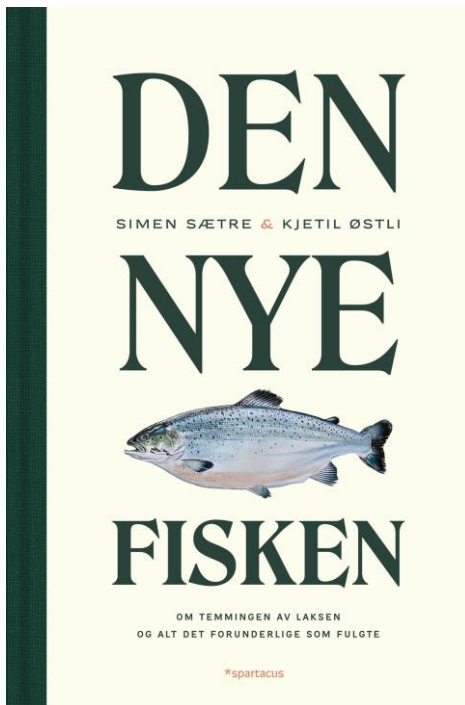


Cappelen Damm Agency *Fall 2021*



The New Fish – The Global History of Salmon Farming

In the early 1970s, a group of scientists researched how to make more food for the population of the world. They looked to the sea.

They sampled genes from salmon in 41 Norwegian and Swedish rivers, and designed a new salmon that was fatter, more docile, and faster growing.

This was the beginning of a new industry - salmon farming.

The industry spread from coastal Norway to Scotland, Canada, Australia, Ireland, Chile, Iceland, and the Faroe Islands. Jobs were created, business boomed, and salmon farmers became extremely rich. A new type of food, the salmon sushi, spread around the globe.

But as soon as this new fish was let loose in nature, unexpected things started to happen. Wild salmon stocks disappeared, diseases spread in salmon farms, salmon louse swarmed, and the new industry became highly contested.

In a prizewinning five-year investigation, authors Simen Sætre and Kjetil Østli has taken a closer look at the global salmon industry. For the first time, the global history of salmon farming is told. The result combines nature writing from Norwegian fjords, the coast of Canada, Icelandic landscapes and the far south of Chile with classical muckraking and character-driven literary non-fiction.

The authors start out with a question: What happens when you place a new animal in the sea?

This book will tell you the answer.

SELECTED TITLE WITH NORLA FALL 2021.

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Praise for the book:

The New fish is a much-needed review of the billion-dollar industry that is Norwegian salmon farming. But more than that it is also an equally exciting and well-written story about man's cynical and at times mindless march towards domination over nature. This is a book that risks seriously clouding you joy the next time you find crazy cheap salmon in the deep freezer in your store.

Patrik Svensson – author of international bestseller *The Book of Eels*

You will choke on your sushi, or at least it will lose its taste, if you are one of us who care about ecology, animal welfare and democracy. Exemplary researched and masterly written. This book is this year's most important non-fiction publication.

Morten Strøksnes – author of international bestseller *Shark Drunk*

Kjetil S. Østli and Simen Sætre

Kjetil S. Østli (b. 1975) is a journalist and author. He co-runs the online magazine Harvest. In 2002 he received the Arne Hestnes Prize and NTB's Language award in 2007. He has been haunted by Norwegian publishers for many years, and with Cops and Robbers, Østli finally made his debut. This debut also earned him the prestigious Brage Award in 2009.

Simen Sætre (b. 1974) is one of the most renowned Norwegian investigative journalist, and works for Morgenbladet. He has previously published four books, including Hugo. A Biography (2006), which earned him a nomination to the Brage Prize.



Chapter synopsis

Prologue.

Man conquers the world and the fish too. Why fish was domesticated, and why we started our investigation.

Chapter 1, in which the new fish is created.

We meet the man who started breeding of salmon and in the 1970s laid the foundation for an entire industry.

Chapter 2, where the pioneers build an industry.

How some struggling pioneers started salmon farming on the coast of Norway, and how the industry spread and became a large-scale global industry. And the birth of the salmon sushi.

Chapter 3, in which we introduce the antagonist of the story, the louse.

A tiny biography of the little creature that drives salmon farmers crazy.

Chapter 4, in which one of the authors goes back to the foundation and the summers with the wild salmon.

Memories from a childhood with angling along the Norwegian salmon rivers.

Chapter 5, where someone dreams of an even better fish.

Scientists makes the world's first genetically modified salmon, but the trials are controversial and become tabu. We investigate a repressed story from the farmed salmon's childhood.

Chapter 6, where the new fish finds its color.

In the beginning, the flesh of the farmed salmon was pale and grey, but farmers find a way to make the fish pink, like in nature.

Chapter 7, we get lost in the story and meet a monster.

In a reflection on our story, we turn to the tale of Frankenstein. Why is Mary Shelleys story still so scaring to humans?

Chapter 8, the new fish escapes.

The new, domesticated salmon escapes from the pens, swims upriver, mates with its wild relatives and gives birth to a new species, half wild and half tame, but not apt to a life in nature.

Chapter 9, the new fish is attacked by lice.

The salmon farmers use chemicals to kill the salmon lice swarming the pens, but the lice become resistant. We investigate an animal tragedy.

Chapter 10, an American Warns: The New Fish is Dangerous!

We meet the American researcher who found toxic persistent organic pollutants in the salmon and scared the salmon farming countries to their bones.

Chapter 11, where we read every book ever written about salmon farming.

We turn to literature and seek a deeper understanding of our topic.

Chapter 12, where we try to solve an old mystery.

What happened when the salmon feed was poisoned, the Russians stopped salmon import, and Norway branded by an American scientist a “fifth colonist”? We dig into a story that has given life to conspiracy theories.

Chapter 13, where someone wants to make salmon the cleanest fish in the world.

Toxicologists want salmon to be cleaned of environmental toxins. A research project is founded. Then strange things start happening.

Chapter 14, the new fish gets sick.

Salmon farming is booming in Chile, but a virus soon spread like a wildfire from pen to pen. A veterinarian traces the infection source to a large company and puts her career at risk.

Chapter 15, where a scientist is muzzled.

A Canadian researcher finds clues that farmed salmon infect wild salmon, threatening the wild salmon stock, but is not allowed to say so. She later discovers that she is muzzled by the office of the prime minister.

Chapter 16, great plans are made for the new fish.

A plan is set for a fivefold growth of salmon farming, but it is unclear how this became policy. We investigate and find a surprising answer.

Chapter 17, where the new fish is to be fixed.

Scientists change the chromosomes of salmon so that the salmon cannot breed, but the new, “triploid” fish has many deformations. The result is an animal tragedy.

Chapter 18, an unfortunate story about a mysterious substance.

A Russian researcher is hired to investigate ethoxyquin, a synthetic substance in the fish, at the Norwegian seafood institute. She faces trouble when it appears that the substance is genotoxic.

Chapter 19, where the feed companies take code names and make a cunning plan.

We tell the fascinating story “The Ugalde family”, a criminal cartel that ruled the Chilean salmon feed industry for more than 15 years.

Chapter 20, we visit a museum for salmon and start to ponder.

A salmon museum for school children is owned by the industry, and, we find, part of a plan to improve the industry’s reputation. This leads to a reflection on the polarized knowledge field of salmon farming.

Chapter 21, where someone will prove that the new fish is healthy anyway.

We dive into the wonderful world of nutrition research.

Chapter 22, the little shrimp, and a predicted murder.

For years, the chemicals against salmon louse were regarded harmless, until scientists started tests on shrimp and lobster. Their findings meant trouble – for the scientists.

Chapter 23, in which a chief stands up.

We go to the west coast of Canada to talk to the indigenous peoples who occupied salmon farms for 288 days.

Chapter 24, where we go to the heart of the matter.

Millions of farmed salmon die every year because their heart cracks. Their body has grown too fast.

Chapter 25, where we try to solve a vanishing mystery.

