FISH FARMING IN SOUTH SKYE LOCHS

by

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OUTLINE

There are numerous threads in the arguments for and against salmon aquaculture:

- Landscape modification, neutral or deterioration.
- Local employment, improved or otherwise.
- Local prosperity, enhanced or otherwise.
- National prosperity, enhanced or otherwise.
- Scottish Government treaties and policy re farmed fish production.
- Contradiction of government policies on commerce and conservation.
- Noise and light pollution.
- Fish feed and effluent pollution: dilution and dispersal.
- Chemicals added to the environment.
- Escaping diseased non-native fish species and 'pollution' of local wild gene pools.
- Fish/sea lice attacking wild fishes.
- Wild fish population crashes (e.g. salmon, sea trout, cod).
- Ecological effects on the sea bed beneath fish farm.
- Ecological effects beyond the fish farm, nearby and distant. Biodiversity and habitat safety.

This discussion will deal specifically with effects of fish farming on biodiversity and ecology in the Lochs Slapin, Eishort and Scavaig, the south Skye lochs. Meanwhile, the other issues all need to be addressed.

JOINED-UP THINKING NEEDED AT HOLYROOD

> "It's great news for Scottish aquaculture. It's great news for the salmon industry. [Farmed salmon] is part of the essence of Scotland. Two years ago Scots salmon sales [to China] were zero. Now they're about fifty million pounds. That's all happened through the work of the [aquaculture] industry and through the work of the Scottish Government, making sure that that great Scottish product is moving into new market places." – Alex Salmond (Scottish First Minister).

> **"This study has shown that the salmon farms had demonstrable detrimental effects on the conservation status of the maerl beds studied to distances of at least 100 m from the cage edges." – SNH Commissioned Report No. 213 (2006)** ***Impact of marine fish farm deposition on maerl beds.***

> "The waters around Scotland are rich in such fascinating biodiversity and it's our responsibility to protect this fragile environment. That's why we have ramped up our marine survey work, with plans being prepared for new surveys in 2012 to further our knowledge of what lies beneath Scotland's seas." – Richard Lochhead (Cabinet Secretary for Rural Affairs and the Environment).

On one hand The Scottish Government seeks to double farmed salmon production so that it may fulfil a trade agreement with the Chinese Government, whilst on the other it is proud of its measures to conserve the marine environment. Scientific research shows that the two are incompatible. To many informed people, salmon fish farming in open waters is an unsustainable procedure that should cease altogether. Whether or not we agree with a global ban, there are good specific, local reasons to consider south Skye lochs are unsuitable for aquaculture.

Skye has been targeted by multinational companies, mostly of Norwegian origin, for a massive increase in fish farms and aquaculture companies are competing for – cynically, co-operating to occupy – positions in all Skye sea lochs. A recent application for planning permission[1] from Marine Harvest[2] has now passed the public consultation stage (2 November) and we await the outcome. The location of this proposed fish farm is by the coast off the western shore of Siusnish by Loch Slapin (NG 582167).

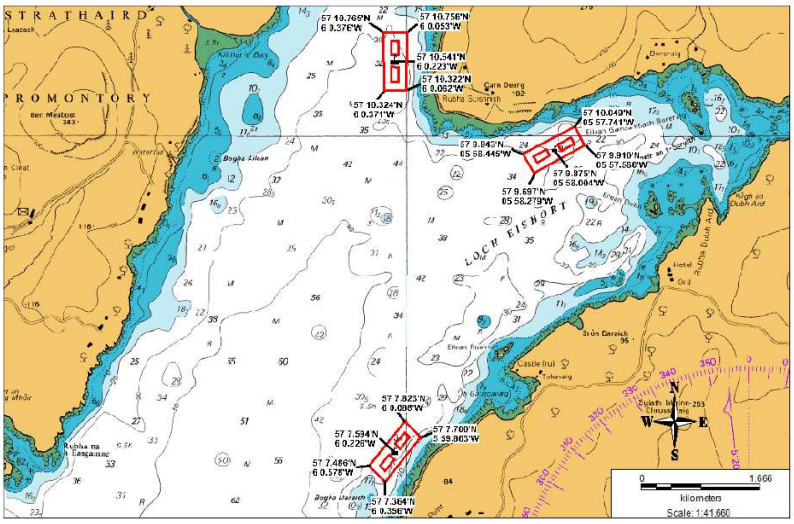

Figure 2a – The three proposed Loch Slapin and Loch Eishort sites [Hjaltland]

