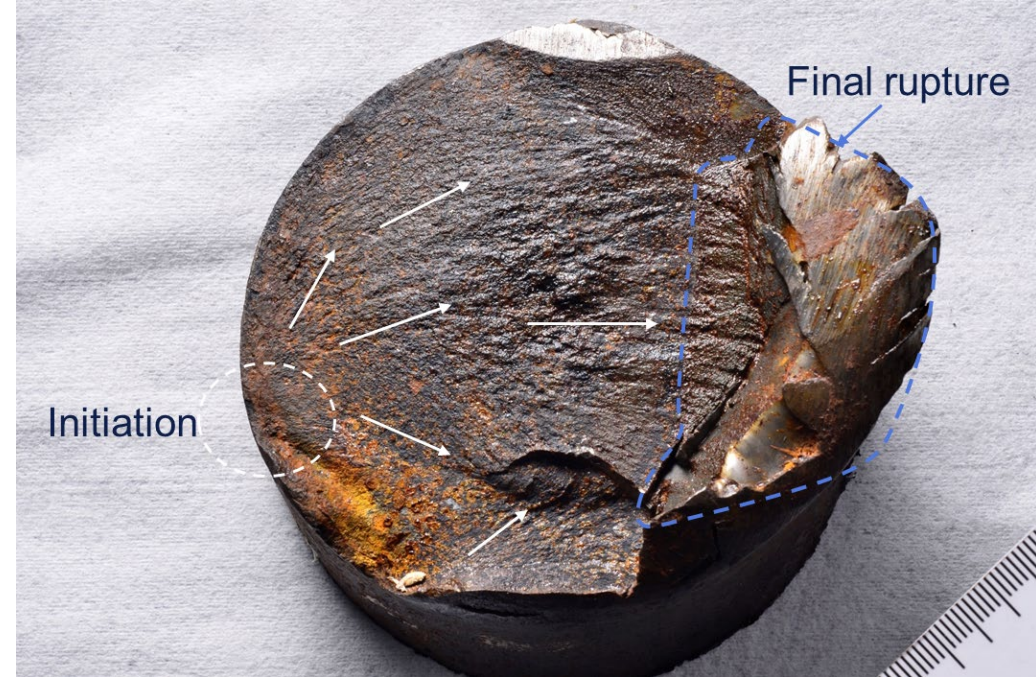


Kjettingbrudd på høyfast kjetting

Marine operasjoner i praksis – Kristiansand 17. April 2024

Ingrid Skutle Høgsæt, DNV Technology Centre, Oslo

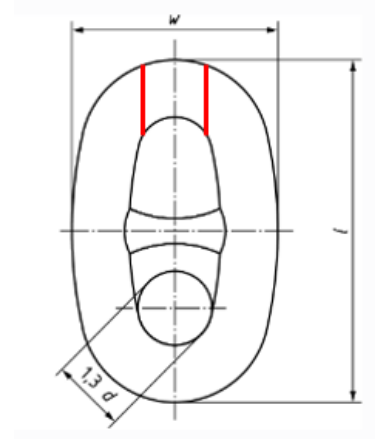
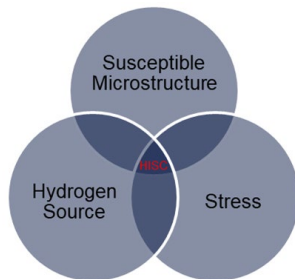
Summary of findings from failure investigation Scarabeo 8 pre-lay (IKMs 145m 84mm R5)



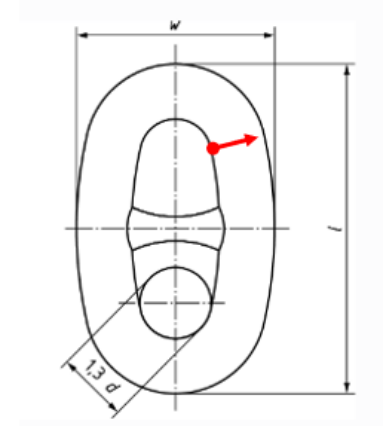
- Material properties are according to standard (ductile material)
- Brittle failure mode in a material that show ductile behaviour when tested according to standard methods.
- Fracture initiation most likely due to bending in addition to pure tension
- Failed at a load well below break load

Offshore chain for mobile mooring - Use and failure modes

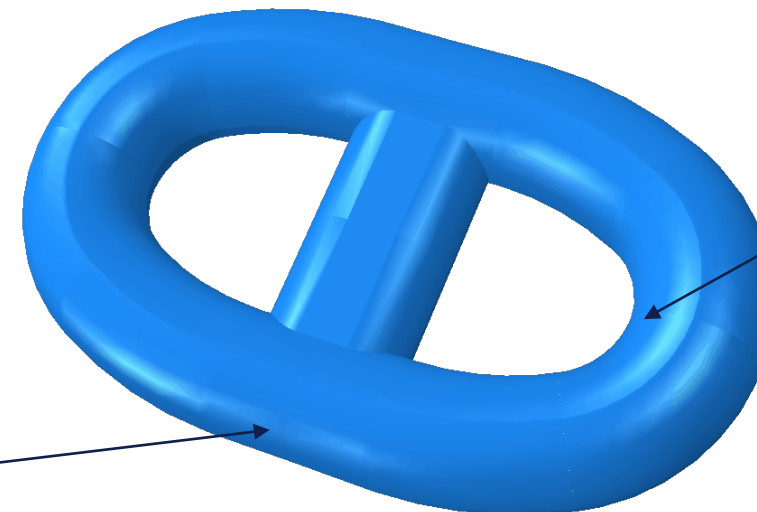
- Studded chains (76)/84mm R4/R5
- Service history: High loads during anchor pre-set/retrieval, handling at base and between use
- There have been a number of incidents on the Norwegian shelf with failures in high-strength anchoring chains in recent years
 - Failures have occurred often at load levels that are significantly lower than the breaking limit.
 - Failures are believed to be connected to hydrogen embrittlement
 - Usability and suitability of high strength mooring chains (havtil.no)