Why did the wild salmon disappear from the world-famous salmon river of Vosso? We go to the river to examine and meet the people trying to save the stock.

Chapter 26, where we go out of the story and meet a dreamer.

To understand our story of the new fish, we consider another classic: Goethe's play "Faust".

Chapter 27, the new fish will save the world (say the owners of the new fish).

Industry spokesmen and government officials all allege that salmon farming is a remedy against climate change, gives food security for the poor, and is blessed by the United Nations. We take a closer look.

Chapter 28, the story of a tragic hero.

The unfortunate fate of the cleaner fish, sent in millions to the pens to eat lice from the salmon and die.

Chapter 29, we become fascinated by a rich, young man.

We follow the money and ponder how the salmon industry created the world's youngest billionaires. On the way, we investigate a lobby campaign against tax on ground rent.

Chapter 30, we go to a conference about ... lice.

Salmon lice has become an advanced field of science and a growth industry in its own right, as the industry spends a billion dollars a year on remedies. Report from a lice conference.

Chapter 31, a scientist asks: How healthy is the fish?

The story of a researcher who found that environmental toxins from salmon and other fatty fish can harm children, and what happened to her career. The EU fears for sperm quality if people get too much dioxins from the fish, but other scientists say salmon is health food.

Chapter 32, the new fish gets an enemy.

We meet, on a remote Canadian island, the world's most famous and infamous salmon farming opponent.

Chapter 33, the new fish conquers a new land.

The fjords in Norway, Chile, Scotland, and Canada are full, and the salmon farmers go new places to farm fish. In Iceland the fjords are cold and clean, but now the Icelandic chefs have sharpened their knives in protest.

Chapter 34, what happens when writing about salmon.

How salmon farming has become one of the most controversial industries ever. And how we, during our work over five years, was ourselves branded.

Chapter 35, where we ponder what we have learned.

We reflect on the story about the new fish and find an expression for the story: The law on unintended consequences.

Chapter 36, we seek a last, secret paradise.

We get a secret map from a mysterious man and travel to a last, pristine place in the far north of Norway to fish for wild salmon. But when we finally reach the place, we are confronted with an unpleasant surprise.

Epilogue.

The present situation. Salmon farming meet protests near and far and move production on land and far at sea. We investigate the future and ask: How can we be proud of that farmed salmon?

Den nye fisken (The New Fish)
by Kjetil Østli and Simen Sætre

Publisher: Cappelen Damm
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Prologue, wherein mankind conquers the world and sets its sights on the fish

Why did we domesticate the fish? Or rather, why didn't we do it sooner? Evolution gave us toes to stand with, bodies to walk upright with, fingers to grip and create with, teeth to eat with. We were able to hunt over long distances, tracking our prey until it collapsed and lay trembling before us.

We mastered fire, and that fire allowed us to cook, stay warm and keep predators at bay. We spent less time chewing and more time thinking instead. The fat and nutrition from the meat allowed our kind, high on energy, to take a new leap. Our bodies changed, and our brains grew larger. More capacity for thought enabled us to plan. We learnt to group together and work as a team. Some of us gathered nuts and berries and looked after children, others made clothes out of hides and tinkered with arrowheads and simple tools, and others kept watch or hunted. As the animals around us reinvented the wheel again and again, our ancestors were able to accumulate knowledge and, in the warmth of the fire, share it. And so, the scene was set for the biggest-brained African primate to reach for its ultimate potential.

When *Homo sapiens* bid farewell to its distant and close relatives—chimpanzees and baboons, *Homo floresiensis* and *Homo erectus*—our tools were unrivalled. We spread across the globe. We were such skilled hunters that we contributed to wiping out the large animals that grazed where we migrated, animals such as the American mastodon, the mammoth and the Irish elk. And our relatives, the Neanderthals. They're all gone now.

Then something strange happened. Wow, it's so lovely here! Should we stay a while? We grew less inclined to roam forests and valleys, and in the end, we stopped. Around ten thousand years ago, more of more of us started to abandon the nomadic hunter-gatherer way of life. Increasingly, we settled in humid and fertile areas. We established tribes, then villages, then towns and states. We got chiefs and separated society, culture and religion, laws and rules—and looked upon the nature around us

through new eyes. Nature became something we could exploit, conquer, plough, transform, cultivate. We had once searched for food, hunted it. Now we started to make and create food. The Neolithic Revolution was underway, the first of the agricultural revolutions. And we perhaps didn't live any longer or get any stronger. Some research suggests that we lived shorter lives and were smaller in stature at the start of this period. But we multiplied. Oh, how we multiplied.

What was the reason for this change? One theory is as follows: as we became more numerous, and there were fewer large animals to eat, farming became more reliable, particularly during periods of climate change. But if we assume that everything is about staying alive, we overlook something crucial about our species: namely the curiosity, the urge to create, the drive to take our fate into our own hands. Because now we were really getting somewhere. We tamed and domesticated, we tried and failed. We cultivated wild wheat, rice, barley, lentils, peas, potatoes. We caught wild animals, and instead of eating them straight away, we kept them as livestock.

We caught the horse, a wild little creature from the grasslands, and bred it to be big enough to carry and pull loads. We also tamed the aurochs. We caught junglefowl and kept them for eggs and cockfights. We transformed the wild boar into a serene creature that provided plenty of meat and developed a taste for bacon. New plants were harvested, more animals were domesticated and made our tools. Not only the horse and the cow, but also the cat, the guinea pig, the donkey, the mallard, the water buffalo, the camel, the turkey, the honeybee, the llama, the silkworm, the pigeon, the goose, the yak, the elephant ... The list goes on.

When our forefathers and foremothers started experimenting with domestication and breeding, it is unlikely that any of them knew how it would catch on. Consider this: today, humans and livestock make up 96 per cent of mammals. Wild animals? There are few of them left, only around four per cent.

A number of changes take place in animals that we domesticate. Charles Darwin ruminated on this. Why do domesticated animals have so much in common, regardless of species?

Their faces change shape. They have floppy ears, smaller teeth, smaller brains, bigger stomachs and aren't as muscular as their wild ancestors. They are reliant on their mothers for longer. Their brains are shrunken compared to those of their wild counterparts.

This is referred to as domestication syndrome. Perhaps it's only logical. The aim of domestication is changing animals' behaviour and body shape, breeding them for what we need them for. Homo sapiens was fast becoming Homo deus, a godlike species ruling over nature and animals.

We took a leap that distanced us from tens of thousands of years of history and staked out a new path—but without a map to navigate with. Major changes always have consequences, some visible in the short term, others invisible until they're upon us. Even the best of intentions can do irreparable damage.

We made steady improvements, and the invention of more and more machines

kicked off the Industrial Revolution. As we grew increasingly numerous, and word of famine spread, we were once again prompted to come up with new ideas. Another revolution came, known as the Green Revolution. How could we produce more food more efficiently? The Green Revolution built on the Industrial Revolution. Machines entered the agricultural scene, synthetic fertilisers made plants grow quickly, and chemical substances allowed us to combat pests and fungi. Using principles from industry and factories, we bred animals for the mass production of meat. We used new knowledge to maximise crops and made animals grow faster. All this took place with idealism and fervour.

Unease grew in the shadow of this optimism. In her book *Animal Machines* from 1965, British animal activist Ruth Harrison criticised “industrial livestock production” and “animal factories”. In her book *Silent Spring* from 1962, American marine biologist Rachel Carson warned of the dangers of chemical insecticides. Not only did the poison affect pests, but also other animals and species—including humans. Many insecticides remain in the environment for years. Put simply, they are environmental poisons. They harm us in ways we are only now starting to understand the extent of.

A growing movement of environmental activists thought that the way we were living would have consequences. We prospered while rendering the planet almost unliveable for other creatures. We polluted the atmosphere and depleted the seas, leaving nowhere untouched.

According to biologist Edward O. Wilson, we are a danger to ourselves and to the rest of life. He writes that today’s world is like ‘a Star Wars civilisation, with Stone Age emotions, medieval institutions, and godlike technology’ and that ‘except for behaving like apes much of the time and suffering genetically limited life spans, we are godlike’.

