

Collective action under shared biological risk: Evidence from pancreas disease control in salmonid aquaculture in Norway

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Presentation outline

Problem

Dilemma

Evidence

Implications

What would you do?

- Imagine you are a salmon farmer in this fjord. Your fish are infected with a contagious disease. You are told to depopulate immediately.
- If you:
 - Depopulate immediately → large loss
 - Delay → potential private gain, but risk spreading disease



Why this matters

- Pancreas disease is a highly consequential disease. It affects:
 - Fish welfare
 - Production efficiency
 - Market access
 - Causes losses at both farm and industry level

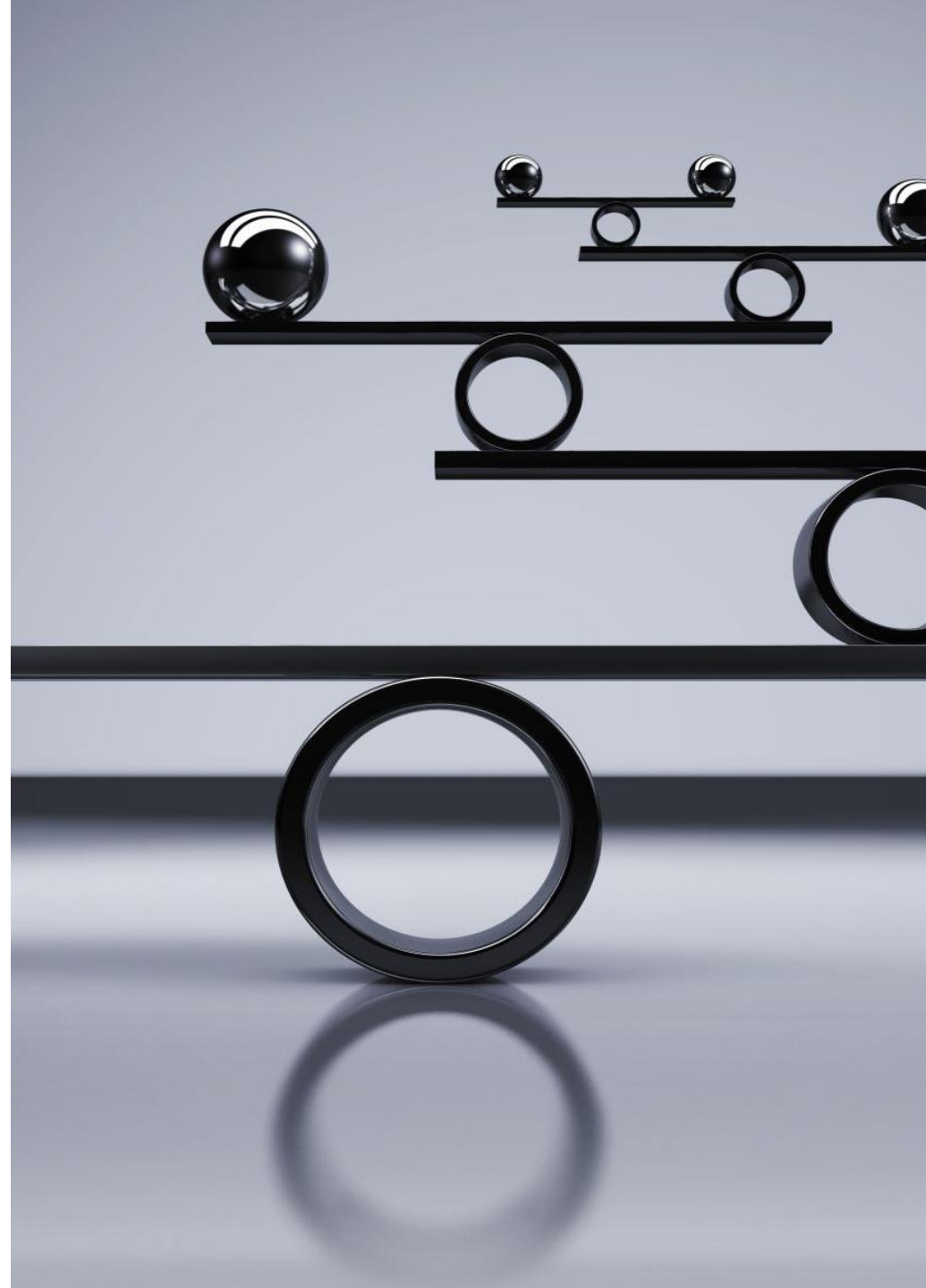
- Combined biological and economic challenge



Pancreas Disease (PD) in Atlantic salmon can have severe effects on growth.
Credit: Trygve Poppe

