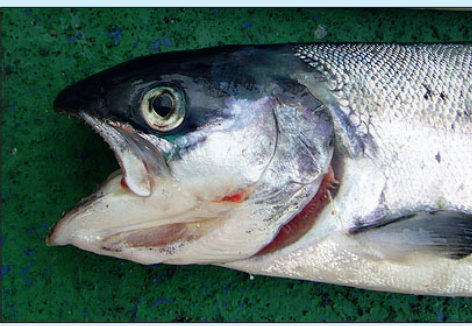
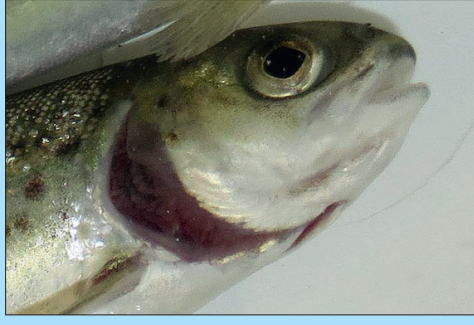
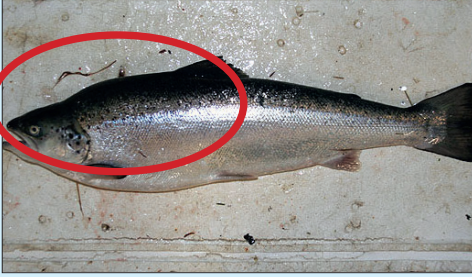
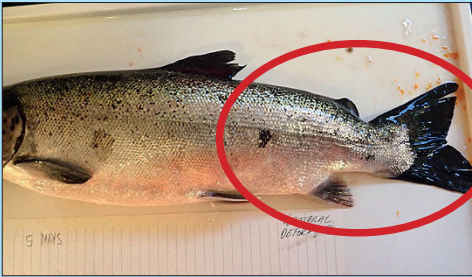
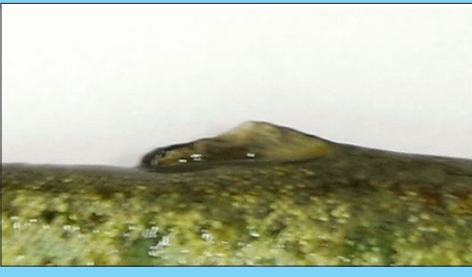


FISHWELL Morphological Operational Welfare Indicators (OWI's) for farmed Atlantic salmon v1.1

Level 0: Little or no evidence of this OWI, i.e. normal (not illustrated).

Level 1, minor to Level 3, clear evidence of the OWI.

	Eye haemorrhaging	Exophthalmia	Opercular damage	Snout damage	Upper jaw deformity	Lower jaw deformity	Emaciation
1	 Minor haemorrhages	 Eye protruding a little	 Operculum only partly covering gills	 Minor wound on snout (either jaw)	 Suspected malformation	 Suspected malformation	 Potentially emaciated
2	 Larger haemorrhages, or traumatic injury	 Moderate eye protrusion	 Operculum absent on one of the gills (gill exposed)	 Moderate wound and broken skin on snout	 Distinct malformation	 Distinct malformation	 Emaciated
3	 Large haemorrhages / traumatic injury. Eye may be ruptured	 Major eye protrusion	 Both opercula absent (both gills exposed)	 Large deep and extensive wound. Can cover the whole head	 Major malformation, jaw pointing backwards	 Major malformation, jaw pointing backwards	 Extremely emaciated

	Vertebral deformity	Skin haemorrhages	Lesions / wounds ^{a,b}	Scale loss	Sea lice infection	Healed fin damage	Active fin damage ^c
1	 Signs of deformed spine	 Minor haemorrhaging, often on the belly of the fish	 One small wound (< 10 pence piece)*, subcutaneous tissue intact (no muscle visible)	 Loss of individual scales	 Light infection	 Most of the fin remaining	 Most of the fin remaining
2	 Clearly visible spinal deformity (e.g. short tail)	 Large area of haemorrhaging, often coupled with scale loss	 Several small wounds	 Small areas of scale loss (< 10% of the fish)	 0.05 - 0.08 pre-adult or adult lice cm² of fish skin	 Half of the fin remaining	 Half of the fin remaining
3	 Extreme deformity	 Significant bleeding, often with severe scale loss, wounds and skin edema	 Large, severe wounds, muscle often exposed (≥ 10 pence piece)	 Large areas of scale loss (≥ 10% of the fish)	 ≥ 0.08 pre-adult or adult lice cm² of fish skin	 Very little of the fin remaining	 Very little of the fin remaining



The FISHWELL scoring scheme for morphological OWI's for farmed Atlantic salmon is reproduced from the manual "Welfare Indicators for farmed Atlantic salmon: tools for assessing fish welfare" written by researchers from Nofima, Institute of Marine Research, Norwegian Veterinary Institute, Nord University (all Norway) and the University of Stirling (UK).

This handbook suggests a unified scoring system that is primarily aimed at farmers to help them assess welfare and rapidly detect potential welfare problems out on the farm.

It is an amalgamation of the injury scoring schemes used in the Salmon Welfare Index Model (SWIM) (Stien et al., 2013), the injury scoring scheme developed by the Norwegian Veterinary Institute (NVI) (Grøntvedt et al., 2015; Gismervik et al., 2016) and also from other schemes developed by J. F. Turnbull (University of Stirling) and J. Kolarevic and C. Noble (Nofima).

The handbook standardises scoring for 14 different indicators to a 0-3 scoring system.

Pictures used in the system represent examples of each scoring category. We suggest dorsal, caudal and pectoral fins as the primary fins to monitor for fin damage. As a comprehensive system for the classification of vertebral deformities, similar to that in human medicine, has not yet been developed for Atlantic salmon, we suggest a simplified scoring system similar to that used in the RSPCA welfare standards for farmed Atlantic salmon (RSPCA, 2018).

For the full references for the four citations listed above, please refer to the FISHWELL handbook.

The PDFs of the manual and scoring scheme can be downloaded from www.nofima.no/fishwell/english

Suggested citation for the manual: Noble, C., Gismervik, K., Iversen, M. H., Kolarevic, J., Nilsson, J., Stien, L. H. & Turnbull, J. F. (Eds.) (2018). Welfare Indicators for farmed Atlantic salmon: tools for assessing fish welfare 351pp. (ISBN 978-82-8296-556-9)

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^a For pre-smolts "one small wound" should be < 1 cm.
^b NB! Wounds that penetrate the abdominal cavity should be scored as a 3) irrespective of size
^c Splitting and/or haemorrhaging