

streamscapes | biodiversity

# SALMON SANCTUARIES



Foreword by Michael D. Higgins, President of Ireland



## Safety first!



The 'StreamScapes' programme involves a hands-on survey of your local landscape and waterways. Safety must always be the underlying concern. If you are undertaking aquatic survey, remember that all bodies of water are potentially dangerous places.

Slippery stones and banks, broken glass and other rubbish, polluted water courses which may host disease, poisonous plants, barbed wire in riparian zones, fast moving currents, misjudging the depth of water, cold temperatures... all of these are hazards to be minded!

If you and your group are planning a visit to a stream, river, canal, or lake for purposes of assessment, ensure that you have a good ratio of experienced and water-friendly adults to students, keep clear of danger, and insist on discipline and caution!

## Notes for Teachers

For schools undertaking the 'Salmon Sanctuaries' course, you will be supplied with copies of this book and access to the 'Salmon Sanctuaries' short video. It is recommended that the teacher facilitates the class going through this booklet in a single session, which is the Salmon's story, and then to watch the accompanying video (which reinforces this book's messages) on the following day, which may also include an optional field trip or online session with StreamScapes staff teachers.

## Acknowledgements

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## Foreword

May I extend my deepest gratitude to all those involved in the production of this important booklet. Our connection to the natural world is a deep rooted one, stretching back to the beginning of mankind. The safeguarding of our national biodiversity is vital if we are to continue to benefit from the many essential services gifted to us by nature and its natural habitats.

We are all custodians of those habitats, responsible for their protection, their renewal and their passing on to future generations.

Natural salmon habitats, once lost, can be difficult to reclaim. When we protect them we are also protecting our water, our woodlands, the quality and supply of our food and the health and well-being of our communities.

Here in Ireland we learn, in childhood, the story of An Bradán Feasa – the salmon of knowledge. It is a story of regeneration, renewal and the passing on of old wisdom. This valuable booklet invites us to reflect wisely, to care for our age old relationship with nature by cherishing and regenerating our natural resources and thus protecting our wondrous and fragile planet for ours and future generations.

