

Nociception and pain in fish: implications for practices in the aquaculture chain

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Introduction, aims, material and methods

- Interest for welfare of farmed animals, including fish, is increasing.
- More research is done to further our knowledge on fish welfare in aquaculture.
- Scientific evidence for nociception in fish, as in other vertebrates, is accruing.
- Behavioural and physiological responses of two teleosts receiving two presumed standardized painful stimuli are investigated over a period of 24 h.
 - Nile tilapia (*O. niloticus*) received a caudal tailfin clip,
 - Mozambique tilapia (*O. mossambicus*) received a caudal electric shock (1 sec, 15 Volt DC, 64 ± 34 mA).
 - For each time point, a control for handling stress was included.

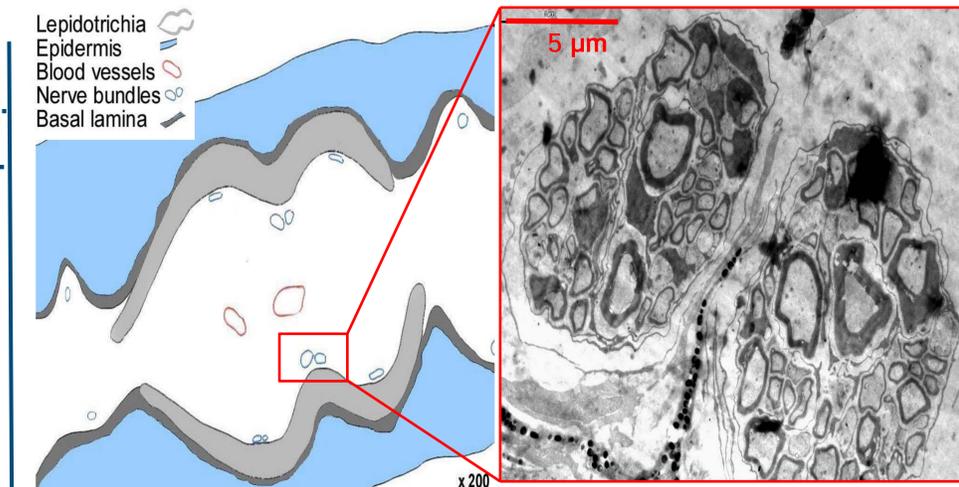


Fig 1. Localisation of nerve fibres in the tailfin of common carp, *Cyprinus carpio*.

Results: Gill histology

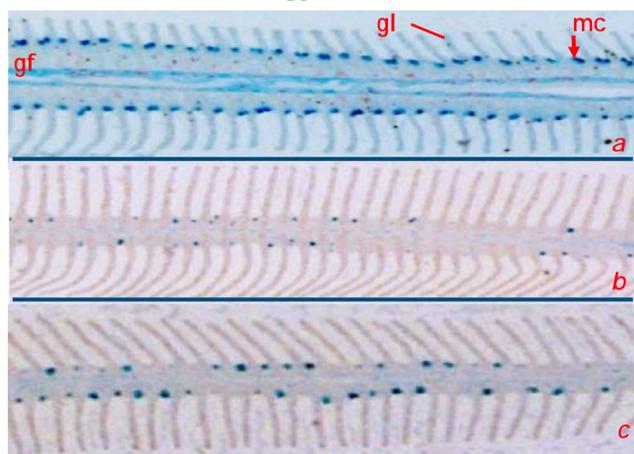


Fig 2. Quantification of the mucus cell frequency in Nile tilapia gills. A significant decrease of filled mucus cells is visible in the 1 h post-fin clip group only. Mucus cells (mc) between the lamellae (gl) in the gill filamental (gf) epithelium. Control situation (a), 1 h post fin clip (b) and 1 h post handling (c).

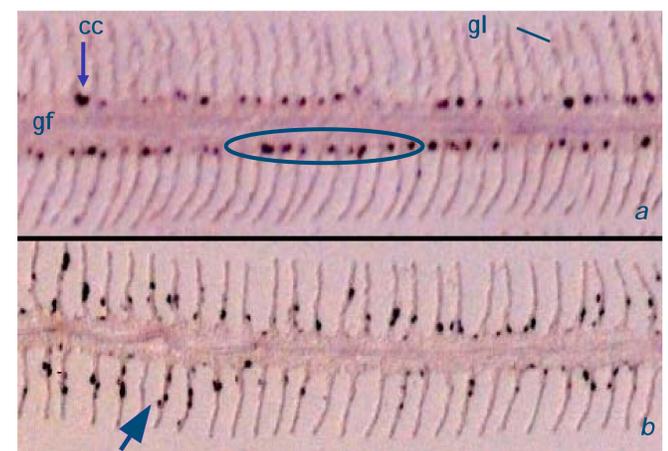
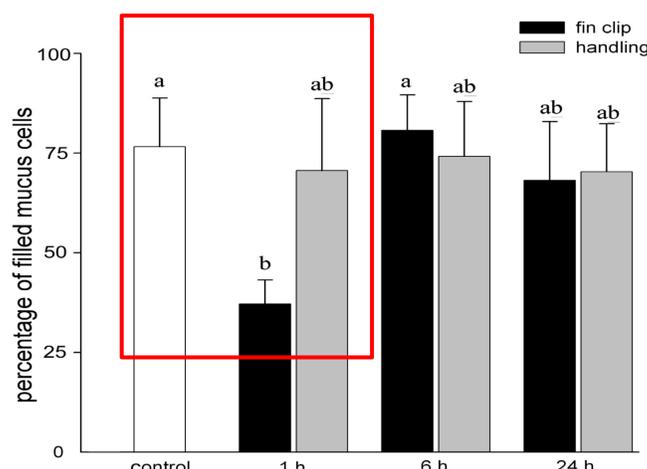