Public responses were ninety against and one for, and statutory consultees' responses have been far from favourable and Marine Harvest does not hold the lease on the site for which they applied for planning permission. That doesn't mean that the site is likely to be reprieved, because another Norwegian company called Grieg Seafood Hjaltland UK Ltd[3] (Hjaltland) is also looking for options in the exactly same place and it seems they, or perhaps another company, do have the lease (hence suspicions about collaboration). They also seek to install fish farms in the other two sites shown in Figure 2a as well as another three in the sound of Soay, Loch Scavaig, at the foot of the Cuillin Hills and more besides, outside the south Skye region.

BIODIVERSITY: UK BAP – SKYE & LOCHALSH LBAP

The three south Skye lochs under consideration by fish farm companies, Slapin, Eishort and Scavaig, are undeniably a major part of some of the most glorious and underdeveloped

1 http://wam.highland.gov.uk/wam/applicationDetails.do?activeTab=neighbourComments&keyVal=MAJJ5LIH09500&neighbourCommentsPager.page=1

2 http://www.marineharvest.com

3 http://www.shetland-products.com

scenery in Scotland, places of peace and spectacle, much loved by locals and visitors. Views of the area are admired and enjoyed from every angle, from Cuillin summits, from out at sea, from Elgol, Camas Malag, Ord and Tokavaig.

However, the biology of the three lochs, if less often appreciated than the scenery, is of vital importance. Here are the marine locations of UK Biodiversity Action Plan (BAP) Priority Habitats and Species, key ecological designations that are ostensibly protected by law. Not, it seems, when aquaculture is the political preference, and their underestimated qualities tend to get 'overlooked'. Whilst he biology of these lochs is of extraordinary ecologically importance, it also informs and educates countless local and visiting naturalists and lay people, not forgetting children.

Therefore, it has become my task as best I can to identify the biota and biomes[4] that live in and around these lochs and, with the help of the community and maybe divers from here and elsewhere, to map and record their locations and extents accurately. The aim of this exercise is to place data previously unavailable, inaccessible or underappreciated before the statutory bodies who will then be obliged to consider them in the light of Scottish and international conservation law.

MAERL BEDS

Maerl beds consist of several different calcareous red algae (seaweeds) the presence or absence of which is often related to the salinity of the sea water they live in. The waters of Lochs Slapin and Eishort are, except near the mouths of burns and rivers, more-or-less fully saline and the maerl species in the lochs are predominantly *Phymatolithon calcareum*. Beneath the waves and alive, *P. calcareum* is deep purple-red, whilst dead fragments pile deep on loch shores as the pure white 'coral' that makes beaches so attractive to visitors. Both dead and alive, maerl is home to an incredible array of marine species and not only is it considered to create a UK BAP Priority Habitat in its own right, but when occupied by sea/eelgrass *Zostera marina* forming 'meadows' or gathered into reefs by horse mussels *Modiolus modiolus* and flame shells *Limaria hians*, maerl is the basis of three other UK BAP Priority Habitats. A fifth UK BAP Priority Habitat is the intertidal boulder beds we find all along these loch shores where numerous unusual and rare creatures are routinely found and a sixth, mud habitats in deep water, is found at the proposed Suisnish fish farm site.

The above named organisms that variously make up the four maerl-based UK BAP Priority Habitats have been recorded in the area of Lochs Slapin and Eishort, yet in most cases their locations have yet to be properly mapped. Once disrupted or eliminated by dredging or eutrophication,[5] slow-growing maerl may take hundreds of years to recover. Therefore, damage to maerl beds is unadvisable if local extinctions and ecological impoverishment are to be avoided. Due mainly to dredging for its lime content, Maerl has long been in decline and recently aquaculture has been recognised as an additional adverse pressure compromising its existence.