*Michael D. Higgins, President of Ireland*

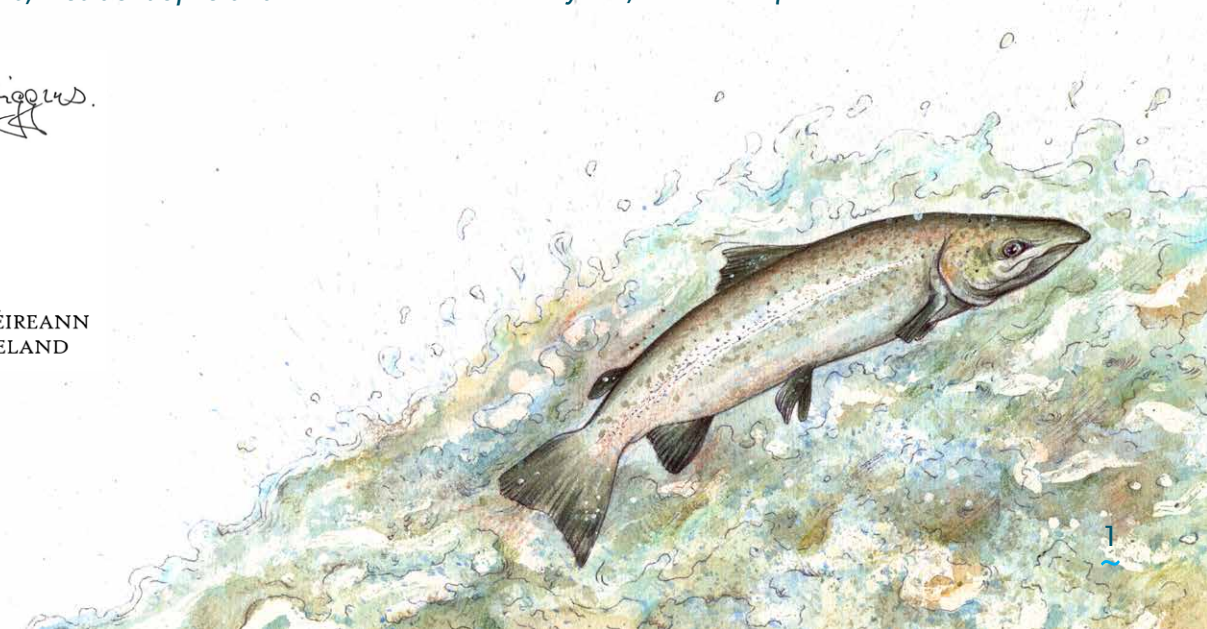


UACHTARÁN NA hÉIREANN  
PRESIDENT OF IRELAND

## Introduction

The fact that Salmon require 'Sanctuaries' in this day and age is a sad reflection of the way that we have treated our rivers and wider environment with disdain. Across its wide trans-oceanic range, from the USA and Canada over to Scandinavia; from the Rhine to the Loire, the UK and Ireland, the Atlantic Salmon has been in retreat for over two centuries. Though there are glimmers of hope in some places, water quality across many countries continues to deteriorate and our storied Salmon continue to suffer... hence the need for sanctuary as refuge for survival. But 'Sanctuary' has another meaning as well, and that is of a sacred place. For older traditional cultures Salmon represented an icon whose presence and story was of the highest value, and it is perhaps here, in understanding the wide value of salmon in our midst, that we may start to better understand this wonder and to be motivated to conserve and restore its presence in our valleys. Awareness is the first step; in these pages we explore the wondrous and complex story of how our salmon, our rivers, our seas, and we ourselves are all bound together within a web of ecosystems and a fragile wider biodiversity that we are all mutually dependent upon.

*Mark Boyden, StreamScapes Director*





# Where do salmon come from?

In midwinter, snow may whiten the hills of River Catchments that flow into the north Atlantic. With water temperatures hovering near 0°C, ice may be found in upland streams. At this time, when migratory birds have flown south, and trees stand dormant in a bitter wind, there is a quickening instream which sows the seeds for years to come. In the cold current, home from their marine wanderings, adult salmon pair off and move up into the riffle from the pools in which they have lain. The female salmon twists onto her side. With great thrusts of her tail, she draws small stones from the streambed up into the flow which, as they are swept to the downstream side, opens a furrow to create a most unlikely nest. Then, with the male swimming slowly beside and upstream of her, he releases his milt and this mixes with and fertilises the pinkish orange pea-sized ova (eggs) that she is depositing. Finally, she returns to lift gravel once again with her tail, just upstream of the furrow, to bury the eggs and complete the redd, or salmon's nest.

