

## The Slime of the Ancient Mariner

Mist rolled in over the minch as the ship's bell chimed dully over the deck. "We're behind by four days now cap'n, cook's gettin' worried about supplies". The *Alba Troos* was sailing to Iceland, delivering the final whisky shipment from the Highlands of Scotland before winter set in across the North Atlantic. There had been recent tales of ships returning from such voyages, completely encrusted in barnacles, cockles and worms, the weight of which slowed the ship's progress to such extent that crews barely made it back to port before their rations ran out. Such an ominous sight was enough to get the sailors chuntering and that was before they'd heard whispers of the tentacled behemoth that was said to hunt these mollusc-laden boats.

"Wind's due to pick up later this evening, Kyle. If you could check with Dr Simpson on her progress with the sample, that might help us get rid of these foul freeloaders!" Captain MacArthur was no fool; she knew the shipment would pay handsomely on its arrival in Reykjavik, and the risk of a couple of days on half rations (and a borderline mutinous crew) was worth the journey. She had however, requested the help of a microbiologist from the university to accompany them on the trip – if their mission could be the one to find the solution to this maritime scourge, that would be a fine bonus!

Dr Kara Simpson removed her gloves as she slumped back in her chair in the galley of the ship, which had been converted to a make-shift laboratory. Her studies of the mollusc samples taken from the hull revealed a dense film of microbes that had colonised the surface of the boat, providing a sturdy foundation to which larger, heavier marine life had attached. These shellfish were adding so much weight to the boat that the vessel could barely move. Since diesel engines has been outlawed following the climate crisis of the 2020s, shipping had returned to sail-power, but these mollusc hitchhikers were causing more drag than the wind could overpower.

A rap at the door announced the arrival of the ship's mate, Stefanos Kyle. "Come in!"

"Cap'n's requesting a report on your progress ma'am. Please report to the ward room in ten minutes"

"Thank you Stefanos – sorry – Officer Kyle. I'll be there."

The merchant navy was an unfamiliar environment for Kara, who was accustomed to the more relaxed atmosphere of her university lab – but this was a great opportunity, and a problem she knew had to be fixed. If only she had better news...

"They used to use a cocktail of antifouling molecules on commercial ships, but half of these were banned for being too toxic and the bacteria have simply developed resistance to the rest. There's no easy fix for this I'm afraid." Kara's statement was left to hang in the damp, salty air while Captain MacArthur rolled her eyes at this uninspiring report.

"Indeed, I remember the old harbourmaster cursing these damn things – biofilms, aren't they? We used to try all these special paints, different materials... The only thing that ever worked was rolling up our sleeves and scrubbing the ships in dock! But before you knew it, the biofilm slime was back and with it came the shellfish. We never thought we'd be returning to sail power, but then that meddling Greta Thunberg had to stick her oar in-"

The ship swayed torpidly from side to side, the whole vessel groaning with the strain of the extra weight.

“Dr Simpson, you must continue working on the samples, there must be something, some treatment-

“There is one treatment I’ve only just started working on, but...maybe...well, it would need volunteers, and it’s a big gamble. The bacteria that are coating the ship, they communicate with each other using tiny molecules as signals – it’s normally known as quorum sensing. I’ve been testing a drug which I think might neutralise the signals, block them from being passed from one bacteria to another, and I think that might result in the film weakening and dispersing from the hull. But the only way to get this treatment to the biofilms is to apply it directly. We’re going to need to dive beneath the ship.”

As the afternoon had worn on, the mist had thickened and the ship had begun to drift off course, pulled by the currents that weave to the north of Shetland.

“Something needs to change otherwise we’ll find ourselves wrecked on the Faeroes, or worse. We’ll round up volunteers from the crew, Officer Kyle will help you gather the materials you need.”

