River Plastic Interceptor

Nine autonomous interceptors worked five rivers through two monsoon pulses. This report covers what the fleet caught, what broke, what we changed, and what must happen before the water rises again.

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PLASTIC INTERCEPTED

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INTERCEPTORS ON STATION

across five rivers

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PLASTIC INTERCEPTED	**INTERCEPTORS ON STATION**	**FLEET UPTIME**
+38% on Season 02	across five rivers	against a 92.0% target

1.MISSION RECAP

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Tideworks operates river plastic interceptors: moored, solar-charged machines that harvest floating debris before it reaches the sea. The logic is blunt. Roughly a thousand rivers carry about eighty percent of the plastic entering the ocean, and a river mouth is the last point where that material is still concentrated, still dry enough to bale, and still cheap to handle. Once it disperses at sea, recovery cost rises by an order of magnitude and the clock starts on fragmentation.

1.MISSION RECAP

> *A tonne stopped in the river costs a tenth of a tonne chased at sea — and it never becomes microplastic.*

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Season 03 ran the full fleet from April to October: nine interceptors across the Klang, Río Ozama, Citarum, Motagua and Juan Díaz. The season target was 2,000 tonnes at 92 percent fleet availability, with zero bycatch incidents. We closed at 1,842 tonnes and 94.2 percent uptime, with one bycatch near-miss described in the incident log below.

2.SYSTEM ARCHITECTURE

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Every interceptor is the same four-stage chain, sized to its river. A floating barrier crosses the debris line at an angle, using the current itself to walk material toward the bank; a cleated conveyor lifts the catch out of the water; a shuttle on a 24-metre rail distributes it across six skips on a moored barge; a tug swaps the barge when the skips report full. No crew stays aboard — each machine reports over LTE and falls back to satellite when the cell network drowns in a storm.

2.SYSTEM ARCHITECTURE

FIG 01 · INTERCEPTOR CHAIN — RIVER TO BARGE

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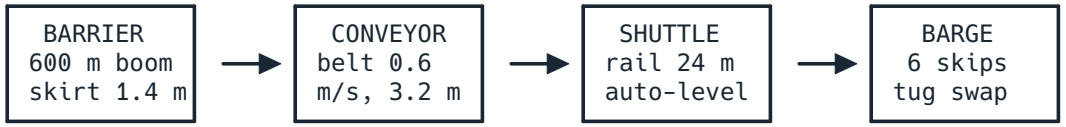

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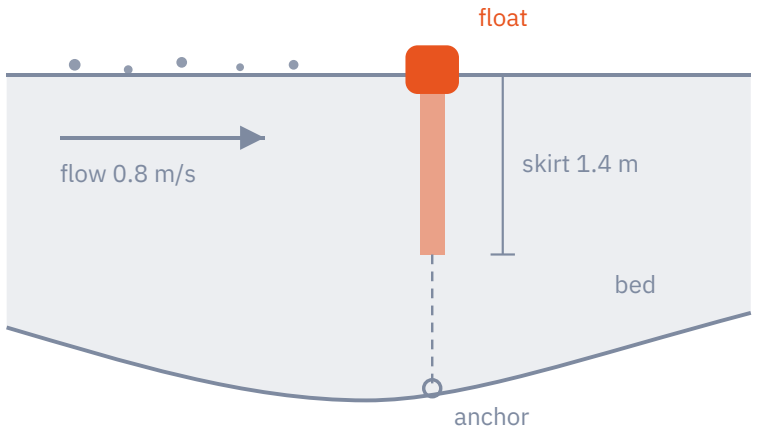

River cross-section at the barrier line. The skirt arrests the surface layer; fish, silt and the cold under-current pass beneath.

2.SYSTEM ARCHITECTURE

The barrier does no catching on its own — it is a fence, not a net. A 1.4-metre skirt hangs beneath the float line, deep enough to arrest the surface layer where better than ninety percent of buoyant plastic travels, and shallow enough to pass fish, silt and the cold under-current untouched. Skirt depth is the most argued number in the company; Season 03 held it at 1.4 metres on every river, and the bycatch record supports the choice.

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FIG 02 · POWER LOOP — ARRAY, BANK, WINCH

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Power is the quieter constraint. The solar array feeds a 9.6 kWh LFP bank through a charge controller, and the winch and conveyor drives are the only loads that matter. In a clouded monsoon week the bank runs the conveyor for roughly eleven hours a day — which is why the surge-shedding logic described below exists at all.

3.DEPLOYMENT LOG

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Excerpted from the season operations channel: one line per event that changed fleet state. Dates are local to each river, and an event is logged when the state change completes, not when it begins. Full logs, including the 4 Hz mooring-strain series, ship in the data annex.

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23 SEP	**Juan Díaz**	I-09 commissioned; first extraction after 38 min

4.EXTRACTION DATA

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Weighbridge totals per river, set against each river's share of the 2,000-tonne season target.[a] The Klang remains the workhorse of the fleet and closed within seven percent of its full-season number. The Motagua and Juan Díaz totals read low, but both stations commissioned mid-season; their run-rate across the final six weeks was on plan.