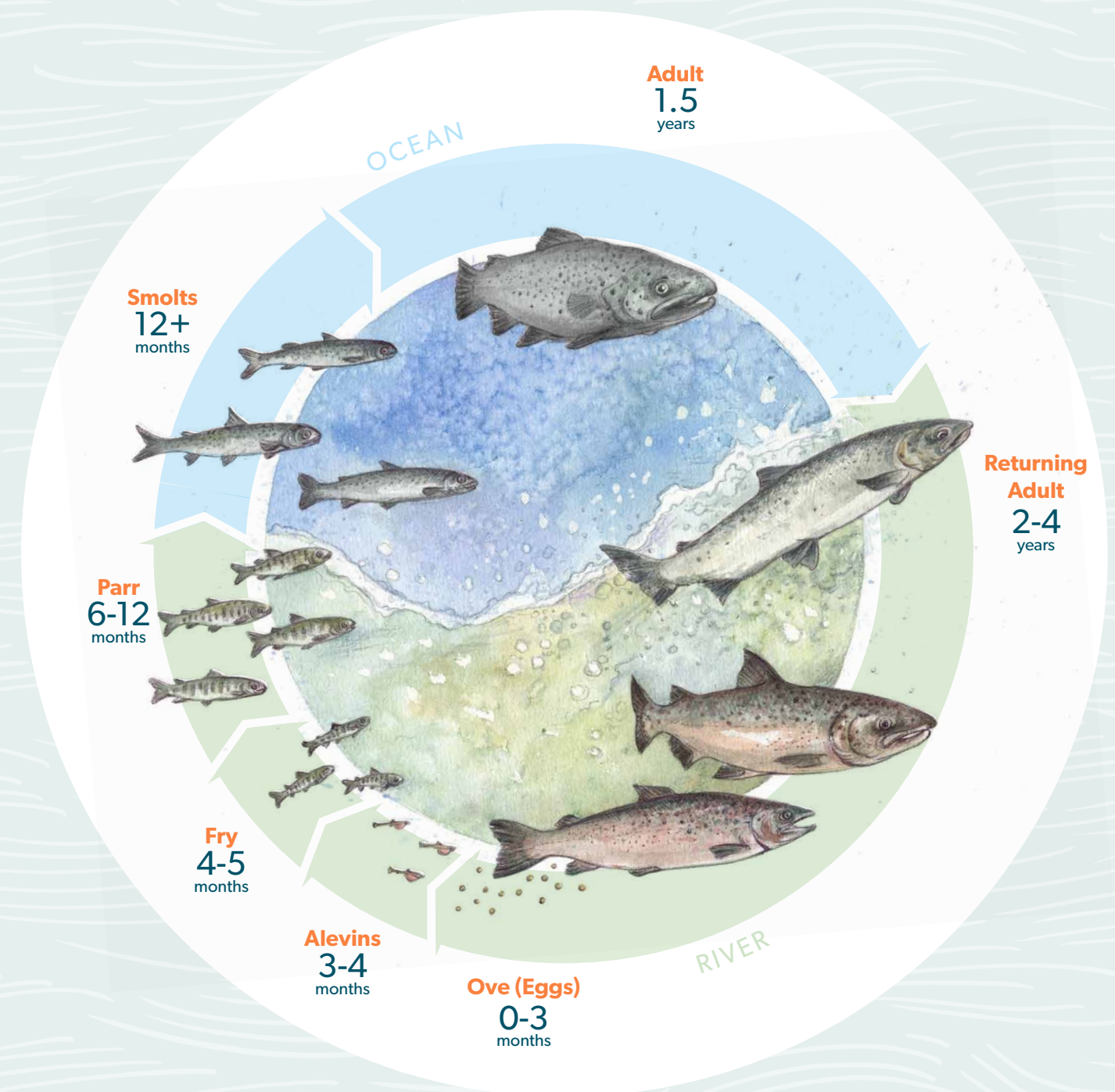
The fertilised **ova** rest in the bed of the stream, incubating through the short days and long nights of the winter. As the days lengthen, they hatch and the tiny **alevins** (baby salmon) emerge from their shell but remain sheltered in the stones, slowly absorbing the embryonic sac with which they are born. By late spring, they have formed into recognisably tiny fish (**fry**), with developed fins and the appearance of scales. As the water warms, the season opens and life emerges. The juvenile salmon **fry** dart in and out from the stony streambed and begin sampling available food. As they grow, they spread out along the river, and by autumn they have become **parr** (5-8cm long), occupying any suitable habitat

that offers them sheltered concealment (under instream woody debris, or within the bubble curtains of waterfalls) and access to food.

In winter their metabolism slows, and with it their appetite and activity. Rivers have varying capacities to produce feeding for young salmon... it may take one to several years for a parr to become a **smolt** and head out to sea. Smolts are silvery and undergo changes that prepare them for life in salt water. In Spring, smolts run down to the tide, to spend some days in their river's estuary to become adapted to the saline environment. They then begin their journey up into the North Atlantic to access nutritional resources which far exceed those found in their river. After a year or two in the marine environment, they answer the inner call that compels them to undertake the return journey to enter the mouth of their river of origin. Travelling back upstream, salmon rest in deep pools when water levels slacken and then, in times of higher flows, unleash their power to move up against the flow, mounting waterfalls along the way.

Winter fastens the Salmon in to shivering dance, sowing seed in endless circle, often in the very gravel beds where they themselves hatched. This moment, of salmon spawning in the coldest and darkest of days, is the end, and the beginning, of another cycle. The final stage in this cycle is that, after spawning, the salmon is referred to as a **kelt**; kelts, left thin and emaciated after spawning, often die. However, if they are able to reach the sea and begin feeding again, Atlantic Salmon are occasionally able to recover and spawn more than once.

