

THE OCEAN IS NOW A CONDITION OF SPORT: WHO HOLDS THE FORECAST?

**SF4SPORT | STRATEGIC FORESIGHT SERIES
2026**



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EVIDENCE REVIEW

PEER REVIEWED RESEARCH AND POLICY SOURCES, 2003 to 2026

REGULATORY FRAMEWORK

**EU OCEANEYE, EUROPEAN OCEAN PACT, OCEAN ACT 2027,
WORLD TRIATHLON E. COLI THRESHOLD, ATP TO WTA WBGT**

SCOPE NOTE

This report is a strategic foresight and environmental scanning output. It is not legal advice.

METHODOLOGY

SF4SPORT, STRATEGIC FORESIGHT FOR SPORT

Environmental scanning to Policy alignment to Evidence synthesis

On 3 June 2026, the European Commission adopted OceanEye, its flagship ocean-observation initiative, with the stated ambition of making the EU the world's leading provider of ocean intelligence, targeting 35% of the global ocean observing system by 2035 and a fully operational European Digital Twin Ocean by 2030, offered as a free public service. In this scan we open here because OceanEye is fresh, its cultural-engagement lane is funded yet entirely unclaimed by sport, and the same sovereign stack being built for climate and biodiversity policy is, by quiet adjacency, the future governing layer for aquatic sport, a connection almost no one is making.

OceanEye Arrives 3 June 2026, and Sport Is Not in the Room

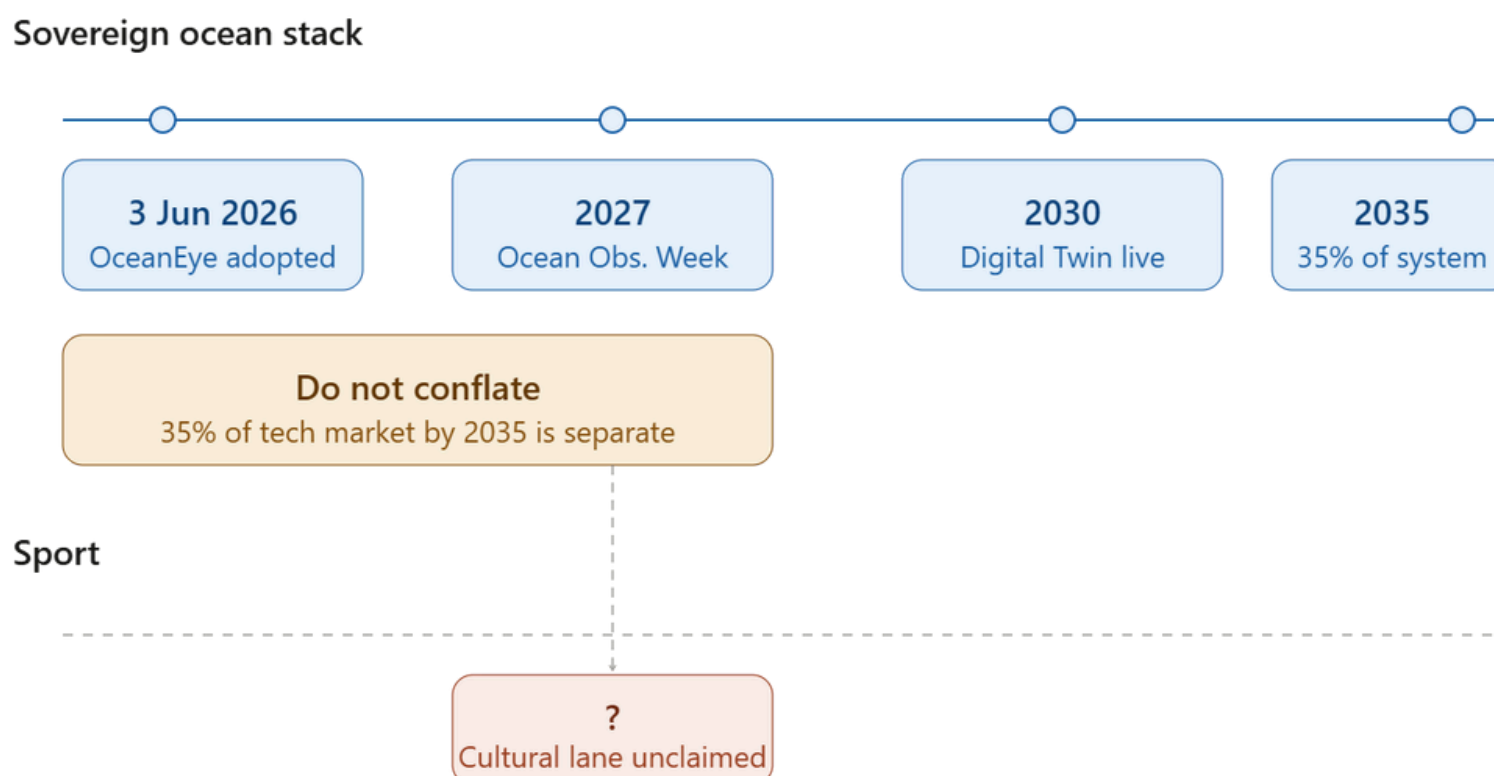
On 3 June 2026 the European Commission adopted OceanEye, its flagship ocean-observation initiative, with the stated ambition of making the EU the world's leading provider of ocean intelligence. In this scan we find a freshly built sovereign data stack, a funded cultural-engagement lane carried inside it, and almost no claim staked on either by the sporting world.

The headline targets confirmed against primary sources are precise: the EU aims to provide 35% of the global ocean observing system by 2035 and to deliver a fully operational European Digital Twin Ocean by 2030, offered as a free public service (European Commission; DG MARE). The package rests on four pillars, unified data governance, a new international alliance for the Global Ocean Observing System (GOOS), the Digital Twin and innovation markets, and public engagement, and carries roughly €92m, of which €62m is the Horizon Europe contribution to GOOS and global data systems and around €30m supports observation-technology innovation (European Commission).

Signal 1

One disambiguation this scan flags for designers and downstream readers: OceanEye carries a second, distinct 35% target, capturing 35% of the global market for ocean-observation technologies by 2035, easily conflated with the 35% of the global observing system figure used above. These are not the same number. Do not merge them.

What the scan identifies as the unclaimed ground is OceanEye's cultural and educational lane: public installations, museum exhibitions, a New European Bauhaus Lab turning ocean data into art, an Ocean Observation Week in 2027, and school engagement through EU4Ocean (DG MARE). This lane is real, funded, and, in this scan, almost entirely unclaimed by sport. We did not identify a sporting body, federation, or athlete-led coalition positioned within it.



Signal 1

The deeper observation is one of adjacency, not connection. The same sovereign intelligence stack being built for climate and biodiversity policy is, by quiet adjacency, the prospective governing layer for aquatic sport, where events can safely be held, for whom, and when. This scan does not find that connection being made by anyone, and it is the absence, not a stated EU intention, that is the finding here: we found no institutional bridge between OceanEye and aquatic-sport governance, and this signal should be read as the open edge of that gap rather than evidence that the bridge is planned.

***From where Sport Singularity sits.** A sovereign, free, public ocean-intelligence layer is being stood up on a published timeline, and the cultural lane inside it is funded and empty. Sport is the largest cultural platform humanity has for reaching the disengaged, yet in this scan it is not in the room where this is being built. The window reads as open precisely because OceanEye is fresh, the engagement pillar is unclaimed, and the bridge to the bodies that govern who competes, and where, when, and how safely, is, on the evidence we could find, unbuilt. We carry this as an opportunity assessment grounded in an observed absence, not as a claim that the EU has invited sport in.*

Sport Singularity editorial voice

Pathogens, Not Physics, Postponed the Paris 2024 Triathlon

The deciding variable for an elite aquatic event was not wave, wind, current, or heat, it was faecal bacteria. The Paris 2024 men's triathlon was postponed and training swims cancelled once the Seine breached World Triathlon's *E. coli* threshold, and this scan finds it is precisely the variable the sovereign ocean stack does not forecast.

The Paris 2024 men's triathlon was postponed, and training swims cancelled, after the Seine exceeded World Triathlon's *E. coli* go/no-go threshold of 1,000 CFU/100mL following rainfall. One of four testing sites returned readings of 980 to 1,553 CFU/100mL, straddling and exceeding the limit (NPR; SwimSwam).

Signal 2



This was not a budget failure. Paris spent roughly €1.4bn (about US\$1.5bn) improving the Seine ahead of the Games, and bacteria still fluctuated with rainfall, because the hazard tracks weather, not capital expenditure (Bloomberg).

The deciding mechanism was reactive, not predictive. Go/no-go calls were made via daily lab grab-samples judged against fixed thresholds in dawn coordination meetings; a marathon-swim training session was cancelled after one such early-morning meeting, and the men's race was postponed (SwimSwam). A sample is drawn, sent to a lab, returned, and judged against a line in the rulebook, a snapshot of yesterday's water used to decide today's race.

Signal 2

This scan flags the structural mismatch directly. The deciding variable, faecal pathogens driven by rainfall and combined-sewer overflow, is exactly what the sovereign ocean stack does not forecast. As captured in Signal 1, the European Digital Twin Ocean and Destination Earth's extremes twin forecast physics and biogeochemistry: currents, waves, tides, chlorophyll, coastal flooding (EDITO; ECMWF; Copernicus Marine). What decided Paris 2024 sits outside that stack. The pathogen-predictive capability that did inform the event was bespoke, the Fluidion/Bayesian Seine models built for that single elite venue, not the public sovereign layer (Wisconsin DNR).

Scope discipline: this is one event in one river. This scan does not support the generalisation that every aquatic venue behaves like the Seine, nor that grab-sampling failed; within its design it worked, and the men's race was held a day later. The narrower finding is sharper: the decision standard for elite aquatic sport remains reactive and threshold-based, and the variable it turns on is not in the sovereign forecast.

