Dealing with escapement issues

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Content

Escapes of fish from aquaculture: causes, consequences and methods to prevent escape

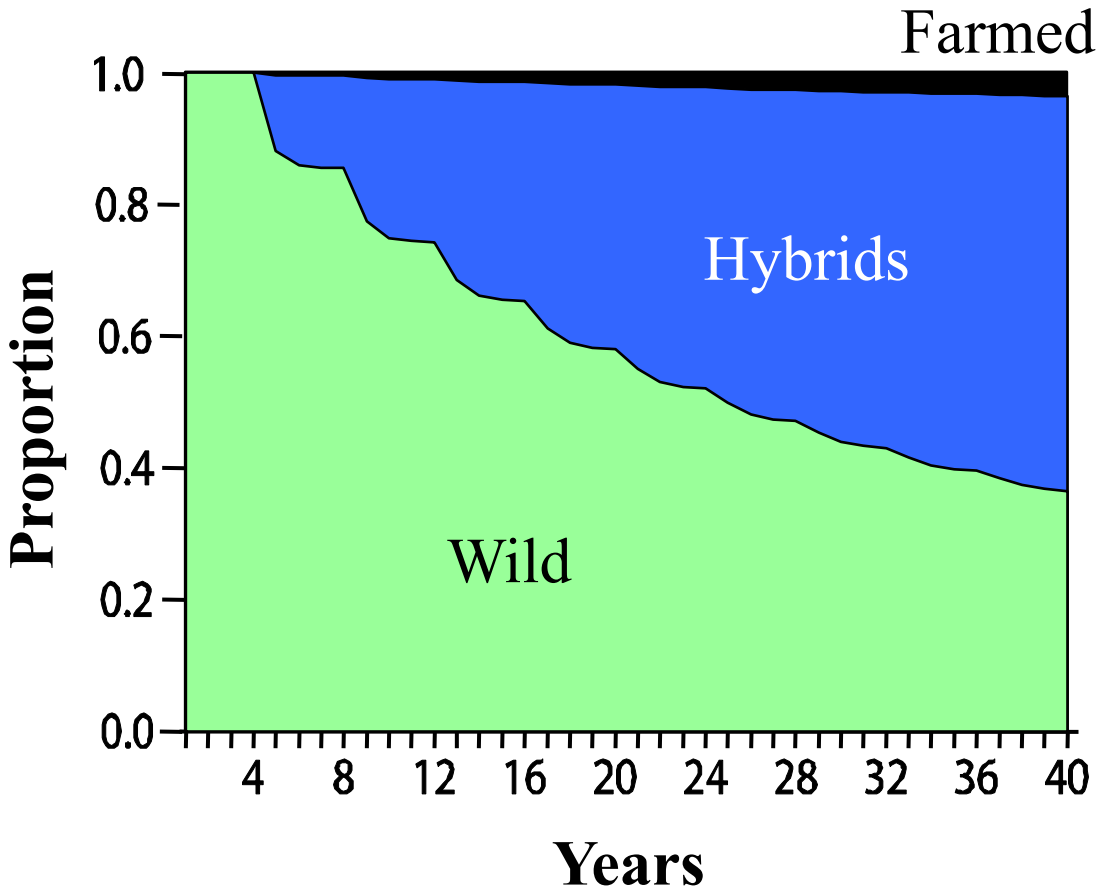
- Introduction and consequences
- Extent and causes of escapes
- Mitigating and preventing escapes
- Summary and recommendations

Why prevent fish escape

- Ecological “pollution” – threat to wild fish
  - Interbreeding between selected stock fish and wild stock
  - Introduction of new species
  - Competition for food and space
  - Transfer of pathogens and parasites
- Economy
  - Loss of stock and income
  - Cost related handle the escape incident
  - Public perception
- Responsibility towards the nature - ensure diversity of species