# Salmon life cycle



# Where do salmon go?

The miracle of salmon rests in part in their occupying and knowing all aquatic habitats from small streams to vast seas. The pristine rivers where salmon spawn are generally low in food supplies and this is why they head to sea...to access greater marine nutritional resources. Salmon need this sustenance to achieve sexual maturity, to give them the power to be able to travel back upstream and to leap up considerable waterfalls to reach their spawning areas. After 1 or 2 years in the Atlantic, salmon may weigh anything from 1kg up to 20kg. This map shows the range of countries that Atlantic Salmon originate in, and an indication of where they migrate in the course of their ocean journeys.





# What makes a good river?

We've seen how far our salmon can travel into the Atlantic Ocean after leaving their river. But let's go back, like the Salmon(!), and look at the important spawning and nursery habitats in our rivers. What makes a good river? Salmon are very fussy about their homes (habitats)... they favour sparkling water tumbling over crisp gravels in the dappled light of a diverse riparian zone. For

nutrition, they depend upon a suite of organisms that share their requirement for pristine aquatic environment. Where geography allows, a healthy river will freely meander, snaking through the landscape and creating wetlands in level, low-lying areas. The river's depth will be constantly changing, with a pool-riffle continuity. Pools offer calmer waters where larger fish will rest,

while riffles are shallow, fast-flowing areas which recharge the oxygen content of the water and provide spawning and nursery habitat for salmon. Waterfalls? No bother! Salmon will leap up nearly 4m to ascend a waterfall and access habitat above it. What else do we look for? A healthy river will have stable banks, interspersed with native trees, shrubs and plants which attract bird, bat, and insect life and also contribute leaves and woody debris into the stream which act as food source for insects. An intact and robust riparian

zone can help buffer the effects of both urban and rural land-use impacts including silts and pollutants, which can limit your river's capacity to support a wide range of biodiversity. Just remember: *A River and its entire Catchment; its geology, landscape, and weather, with all life forms from microscopic bacteria through plants, birds, fish and the mammals (including Humans), together create a grand Ecosystem that needs clean clear waters at its heart!*

*A River & its Catchment, together with all of its life forms, combine to create a grand Ecosystem dependent upon clean clear waters.*

Native trees, shrubs & plants stabilise banks and provide food & energy to nourish all life.

Rainfall: "Low-anchored cloud... font & source of rivers."  
Henry David Thoreau

Waterfalls? No problem! Salmon can leap up to 4m high!

Balanced bankside vegetation allows 'dappled light' (not too much; not too little) to reach the river.

Good 'Buffer Zone' protects river from impacts of human activities.

Bird & Mammal visitation complete the River 'Web-of-Life'.

A wide range of various-sized stones & gravels for fish spawning & Aquatic Bug Habitats.

Shallow, fast-flowing riffles recharge oxygen and provide Salmon spawning & nursery areas.

Pristine waters achieved through Humans' 'Best-Practice' enables rich biodiversity.

Deep pools offer shelter for large fish.



