Economics of diseases in aquaculture –how to quantify losses

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Intro: Why is quantification of losses usefull?

- Politicians respond to money!
- …and so does the farmers…!
- Helps to make choices:
  - Decide between tradeoffs
- Offers a possibility for evaluation of strategies
- As many factors as wanted can be included:
  - Only money
  - Also welfare
  - Societal consequences

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Where in Aquaculture can it be applied?

- Cost of disease outbreaks
- Cost-benefit of prevention
- Understanding incentives and constraints of
  - Farmers and
  - Decision-makers
- Insights into potential impacts of different policies
- For the individual farmer: What to do?

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Quantifying direct costs of diseases in Aquaculture –basic approach

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Preventive Veterinary Medicine

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Stochastic modelling of direct costs of pancreas disease (PD) in Norwegian farmed Atlantic salmon (*Salmo salar* L.)

Arnfinn Aunsmo [a,b,*], Paul Steinar Valle [a,c], Marianne Sandberg [a], Paul Johan Midtlyng [a], Torkjel Bruheim [d]

Preventive Veterinary Medicine

Volume 121, Issues 3–4, 1 October 2015, Pages 314-324

The economic benefits of disease triggered early harvest: A case study of pancreas disease in farmed Atlantic salmon from Norway

J.M. Pettersen [a], K.M. Rich [a, b], B.Bang Jensen [c], A. Aunsmo [d]

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Skills required for quantifying losses

- Familiarity with spreadsheets
- Basic epidemiologic knowledge
- Elementary calculus
- A great deal of stubbornness to get data….

…..And you're off!

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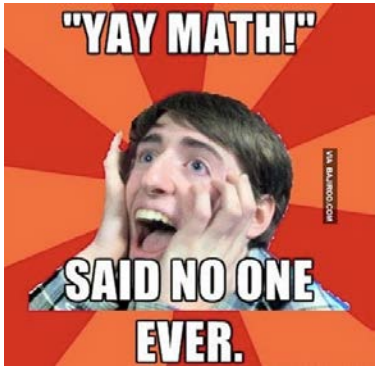
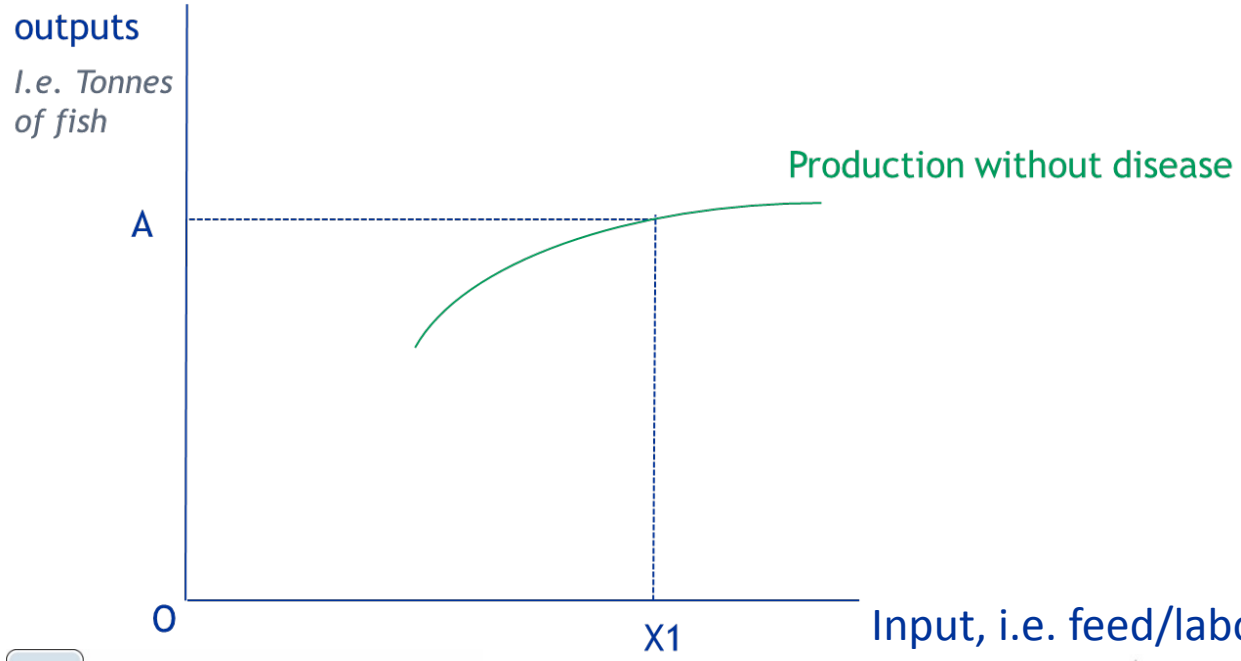
Model –Partial budgeting



