FRESH – Fish REaring and Stress Hazards

FRESH is a recently launched FORMAS-funded research collaboration between the Swedish University of Agricultural Sciences (SLU) and the University of Gothenburg (GU) aiming to increase knowledge about welfare of fish in modern aquaculture systems.

Animal welfare is a complex issue that embraces a combination of disciplines ranging from veterinary medicine and nutrition to physiological and behavioural needs and responses. The goal of FRESH is to link all of the disciplines to understand the different needs and biological risks of the animal by using physiological methods and modern biotelemetry (Fig. 1) to better understand the fish's reaction in common fish farming situations.

A big challenge when studying the welfare of fish is that fish do not have, at least not for us humans, a clearly perceivable body language that can provide guidance on the experiences of the fish. For example, most fish do not have the ability to create sounds, which otherwise is a common way for animals to signal fear and discomfort. The fish may instead display escape behaviour, or "freezing", which means that it remains motionless and also reduces the number of heartbeats and the ventilation rate. These signals may be difficult for us to perceive under common fish culture conditions; such as when netting, sorting, transporting and vaccinating fish. In general, this lack of clearly distinguishable signals from fish makes it difficult for policy makers and when formulating regulations and recommendations on animal welfare in fish farming.

To understand what the fish really perceive as stressful, we must first study their physiological stress responses in order to understand what it perceives as stressful and how it reacts in various situations. This can be done in controlled laboratory experiments attempting to mimic e.g. handling situations, various conditions in the farming environment or to test new feeds. However, it is often difficult to completely emulate a specific farming situation where a multitude of interacting factors are present, and so a better approach may be to measure how fish reacts to various stressors on site at the aquaculture facility. Recently developed biotelemetry equipment (see Figure 1) allows us to do this by using so called "focal fish" that are instrumented with physiological biotelemetric devices. This means that a number of fish in a culture tank or holding pen are instrumented in the body cavity with small implants capable of monitoring blood flow, heart rate and blood pressure and are then released back into the culture. Hours, days or even weeks later the fish is caught and the researcher can download information on how various situations in the culture have affected their physiology. In this way we can also see if the specific situations that we recreate in the laboratory, with the possibility of even more detailed measurements of physiological responses, are representative of the real situation occurring in aquaculture rearing systems.

Our team is involved in developing this new technology together with a bioengineer from USA. We also have a system to measure heart and ventilation rates non-invasively on fish in the laboratory precluding surgical procedures. The principle is based on the fact that actively working muscles emit weak electrical potentials. Thus, by placing electrodes in the water that surrounds the fish, we can record the weak signals from the heart and ventilatory muscles and measure changes in these stress-sensitive physiological systems without even touching the fish.

Follow the project on: http://www.slu.se/en/departments/animal-environment-health/research/research-project/animal-welfare-in-modern-production-systems-for-fish/

The project group consists of: Bo Algers (SLU, co-ordinator), Michael Axelsson (GU), Lotta Berg (SLU), Albin Gräns (GU), Anders Kiessling (SLU), Torbjörn Lundh (SLU), Erik Sandblom (GU), Kristina Sundell (GU) och Henrik Sundh (GU).

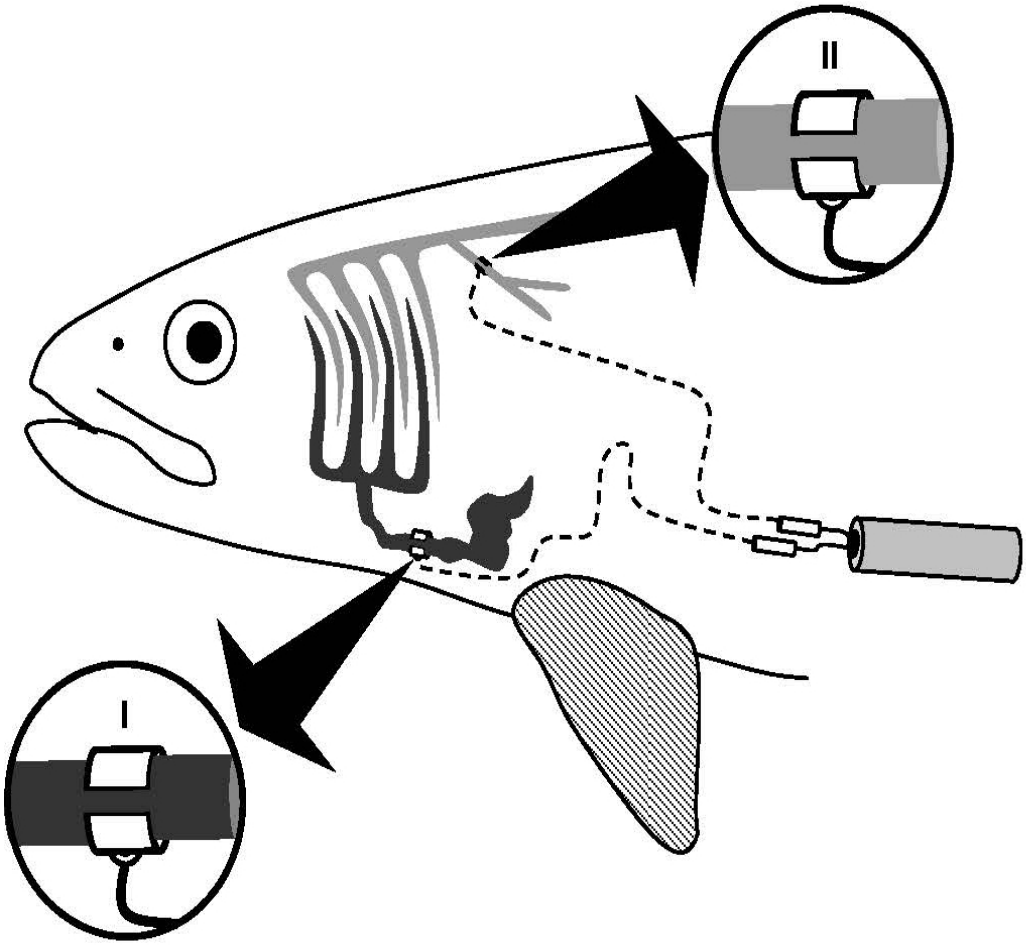

Figure 1. Biotelemetry system for fish implanted in the peritoneal cavity of a salmonid fish. The system has two so-called "Doppler blood-flow probes" which are placed around the aorta (I) and the large blood vessel to the gastrointestinal tract (II). (Picture: Albin Gräns)

Figure text: Modern cage farm on the Norwegian west coast. Net pens can be up to 120 meters in circumference and hold over 100 000 animals. To study the experience of individual fish with conventional technology is almost impossible, but absolutely essential to ensure not only the welfare of the animal, but also to improve the functionality of modern fish farming systems. (Photo: Anders Kiessling)