

Electrical stunning of Atlantic cod (*Gadus morhua*), haddock (*Melanogrammus aeglefinus*) and saithe (*Pollachius virens*) – effect on fish welfare, handling stress and quality

Hanne Digre¹, Ida Grong Aursand¹, Leif Grimsmo¹, Bert Lambooi², Hans van de Vis³, Ulf Erikson¹

¹SINTEF Fisheries and Aquaculture, 7465 Trondheim, Norway ²Livestock Research, Wageningen, The Netherlands ³IMARES, Wageningen, The Netherlands
Contact: hanne.digre@sintef.no

Abstract

Once fish are captured and handled, some quality loss is practically inevitable. The ultimate goal would be to bring the catch on board live. Rapid bleeding of live fish shortly after landing is believed to be the remedy for quality reduction due to delayed bleeding of moribund fish. To facilitate safe and easy handling of live fish during the bleeding operation, stunning before bleeding would be a great asset. The aim of this research was to study electrical stunning of cod, haddock and saithe, and its effect on fish welfare, stress and quality. The results show that electrical stunning is a promising method for stunning of the catch. A throat cut 30 sec post stunning can be a suitable method for killing of electrically stunned cod and haddock, as no recovery occurs. However, there are challenges related to the electrical stunning of saithe that needs to be solved, namely broken vertebrae and ruptured blood vessels.

Experimental setup

The electrical stunner used was a prototype developed by the Norwegian equipment vendor SeaSide AS. For stunning, different voltage has been used (20, 40, 50, 70, 100 V) on individual wild caught cod, haddock or saithe for 0.7-7 sec. After electrical stunning, the fish were observed in a water-filled tank for 10 min to observe potential recovery. Different stress and quality parameters were measured. For the experiment involving haddock and cod, assessment of electrical activity in brain and heart (EEG and ECG) were assessed immediately after the fish were landed on deck, during electrical stunning, and during recovery.

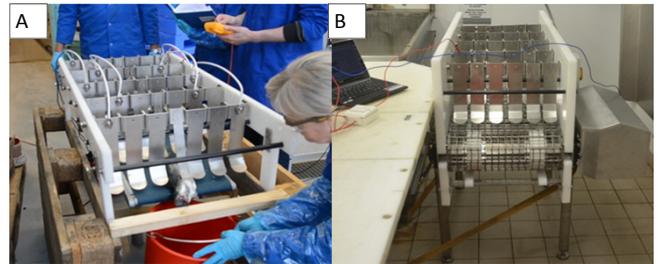
Results from two experiments are presented, one with focus on cod and haddock, and the other one with focus on saithe and cod.

The fish analyzed were taken from:

- current storage method for fish on the vessel (in dry bins)
- current storage method onboard (in dry bins) followed by electrical stunning
- holding tanks for live fish followed by electrical stunning



Evaluation of trawl-caught saithe after electrical stunning in air. Polarity: (-) on steel conveyor belt, and (+) on electrodes (flaps)



Electrical stunners, modified STANSAS #1

- A: Electrical stunner with (+) and (-) electrodes (flaps) on every other row (non-conducting conveyor belt)
B: Electrical stunner with (-) on steel conveyor belt and (+) on electrodes (flaps)



Evaluation of potential blood spots and discolorations on saithe

Results

- Electrical stunning is a fast and efficient method for easy handling of fish before bleeding
- Fish remained conscious after landing and storage onboard. Therefore, electrical stunning and subsequent killing with a throat cut, may provide an option for improving fish welfare on-board commercial fishing vessels.
- Electrical stunning with a combined AC and DC of 0.34 and 0.36 A_{rms} and 52 V_{rms} for 0.7 seconds induced immediate unconsciousness in wild cod and haddock, respectively.
- It is recommended to stun wild cod and haddock with 52 V_{rms} for more than 3 seconds and kill both fish species in unconscious state by applying a throat cut as soon as possible after landing onboard.
- Handling stress was basically determined by the catching process.
- Cod and haddock did not recover after 3 hours storage in live holding tanks onboard before stunning.
- No damages or quality changes were observed after stunning for haddock and cod.
- For saithe, between 10-45 % of the fish had broken vertebrae and ruptured blood vessels. Might possibly be avoided by using a frequency adjustment (alternate between low and high frequency). More research is needed to improve conditions for the electrical stunning of saithe.

Thanks to:

- The Research Council of Norway, (MAROFF, BIA, Matprogrammet),
- The Norwegian Seafood Research Fund (FHF)
- SEASIDE, Melbu Systems, MMC, C-Flow, Gunnar K, Hardhaug, Helmer Hansen, among others.