The main threat to maerl in the south Skye lochs will be eutrophication, changes (usually increases) in nutrient levels caused by inputs of feed at fish farms, excess feed and excrement. This amounts to many additional tonnes of compounds based on carbon, nitrogen and phosphorus, which unless immediately diluted to extinction, will have profound, perhaps irreversible detrimental effects upon marine ecosystems as they drift around the lochs. In the

[4] A Biome is a large naturally occurring community of flora and fauna (biota) occupying a major habitat.
[5] Eutrophic describes the excessive richness of nutrients in a lake or other body of water (or soil). Oligotrophic is the natural, low nutrient state of a habitat and Mesotrophic is in between.

past, such changes have passed unnoticed, because 1. beneath the sea they are unobservable, and 2. Local marine ecosystems have not been fully recorded and understood, if at all, so that past qualities cannot be recognised.

Scientific literature attests to these facts (see Appendix II – Select Bibliography): Grall & Hall-Spencer (2003); Hall-Spencer *et al.* (2006); Sanz-Lázaro *et al.* (2011); European Community Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora; Greathead *et al.* (2012).

Loch Slapin has a maerl bed somewhere not far off Suisnish (persuasive evidence around Kilmarie and by Dun Liath, and to a lesser extent at Torrin where we have also found significant numbers of seagrass fragments).

Loch Eishort is the jewel in the local lochs crown, with visible and well visited maerl beds and seagrass beds exposed at low spring tides, and records of horse mussel and flame shell reefs, which very much need to be accurately located and recorded.

The four maerl-based habitats, plus intertidal boulder beds and deep water mud, make six UK BAP Priority Habitats in these lochs and the records we have allow only glimpse into which and how many vitally important species are present there. These aspects of natural history have been overlooked or ignored so far by fish farm environmental impact assessments, so it is an aspect of planning that needs to be emphasised, recognised and urgently remedied.

NORTH SLEAT SEASHORES & THEIR THREE LOCHS

The author has visited the north Sleat shore on numerous occasions as well as surveying the entire coastline for a Highland Council publication, assessing the qualities of 46 selected shores known or suspected to be far from ordinary.[6] He is of the opinion that the shores that run from the Point of Sleat to Drumfearn, Broadford to Kyleakin, Plock of Kyle to Fernaig are perhaps the finest in the Highlands (possibly in Britain) for seashore biodiversity, with a few outlying special places including Laide, Balchladdich, Balintore and others.

A common feature of these finest south Skye and western Lochalsh shores is offshore beds of maerl.

For seashore biodiversity, these shores require protection or else their quality is likely to deteriorate, becoming ordinary and of reduced interest to the biologist, as has already happened in other places, e.g. Robin Hood's Bay in Yorkshire and Millport, location of one of the world's foremost marine biology institutes. The author witnessed the declines at these sites during over thirty years of visits from the mid 1970s well into the 2000s. There are species in Skye and Lochalsh that are rarely found elsewhere, though this unusual richness is recognised by very few people.

Many are highly sensitive to pollution, such as is inevitable in the vicinity of a sewage outfall, a river that has run through intensively agricultural land or a fish farm. It is inevitable that after large quantities of fish food have been poured into cages and later released into the marine environment as excess or fish excrement, that nutrient levels will change locally and certain chemical compounds and sediments, that might detrimentally affect sensitive habitats nearby (or unexpectedly distant) will increase significantly and drift into other areas of the loch system.

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[6] Merryweather, J.W. (2012). *Highland Seashores: the friendly guide to seashore wildlife for residents and visitors*. Free DVD-ROM obtainable from janet.bromham@highland.gov.uk at The Highland Council.

It is well known that environmental increases in organic, nitrogenous and phosphoric compounds particularly, as they increase productivity they also suppress biodiversity. In lochs with fish farms algal and cyanobacterial blooms are becoming the norm, even we hear, during the days of fish farming at the head of Loch Eishort, off Heaste.

Natural ecosystems thrive on low concentrations of nutrients, parsimoniously recycled *via* ecological (often symbiotic) networks of their component species. Artificial monocultural systems lack those ecological mechanisms for recycling and, therefore, behave completely differently. Inputs must be set to excess, leading to massive wastage that is detrimental to surrounding land – we plainly see these in agricultural situations – or in the case of fin fish aquaculture, sea waters.

