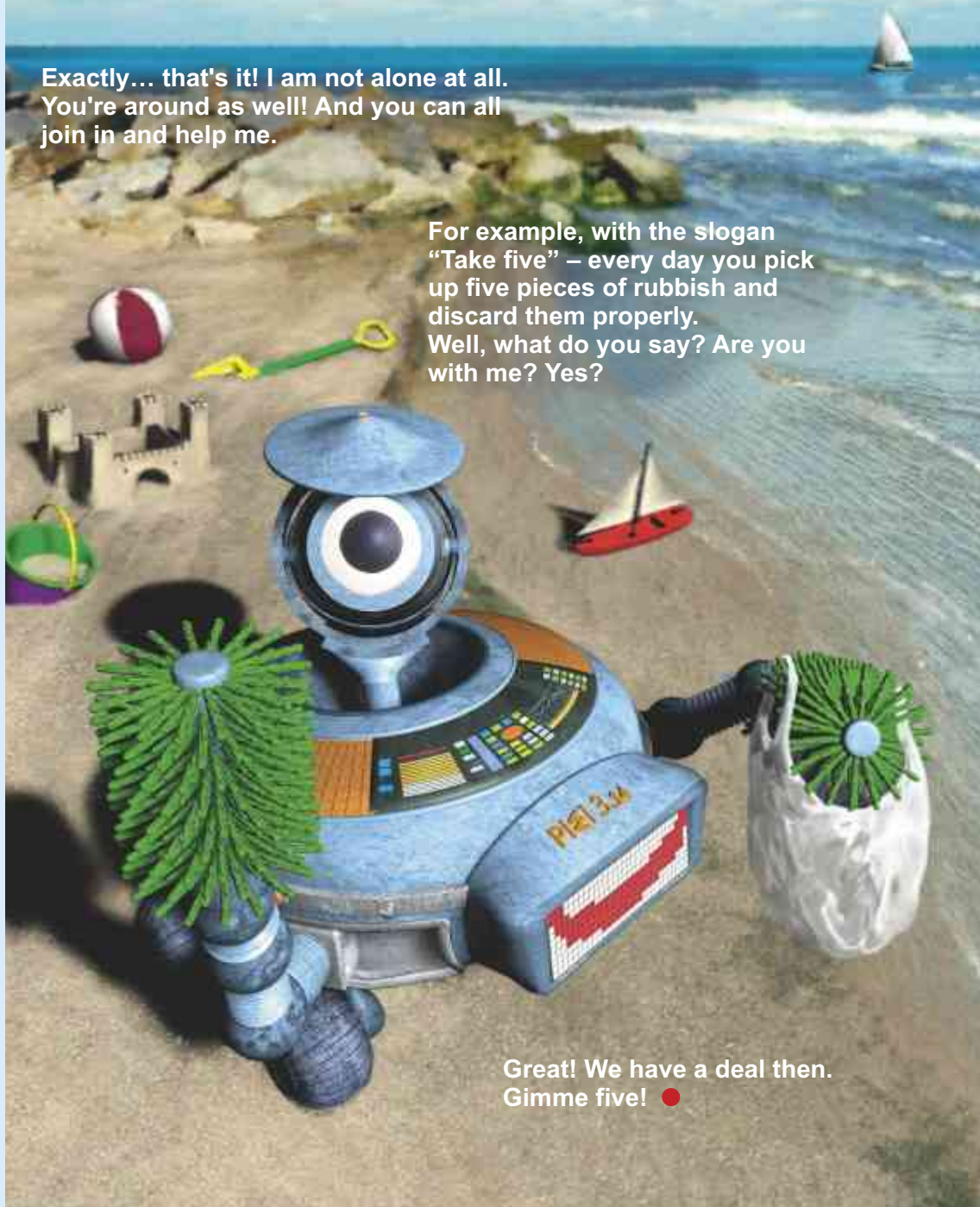
Hmmmm... I haven't only cleaned up, I've encouraged a lot of folk to do something! Hmmmm....

● And if you still want to know more, I'll just sum up the most important points. So, here's what anyone can do. The best thing - and therefore the major rule above all else: avoid producing rubbish in the first place. If you can't do that reduce, reuse and recycle as much as possible. For instance, take materials to recycling bins, like the bottle banks for all things glassy. But there are also litter bins for a lot of other waste at the recycling points. Do you know where your nearest recycling point is and what you can take there? Well, how to avoid waste? Above all start with shopping. Now brace yourselves, when it comes to plastic waste nearly half of it is packaging material! Yes, indeed. Nearly everything you buy is wrapped in plastic these days. But you can all be on the lookout when you go the supermarket with your mums and dads or others. At the fruit counter, not all the goodies like bananas, pineapples and melons need a separate bag, many can be bought without additional plastic wrapping, and so on... You can probably think of a lot of ways to reduce the amount of plastic waste at home, can't you? How about doing a quiz or competition with your friends to see who can think of the most ideas? Make a poster together, a newspaper article or even a video. I'd love to see them. Please share your ideas on piwipedia.de. I'm really looking forward to receive them.

Exactly... that's it! I am not alone at all. You're around as well! And you can all join in and help me.

