PROJECT: BARRIER
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CtrlAQUA

Importance of an intact skin

HYPOTHESIS:

An intact skin barrier will improve the fish's ability to overcome health challenges, aid wound-healing, and resist infection.

DURATION: 2017-2019

FISH SIZE TESTED: 100-700 G

SALINITY TESTED: Salt water

HIGHLIGHTS ABOUT SKIN STRUCTURE:

- Fish skin is structured into three different layers, the mucus (slime), with underneath epidermis and the dermis. The scales in the dermis provide additional strength to the skin. Each skin layer consists of different cell types with different functions, e.g., immune response and in the repair and regeneration of skin damage.
- The slime layer is composed of glycoproteins called mucins, which is why this layer is called "mucus". Skin mucins are complex gel-forming proteins with rod-like structures that bind bacteria, which then will be washed away from the skin surface. The mucus layer is also protective as it contains a number of antimicrobial components. Maintaining mucus production could be favorable for fish welfare reducing susceptibility to bacterial infections.
- The outermost cell layer of the fish skin, the epidermis, consists of mainly two cell types. The mucus cell produces the slime layer described above, and the keratocyte cells are rapidly migrating cells that cover wound surfaces in fish skin's initial wound-healing process.
- The epidermis layer is also where the skin barrier function based on active ion transport is found. Scale loss is an apparent indication of complete loss of skin barrier function. The rapid migration of skin keratocyte cell covers the exposed surface and seal the surface after hours restoring the barrier function. Complete healing of the skin with regeneration of scales will take 5 weeks at 10 °C.
- Both chronic stress (high density; 50-80 kg m3 vs 14-30 kg m3) and acute stress (crowding; 300 kg m3) impair skin barrier by increasing permeability towards ions and small molecules.
- Underneath the epidermis is the dermis. This layer comprises matrixes of collagen fibers that give the skin strength and elasticity. The dermis has more blood vessels and has also pigmented cells in the deeper part, which are involved in fish coloration.

RECOMMENDATION:

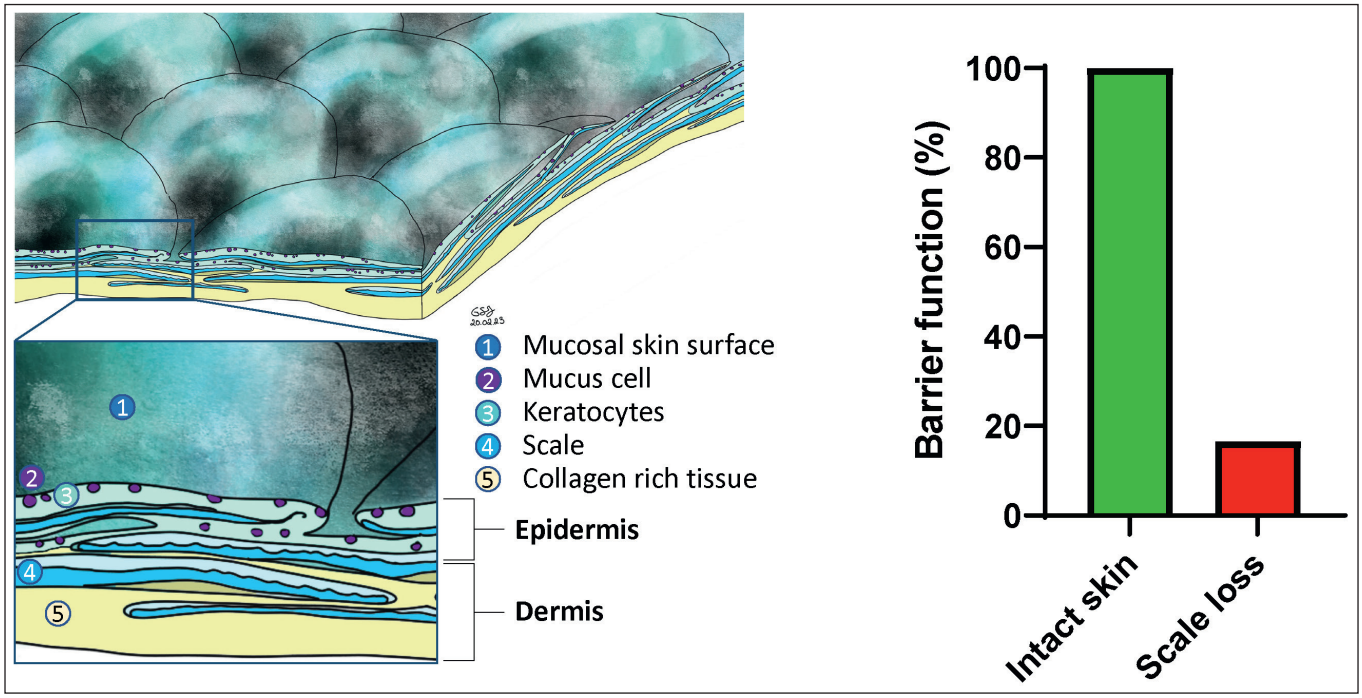
Epidermis in the skin is very important. Handling, e.g. sea lice treatments, that leads to scale loss or damage of the skin surface causes increased cost for the salmon to maintain homeostasis and cause reduced protection against infectious microorganisms. The scale less surface will be sealed by skin cells within hours to restore barrier function towards ions. Complete healing of protective skin functions from large areas of scale loss (~10%) will take 5 weeks at 10 °C.

The factsheet is ready for commercial implementation

READ MORE:

- Deliverable: D3.1/BARRIER/2015,
- D3.4 and D3.5/BARRIER/2016
- D3.1/BARRIER/2017

Please note: Fact sheet is meant as information on how the skin is structured, and why it is important to have all layers and their main functions.



Atlantic salmon skin is composed of a mucosal surface with an epidermal and dermal layer containing different cells and structures throughout the layers. Loss of scales with the epidermis results in an almost complete loss of barrier function towards ions. It decreased by 80%, leaving the tissue highly permeable the first hours after damaged.