- Direct Costs = BL + EC + T + P -I
- BL=Biological losses
- EC=extraordinary costs
- T=costs of treatment
- P=costs of prevention
- I=insurance pay-out

Biological losses DC = BL + EC + T + P -I



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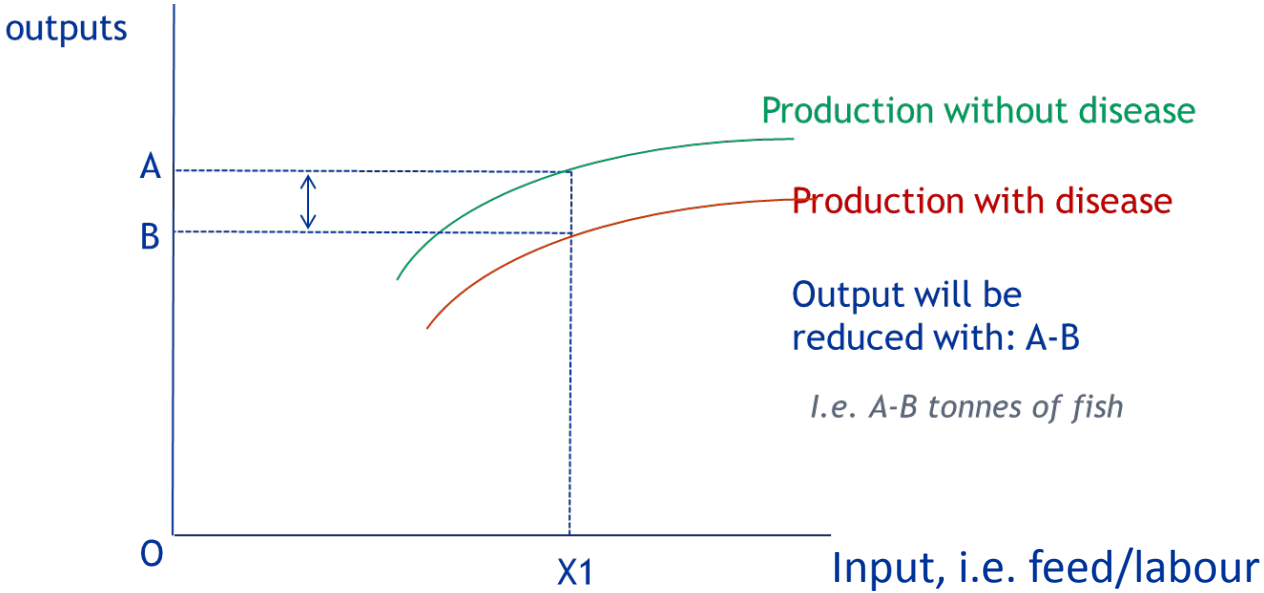
Biological losses DC = BL + EC + T + P -I



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Biological losses DC = BL + EC + T + P -I

- Data:
  - Mortality
  - Growth
  - Feed conversion
  - Quality of fish
- Sources of data:
  - Publications
  - Production / slaughter data
  - Expert panel
  - Sales data