Looking at it from this perspective, our intelligence and urge to create is also dangerous. This concept is explored in Johann Wolfgang von Goethe’s *Faust* and Mary Shelley’s *Frankenstein*. In these works, the human brain creates something new and impressive, but the result is frightening. In Goethe’s case, the tragedy of development is described, with high social ambitions upsetting the balance of nature. For Shelley, the new creation literally becomes a monster.

Even in the face of all these warnings, the enterprising remain optimistic. Our intelligence has got us this far, so now it can save us. Problems are solved with new research and smarter innovation. If it gets too warm, we’ll develop technology to stop it getting much warmer too quickly. If the atmosphere fills with carbon dioxide, we’ll trap and purify more carbon dioxide. If we start running out of wild animals to eat, we’ll breed more livestock or change our eating habits. What’s that? Fewer fish in the sea? Then we’ll farm more of them to eat.

Yes, fish. Shouldn’t they be domesticated, too?

Some people say it started with fish that were stranded in pools when rivers dried up. Others talk about fish that swam inland at high tide but remained in lagoons after the tide went out. Or did it start with Chinese rulers who wanted fish all year round, prompting servants to start breeding carp in ponds around the palaces? In Europe,

experiments were carried out on trout. Hatcheries were established, and fish were released into rivers and lakes.

People could see the money in it. And which fish would people pay the most for? Salmon!

Yes, salmon, king among fish, with the resilience to climb waterfalls and rapids. Beautiful, wild and shimmering on the outside, alluringly red on the inside, full of goodness and mystery. A superior fish served on festive occasions or ordered at fancy restaurants.

Imagine being its master. Humans were already the masters of the cow, the sheep, the pig, the horse, the chicken, the cat, the llama, the dog ... but the salmon? Some tried around 1950, in tidal straits and with floating nets. They kept the fish trapped in bays and coves, but they were still wild and scared.

Why does something happen? Does it start with one innovator? An environment, a sequence of events?

We started to investigate fish farming in 2016, for a series of articles on salmon research. We were tipped off to the fact that many salmon researchers felt permanently under scrutiny. Apparently, the authorities disliked any research that might curb growth. We made some calls and were surprised. We got a strange feeling. An uncomfortable feeling. 'I don't want to talk about it. It'll ruin my holiday,' one researcher said. Another stopped answering the phone. A third said, 'If you have anything negative to share about salmon, you need to brace yourself'. A fourth said, 'You don't know what I'm getting at? This is politics. We live in a seafood nation'. These were researchers who had worked on salmon or fish farming projects. Researchers who had got into trouble, conflicts, and suffered a blow. They were afraid of coming across as negative, or not being believed. Some had left the field. This made an impression on us. Researchers are supposed to purvey knowledge, seek the truth. It's a bad sign for society when they don't dare speak openly.

The seafood nation seemed to be a place of unsolved mysteries and bottomless controversies, where money talked, dual roles were par for the course, and critics were branded activists. This was a realm of lawyers with unknown clients attacking research institutes, and lobbyists writing secret emails to ministers. Salmon farming was an unenterable outpost. Or at least that was how it looked, back then, from the outside.

We subsequently came to realise something that propelled us through five years of work. In only a few decades, an industry had emerged that made people rich. According to Forbes, three of the world's richest people under the age of 30 are Norwegian salmon heirs, and 37 new seafood billionaires have been made in the last ten years alone. They were hailed by the authorities, by their own media, by politicians with visions of salmon coming to the country's rescue when the oil ran out. They called it the salmon dream. It was described in books as industry-sponsored, applauded by government bodies and shrouded in claims of sustainability, climate friendliness and feeding the world.

The salmon dream gained momentum. Criticism was deflected. Obstacles were countered with expensive lawyers and removed by the best lobbyists. But all that wealth

and power came at the cost of something else. The farmed salmon itself, dumb and defenceless, bred to grow as quickly as possible, so quickly that its heart might explode. The cleaner fish, which was used to counter the salmon louse but died on the job. Prawns and lobster, the fjord environment, the wild salmon, which was now considered to be “near threatened”. And the researchers seeking knowledge of all this. One side had power, money and the authorities’ blessing. The other had none of these things, barely even a voice. This disparity motivated us.

As we worked, we discovered that the salmon dream was astonishingly poorly thought out. Decisions were made quickly to solve problems as they arose. The consequences were only seen later, which once again caused problems. We started to realise that the story of the farmed salmon was less a dream than a chain of unintended consequences.

If you put a new animal in a fjord, you set something in motion. And what happens then?

That’s the question. The answer is this book.

Now, let’s hit the road and go visit the man who started it all.

CHAPTER 1- Wherein the new fish comes into being

We park in a quiet street of small houses, within walking distance of the Norwegian University of Life Sciences in Ås.

A sprightly 91-year-old in a checked shirt and a grey cardigan meets us at the door. His eyes are sharp, his tongue quick. The health and inquisitiveness of this man are so robust that he didn’t retire until he turned 88. Two old clogs sit on the doorstep, and Trygve Gjedrem tells us that he carved them himself.

Remember that name. Trygve Gjedrem made Norwegian history. If you drive along the coast and see a fish farm, know that this man is a progenitor of billions of salmon.

At first, Gjedrem doesn’t want to talk about himself. He wants to tell us about his old mentor.

‘Harald Skjervold was his name. He saw what was brewing along the Norwegian coast. “This is going to be big!” he said when he saw what the salmon-farming pioneers were up to. “These people need help! They can’t control wild animals,” he said. “Wild animals aren’t made to be kept in a net!”’

The 91-year-old lifts his arms in an expression of admiration.

‘What a guy! What a mind!’

We’re transported back to the 1960s before we’ve even had a chance to sit down with our coffee. Small company Mowi had started feeding salmon in small, sheltered cove. Two fishermen, Sivert and Ove Grøntvedt, had cobbled together a seine net and put salmon in the sea. The rumour spread along the coast. It seemed that they were making

money from it, and if Sivert and Ove could do it, so could others.

‘But the salmon were terrified, and Skjervold said to me, “This is a job for us! We need to help build this industry!’

And that was how Trygve Gjedrem became part of this story.

It wasn't what he'd envisioned for himself. He was supposed to be a sheep farmer. His family kept sheep, he wrote his thesis about sheep, was supposed to dedicate his life to sheep. During a stay in the USA in the 1960s, everything changed. That was where he met Jay Laurence Lush, a renowned researcher, a world leader in genetics and breeding livestock. Some people call him the father of scientific animal breeding. He was a driving force behind the Green Revolution.

A wave of formidable engineering and new ideas about efficient food production swept the world. It was the spirit of this age that agricultural student Gjedrem breathed as he immersed himself in breeding sheep to produce better wool. And then Harald Skjervold, professor at the Institute of Animal Genetics and Breeding, came along and tapped the promising student on the shoulder, announcing ‘we need to go to the coast’. Skjervold thought that the principles of animal breeding ought to be tested on salmon—that agricultural knowledge could also be applied to fish.

Gjedrem was sceptical.

‘I don't know anything about salmon,’ Gjedrem told him.

‘None of us do!’ the professor replied.

But Skjervold was a visionary, the sort of person who thinks big and towards whom other people gravitate. He went to Oslo and met with the Minister of Agriculture. There, he outlined his ideas for the salmon, persuading the minister. Money was allocated, and Skjervold's disciples were sent across the country: ‘Go along the coast and find somewhere for a research station’. They found that place in Sunndalsøra in Møre og Romsdal.

Gjedrem was ready to change his mind now. Excited and uncertain, he went home to see his father, the sheep farmer.

‘Work with salmon?’ his father said. ‘How?’

Gjedrem explained the ideas to his father, who wore a grave expression.

‘Trygve. This won't end well.’

Gjedrem's brother stood silent in the background. But Gjedrem defied his father and abandoned the sheep for the salmon.