Introduction and consequences

Escape of farm salmon Norway

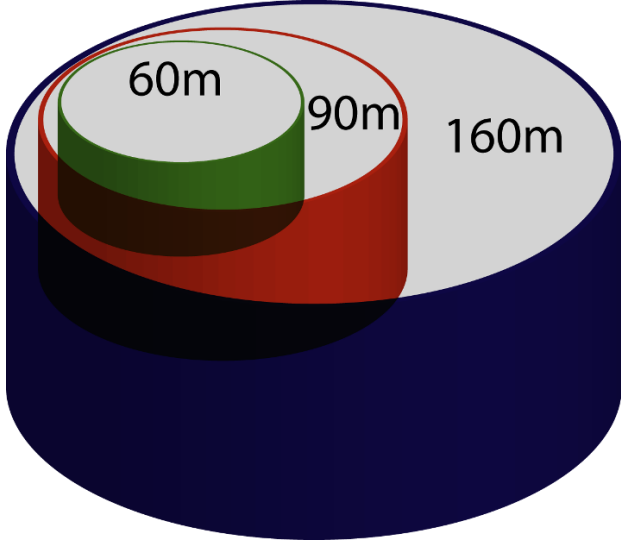


- A model of a **possible** situation for Norway
- 20% farm escapees in each generation
- Development of a salmon population, i.e. composition of the spawning stock
- Hybrids will dominate

Hindar, K., Fleming, I. A., McGinnity, P., and Diserud, O. 2006. Genetic and ecological effects of salmon farming on wild salmon: modelling from experimental results. – ICES Journal of Marine Science, Vol. 63