From where Sport Singularity sits. Paris spent €1.4bn and still had to decide its marquee swim at dawn, by hand, on a single overnight lab result. That is not a story about a dirty river; it is a story about a missing forecast. The sovereign stack being stood up across Europe can model the storm surge that floods a venue, but not the bacteria that decide whether anyone can swim in it, and the gap is filled, for now, only by bespoke sensing that one Olympic budget could afford. The events that cannot afford it are everyone else's.

Sport Singularity editorial voice

Heat Has Already Rewritten the Rulebook: 85% of Athletes Report Harm

Heat is the one ocean-and-climate variable that has already moved from concern to codified rule: a 2023 World Athletics survey of 373 athletes found 85% saying their sport had experienced adverse consequences from climate change and 75% perceiving a direct impact on their own health and performance, and governing bodies have responded with Wet Bulb Globe Temperature thresholds, not statements. This scan found no equivalent codified response on the water-pathogen side (see Signal 2).

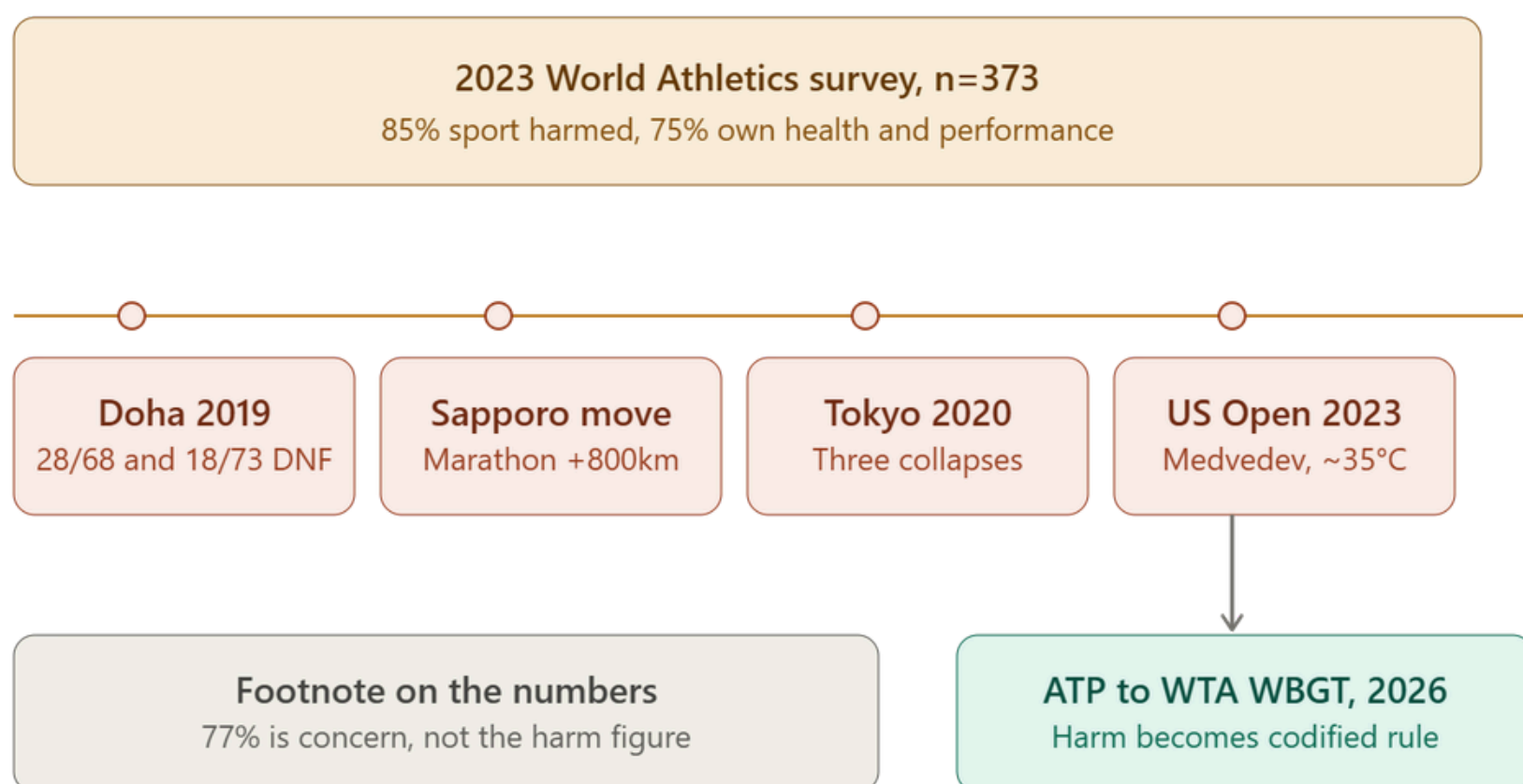
Signal 3

The physiological case that heat has become a condition of sport is the best-established part of this scan's evidence base. The headline athlete-perception figures come from a 2023 World Athletics survey of 373 athletes: 85% said the sport had experienced adverse consequences from climate change, and 75% perceived a direct impact on their own health and performance (World Athletics). A note for precision, because this scan repeatedly found the wrong number in circulation: the often-cited 77% is not the harm figure, it refers only to athletes describing themselves as extremely or very concerned about the climate crisis. This scan uses 85%/75% and treats the 77% framing as inaccurate.

The collapses are not abstractions. At the Tokyo 2020 Olympics (held 2021), triathlon gold medallist Kristian Blummenfelt collapsed at the finish, tennis player Paula Badosa retired with heatstroke in a wheelchair, and archer Svetlana Gomboeva collapsed from heat exhaustion (CBS News). The Olympic marathon had already been relocated around 800km north to Sapporo over heat concerns, reinforced by the Doha 2019 World Championships, where 28 of 68 women and 18 of 73 men failed to finish the marathons in extreme heat and humidity (World Athletics results; ESPN). At the 2023 US Open, Daniil Medvedev took two medical timeouts and used an inhaler in around 35°C heat, warning that one player is going to die (Euronews).

Signal 3

The governance response is what distinguishes heat from the other hazards in this scan: it has hardened into rules. Governing bodies have adopted Wet Bulb Globe Temperature (WBGT) thresholds across tennis, athletics, open-water swimming and football, and the ATP will align with the WTA heat policy, both built on the WBGT index, from the 2026 season (ATP Tour; Sport Resolutions). This scan reads the relocated Olympic marathon, the WBGT thresholds, and the 2026 ATP to WTA alignment as evidence that for heat, schedule, venue and stoppage are already gated by an environmental index: the rulebook has been rewritten, not merely debated.



Signal 3

Two scope notes. First, this scan does not support generalising the 85%/75% figures beyond the surveyed population: they are athlete-reported perceptions from a single 373-athlete survey, not a measured cross-sport outcome. Second, the named collapses and DNF counts are discrete elite-event incidents; they evidence that heat already decides outcomes at the top tier, but the broader distributional burden, who bears heat risk when adaptation capacity is unequal, is a separate finding (see Signal 5).

***From where Sport Singularity sits.** Heat is the proof-of-concept the rest of this report is built against: it is the one environmental variable where the chain from athlete harm to codified rule has already closed, a measurable index (WBGT) now decides when play stops, and an Olympic marathon was physically moved 800km to escape it. The instructive contrast is with the water column (Signal 2), where the deciding variable, faecal pathogens, has no equivalent forecast-led, codified gate. Heat shows what a governing layer looks like once it exists; the open question this scan keeps returning to is why the same discipline has not yet reached the water.*

Sport Singularity editorial voice

UK Grassroots Sport's £320m Weather Bill Falls Hardest on Those Least Able to Pay

The most human evidence of climate's grip on sport is not in elite stadiums but at the grassroots, where a DCMS-commissioned study puts the annual weather bill at £320m and where the clubs least able to adapt serve the communities that most need to play. One caveat up front: the becoming elitist finding is a UK-grounded, globally-extrapolated risk, not a measured worldwide outcome.

A DCMS-commissioned study (Alma Economics, September 2025) estimates that adverse and extreme weather costs UK grassroots sport £320m per year, roughly £200m in facility maintenance and repair and £120m in lost revenue from cancellations and forced closures (GOV.UK). Separately, around 120,000 grassroots football matches are cancelled each year in England due to bad weather, a football-specific number the study cites from secondary sources, not a count across all grassroots sport, and it should not be generalised as such. The same modelling projects the annual impact rising by an additional £95m at 2°C of warming and £190m at 4°C, on top of the £320m baseline; the source attaches no date to when those warming levels are reached, so these are conditional scenario figures, not dated forecasts.

