# PHYSIOLOGICAL AND BEHAVIOURAL EFFECTS OF HANDLING PROCEDURES ON ATLANTIC SALMON



## SUMMARY

**This output concerns information on the effects of handling procedures (pumping and netting) and use of sedation on the acclimation time and stress of farmed Atlantic salmon (*Salmo salar*). By improving the protocols for handling fish during transfer activities, welfare can be improved on fish farms, and researchers' experimental methodology can be more robust and tailored for implementation.**


## KNOWLEDGE NEED

Handling of fish is necessary, both in commercial farming operations and in research facilities, but causes stress and discomfort for the fish. The acclimation time – the time for the fish to resume normal physiology and behaviour – will depend on the severity of the stress experienced by the fish. An important consideration when conducting fish experiments *in vivo* is the use of animals that are in a stable physiological, biochemical and behavioural state so that the effects of potential treatments can be clearly distinguished. Without this consideration, the quality of research and findings are undermined. Therefore, it is important for both aquaculture farmers and researchers to understand the effects of handling on the stress and acclimation time of the fish.


## POTENTIAL IMPACT

- Improved experimental methodology leading to higher-quality results that are implemented by the aquaculture industry.
- Improved handling protocols for aquaculture farmers, leading to improved welfare of farmed Atlantic salmon.

**EATiP - Strategic Research and Innovation Agenda (SRIA)** Thematic Area 7 – Aquatic Animal Health and Welfare; Goal 3, Goal 4; Thematic Area 6 - Knowledge Management; Goal 4. To see the full list and descriptions of the thematic areas and goals, please visit: **bit.ly/3hBDpGH**

## UNDERLYING SCIENCE

An experiment was performed with a 2 x 2 factorial design, incorporating the variables of handling procedure (pumping or netting) and sedation/no sedation. Atlantic salmon smolts were pumped or netted from 4 large tanks (3.3 $m^3$) with water salinity 12 ppt, to 12 smaller tanks (0.5 $m^3$) with water salinity of 32 ppt, where they stayed for a period of 30 days. To measure both the acute stress responses and longer-term effects, samples of blood, skin and gills were taken before transfer and at regular intervals after transfer. The samples were analysed for plasma cortisol, blood glucose and lactate, serum ion concentrations, skin histology and gene expression. Fish welfare and growth rate were also assessed. Feed intake was measured daily, both in the large and small tanks for the 30-day trial period, to assess if handling method affected the time to resume normal feed intake.

## RESULTS

- When assessing the primary, secondary and tertiary stress response, there were no large differences observed between using pumping or netting for transfer of Atlantic salmon smolts between indoor tanks.
- Feed intake resumed to pre-handling levels within five days in all treatment groups, but it took a few days longer to feed normally for the pumped fish. During the 30-day trial, there were no significant effects of handling method or sedation on feed intake and growth.
- Compared to not using sedation, sedated fish had better skin health as assessed by histology, gene expression and visual assessment, for both transfer processes. This is most likely due to sedated fish being calm during transfer.
- Sedation reduced plasma cortisol, blood lactate and plasma ions shortly after handling. However, there was a delayed increase in plasma cortisol in sedated fish 24 hours after handling.

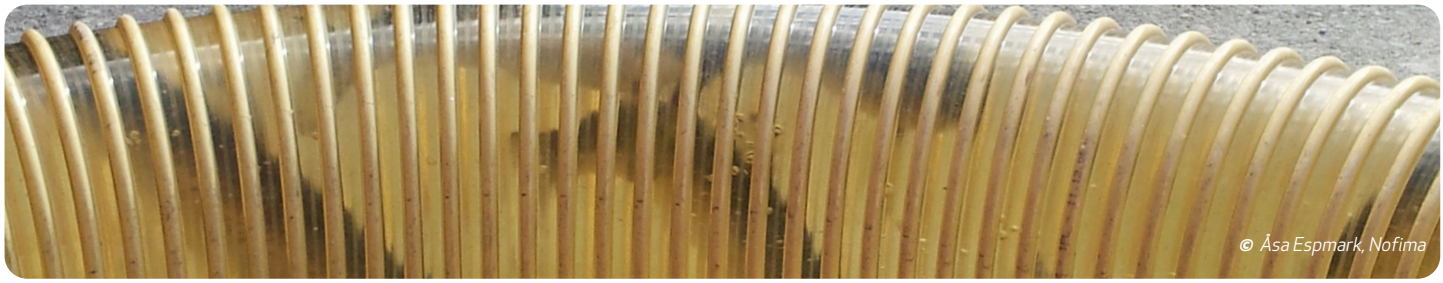
## END-USERS & POTENTIAL APPLICATIONS

**END-USER 1: Aquaculture researchers**
**APPLICATION:** Improved experimental methodology, leading to transfer of higher quality results to industry for implementation.

**END-USER 2: Atlantic salmon farmers**
**APPLICATION:** Implementation of improved protocols in standard operating procedures means fish farmers will reduce the negative (and costly) consequences of stress-inducing and potentially harmful transfer activities.

## STATUS

- The results are in the process of being published.
- Together with previous work on handling procedures the topic will continue to be a focus area and highly relevant as part of the development of new farming procedures and technologies.




## AT A GLANCE

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