

Research and Environmental Protection of Norwegian fjords: A Standstill

Sergio Manzetti

Research Scientist, Fjordforsk Marine Toxicology and Environmental Sciences, Nedre Brekke Vei 38, Norway

Abstract

The two longest and deepest Norwegian fjords, the Hardanger fjord and Sognefjord are representing two large ecosystems which are undergoing a severe environmental threat. Unfortunately, since the publication of "A critical View of the Environmental condition of the Sognefjord" [1] no new measures have been implemented. The legislative system still accounts the County as the representative entity for addressing and implementing the necessary measures for defending these vulnerable ecosystems. Recent developments indicate that the Norwegian Salmon (the Voss-salmon) has received some attention from the Norwegian Environmental Ministry, however the Sognefjord has not been subjected to any legislative changes for increasing protection of its marine life and environment and aquaculture stations are increasingly being proposed in this region as well. This brief editorial refers the news and changes which have occurred recently with regards to environmental condition of Norwegian fjords.

Introduction

The two principal fjords of Norway, Hardangerfjord and the Sognefjord, assembly on its more than 20.000 km long coast line and are the longest and deepest fjord of the country. The Geiranger fjord, which is also famous for its tourism-attractions in Geiranger and Hellesylt represents a third and important fjord, which however is not as deep and long. The Sognefjord, which is built after a ten-thousand's year old excavation of the marine basin by large glaciers, is the most impressive, with a maximum depth of 1308m below sea level. Its marine landscape is represented by a large number of underwater canyons and trenches which reach as steep inclinations as 400m/10m (depth/distance from shore – outside Undredal village). Furthermore, the Sognefjord has the widest and longest underwater plateaus, encompassing hundreds of km², particularly in the region between the villages of Fresvik and Vadheim. This underwater plateau stretches more than 260 km² and has a mean depth of approx 1100m. The current knowledge of the marine species of the Sognefjord is limited to the regular limitations imposed by the great depths and pressures, however a series of recent findings have indicated that this fjord, as also the Hardangerfjord receives "visitors from abroad". Examples of this come from local sport-fishermen who have photographed a moon-fish towards the interior of the fjord, in Aurland municipality [2]. Earlier observations of moonfish occurred in 2003 [3], in the same municipality, which however results as a rare and unusual occurrence in Norwegian fjords. Speculations on these findings refer to climate changes and implications for underwater current temperatures, however, the temperature-fluctuations of the fjord have not been mapped at all. According to studies [1], the Sognefjord is the most heavily affect fjord by hydroelectric power plant activities, which have been blamed for affecting both salinity and temperature of the inner parts of the fjord. Additionally to these negative influences, the Sognefjord has been heavily exposed to environmental pollution from various sources. The primary sources, which represent also the most critical toxic compounds, are from Ardal and Hoyanger, two large industries who have recently been imposed sanctions for leaking several tons of PAH's (polycyclic aromatic hydrocarbons) in the fjord [4], some 125 kg lead in the region of Hoyanger and an unknown amount of mercury [5]. The third source of pollution, is the critical and not-studied source of pollution by cruise-ships: approximately 200 cruise ships visit every year the inner areas of the fjord, with particular emphasis on Skjolden and Flåm, releasing an unknown amount of pollutants [1]. In this context, the Norwegian Ministry of the Environment has yet not declared a region-specific limitation for

accommodating cruise ships, so to preserve the sensitive underwater ecosystems from non-regulated release of greywater, combustion-fumes and poor regulation of acoustic pollution which echoes in the underwater trenches of the fjord.

No attention has been given either to the air-pollution that the cruise ships release, except for Bergen, who as a coast-town, receives a high number of cruise ships every year [6]. Here a series of complaint have brought forth the topic on the electrification of cruise ships at dock, an issue which is completely neglected by the county of Sogn og Fjordane, for the particularly exposed harbor of Flam and Skjolden.

In regards with the Hardanger fjord, the situation is also on halt. This fjord is Norway's most exposed fjord to aquaculture stations, a trend which has almost exterminated the native "Vosso-laks" tribe (Voss salmon), as the aquaculture stations are placed as hinders for the salmon fry when leaving the rivers towards open sea. The majority of aquaculture stations have not changed or altered their activity, however after recent protests from various groups [7] the Ministry of the Environment in Norway is proposing a limitation of a maximum quote of yearly production of 50.000 tons of aquaculture salmon and trout for the aquaculture stations in the Hardangerfjord [8], a gentle but however inefficient measure for the drastic condition of the fjord.

In addition to the densest population of aquaculture stations which affects the rapid extermination of wild-salmon returning to Hardanger rivers, the Hardangerfjord is also exposed to a series of cases of industrial pollution, primarily represented by dumping of mercury over the years, which has been exposed by the measured critical levels in tusk-fish very recently [9].