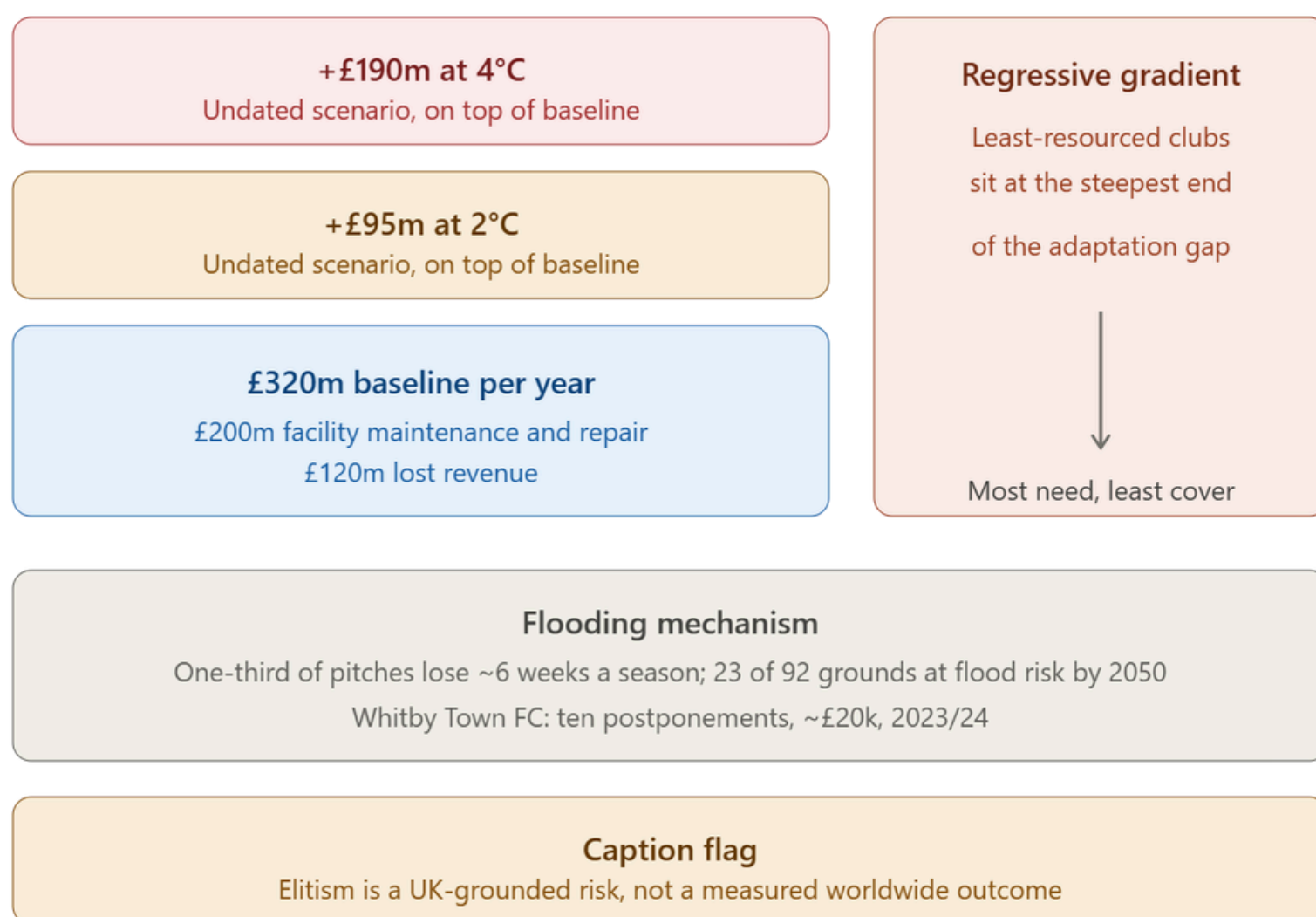
Signal 4

The regressive shape of the burden is what makes this a spine finding rather than a line item. The accompanying Reading University/BASIS research warns that grassroots sport risks becoming elitist because lower-resourced clubs cannot afford to protect their grounds, leaving under-served communities denied the wider health and economic benefits of sport (Connectsport). The government report itself notes that low socio-economic groups, older people, children and disabled people are the most impacted. This scan does not support generalising the elitism thesis into a measured worldwide outcome: it is a single national research line, credible and quotable, but one country and one study cluster, with the global generalisation asserted as reasoned inference rather than separately evidenced.

The physical mechanism is flooding and drainage failure. Around one-third of England's grassroots pitches already lose roughly six weeks a season to flooding and inadequate drainage; 23 of the 92 EFL/Premier League grounds (often loosely generalised to UK football grounds) are projected to face partial or total annual flooding by 2050; and Whitby Town FC had ten home games postponed for waterlogged pitches in 2023/24, with estimated losses of around £20,000 (Met Office; Rapid Transition Alliance; Round Our Way). The pattern is structurally regressive: the clubs least able to pay for drainage, covers, and ground protection are the ones serving the communities that most depend on accessible sport.

Signal 4

One honest gap belongs here, because it is itself a finding. Robust economic figures exist at the aggregate UK grassroots level, but this scan found no quantified cost estimates isolating the climate burden on the lowest-income cohorts at this tier, and (carried into Signal 5) none isolating para-athletes specifically. The elitism thesis should therefore travel as a well-sourced risk, not a fully quantified worldwide outcome.



From where Sport Singularity sits. The £320m headline is not the story, the gradient underneath it is. Climate does not bill every club equally; it bills hardest exactly where the cheque is hardest to write, and that turns a weather problem into an access problem. Predictive intelligence and protected drainage will be bought by those who can already afford them, which is why the equity question is decided not by the hazard but by who holds the tools to anticipate it. We carry the elitism finding as a risk, not a verdict, but a risk with this shape rarely resolves in favour of the under-served on its own.

Sport Singularity editorial voice

Adaptation Capacity Runs Inverse to Need: Para-Athletes at the Sharp End

The bodies least equipped to absorb heat and polluted water are the ones least likely to have anyone on site who can intervene. This scan found the protective resources cluster away from the cohorts at highest physiological risk, and found, tellingly, no quantified cost estimate isolating that burden at all.

The clearest single data point sits in US schools. A study of 3,482 US public secondary schools (Barter et al., J Athletic Training, 2023) found only 38.7% had a full-time athletic trainer and 26.9% had none at all, and the schools with no trainer carried markedly higher free/reduced-lunch eligibility (52.9% vs 41.1%). The scope is precise: the sample drew from 15 selected states, so national is approximate, and this is one country. The pattern captured here is a socioeconomic gradient in on-site medical cover, not a measured worldwide outcome.

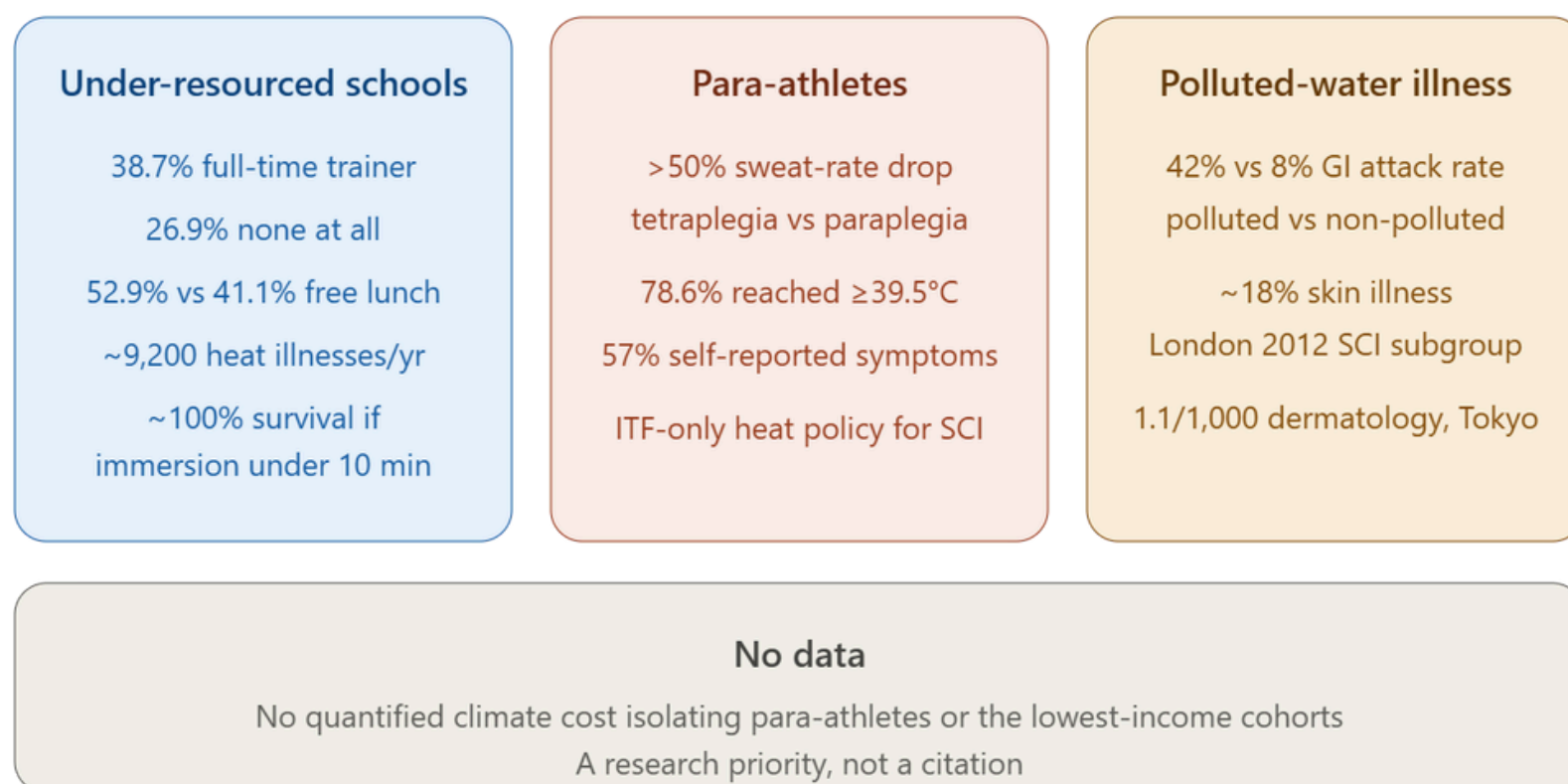
That gradient matters most under heat. An estimated 9,200 US high-school athletes experience time-loss heat illness annually (CDC/High School RIO), and survival from exertional heat stroke approaches 100% when cold-water immersion begins within about ten minutes of collapse (Korey Stringer Institute). The two facts compound: the least-resourced athletes carry elevated heat exposure and are the least likely to have the one person on site whose presence converts a near-certain-survivable event into a fatal one. This scan does not extend that finding beyond the US dataset that supports it.

Signal 5

Para-athletes sit at the most acute intersection. Spinal cord injury impairs sweating and heat dissipation: tetraplegia is associated with a more than 50% reduction in estimated whole-body sweat rate versus paraplegia, a figure deriving from a specific exercise-in-heat study of trained wheelchair athletes (Price & Campbell, 2003), not a universal or resting measurement. In paratriathlon data (28 mixed-impairment athletes racing in 33°C air), 78.6% (22 of 28) reached a core temperature of 39.5°C or above and 57% self-reported heat-illness symptoms. Yet in this scan only one international federation, the International Tennis Federation, via its wheelchair-tennis regulations, had implemented a heat policy for spinal-cord-injury athletes, and even that lacked detailed risk-management guidance.