Fig 3. chloride cells (cc) between the lamellae (gl) in the gill filamental epithelium (gf). Control situation (a). Lamellar migration (blue arrow) occurs in both groups from 6 h onwards (b).

Behaviour

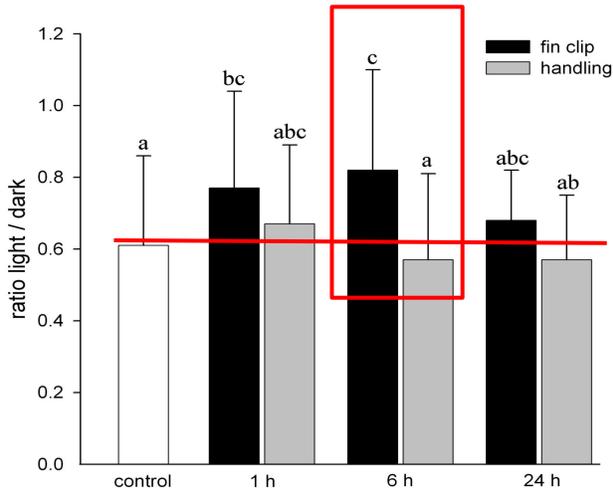


Fig 4. Scototaxis (dark/light preference) of Nile tilapia as function of treatment (fin clip vs. handling).

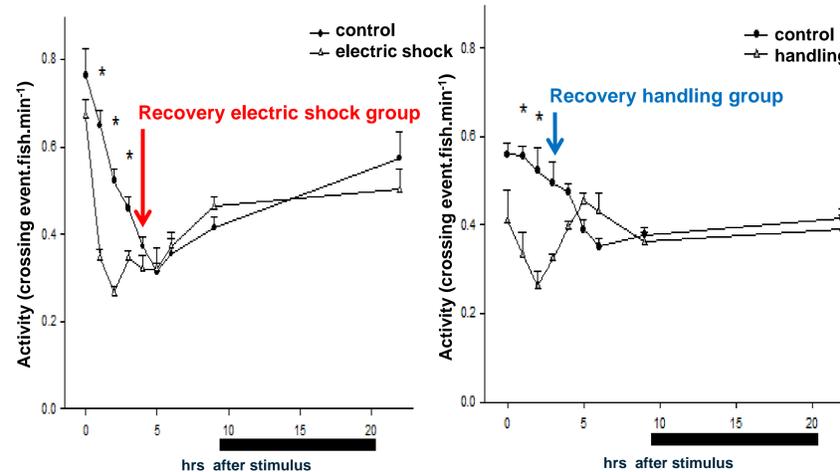


Fig 5. Activity of Mozambique tilapia, in function of treatment (electric shock vs. handling). Recovery is faster for the handled group (3 h) compared to the electric shock group (4 h). Chaffing also is resumed earlier in handled group (1h45) compared to the electric shock group (2h05).

Physiological parameters

- Cortisol, glucose, lactate, osmolality and branchial Na^+/K^+ -ATPase activity were affected by the stimuli compared to the control situation, but did not differ between the painful stimulus and the handling stress.

- The tailfin clip and the electric shock result in a differential response regarding the parameters affected and the time-course of these effects.

Conclusions and perspectives:

- Nociceptive A- δ and C-fibres in the tailfin together with behavioural and branchial responses show that both stimuli may be perceived as painful.
- The results substantiate a differential response to a presumed painful stimulus compared to that of handling treatments.
- The nature of the stimuli can explain the differences between them;
 - Fin clip: tissue-damaging, similar to common wound in aquaculture (fights), responsible for an acute response.
 - Electric shock: type of stimulation never encountered before, may elicit a deeper, longer lasting reaction.
- Investigation of the neuro-physiological effects of a fin clip and the potential alleviation effect of analgesics on behaviour, in zebrafish (*D. rerio*).
- Utilisation of several molecular biology techniques to investigate possible affected parameters (C-fos, endorphins, substance P, etc...).