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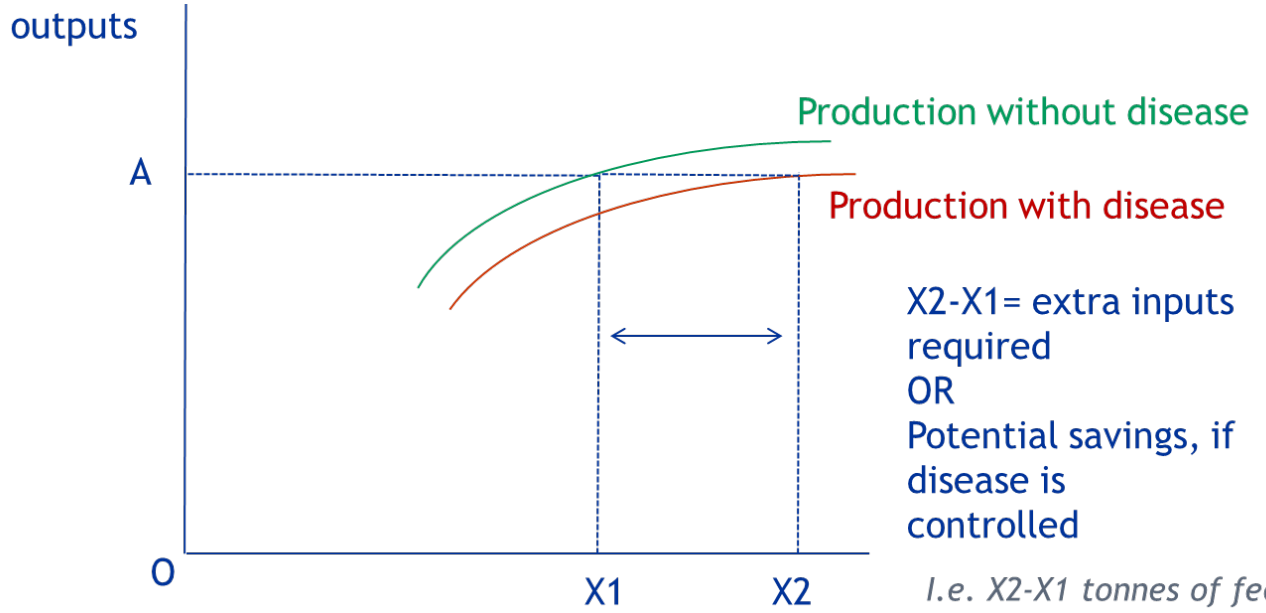
PD-example:

- Expert opinion
- 11 experts
- Compare to site without PD

Biological effects	Minimum	Most likely	Maximum
Biological feed conversion ratio	0.06	0.14	0.22
Harvest weight (kg)	−0.47	−0.99	−1.53
Weight mortalities (kg)	0.7	1.8	3.6
Ordinary quality (% of biomass)	1.3	3.3	7.8
Production quality (% of biomass)	0.9	2.7	6.7
Condemned (% of biomass)	0.8	1.9	4.1
Compensation for reduced growth (%)	11.4	44.9	81.9

Extraordinary costs DC = BL + EC + T + P -I



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Extraordinary costs

DC = BL + EC + T + P -I

- Data:
  - Labour
  - Equipment
  - Health surveillance
  - Wellboats
  - Feed
- Sources of data:
  - Questionnaires….

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Treatment and prevention DC = BL + EC + T + P -I

- Data:
  - Medicine
  - Vaccination
  - Functional feed
  - Equipment (ie.extra nets)
  - Extra labour
  - Wellboats
- Sources of data:
  - Veterinary registers
  - Vaccine companies
  - Production data
  - Expert panel
  - Questionnaire

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Examples of PD-costs

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Model component	Cost element	Source of data
Biological losses	Mortality, reduced growth, feed conversion and quality	Expert panel
Biological losses	Reduced price due to reduced quality	Expert panel combined with sales data
Biological losses	Managemental compensatory actions	Expert panel
Extraordinary costs	Mortality handling	Expert panel combined with outbreak questionnaire
Extraordinary costs	Labour, equipment, health surveillance, wellboat costs	Outbreak questionnaire
Treatment	Functional feed	Outbreak questionnaire
Prevention	Functional feed, improved nets, additional staff, wellboat costs, new sites, boats and land bases	Expert panel
Insurance	Pay-out	Expert panel combined with insurance company

Examples of PD-costs and prices

Variables	Costs and prices (NOK)
Sales price 2007	21.15
Price per kg feed	7.46
Cost of insurance	0.15
Financial costs	0.25
Smolt cost	8.08
Fixed cost (per smolt)	20.0