[a] Wet mass at the transfer weighbridge, corrected to dry-mass equivalent using per-river moisture coefficients sampled weekly.

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Juan Díaz	235 t	59%

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FIG 03 · EXTRACTION BY MONTH

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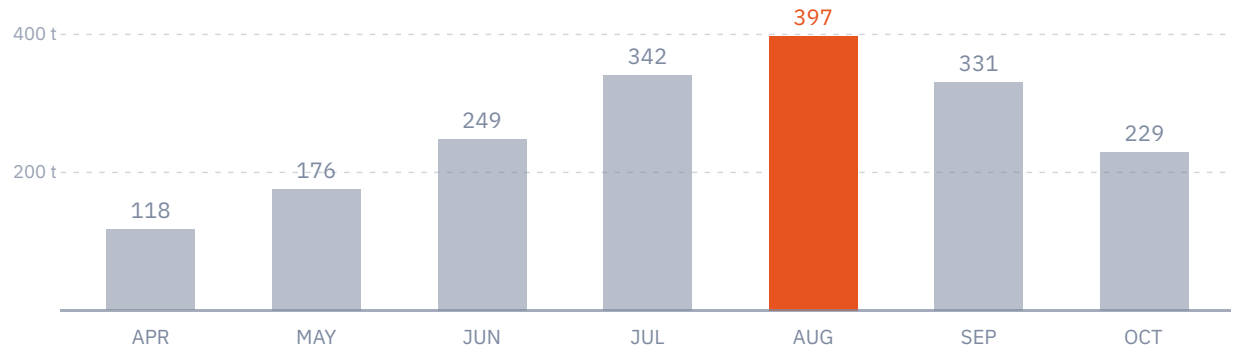

Monthly extraction, all rivers, tonnes dry-mass equivalent. August carried the monsoon peak.

4.EXTRACTION DATA

The August peak is the monsoon spike the fleet is built around: the same pulse that raises debris flux also raises current speed, and catch efficiency falls exactly when supply rises. The distance between those two curves is what the next-season work list attacks.

5.INCIDENTS AND FIXES

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Three events this season met the reporting threshold, and none released catch back to the river. The pattern behind all three is the same: monsoon-pulse loads exceeded the numbers the hardware was originally specified against, and the fixes below re-specify rather than patch.

5.INCIDENTS AND FIXES

> Debris-surge overload is the fleet's structural risk. On 08 SEP the Klang delivered six times its median flux inside two hours; mooring-leg strain reached 31.8 kN against a 36.5 kN design limit before shedding opened the gate. The margin was real, but thinner than we accept.

5.INCIDENTS AND FIXES

> Telemetry, not hardware: I-04 dropped its LTE link for nine days in June and buffered flawlessly to satellite -- but the satellite path silently discarded strain-gauge packets over 4 kB. The June strain series for the Citarum is interpolated where the annex shows a dashed line.

5.INCIDENTS AND FIXES

INC-07 · KLANG — During the 08 SEP surge, two 12 mm bow shackles on the upstream mooring leg showed fatigue cracking at the crown on post-event inspection. No failure occurred. Root cause: cyclic loading at a 4-6 second period from wake chop, a spectrum absent from the original specification. All shackles fleet-wide were replaced within 21 days.

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FIG 04 · WINCH WATCHDOG (EXCERPT)

5.INCIDENTS AND FIXES

```
# rpi-telemetry/watchdog.py -- trip shedding before the strain limit does
WINDOW_S = 120 # rolling window, seconds
LIMIT_KN = 36.5 # mooring design limit
DUTY_MAX = 88.0 # winch duty ceiling, percent

def poll(bus):
    strain = bus.window("moor.strain_kn", WINDOW_S)
    duty = bus.window("winch.duty_pct", WINDOW_S)
    if strain.mean() > 0.8 * LIMIT_KN and duty.peak() > DUTY_MAX:
        bus.publish("mode.request", "SHED") # open gate, park conveyor
        log.warning("shed: %.1f kN, %.0f%% duty", strain.mean(), duty.peak())
    return Health(strain=strain.mean(), duty=duty.peak())
```

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WHAT WE CHANGED

5.INCIDENTS AND FIXES

1

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2	**Strain telemetry**	Every mooring leg now carries a load pin sampled at 4 Hz, feeding the watchdog excerpted in FIG 04.

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3	**Barge-swap protocol**	The tug now holds station downstream during the exchange; median swap time fell from 26 to 11 minutes.

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4	**Surge shedding**	Above six times median flux the barrier gate opens and the conveyor parks; catch resumes when the pulse passes.

6.NEXT SEASON

RISING WATER

and the work before it

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Season 04 adds two rivers and freezes the fleet hardware — the only change aboard is the shackle re-specification already shipped. The budget moves to software: a dispatch model that forecasts debris pulses from upstream rainfall, staging barges before the surge instead of after it.[b] If the model earns trust on the Klang, the whole fleet stops being reactive the following year.

[b] The pulse model trains on three seasons of flux data against upstream gauge networks; pilot deployment on the Klang and Citarum begins in April.

6.NEXT SEASON

We end the season where the mission starts: the river is the cheapest place the ocean will ever be cleaned.