Polluted water compounds the danger for the same cohort. Insensate skin and prosthetic friction drive dermatological illness well above able-bodied rates: skin conditions reached up to around 18% of illnesses in the spinal-cord-injury subgroup at London 2012, and dermatology had the highest incidence of any organ system (1.1 per 1,000 athlete-days) at Tokyo 2020. A triathlon study found a 42% gastrointestinal-illness attack rate after swimming in sewage-polluted seawater versus 8% in non-polluted water (Harder-Lauridsen et al., PLOS One 2013), the same pathogen exposure that, per Signal 2, decides whether aquatic events run at all.

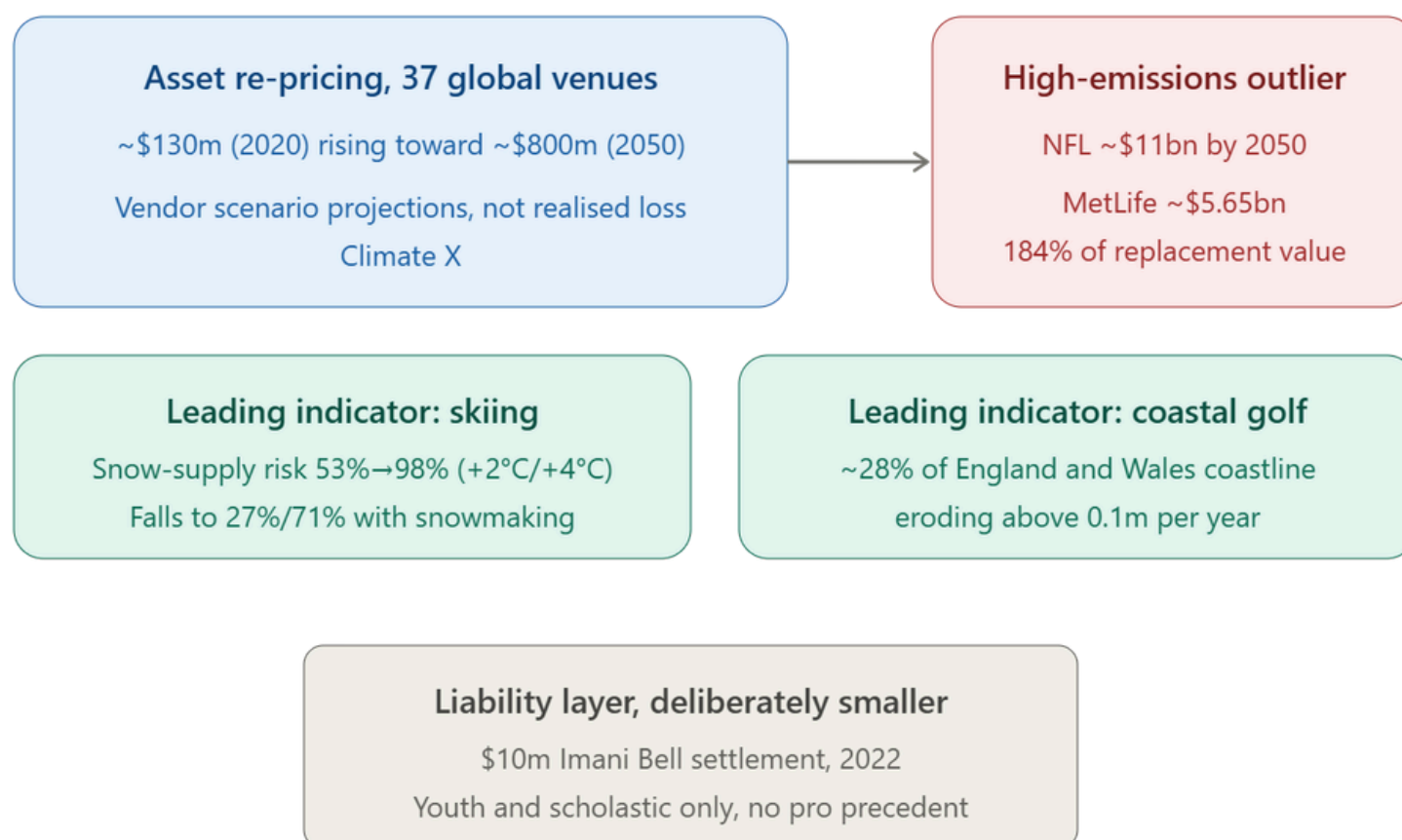
Signal 5



The data gap is itself the finding. Robust aggregate economic figures exist (see Signal 4's £320m baseline), but this scan found no quantified cost estimate isolating the climate burden on para-athletes specifically, nor disaggregated data for the lowest-income cohorts. The literature itself describes para heat-risk evidence as notably limited and dermatological outcomes as underreported. This is not a citation we failed to locate; it is an absence, and absences in exactly the cohorts least able to fund their own protection are not neutral.

From where Sport Singularity sits. The three signals before this one describe a hazard arriving from outside, a sovereign forecast no sport claims, a river that fails a pathogen test, a heat index that relocates a marathon. Signal 5 turns the lens inward: the same hazard does not land evenly. It is filtered through who has a trainer at the touchline and whose physiology cannot tell them they are overheating. The decisive detail is the one with no number attached, the empty cost cell for para-athletes and the poorest cohorts. A risk that cannot be priced is a risk that cannot be insured against, budgeted for, or argued in front of a federation. Quantifying it is not an academic footnote; it is the precondition for the equity instrument the later trends describe.

Sport Singularity editorial voice



Climate Is Re-Pricing Sport's Assets: Up to ~\$11bn Across NFL Stadiums by 2050

Climate X projects up to ~\$11bn in cumulative climate losses across the 30 NFL stadiums by 2050 under a high-emissions scenario, with one venue alone modelled at 184% of its own replacement value. The re-pricing is already legible in the property and insurance layer; the courtroom layer, by contrast, is live only in youth and scholastic negligence, not yet a professional-venue wave.

The headline figure comes from a Climate X analysis projecting up to ~\$11bn in cumulative climate losses across the 30 NFL stadiums by 2050 (high-emissions scenario), with MetLife Stadium alone at ~\$5.65bn, 184% of its ~\$3.07bn replacement value, meaning modelled climate losses exceed what it would cost to rebuild it (Climate X). A separate Climate X analysis of 37 global venues, the 12 US 2026 FIFA World Cup venues plus the 25 largest European stadiums, projects losses rising from ~\$130m (2020) toward ~\$800m (2050) (Climate X). These are vendor scenario projections, not realised losses; this scan reports them as the asset-pricing signal they are, not as settled fact.

The stranded-asset template already exists elsewhere in sport. Low-altitude skiing is the clearest precedent: without snowmaking, ~53% of European resorts face very high snow-supply risk at +2°C, rising to ~98% at +4°C; with snowmaking on 50% of pistes, those figures fall to 27% and 71% (Nature Climate Change). Coastal golf is following the same arc, with about 28% of the England & Wales coastline experiencing erosion above 0.1m/year (ClimateChangePost; Burgess et al. 2004). This scan reads ski and coastal golf as leading indicators of how physical exposure becomes financial exposure, not as evidence that the NFL or World Cup figures are themselves realised.

Signal 6

The liability layer is the part most often over-read, so this scan is deliberately strict about it. Heat-exposure liability is live but concentrated in youth and scholastic negligence, including a \$10m settlement (2022) paid by a Georgia school district over the 2019 heatstroke death of 16-year-old student athlete Imani Bell (CNN; The Conversation). This scan does not support the generalisation that a professional-venue liability wave has arrived: no professional-tier exposure ruling was identified here. On the insurance side, carriers increasingly require loss-control and continuity plans as a condition of capacity, though sport-specific premium percentages remain qualitative and are not quantified in this scan.

***From where Sport Singularity sits.** The re-pricing is happening on the balance sheet before it happens in the courtroom, vendors are already attaching dollar figures to physical exposure (MetLife at 184% of replacement value is the line that should focus minds), while liability remains, in this scan, a scholastic-negligence story. That ordering matters: by the time exposure becomes a professional-tier ruling (the wild card paired with Trend 3), the actuarial verdict will already have been priced in. The deeper signal is geographic. Insurability and erosion do not fall evenly; they fall on the least-defensible venues and the least-resourced clubs first, the same regressive gradient running through this scan. Predictive intelligence is the only instrument that lets exposure be managed rather than simply repriced and abandoned.*

Sport Singularity editorial voice

The Ocean Has Shifted From Backdrop to Governing Layer

Three signals converge here. Signal 1 (sovereign ocean intelligence arrives), Signal 2 (pathogens postponed the Paris 2024 triathlon) and Signal 3 (heat has already rewritten the rulebook) describe one underlying shift: the marine and climatic environment has moved from the set-dressing of sport to a gatekeeper that now decides venue, schedule and eligibility. This is an observed convergence, not a forecast; the evidence is already on the record.

For most of its history, the ocean and the wider climate sat behind sport as scenery, the bay a regatta crossed, the river a city swam, the heat a marathon endured. What this scan captures across three otherwise separate signals is that the environment has stopped being scenery and become a condition: an input that gates who competes, where the event is held, when it can start, and how safely it can proceed at all. None of the three signals is, on its own, a claim about the future; each is a documented fact, and it is their convergence that constitutes the trend.

Trend 1

Signal 3 establishes that heat already governs eligibility, schedule and venue. The evidence is physiological and on the record: the Tokyo 2020 collapses, the Olympic marathon relocated ~800km to Sapporo, the Doha 2019 DNF counts, and Medvedev's warning in ~35°C at the 2023 US Open, with the 85%/75% World Athletics survey behind them. The institutional response is now codified: WBGT thresholds across tennis, athletics, open-water swimming and football, with the ATP aligning to the WTA WBGT policy from the 2026 season. Heat is no longer something athletes endure; it relocates marathons and rewrites match protocol.

