Feeding in deep farming
from a technology perspective

REPORTED bFCR in deep farming

1.05 → 1.37

What separates the two ends?

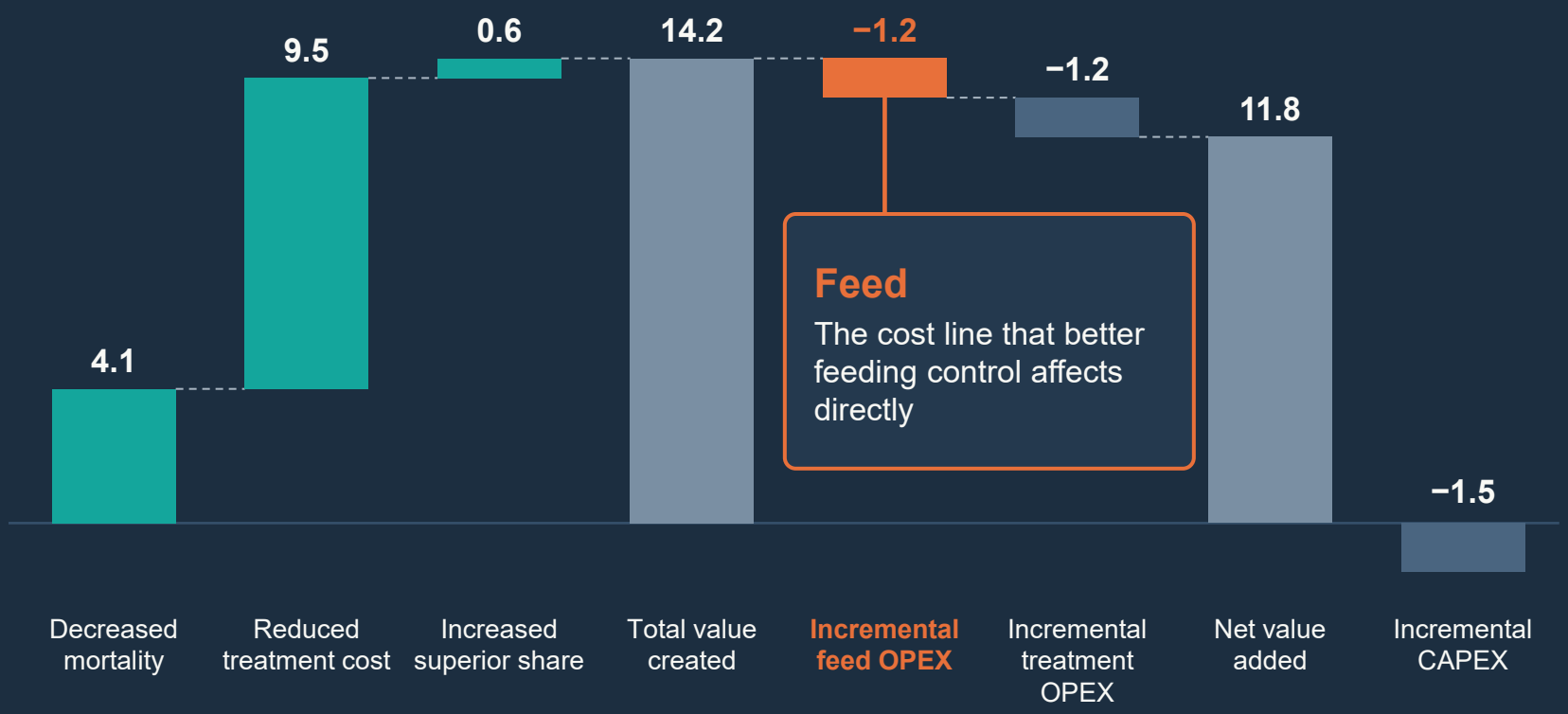
AKVA GROUP™

Deep farming works. Now we need control of the feeding.

Modelled business case for lice-exposed sites

ROI calculation for one harvest of submersible pens, MNOK

MODELLED



~12 MNOK

net value in the first harvest

~1.5 MNOK

extra capital cost versus surface pens

~8×

return on the first harvest

Biology delivers. Feed conversion varies widely.