# Biodiversity and 'Food Webs' along rivers

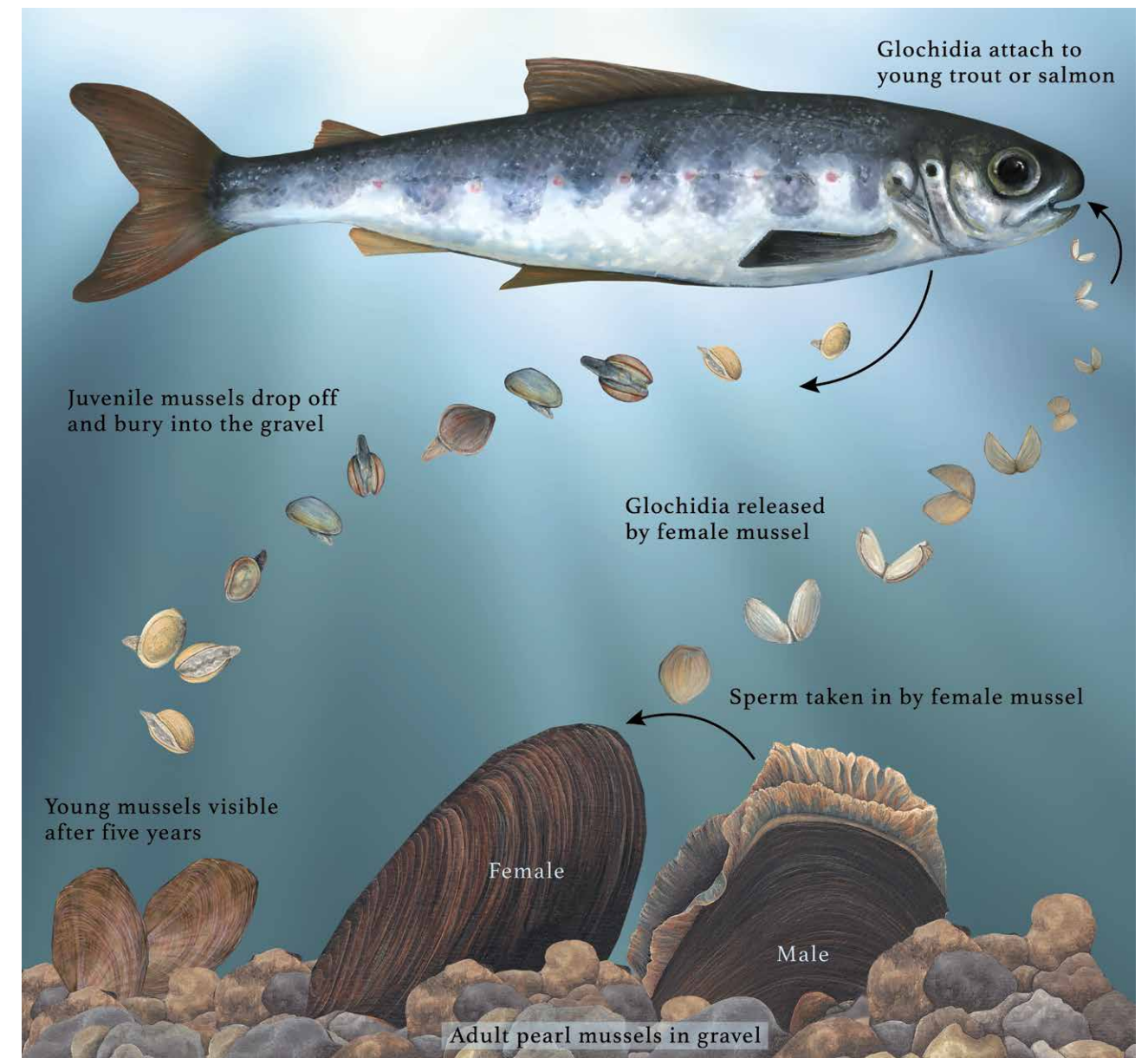
No species can exist on its own; salmon are part of a huge complexity of different life forms and processes which all depend upon the cool clean clear waters of your local river. All of these life forms interact, from **leaves** (and even whole trees!) which fall into rivers, through **fungi** and microscopic **diatoms** and **bacteria** which break these down, **aquatic insects** which graze all of these (and each other!); young **salmon** that eat these bugs and who in turn are eaten by other species including **eels**, **heron**, **otters**, **kingfishers**, as well as other salmon and **trout**. Even as adult salmon may die in your river after spawning, their remains are scavenged and scattered enabling the minerals and organic content that they have gained from their time at sea to be dispersed across the landscape, contributing nutrition to all of these species... Your valley really is a self-sustaining greater organism which, if it allows for a degree of wilderness, can continue to retain this rich Biodiversity permanently. What we can do is to try to be as intelligent as the world around us!



## But it is not all predators and parasites!

Sometimes species work together to achieve something beneficial to both concerned, and even for the wider Biodiversity; this is called 'Symbiosis'. As example, Freshwater Pearl Mussels (FPM) live in salmon rivers. When they spawn, these microscopic juveniles are only

viable if they pass into a juvenile salmon or trout's gills where, if they are successful, will remain attached to the gill (without harming the host fish) for many months before dropping off and diving down into the river gravels. This is how FPM achieve dispersal through a river system. In turn, FPM (as bivalves) filter and remove nutrients from the water for their own growth, thereby helping to keep the river pristine for the salmon – another miracle of Biodiversity!