It was far from ideal, but the crew was getting desperate, and they knew too well that being delayed like this made it more likely they would run out of supplies, or get caught in bad weather that they had intended to keep ahead of. The biofilm was getting stronger and attracting more crustaceans with every hour they were at sea; a briefing was to be held that evening, with the first divers going under at dawn. Dr Simpson ran through the mechanism again and again as she blindly looked out over the mist cloaked water – she barely noticed the flicker of a tentacle as the colossal squid that had been following the *Alba Troos* slipped silently beneath the ship...

The dark slowly lifted to a porous gloom as the sun rose somewhere behind the mist. Four pairs of divers kitted out with chisels, air tanks, and the all important syringes containing the antifouling formula assembled on the deck.

“So remember, initially chisel off a patch of the shellfish and once you can see the surface of the boat, use the syringe to penetrate any space between the ship and the shells you can get to. We’ve only got enough air for 10 minutes, so don’t strain too hard removing the crust and keep an eye on your partner. Any questions?”

Dr Simpson had taken the decision to lead the divers – one pair were to take the hull, the second the stern and the remaining two on port and starboard sides of the ship. Officer Kyle joined the young microbiologist at the hull ready to go overboard. It was certain that none of the crew had signed up for this baleful task, but Dr Simpson felt a responsibility to keep these sailors as safe as she could; after all, this was her idea...

With a sudden chilling splash, each pair plunged into the icy grip of the Norwegian sea. Trying to avoid the searing cold of the water against their faces, the pairs descended beneath the ship, taking one last gulp of sea air.

Working quickly, they searched the surface of the biofilm-crust, seeking a suitable place to break in. Kara placed her chisel against a flattened section of barnacles, whilst Officer Kyle swung at it in an attempt to dislodge the calciferous scab. The drag of the water and restricted movement of the cold dry suits made this a near impossible challenge; exchanging panicked looks as the clock wore on and the air tank pressure dropped, they moved to another section to try again there. They could hear the other teams frantically clanging, the slightly deadened thuds reverberating through the water.

At last, a huge lump of shells flaked off the hull and they quickly jammed the syringe into the glutinous slime. Dr Simpson trembled with fear, cold and trepidation as she injected the solution into the biofilm, willing it to spread through the network and shut down the communication between the microscopic bacteria that were causing this enormous problem. It took a minute or so, until it was almost time for the divers to return to the surface, but suddenly chunks of the mollusc crust started to drop from the boat, trailing globules of slime as they tumbled through the water.

Exchanging looks of relief and delight, Dr Simpson and Officer Kyle signalled to return to the surface, but suddenly the microbiologist's vision became blurred – the slime that was budding from the boat had caught on her goggles, and the biofilm had reformed!

Pushing her way up to the surface, she could feel a slipperiness on her wetsuit; her formula had successfully dislodged the film from the boat, but only blocked the signals temporarily. The bacteria had switched their communication channel, and just as quickly as they were dispersing from the ship, the biofilms were reforming on the nearest solid object – the divers.

Dr Simpson managed to break the surface of the water and gasped for air as she ripped off her scuba mask and wiped the biofilm from her face.

“Simpson! What is it? None of the others are back up yet and it's been twelve minutes!” a tense Captain MacArthur called from the deck.

“It's the biofilms – they're reattaching and covering us in slime as soon as we remove them from the hull! It's making it almost impossible to see or hear anything!”

Suddenly the surface of the water broke but instead of a fellow diver, a huge glistening tentacle rose into the air, thrashing for the exposed woman-overboard. The symbiosis between the biofilm-forming bacteria and Giant Scandinavian Squid was paying off for the tentacled beast – at last they had led it to a fresh meal!

One by one, the divers were engulfed into the cavernous mouth of the squid, amid the desperate cries of the remaining sailors who watched in horror from the deck. The tales were true; the crews of these ships were cursed by the biofilms to meet a devastating end should they come into contact with this potent slime.

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The following spring, a whisky bottle emerged from the lapping waves on Achmelvich beach in northern Scotland, much to the delight of a passing kayaker.

“That's smashing – a fine bottle of 18 year old malt! Don't mind if I do... just need to get these damn barnacles off the cap and I'll pour myself a wee dram...”