Introduction and consequences

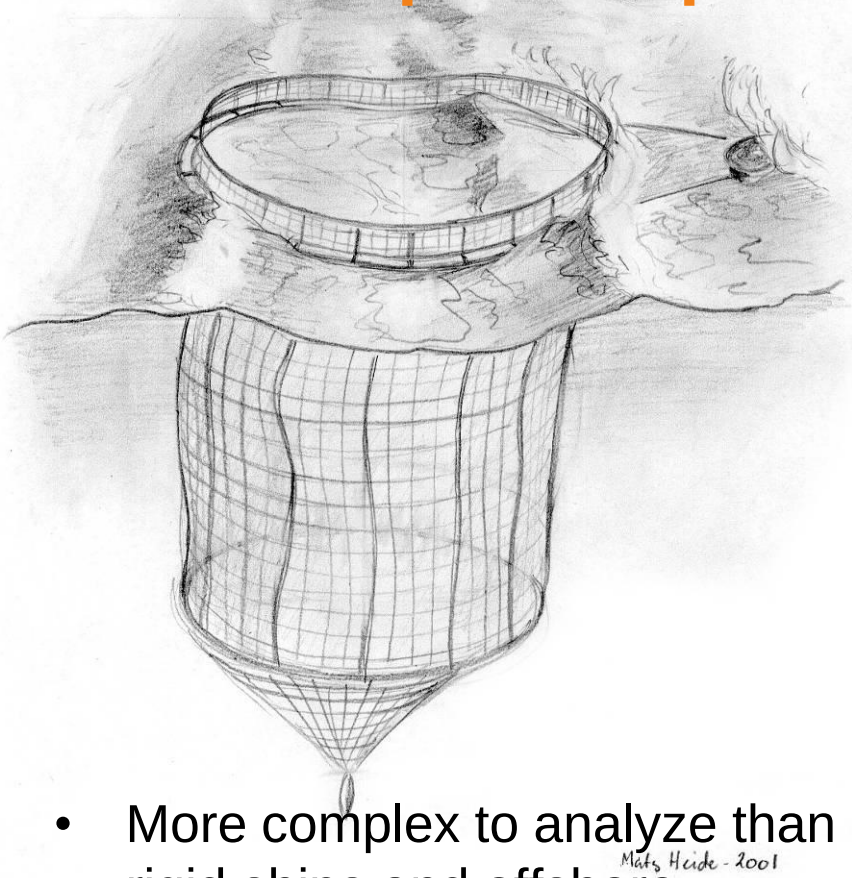
The number challenges

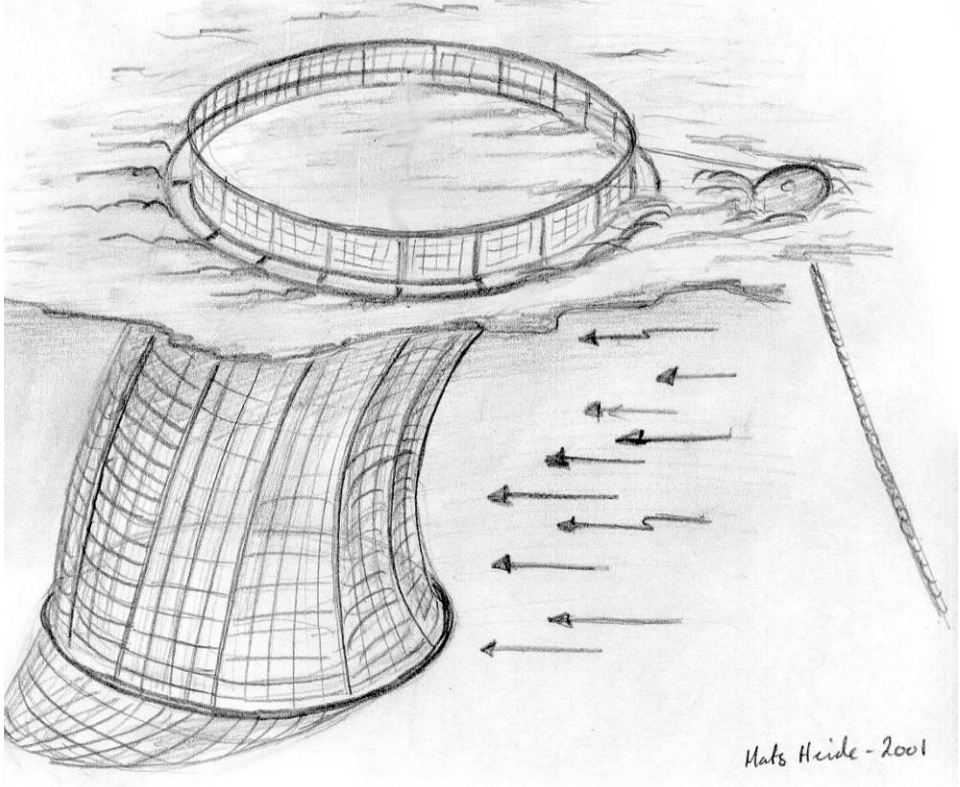


- Increasingly larger farms
  - Circumference 60 → 160m
  - More than 500 000 fish in one single cage
  - 10-12 cages at one site
  - More than 10 000 tons at one location
- 300 million salmon standing in Norwegian cages
- One tenth of a percentage is several hundred thousand fish
- 500 000 – 1 000 000 wild salmon return each year to spawn