‘And then we threw ourselves right in at the deep end!’ Gjedrem says, clapping his hands.

Picture a factory floor. Plastic tubs lined up as far as the eye can see. 216 large tubs. The water gurgles as small, dark creatures swim beneath the surface. The smell of the feed, minced fish offal, permeates clothing. Researchers walk around with clipboards, and Gjedrem oversees all of this. He had salmon taken from key salmon rivers in Norway. People sent mason jars and plastic containers of fertilised roe that arrived by sea, road and

air.

Roe arrived from the Vosso, known for big salmon able to swim through floods and rapids. And from the Namsen, a river that draws anglers from all over Europe. And from the Alta, one of the rivers that the king of Norway fishes in. Soon enough, young salmon from the Målselv, the Nidelva, the Lærdalselva, the Etneelva, the Surna, the Rauma and the Gaula also swam around in the tubs at the station.

Gjedrem wasn't satisfied until they had genetic material from forty Norwegian rivers and one Swedish river.

Each of the fish was different, adapted to its river. Some came from long rivers and had significant fat reserves to help them survive the migration upstream. Others came from short rivers in the far north and had to grow quickly to be able to spawn during the short summer.

All these fish had unique qualities. It was imprinted in them that they should live in the river until they grew large enough, then seek out saltwater and roam the ocean for years. It is baffling to us humans that they can find their way back to the exact same river they started their lives in, years later, using their sense of smell or navigation systems.

But now they were swimming around in tubs at the research station and being measured and recorded. Which grew the fastest, and which grew the biggest?

'It was scary in the beginning,' Gjedrem remembers.

When he stepped onto the factory floor, the tubs grew frenzied. The fish panicked and wanted to hide, like they would in their rivers. This new life was stressful. Fish would also vanish for unknown reasons. The researchers counted, but the disappearances were a mystery. Then Gjedrem worked it out.

'I spotted a fry with "two tails". One fish was down the throat of another. They were eating each other.'

The salmon was a predator. They were cannibalising each other.

'How do you domesticate a wild animal?'

Gjedrem sits with his best ear angled towards us. He goes to get a hearing aid before picking up where he left off.

Some fish coped better in captivity than others, he explains. After three generations of breeding, they stopped eating each other.

'The salmon from the Namsen were the best, but we didn't only use the Namsen. We used several rivers in the salmon we presented to the farmers. It was a select fish, bred for growth and survival.'

The genes mixed, and the salmon changed.

To find the best salmon for farming, the researchers cooperated with the farmers. They supplied smolts (young salmon ready to migrate from river to sea) to Sivert Grøntvedt, one of the pioneers.

'Sivert came to see us one day at the research station. He was grave. "Trygve," he said. "This fish is different." "Oh?" I asked. "This fish is calmer. And it grows faster."' Sivert had seen it with his own eyes! And after others heard that, they wanted to try, too.'

It was a breakthrough.

‘It was clear to see. This salmon was tamer. It was starting to behave like livestock.’
Gjedrem goes to get books and yellowed documents. He flips through pages, points at graphs, shows us how the salmon grew.

‘The first generation were wild. Then we chose individuals for breeding based on growth. Only growth.’

Gjedrem lowers his voice, speaks more softly.

‘And then we saw growth of FIFTEEN PER CENT!’

He slaps the table so hard that the coffee cups rattle. That’s how quickly the fish grew.

‘Fifteen per cent in one generation! As I’m sure you can imagine, we were overjoyed!’

The title of one of the publications he shows us is Salmon farming (fish as livestock). It is based on his lectures and describes his experiments.

All breeding aims to change a group of animals, it says. The aim is to produce a fish that is to the liking of the consumers. The basis of everything is the gene.

Every gene has a special effect on the fish. In breeding, the aim is to exploit the potential of the genes. This is done through selection. Breeding methods form the basis of this. If you breed animals that are closely related, this is called inbreeding. Then the fish become more similar, but they can also become less vigorous.

Purebreds are obtained by crossing animals from the same population that are not related.

In this way, heterosis is achieved. Then you get a new animal that is better than both its parents. It’s like things fall into place, but better. Two plus two becomes five.

Imagine the researchers’ joy when this happens! How they beam at their graphs and diagrams!

And so, what if you were to take the experiments further? Cross salmon with mountain trout? Trout with Arctic char?

That would be interspecies breeding. They tested that at the research station, too.

Soon there were strange fish swimming around in the tubs. Arctic char, mountain trout, sea trout and salmon in all combinations. When they mixed the fish with pink salmon, they died. When they tried rainbow trout instead, the researchers noted: ‘No good when the chromosome pairs need to find each other’.

But the mixture of salmon and Arctic char was promising. After three years, that fish was bigger than both its parents. The only problem was its strange colouring. The researchers thought that the strange fish might be difficult to sell, so they didn’t take it any further.

In 1975, the researchers discover dead fish. They are covered in a layer of slime, their skin is bluish, and some have been attacked by a fungus. Parasites swarm their skin, gills and oral cavities, clinging on with hooks and suction cups. In pain, the fish rub themselves against the sides of the tubs, under attack from *Gyrodactylus salaris*. This parasite had never been seen in Norway before. People speculate as to how the parasite got here. There are murmurings about fries imported from Sweden. Later, the parasite

spreads to the rivers, affecting 50 Norwegian watercourses.

This is how a new concept is introduced to the young fish-farming nation: biosecurity. The danger of transporting biological material across national borders.

‘It was a terrible time for our employees,’ Gjedrem writes in one of his books.

But the successes are remembered above all else, and one word in particular: growth.

Gjedrem leans forward and slaps the table again.

‘We selected for increased growth and survival in captivity. And what did we see in terms of survival? Clear results! Our salmon grew quicker and survived in farm conditions. This had a dramatic effect on the industry.’

His eyes gleam as he relives their triumph.

Since then, new targets have been set for breeding the best farmed salmon possible. Better feed. Resistance to disease. Delayed puberty, so the salmon don’t waste energy on mating. The right shape for the fish. If the shape varied too much, the consumer might think the quality was poor. They improved slaughter procedures, made sure the meat had the right amount of fat in it. They made salmon that were the right colour: red.

They found out that the salmon grew faster if the water was warmer and there was more light.

Gjedrem leans back in his chair.

‘Did you love the fish?’

‘I wouldn’t say that. A fish isn’t like a dog.’

Christian literature can be found tucked between books on breeding on Gjedrem’s shelves. Gjedrem is a religious man.

‘What’s your take on not messing with God’s creation?’

He seems surprised by the question but doesn’t puzzle over the answer.

‘If I can halve feed consumption and increase returns, the breeding is positive. As far as I’m concerned, livestock breeding is the way forward for us.’

‘So it’s fine to play God?’

‘If I were you, I’d be asking questions about genetic engineering.’

‘What do you make of the salmon industry today?’

‘I’m impressed. No one could have predicted how it would grow. Not even Skjervold. Just look at our coastline! When you think about how it started, how new everything was in 1971, it really is a dream. And it’s all happened in our lifetime.’

The breeding that started in 1971 is subsequently estimated to be worth 1.5 billion Norwegian kroner per generation of salmon.

An international evaluation has established that the research environment at the station was world-class. Via a somewhat circuitous route, the station became the company AquaGen and was acquired by the EW Group, a multinational agribusiness known for its quick-growing chickens.

Trygve Gjedrem remained unknown outside of the salmon industry but was

recognised by American author Paul Greenberg, who paints a picture of him as “the father of salmon farming”.

The salmon that he bred using genes from 41 rivers now swims in facilities all over the world, grows almost twice as fast as its wild forefathers and feeds millions of sushi lovers.

But it feels like there’s more to this. To start, let’s look at how people endeavoured to make something of Gjedrem’s life project.

CHAPTER 2 - Wherein the pioneers build an industry

Winter 1975: a snapshot.