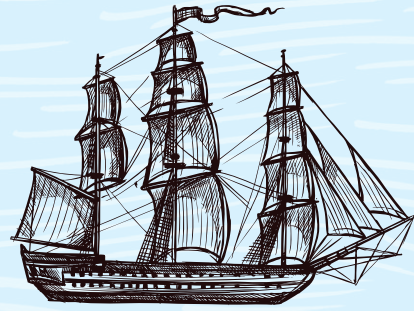


### Did you know?

Wild Atlantic Salmon (*Salmo salar*) often share their Catchments/Watersheds with their cousins Brown Trout (*Salmo trutta*) and Arctic Charr (*Salvelinus alpinus*), two other exciting salmonids.



# Salmon Art, Lore & Mythology



Apart from *Atlantic* salmon, there are also several different species of salmon which live in the rivers and seas of the northern *Pacific* Ocean. Wherever salmon are found, they became important in nutritional and cultural terms to widely distributed peoples. These nations/cultures include the **Ainu of Japan**, the indigenous peoples of **Kamchatka** and the **Bering Sea**, the tribes of the **Pacific Northwest** as well as of what is now **Atlantic Canada**; the **Sami of Finland**, and the **aboriginals of Scotland, Ireland, Brittany (France) and Galicia (Spain)**. Common to all of these widespread cultures was an awareness and acknowledgement of the interdependencies of the natural world, a reverence for all species (with salmon often as pinnacle) upon which human nutrition and welfare depended, and a way of life informed by the desire for a permanent relationship with the Earth. Many of these cultures produced Salmon Art, samples of which you may see in the map here; and salmon also inspired mythology, lore, and story-telling.



Can you learn of any Salmon stories from your own Locality?

Can you think of any ideas about how to draw salmon, and to convey the importance of their presence to your community?

*Sample of Salmon Mythology from Ireland:*

## *The Salmon of Knowledge*

*For seven years Finnegas the Druid lived on the banks of the Boyne trying to catch the Salmon of Knowledge.*

*The prophecy was that he who would eat the Salmon would get all the wisdom of the world.*

*One day Finnegas at last caught the Salmon, and gave it to his servant Demna to roast on a spit, warning him not to eat the smallest bit of the fish. When the Salmon was cooked, Demna laid it before his master. When Finnegas looked at him, he saw the light and fire of wisdom and poetry in his eyes and asked, "Have you eaten of the Salmon?" "No", Demna replied, "but when I was turning it on the spit, it burned my thumb which I put into my mouth to ease the pain." Finnegas said resignedly "That is enough, you have eaten of the Salmon of Knowledge and in you the prophecy is fulfilled. Your name is Finn MacCumall."*