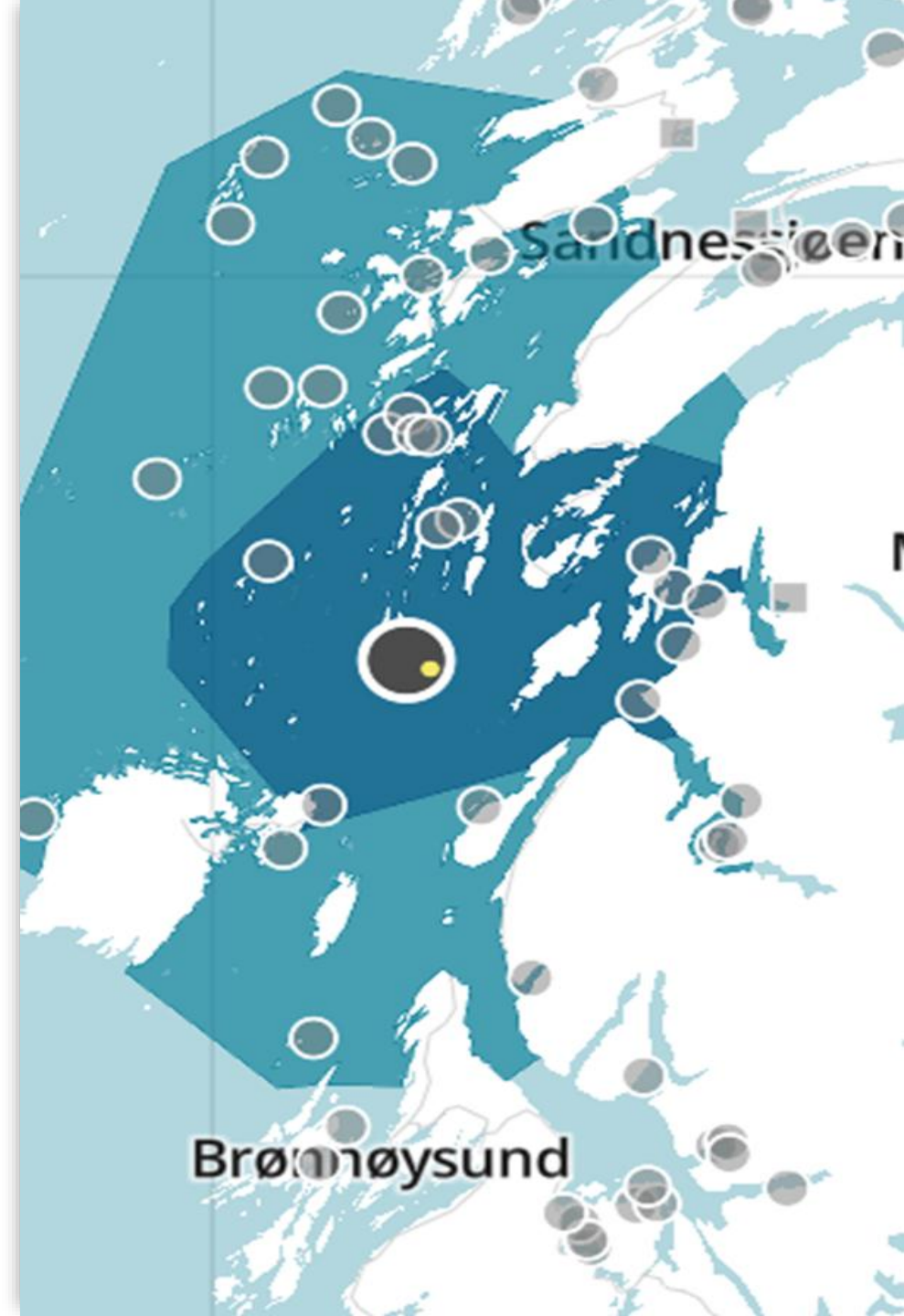
The dilemma ...

- Benefit for the system but costly for individuals
- Individual incentives from override
- Shift in burden



Case: Norway 2023

- Multiple outbreaks
- Non-endemic area
- Large variation in losses



Our approach

- Epidemiological model (spread)
- Economic model (profit)
- Compare strategies

Disease spread

- The epidemiological model simulates transmission between farms over space and time.
- It allows to explore:
 - Immediate vs delayed depopulation
 - Impact on neighbouring farms

Epidemiological Dashboard

Experiment Comparison (Advanced: Multi + Filters + Policy-Aware Overlays + Baseline Delta)

Filter experiments

Scenario

PO

Neighbor mode

Select experiments

Experiments (multi-select)

EXP_067 × EXP_068 × EXP_070 ×
EXP_071 × EXP_074 × EXP_072 ×

Metric + plot mode

Metric

infections = monthly incidence (new infections). infected_farms = currently infected farms (stock). prevalence = mean within-farm infection level.