For example, with the slogan "Take five" – every day you pick up five pieces of rubbish and discard them properly. Well, what do you say? Are you with me? Yes?

Great! We have a deal then. Gimme five! ●



An aerial photograph of a beach. The ocean is a deep blue, with white foam from breaking waves visible. The waves are moving towards the shore, which is a light-colored sand. The perspective is from a high angle, looking down at the water and the beach.

...And if you want to know more before we get going with the clean-up, just turn the page: There's a wealth of information packed onto two pages. Everything you need to know.

But I have to take my leave now! Well, it's really time for me to go home and catch my breath in my little world. Come to think of it, how will it look now? I was away for some time, it's quite possible the pool isn't so clean anymore... so much for happy little world... OK, OK, I have to go home now.

Cheers, all the best and see you soon!



PIWI LIBRARY

(Piwipedia for adults)

● Definition of marine litter

"Marine litter is any persistent, manufactured or processed solid material discarded, disposed of or abandoned in the marine and coastal environment. (UNEP 2005)

● Composition of marine litter

When examining the amount of metal, wood, glass, clothes, organic and other litter and plastic, it is the plastic that predominates with a share of 83% in total, depending on regional conditions.

● Origin of litter How it gets into the sea

When marine litter is categorised into sea-based sources (from the sea into the sea) and land-based sources (from land into the sea) it is the land-based litter that predominates with a share of approx. 80%. Possible pathways from land are, for example, rivers, storms, rainwater transport, etc. Sea-based litter is caused by different activities like shipping, fishing, cruise liners but also illegal ocean dumping.

● Distribution on the earth

Marine litter is circulated by currents and becomes concentrated in certain areas. Even the wind plays a role in the movement of marine litter. There are several known concentrations of mainly plastic litter which converge in vast circular currents to become what is known as rubbish whirlpools, gyres or garbage patches. There are currently five such known areas in the oceans, two each in the northern and southern hemispheres of the Atlantic Ocean and Pacific Ocean and one in the Indian Ocean.

● Distribution in the sea

The visible part of sea litter on beaches is only a tiny fraction of the whole range of rubbish. It is estimated about 70 % has sunk down to the bottom of the sea, about 15 % is washed ashore and the remaining 15 % is floating in and on the sea.

● Impact on humans and animals

Main effects:

- 43% of whales and dolphins, all sea turtles, 36% of seabirds, many fish and other animals of the sea (e.g. mussels) mistake plastic for food. More than 90% of fulmars have plastic in their stomachs, with an average of 36 pieces each.
- 136 marine species get caught, entrapped and strangled in plastic waste.

- Non-native species “travel” on plastic waste to places far away where they have no natural enemies and so breed uncontrolled and supersede native species.
- Humans ingest microplastics and their harmful substances when consuming marine animals. For example, in a study on microplastics in mussels from marine aquacultures by Lisbeth Van Cauwenberghe and Colin R. Janssen, it was established that one dish of mussels contains 90 items of microplastic.

● Microplastics

Microplastic is the name given to any plastic marine litter that is less than 5mm in size. Lately this topic has come more to the fore because of its negative effects on animals and human beings, and due to the increasing amounts found in the sea.

Microplastics can be the result of larger plastic parts breaking down (known as secondary microplastics), but can also refer to microparticles that are produced in micro dimensions (known as primary microplastics) which are used in cosmetics. The microfibers that are released when washing synthetic clothes also contribute to the pollution of the water and the seas.

● Outlook

Current figures suggest there are already 100-142 million tons of plastic waste in the seas, and it is projected that up to 10 million tons are added every year. As the annual production of plastics is

on the increase – in 2016 it was 235 million tons globally, in 2017 already 348 million tons and it will go on– these figures are expected to rise. Solutions are being sought with different technical strategies to remove the plastic waste from the seas. But they still need to be proved viable in practical use. For the time being, the most important and primary aim has to be to prevent further intrusion of plastic waste into the waters.

We have used the following assumptions and data for the calculation examples:

- a 12-ton truck has a length of 8 meters.
- According to information from the Federal Environmental Agency, there are currently between 100 and 142 million tons of plastic garbage in the sea.
- Every year about 10 million tons of plastic are added.

(Source:

www.umweltbundesamt.de/themen/wasser/gewaesser/meere/nutzung-belastung/muell-im-meer
FAQ: What amounts of waste are in the oceans?)

● References

Information, scientific articles, charts and graphs can be found on our website:

www.piwipedia.de



...and here's some space for your ideas, stories, notes and all you can think of...



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The Pool-Cleaning-Robot PIWI (Pool-Intelligent-Water-Inspector) PiXi.3.14 keeps his pool clean and ship-shape and is quite happy. However his friend, Wilma the cat, confuses the issue when she tells him what the next stream looks like. The two of them get on their way to sort things out. But that is not the only job, as the stream flows into the river and the river into the sea. Everywhere PIWI makes new friends but also finds lots of rubbish. On his trip to the ocean PIWI enjoys lots of adventures, - he saves ducks, is kidnapped, lands up in a soup of plastic and...and...and – and learns almost as much about rubbish as the rubbish volume itself. He has luckily shared that information with us: as "Piwipedia" – in book form and the net!



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