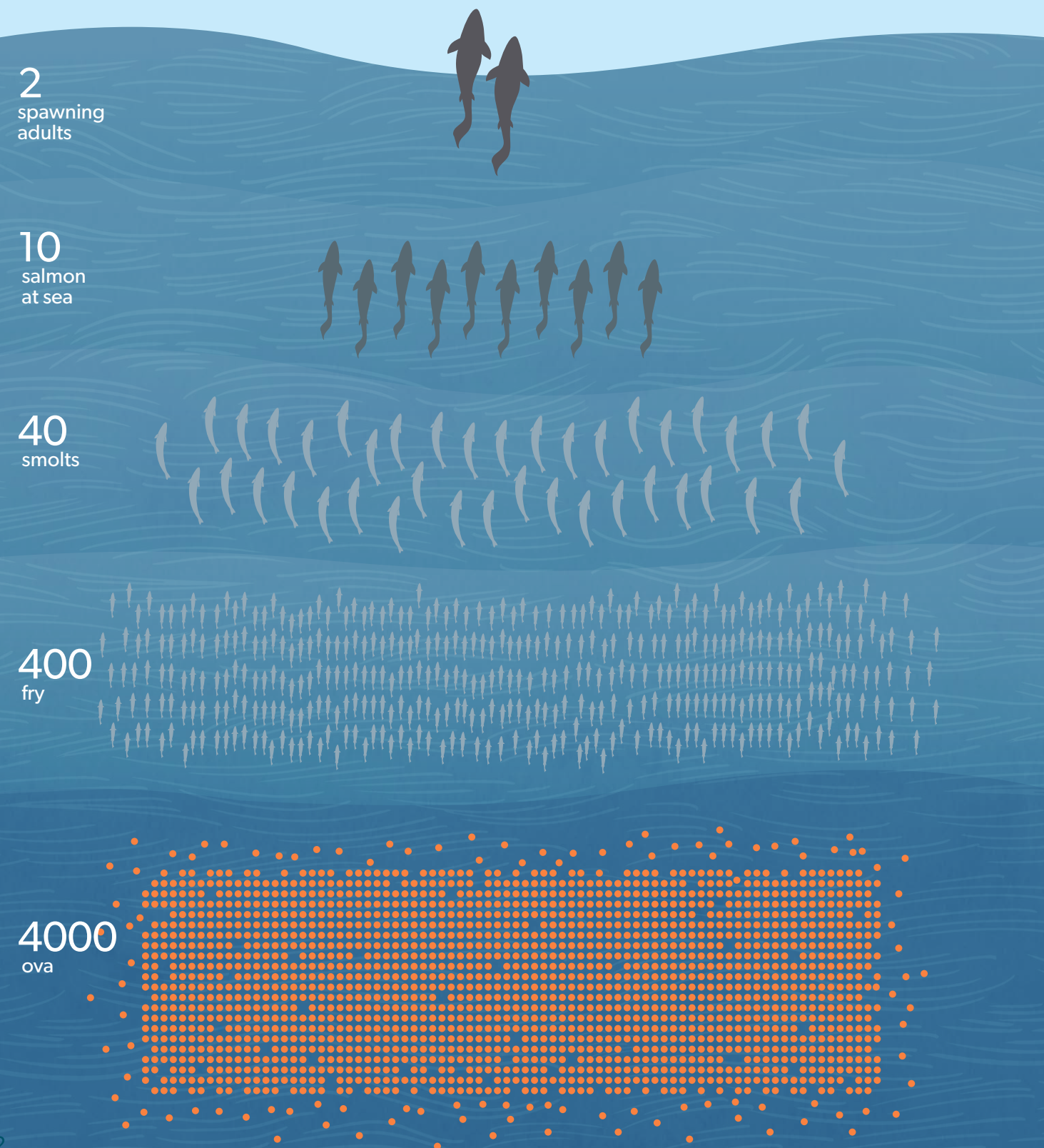
*From then on, Finn had the eternal knowledge that the salmon got from eating the nuts of the nine hazel trees that hung over Connla's well, the source of all wisdom and knowledge.*



# Salmon survival

It's not easy being a salmon! A female salmon may lay 4,000 eggs (or more!) but on average only 2 of these will go on to complete their Life Cycle and survive to spawn themselves.

Along the way, from the time they are tiny ova right up to when they are large adults, they suffer various reasons for their mortality including being an important food source for many other species.



# Household Best Practices

## Home Truths

The StreamScapes method views our toilets, sinks, baths and showers as tributaries to our rivers. What we put in them has a huge capacity to impact on local water quality and biodiversity.

Outside our homes in our gardens and yards we have an equal ability to create or destroy natural habitats. The tips below will help restore water quality & biodiversity.

Avoid any cleaning products with **phosphates** or **bleach** – they spoil the good work of your sewage treatment plant / septic tank, leading to aquatic pollution – use instead ‘eco-friendly’ products.



Use the **minimum of any cleaning product** – enough is enough.

**Do not use in-sink food macerators** (they put added strain on sewage treatment) – compost your vegetable wastes and use as fertiliser in your garden.



Any common household product labelled **hazard** or **poison** or **irritant** must be treated as toxic waste when disposing of – follow Local Authority guidelines and do not put in drains!



Keep your garden low-maintenance and low water-dependent, but covered in established sod (and not hard-surfaced) to avoid contributing to peak urban rainfall run-off. Use native plants and trees to establish suitable local habitats.



Avoid herbicides, pesticides, and application of fertilisers – find natural ways to garden.



Finally, control your use of water at home and in the garden – treat it as the precious substance that it is.



**Don't let nature go down the drain.**



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