Three men set out with the intention of mapping the new industry. They drive along the length of the Norwegian coast and note down the fish farms—fish farms that will start using the new fish in the coming years. They stay in a converted bus that they call “Aquarius”. They have berths, an office and a small laboratory on board. The expedition is led by oceanographer Olav Hansen. Accompanying him are his assistant, Kåre Sandtorv, and his secretary, Nils Riisnes. If they see a fish farm, they stop the bus, knock on the door and have a chat. We have a form for you to fill out, they say. We need to register your farm. Curiosity brings the farmers to the door. They have their own questions that catch the strangers off guard. Where have they been? What are the others saying? How are the others doing it?

Between the lines of the report—unimaginatively entitled Report on registration of fish farms in 1974 and 1975—the three emissaries paint a picture of people groping in the dark. Bejumpered men in coves having a go and seeing what happens. There is a pervasive odour of seaweed, seawater, and fish guts. Homemade corrals and simple seine nets float out in the water, haphazardly nailed together. The farmers can see them from the shoreline, or from their windows at home. They go down in the morning to check that everything is in order, and then again in the evening before they go to bed. They’ve jumped on the bandwagon, hoping that this might become something, perhaps something big, but they know so little. This is the time of the pioneers, and of leaps of faith. They’re raising fish they don’t understand. Sure, the research station in Sunndalsøra is breeding a better salmon, but what they have in their corrals are still wild animals. Fish die suddenly without anyone knowing why. They are afflicted by diseases for which there are still no names. There’s no point calling the vet because even she doesn’t know what to suggest. Rumours are rife about people who “know things”, people who receive phone calls from all along the coast.

The three report writers note that the knowledge level is low, and the need for education urgent. Most people seem to have started without practical experience or training. It seems that the knowledge of the somewhat more experienced farmers isn’t trickling down to those who know less. Those who have worked with livestock before have an advantage, but if they haven’t worked with fish, they struggle to build good farms

and care for the fish in the sea.

The trio registers 180 farms in total, 156 of which are “large”, meaning that they produce more than 1,000 kg. There are even more small hobby farms, and they are difficult to regulate. They keep finding unregistered and incorrectly registered farms, and unapproved hatcheries where the roe is artificially inseminated. The regulations for slaughtering and producing fish are being broken in many places.

The hygiene is the worst. They take samples from the water, checking the oxygen content, salinity, temperature, and seabed sediment. They note that corrals are set up in water that is too shallow, or too close to each other, so that excrement and feed residue float from one to the next, making the environment almost uninhabitable for the fish. ‘No other form of food production in Norway today has such a glaring lack of rules for hygiene requirements,’ the report writers note. The equipment used to grind the feed isn’t cleaned properly. ‘There is a stench from rotting feed residue and scrap and equipment strewn around the farm area at several grow-out facilities.’ At some farms, the environment is so polluted that the report writers doubt whether the fish could even be fermented or cured. They fear that the poor hygiene could create an aversion to farmed fish. This has already happened in several places, but ‘in the long term, it could also have a negative effect on the larger markets’.

They note that feeding takes time, and that it is a laborious task. The farmers buy batches of frozen capelin, sprats and offal from pollock. This is ground up, and the salmon are fed by hand. If the capelin is rancid, the salmon can get sick. Many workers also sustain wrist injuries due to all the feeding. ‘No branch of animal husbandry today would have a chance of survival with such primitive and labour-intensive feed processing and feeding techniques,’ they write.

Fish diseases are spreading. On their bus trip through Western Norway, they estimate that 80 to 90 per cent of fish suffering from vibriosis, a bacterial disease that causes the fish to lose their appetites, develop sores and abscesses. In some places, half of the fish die before it is time for them to be slaughtered. Wild fish such as pollock swim around the farms. At some farms, the report writers estimate that there could be 20 to 30 tonnes of pollock around the corrals, ‘which undoubtedly have a negative impact on the environment inside the corrals’.

And then there were the lice. ‘It seems that keeping large concentrations of fish for several consecutive years in restricted environments significantly increases the likelihood of severe salmon louse attacks,’ the report writers note. There are no good treatments, but there are rumours about formalin, a colourless liquid with a sharp smell. However, ‘bathing the fish in a formalin solution is extremely cumbersome’.

Rendered desperate by the lack of anti-louse treatments, some farmers turn to home remedies. Garlic has been used against lice and fleas since the Middle Ages. The salmon pioneers cut up garlic and throw it to the fish or add it to their feed. Some bought truckloads of onions and hung it in bags around the corrals in the hope that that would work. A stench of rotten onions hung in the air around farms along the coast.

A difficult beginning, starting an industry from scratch, precipitates a kind of selection. Only the most adaptable survive. They fight the forces of nature, driven by protestant work ethics. Those unable to adapt die. The big eat the little. Methods evolve quickly, and those deemed no good fall to the wayside. New research is taken into use from one day to the next.

What keeps the entire endeavour going is endless hope. As the report writers note in their report to the Directorate of Fisheries and Statistics Norway: ‘Due to the relatively high price of salmon, interest in salmon has seen a significant increase in recent years.’ They think that salmon will always be more expensive than farmed fish such as rainbow trout. Even though it is more difficult to produce, there are plus sides. The fish farmers have also become more conscious of quality. The report writers think that a better fish and smarter marketing could stabilise the industry and increase profitability.

The success of some farms inspires others. ‘If Sivert and Ove can do it, so can we!’ These inspirational figures were the Grøntvedt brothers from Hitra. They were the first to farm fish in corrals, meaning large seine nets with frames inside which the fish were confined.

Some people pinpoint the “birth of the salmon industry” as 28 May 1970, when the brothers put 16,000 smolts—young fish ready to migrate—in the sea. But if you look more closely at this picture, cracks appear. Because behind those corrals stands forgotten district sheriff Arne Ratchje from Hitra. So is he the father of the salmon farming industry? No, because he got the sketches from another district sheriff, Ingar Holberg from Smøla. Holberg kept fish in tanks, but then a pump started smoking, and the fish were close to dying. At the eleventh hour, he got hold of a seine net and managed to transfer the fish to the sea. This worked, and he exchanged letters with Ratchje, who drew the corrals used by the Grøntvedt brothers, who in turn eventually got their fish from Trygve Gjedrem. So is Holberg the hero? No, because even then a besuited man in Bergen, Mr Mowinckel, was keeping salmon in secluded fjord arms. He gave his name to what later became Mowi, the biggest fish farming company in the world. But he probably wasn’t the first, either, because who could forget the Vik brothers in Sykkylven? And what about those hipsters in Lovund? The truth is that many people contributed. No one did everything, but many did something. The Grøntvedt brothers’ corrals were a technological development. The report writers from the Directorate of Fisheries in 1975 think that they made people reckless: ‘The Grøntvedt corrals have undoubtedly led to many farmers starting up with a relatively large numbers of fish without sufficient experience and knowledge.’

Was it salmon fever? A new gold rush?

Such notions have been posited. Accounts from the farmers suggest that the pioneers were viewed as fools. This is ludicrous! Just nonsense! people said. Salmon farming wasn’t worth investing in. ‘We don’t want anything to do with that rubbish’, the pioneers sometimes heard when they arrived with their fish and tried to sell them. They were often looked down on as “inexperienced dabblers”.

Despite the opposition, they're on to something. Production increases, the technology develops, the fish grow quicker, and the units get bigger. The market expands, distribution improves, and demand is sky-high. The people want salmon!

However, the industry is not without its frustrations and serious problems setting it back. Hitra disease, or cold-water vibriosis, is one of them. Salmon die in droves and businesses fail, but then a vaccine is developed that can save the salmon. Bremnes syndrome—the disease known as infectious salmon anaemia (ISA)—hits the farmers hard, but procedures are found to combat it. In 1987, the industry uses fifty tonnes of antibiotics against several diseases. This constitutes sixty per cent of all antibiotics used in Norway. Three quarters of it ends up in the environment below the corrals. This gives the industry a reputation that is hard to shake, but once again they deal with it and find solutions. The development of new vaccines gives them the upper hand over diseases and the use of antibiotics in Norway.