Overload failure



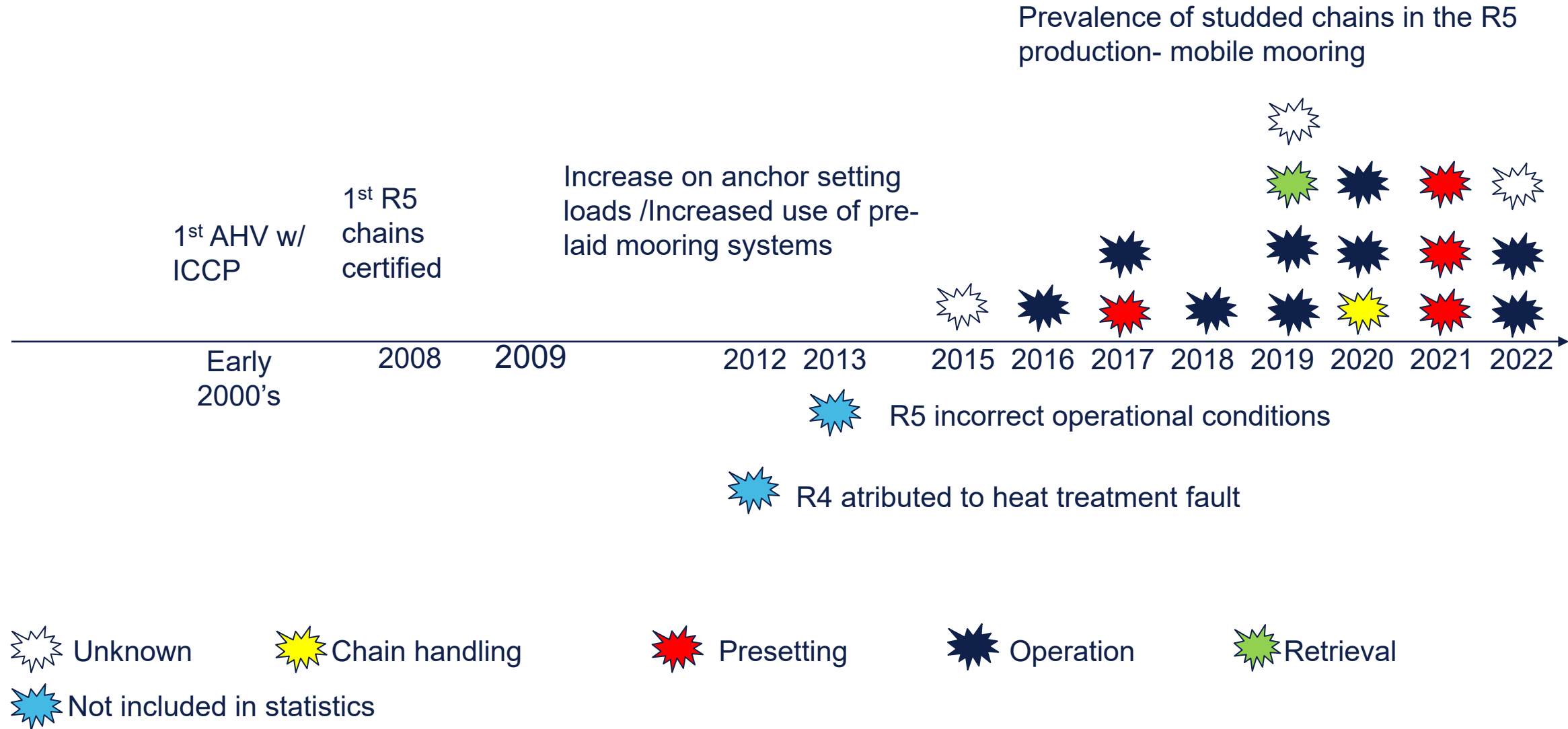
Tension-fatigue failure



Crown/Bend
Interlink dents and we

Straight part
Drag marks

Historic background



Joint Industry Project 'High strength chain JIP'

Challenge:

- Several incidents reported with brittle failures in a material shown to be ductile through the standard tests.
- The presence of hydrogen in combination with a material that is susceptible to hydrogen is considered to be part of the cause.
- A criteria to identify an acceptable susceptibility threshold for mooring chain materials is missing

Goal of the JIP:

- Define acceptance criteria and an associated test procedures to differentiate between materials with detrimental and acceptable susceptibility to hydrogen degradation.
- Define boundary conditions for safe operation.

Status:

- 13 participants: 3 chain manufacturers, 4 oil companies, 4 rental companies and 2 rig owners. HavTil (Observers)
- Started Autumn 2023. To be completed Q1 2025.
- If interested in more information, please contact: Ingrid.skutle.hogsamet@dnv.com

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