The approach of attempting to move the aquaculture stations to

Corresponding author: Sergio Manzetti, PhD., Research Scientist, Fjordforsk Marine Toxicology and Environmental Sciences, Nedre Brekke Vei 38, 5743 Flåm, Norway, E-mail: Sergio.manzetti@gmail.com

Received July 15, 2011; **Accepted** August 30, 2011; **Published** September 06, 2011

Citation: Manzetti S (2011) Research and Environmental Protection of Norwegian fjords: A Standstill. J Marine Sci Res Development S2:001. doi:[10.4172/2155-9910.S2-001](https://doi.org/10.4172/2155-9910.S2-001)

Copyright: © 2011 Manzetti S. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

other fjords, has also been recently discussed, however it has been heavily debated from regional and local representatives objecting strongly to the danger of affecting the salmon tribes returning to the rivers of the Sognefjord, particularly in Lærdal, and Aurland county. Additionally, the aquaculture industry has been confronted because of its plans to control its waste-production without the interference of environmental groups. However, the identification of large bulks of excrements under the aquaculture stations was documented by a group through the use of underwater ROV-units [10], putting enormous pressure on the Norwegian environmental agencies to stop non-regulated fish-farming in narrow and poorly circulated parts of the Norwegian fjords.

Summing up, the condition of Norway's two largest and deepest fjords has not been subjected to any measures from the Ministry of the Environment, particularly referring to the environmental threats described here. The lack of controls of both water and air in the innermost parts of these fjords keeps the knowledge of the fjords condition to a reduced level, and the information seems to be only available from local sport-fishermen reporting a continuous decline in fish or inhabitants complaining on the high smog-doses from cruise ships. According to the experience of Fjordforsk [1], the presence of fish in the innermost parts of the fjord of Sognefjord in particular, has declined considerably since 2006. To report an example, a test carried out in 2011, showed the presence of 8 small sharks on a total of 200 hooks on a fishing line placed strategically at the junction between the Nærøyfjord and the Aurland fjord at a depth of 200m. From earlier experiences, such an extension of fishing line in this region would give a high amount of tusk fish in particular, and other non-voracious fish. However, the presence of voracious fish as small sharks seems to be the only fish left after the decline of fish since the early 1990's. It is hypothesized in this study that mammals and sharks, giving birth to embryos and not laying eggs, may be more tolerant to the fluctuations

of salinity and temperature in the innermost parts of the fjord, precisely because the sensitivity of fish-eggs to salinity fluctuations has been shown to give rise to complications for egg-laying species [11].

There are therefore few references of national projects on the condition of the viability of the fjords and the circulation and transformation of wastes from man-made sources. The absent scientific activity in these exotic and unique ecosystems calls for the attention from environmental scientists and marine biologists to participate in international studies on: a) aquaculture effects on fjord chemistry, b) circulation of wastes in fjords and how industrial and waste-generating constructions affects it, c) the fate of wild salmon affected by aquaculture and d) the effects of fresh water discharge from hydroelectric-power plants on fjord ecosystems.

References

1. Manzetti S (2010) A critical View of the Environmental condition of the Sognefjord. *Mar Pollut Bull* 60: 2167-2174.
2. Eggum T (2009) Unusual visit in Aurland. *Sogn Avis*.
3. Finstad BHH (2009) Tropical mid-winter guest in Aurland. *Sogn Avis*.
4. Hjetland GB (2009) 4 tons of PAH's discarded in the Ardal fjord. *Sogn avis*.
5. *Dagbladet*. Fabric shut down after illegal dumping of lead and mercury.
6. Andersson A (2008) *Bergens Tidende*.
7. County of Hordaland. Year report 2010.
8. NRK (2011) Towards a reduction of aquaculture in the Hardangerfjord.
9. Hordaland (2011) Mercury above the EU limit of Hardanger-fish.
10. Norwegian Environmental Society (2010).
11. Vines CA, Robbins T, Griffin FJ, Cherr G (2000) The effects of diffusible creosote-derived compounds on development in Pacific herring (*Clupea pallasii*). *Aquatic Toxicol* 51: 225-239.

Submit your next manuscript and get advantages of OMICS Group submissions

Unique features:

- User friendly/feasible website-translation of your paper to 50 world's leading languages
- Audio Version of published paper
- Digital articles to share and explore

Special features:

- 100 Open Access Journals
- 10,000 editorial team
- 21 days rapid review process
- Quality and quick editorial, review and publication processing
- Indexing at PubMed (partial), Scopus, DOAJ, EBSCO, Index Copernicus and Google Scholar etc
- Sharing Option: Social Networking Enabled
- Authors, Reviewers and Editors rewarded with online Scientific Credits
- Better discount for your subsequent articles

Submit your manuscript at: www.editorialmanager.com/environsci