The new industry spreads from the Norwegian coast to cold, sheltered fjords around the world. Its path reflects the voyages of the Vikings, from Western Norway to Scotland, the Faroe Islands, Iceland and Vinland (America). The Scots began early, with the company Marine Harvest. In Ireland, a biology teacher set up a farm on Clare Island and soon had a staff of over a hundred. In the Faroe Islands, there were farms in every fjord and every strait. Iceland experimented with land-based farms in Grindavik. The Tasmanian authorities, with support from Norwegian investors, managed to start farming despite the warm water. On the west coast of Canada, experiments were carried out with Atlantic salmon at a research station near the city of Nanaimo. In Chile, Augusto Pinochet's dictatorship discovered that salmon could earn them export income.

In days gone by, salmon was a luxury fish for festive occasions or eating out at restaurants, or reserved for salmon farmers along the coast, but now more people have access to it. Salmon can now be served for dinner all year round, even on normal workdays.

In 1985, the Market Council for farmed fish places an advertisement in newspapers all over Norway. The teething troubles are past, the initial struggles over, and the advertisement oozes youthful confidence:

SALMON for Ole and salmon for Lise.
SALMON on the table no matter the season.
SALMON for sheriffs and for priests.
SALMON for workdays and for feasts.
SALMON is food that everyone likes.
SALMON for punks and for tykes.
SALMON is food that is sure to delight,
SALMON is simple to prepare just right.
SALMON can be boiled; salmon can be fried.
SALMON can be grilled, smoked and dried. [...]
SALMON for young and old alike,

SALMON for those who like to hike.
SALMON for losers and for winners.
SALMON for lunches and for dinners. [...]
SALMON is delicate and very tempting,
SALMON won't leave your wallet empty.
SALMON is Norwegian, and as you see,
SALMON is the best a fish can be.

“Project Japan” starts that same year. Norway tries to get the Japanese interested in farmed salmon. They're reluctant. They eat a lot of fish, but not salmon. The taste is wrong, the colour is wrong, and they're concerned about parasites. The Japanese use tuna in their sushi instead. Bjørn Eirik Olsen tries to change their minds. He knows Japan, speaks Japanese and has mastered the martial art of aikido. He lives in Japan for several months of the year as he does his utmost to convince the Japanese at the behest of the authorities. The key, Olsen thinks, will be to get housewives to choose salmon, or “noruee saamon”, as the marketers call the fish. The chefs and fishmongers are conservative, the sushi culture set in its ways, but the housewives are open-minded and start buying the salmon. When the salmon farmers' cooperative (FOS) subsequently goes bankrupt in the early 1990s, there is a large stock of frozen salmon in Norway. Olsen and his colleagues manage to sell 5,000 tonnes of salmon to Japan and get sales going. The Japanese start using salmon in their sushi just as sushi is on its way out into the world as a healthy new dish. Sushi becomes a global wave that the salmon can surf as sushi restaurants open in every city, sushi stands start appearing on street corners and sushi starts to be sold in shops.

1989: another snapshot.

Fifteen years after Aquarius toured Norway, the journal *New Scientist* visits Norway. It wants to chronicle the salmon boom. Norway is breeding a super salmon, a fish made to live in captivity, the journalist writes excitedly. Each generation of salmon grows faster than the last. ‘It's fantastic,’ Trygve Gjedrem says. ‘If the growth continues at this speed, it'll double in 18 years. That's much faster than for terrestrial livestock.’

The journal says that the new industry is changing the Norwegian coast. 747 farms have already been established, and new applications are pouring in. ‘No other industry is growing as rapidly as fish farming,’ states a report to the Norwegian Parliament. In 1980, production was 6,800 tonnes. Ten years later, 161,500 tonnes were produced in one year. The growth is stupendous. 7,000 people work in the industry now. There are many small businesses, and the geographical spread is vast. Salmon farming has become an export industry, and the global consumption of farmed seafood is expected to rise.

In some books, the early days are described with nostalgia, as if something was lost to the success. In his book *Brukte havet* (The Used Sea), Erling Osland says that the development was too rapid: ‘We thought it was growing fast enough. The industry

wouldn't have benefitted from the growth some politicians wanted. [...] The way things were in the mid-eighties, it often seemed as though all that mattered was producing as much as possible and granting more and more licences.'

In their book *Statsmakt mot laksepionerer* (The State vs the Salmon Pioneers), Bernt Kristiansen and Odd Strand hint at such a case. 'We lost morale as time went on. The new coastal industry became an arena full of sharp elbows,' the authors write. 'The competition was sometimes near cannibalistic, and monetary power ruled the roost.' A cautionary finger is pointed at 'economy becoming more important than biology'. The authorities' abuse of power is strongly criticised. One of the main characters in the book is the pioneer Endre Rundhovde from Osterøy, who was told: 'You have to remember that it is the fate of the pioneer to be ruined. Then comes the profitmonger. He has nothing to offer. He just reels in the haul.' In this book, innocence is washed down the drain. There is a longing for something past and pure.

By this time, there are a hundred thousand more farmed salmon in the corrals than there are wild salmon in the rivers, and the new fish has started to escape. Moreover, corrals containing millions of salmon give good conditions for viruses, bacteria and parasites. It is here that a small copepod finds its niche, reproducing at a rate of knots.

CHAPTER 3 - Wherein we introduce the antagonist of the story: the louse

While it is still in the water, the life of the salmon louse hangs in limbo. Imagine the anticipation. The hanging in the light and waiting. All that tiny larva has from its mother is an egg yolk in its stomach to provide a little nourishment.

It knows nothing, understands nothing, has no sense of the world. That small copepod, *Lepeophtheirus salmonis*, has surrendered itself to the ebb and flow of the ocean currents and is almost incapable of controlling itself, only swimming in small, impulsive bounds.

Its simple eyes cannot see, can only sense waves of light. But it likes the light, is drawn to it.

During the day, when the sun is shining, it seeks its way up towards the surface. During the night, when the moon casts its pale light over the fjord, it sinks back down.

It can't hear, can only sense the movement of fish swimming past. It has no brain to speak of. Yet somewhere deep down, it must understand what is at stake.

It has ten days to live. More if the water is cold, less if the water is warm.

The louse needs to find a salmon before those ten days are up if it doesn't want to die of hunger.

What are the chances of it succeeding? Of a salmon randomly swimming past, close enough that the louse can grab hold? Those who have fished for salmon know the odds. Have you ever seen a healthy salmon swim so close to you that you could touch it? Never.

The salmon must swim right up to the larva. The louse cannot jump, it can barely

even swim, just drift through the water and hope that the currents will take it to the salmon.

The moment this happens is the most crucial of the larva's life. If it falls off, it is doomed, a tourist in the wake of the ferry, dead, done for.

But if it does manage to grab hold, its instincts kick in, a switch is flipped, an action plan set into motion that has been imprinted over the course of millions of years of evolution. On its miniscule head, it has two antennae shaped like hooks. These hooks allow the louse to burrow into the fish's skin. That's how it attaches itself. Then it takes a sniff. Double checks.

It isn't a pollock, is it? Or a cod? No, it's a salmon. A salmon!

Oh Lord. Jesus. Damn, that's good.

Our louse is now one of the chosen few. It has found a "host". From now on, it can cruise around at high speed on a silver torpedo, living it up. It has everything it could ever desire: mucus and skin.

Soon, as a coming-of-age ritual of sorts when it's a bit bigger, it will taste something even better: blood. And once it has tasted blood, it won't stop drinking it. Blood, blood, from here to eternity.

In a moment of relief, or in the confusion of finding its host, it changes its shell.

And you must wonder: how can this creature, which is so reliant on chance, currents and luck, have survived in the sea for millions of years?

The answer can be found in its incredible strategy for reproduction. It starts with the male louse searching the salmon. He is the first to reach maturity. Appearance-wise at this stage he resembles a carafe, or an upside-down banjo, if you prefer. Others have suggested he's shaped like a vacuum cleaner. If they say so.