Signal 2 establishes that water quality governs the same way, and that the deciding variable is biological, not physical. The Paris 2024 men's triathlon was postponed after the Seine breached World Triathlon's *E. coli* threshold following rainfall, despite a ~€1.4bn clean-up, and the go/no-go calls were made reactively on daily dawn grab-samples. The variable that actually governed the event was a faecal pathogen tied to rainfall and combined-sewer overflow, not waves, currents or temperature.

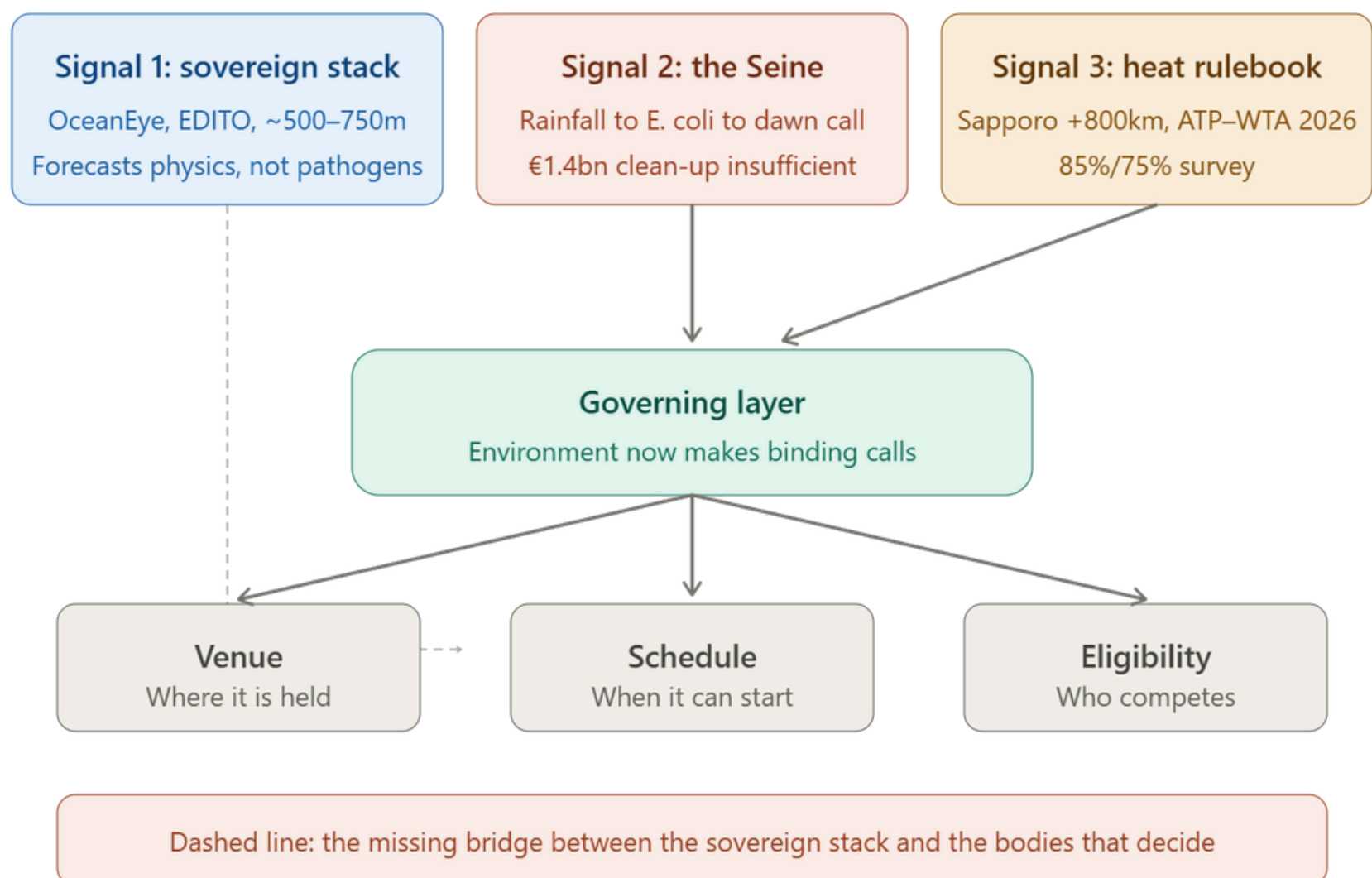
Trend 1

Signal 1 establishes that a sovereign intelligence layer for the ocean now exists, and that it forecasts the wrong variable. OceanEye was adopted on 3 June 2026, targeting 35% of the global observing system by 2035 and a free, fully operational European Digital Twin Ocean by 2030. The adjacent EDITO already delivers AI forecasting, seasonal chlorophyll, wave and tide prediction and a marine-plastic tracker, and Destination Earth's extremes twin can zoom to roughly 500 to 750m resolution on a fixed location and date, conceptually a near-perfect fit for a fixed-venue, fixed-date race. But this sovereign stack forecasts physics and biogeochemistry, not the faecal pathogens that decide aquatic events, so the governing layer is being built at sovereign scale precisely next to the variable that postponed Paris, and in this scan no institutional bridge was found between Copernicus/EDITO/Destination Earth and aquatic-sport governing bodies such as World Triathlon or World Aquatics.

Trend 1

Read together, the three signals describe a single structural shift. The environment now gates sport along three independent axes at once: heat decides eligibility and schedule (Signal 3), water decides whether an aquatic event runs at all (Signal 2), and a sovereign forecasting capability that could anticipate all of this exists but is unconnected to the bodies that make the calls (Signal 1). This scan does not support the generalisation that every sport everywhere is now environmentally governed in the same degree; the strongest, best-evidenced cases are aquatic, endurance and heat-exposed disciplines. But within that bound the direction is unambiguous: the ocean and climate have moved from backdrop to governing layer, and the decisions are currently being made reactively, at dawn, against fixed thresholds, with the most relevant predictive variable left unforecast.

Trend 1



From where Sport Singularity sits. The interesting thing is not that the environment matters to sport, that has always been true. It is that the environment has acquired the power to make binding decisions, and that those decisions are still being taken with a flashlight at 5am rather than a forecast. The sovereign stack to do better now exists; the bridge to the bodies that need it does not. Whoever builds that bridge will not be improving sport's relationship with the ocean, they will be deciding who gets to compete in it.

Sport Singularity editorial voice

Prediction Is Commercialising Faster Than It Is Becoming Public

Two signals converge here. Signal 1 (the sovereign OceanEye/EDITO stack arrives, with sport not in the room) and Signal 2 (the Seine postponed the Paris 2024 triathlon on a faecal-pathogen reading). Read together, they show a market splitting in two: decision-grade forecasting that decides whether an aquatic event can be held exists, but in this scan it is overwhelmingly private and bespoke, bought for one elite venue, while the free, sovereign stack being built at continental scale forecasts almost everything except the variable that actually makes the call.

Trend 2

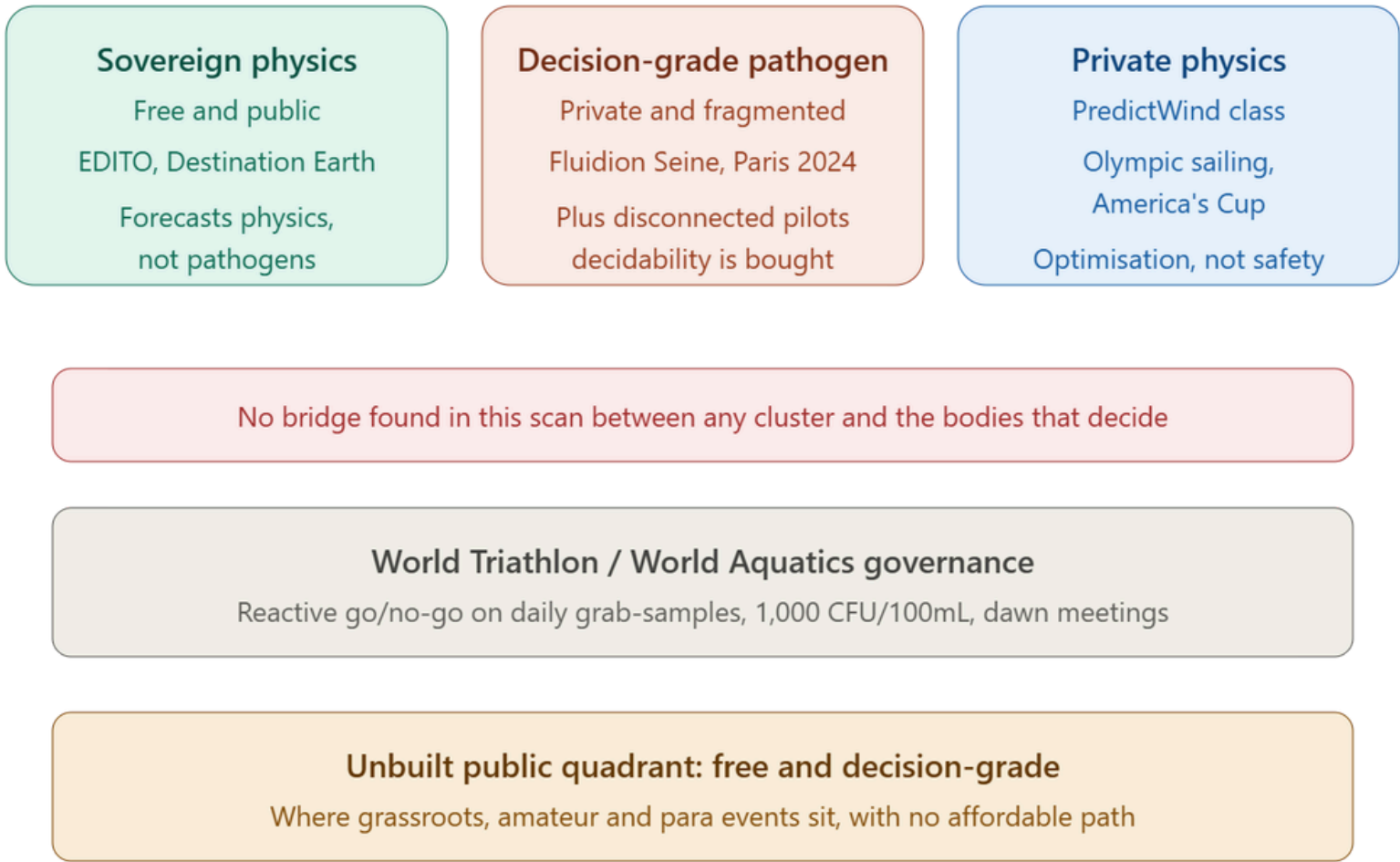
Take the two signals in sequence. Signal 1 is supply at sovereign scale: OceanEye, adopted 3 June 2026, free and public by design, and underneath it EDITO already integrates Copernicus Marine and EMODnet data and runs AI forecasting via GLONET, seasonal chlorophyll, wave and tide, a marine-plastic exposure tracker and a Communities at Risk tool, with Destination Earth's extremes twin zooming on demand to roughly 500 to 750m on a named location and event, conceptually a near-perfect fit for a fixed-date, fixed-venue race.