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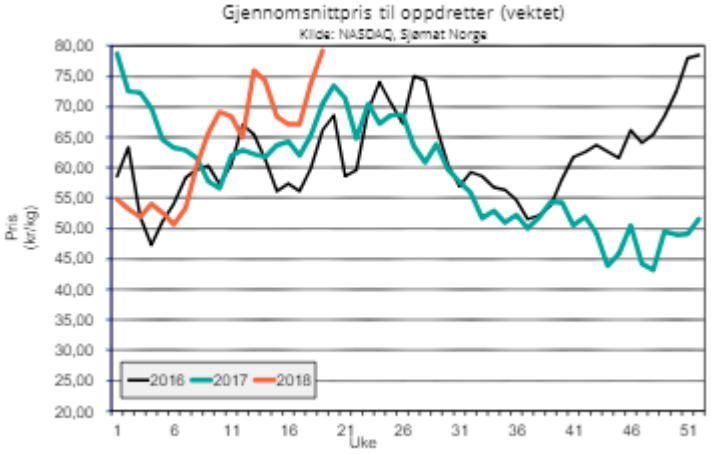
Dealing with uncertainties and variations

- Parameters vary from outbreak to outbreak
  - Mortality due to IPN: 2-30%
- Prices vary:
  - Sales price ie.
- Uncertainties of the effe
  - Ie. How well does the vac



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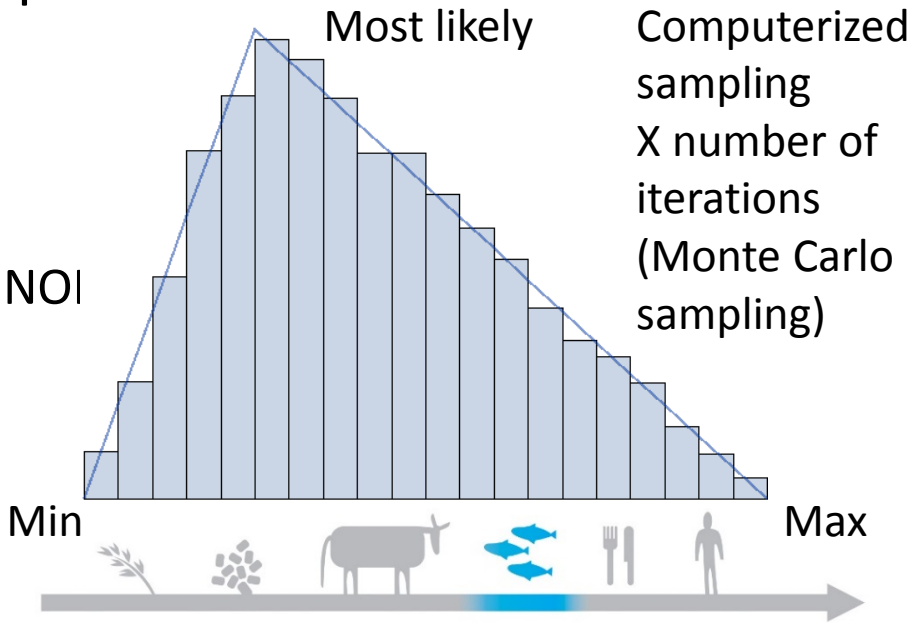
Dealing with uncertainties and variations

- Solution:
  - Put in distributions, and sample from these:
  - Sensitivity analysis:
    - Replace values, ie

    Sales prices (15NOK/20NOK/25NOI
  - Or report the span….



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Results PD-costs:

Model site stocked with 500,000 smolts.

	Mean in NOK million (5% and 95% percentiles)
Biological losses	12.8 (8.8, 17.2)
Extraordinary costs	0.8 (0.5, 1.2)
Costs of treatment	0.3 (0, 0.6)
Costs of prevention	0.8 (0.7, 1.0)
Insurance	−0.3 (−1.7, 0)
Direct costs of PD	14.4 (10.5, 17.8)

Take home message:

- Estimating losses is a powerfull tool
  - And not that difficult to perform…
- Biggest challenge is to obtain data on biological effects
  - But who would know, if not you?
- We need more studies on costs of diseases!!!

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