He looks around. Are there others clinging to this skin? Hello? Anyone home?

If it finds females that are too small, youngsters only a few days old, it hunkers down to wait.

Sometimes, when a female is at an age that researchers call pre-copula, the male lies on top of her. There's no decency among lice; lice don't ask for consent.

It's easy to become moralistic when faced with a salmon louse, referring to it as "a nuisance" and "a pest", but we must not forget that it is only doing the best it can. It isn't even a louse, really, like a headlouse; it's a crustacean.

Just like the rat, the seagull, the eagle, and even the human, it is making the best of the cards that it has been dealt.

Are lice stupid? Is founding an industry worth at least five billion kroner stupid?

That's how much we humans spend on killing the salmon louse every year. Five billion to beat a tiny foe.

Hundreds of people are researching it, more are studying it, and even more are waging war against it.

We throw everything we have at it, cutting-edge science, the best technology, pots of money.

We do everything we can to eradicate it, but like James Bond villains, the louse keeps coming back, in new disguises and with new weapons.

It's understandable that a book about the salmon louse would have the title *Lepeophtheirus salmonis* – A Remarkable Success Story.

The key to its success is what happens when the female louse becomes pregnant. In that moment, she experiences a profound change. What only a few days earlier was an innocent child becomes a louse egg machine overnight. She has grown larger than the male, one to two centimetres long.

Almost all the strength she has is used to produce egg strings that look like stacks of coins.

Does she lay ten eggs? No. Twenty eggs? No. She can lay several hundred eggs in each egg string.

Since she has two egg strings, up to 800 eggs are released into the water.

This depends on the temperature, but at 10 degrees, it is estimated that the average is 500 eggs.

But the female doesn't stop there. The male has left her a package of his sperm, a spermatophore. The female stores the sperm in her spermatheca, a sort of sac. She can store sperm from several males at the same time. This is efficient and saves time.

As soon as she has released her first eggs into the water, she can go straight into the spermatheca.

That's how she fertilises herself. And the male? No longer needed. Is the tiny male completely spent? Does he lie there bitter and through, only half the size of his female counterpart?

Nope.

He looks for more adolescent females to lie behind.

He has more spermatophores to deliver to more spermathecae. In this way, the female can harvest sperm from several males in her spermatheca, fertilise herself again and release hundreds of new eggs.

500, for example. Then, after ten days or so, another 500. Then, ten days later, 500 more. Then 500 more.

She doesn't stop until she's laid several thousand eggs.

We don't know how long the louse can keep going, but one louse that lived in a laboratory in Bergen supposedly lived for 452 days and laid over 10,000 eggs, perhaps as many as 20,000.

The louse thereby increases its chances of continuing its line by several thousandfold, with thousands of small larvae drifting around in the water, dreaming of surfing on a silver salmon.

This is the key to the salmon louse's existence.

The first known description of the louse is from 1600 or thereabouts. The author is Peder Claussøn Friis, and the book is called *Om Diur, Fiske, Fugle oc Trær udi Norrig* (On Animals, Fish, Birds and Trees in Norway). He writes that the louse attaches to the

salmon in the sea but falls off in fresh water when the salmon makes its way upriver. Claussøn Friis describes exactly how the fish tries to ‘scrape off’ the big lice ‘attached to its rump’ ‘in waterfalls and on rocks’. According to him, the lice are like ‘big spiders’.

They ‘have a long beak’ and cling to the salmon as they ‘bite through their tough skin until blood comes out’.

A hundred and fifty years later, in 1753, author and bishop Erik Pontoppidan also gives an account of the salmon louse. Fascinated, he describes how large schools of salmon swim up the rivers, ‘partly to refresh themselves in the fresh water’, but also to ‘rub and rinse off greenish vermin using strong currents and waterfalls’. This “vermin” can only be the louse, which can ‘get between the fins and cause it trouble’.

Later, the louse featured in angling literature.

In 1910, Sophus Aars gives an animated account of a fifteen-kilo salmon that ‘gleams brilliantly silver!’. He suspects that it had just come from the sea.

This is confirmed ‘by the sight of the sea lice still clinging to it’. But not even Sophus Aars can refrain from making harsh comments about ‘these disgusting insects from the deep, parasitising their plump hosts’.

In 1971, the louse is described almost positively in the magazine Jakt, fiske og friluftsliv (Hunting, Fishing and Outdoor Recreation). ‘The salmon has its highest meat value when it is fresh from the sea, fat as a pig, gleaming silver and infested with sea lice, providing a sport that is second to none’.

Back then, the salmon louse was a copepod like any other, one of a number of parasites drawn to a specific fish such as the cod louse, pollock louse, halibut louse, mackerel louse and turbot louse.

But a warning of the troubles, tragedies, lawsuits and research conferences that this creature will bring comes in an observation from the researcher H.C. White. The place is Moser River on the east coast of Canada. The year is 1940.

The researcher witnesses a strange occurrence. The summer is hot and dry, and salmon have gathered at the mouth of the river. The salmon are riddled with sores and lice. As it gets hotter and the weeks pass, the lice become more aggressive. Small salmon with lice from their eyes to the tips of their tails can be seen. One salmon is so overrun that its skin is barely visible because of parasites. Others swim around bleeding from head wounds or with flesh falling from their bodies. One day in August, their torment comes to an end, with a multitude of fish left dead.

After this, the researchers realised something that would later become significant.

Imagine if the lice weren’t hatched in a sea, but in a corral containing hundreds of thousands of salmon swimming around close together, as if lying in wait for their prey. Here the lice could reproduce exponentially and stage an explosive attack. They would multiply so rapidly that they would also threaten the source of the industry, the wild salmon.

CHAPTER 4 - Wherein one of the authors goes back to the beginning and tells us about the wild salmon

One of us fished for salmon as a boy and stopped when there were fewer salmon in the river. This is not the reason for us writing this book, but this is: the story of a fish and a culture, of a bygone time.

Still dark, air frigid, grass wet. On go your waders. Your raincoat and backpack. The sun will be up soon. Your pulse quickens as you head upstream along the river path, breathing in the smell of deciduous forest after the rain. Imagine, just imagine! The feeling in your hand, in your arm, the adrenaline pushing your blood pressure up. The sudden flash of silver when it rises out of the darkness. Imagine. When it comes to salmon, joy is short-lived. For long periods, there isn't any. It comes in moments. For anglers, the anticipation of these moments builds for months. Mist drifts along the ground as the rain evaporates and you leave the campsite and enter the forest, passing the rapids on your way to the deep pools. Hyper-focused and so full of nervous energy that you overheat and end up with a migraine.

Childhood summers smell of forest. When I breathe in damp earth, rotting leaves, resin from the trees, it's my childhood that I smell, and what I remember vividly, as if it were a film, is time spent by the river. My family spent every summer by the river. Almost everything else changed—the Berlin Wall fell, the Soviet Union collapsed, trousers got wider and then narrower, girls suddenly looked different, and heavy rock was played on MTV—but here, on the banks of a small river in northwest Norway, everything stayed more or less the same. The water flowed down from the mountains and out into the sea. The salmon came from the sea and up the river. We stood up in the darkness, fishing as day broke.

We weren't the only ones. The same families came back every year. Fineide, who was convinced he'd land a whopper if he tied a bit of red wool to his hook. Holm, who could catch a fish in a dry river. Hunnstad, who would say 'I'ma go get me a salmon' as he waded out into the river.

That was what Norwegians did in July and August, in tents, cabins and camper vans.

After the Second World War, salmon fishing became a national pastime. Fishing equipment got better and more affordable, and people had the time and money to travel from all over the country with lures, worms and flies. From the 1960s, hundreds of thousands of people stood gazing at pools and rapids, on the lookout for salmon and those moments of joy.