Signal 2 is the demand that actually decides events, and it points where the sovereign stack does not. The Paris 2024 men's triathlon was postponed after the Seine breached the *E. coli* threshold following rainfall, despite a ~€1.4bn clean-up, with go/no-go made reactively on daily grab-samples. The deciding variable was a faecal pathogen; the sovereign stack forecasts physics and biogeochemistry, not the pathogens that decide aquatic events.

Where the two collide, the market has split into three clusters this scan can name, and the public, decision-grade quadrant is empty. First, mature private physics: PredictWind-class high-resolution wind/wave/current forecasting already runs Olympic regattas and the America's Cup, proof that sport will buy bespoke prediction, but for optimisation, not safety. Second, private and fragmented decision-grade pathogen prediction: the bespoke Fluidion/Bayesian Seine models built for Paris 2024, plus scattered local pilots such as Hong Kong's operational beach-water forecast, US Great Lakes nowcast models, and Barcelona's IMPETUS QMRA combined-sewer-overflow early-warning pilot. Decision-grade pathogen forecasting therefore exists, but in this scan it was bought for one elite event or sits in disconnected municipal pilots. Third, the sovereign physics stack (EDITO, Destination Earth), free and public, but forecasting everything except the go/no-go variable.

Trend 2

The connecting line between any of this and aquatic-sport governance is the one this scan could not find. We found no evidence that the local pathogen pilots are tied to the sovereign EU platform, and no institutional bridge between Copernicus/EDITO/Destination Earth and bodies such as World Triathlon or World Aquatics. The shape of the gap matters: it is not that governing bodies sit low on a single readiness ladder, it is that two systems must meet and currently do not, sovereign-scale physics on one side, decision-grade pathogen prediction on the other, and the only place they have met so far is inside a bespoke, paid-for service procured by an Olympic host. This scan does not support the generalisation that no public pathogen forecasting can exist; it supports the narrower finding that the free-and-decision-grade combination was not identified anywhere here.



Trend 2

That is where the equity through-line lands directly: bespoke decidability is bought. Paris commanded Fluidion-style sensing because Paris could. The empty public quadrant is exactly where youth, amateur and para events live, the cohorts that will never afford bespoke pathogen modelling. A sovereign, free, predictive water-safety layer would not merely be an innovation; it would be the equity instrument, protecting the events that elite money already protects for itself. Commercialisation racing ahead of publication is therefore not a neutral sequencing problem; it is a distributional one.

***From where Sport Singularity sits.** The instinct is to read private moves first as the normal, benign order of innovation, vendors prototype, the public sector standardises later. In aquatic sport we read it as a window that is quietly closing. The decision-grade variable has now been demonstrated as buyable (Fluidion at Paris 2024) and as fundable at sovereign scale (OceanEye, free to the public by design), but those two facts have not been introduced to each other, and the longer they stay apart, the more decision-grade forecasting hardens into a service you procure rather than a public good you inherit. OceanEye is fresh, its public-engagement lane is funded yet unclaimed by sport, and a 2027 Ocean Act legislative moment is coming. The bridge between the sovereign stack and aquatic-sport governance is, on this scan, still unbuilt, which is precisely why it is still buildable, and why building it public is an equity decision, not a technical one.*

Sport Singularity editorial voice

Insurance and Liability Are Redrawing Sport's Viable Geography

Three signals converge here. Signal 4 (the regressive £320m UK grassroots weather bill), Signal 5 (the adaptation gap deepest for para-athletes and under-resourced schools) and Signal 6 (the ~\$11bn NFL-stadium re-pricing) describe one movement: exposure and adaptation capacity pulling in opposite directions, so the places and people most at risk are precisely those least able to insure, repair, or staff their way out. This is a reasoned convergence of three verified lines, not a single proven law; this scan does not find a single dataset that proves the inverse relationship as a measured global outcome.

Trend 3

The exposure side is hardening into balance-sheet numbers. Signal 6 captures the re-pricing directly: up to ~\$11bn across the 30 NFL stadiums by 2050, MetLife alone at 184% of replacement value, and 37 global venues rising from ~\$130m (2020) toward ~\$800m (2050). Stranded-asset templates already exist outside the stadium, ~53% to ~98% snow-supply risk for European ski resorts at +2°C to +4°C, and ~28% of the England and Wales coastline eroding above 0.1m/year. The scan reads these as leading indicators of an asset class being re-rated, not yet a settled market.

The liability side is live but, in this scan, narrowly placed. Heat-exposure liability is real, a \$10m settlement (2022) followed the 2019 heatstroke death of 16-year-old Imani Bell in Georgia, but concentrated in youth and scholastic negligence, not a professional-venue wave. Carriers increasingly require loss-control and continuity plans as a condition of capacity, though the sport-specific premium effect remains qualitative here. The governance scaffolding is moving in parallel: WBGT thresholds spreading across tennis, athletics, open-water and football, with the ATP aligning to the WTA WBGT policy from the 2026 season, a shift this scan reads as guidance hardening toward a standard of care.

Trend 3

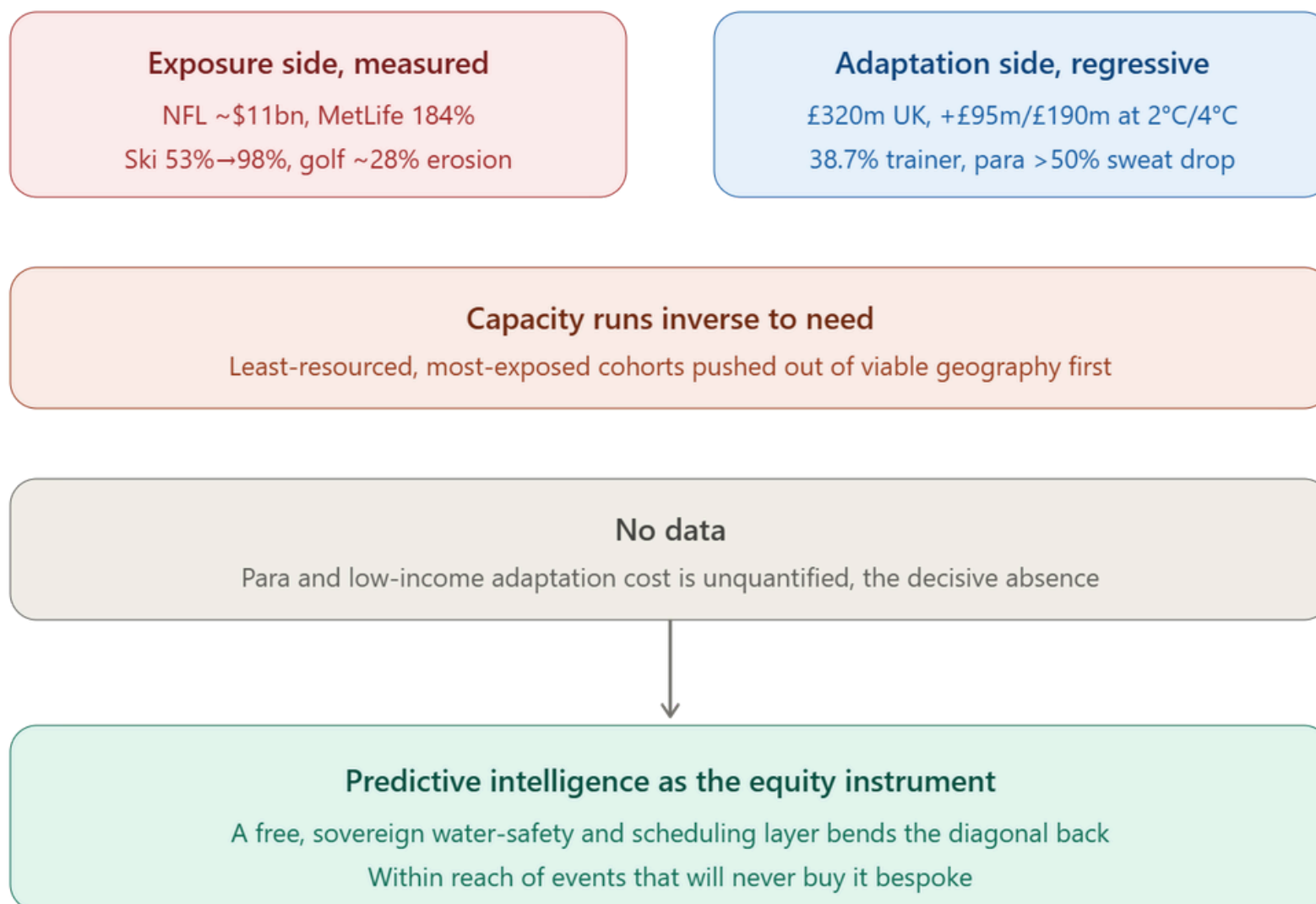
The adaptation side runs the other way, and this is the trend's load-bearing claim. Signal 4 establishes the regressive structure within one national line: £320m a year for UK grassroots sport, an additional £95m at 2°C and £190m at 4°C, and ~120,000 grassroots football matches cancelled annually in England. The Reading/BASIS line warns grassroots sport risks becoming elitist because lower-resourced clubs cannot protect their grounds, a UK-grounded, globally-extrapolated risk, not a measured worldwide outcome. Signal 5 sharpens the same gap to the individual body. Only 38.7% of US public secondary schools had a full-time athletic trainer and 26.9% had none, with no-trainer schools carrying markedly higher free/reduced-lunch eligibility (52.9% vs 41.1%). Against ~9,200 US high-school athletes suffering time-loss heat illness annually, and exertional-heat-stroke survival approaching 100% with cold-water immersion within ~10 minutes, the least-resourced athletes carry the highest heat risk and are least likely to have anyone on site who can save them. Para-athletes sit at the most acute intersection: a more than 50% sweat-rate reduction in tetraplegia versus paraplegia, 78.6% of paratriathletes reaching core temp 39.5°C or above and 57% self-reporting symptoms, and only the ITF with a heat policy for spinal-cord-injury athletes. Polluted water compounds it, ~18% skin illness in the SCI subgroup at London 2012, the highest organ-system incidence at Tokyo 2020, and a 42% versus 8% GI attack rate after sewage-polluted swimming.