What the move down has given, and where the results differ

REPORTED

80% fewer lice treatments

REPORTED

11 pp lower mortality

REPORTED

12 pp more fish graded superior

Biological feed conversion ratio (bFCR) in deep farming

REPORTED

1.05 — Very good feed performance is possible at depth

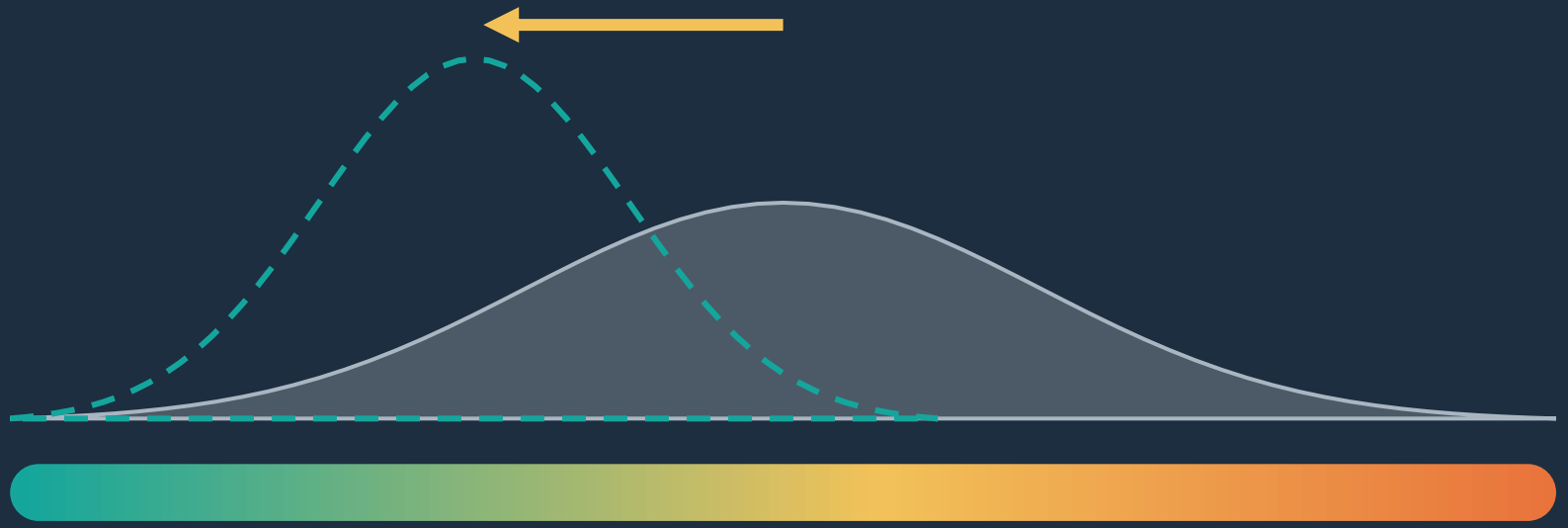
Not yet routine — **1.37**

CALCULATED

The gap: **0.32 kg** more feed per kg of growth
= 320 tonnes of feed per 1,000 tonnes produced

REPORTED

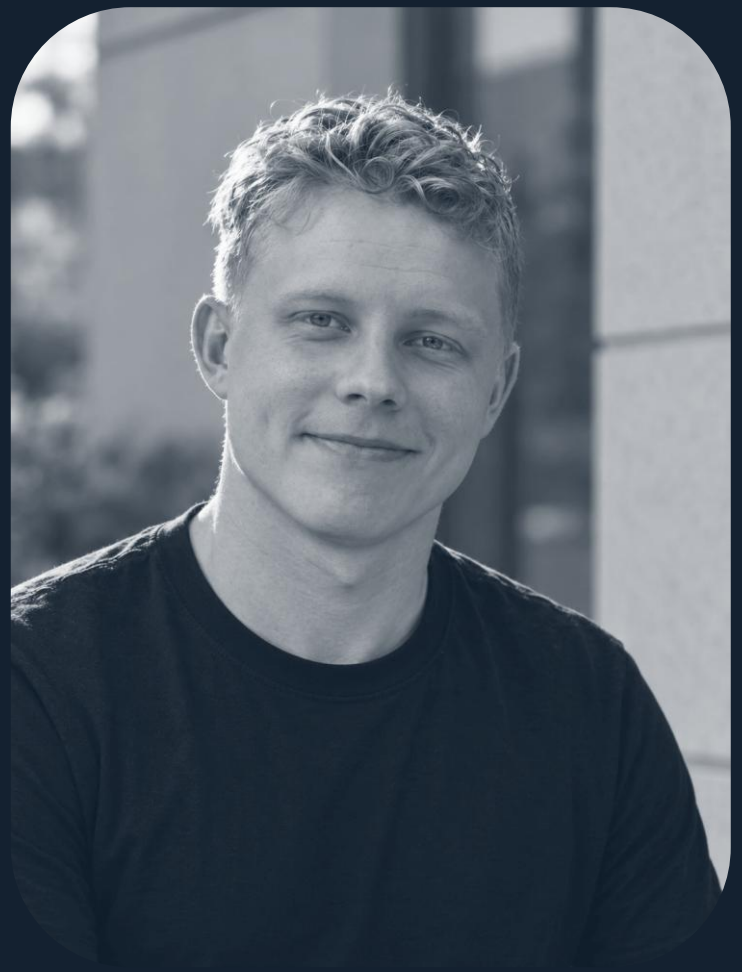
Reported on average: **5–10% higher** FCR
than conventional farming with airborne feeding