Plot mode

- Absolute
 Difference vs baseline

Baseline experiment (for delta)

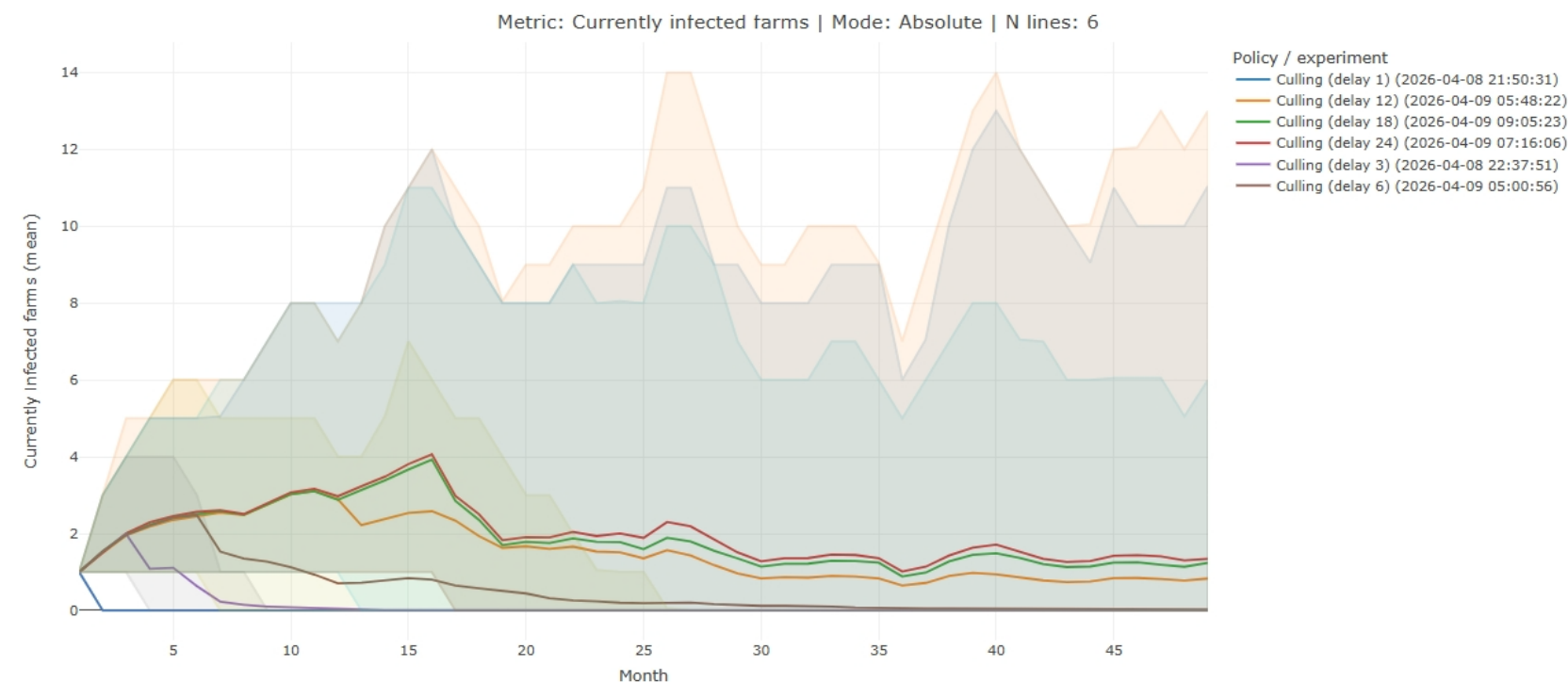
Show 90% interval (p05-p95)

Optional overlays

- Overlay all experiments matching current filters
 Overlay NULL policy experiments
 Overlay culling policies
 Overlay testing policies

Selected experiments metadata

experiment_id	policy_label	policy_family	timestamp	scenario	PO	neighbor_mode
EXP_074	Culling (delay 18)	culling	1775725523.00	PO8_modePO_km100_gen4_sims1000_sl3	8.00	PO
EXP_072	Culling (delay 24)	culling	1775718966.00	PO8_modePO_km100_gen4_sims1000_sl3	8.00	PO
EXP_071	Culling (delay 12)	culling	1775713702.00	PO8_modePO_km100_gen4_sims1000_sl3	8.00	PO
EXP_070	Culling (delay 6)	culling	1775710856.00	PO8_modePO_km100_gen4_sims1000_sl3	8.00	PO
EXP_068	Culling (delay 3)	culling	1775687871.00	PO8_modePO_km100_gen4_sims1000_sl3	8.00	PO
EXP_067	Culling (delay 1)	culling	1775685031.00	PO8_modePO_km100_gen4_sims1000_sl3	8.00	PO

