Salmon Watch Ireland

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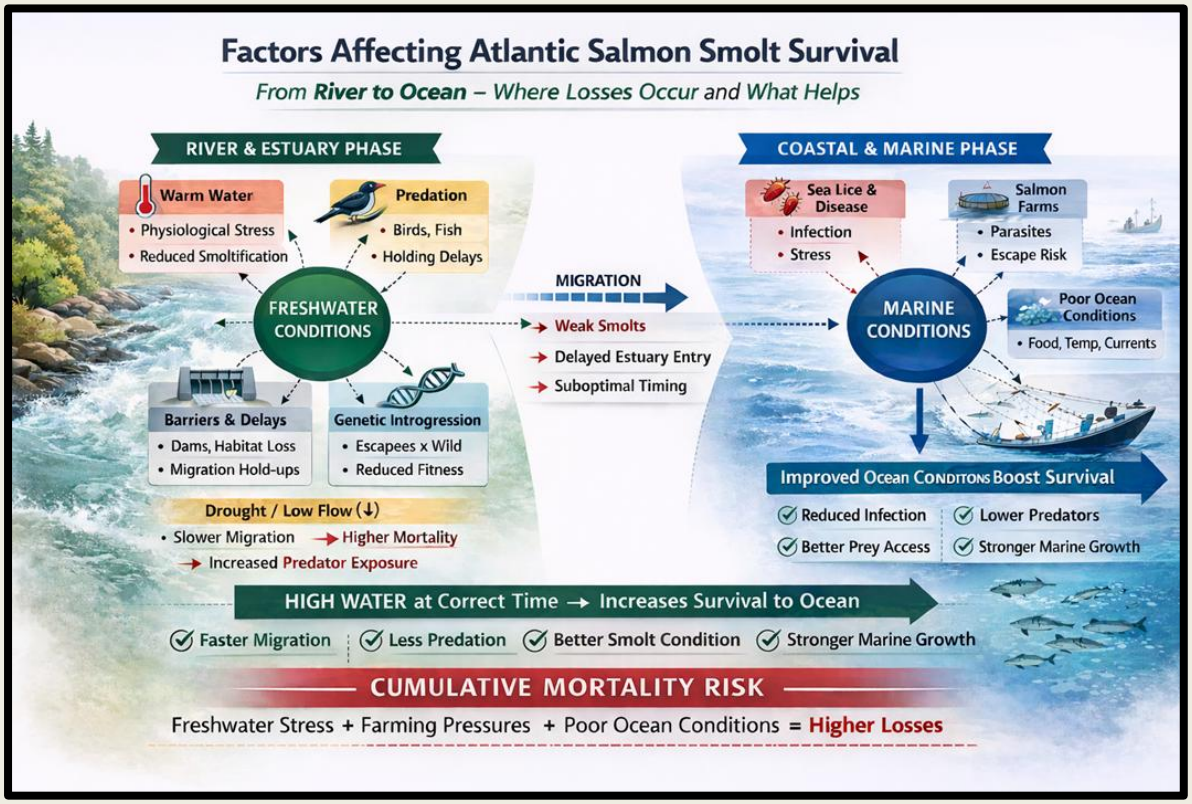
Freshwater Survival Newsletter

Atlantic Salmon Smolts – What Irish Research Is Telling Us

Atlantic salmon numbers across Ireland and the wider North Atlantic have declined significantly over recent decades, with many rivers now supporting only a fraction of their historic runs. While marine survival remains a major concern, freshwater conditions are changing rapidly and are increasingly recognised as a key driver of reduced productivity. Warmer rivers, more frequent summer droughts, prolonged low-flow periods, and increasingly intense rainfall events are altering habitat stability at every life stage, from egg incubation and juvenile rearing to smolt migration.



Mild winters can disrupt developmental timing, warm water and drought can significantly slow downstream movement and increase predation exposure, and extreme spates can displace juveniles and damage spawning gravels. Together, these shifts in freshwater climate patterns are reshaping the environmental window

within which salmon must successfully grow, migrate, and survive before ever reaching the sea.

The Freshwater Bottleneck: More Important Than We Think

Before Atlantic salmon ever face the open ocean, many are lost in rivers and estuaries.

Research from: River Bush, Burrishoole, River Erriff and studies carried out by Inland Fisheries Ireland and the Marine Institute all point to a consistent conclusion that freshwater survival is a major driver of overall salmon returns.

The Butler Pool Waterville – No estuary and direct discharge to sea- Heavy impact by predators at sea entry – Similar profile to River Bush

River Bush: Long-Term Evidence of Freshwater Mortality

The River Bush provides one of Europe's longest-running salmon datasets.

Key Insights:

- **Significant mortality occurs during downstream migration.**
- **Low-flow springs reduce survival.**

- Bird predation (cormorants, goosanders) can be substantial.
- Larger smolts generally survive better.

Low discharge slows migration, increasing predator exposure time.

Burrishoole: Life-Cycle Monitoring from Egg to Adult

Burrishoole allows full life-cycle tracking.