How do we reduce the variability and shift the curve to the left?

Odin S. Rørvik

Innovation department manager, Precision Feeding, AKVA group



Our focus: strengthening the *precision feeding loop*.

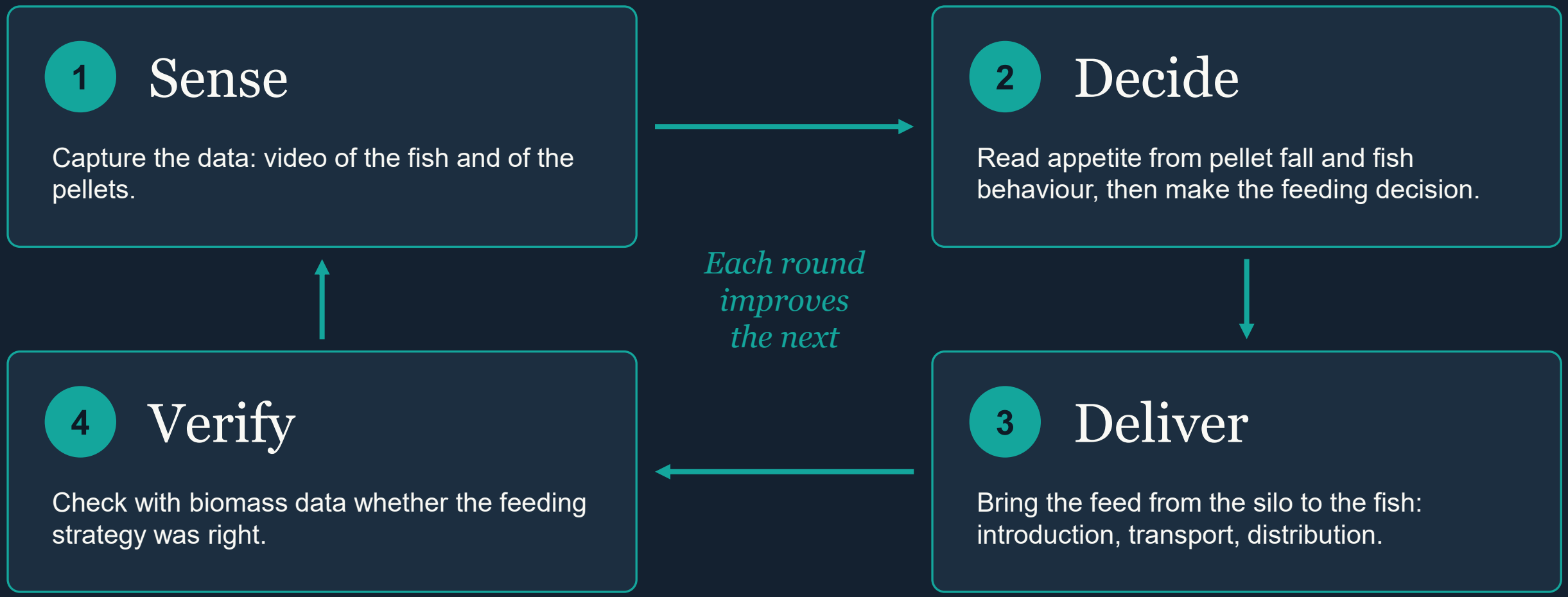
Developing technology that helps our customers achieve better results.

WHY I AM HERE

Not to give you all the answers. I don't have them. To share some thoughts, and to learn from your experiences.