Trend 3

Signal 5 sharpens the same gap to the level of the individual body. The athletic-trainer evidence (Barter et al., 2023; 3,482 US public secondary schools, 15 selected states, so national is approximate) found only 38.7% had a full-time athletic trainer and 26.9% had none, and no-trainer schools carried markedly higher free/reduced-lunch eligibility (52.9% vs 41.1%). Against ~9,200 US high-school athletes suffering time-loss heat illness annually, and exertional-heat-stroke survival approaching 100% with cold-water immersion within ~10 minutes, the least-resourced athletes carry the highest heat risk and are least likely to have anyone on site who can save them. Para-athletes sit at the most acute intersection: tetraplegia is associated with a more than 50% reduction in estimated whole-body sweat rate versus paraplegia (Price & Campbell 2003, an exercise-in-heat study, not a universal resting measure); in paratriathlon data (28 athletes, 33°C air) 78.6% reached core temp 39.5°C or above and 57% self-reported heat-illness symptoms; and only the ITF (wheelchair tennis) had a heat policy for spinal-cord-injury athletes. Polluted water compounds it, skin conditions reached ~18% of illnesses in the SCI subgroup at London 2012, dermatology had the highest incidence (1.1/1,000 athlete-days) at Tokyo 2020, and a 42% GI-illness attack rate followed swimming in sewage-polluted seawater versus 8% in non-polluted (Harder-Lauridsen et al., 2013).

Trend 3

The decisive finding is an absence. This scan found no quantified cost estimates isolating the climate burden on para-athletes or lowest-income cohorts. The exposure side is being priced in billions; the adaptation side for those most exposed is not being priced at all. That asymmetry, measured exposure against unmeasured, unfunded adaptation, is the mechanism by which capacity runs inverse to need, and the data gap is itself the finding.



The Decisive Variable Is Governed by a Different System Than the One Being Built

The forecast that decides whether an aquatic event can safely run, faecal pathogens and combined-sewer-overflow risk, is not the forecast the sovereign ocean stack produces. This scan found no institutional bridge between Copernicus/EDITO/Destination Earth and any aquatic-sport governing body, and no public evidence of a free, predictive, decision-grade water-safety service. The gap is not a low rung on a readiness ladder; it is a specific empty quadrant.

A readiness ladder would tell us that aquatic-sport governance is behind and needs to climb. In this scan that framing misreads the failure. The problem is not that the bodies sit low on a single scale of preparedness, it is that two different things must meet and currently do not. The intelligence being built at sovereign scale (OceanEye, EDITO, Destination Earth) forecasts physics and biogeochemistry: currents, waves, tides, chlorophyll, coastal flooding, marine-plastic exposure. The variable that actually decides an aquatic event, the *E. coli* count judged against World Triathlon's 1,000 CFU/100mL threshold, driven by rainfall and combined-sewer overflow, is governed by an entirely separate, mostly reactive system of dawn grab-samples. Both can be mature, and the event can still be ungoverned, because the two never connect.

To map that precisely we introduce a bespoke instrument.

A transparency note. The Aquatic-Sport Governing-Layer Exposure Map is a proprietary analytical framework developed by Sport Singularity for this series. We state that openly: it is our product concept, our interpretive lens on the evidence, not an external standard or a finding reported by any source in this scan. The facts plotted on it trace to the verified evidence base; the axes, the quadrant logic, and the white-space diagnosis are ours.

The framework. Two axes. The X-axis is sovereignty of the intelligence, from Private/Bespoke (left) to Sovereign/Free-Public (right): who controls and pays for the forecast. The Y-axis is decidability for aquatic events, from Forecasts Physics Only (bottom) to Forecasts the Go/No-Go Variable (top), the go/no-go variable being faecal pathogens and CSO risk. Crossing them yields four quadrants, and the diagnosis lives in which one is empty.

The Gap

Forecasts the go/no-go variable, pathogens and CSO

Q2: private decision-grade

Fluidion Seine models, Paris 2024

Hong Kong, Great Lakes,
Barcelona IMPETUS pilots

Bought by elite venues
decidability is bought

Q4: sovereign decision-grade

Empty

A free, public, predictive
water-safety and scheduling layer

Where grassroots and
para events live

Q1: private physics

PredictWind class

Olympic regattas,
America's Cup

Optimisation, not safety

Q3: sovereign physics

EDITO, Copernicus, EMODnet

Destination Earth, ~500–750m zoom

Free and public, but forecasts
everything except pathogens

Forecasts physics only

Private and bespoke

Sovereign and free-public

Diagonal: the maturation path Q1 to Q4

No bridge found into Q4 from either Q2 or Q3

What exists, and what is missing

Read across the map, the existing capability is real and well-evidenced; it simply sits everywhere except the quadrant that matters.

What exists, captured in this scan: sovereign physics and biogeochemistry at scale (Q3), where EDITO integrates Copernicus Marine and EMODnet data with GLONET AI forecasting, seasonal chlorophyll, wave and tide forecasting, a marine-plastic exposure tracker and a Communities at Risk tool, and Destination Earth's extremes twin zooms on demand to ~500 to 750m; bespoke decision-grade pathogen prediction for one elite event (Q2), the Fluidion/Bayesian Seine models built for Paris 2024; fragmented local pathogen pilots (Q2) such as Hong Kong's beach-water forecast, US Great Lakes nowcast models, and Barcelona's IMPETUS CSO early-warning pilot; mature private weather and ocean forecasting in sport (Q1), PredictWind-class wind, wave and current for Olympic regattas and the America's Cup, for optimisation, not safety; reactive go/no-go governance, daily grab-samples judged against World Triathlon's 1,000 CFU/100mL in dawn meetings; and a funded sovereign cultural-engagement lane with a legislative moment, OceanEye's public-engagement pillar, EU4Ocean, Ocean Observation Week (2027), and the forthcoming Ocean Act (2027, via a revised Maritime Spatial Planning Directive).

What is missing, not identified anywhere in this scan: the Q4 service itself, a predictive pathogen pipeline fused into a forecast-led go/no-go and scheduling tool, with no public evidence of one operating; any institutional bridge between Copernicus/EDITO/Destination Earth and aquatic-sport governing bodies such as World Triathlon or World Aquatics; a shared, forecast-based decision standard to replace reactive dawn grab-sampling; a free, public route to decision-grade water-safety intelligence for youth, amateur and para events, the cohorts that will never afford bespoke sensing, which is the equity mechanism, not a separate story; sport's claim on the empty OceanEye cultural-engagement lane; and quantified climate-cost data isolating para-athletes and lowest-income cohorts, a genuine data gap and research priority, itself a finding.

What exists, and what is missing

What exists

Q3 sovereign physics

EDITO, Copernicus, Destination
Earth, ~500–750m zoom

Q2 bespoke pathogen

Fluidion Seine, Paris 2024

Q2 local pilots

Hong Kong, Great Lakes,
Barcelona IMPETUS

Q1 private physics

PredictWind, optimisation
not safety

Reactive governance

Dawn grab-samples,
1,000 CFU/100mL

Funded cultural lane

EU4Ocean, Ocean Obs.
Week 2027, Ocean Act 2027

What is missing

The Q4 service itself

Forecast-led go/no-go and
scheduling, none operating

Any institutional bridge

EDITO to World Triathlon
or World Aquatics

A shared decision standard

Forecast-based, replacing
reactive sampling

A free public route

For youth, amateur, para,
the equity mechanism

Sport's claim on the lane

The empty OceanEye
cultural-engagement pillar

Para and low-income cost

A data gap and research
priority, itself a finding

The core white space. The empty cell is Q4: sovereign-and-decision-grade. It is not a high rung no one has climbed; it is a quadrant no one has occupied. Both routes into it are unbuilt, there is no bridge upward from sovereign physics (Q3) that adds the pathogen layer, and none rightward from the bespoke pathogen models (Q2) that makes them free and public. The decisive observation is that in this scan decidability is bought: the only decision-grade pathogen prediction we found was the bespoke kit commissioned for one elite event. That is exactly why the empty public quadrant is where grassroots, amateur and para events live, they sit at the bottom-left of the map with no affordable path to the top-right.

Scope discipline. This is a synthesis of individually well-evidenced components, and the gap is framed as an absence we could not find filled, not a proven non-existence. Each box on the map traces to the verified base; the claim no bridge found is bounded to this scan. This scan does not support the generalisation that no such service could exist or is being attempted privately, only that none surfaced in the public evidence reviewed.