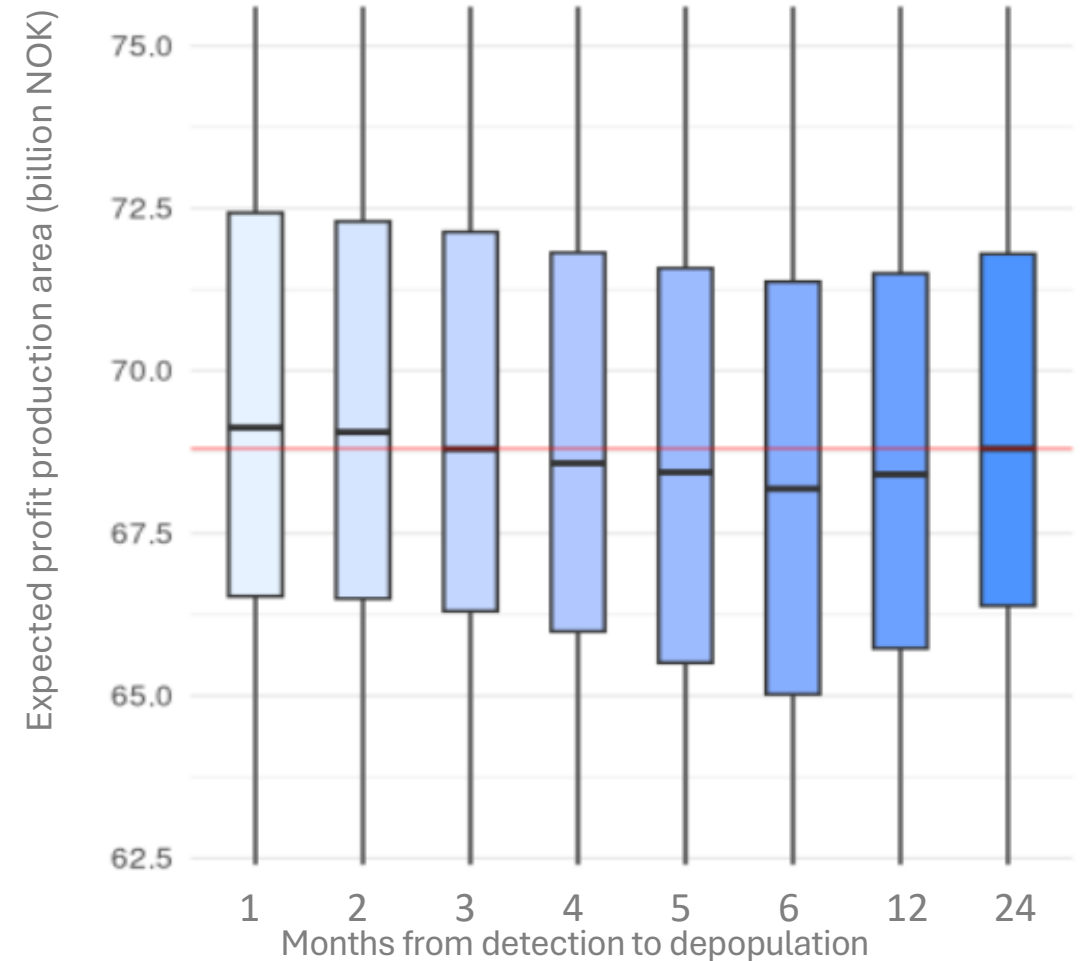


Economic impact

- The epidemiological model outcomes are translated into economic outcomes.
- Using partial budgeting approach, the model estimates profit.
- Farm vs area level efficiency shifts

Economic Dashboard & Results

- The dashboard is under development, but preliminary results show:
 - Immediate → best for area
 - Short delay → reduced benefit
 - Long delay → negative outcome



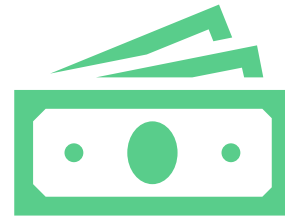
The core problem

- From the findings so far:
 - The system works from a biological and economic perspective
 - But incentives are misaligned

Implications



Full compliance cannot be assumed



Need aligned incentives



Policy design matters

Discussion

- Compensation mechanisms?
- Regulation vs coordination?
- Shared responsibility?

Take-home message

- Collective action problem
- Fast action benefits system
- Align incentives with outcomes

Scientifically ambitious,
forward-looking and collaborative
– for One Health



Norwegian
Veterinary Institute