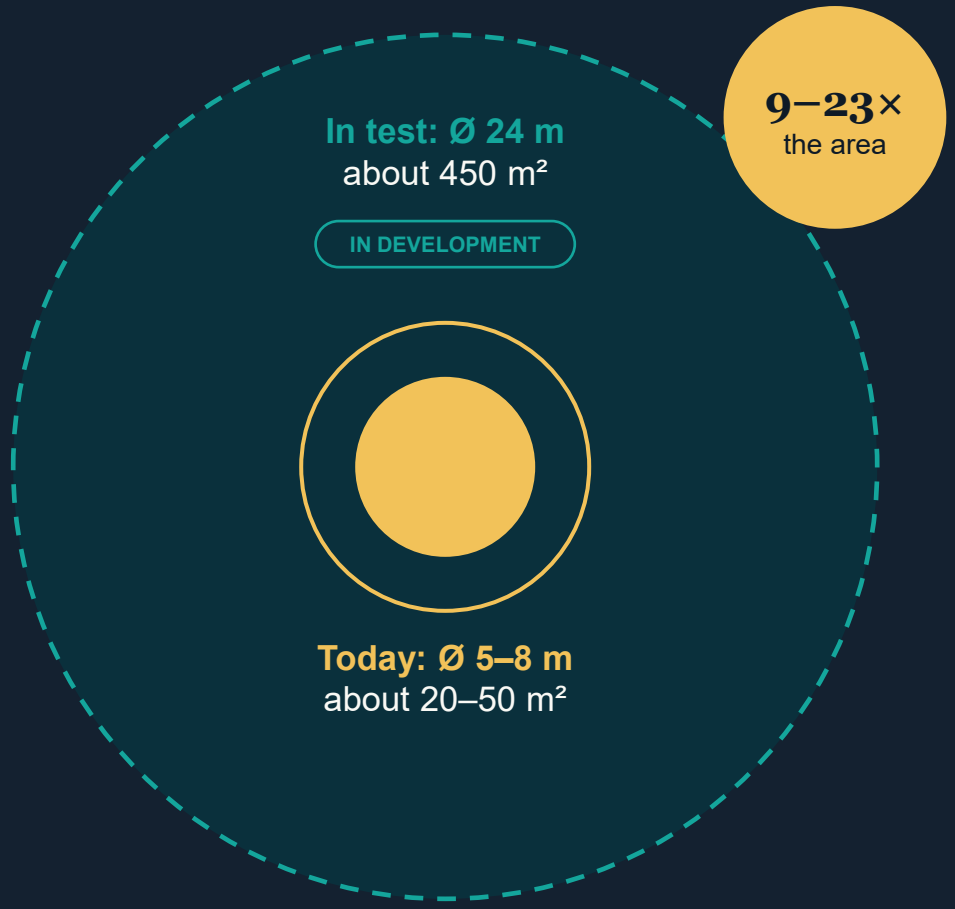
Feeding is a *self-reinforcing* loop

Sense, decide, deliver, verify



The feeding area is small, and fish crowd under it

Sense: where the pellets land, and what the operator can see



What operators tell us

- Fish crowd below the feed outlets
- The feeding area is close to the air dome, where fish refill their swim bladders
- Start and stop signals are hard to read

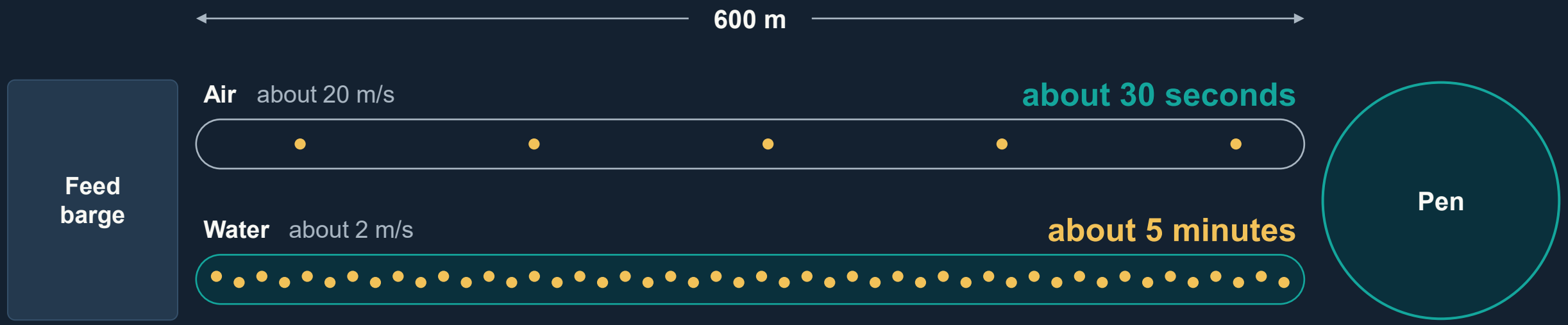


The Ø 24 m test is under way. No results yet.