Introduction and consequences

The simple complex construction





- More complex to analyze than rigid ships and offshore construction

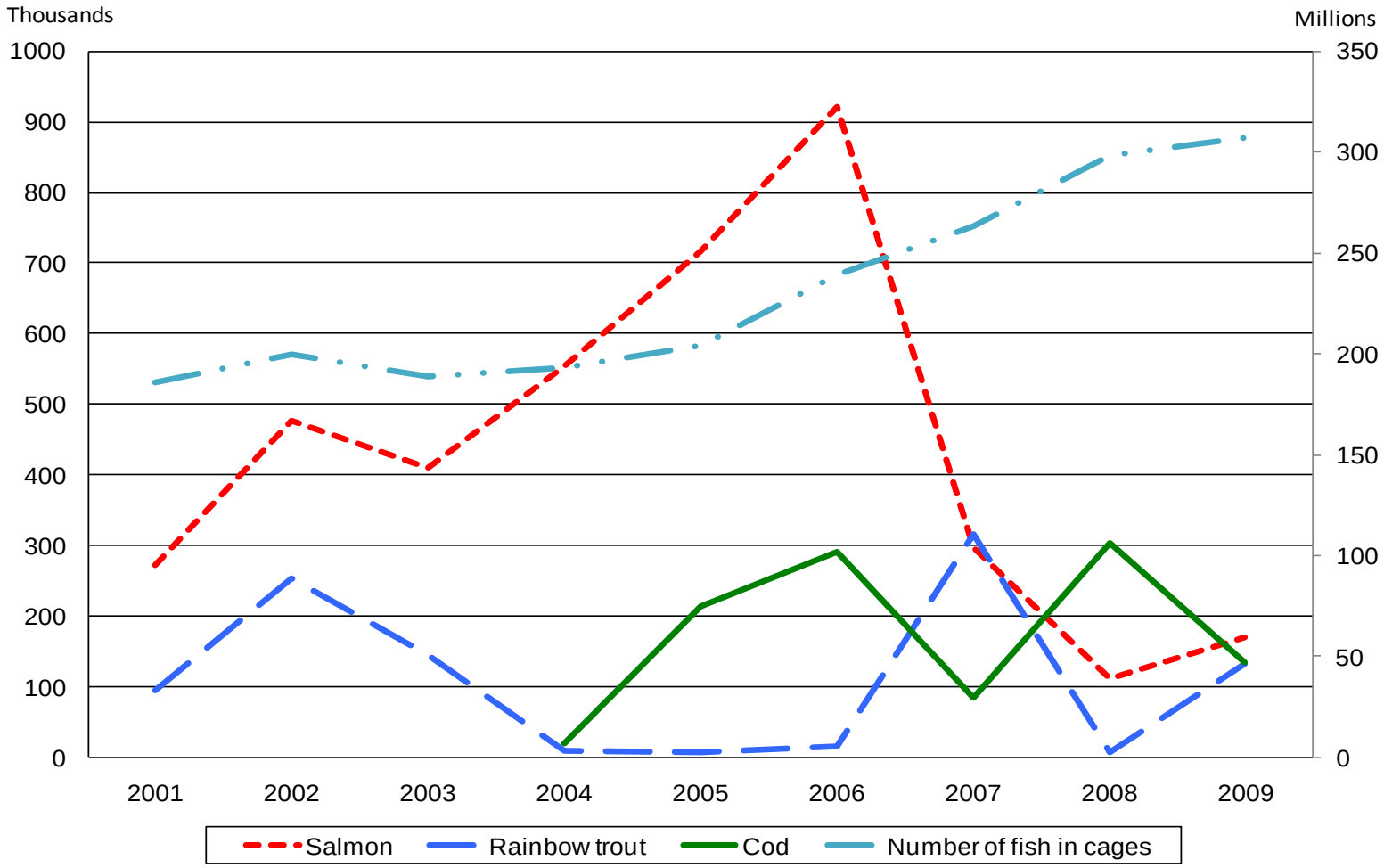
- More fragile – strength, wear and tear
- Less than 5% of the total costs

Types of escapes

- Escape of fertilized eggs for pelagic spawners
- Escape of farmed fish – from juveniles to slaughter sized fish
- Escape from sea based farms
- Escape from land based farms
- Escape during transportation