Contrary to the conventional, naïve optimism of politicians and lay persons, natural ecosystems which we cannot fully define – e.g. maerl-based habitats – cannot be restored once degraded.[7] However, what we do know, because statutory Scottish authorities tell us so:

> "… evidence suggests that maerl continues to be under threat from damaging human activities, such as fisheries and fish farm operations."[8]
>
> "Eutrophication is also considered to be an important threat to maerl beds."[9]
>
> "… the true value of maerl is as a living community, for the many animals that shelter amongst it, and the commercially valuable species it helps support."[10]
>
> "Protecting living maerl beds is vital to the wise management of Scotland seas."[11]
>
> "Scotland's seas provide rich and diverse ecosystems that are home to a wide array of plants and animals, including internationally important species. It's our duty to protect this precious environment." – Richard Lochhead (Cabinet Secretary for Rural Affairs and the Environment)[12]
>
> "Maerl beds are extremely sensitive to [*among other anthropogenic threats*] aquaculture ..."[13]

FINALLY

> "With many new discoveries 2011 has been an exciting year for everyone involved in the marine surveys around Scotland. Scotland's seas really are a fantastic asset. The findings from [a series of 15 marine surveys in 2011] will help us to manage them sustainably and ensure future generations can also enjoy the benefits of a healthy and diverse marine environment." – Susan Davies, director of policy and advice with Scottish Natural Heritage.[14]

Judging by what the author knows of them, Lochs Slapin, Eishort and Scavaig are arguably all equal to any of the 15 sites included in SNH's 2011 surveys. Their biodiversity should not be compromised by industrial development until suitable marine research proves they would be unharmed by it or – heaven forefend we should take such an attitude, though we frequently do – they are considered expendable, commercial interests allowed to take precedence over the environment we share with our descendants and all other life forms to our multifarious benefit.

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[7] Merryweather J.W. (2007). Planting trees or woodland? An ecologist's perspective. *British Wildlife* 18:4 250-258.
[8] European Community Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC) http://jncc.defra.gov.uk/pdf/Article17/FCS2007-S1377-audit-Final.pdf
[9] ibid.
[10] SNH: http://www.snh.gov.uk/about-scotlands-nature/species/algae/marine-algae/maerl/
[11] ibid.
[12] ibid.
[13] ibid. footnote 5 above.
[14] ibid.

At present all indications are that these three lochs are indeed precious and, therefore, their wildlife should be jealously protected. Plans for fish farm developments should be rejected if any doubt remains about environmental safety of surrounding waters.

CONCLUSIONS

All indications from scientific study are that fish farming is harmful to marine biological communities. Its effects on the health and populations of wild fishes and ecological community structure in the sea are demonstrably unacceptable. Environmental impacts can be profound and recovery an extremely long or – when injurious practices have been allowed to go too far – even impossible process.

Aquaculture of the sort that is being imposed all along the west Highland coast should be modified before being allowed to proceed further. Effluent has to be controlled by containment and if that cannot be achieved in the sea, that means developing land-based methodologies. That might be expensive for aquaculture companies, but it is infinitely preferable to the environmental degradation that is undeniably happening now. The seas and the living creatures therein must be protected or they will be irreparably damaged to our eventual detriment and deep regret.

The situation might be more serious than previously thought:

“The present study demonstrates that fish farming not only influences physico-chemical and biological parameters but also alters the functioning of the ecosystem from a trophic point of view, affecting mainly the grazers and the evenness among the trophic groups. This work shows that the level of fish farm impact on the benthic community might be underestimated if it is assessed by only taking into account data obtained from waste dispersion rates. The unattached coralline algae habitat studied seems to be very sensitive to fish farming compared with other unvegetated benthic habitats.

“Environmental protection agencies should define different aquaculture waste load thresholds for different benthic communities affected by finfish farming, according to their particular degree of sensitivity, in order to maintain natural ecosystem functions.”

– Sanz-Lázaro *et al.* 2011.

APPENDIX I – UK BAP Habitats present in south Skye lochs

1. Maerl beds composed of *Phymatolithon calcareum*. (Lochs Slapin & Eishort)

Current and potential threats (JNCC).

- *Finfish farms* nutrient and chemical discharges that can effect the fauna associated with maerl beds may be affected. [poor English, but meaning clear]

2. Seagrass or Eelgrass 'meadows' occupied primarily by *Zostera marina*. (Lochs Slapin & Eishort)

Current and potential threats (JNCC).