Example frame from a SmartEye Modular camera.

A stop decision takes five minutes to reach the pen

Decide: the delay between decision and delivery



> Everything sent during the last five minutes is still on its way when the operator presses stop.

Observe: decision support for more consistent feeding

Decide: machine learning on camera data, now being adapted to deep farming



TODAY

A machine-learning decision tool that helps operators feed more consistently across multiple pens.

IN PILOT

Being made available for deep farming. Pilot projects are ongoing.

IN DEVELOPMENT

Algorithms that read fish behaviour, predicts appetite, and distinguish air-dome activity from feeding activity.

The potential: more consistent feeding at depth, and less variation in the results.

Not yet documented in deep farming. The pilots will show how much.

Pellet yield: losses compound from silo to fish

Deliver: three phases in air and in water, and a pellet that has to survive all of them

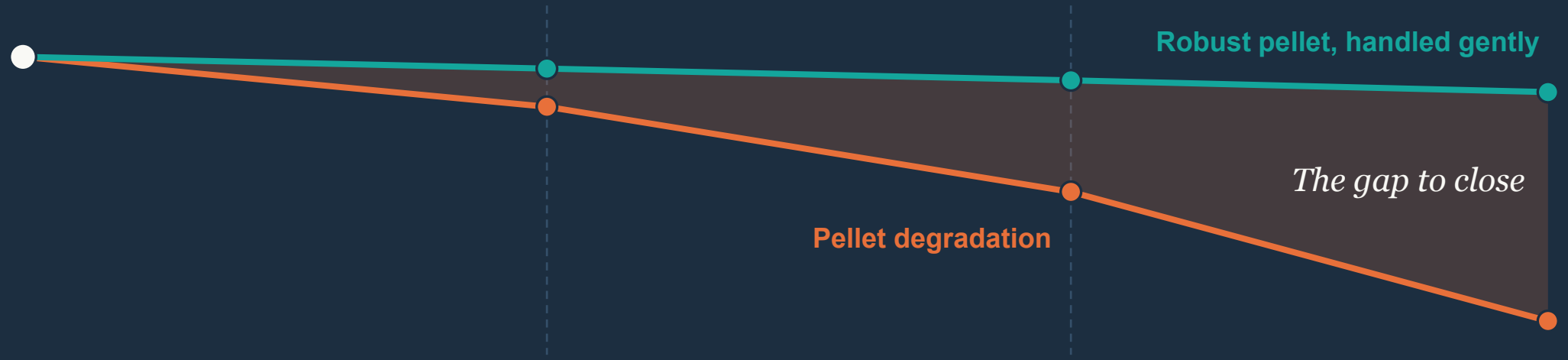
Airborne
dust and breakage

Waterborne
water exposure

Airborne	Dosed	Transported by air	Distributed above water, with a spreader
Waterborne	Introduced to water	Transported by water	Distributed under water

PELLET YIELD

the share of the nutrition that reaches the fish



In air we can measure pellet yield. In water, not yet.

Deliver: how do we determine the pellet yield?

AIRBORNE FEEDING

Standardised methods

We can determine the pellet yield.

Dust and breakage tests

WATERBORNE FEEDING

No standard method yet

Dust and breakage tests are not valid once the pellet has been exposed to water.

≈ 0.5%

dry-matter loss per 100 m

PRELIMINARY TEST

A rough rule of thumb from initial tests of transport methods, with the Institute of Marine Research. Depends on many variables.