***From where Sport Singularity sits.** The instinct in foresight work is to grade institutions on a ladder and tell them to climb. The map argues the opposite: aquatic-sport governance does not need to climb a known path so much as someone needs to build the rung that isn't there. The sovereign stack is being constructed for climate and biodiversity policy, and by quiet adjacency it is the future governing layer for who competes, where, when and how safely, but only if the pathogen layer and an institutional bridge are added. The equity stakes make the quadrant logic concrete: as long as decidability is something you buy, the empty public quadrant is precisely where the under-resourced are stranded, and a free sovereign forecasting layer is the single instrument that doubles as the equity fix. The bridge into Q4 is the most original, defensible position available, and in this scan we could find no one occupying it.*

Sport Singularity editorial voice

The First Professional-Tier Athlete Wins a Heat-or-Pollution Liability Ruling

A professional-tier athlete, or their estate, brings and wins a negligence or duty-of-care claim over heat or polluted-water exposure at a sanctioned elite event, breaking liability out of the youth and scholastic pattern that, in this scan, is the only place such cases have so far landed. No professional-venue precedent was identified; this is an anticipatory claim, not an observed one.

This is a scenario assessment, not a prediction.

***Wild card:** A low-probability, high-impact event that could disrupt the entire landscape overnight.



The trigger has three legs, and what makes it non-linear is that they are independently maturing and would only need to align once. The first is an existing liability template, confined to youth/scholastic negligence: the \$10m settlement (2022) over the 2019 heatstroke death of 16-year-old Imani Bell. It establishes that a duty-of-care breach over heat exposure is litigable and expensive, but only below the professional tier. The second is the hardening of environmental thresholds from guidance into something that looks, in court, like a standard of care: World Triathlon's 1,000 CFU/100mL E. coli threshold, and WBGT heat protocols now formalising across tennis, athletics, open-water and football, with the ATP aligning to the WTA WBGT policy from the 2026 season. Once a federation writes a numeric threshold, a plaintiff can argue that crossing it and proceeding anyway is negligence per se. The third is documented exposure at the elite level itself: the Paris 2024 postponement, the Tokyo 2020 collapses, the Doha 2019 DNF counts, and Medvedev's warning in ~35°C at the 2023 US Open. The evidentiary record of harm at sanctioned elite events already exists; what does not yet exist is a winning professional-tier suit that fuses these legs into precedent.

The non-linearity is in the second-order effect, not the verdict itself. A single adverse ruling would not merely add one liability; it would reclassify federation thresholds from advisory guidance into an enforceable standard of care overnight, and that reclassification is what carriers price against. This is why the scenario is high-impact despite low near-term probability: the change is a phase shift in legal status, not an incremental cost.

Pairs with Trend 3. If it materialises, this Wild Card accelerates exactly the re-pricing Trend 3 describes: carriers building loss-control and continuity into capacity, and the viable geography of elite events contracting toward venues and dates that are defensible in court, the same dynamic that, on the equity axis, pushes the least-resourced and most-exposed cohorts out first.

***From where Sport Singularity sits.** The figure that should keep federation general counsel awake is not the \$10m Imani Bell settlement, it is the gap between that settlement and the elite tier, because every condition that produced it now exists one tier up. The numeric thresholds the sport movement adopted to protect athletes are also, read in a courtroom, the precise lines whose crossing converts a tragedy into a breach. In this scan the professional-tier claim has no precedent; the honest reading is that this is a low-probability scenario, not a forecast. But the indicators to watch are unglamorous and already in motion, an insurer's capacity clause, a motion-to-dismiss ruling, a contested cancellation, and the institution that treats decision-grade environmental forecasting as a defence rather than a courtesy is the one that will still be sanctionable when the standard of care moves.*

Sport Singularity editorial voice

Wild Card 1: first professional-tier heat or pollution ruling

Pairs with Trend 3, low probability, high impact

Trigger

A professional-tier athlete or estate brings and wins a negligence claim over heat or polluted-water exposure, breaking out of the youth and scholastic pattern

Probability

Low near term, liability concentrated in youth negligence, \$10m Imani Bell, 2022
No professional-venue precedent, the claim is anticipatory

If it materialises

Thresholds (1,000 CFU/100mL, ATP–WTA WBGT) shift from guidance to standard of care
Carriers price loss-control and continuity into capacity
Viable geography contracts toward defensible venues, accelerating Trend 3

Early weak indicators

Capacity clauses requiring loss-control; federations formalising WBGT into binding protocol
A pro-level suit surviving dismissal; an event cancelled then contested on the data

A Pathogen Cluster at a Marquee Open-Water Race Makes the Sport Un-Sanctionable Without a Forecast

A marquee open-water or triathlon event proceeds, or is reactively cancelled too late, and a cluster of competitors suffers serious illness from a warming-amplified pathogen, turning the abstract warm-water trend into a single, televised, attributable harm. This is not a forecast but the concrete face of a hazard trend that is already rising while detection stays reactive. This is a scenario assessment, not a prediction.



Three legs hold this scenario up, each independently evidenced in this scan. The first is the warming-amplified hazard itself: *Vibrio vulnificus*, which thrives in warm brackish water, rose roughly eightfold in the eastern US between 1988 and 2018, with the northern extent of cases shifting north about 48km a year and wound-infection fatality as high as ~18% (Nature, 2023). One Netherlands modelling study (data 2009 to 2021) finds *Vibrio* concentrations rise by a factor of ~1.5 per °C; this scan flags that as a single-study figure, not a universal constant, while noting other studies project larger increases (factors of ~1.6 to 7.6). The second is the documented attack rate that makes a cluster credible: a 42% gastrointestinal-illness attack rate after swimming in sewage-polluted seawater versus 8% in non-polluted water (Harder-Lauridsen et al., PLOS One 2013). The third is the detection gap: go/no-go calls are still made reactively, via daily dawn grab-samples judged against fixed thresholds, as at Paris 2024. A grab-sample tells you about the water that was tested, at the time it was tested; it does not forecast the water athletes will swim in.

The non-linearity sits in that gap. The underlying hazard trend is a slow, continuous climb, northward range expansion, rising concentrations per degree of warming. But the event is discontinuous: it converts a statistical trend into a named, attributable harm at a marquee venue, on camera, with identifiable victims. That is the mechanism that flips a nice-to-have forecasting capability into a precondition for holding the event at all. The scan does not support the claim that this is likely; it supports the claim that the hazard is rising and the detection method is structurally blind to the variable that decides events.

A bounding note this scan insists on: the plastisphere-to-athlete-infection chain, microplastics as a vector for antibiotic-resistant pathogens, is plausible and growing in the literature but is not demonstrated to cause documented athlete infection, and is therefore not treated as a present-day hazard here.

Wild Card 2

Pairs with Trend 1. If this materialises, it is the hardest possible expression of Trend 1: the deciding variable for whether a race can be held is a pathogen the sovereign ocean stack forecasts everything around but not directly. It would force the empty Q4 quadrant from optional white space to mandatory infrastructure, and harden the ocean's role from condition to gatekeeper.

***From where Sport Singularity sits.** The danger in this scenario is not the pathogen, it is the latency. A grab-sample at dawn is a measurement of yesterday's risk presented as today's permission. The hazard trend in this scan moves smoothly; the institutional response will not, because it waits for a body, a name, a broadcast. The cheapest moment to build the forecast is before the cluster, not after it, and the events that will never be able to buy a bespoke sensing rig are precisely the youth, amateur and para races that have the least margin to absorb a bad call.*

Sport Singularity editorial voice

Wild Card 2

Wild Card 2: open-water pathogen event at a marquee race

Pairs with Trend 1, low probability, high impact

Trigger

A marquee event proceeds or is cancelled too late and a cluster falls seriously ill
The 42% vs 8% GI attack rate made real; echoes Vibrio's ~8× rise 1988–2018
~48km/yr northward shift, ~18% wound-fatality, ~1.5×/°C sensitivity

Probability

Low for a single event; hazard trend rising, reactive grab-sampling leaves a detection gap

If it materialises

Open-water events become un-sanctionable without decision-grade pathogen forecasting
The empty Q4 layer shifts from optional to mandatory; the ocean's role hardens

Early weak indicators

Northward Vibrio expansion near event waters; rising sewer overflow after rainfall
Post-race illness clustering; federations adding pathogen forecasting to bid rules

Caveat: plastisphere-to-athlete-infection chain plausible but unproven, not a present-day hazard

So What Now?

This scan does not end on a prediction. It ends on a position. Across six signals and three trends, one shape kept recurring: the environment now governs sport, the sovereign intelligence to anticipate it now exists, and the two have not been introduced to each other. The forecast that decides whether an aquatic event can safely run is governed by a different system than the one being built at continental scale, and no institutional bridge between them was found.

That absence is not a deficit to apologise for; it is the opportunity, read honestly. OceanEye is fresh, its cultural-engagement lane funded and unclaimed by sport, and a 2027 Ocean Act legislative moment is approaching. The empty Q4 quadrant, sovereign, free-public, decision-grade water-safety forecasting, is not a high rung no one has climbed; it is a quadrant no one has occupied. As long as it stays empty, decidability remains something an Olympic host buys, and the youth, amateur and para events that will never afford bespoke sensing stay stranded.

So the question this scan leaves open is not whether the ocean will keep governing sport, the evidence on that is already on the record. It is who will build the bridge, and whether it will be built public. Whoever does will not be improving sport's relationship with the ocean. They will be deciding who gets to compete in it.

So What Now?

OceanEye is fresh

Adopted 3 June 2026

Cultural lane open

Funded, unclaimed by sport

Legislative moment

Ocean Act, 2027

The unbuilt bridge into Q4

Sovereign, free-public, decision-grade

The open question

Who builds it, and whether it is built public

**“The ocean is already
deciding who
competes. The only
open question is who
holds the forecast...”**

-SF4Sport, 2026

**it's time to change
the rules.**

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