- *Increased turbidity reducing photosynthesis.*
- *Nutrient enrichment* at low levels, may increase production in *Zostera* while high nitrate concentrations have been implicated in the decline of mature *Z. marina*. Phytoplankton blooms, resulting from nutrient enrichment, have been shown to reduce biomass and depth penetration of eelgrass. Eutrophication can also result in a shift to phytoplankton epiphyte or macroalgal dominance.

3. Reefs formed by Horse Mussels *Modiolus modiolus*. (Loch Eishort)

Current and potential threats (JNCC). Not specified, but this habitat is frequently based on maerl.

4. Reefs formed by Flame or File shells *Limaria hians*. (Loch Eishort)

Current and potential threats (JNCC). Not specified, but this habitat is frequently based on maerl.

5. Intertidal Underboulder Communities. (Lochs Slapin & Eishort)

Current and potential threats (JNCC). None directly relevant. However, seashore biodiversity might well be susceptible indirectly to environmental changes caused by fish farm activity or even directly by sedimentation or eutrophication where fish farms are nearby.

6. Mud Habitats in Deep Water. (Lochs Slapin & Eishort)

Current and potential threats (JNCC).

- *Marine fish farms* may have direct effects on mud communities, including smothering and increasing the Biological Oxygen Demand of the mud. Additional effects may result from the discharges of chemicals, some of which are especially toxic to crustaceans.
- *Pollution* Nutrient enrichment leading to eutrophication can have significant detrimental effects. This can lead to changes in the structure and composition of deep mud communities.

APPENDIX II – Select Bibliography

Grall J. & Hall-Spencer J.M. (2003). Problems facing maerl conservation in Brittany. *Aquatic Conservation: Marine & Freshwater Ecosystems*. 13: S55-S64.
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Sanz-Lázaro C., M.D. Belando, L. Marín-Guirao, F. Navarrete-Mier, A. Marín (2011). Relationship between sedimentation rates and benthic impact on Maërl beds derived from fish farming in the Mediterranean. *Marine Environmental Research*. 71(1): 22–30.

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APPENDIX III – Some videos that present views on fish farming and conservation

Jean-Michel Cousteau http://www.youtube.com/watch?v=1YD9KDE92J8
Pure Salmon Campaign, Part 1 http://www.youtube.com/watch?v=4ZBbYzyuwF0
Part 2 http://www.youtube.com/watch?NR=1&v=5dJoGvHBaS8&feature=endscreen
Part 3 http://www.youtube.com/watch?v=zheaUQqehnw&NR=1&feature=endscreen
Part 4 http://www.youtube.com/watch?v=-IKf6QJtVdw&NR=1&feature=endscreen
Scottish Government http://www.youtube.com/watch?v=CDR0gKjEDTM&feature=youtu.be
Attenborough http://www.youtube.com/watch?v=ebfS929i7TY&feature=player_embedded

ABOUT THE AUTHOR

James Merryweather is an early-retired research ecologist, trained by and working with Prof. A.H. Fitter at the University of York. His research was part of a wider project to discover the behaviour of the fungus-root symbiosis, arbuscular mycorrhiza, using bluebell *Hyacinthoides non-scripta* as his 'research tool'. Whilst at York he assisted with teaching marine biology at the University Marine Biological Station, Millport for thirty-two seasons, hence his expertise in seashore ecology and delight in sharing that knowledge with others.

He is the compiler of user-friendly field guides (www.slef.org.uk/free-stuff.asp), including two on British ferns and associated flowerless plants published by the Field Studies Council (www.field-studies-council.org/publications.aspx) and a set of computer guides issued on a DVD by the Highland Council's biodiversity department. The latest to be added to that series is *Highland Seashores: the friendly guide to seashore life for residents and visitors*, which is proving very popular and will be properly launched in 2013 at the start of an exciting initiative: The Highland Seashore Biodiversity Project.

Before moving to the Highlands in 2003 he was for almost thirty years a shawm/curtal/bagpipe playing member of renaissance band The York Waits and he is currently the principal bassoonist in the remarkable Skye & Lochalsh Orchestra. He lives in Auchtertyre, Lochalsh and contributes to the activities of Skye & Lochalsh Environment Forum, Wester Ross Environment Network, Scottish Wildlife Trust (Skye) and South West Ross Field Club, his particular role being leading field trips around the region and beyond.