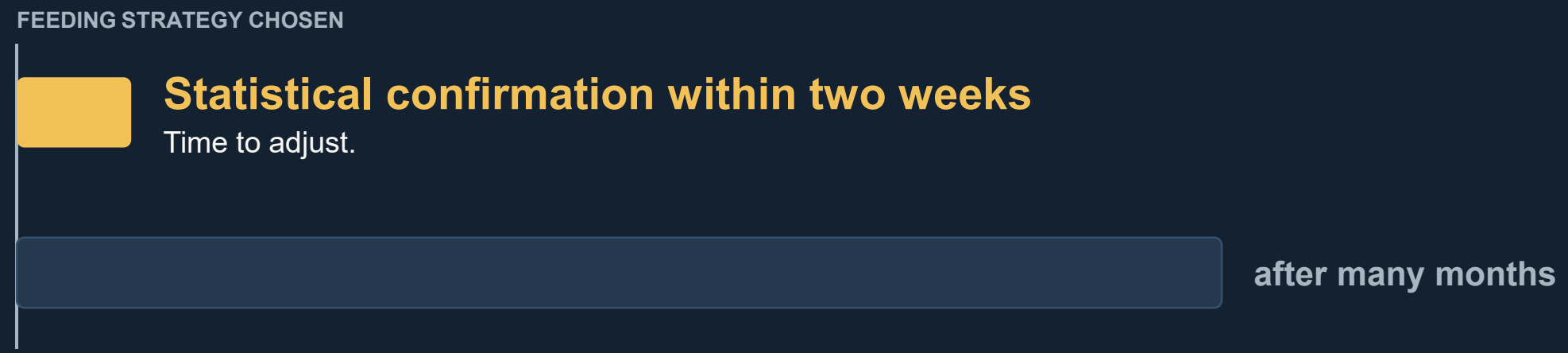
IN DEVELOPMENT

We're exploring new methods, and we welcome collaboration.

To benchmark new developments, and the pellet yield through different systems. We are not there yet. If you want to join, or want to know more. Reach out.

We can already verify within two weeks

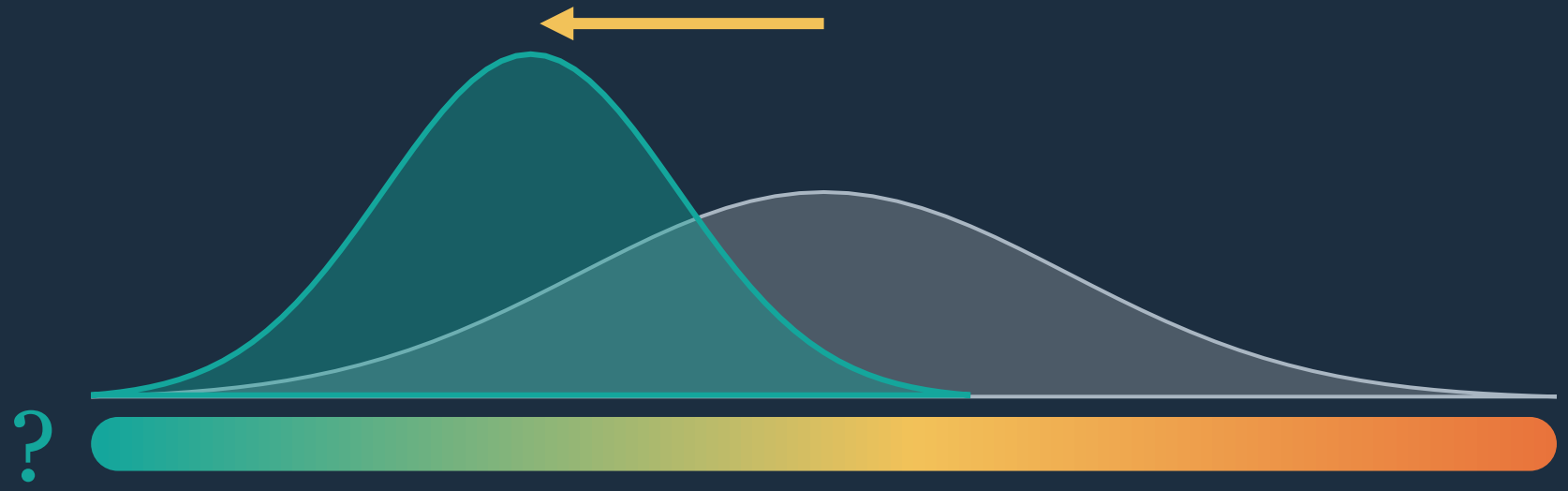
Verify: the step that makes the loop learn, and it is available today



What drives the variability and the higher FCR?

No single cause has been identified. Three places to look.





How?