Causes and extent of escape

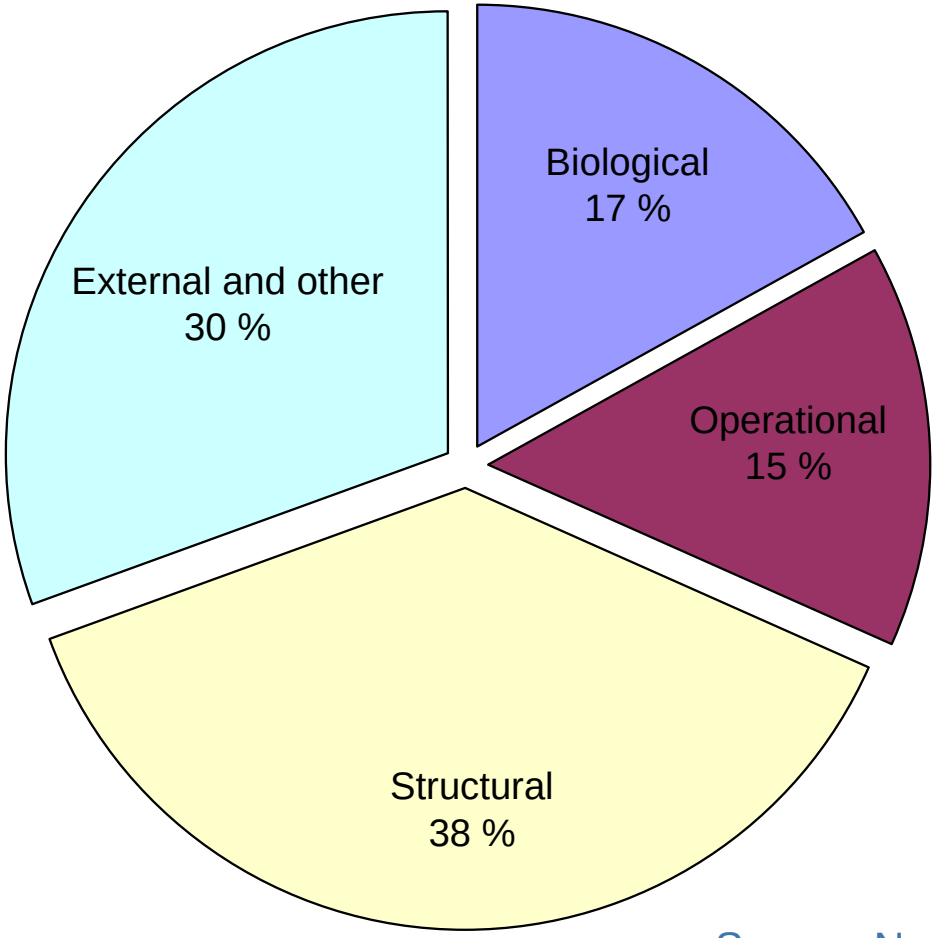
Number of escapees in Norway 2001 - 2009



Source: Norwegian Directorate of Fisheries

Causes and extent of escape

Causes of escapes Norway 2006 - 2009



- 20% large escapes incidents (> 5000 fish) – 94% of total number of fish
- 44% of small escape incidents (< 200 fish) – 0.27% of total number of fish
- Hole in the net cage is how the fish escape

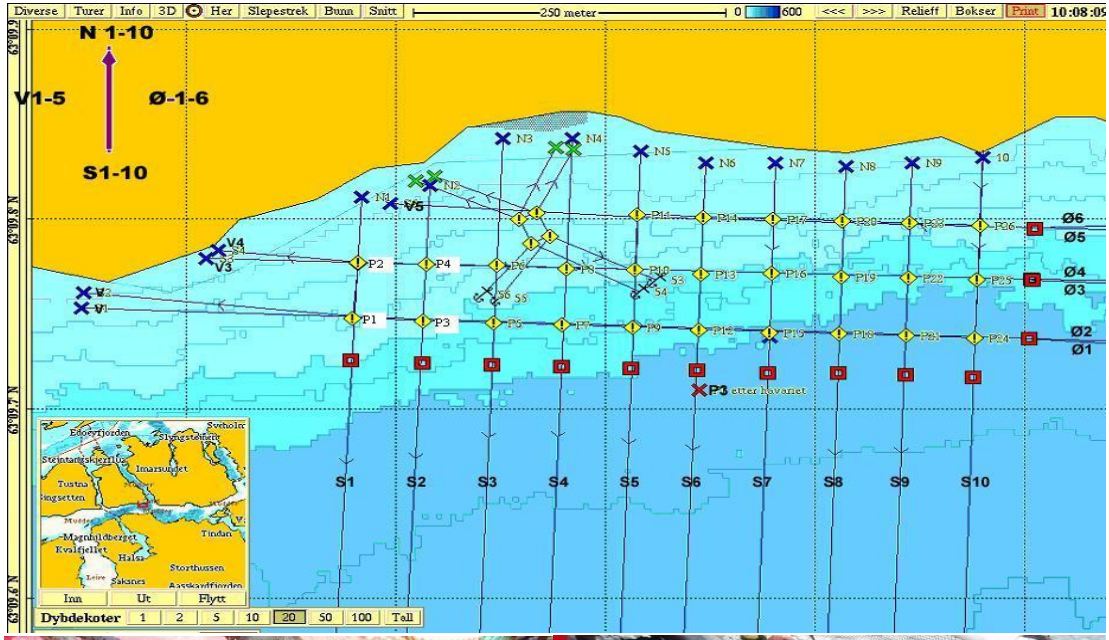
Source: Norwegian Directorate of Fisheries