This was new. Earlier, in the 19th century, salmon fishing had been a hobby for the upper class and a means of putting more food on the table for landowners. Every summer, well-to-do Brits visited Norwegian salmon villages. They travelled from squalor and pollution,

writes Kjersti Sandvik in *Laksefever* (Salmon Fever). Back home in the United Kingdom, industrialisation was decimating the landscape. Rivers were dammed, the water used to power the factories. The riverbanks were lined with logging operations, mills and agriculture. The British salmon was encountering more and more obstacles when it swam upstream to spawn.

In the United Kingdom, as in other places, they let the water wash the filth away, the rivers carrying sewage, waste and discharge away from mines, factories, laundries, and oil and petroleum refineries.

As usual, the water had been tasked with cleaning up after us, but this time it was more complicated.

It was soon clear to see and smell that the country's rivers had more filth in them than the water could manage.

In his book *Salmon*, author Mark Kurlansky calls it a cost–benefit analysis where the rivers were consigned to suffer in the name of progress.

The industrialists made English one of the world's most powerful nations, but also one of the most polluted.

Low-oxygen zones appeared in the rivers where neither plants nor fish could live. Insects disappeared, salmon died in droves, and it also became more difficult for them to reproduce.

Kjersti Sandvik writes that the London summer of 1858 was boiling hot—over thirty degrees. Filth fermented in the Thames, and contagious diseases spread.

The *Illustrated London News* reported: ‘We can colonise the remotest ends of the earth; we can conquer India; we can pay the interest of the most enormous debt ever contracted; we can spread our name, and our fame, and our fructifying wealth to every part of the world; but we cannot clean the River Thames’.

In 1868, there were 61 mills by the river. 299 if you counted the tributaries. Salmon trying to spawn were thwarted at every turn.

Author Charles Dickens warned: ‘A few years, a little more overpopulation, a few more tonnes of factory poisons, a few fresh poaching devices and the salmon will be gone’.

This development soon reached other places in Europe. Stocks decreased in the Rhine and the Seine, once good salmon rivers. In Spain, salmon started to be described as a luxury item. In New England in the USA, the salmon was something bygone, a dreamlike memory. In 1848, the American author of *Walden*, Henry David Thoreau, wrote about how dams and factories were destroying salmon migration routes.

Considering all this, it's no wonder that salmon tourism came to be. Clean, fertile fjords and rivers have made Norway the foremost homeland of the Atlantic salmon. A third of them can be found in Norway. As industrialisation rolled on in the USA and in Europe, this old country lagged behind, and maybe that's why Norwegian rivers remained intact for so long. This country had 450 salmon rivers. The stocks of large salmon were impressive. Norway was unsullied. A postcard from paradise.

Lords and nobles came first. Then we came, the people, with tents and tackle and bait boxes.

The other thing I remember from childhood summers by the river is the floods. We would gaze at the sky for days. It's too small, the adults sometimes said about the river, too dry. Everyone waited for black clouds and rain that would cause the river to swell. Why? So that the salmon would "go". Salmon don't travel up dry rivers—they need water. And in the days following the floods, when the water ran from brown to clear, that's when what I remember best happened, the flashes of silver. Little invokes such a depth of feeling in me as flashes of silver against yellowish-brown rocks and sand. Then: momentary, lightning-quick leaps. Illusions, almost, of something coming from the deep and rising high enough in the water that the sunlight could bounce off it. It was incredible.

Now I've got him, my mum would say.

Four words, with a pause between each.

My dad was more succinct. Got 'im!

I just whooped.

The fishing line was yanked upriver one moment, then down the next. Fear rose inside me. It can't go down the rapids; the line'll break! A lump formed in my throat, my excitement pulling it tight. This is my childhood. This feeling. This pursuit. This waiting. Walking through the forest at first light. Coming to a pristine river, an unfished spot, a crystal-clear pool, and feeling your pulse quicken. Tingling in your temples, dryness in your mouth, clumsy fiddling before the first cast.

Our family was foraging. The word makes me feel old. Foraging. It'll have to be explained soon, kept alive artificially. Who spends their summer foraging when Toscana beckons with its wines and Crete with its white beaches? Not even me.

Every summer, we gathered food for the winter. Trout in Hemsedal, salmon in Western Norway, cod from Lofoten, mullet from the mountains. That was just what we did—until we didn't anymore.

Did Mum and Dad get too old? Did I lose interest in salmon fishing? Maybe there are several reasons. We caught fewer salmon. My father made a note of each fish in a fishing diary. The decline can be seen in the downward curve, and in my father's totals each season. 44 ... 36 ... 31 ... 28 ... 11.

Some people spoke of dry periods and low water levels. Others blamed seals in the fjords, net fishing in the sea, or "the otters"—recreational anglers who took too much. After a while, people also started talking about hydroelectric power, and about "the farming", all the facilities that the salmon had to swim past on their way to and from the sea. The explanations were thrown around like cigarette butts. That was just how it was. What we'd once had was gone now.

Many summers passed before I went back to it. I was invited to spend two days fishing in a river that had lain dead, destroyed by the *Gyrodactylus salaris* parasite spread by salmon

that had escaped from the many farms. But now the river had recovered, just. I'd stopped salmon fishing, really. That proud animal had become vulnerable, like a traumatised child you want to hold. But I said yes. I was a fly fisher now. My parents sat at home, eagerly awaiting updates. It was a late summer night when I left the cabin. Darkness was creeping down the mountainside. I waded carefully across a slow-flowing section of the river towards an avenue of birch trees that the owner must have planted at some point, perhaps for the English millionaires.

I felt my way forwards in the darkness, step by step, not wanting to compromise my night vision with a headlamp.

I followed the embankment down towards the tailout, as it's called, where the water from a pool picks up speed as it is funnelled downstream towards rocky rapids. The fish like to lie there.

I moved carefully across smooth rocks, the river pressing against my waders. I cast downstream, and even though it was dark, I could see. I could see almost everything.

The mountains above me, the silhouettes of the trees, black shadows against the bluish-black sky. I could see the dark river, waves of black. And I could smell. Damp earth, wet grass, like when I was a child. My pulse quickened as I approached the tailout. A short cast downstream, then a longer one, my heart pounding like a bass speaker at a village fete.

Then came the moment. The lightning that ripped through the silence of the night. If you haven't caught a salmon in the pitch darkness, you'll have to imagine it. Imagine holding a delicate thread, like I held the line. There are twenty metres of thread between you and what you're hunting, and it's dark. The fly floats on the surface of the water, until ... until ... until the thread you're holding jerks, tugs and pulls, and your throat tightens, like when you were seven, eight years old, because you have a wild animal on your hook, and you shout into the night: Now I've got him!

Everything like before, nothing had changed. I didn't switch my headlamp on until I'd got the fish in the landing net, and there. There! A flash. A silver flash that turned to gold in the light from my headlamp. Glorious, gleaming gold. I plunged my hands into the water and unhooked the fly. Then I lifted it up and held it against the flow, rocking, like when you're trying to lull a child to sleep. Those who have held a salmon have felt wild, solid muscle in their hands. There's a picture of me in that moment, with the salmon. My face is unrecognisable. But my parents, who received the picture on their phones, recognised it. It was me as a child.

I found myself murmuring to it. I'm sorry, like a remission of sin. Then I let it go. I couldn't eat it.

Every December, my father used to serve gravlax, and for Christmas we had homemade gravlax. These gifts were smothered in dill and wrapped in silver foil. It's now called graved wild salmon in the few shops that sell such things, for a price per kilo that suggests impending extinction. Wild salmon? Would you look at that. The language has changed,

adapted over time. We call it wild salmon now, just like some Norwegians have started saying “wild snow”. But back to my father. One Christmas, he looked embarrassed when the gravlax was set down on the table. He hadn’t caught enough salmon during the summer, he told us. Although it was a difficult decision for him, he’d tried to find wild salmon in the shops, first locally, then further afield. He did eventually find it somewhere, but the price had been so outrageous that he still won’t let it go. That was why he served graded farmed salmon. He graded farmed salmon for a couple more years, but then one day he just stopped.

Everything like before, everything changing.