What We Learn:

- Mortality occurs in freshwater, estuary, and early marine phases.
- Smolt timing affects adult return rates.
- Environmental matching (flow + temperature + timing) is critical.
- Freshwater conditions influence marine success.

Freshwater is not neutral — it shapes fish condition entering the sea.

River Erriff: Telemetry Shows Early Losses

Telemetry reveals:

- Mortality begins almost immediately during migration.
- Faster migrants survive better.
- Higher spring discharge improves survival.
- Estuarine losses can be significant.

Spring freshets help smolts move quickly through predator zones.

Low Water & Warm Springs: A Common Risk Factor

Across Irish systems:

- Low discharge slows migration.
- Warm water increases physiological stress.
- Holding behaviour increases predation exposure.
- Delayed migration may disrupt marine timing.
- Smolts moving slowly in low, warm conditions are more vulnerable.

Kerry Blackwater: Typical spate system discharging to ocean directly – High water pulses in spring reduce predation and help smolts get to sea without undue stress.

Southern Rivers: Long Estuaries Add Complexity

The River Suir, Blackwater and River Nore have extended tidal reaches.

Additional Challenges:

- **Longer exposure to predators.**
- **Fluctuating salinity gradients.**
- **Weak freshwater plumes in dry years.**
- **Warmer estuarine water.**

In dry springs, these systems may pose elevated risks compared to shorter western rivers.

Does Higher Spring Flow Help?

Evidence suggests yes.

Higher discharge:

- **Speeds downstream migration.**
- **Reduces holding behaviour.**
- **Dilutes predator efficiency.**
- **Extends freshwater plume offshore.**

- **Supports smoother marine transition.**

Natural spring pulses appear beneficial overall.

Munster Blackwater Estuary – Typical of long estuaries in south coast rivers – Exposure to predation is higher in low flow conditions.

Smoltification & Salinity Readiness

Smoltification depends on:

- **Photoperiod**
- **Temperature**
- **Environmental stability**

Stressful freshwater conditions may:

- **Impair salt regulation.**
- **Delay migration.**
- **Reduce seawater tolerance.**

Stable spring conditions matter for physiological readiness.

The Integrated Picture

Across Bush, Burrishoole, Erriff, southern rivers, and environmental-genetic research:

Consistent Themes:

- **Freshwater mortality is significant.**
- **Low, warm springs reduce survival.**
- **Faster migrants survive better.**
- **Long estuaries increase exposure risk.**
- **Genetic integrity supports environmental resilience.**
- **Stressful conditions amplify vulnerability.**

Freshwater survival is one of the most manageable parts of the lifecycle.

- **Protect natural spring flow regimes.**
- **Limit abstraction during migration.**
- **Reduce thermal warming through riparian shading.**
- **Maintain connectivity to avoid migration delays.**
- **Safeguard genetic integrity of wild stocks.**
- **Continue telemetry and long-term monitoring.**

When a smolt leaves its river, its fate is not sealed at sea alone.

River flow, Temperature, Predator exposure, Estuary length, Genetic adaptation.

All shape survival before the Atlantic is ever reached.

Freshwater is not just the beginning of the journey — it is a decisive stage that can determine its outcome.

Sea Lice & Coastal Exposure

Sea lice associated with marine salmon farms can increase parasite loads on outward-migrating smolts.

Potential impacts:

- **Increased stress.**
- **Reduced growth.**

- **Higher marine mortality.**
- **Cumulative physiological burden.**

When freshwater stress and marine parasite pressure occur together, cumulative mortality risk increases. This is consistently experienced in salmon farming areas.

Environmental Stress + Salmon Farming Pressure = Compounding Risk

Irish evidence suggests:

Low-flow, warm springs:

- **Increase freshwater mortality.**
- **Slow migration.**
- **Increase estuarine exposure time.**

Add coastal parasite pressure:

- **Smolts in weaker condition may be less resilient.**
- **Genetic introgression may reduce environmental robustness.**
- **Survival probabilities decline further.**

For more information: https://smoltrack.eu/

Conclusion

In conclusion, the pressures acting on salmon do not begin at sea — they start in the earliest freshwater stages and can shape survival long before ocean entry. Extreme and violent spates can scour redds, displace fry and parr, and destabilise juvenile habitat, while prolonged drought reduces available holding water, concentrates fish, increases density-dependent competition, and heightens predation risk. These stressors can weaken cohorts well before smolt migration begins. In addition, pollution pressures in long, slow-moving estuaries — particularly during warm, low-flow periods — may contribute to reduced dissolved oxygen levels, creating physiological stress for both outward-migrating smolts and returning adults. Taken together, hydrological extremes, habitat compression during drought, and declining water quality in transitional waters reinforce the reality that freshwater conditions at all life stages play a critical role in determining overall salmon survival.

Introducing Hydronet: A comprehensive data set to examine river data including water height and temperature – A must for anyone interested in historic and current data. Please click on Map: