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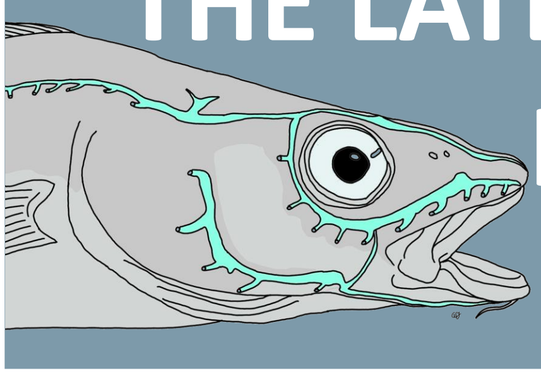
THE LATERAL LINE AND SENSORY RECEPTORS IN ATLANTIC COD (*GADUS MORHUA*)



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Introduction

The lateral system in fish differs in morphology and architecture between species. All the fish species described so far have specialized cells associated with the lateral line, such as sensory cells and mechanoreceptors (neuromasts). These cells have various functions and are used to detect e.g., water movements, pressure gradients, smell and danger. Deformities, wounds and infection routes to and via the lateral line may impact upon the health and welfare of fish and more knowledge is required to understand how the lateral line regenerates, heals and affects fish behaviour and wellbeing. In this study we have examined the trunk and cephalic lateral line of farmed Atlantic cod (*Gadus morhua*) larvae.

Method

Atlantic cod larvae (N=8) from the Norwegian National cod breeding program were killed with an overdose of Finquel vet. (MSD Animal Health) and stained with fluorescent dye DiASP (4-(4-Diethylaminostyryl)-1-methylpyridinium iodide dissolved in dimethyl-formamide), as described by Nakae et al. (2012) to visualize the lateral line neuromasts and skin sensory buds. Six fish were stained with DiASP for 1 hour, and two remained unstained (control). All fish were subsequently photographed using a fluorescence microscope (Nikon Eclipse TE2000-S).

Results

The DiASP staining revealed canal neuromasts along the trunk- and cephalic lateral line, and in some areas the superficial neuromasts (Figure 1). In addition to these, skin sensory buds were visible clustering around the neuromasts and otherwise scattered in a highly organized pattern along the entire body length and head, included on the fins (Figure 2). The highest density of fin sensory buds were around the basal area of the fins.

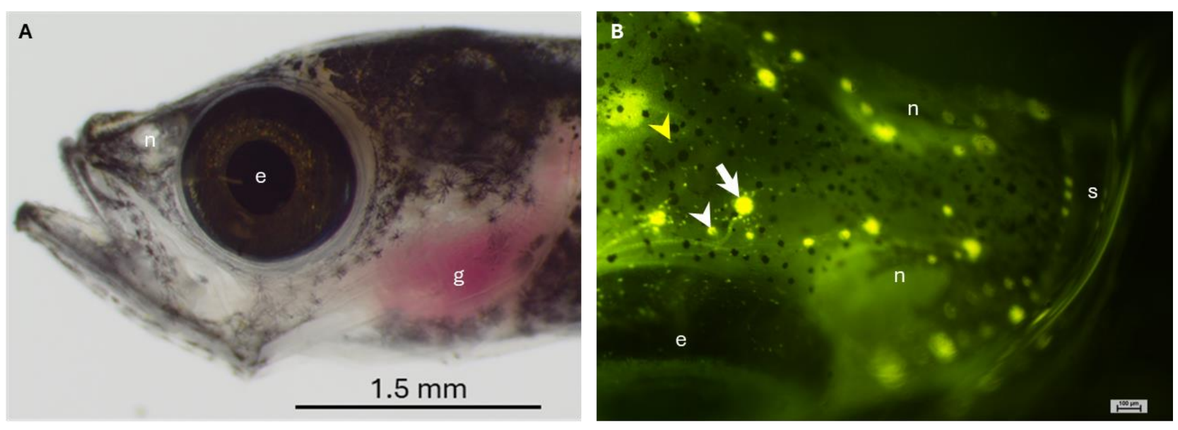


Figure 1. The cephalic lateral line in cod larvae (Gadus morhua). A) Loupe image of the head of the larvae, visualized by DiASP staining and fluorescence microscopy.. B-C) Canal neuromasts (arrow), superficial neuromast (white arrowhead) and skin sensory buds (yellow arrowhead) in the supraorbital- and infraorbital canal of the cephalic lateral line. D) Canal neuromasts (arrow) and skin sensory buds (yellow arrowhead) in the trunk lateral line. Abbreviations: e, eye; g, gill; n, nostrils; s, snout.

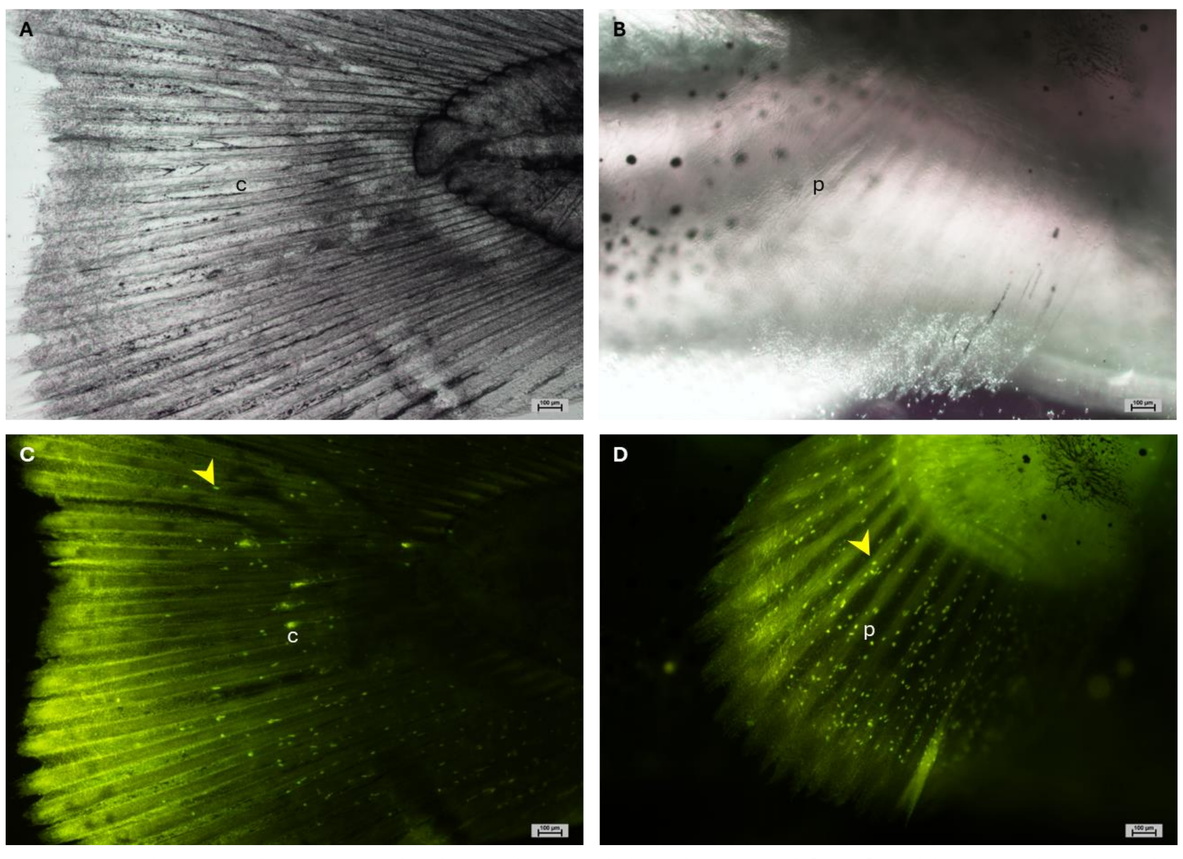


Figure 2. Showing the sensory buds on the caudal and pectoral fin of cod larvae, shown with brightfield (A,B) and fluorescence microscopy (C,D). BF image of caudal fin, A) and B). Fluorescent image of C) pectoral fin and D) caudal fin with it sensory buds (yellow arrowhead). Abbreviations: p, pectoral fin; c, caudal fin.

Discussion

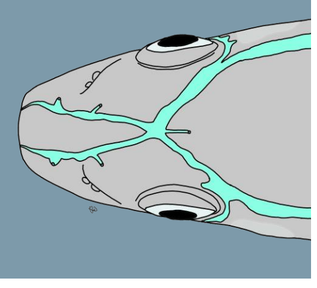
The sensory organ apparatus in cod skin is a complex system, including the lateral line (starting on the head and ending at the tail), and sensory buds distributed in connection with and in proximity to it. High density sensory areas includes the lateral line itself, as well as the snout, head and fins. These areas are at risk for wound development and damage, especially during handling and other operational procedures in intensive production systems. A deeper knowledge of the specific receptor functions will help improve our understanding of fish health and welfare.

Reference

NAKAE, M., ASAOKA, R., WADA, H. & SASAKI, K. 2012. Fluorescent dye staining of neuromasts in live fishes: an aid to systematic studies. Ichthyological research, 59, 286-290.

Conclusion

- Atlantic cod have a cephalic and trunk lateral line with canal- and surface neuromasts
- The skin consists of scattered sensory cells both on the body and on the fins
- Increased knowledge of the functions of the lateral line will increase our understanding of fish health and welfare



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