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Statens tilsyn for planter, fisk, dyr og næringsmidler



RISK ASSESSMENT OF RECIRCULATION SYSTEMS IN FISH HATCHERIES

To ensure good animal welfare in Norwegian fish farms certain water quality related issues and various water quality parameters must fulfil requirements set in the Regulations relating to Operation of Aquaculture establishments (*Forskrift 2008.6.17 nr. 822 om drift av akvakulturanlegg*). At the time these regulations were issued most hatcheries used a flow-through system for their tanks; that is they operated with a continual renewal and exchange of water. The recommended exchange rate is 0.25 litre of water per kilogram fish and minute. In the spring of 2009 (when this commission was first planned) 10-15 hatcheries recirculated tank water. In general those hatcheries operated with a daily water renewal rate as low as 5–20 percent. However cases where the renewal rate was only one percent were known of. Such low renewal rates are only possible by allowing the water (after use in the farm tank) to pass through a water treatment unit where metabolites such as carbon dioxide are removed and oxygen supplemented. As there is an increasing interest in recirculation systems, we expect that in the last two years other hatcheries have started with recirculation of tank water and that this shift towards recirculation systems will continue.

There are several accounts of cases that indicate that fish held in tanks where water is recirculated, are being exposed to situations where their welfare is severely affected or at least somewhat impaired. However we also have some information indicating that animal welfare conditions in certain circumstances are improved when fish are held in recirculation systems compared to flow-through systems.

Providing a suitable environment with an adequate supply of good quality water is a fundamental welfare principle. Even in flow-through systems there has been a tendency to use too little water. This is due either to the water supply being insufficient compared to the amount of fish produced or to the cost of pumping/heating the water. For the same reasons the fish farming industry is now showing an increasing interest in recirculating tank water. Legislation sets certain minimum requirements to ensure a good living environment for the fish and to prevent injury by correct handling procedures and use of sound equipment. We are however concerned that the high rate of recirculation of water might set fish welfare at risk and that current legislation might not address the problems generated by recirculation systems.

**Norwegian Food Safety Authority,
Head Office, Department of Legislation,
Section for Animal Welfare and Fish
Health**

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To be able to judge whether existing legislation is adequate in safeguarding fish welfare also in hatcheries where water is recirculated, we need an assessment of the current situation and whether or to which degree a risk of injury, disease or other unnecessary suffering exists.

We request that the following aspects be assessed in connection with **water recirculation systems** in land based facilities:

- 1) Is there a risk that methods and technical equipment commonly used in Norway for recirculating water will not allow for the provision of a suitable environment that satisfies fish's basic requirements to sufficient water of a certain quality? If so, please describe which elements of the method or component of the equipment which set fish welfare at risk. Do certain methods or types of equipment better satisfy fish needs?
- 2) Which risks to animal welfare exist due to faulty assembling or operation of the equipment or use of a method? What can be done to remedy this fact? Can certain operational routines or monitoring of water quality parameters compensate or prevent animal welfare being set at risk? If so, please specify which routines are necessary and which water quality parameters that need to be monitored to have sufficient control with and maintain an acceptable water quality that satisfies fishes' needs.
- 3) What is the risk of a fluctuating water quality environment with ever changing levels of various parameters ensuing in a recirculation system compared to a flow-through system, and which factors represent a risk to the stability of the environment provided?
- 4) Is there a risk of poor or inadequate water quality conditions developing due to the amount of renewal water per tank in a recirculation system? The systems total capacity to maintain a good water quality must also be taken into account in conjunction with the assessment of the water renewal rate. Will certain water renewal schemes reduce or minimize this risk? Do other factors such as feeding regimes, stocking density, etc. interact with water quality maintenance in such a manner that animal welfare is set at risk?
- 5) Does available knowledge on how to operate the recirculation system in accordance with the bio filter's capacity, fish density, and feeding regime, in itself represent a risk e.g. due to either inadequate or incorrect knowledge? If the operational knowledge of the system is sufficient, is it rather the farms that do not train their staff in correct management of recirculation systems thus creating an increased welfare risk?
- 6) Is there a greater risk of disease occurrence in recirculation systems compared to flow-through systems and is it possible to maintain a good health status for a long term perspective (years)? It should be taken into consideration that in hatcheries with a flow-through system a segregation of different life-stages and an all in all out procedure is practiced with disinfection of all equipment between different batches. If such a procedure is no longer possible in a water recirculation system, is there an increased health risk that can be attributed to retaining the bio filter between different fish groups?

Water recirculation systems are defined as: Technological solutions where more than 60 % of the tank water is reused or where biofilters convert fish waste to by-products of the nitrogen cycle. These biofilters are a prerequisite for the system as it otherwise would not be possible to maintain good water quality in the fish tanks.

This commission is limited to salmon and rainbow trout.

We require that a report is submitted to the Norwegian Food Safety Authority at the latest by 15 November 2011. The officer in charge is Bente Bergersen (tel. 55 21 57 21) until 1 March 2011 and from this date Kathrine Ryeng (tel. 23 21 67 79).

Yours Sincerely

Torunn Knævelsrud
Head of Section

Annex – Legislative requirements

The requirements in today's legislation (Regulations relating to Operation of Aquaculture establishments) that concern hatcheries are as follows:

§ 22. *Water quality*

Fish shall at all times have access to sufficient amounts of water of a certain quality so that the fish have good living conditions depending on their species, stage of development, weight and physiological and behavioural needs, and not risk undue suffering or injuries being inflicted on them, including later injuries such as deformities.

The water quality and the interaction of the various water parameters shall be monitored as needed. Effective measures shall be implemented if there is a risk of unnecessary suffering or injury.

The quantity of metabolic waste products accumulated in the water shall be within sound limits.

§ 24. *Water quality in land-based aquaculture establishments*

The intake water and effluent water system in land-based aquaculture establishments shall be designed and maintained in a manner that ensures sufficient through flow of water.

The establishment shall have a backup system that upon failure of the system can meet the fundamental physiological needs of the fish with respect to oxygen and metabolites.

Systematic measurements of water quality parameters O₂, pH, salinity and temperature shall be taken. The salinity measurement requirement does not apply when the water stems exclusively from a freshwater source. Measuring of pH does not apply when the water stems exclusively from the sea.

§ 20. *Methods and technical appliances*

Methods, technical appliances and equipment used for fish, including relocation equipment, pipe systems and automatic vaccination equipment, shall be suitable with respect to the welfare of the fish.

New methods and technical solutions shall be tried and tested, and shall have been documented to be sound in terms of welfare, before use.

If operations depend on electricity to meet the needs of the fish in a proper manner, there shall be access to sufficient electricity and access to an emergency generator or emergency oxygen with the necessary capacity.