Improving safety and risk management in exposed aquaculture operations

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Objectives of PhD project

- Develop improved risk management strategies and systems in fish farming, integrating technical, human and organizational factors.
  - Analyse current risk assessments practices according to the regulatory requirements.
  - Identify and analyse organisational factors that are relevant for risk management in the aquaculture industry.
  - Study the current health, safety and environment (HSE) status in fish farming and on board service vessels.
  - Identify safety barriers relevant for reducing risk for fish escape and occupational accidents during fish farm operations.
Methods

- Literature study
- Accident data
- Interviews: practices for operational safety and risk management
- Observations, "safety audits"
- Workshops
Norway

Norwegian aquaculture locations – interactive map at www.fiskeridir.no
Challenging work environment
Today's fish farms already operate at the safety limit for available technology, fish welfare and personnel

- Structural breakdowns
- Fish escapes
- Parasites and infections
- Reduced availability of farms
- Postponed operations

The Norwegian aquaculture industry is the 2nd most risk exposed occupation in Norway, according to the rate of occupational injuries and fatalities
Current practices for risk monitoring in Norwegian fish farming

- Escape of fish reported
  - Every escape, also upon suspicion

- Fish welfare
  - Lice counts conducted on a regular basis as defined by the authorities
  - Parasite monitoring
  - Water quality

- Occupational accidents
  - Serious occupational accidents are reported to the Norwegian Labour Inspectorate Agency
  - Personal injuries reported to the Labour and Welfare Administration (insurance claims)

- Company-internal measures
  - Number of reported nonconformities or near misses
  - Operating reports
A need for systematic safety work

- Accident causality is complex with several contributing factors

Common cause identified:
- Poorly implemented risk management
  - Risk assessments may lack or not be used in decision-making
  - Operators are not aware of all hazards during operations
  - Procedures are changed without assessing the risks
  - Insufficient training of personnel
Safety requirements and the regulatory authorities

- Fish escape prevention
- Technical requirements fish farm
- Technical requirements vessels
- Maritime Authority
- Fish welfare
- Food safety
- Environment
- County Governor
- Food Safety Authority
- Health, safety and work environment
- Labour and Inspection Agency
Risk assessment process according to NS5814:2008

Planning
- Initiate process, define problem and scope
- Organise the work, establish work group
- Choose method and data sources
- Establish description of system and object to be analysed, document conditions and assumptions

Risk analysis
- Identify hazards and undesired events
- Analyse causes and probabilities
- Analyse consequences
- Describe risk as a correlation between consequence and probability

Risk evaluation
- Evaluate risks against risk acceptance criteria
- Identify mitigating measures, compare alternatives and their risk-reducing effect
- Document in writing and conclude

Work operations with high risk

- Crane operations
- Delousing
- Well boat operations
- Daily work and maintenance
- Inspections of mooring lines and net cage
- Net cage replacement
- Transfer of fish
- Feed deliveries

Removal of ice from floater and rail of a fish cage.
Current practices for risk assessments

- Companies aim to comply with requirements of five authorities
- Priorities affected by possible harms for profit or reputation
- Quality and implementation level vary considerably
- Assessments during operations are not documented
- Qualitative risk assessments prevail
- Several areas to cover

Well boat arriving
Have risk assessments been performed in the course of the last four years?
Challenges regarding risk assessment performance

1. Performed at manager level, no involvement of operators
2. Low motivation, "unavoidable exercise"
3. Focus on documentation, not the actual safety level
4. Too broad scope
5. Follow-up work not prioritised

Maintenance work on anchor lines and coupling plates.
Improved approach: workshops for hazard identification

- Based on preliminary hazard analysis and NS5814:2008

1. Stakeholders involved in planning process
2. Operational and shift managers, operators, safety representatives and managers mixed in groups
3. Work operations selected and described in detail
4. Hazards identified for each task and equipment involved
5. Operators fully involved, incl. developing risk-reducing measures
6. Risk evaluation not a central task, left to HSEQ personnel (risk experts) to finish.
7. Arena for exchange of experience
Examples of input in workshops
The status of risk assessments in Norwegian fish farming
(Holmen, Utne, Haugen & Ratvik ESREL 2017)
Conclusions

- Safety challenges in the Norwegian fish farming industry
  - Occupational hazards
  - Escape of fish
  - Parasites and infections
  - Harsh work conditions
- Fragmented regulations – fragmented risk monitoring
  - Five regulatory authorities.
- The practices for risk management and worker involvement vary considerably between companies
- There is a need to improve risk assessment practices according to regulations
  - Improved approach suggested for stronger operator involvement.
Thank you for the attention!

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