Causes of escape - Example

Progressive break down

- Complex mooring
  - many components
- Dependent on one single component
- One mooring slips/break

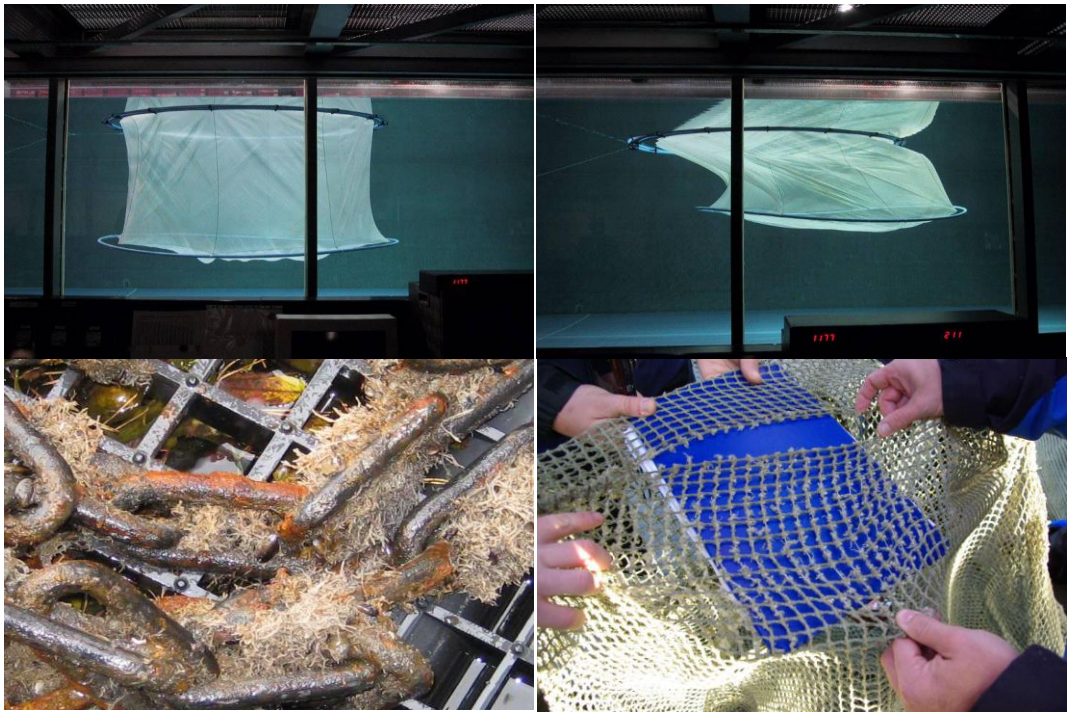
- Connector plate fail
- Progressive break down and complete system failure
- Solution:
  - Test of anchor
  - Increased dimensions
  - Understanding mechanisms
  - Design against progressive break down



Causes of escape - Example

Abrasion between net and chain

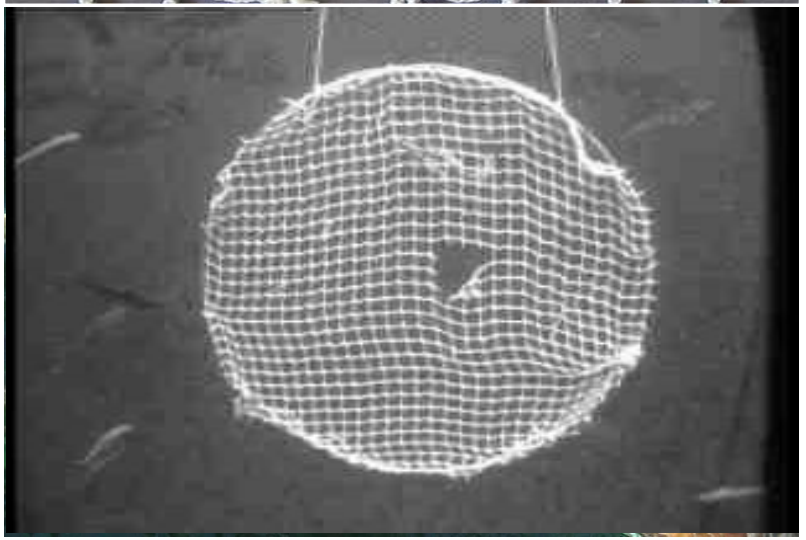
- Hole in nets most common reason for escapes
- Several cases in Norway last years
- Abrasion between nets due weights system and weight ring
  - Larger units
  - Change in operations
- Understanding of mechanisms and operations
- Design of net cage



Causes of escape - Example

Fish biting

- Cod (and other fish) bite and nibble on netting and create holes
- Difference in exploratory behavior – difference in changes to find and swim through holes
- More frequent inspections
- New net cage material
- Understanding of fish behavior to design proper net cage



Mitigating and preventing escapes

How to reduce the impacts of fish escape?

- Use of local brood stock
  - Unlikely in the long-term
- Recapture of escapees
  - Coordinated recapture fishery or conditioned fish
  - In salmon recaptures are however low – just a few percent
- Parasite and disease control in farming
  - Coordinated treatment or vaccination
  - Ensure escapees do not have pathogens to transfer
- Strengthen wild stocks
- Sterile mono sex species
- First line of defense and main solution - **to reduce escape it self** – only sustainable long term solution for industry and environment

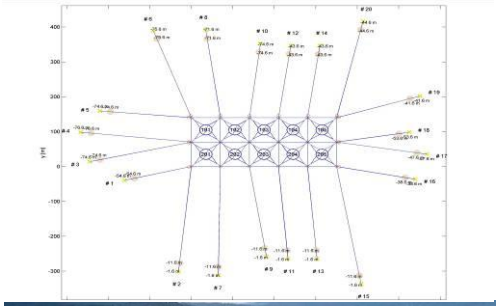
Mitigating and preventing escapes

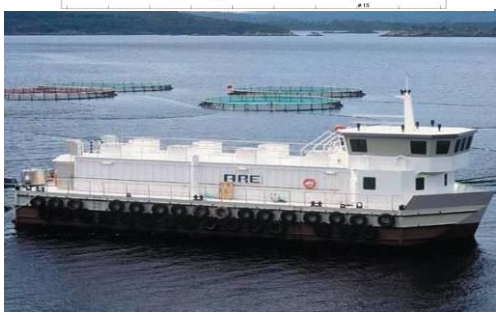
Recommendations

- Mandatory reporting
- Mechanisms to collect, analyze and learn from reported incidents
- Technical assessments of selected incidents
- Technical standards for equipment and operations
- Mechanism to enforce standards
- Training and education

Mitigating and preventing escapes

Official technical requirements in Norway





- Official regulations describing the system - NYTEK
- NYTEK point to NS 9415 “Marine fish farms Requirements for design, dimensioning, production and operation”
- Applies to:
  - Floater, net cage, mooring system and feed barge
- Classification of all aquaculture locations/sites
  - Wind, current and waves
- Product certification of all new equipment
  - Approved according to requirements in NS 9415
  - Control of production
  - Mooring analysis
- Use and installation manuals

Mitigating and preventing escapes

How the system works

- Accreditation company/body (Norwegian Accreditation)
  - Control and issues accreditation
- Accredited Certification Company (Private)
  - Certify equipment and producers according to NYTEK and NS 9415
- Farmers need to use equipment that are certified
  - Classification of site by a competent body
  - Equipment certified suitable for site
- Mooring analysis and mooring equipment from a certified company
- Farmer responsible for installation and control
- Norwegian Accreditation can withdraw accreditation
- Equipment can be pulled back or withdrawn from market
- Norwegian Directorate of Fisheries can withdraw license

Summary

- Need to prevent fish from escaping
  - Avoid ecological ”pollution”
- Challenge
  - Construction
  - Number issue
- Reporting and learn from experience
- Develop operations and technical standards
  - ISO work group on Aquaculture standards
  - EU project – Prevent Escape
- Enforce standards
- System design
- Education and training

Thank you for yor attention